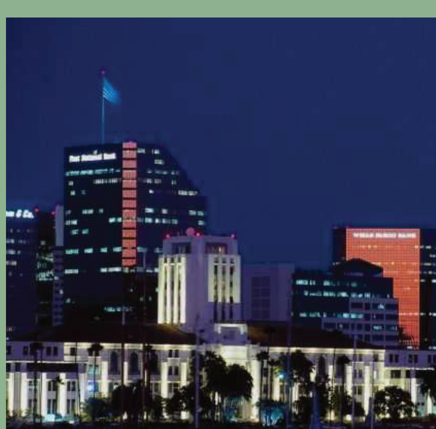
Reviewer Instructions:

1. All review comments to be provided **electronically** using this review form.
2. Focus the review on substantive issues within your disciplinary, regulatory, or policy area.
3. Look only at the portions relevant to your agency and the land under your management. The individual land management agencies will be amending land use plans or issuing a Record of Decision, so please don't alter the other agencies' roles and responsibilities.
4. Target the review on the adequacy and reasonableness of text and analyses within your disciplinary, regulatory, or policy area. Please be aware that this is a programmatic EIS.
5. All comments should be as specific as possible. Comments such as "text unclear" or "expand" do not provide sufficient information for revising the document.
6. Describe your recommended revision (based on your comment) as clearly as possible so that the necessary and appropriate revision can be implemented.
7. For field unit reviewers (i.e., Field Office, National Forest, National Wildlife Refuge), direct the review on your geographic region (especially for corridors that cross your administrative boundaries). Do not conduct a NEPA review of the entire document. Areas to cover for your administrative unit include:
    - Do the maps reflect the correct siting of the corridor(s)?
    - Are there unrecognized resource issues because of the siting that are not disclosed in Chapter 3?
8. Do not comment about grammar, punctuation, and formatting. Limit editorial comments to only issues of clarity.
9. Review all figures for legibility and clarity.
10. All cells, including the "Comment" and "Recommended Revision" cells, will expand to accommodate any amount of text.
11. The Review Form will accept up to 40 comments. If you have more comments, please open another review form and continue numbering the comments sequentially.
12. Ensure that the Adobe Acrobat Reader Navigation toolbar is open before attempting to view Vol. III maps. To open the toolbar, choose View > Toolbars > Navigation or right-click (Windows) or Control-click (Mac) in toolbar area and choose Navigation.

Review Comments: WWEC interim final Draft PEIS, October 2007				
Reviewer:				
Agency and Administrative Affiliation:				
Primary Disciplinary Area (e.g., ecology, land use planning, regulatory oversight):				
Comment Number	**Page**	**Line Number**	**Comment**	**Recommended Revision**

Review Comments: WWEC interim final Draft PEIS, October 2007				
Reviewer:				
Agency and Administrative Affiliation:				
Primary Disciplinary Area (e.g., ecology, land use planning, regulatory oversight):				
Comment Number	Page	Line Number	Comment	Recommended Revision

If you have more comments, please open another review form and continue numbering the comments sequentially.



October 2007

Programmatic Environmental Impact Statement, *Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE/EIS-0386)

Draft

Volume I: Executive Summary and Main Text

Lead Federal Agencies

U.S. Department of Energy

U.S. Department of the Interior, Bureau of Land Management

Cooperating Federal Agencies

U.S. Department of Agriculture, Forest Service

U.S. Department of Defense

U.S. Department of the Interior, Fish and Wildlife Service

COVER SHEET

Responsible Agency: U.S. Department of Energy (DOE) and the Department of the Interior (DOI), Bureau of Land Management (BLM) are co-lead agencies; the U.S. Department of Agriculture, Forest Service; the Department of Defense; the DOI, U.S. Fish and Wildlife Service; the Coeur d'Alene Tribe; the California Energy Commission;, the California Public Utilities Commission; the state of Wyoming; and the Lincoln, Sweetwater, and Uinta counties and conservation districts in Wyoming are cooperating agencies.

Title: Draft Programmatic Environmental Impact Statement (PEIS) for the Designation of Energy Corridors on Federal Land in 11 Western States (DOE/EIS-0386).

Location: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Contacts: *For further information about this PEIS, contact:* LaVerene Kyriss, Document Manager, DOE, Washington, DC 20585; phone: (202) 586-1056; fax: (202) 586-8008; or visit the PEIS website at: http://corridoreis.anl.gov.

For general information on the DOE's National Environmental Policy Act (NEPA) process, contact: Carol Borgstrom, Director, Office of NEPA Policy and Compliance, Office of the General Council (GC-20), DOE, 1000 Independence Ave., SW, Washington, DC 20585-0103; phone (202) 586-4600 or leave a message at (800) 472-2756.

For general information on the BLM's NEPA process, contact: Ron Montagna, (202) 452-7782, or Kate Winthrop, (202) 452-5051, at: BLM, WO-350, MS 1000 LS, 1849 C Street, NW, Washington, DC 20240.

Abstract: The Energy Policy Act of 2005, enacted August 8, 2005, directs the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior (the Agencies) to designate, under their respective authorities, corridors on federal land in the 11 western states for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities (energy corridors).

The Notice of Intent to prepare this PEIS was published on September 28, 2005 (70 FR 56648). The Agencies held public scoping meetings throughout the 11 western states in October and November 2005.

The Draft PEIS analyzes the environmental impacts of designating federal energy corridors on federal land in 11 western states and incorporating those designations into relevant land use and resource management plans. The Draft PEIS analyzes a No Action Alternative and a Proposed Action. Under the No Action Alternative, federal energy corridors would not be designated on federal lands in the 11 western states; the siting and development of energy transport projects would continue under current agency procedures for granting rights-of-way. Under the Proposed Action, the Agencies would designate and incorporate through relevant land use and resource management plans certain federal energy corridors that would consist of existing, locally designated federal energy corridors together with additional, newly designated energy corridors located on federal land. The Proposed Action is the preferred alternative.

The Agencies will issue decisions subsequent to the Final PEIS in the form of Records of Decision, no sooner than 30 days after publication of the Final PEIS.

Comment Period: In preparing the Final PEIS, the Agencies will consider all comments received or postmarked during the 90-day public comment period that will begin when the U.S. Environmental Protection Agency publishes a Notice of Availability of this Draft PEIS in the *Federal Register*. The Agencies will consider late comments to the extent practicable. The Agencies will hold public hearings in the 11 western states as well as in Washington, DC. Locations and times for the 27 public hearings that are planned to be held will be announced in the *Federal Register* as well as in local media.

DOCUMENT CONTENTS

VOLUME I

VOLUME II

VOLUME III

CONTENTS

CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

FIGURES

FIGURES (Cont.)

FIGURES (Cont.)

TABLES

TABLES (Cont.)

TABLES (Cont.)

TABLES (Cont.)

TABLES (Cont.)

TABLES (Cont.)

TABLES (Cont.)

TABLES (Cont.)

NOTATION

The following is a list of acronyms and abbreviations, chemical names, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

a.m.	ante meridian
AC	alternating current
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
AD	anno Domini
AGFD	Arizona Game and Fish Department
AHPA	Archaeological and Historic Preservation Act of 1974
AIRFA	American Indian Religious Freedom Act of 1978
ANFO	ammonium nitrate/fuel oil
ANL	Argonne National Laboratory
APE	Area of Potential Effect
API	American Petroleum Institute
APLIC	Avian Power Line Interaction Committee
APP	Avian Protection Plan
AQRV	air quality-related value
ARPA	Archaeological Resources Protection Act of 1979
ASME	American Society of Mechanical Engineers
ATV	all-terrain vehicle
AUM	animal unit month
BC	before the Christian era
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1977
CAISO	California Independent System Operator
CASQA	California Stormwater Quality Association
CDFG	California Department of Fish and Game
CDW	Colorado Division of Wildlife
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CRMP	cultural resources management plan
CRP	Conservation Reserve Program
CWA	Clean Water Act
dbh	diameter at breast height
DC	direct current

DNL	day-night average sound level
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of Interior
DOT	U.S. Department of Transportation
E.O.	Executive Order
EA	environmental assessment
EDMS	Emissions Data Management System
EFH	essential fish habitat
EIA	Energy Information Administration
EIS	environmental impact statement
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 2005
ERS	Economic Research Service
ESA	Endangered Species Act of 1973
ESD	emergency shutdown
ESRI	Environmental Systems Research Institute, Inc.
ESU	evolutionarily significant unit
FAA	Federal Aviation Administration
FO	field office
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FLM	federal land manager
FLMA	Federal Land Management Agency
FLMP	Forest Land Management Plan
FLPMA	Federal Land Policy and Management Act of 1976
FMP	fishery management plan
FPPA	Farmland Protection Policy Act
FR	*Federal Register*
FS	U.S. Department of Agriculture's Forest Service
FY	fiscal year
GAO	Government Accountability Office
GIS	geographic information system
GSA	U.S. General Services Administration
HLR	hydrologic landscape region
HLU	Hydrologic Landscape Unit
HMA	herd management area
HMMH	Harris Miller Miller & Hanson, Inc.
HTS	high-temperature superconductivity
HVAC	high-voltage alternating current
HVDC	high-voltage direct current

IBA	important bird area
IMPROVE	Interagency Monitoring of PROtected Visual Environments
IOP	interagency operating practice
KOP	key observation point
L_{dn}	day-night average sound level
L_{eq}	equivalent sound level
LN2	liquid nitrogen
LNG	liquefied natural gas
LPG	liquid petroleum gas
LRMP	land resource and management plan
MBTA	Migratory Bird Treaty of 1918
MLA	Mining Leasing Act of 1920
MOA	Military Operating Area (also Memorandum of Agreement)
MOU	Memorandum of Understanding
MPCA	Minnesota Pollution Control Agency
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MTRs	Military Training Routes
MVA	million volt-ampere
NAA	nonattainment area
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NCA	National Conservation Area
NCDC	National Climatic Data Center
NDOT	Nevada Department of Transportation
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act of 1966
NLCS	National Landscape Conservation System
NMFS	National Marine Fisheries Service
NNHP	Nevada Natural Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPL	National Priorities List
NPS	National Park Service
NRC	National Research Council
NRCS	National Resources Conservation Service
NRDC	National Resources Defense Council
NREL	National Renewable Energy Laboratory
NRHP	*National Register of Historic Places*
NRI	National Resources Inventory
NWCC	National Wind Coordinating Committee
NWFP	Northwest Forest Plan
NWRS	National Wildlife Refuge System

OD	outside diameter
OPS	Office of Pipeline Safety
ORV	off-road vehicle or outstandingly remarkable value
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
p.m.	post meridian
PA	Programmatic Agreement
PCB	polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
PFYC	Potential Fossil Yield Classification
PHMSA	Pipeline and Hazardous Materials Safety Administration
PM	particulate matter
PM_{10}	particulate matter with a diameter less than or equal to 10 microns
$PM_{2.5}$	particulate matter with a diameter less than or equal to 2.5 microns
POC	point-of-contact
POD	plan of development
PPE	personal protective equipment
PSD	Prevention of Significant Deterioration
RMP	Resource Management Plan
ROD	Record of Decision
ROW(s)	right(s)-of-way
SAAQS	State Ambient Air Quality Standards
SCEC	Southern California Earthquake Center
SCGC	Southern California Gas Company
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office(r)
SIP	state implementation plan
SMP	suggested management practice
SMS	Scenery Management System
SOP	standard operating procedure
SUA	Special Use Airspace
TAPS	Trans-Alaska Pipeline System
TDS	total dissolved solids
THPO	Tribal historic preservation officer
TSP	total suspended particulates
TSS	total suspended solids
TVA	Tennessee Valley Authority
U.S.	United States
UDWR	Utah Division of Wildlife Resources
USC	*United States Code*
USDA	U.S. Department of Agriculture
USDS	U.S. Department of State
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

VOC	volatile organic compound
VRM	Visual Resource Management
WGFD	Wyoming Game and Fish Department
WIZ	water influence zone
WRAP	Western Regional Air Partnership
WRCC	Western Regional Climate Center
WSA	Wilderness Study Area
WWEC	West-wide energy corridor

CHEMICALS

CO	carbon monoxide
CO_2	carbon dioxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
O_3	ozone
Pb	lead
SO_2	sulfur dioxide
SO_x	sulfur oxides

UNITS OF MEASURE

cfs	cubic feet per second	lb	pound(s)
dB	decibel(s)	μg	microgram(s)
dBA	A-weighted decibel(s)	$\mu g/m^3$	microgram(s) per cubic meter
dBC	C-weighted decibel(s)	mph	mile(s) per hour
		MVA	million volt-ampere(s)
°F	degrees Fahrenheit	MW	megawatt(s)
g	unit of gravitational acceleration (1 g = 32 feet/s^2)	ppm	part(s) per million
		psig	pound(s) per square inch gauge
Hz	cycle(s) per seconds (hertz)	s	second(s)
kV	kilovolt(s)	t	ton(s)

ENGLISH/METRIC AND METRIC/ENGLISH EQUIVALENTS

The following table lists the appropriate equivalents for English and metric units.

Multiply	By	To Obtain
English/Metric Equivalents		
acres	0.4047	hectares (ha)
cubic feet (ft^3)	0.02832	cubic meters (m^3)
cubic yards (yd^3)	0.7646	cubic meters (m^3)
degrees Fahrenheit (ºF) –32	0.5555	degrees Celsius (ºC)
Feet (ft)	0.3048	meters (m)
gallons (gal)	3.785	liters (L)
gallons (gal)	0.003785	cubic meters (m^3)
inches (in.)	2.540	centimeters (cm)
miles (mi)	1.609	kilometers (km)
miles per hour (mph)	1.609	kilometers per hour (kph)
pounds (lb)	0.4536	kilograms (kg)
short tons (tons)	907.2	kilograms (kg)
short tons (tons)	0.9072	metric tons (t)
square feet (ft^2)	0.09290	square meters (m^2)
square yards (yd^2)	0.8361	square meters (m^2)
square miles (mi^2)	2.590	square kilometers (km^2)
yards (yd)	0.9144	meters (m)
Metric/English Equivalents		
centimeters (cm)	0.3937	inches (in.)
cubic meters (m^3)	35.31	cubic feet (ft^3)
cubic meters (m^3)	1.308	cubic yards (yd^3)
cubic meters (m^3)	264.2	gallons (gal)
degrees Celsius (ºC) +17.78	1.8	degrees Fahrenheit (ºF)
hectares (ha)	2.471	acres
kilograms (kg)	2.205	pounds (lb)
kilograms (kg)	0.001102	short tons (tons)
kilometers (km)	0.6214	miles (mi)
kilometers per hour (kph)	0.6214	miles per hour (mph)
liters (L)	0.2642	gallons (gal)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
metric tons (t)	1.102	short tons (tons)
square kilometers (km^2)	0.3861	square miles (mi^2)
square meters (m^2)	10.76	square feet (ft^2)
square meters (m^2)	1.196	square yards (yd^2)

1 WHY ARE FEDERAL AGENCIES PROPOSING TO DESIGNATE ENERGY CORRIDORS IN THE WEST?

On August 8, 2005, the President signed into law the Energy Policy Act of 2005 (EPAct). In Subtitle F of EPAct, Congress set forth various provisions that would change the way certain federal agencies[1] (Agencies) coordinated to authorize the use of land for a variety of energy-related purposes. Section 368 of EPAct requires, among other things, the designation of energy corridors on federal lands in 11 western states[2] and the establishment of procedures to ensure that additional corridors are identified and designated as necessary and to expedite applications to construct or modify oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities. The Department of Energy (DOE) and Department of the Interior (DOI), Bureau of Land Management (BLM), are the lead agencies in preparation of this Programmatic Environmental Impact Statement (PEIS), and the Department of Agriculture (USDA), Forest Service (FS); Department of Defense; and DOI, Fish and Wildlife Service (USFWS), are among the cooperating agencies in preparation of the EIS.

Corridor designation and associated plan amendments are based on the following direction provided in Section 368:

> ". . . The Secretary of Agriculture, the Secretary of Commerce, the Secretary of Defense, the Secretary of Energy, and the Secretary of the Interior (in this section referred to collectively as "the Secretaries"), in consultation with the Federal Energy Regulatory Commission, states, Tribal or local units of governments as appropriate, affected utility industries, and other interested persons, shall consult with each other and shall—
>
> (1) designate, under their respective authorities, corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on Federal land in the 11 western states (as defined in Section 103(o) of the Federal Land Policy and Management Act of 1976 (43 USC 1702(o));
>
> (2) perform any environmental reviews that may be required to complete the designation of such corridors; and
>
> (3) incorporate the designated corridors into the relevant agency land use and resource management plans or equivalent plans."

Text Box 1-1
Designating Energy Corridors

If the Proposed Action were taken, each Agency would designate a portion of its lands as corridors, defined by a centerline and stated width, that can be used for energy transport projects. The energy corridors would be incorporated into each Agency's land use or resource management plans as areas that are the preferred locations for energy transport projects.

However, designating an energy corridor with a defined corridor centerline and width would not mean that the Agency is approving any specific project. Each proposed energy project would be subject to a project-specific National Environmental Policy Act review. Each proposed energy project would also require a formal, Agency-approved project right-of-way that would contain project-specific requirements. A right-of-way would authorize use of a portion of any designated energy corridor, and the granting of a right-of-way would require a prior project-specific environmental and engineering review.

---

[1] Department of Agriculture, Department of the Interior, Department of Defense, Department of Energy, and Department of Commerce (DOC).

[2] The western states are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Congress also addressed the need for the Agencies to establish procedures that could potentially increase the efficiency of using designated corridors for energy transport and distribution projects. Congress stated:

> "The Secretaries, in consultation with the Federal Energy Regulatory Commission, affected utility industries, and other interested parties, shall establish procedures under their respective authorities that—
>
> (1) ensure that additional corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on federal land are promptly identified and designated as necessary; and
>
> (2) expedite applications to construct or modify oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities within such corridors, taking into account prior analyses and environmental reviews undertaken during designation of such corridors."

Because of the critical importance of improving the western electrical transmission grid, Congress specifically directed the Agencies in Section 368 to consider the need for upgraded and new facilities to deliver electricity throughout the western states:

> ". . . In carrying out [Section 368], the Secretaries shall take into account the need for upgraded and new electricity transmission and distribution facilities to (1) improve reliability; (2) relieve congestion; and (3) enhance capability of the national grid to deliver electricity."

Finally, Congress directed the Agencies to make the designated energy corridors useful to potential applicants by stating that designated corridors "at a minimum specify the centerline, width, and compatible uses of the corridor."

Section 368 *does not* require that the Agencies consider or approve specific projects, applications for rights-of-way (ROWs), or other permits within designated energy corridors.

Text Box 1-2
Private Lands and Section 368

As specified by Section 368, the federal energy corridors would be designated only on federal land. Project proponents that use the corridors would identify the preferred project-specific route across and plan for gaining access to private lands. Project applicants would secure access on private lands in the same manner that they currently obtain access on those lands, independent of the federal corridor designations.

Importantly, Section 368 *does not* direct, license, or otherwise permit any on-the-ground activity of any sort. If an applicant is interested in obtaining an authorization to site a project within any corridor designated under Section 368, the applicant would have to apply for a ROW authorization, and the Agencies would consider each application by applying appropriate project-specific reviews under requirements of laws and related regulations including, but not limited to, the National Environmental Policy Act (NEPA), the Clean Water Act, the Clean Air Act, Section 7 of the

Text Box 1-3
Section 368 Energy
Corridor vs. Right-of-Way

Right-of-way: A land use authorization to allow construction and operation of a specific energy transport project on identified federal lands. "Right-of-way" is also used to refer to the lands so authorized.

Energy corridor: A designation applied to identified federal lands where the construction, operation, or upgrade of one or more energy transport projects is preferred. As guided by the Federal Land Policy and Management Act of 1976, corridors assist in minimizing adverse impacts and the proliferation of separate ROWs. No construction, upgrade, or operation may occur without an authorized right-of-way and appropriate environmental review.

Endangered Species Act (ESA), and Section 106 of the National Historic Preservation Act.

1.1 WHAT IS THE PURPOSE AND NEED FOR DESIGNATING WEST-WIDE ENERGY CORRIDORS?

The purpose and need for Agency action is to implement Section 368 by designating corridors for the preferred location of future oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities and to incorporate the designated corridors into the relevant agency land use and resource management plans.

Section 368 directs the Agencies to take into account the need for upgraded and new infrastructure and to take actions to improve reliability, relieve congestion, and enhance the capability of the national grid to deliver energy. This action only pertains to the designation of corridors for potential facilities on federal lands located within the 11 western states.

In addition, this action is intended to improve coordination among the agencies to increase the efficiency of using designated corridors.

1.1.1 The Existing Western Electricity Transmission System

Electricity consumers in the West rely on an integrated network of more than 49,430 miles of transmission lines to move electricity from generation sources like coal-fired power plants, hydropower facilities, or wind farms to demand centers, and thus provide a reliable supply of power to homes and businesses. Due in part to the West's unique geography and population distribution, where fuel sources and energy generation facilities are often remotely located and large population centers are spread far apart, the electricity transmission grid in the West is typified by high-voltage transmission lines spanning very long distances (see Figure 1.1-1). While these long-distance lines are necessary to provide consumers with reliable and affordable power, the required length of these lines and the complex mix of federally administered public lands with private, Tribal, and state-owned lands make planning and siting energy transport infrastructure a challenge.

Text Box 1.1-1
The Western Electricity Transmission Grid

The western electricity transmission grid is an interconnected network of transmission lines that:

- Encompasses parts of 14 western states, two Canadian provinces, and northwestern Mexico.
- Provides for the long-distance transmission of electricity across these areas in response to electricity demand and supply.
- Currently has more than 49,430 miles of 230-kV or higher electricity transmission lines in 11 western states.

Demand for electric power has grown in the West; however, the capacity to deliver that power has not kept pace. The need for additional electric infrastructure in the West is influenced by several factors, including (1) market restructuring, (2) new energy policies seeking renewable resources, (3) population growth, (4) underinvestment in new lines and technology by the utility sector, and (5) system reliability concerns. Some of these points are further addressed in Text Box 1.1-2. Inadequacies in the electricity transmission system manifest themselves in many ways. One such indication of inadequacies in the electricity transmission system is a phenomenon known as "congestion" (see Text Box 1.1-2). Congestion is a condition of the electricity transmission system resulting from overuse of certain electricity transmission pathways in the system. As a result of congestion, electric system operators can be forced to use generation resources at certain times that may not be as economically or environmentally desirable to deliver the requisite

Text Box 1.1-2
Key Electricity Transmission Issues in the West

Cost. Restructuring and the introduction of free-market forces require adequate transmission to ensure that customers receive competitively priced electricity. Inadequate transmission service can hinder the ability of electricity consumers to access low-cost power and cause costly reliability problems such as blackouts.

Reliability. Customers expect the transmission system to deliver an uninterrupted stream of electricity and avoid disruptions and outages. Reliability can be an issue when demand areas (the customers) have inadequate local sources of energy supply and, therefore, energy must be transported from distant sources during periods of high demand. For example, much of California has inadequate local electricity production. This situation results in the long-distance transmission of electricity to meet peak demands. Any disruption in these long-distance transmission systems can result in local outages in the customer's area.

Redundancy. Multiple long-distance transmission systems provide needed backup if one system fails or cannot meet demand. Increased redundancy thus increases system reliability.

Congestion. Congestion occurs when actual or scheduled flows of electricity on a transmission line or related piece of equipment are restricted below desired levels due to either:

- Physical or electrical capacity of the line, or
- Operational restrictions created and enforced to protect the security and reliability of the grid (DOE 2006a).

Future demand. Population and economic growth, especially in rapidly developing urban and suburban areas over the next 20 years, will increase the demand for energy transport capability.

electric power to consumers and to maintain reliable operation of the grid and thus delivery of electricity.

In response to Section 1221(a), a separate provision of EPAct, the DOE recently completed a nationwide analysis of electricity transmission congestion. The *National Electric Transmission Congestion Study* examined in-depth historical data, existing studies of transmission expansion needs, and regionwide modeling of the western transmission grid. The report concluded that a combination of several factors, including new energy demands and lack of investment in energy transport facilities, are creating electric infrastructure problems in some areas in the West (DOE 2006a) (see Figure 1.1-2). Specifically, DOE identified three types of areas in the West where attention is warranted:

- *Critical Congestion Areas.* These are places where it is essential to remedy existing or growing congestion problems because the current/near-term effects of congestion are severe. The

  DOE study identified southern California as the only Critical Congestion Area in the West. In southern California, the California Independent System Operator (CAISO) observed that various combinations of extreme peak demand, high generation unavailability, or critical transmission losses could cause the southern California area to be short on local generation capacity and require the CAISO to cut loads to maintain grid reliability (CAISO 2006).

- *Congestion Areas of Concern.* DOE identified these as places where large-scale congestion problems exist or may be emerging, but more study is needed to determine the extent and magnitude of the problems. Congestion Areas of Concern in the West include the Phoenix–Tucson area, the Seattle–Portland area, and the San Francisco Bay area. In each of these areas, DOE identified increasing congestion problems such that, even though they do not represent grave threats to system reliability at present, the congestion affecting these areas is a matter of concern due to increasingly poor conditions on the electricity transmission system.

- *Conditional Congestion Areas*. These are places where some transmission congestion exits, but if resources were fully developed (new generation) without the simultaneous development of new means of transmission, congestion would become severe. Conditional Congestion Areas in the West are currently found in the Montana–Wyoming area because of potential coal and wind development.

1.1.2 Natural Gas Transport Infrastructure in the West

Currently, natural gas provides 23% of the total energy consumed each year by the United States, second only to petroleum (EIA 2006c). Figure 1.1-1 illustrates the immensity of the pipeline infrastructure that has developed to accommodate the West's demand for natural gas. In the last 20 years, due in large part to market changes and environmental considerations, natural gas has played an increasingly important role as an energy source for the generation of electric power. There are currently more than 27,000 miles of major natural gas pipelines (>16-inch diameter) in the 11 western states. Overall, even though the need for increased natural gas infrastructure is not now urgent in most locations, market forecasts for natural gas resources make clear that there is a need to ensure that current land use planning decisions are able to facilitate a reliable natural gas transport network in the future. For example, by 2025, the Energy Information Administration (EIA) estimates that the current 23 trillion cubic feet of natural gas capacity in the United States will be insufficient to meet the 25% increase in demand projected over that same time (EIA 2007a).

The need for new natural gas infrastructure arises in the West for three principal reasons. First, demand for natural gas is expected to rise considerably in the short term. Pipeline capacity shortages are already evident in several key areas. In the Pacific region, EIA forecasts there will be a need for a 45% increase in pipeline capacity in the next 10 to 15 years. As the Federal Energy Regulatory Commission's (FERC's) *2006 State of the Markets Report* (FERC 2006) notes, a "lack of pipeline capacity to flow gas from western Wyoming to market was a chronic issue early in this decade" and, in 2006, "led to brief but severe price volatility" in the western Rockies. As a result of tight pipeline capacity for the export of natural gas from western Wyoming, five times during the fall of 2006 relatively minor changes in pipeline infrastructure led to significant price changes (FERC 2006). Second, safety considerations related to the age of pipelines in many areas across the United States are also adding to the demand for new pipeline infrastructure. Lastly, market developments will influence the location of and need for new pipelines. One such example is the development of new resources in the Mountain West area, where additional pipeline capacity will be needed to transport new supplies to demand centers. Also, as conventional resources are economically exhausted, onshore unconventional resources are expected to become an increasingly important source of domestic supply (EIA 2007a). Increased liquefied natural gas (LNG) imports may also necessitate building increased pipeline capacity to facilitate new transport and distribution lines (National Commission on Energy Policy 2006).

1.1.3 Oil and Products Pipeline Infrastructure in the West

Currently, the United States relies on 2 million miles of oil pipelines as the principal means of delivering supplies of oil and refined petroleum products like gasoline to market. These pipelines are essential to maintain secure delivery for the more than 20 million barrels of oil and the 17 million barrels per day of refining capacity necessary to fuel upwards of 220 million cars and trucks on United States roadways (National Commission on Energy Policy 2006).

Two principal factors indicate that the oil pipeline delivery system needs improvement. First, demand for petroleum products in the transportation sector is expected to continue to grow at a rapid pace. Even though alternatives to petroleum products such as ethanol, biofuels, and electricity may become more competitive as technology advances, demand for oil is nevertheless expected to increase for the next several decades. The EIA forecasts a 20% increase in oil consumption by 2020 (EIA 2006d). Additionally, other market factors such as increased petroleum imports due to reduced refinery capacity and expected growth in the production of synthetic liquid fuels like "coal-to-liquid" are expected to affect the need for siting new and upgraded pipeline infrastructure (National Commission on Energy Policy 2006). Second, many of the existing oil pipelines currently in place are aging, further creating the need for new or improved pipeline capacity.

1.1.4 Hydrogen Pipeline Infrastructure Systems

Although hydrogen fuel technologies may have a significant role as a future energy source, insofar as pipelines are concerned, hydrogen generation and transport technologies are still in developmental stages. Currently, fewer than 50 retail stations provide hydrogen fuel to automotive consumers. Without a clear infrastructure system in place, it is difficult to estimate future demand for hydrogen and what hydrogen infrastructure will be needed. Nevertheless, because of the potential role that hydrogen could play in meeting future needs, the Agencies sought in this action to identify locations where future hydrogen pipelines might be suitably located.

1.2 WHAT ARE SOME OF THE EXISTING ADMINISTRATIVE CHALLENGES TO FEDERAL RIGHTS-OF-WAY AUTHORIZATION?

Siting large, long-distance energy transport infrastructure is a complicated task for an applicant and for the Agencies involved in the application process. In addition to addressing the heterogeneous mix of private, state, and Tribal land ownership in the West, energy transport projects must confront a complex pattern of federally controlled lands that are administered by different land management agencies, each with its own set of rules and procedures for granting ROWs for land uses. As a result, energy transport project applicants must satisfy the often disparate requirements of multiple agencies for the same project.

Currently, the Agencies producing this Programmatic Environmental Impact Statement (PEIS) have procedures to authorize ROWs on the lands that they administer. In some locations in the West, the Agencies may work cooperatively to address an application. However, these cooperative arrangements are generally limited in nature and apply to special resource management issues that require joint land management decisions. Generally, the local administrative offices (e.g., BLM field office [BLM FO] or FS national forest) address energy transport within the boundaries of their administrative areas. Some of these local offices have designated local energy corridors in their land management plans as the preferred location for energy transport projects. These local corridors sometimes do not link geographically, for example, because the corridors are of different sizes and widths. In addition, it is often difficult to develop interagency cooperation or corridor paths that align over several different local jurisdictional units because the ROW authorization occurs at the local level.

At present, some of the barriers to infrastructure development in the western states include inconsistent agency procedures for granting ROWs; inconsistent agency views on whether proposed energy infrastructure projects would address near- or long-term energy needs; a lack of coordination among agencies that administer contiguous tracts of land when responding to applications for a ROW across their respective jurisdictions; and the lack of coordination within agency offices regarding the appropriate geographic locations of corridors or ROWs.

When an applicant must seek authorizations from several federal agencies or several local jurisdictions within the same agency, that application may receive prompt approval from one unit but remain under review by other units because of different internal deadlines for review, as well as different priorities. Agencies may also have different guidelines or requirements for an application or a use authorization such that the applicant does not have a clear understanding of what information to submit to a given agency during the application process. Further, the agencies may each have distinct views on whether the transport projects are needed. Also, the agencies may apply different criteria or follow different guidelines when assessing the impacts of an energy project. As a consequence, one agency may approve a ROW authorization while another denies the contiguous ROW that exists on its administered lands. Thus, under the existing regulatory schemes, the potential benefits of direct, cost-effective, and environmentally favorable routing of the energy transport project may be encumbered.

In certain instances, the applicant may face delays because an agency may need to amend its land use or resource management plan to include a corridor for the proposed ROW. These delays may be caused by administrative hurdles and internal analyses, reviews, and approvals required by the local office. The absence of coordinated ROW application procedures and adequate coordination between and within agencies has frustrated efforts to develop the energy infrastructure needed in the West.

1.3 WHAT IS THE PROPOSED ACTION TO ADDRESS THE PURPOSE AND NEED?

As directed by Congress in Section 368 of EPAct, the participating Agencies have examined the long-term needs of increased energy infrastructure in the West and propose to designate energy corridors on federal land for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities in 11 western states. In addition, each Agency proposes to amend its respective land use management plans or similar land use plans, as appropriate, to include the designated energy corridors on land it administers.

In considering potential ways to designate the corridors, the Agencies took into account, per Congress' mandate in Section 368, the need for upgraded and new electricity transmission and distribution facilities to improve reliability, relieve congestion, and enhance the capability of the national grid to deliver electricity. The Agencies decided to propose to locate corridors for the West-wide transport and distribution of energy (electricity, oil, natural gas, and hydrogen) between supply and demand areas in the 11 western states while avoiding sensitive resources and land use and regulatory constraints to the fullest extent possible. If applicants develop energy transport projects within the proposed corridors, the resulting

Text Box 1.3-1
Amending Land Use Plans

For the Agencies involved in designating energy transport corridors, the land use planning process serves as the means to formally allocate corridor areas on federally administered lands. The land use planning process is different for each Agency, and the following highlights how each Agency conducts land use planning.

Forest Service

Land management plans guide the FS in fulfilling its responsibilities for stewardship of the National Forest System. Land management plans are generally strategic and contain desired conditions, objectives, and guidance for project and activity decision making in the plan area, usually a national forest. The Chief of the FS designates energy corridors on National Forest System lands in the 11 western states by amending the affected forest land management plans. While forest land management plans may be amended by Forest Supervisors, the Chief reserves the authority for this decision so that all affected land management plans may be amended simultaneously.

FS planning regulations also ensure that the FS, as a participant in a multi-federal agency effort, may waive the appeal or objection procedures in its own regulations and adopt the administrative review procedure of another participating federal agency. In this case, the FS would adopt the Bureau of Land Management objection process and provide a joint agency response to those who file for administrative review of this multi-agency effort.

Bureau of Land Management

Land use planning is the primary method that the BLM uses to maintain the balance between land and resource use and the conservation of sensitive resources. Land use planning is a core function required by the Federal Land Policy and Management Act of 1976, which supports the BLM mission to foster multiple use and sustained yield on public lands. Planning emphases include balancing the development of domestic energy supplies with the protection of sensitive resources, managing rangelands and forests to achieve healthy ecosystems, providing recreational opportunities, and protecting cultural and heritage resources, among others.

Over the past two decades, the magnitude and complexity of resource issues relating to the management of public lands have grown. In response to these changing conditions, the BLM completed more than 40 new or revised plans in the last 5 years, and is currently revising more than 60 additional plans. New plans and plan amendments are subject to NEPA review, and the planning process is often characterized by considerable public interest and involvement. The BLM will continue to develop and amend land use plans as needed to address emerging issues of national importance, such as the recently passed Energy Policy Act of 2005, and will continue to benefit from the participation of its many constituents as it does so.

U.S. Fish and Wildlife Service

The USFWS conducts land management planning based on individual regulations, trusts, agreements, or cooperative relationships that govern individual refuges. The planning process must address both local refuge restrictions or agreements and national policies and laws related to refuge lands.

Department of Defense

The DOD conducts planning at each installation through the production use of a master plan that addresses mission needs, tenant needs, air space issues, natural and cultural resources, and regulatory requirements. The plan is usually maintained by the base civil engineering office and is developed and maintained to ensure that the DOD mission is successfully accomplished at each installation.

Department of Energy

The DOE has no formal land use planning process. Each facility addresses individual mission needs and reports to a primary DOE office and/or program that serves as the landlord of each facility.

infrastructure would aid in alleviating congestion problems associated with electricity transmission in the West.

The Agencies here propose to designate corridors in locations that were selected using a systematic, three-step siting process, which is discussed in detail in Section 2.2 of this PEIS.

The proposed corridor designations would not approve any site-specific activities or projects or prejudge the environmental impacts of individual projects. While the type of environmental review to be conducted is not specified in Section 368, the Agencies have decided to prepare this PEIS to conduct an environmental review at the programmatic level, integrate the NEPA process early in the planning process, and address potential conflicts among Agencies. If the Agencies decide at the end of this environmental review, under NEPA, to designate a system of energy corridors, it will be for the purpose of establishing those corridors as preferred locations for energy transport projects. Again, the designation of such a system of corridors would not authorize parties to proceed with any site-specific projects or to carry out any activities in these corridors. Corridor designation will have no direct impacts that may significantly affect the quality of the human environment. As noted above, if individual projects are proposed, any applications for such projects will be subject to environmental review under NEPA and other applicable laws.

Similarly, if the Agencies decide to amend related land use plans, this also would not authorize any site-specific activities. By amending land use plans at the designation stage, the proposed action may accelerate the process of subsequently applying for energy project ROWs. In particular, an applicant could avoid delays associated with seeking a land use plan amendment for a specific project. However, as with the designation of corridors, the amendment of land use plans would not authorize parties to proceed with any site-specific projects, or to carry out any activities in areas within the corridors, and accordingly will not result in any on-the-ground impacts that may significantly affect the quality of the human environment. If individual projects are sited, as noted above, any applications for such projects would be subject to environmental review under applicable statutes.

The Agencies also note that designating a system of energy corridors would not preclude an applicant from applying for a ROW outside of the designated energy corridors, and the current process to authorize ROWs would apply to the application. However, such an applicant would not benefit from the coordinated interagency application procedures that would be established under Section 368, any land use plans that have already been amended to contain designated Section 368 energy corridors, or environmental analyses already examined in this PEIS.

1.4 HOW WILL THE AGENCIES EXPEDITE THE APPLICATION PROCESS?

Section 368 directs the Agencies to establish procedures under their respective authorities to expedite the application process for energy-related projects within Section 368 designated corridors. The Agencies would include uniform interagency operating procedures (listed and described in more detail at Section 2.4) for reviewing applications for energy ROWs within designated Section 368 corridors. Importantly, the Agencies will appoint one federal point-of-contact (POC) who will represent the Agencies in specified matters pertaining to a ROW application in a designated energy corridor. The POC will be the liaison among the applicant, the Agencies, and any other federal regulatory agency involved in a land use authorization. The Agencies will provide a summary of the duties, responsibilities, and authorities of the POC to the applicant.

To highlight the proposed efficiencies gained by applicants who choose to apply for energy transport projects in the Section 368 designated energy corridors, the authorization process anticipated by the Agencies is described below by application, data analysis, and authorization for land use.

Application Process

- Interagency operating procedures listed in the PEIS and Record of Decision (ROD) should expedite the preparation and review of an application for an energy transport project in a Section 368 designated energy corridor.

- Agencies provide a single federal POC for the application.

- Agencies require one coordinated project-specific environmental review process tiered from the PEIS.

Data Analysis

- Analysis of information presented in this PEIS would assist in describing project-specific potential environmental impacts including findings for threatened and endangered species, cultural resources, proposed mitigation, and wetland impacts.

- Analysis of engineering information addressing proposed ROW use in the designated energy corridor would be guided by guidelines and corridor suitability found in the PEIS and ROD.

- Compatibility issues with other potential energy transport projects that could be colocated in the corridor (e.g., efficient location of individual ROWs within the corridor boundaries) would be developed by the applicant in consultation with the federal POC.

Use Authorization

- Land use plans would be amended to allow energy transport projects to be located in the designated energy corridor. Any land use authorization for a ROW would be consistent with other land uses and agency plans.

- One POC would serve as liaison with the applicant, the Agencies, and any other federal agencies involved in the application (e.g., coordination of ESA Section 7 consultation with the USFWS and National Oceanic and Atmospheric Administration [NOAA] fisheries, or the Advisory Council on Historic Preservation, as needed).

- Land-use authorization would use guidelines and procedures described in the Agencies' individual RODs.

The procedures identified above describe how a ROW applicant and the public may benefit from a streamlined and coordinated review of an application to use a Section 368 designated energy corridor.

The Proposed Action of designating Section 368 corridors does *not*:

1. Guarantee that a specific project would be approved in a designated energy corridor. The Agencies must review each project-specific application and conduct an appropriate environmental review for each project;

2. Limit an Agency's discretion to deny a ROW or other permit within the designated energy corridor or elsewhere;

3. Alter an Agency's internal procedures for review and approval of site-specific projects as facilitated through an appropriate interagency POC;

4. Establish energy corridors on nonfederal lands;

5. Preclude any proposal for a project outside of a Section 368 designated corridor.

6. Limit proponents to applying for permits solely within designated corridors.

1.5 WHY IS A "NO EFFECT" DETERMINATION BEING MADE UNDER THE ENDANGERED SPECIES ACT FOR DESIGNATING ENERGY CORRIDORS ON FEDERAL LAND?

1.5.1 ESA Section 7 Requirements

Section 7 of the Endangered Species Act (ESA) directs each federal agency, in consultation with the Secretary of the Interior and the Secretary of Commerce, as appropriate, to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any listed threatened or endangered. species or result in the destruction or adverse modification of critical habitat.[3]

Under Section 7 of the ESA, those agencies that authorize, fund, or carry out a federal action are commonly known as "action agencies." If an action agency determines that its federal action "may affect" listed species or critical habitat, it must consult with the USFWS of the DOI or the NMFS of the DOC (collectively known as the "Services") or both, whichever has jurisdiction over the species or habitat that may be affected.[4]

If an action agency does not believe that the federal action will have any effect on listed species or critical habitat, the agency will make a "no effect" determination. In that case, the action agency does not initiate consultation with the Services and its obligations under Section 7 are complete.

1.5.2 Agency Status under ESA Section 7

The DOI, USDA, and DOD have concluded that they are action agencies for ESA purposes because each manages federal land where the proposed energy corridors may be designated under Section 368. Each action agency is tasked with designating energy corridors on federal land and incorporating these corridors into appropriate land use plans by amending them.

The DOE has determined that it is not an action agency because it does not manage any federal lands where the proposed energy corridors would be designated under Section 368. As such, the Proposed Action does not involve any action by this agency to incorporate the proposed corridors into any land use plans that it may have issued.

1.5.3 Basis for "Effects" Determination under Section 7 of the ESA

In complying with their duties under Section 7 of the ESA, the action agencies have examined the effects of designating federal land under Section 368 and amending land use plans on listed species and critical habitat. As a result of this examination, the action agencies have determined that designating corridors through land use plan amendments would have no effect on a listed species or on critical habitat. This determination is based on the following:

First: The Proposed Action, designation of energy corridors and amendment of land use plans, would not have any direct impact on the environment. Designation of an energy corridor is an administrative task that occurs when an action agency amends its land use plans to show an area, identified by centerline, corridor width,

---

3 See ESA § 7; 16 USC 1536. The standard for determining when federal agencies must consult under the ESA is different from the standard for determining when federal agencies must prepare an Environmental Impact Statement under the National Environmental Policy Act.

4 See 50 CFR 402.2, 402.13-14.

and compatible use, to be used for Section 368 purposes. The Proposed Action has no impacts on a listed species or critical habitat.

Second: The Proposed Action does not impact the environment within a designated energy corridor, nor does it establish a precedent or create any legal right that would allow ground-disturbing activities within a designated energy corridor.

Third: An application for a ROW, permit, or other authorization for Section 368 purposes describing land in a designated energy corridor is subject to full policy and legal review at the time it is filed and may be denied by an action agency. Any ground-disturbing activities that may occur in a corridor in the future would be reviewed by an action agency under the ESA and other applicable statutes when individual proposals are submitted. If consistent with law, these future activities may be authorized by the grant of a ROW, permit, or other authorization, but only following site-specific compliance with ESA and other applicable laws.

Fourth: An application for a ROW, permit, or other authorization for Section 368 purposes describing land outside a designated energy corridor is subject to full policy and legal review and may be granted by an action agency.

For the above reasons, the action agencies have determined that designating energy corridors under Section 368 of the Energy Policy Act and incorporating these corridors in land use plans would have no effect on listed threatened or endangered species or critical habitat.

The action agencies reach their “no effect” determination not because listed species and critical habitat are unlikely to be present in the corridors described in the alternatives. To the contrary, Table 3.8-5 identifies numerous listed species that occur in the 11 western states where energy corridors could be designated. Portions of the corridors would likely include areas occupied by listed species or within critical habitat.

The action agencies considered preparing a biological assessment and initiating consultation with USFWS and NMFS under Section 7(a)(2). After discussing various approaches, the action agencies determined, however, that the administrative action of drawing lines on a map to designate energy corridors would have no effect on listed species or critical habitat. Preparing a biological assessment before a site-specific project had been proposed to the agencies would be based largely on conjecture and speculation. There would be simply no way to know before such a site-specific proposal is made whether the impacts to be assessed would be those of an overhead electricity transmission line or buried oil or gas pipeline or some combination of uses. Further, without knowing the specifics of when and where a project would occur within a corridor, it would be impossible to know what species, if any, would be affected by these future projects. The agencies considered whether it made sense to make assumptions for the purposes of a biological assessment, but were left with no credible basis on which to make such assumptions. The agencies determined such assumptions would be speculative and not linked to the federal action of designating energy corridors through land use plan amendments. Any biological assessment would be a speculative assessment of effects from future site-specific projects, not of the Proposed Action.

This is not to say that there would be no Section 7 consultations (including preparation of biological assessments or biological opinions where appropriate) on future actions that may affect listed species or critical habitat, On the contrary, the action agencies fully expect that Section 7 consultations will be appropriate as projects within a corridor are proposed. That is, if an application for a ROW, permit, or other authorization is received by an action agency for lands within a designated corridor, further compliance with Section 7 of the ESA would be initiated at that time.[5] This may take the form of preparation of a biological assessment by the action agencies and issuance of a biological opinion by USFWS and/or NMFS; a "may affect, not likely to adversely affect" determination by the action agencies with Service concurrence; or a "no effect" determination by the action agencies. At such time, any biological assessment, biological opinion, concurrence; or "no effect" determination would be based on a detailed ROW application describing the project, site, and method of construction, all features lacking at the present time.

Officials at NMFS do not agree with the action agencies' "no effect" determination. In a written communication received in June 2007, NMFS states that the designation of energy corridors in areas that contain salmonids and their critical habitat "may affect" listed species, thus triggering ESA consultation requirements. NMFS also notes that nothing in this draft PEIS allows it to discount adverse effects. "As a result, DOE should engage in a consultation with NMFS pursuant to the ESA on the proposed designation of energy corridors," NMFS concludes.

Having carefully considered NMFS's position, the action agencies maintain that the Proposed Action would have no effect on a listed species or critical habitat. For the reasons stated above, the action agencies found no causal connection, whether direct or indirect, between the mere designation of energy corridors (by land use plan amendment) and any effect on a listed species or critical habitat. Any effects to a listed species or critical habitat, which are simply unknown at this time, that might occur in a corridor in the future are caused by the grant of a ROW, permit, or other authorization, following full policy and legal review, including any consultation under Section 7 of the ESA. Designation of an energy corridor neither guarantees that a ROW application for lands within a corridor will be granted, nor that an application for lands outside a corridor will be denied. The action agencies further found that NMFS had yet to provide the action agencies with a fully articulated rationale or analysis sufficient to cause the agencies to alter their determination.

The USFWS agrees with the "no effect" determination of the action agencies.

1.6 WHAT ARE THE ALTERNATIVES ANALYZED IN THIS PEIS?

The Agencies have proposed two alternatives:

1. *No Action.* No land would be designated as a Section 368 corridor.

2. *Proposed Action.* Designation of Section 368 energy corridors and amendment of land use plans on federal land. More than 6,000 miles of Section 368 corridors would be designated within federal lands in the 11 western states as identified by environmental, engineering, and land use screening criteria to reduce potential environmental and land use conflicts.

These alternatives are considered in more detail in Chapter 2 of this PEIS. As noted above, the PEIS does not consider project-specific activities because the proposed designation does not involve or direct the authorization of any specific projects.

---

[5] Further, if a future, site-specific proposal may adversely affect essential fish habitat (EFH), the action agencies would consult with NMFS, as required by the Magnuson Stevens Fishery Conservation and Management Act, 16 USC l855(b)(2), prior to approval.

1.7 WHY CONDUCT THE ENVIRONMENTAL REVIEW UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT?

Section 368 requires the Agencies to conduct any "environmental reviews" necessary to complete the designation of Section 368 energy corridors. The proposed designation of Section 368 energy corridors would not result in any direct impacts on the ground that may significantly affect the quality of the human environment. Nevertheless, the Agencies have decided to prepare a PEIS to conduct a detailed environmental analysis at the programmatic level and to integrate NEPA at the earliest possible time. The proposed designation of more than 6,000 miles of Section 368 energy corridors among the various agency land use plans is a forward-looking response, mandated by statute, to address a national concern.

The Agencies recognize that while thousands of miles of corridors may be designated, it is not possible to predict whether or where future applicants would seek to site their projects; nor is it possible to predict with specificity the type of projects that may be proposed at a particular location (e.g., an underground pipeline as opposed to an above-ground transmission line); nor is it possible to predict whether such site-specific projects that may be proposed in the future would involve electricity, gas, hydrogen, or oil energy transport systems. As such, at this time it would be speculative and neither practicable nor possible to evaluate environmental impacts associated with such potential projects. As discussed below, in the event that site-specific projects would be proposed in the future in areas located within designated corridors, such individual projects would be subject to appropriate environmental review and analysis. A discussion of the *generic* impacts of project construction and operation appears in Chapter 3.

Quantifiable and accurate evaluation of impacts at the local scale can be made only in response to an actual proposed energy project, when a proposal for an action with specific environmental consequences exists. Until a site-specific project is presented to the Agencies and the project is evaluated, authorized, and implemented, the land and resources within a designated energy corridor would remain unchanged.

1.7.1 Why Are the Agencies Preparing a Programmatic Analysis?

NEPA requires that federal agencies prepare a "detailed statement for major federal actions significantly affecting the quality of the human environment."[6] Here, the Agencies have concluded that preparing a PEIS at this time to examine region-wide environmental concerns is appropriate, even in the absence of on-the-ground environmental impacts resulting from the designation. Actual local environmental impacts must inevitably await site-specific proposals and the required site-specific environmental review.

The decision to prepare an EIS for a programmatic action such as that described by Section 368 is supported by Council on Environmental Quality (CEQ) regulations at Title 40, Part 1502.4(b), of the *Code of Federal Regulations* (40 CFR 1502.4(b)), which state that "Environmental Impact Statements may be prepared and are sometimes required, for broad federal actions such as the adoption of new agency programs or regulations (Section 1508.8). Agencies shall prepare statements on broad actions so that they are relevant to policy and are timed to coincide with meaningful points in agency planning and decision making."

Preparing a PEIS now is consistent with the CEQ regulations, which encourage agencies to "integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and

6 NEPA § 102(2).

to head off potential conflicts."[7] Further, preparation of a PEIS provides an established and familiar vehicle to examine potential environmental concerns.[8]

A PEIS also allows for early public participation in the Section 368 energy corridor designation process through a mechanism familiar to interested members of the public. The designation of several thousand miles of energy transportation corridors is a large task. The PEIS allows the Agencies very early in the process to seek public input through open comment periods and public forums where concerns regarding Section 368 energy corridors can be raised. The Agencies are seeking public review and comment on this proposal to better inform their decision-making process.

Additionally, this PEIS may greatly assist subsequent, site-specific analyses for individual project proposals by allowing the Agencies to incorporate the relevant provisions of this PEIS into those later analyses, as required by Section 368. For example, if an applicant should apply for a specific ROW within a Section 368 energy corridor, the participating Agencies will have management practices and mitigation procedures developed in the PEIS available for their consideration. The process used to select the corridor locations applied a number of environmental, engineering, and land use screening criteria that served to reduce potential environmental and land use conflicts (see Section 2.2.1). This process and the analysis presented in the PEIS will provide the Agencies with useful information and analysis to inform future decisions.

[7] 40 CFR 1501.2.

[8] BLM regulations also provide that BLM conduct a NEPA review prior to any amendment to its federal land resource and management plans (43 CFR 1610.5-5). The BLM, as well as the FS, have existing land resource and management plans in the areas included in the proposed Section 368 energy corridor designation.

1.7.2 What Is the Scope of the PEIS?

The scope of the analysis in the PEIS includes an assessment of any positive and negative environmental, social, and economic impacts of the alternatives. The Agencies examined the direct, indirect, and cumulative impacts of corridor designation on the natural environment, social systems, and the economy. The analyses conducted in preparation of the PEIS are based on current, available, and credible scientific and engineering information.

As a programmatic evaluation, this PEIS does not evaluate site-specific issues associated with potential individual energy transport projects. The combined and individual effects of location-specific and project-specific impacts are not foreseeable at the Section 368 energy corridor designation stage. Therefore, the Agencies do not speculate about project- and location-specific impacts in this PEIS. Local and project-specific impacts will be evaluated in the future at the individual-project level, and site-specific impacts will be addressed during individual project reviews. Individual project analyses, reviews, and approvals and denials may tier off the PEIS, thus using and referencing the information, analyses, and conclusions presented in the PEIS to supplement the project-specific reviews and analyses. However, individual project-specific decision making will not be supplanted by the PEIS.

1.8 WHAT ARE THE PLANNING DECISIONS THAT ARE BEING PROPOSED IN THIS PEIS?

1.8.1 What Planning Decisions Are Being Proposed in the PEIS?

Upon signing RODs, the BLM, FS, USFWS, and, if applicable, the DOD would amend their respective affected land use plans to incorporate the corridor designation. Corridor designation on these federal lands would be defined by a centerline and width to accommodate future proposed energy transport projects. (Refer to Appendix A for the list of Agency land use plans proposed to be amended upon issuing the RODs.)

1.8.2 What Planning Decisions Are Not Being Proposed in the PEIS?

As specified in Section 368, these energy corridors would be designated only on federal lands, not private lands. Applicants would be required to identify preferred project-specific routes across and plan for gaining authorization to cross private lands. Project applicants would secure authorizations across private lands in the same manner that they currently do, independent of the application process for corridors on federal lands.

In addition, designating an energy corridor does not mean that the Agencies are approving specific energy transport projects. Future proposals for specific energy transport projects require project-specific applications at the Agency level, containing site-specific requirements.

A ROW would authorize specific project actions and would require a prior project-specific environmental review subject to NEPA and other laws and regulations, as well as a coordinated engineering review.

1.9 WHAT KINDS OF OUTREACH ACTIVITIES DID THE PEIS PROJECT UNDERTAKE?

The process to produce the PEIS required a number of process steps (see Figure 1.9-1) that included opportunities for public involvement and comment. The Agencies are undertaking an extensive public outreach effort to maintain an open and transparent process within all levels of organization in each Agency and by members of the public and interested stakeholders.

1.9.1 Public Involvement

A Notice of Intent (NOI) to prepare the PEIS, amend relevant agency land use plans, and conduct public scoping meetings, as well as a notice of floodplain and wetlands involvement, was published in Volume 70, p. 56647, of the *Federal Register* (70 FR 56647) on September 28, 2005. The Agencies advertised the opportunity for the public to become involved through a "scoping" process, in which interested parties could comment on the scope and content of the PEIS. The Agencies conducted scoping for the PEIS from September 28 to November 28, 2005. A summary of the scoping process and what the public presented to the Agencies can be found in Appendix B and at http://corridoreis.anl.gov.

To encourage public participation, the Agencies provided multiple ways to communicate about issues and submit comments. The NOI identified five methods by which the public could submit comments or suggestions to the Agencies on the preparation of the PEIS:

- Public scoping meetings,
- Traditional mail delivery,
- Facsimile transmission (fax),
- Telephone, and
- Public Web site with automated comment form.

Public scoping meetings were held in each of the 11 potentially affected states (see Table 1.9-1). At each meeting location, two meetings were scheduled on the same day: one in the afternoon, and the other in the evening. The public could also provide comments or suggestions on the scope of the PEIS by using the project Web site at http://corridoreis.anl.gov to complete and submit a scoping comment

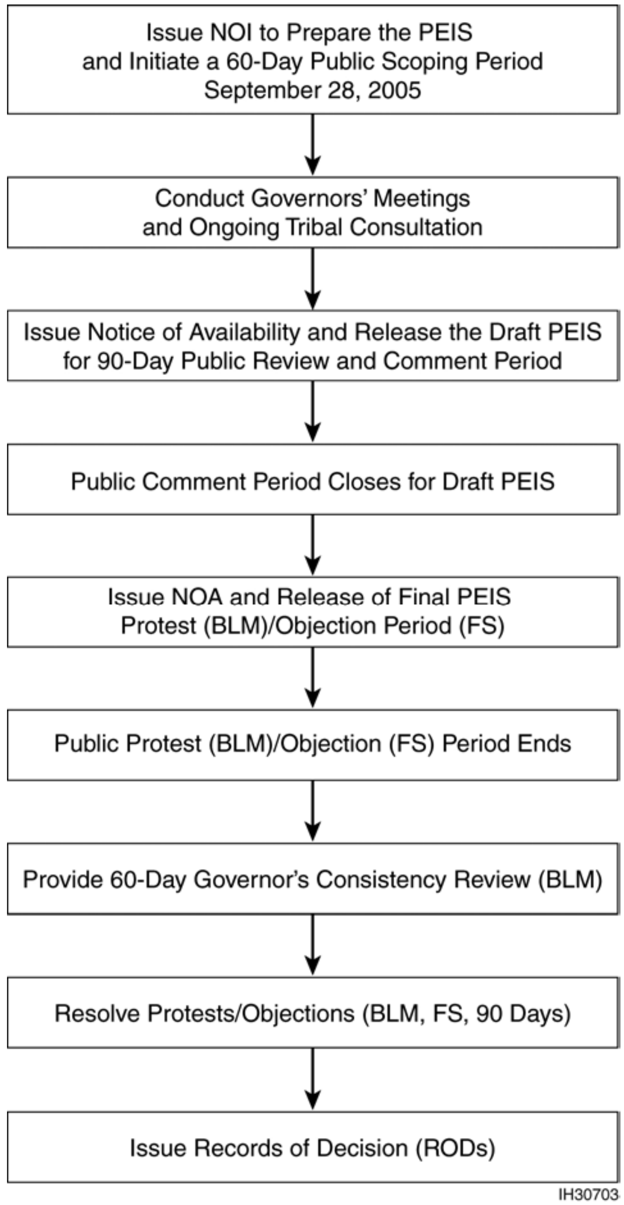


FIGURE 1.9-1 Process for Preparing the PEIS and RODs, Including Steps That Allow Public Comment and Participation

TABLE 1.9-1 Scoping Meeting Summary Statistics[a]

Attendee Affiliation	Denver, CO Oct. 25	Albuquerque, NM Oct. 26	Salt Lake City, UT Oct. 26	Cheyenne, WY Oct. 27	Helena, MT Oct. 27	Boise, ID Nov. 1	Sacramento, CA Nov. 1	Las Vegas, NV Nov. 2	Portland, OR Nov. 2	Phoenix, AZ Nov. 3	Seattle, WA Nov. 3	Total No. of Registered Attendees
	Meeting Location and Date in 2005											
Government	15	16	10	37	24	16	28	9	17	18	6	196
Industry	25	24	25	24	20	9	20	30	16	35	4	232
Environmental	2	0	2	1	1	2	2	4	1	0	0	15
Tribal	2	0	6	0	1	0	0	0	0	6	2	17
Other	6	2	5	2	2	3	0	4	2	3	2	31
Individual/none	4	3	13	7	3	1	1	1	1	12	1	47
Total no. of registered attendees	54	45	61	71	51	31	51	48	37	74	15	538
No. of attendees providing comments	10	5	9	4	8	4	8	10	6	9	2	75

[a] For each date, attendance figures represent the combined attendance of the two meetings held on that date.

form. All comments, regardless of how they were submitted, received equal consideration in the preparation of the PEIS. Comments were received from industry, state and local governments, Tribal Nations, environmental organizations, and unaffiliated individuals. The majority of the comments were associated with electricity and natural gas issues (see Text Box 1.9-1). All scoping comments can be viewed on the public Web site at http://corridoreis.anl.gov. Issues raised during the public scoping period can be found in Appendix B.

Text Box 1.9-1
Scoping Comment Statistics

Commentor Affiliation
- Industry – 48%
- Government – 18%
- Environmental – 8%
- Native American affiliation – 5%
- Unaffiliated individuals – 20%

Commentor Energy Interest (when noted)
- Electricity – 42%
- Natural Gas – 27%
- Oil – 13%
- Renewable – 17%

The Agencies also provided the public with maps of the preliminary corridor routes and alternatives in June 2006. The public was asked to comment on the routes and provide the Agencies with suggestions and recommendations on the preliminary routes. The Agencies used the information provided by the public to assist in developing the Proposed Action presented in the PEIS. The maps and the comments can be viewed at http://corridoreis.anl.gov.

1.9.2 Meetings with the Governors

The Agencies conducted a number of meetings after the scoping period with the 11 western governors and/or their appointed staff. The meetings were a direct outcome of a letter sent on February 6, 2006, by Mr. Kevin Kolevar, Director, Office of Electricity Delivery and Energy Reliability of DOE, to each governor from the 11 western states. In the letter, the Agencies invited the governors and their respective staff members to meet with Agency project managers. The meetings provided the project team with the opportunity to brief the governors and their staff members on the status of the PEIS. Discussion centered on the issues brought up during the public scoping period, data that each state could provide related to corridor location constraints and opportunities, and state-specific items related to energy planning environmental concerns and stakeholder involvement.

1.9.3 Tribal Nation Government-to-Government Consultation

Although EPAct Section 368 does not apply to Indian lands, the Agencies undertook an extensive effort to initiate consultation with potentially affected federally recognized Indian Tribes. In general, the Agencies recognized that Section 368's designation of energy corridors on federal lands has implications for Indian Tribes beyond current Indian lands. For example, it is common for federal lands to overlap with or be encompassed by an Indian Tribe's ancestral or ceded lands where Tribes have ongoing interests. Specifically, Indian Tribes often have interests in protecting cultural resources on federal lands, utilizing or maintaining traditional resources on federal lands, or maintaining usual and accustomed fishing sites in the Northwest. In addition, a number of Indian Tribes are developing energy resources and may be interested in connecting their energy transport systems with an energy corridor on federal lands.

The Agencies sought government-to-government consultation with Indian Tribes as set out in Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments" (65 FR 67249, November 6, 2000), and within policies of the individual agencies. These ongoing consultations are intended to ensure that the designation of energy corridors considers and accounts for the interests of Indian Tribes throughout the NEPA process. These consultations also will assist the Agencies in compliance with Section 106 of the National Historic Preservation Act (NHPA) during the NEPA process.

There are more than 250 federally recognized Tribes with ancestral territorial claims in the 11 western states. Because traditional Tribal territories often lie well beyond modern reservation boundaries, steps were taken to inform all of these Tribes regarding the implementation of Section 368 and to provide opportunities for them to participate in government-to-government consultation. Because of the potential scale of consultation activities, a range of information exchange and consultation activities were employed. Tribes were encouraged to participate in scoping and comment avenues open to all citizens, and were encouraged to use familiar and established channels of communication with local Agency personnel to get and give information. In addition, special regional Tribal information meetings were held, a government-to-government consultation section was included on the project Web site (http://corridoreis.anl.gov), an interagency Tribal Consultation Working Group was established, and a central point of contact for receiving and tracking Tribal information requests was established.

During the public scoping period, potentially affected Tribes were contacted by letters sent by either BLM state directors or FS regional foresters. The letters outlined the scoping process and encouraged the Tribes to submit scoping comments at scoping meetings, by mail or electronically through the project Web site (see Appendix C for an example of the letter). Nine Tribes or Tribal Nations presented issues and concerns to the project team through the public scoping process.

In April 2006, following the scoping period, Mr. Kevin Kolevar, Director of the DOE Office of Electricity Delivery and Energy Reliability, sent a letter to Tribes in the 11 western states inviting Tribal representatives to regional information meetings to be held in May throughout the West. Twenty-nine Tribes sent representatives to these meetings where the project was discussed, Tribal concerns were aired, and Tribes were invited to enter into consultation. The Tribes were also invited to comment on the draft corridor map to be released in June 2006. Five Tribes submitted comments on the map. All invited Tribes received a summary report on the meetings (see Appendix C) and updated statewide corridor maps. Later, letters inviting consultation and summarizing the information presented at the Tribal meetings were sent to 13 additional

Text Box 1.9-2
Government-to-Government Consultation

As a part of the government's treaty and trust responsibilities, federal agencies engage in government-to-government consultation with federally recognized Native American Tribes as part of their project review. Government-to-government consultation with Native American groups has been ongoing throughout the project. As part of the consultation, 252 Tribes in the western United States were contacted concerning the project. A Tribal Consultation Working Group consisting of representatives from the DOE, the FS, and the BLM was established to facilitate coordination and interaction between Tribal groups and the federal Agencies involved with this PEIS. Below are several milestones related to government-to-government consultation:

- April 14, 2006 – All federally recognized Tribes in the 11 western states were invited to regional Tribal information meetings.
- May 9–25, 2006 – Five regional Tribal information meetings held.
- July 10, 2006 – Summary of regional meetings (Tribal Information Update) and invitation to consultation sent to all western Tribes.

Tribes with traditional territorial claims in the 11 western states, but with reservations in other states.

Thirty-five Tribal groups have entered into some form of one-on-one dialogue with the Agencies (see Appendix C). As early as the scoping process, Tribes began to accept the invitation to enter into government-to-government consultation. A single POC was established at Argonne National Laboratory to answer Tribal requests for information and consultation. At the same time, an interagency Tribal Consultation Working Group was set up to implement consultation. This Working Group developed a consultation protocol including points of contact within each Agency, to manage contacts with interested Tribes (see Appendix C). The protocol takes advantage of existing relationships between local Agency representatives and the Tribes. Once a request for consultation was received, it was forwarded to the Tribal Consultation Work Group, which assigned a local Agency POC to initiate discussions. Consultation could occur at any level desired by the Tribe. In general, local POCs provided basic information and fielded requests for additional information such as more detailed maps. In cases where further consultation was desired, the Agency POCs acted as facilitators setting up consultation with project managers. As necessary, Agency project managers traveled to the West to meet with Tribal groups, or Tribal representatives came to Washington, D.C., for discussions. One Tribe, the Coeur d'Alene of Idaho, became a cooperating agency.

Local knowledge of Native American concerns was sought throughout the West to avoid areas sensitive to Native Americans. State and local BLM and FS offices used local knowledge to follow up on the initial contacts with letters and telephone calls to those groups expressing a desire to consult, or who would be most directly affected by the proposed corridors. The most common Tribal request was for more detailed maps (which were provided), to meet again after the draft PEIS was issued, and to be given adequate notice of any planned development in the proposed corridors. Information on potential culturally sensitive areas was also acquired. Where there was local precedent and the established working relationship with local Tribes warranted it, Agency offices included Native Americans in the internal review process of the preliminary draft of this document.

It is likely that Native American groups will have additional comments on the PEIS. This PEIS is being made available to all 252 federally recognized Tribes with traditional interests in the 11 western states. The Agencies will remain in communication with them during the PEIS process. For more information, see Appendix C.

1.9.4 Cooperating Nonfederal Agencies

The Agencies were assisted with the preparation of the draft PEIS by two states, three county governments, two conservation districts, and one Tribe, each of which requested cooperating status.[9] The role of the cooperating agencies was to provide information to the Agencies on environmental, economic, and social issues to be considered during the corridor identification process. The California Energy Commission represented the State of California and in coordination with the BLM and FS established an interagency team of federal and state agencies to ensure that the state's energy and infrastructure needs, renewable energy generation policy goals, and environmental concerns were considered in the PEIS. The other cooperating agencies also provided information on Tribal, state, or local issues that could assist the Agencies in siting corridors and developing the PEIS.

---

9 The cooperating entities were the state of Wyoming; the Coeur d'Alene Tribe; Lincoln, Sweetwater, and Uinta counties, Wyoming; and Sweetwater and Uinta conservation districts, Wyoming.

1.9.5 Ongoing Project Communication with the Public

The Agencies maintain a public Web site and e-mail communication with interested stakeholders at http://corridoreis.anl.gov. The public Web site provides background information, access to all public comments received during public scoping, technical documents, overall project status, preliminary maps of possible corridor locations, and the PEIS. Members of the public can request electronic e-mail updates and news, which are then automatically sent to them. As of September 23, 2007, more than 475,000 Web pages were viewed in 95,000 user sessions by 30,841 visitors. Currently, more than 1,426 individuals and/or organizations have requested and received project updates via e-mail. In addition, more than 9,000 individuals and groups have downloaded the preliminary corridor location maps that were released to the public during June 2006.

Upon release of the draft PEIS, the Agencies will hold a 90-day public comment period, during which comments on the draft PEIS will be received by the Agencies. Public meetings will be held throughout the West and Washington, D.C., during the 90-day comment period. Additionally, written, fax, and Web-based comments can be sent to the Agencies during the public comment period. All public comments will be treated equally, no matter how received.

1.10 WHAT KINDS OF REGULATIONS OR LAWS APPLY TO THE ENERGY CORRIDORS?

Regulations that apply to the granting of ROWs for energy projects are presented in Appendix D. Federal decisions to grant a ROW or designate an energy corridor are made within the context of applicable land use plans developed in cooperation with other federal agencies; state, county, local, and Tribal governments; and the public. Land use plans must comply with all applicable laws, regulations, and executive orders. In addition, holders of approved applications issued by federal agencies must also comply with all applicable laws and regulations and receive all necessary permits.

1.11 HOW IS THE PEIS ORGANIZED?

This PEIS consists of three volumes. Volume I is organized as follows:

- Chapter 1 provides information on Section 368 and the energy transport issues addressed by the designation of energy corridors on federal lands in the West. The purpose and the need for the Proposed Action to designate energy corridors and amend land use and equivalent plans is also contained in Chapter 1. Public outreach, including public scoping, and Tribal consultation through the government-to-government process are summarized in Chapter 1.

- Chapter 2 summarizes the process that was used to develop the Proposed Action evaluated in the PEIS and describes the Proposed Action and No Action alternatives. Chapter 2 also provides a comparison of the alternatives, as well as a comparison of potential environmental impacts on federal and nonfederal lands that could occur with Section 368 corridor designation and land use plan amendment. Chapter 2 also summarizes alternatives that were considered but removed from further evaluation in the PEIS. Finally, Chapter 2 contains interagency operating practices that may be considered and implemented by the Agencies during project-specific review and permitting.

- Chapter 3 describes the environment associated with the Proposed Action and No Action alternatives and also describes the potential environmental effects of subsequent authorization of corridor use, not corridor designation alone under the Proposed Action. Chapter 3 also discusses the types of environmental impacts that could occur on federal and nonfederal lands with the development of energy transmission projects under each of the alternatives. Measures to mitigate potential impacts of project construction and operation are also discussed.

- Chapter 4 discusses the potential cumulative impacts on federal and nonfederal lands of designating Section 368 energy corridors and amending land use plans.

- Chapter 5 identifies the potential unavoidable adverse impacts on federal and nonfederal lands associated with Section 368 energy corridor designation and land use plan amendment, and discusses potential unavoidable impacts from the development and operation of energy transport projects on federal and nonfederal lands.

- Chapter 6 discusses the relationship between short-term use of the environment and long-term productivity of federal and nonfederal lands with the designation of Section 368 energy corridors and the amendment of land use plans. Chapter 6 also discusses these relationships with the construction and operation of energy transport projects on federal and nonfederal lands under the alternatives.

- Chapter 7 discusses the significant irreversible and irretrievable commitments of resources on federal and nonfederal lands that could occur with the designation of Section 368 energy corridors and the amendment of land use plans.

- Chapter 8 lists the names, education, and experience of the individuals who helped prepare the PEIS. Also included are the subject areas for which each preparer was responsible and the contractor disclosure statement

- Chapter 9 presents an alphabetical listing of the references cited in Volume I of the PEIS.

- Chapter 10 presents a glossary of the technical terminology used in this PEIS.

Volume II consists of the appendixes to Volume I:

- Appendix A identifies the land use plan amendments that would be required, by land use plan, as part of the designation of Section 368 energy corridors under the Proposed Action.

- Appendix B provides the summary of public scoping comments on this PEIS.

- Appendix C describes the Tribal consultation process that was employed for this PEIS and summarizes the consultations that have occurred to date.

- Appendix D lists the major laws, regulations, and other requirements that could apply to the designation of Section 368 energy corridors and land use plan amendment, and to energy transport project construction and operation.

- Appendix E provides an overview of energy transport technologies that could be developed and operated within energy corridors. This appendix also describes one detailed scenario of a combination of projects that might be developed and operated within a Section 368 energy corridor.

- Appendix F lists the physical characteristics and development constraints of the proposed Section 368 energy corridors under the Proposed Action.

- Appendix G lists the sensitive resource areas that would be intersected by proposed each West-wide energy corridor (WWEC).

- Appendix H explains important facets of the geographic information system data used in the PEIS and the maps derived from it.

- Appendix I lists the WWEC PEIS webcasts used for corridor review and revision.

- Appendix J displays the proposed energy corridors that would require consultation with the DOD during project planning.

- Appendix K lists the Indian reservations and land trusts in the 11 western states.

- Appendix L lists the potential fossil yield classifications for geologic formations that could be crossed by Section 368 energy corridors under the Proposed Action.

- Appendix M summarizes the surface water and groundwater resources in the 11 western states that could be crossed by Section 368 energy corridors under the alternatives.

- Appendix N presents a floodplain/ wetland assessment of the designation of Section 368 energy corridors on federal and nonfederal lands under each of the alternatives. This appendix also provides an assessment of energy transport project development and operation.

- Appendix O describes the ecoregions that could be crossed by Section 368 energy corridors under the Proposed Action.

- Appendix P provides selected potentially sensitive visual resource areas intersected by or in close proximity to the proposed West-wide energy corridors designated under the Proposed Action.

- Appendix Q describes the archaeological, historic, and ethnographic context of the 11 western states.

- Appendix R describes the process of gathering information on the cultural resources that may lie within the Section 368 energy corridors.

- Appendix S describes the analytical methods used to evaluate potential socioeconomic impacts on federal and nonfederal lands of designating Section 368 energy corridors and amending land use plans, and of constructing and operating individual energy transport projects under each of the alternatives.

Volume III contains the maps and geographic information databases that are cited in the PEIS. The maps found in Volume III include a large scale base map series that covers the West, a state map series, visual resource information along the corridor routes, a map series showing which corridors follow existing transportation and utility ROWs, and a map series depicting the distribution of corridors within BLM FOs and FS regions. Access to the spatial data that is found on the maps can be obtained by going to the public Web site at http://corridoreis.anl.gov and following the download directions. The map data contained on the Web site allows the reader to examine locations of specific interest.

10 GLOSSARY

Abiotic: Refers to nonliving objects, substances, or processes. The abiotic environmental factors include light, temperature, and atmospheric gases.

Accretion: The gradual addition of new land to old by deposition of sediment carried by the water of a stream. In the theory of plate tectonics, accretion means the addition of successive geosynclines to the craton.

Active lek: Any lek that has been attended by male greater sage-grouse during the strutting season.

Active raptor nest sites: Any identified raptor nest site that could provide a nesting opportunity for a raptor.

Aggradation: The process by which the level or elevation of a stream bed is raised by deposition of sediment.

Alluvial: Formed by the action of running water; of or related to river and stream deposits.

Alluvial fan: A gently sloping mass of unconsolidated material (e.g., clay, silt, sand, or gravel) deposited where a stream leaves a narrow canyon and enters a plain or valley floor. Viewed from above, it has the shape of an open fan. An alluvial fan can be thought of as the land counterpart of a delta.

Alluvium: A general term for detrital deposits (i.e., sand, gravel, silt) made by rivers and streams. The term applies to stream deposits of recent time.

Alternating current (AC): A flow of electrical current that increases to a maximum in one direction, decreases to zero, and then reverses direction and reaches maximum in the other direction. The cycle is repeated continuously. The number of such cycles per second is equal to the frequency, measured in hertz (Hz). U.S. commercial power is 60 Hz.

Ambient air: Outdoor air to which the general public has access.

Ambient noise level: The level of acoustic noise at a given location, existing as a composite of sounds from many sources near and far.

Animal unit month: The amount of forage needed by an “animal unit” (i.e., a mature 1,000-lb cow and her calf) for one month.

Antiquities Act of 1906: This law makes it illegal to remove cultural resources from federal land without permission. It also allows the President to establish historical monuments and landmarks.

API gravity: A measurement convention established by the American Petroleum Institute for expressing the relative density of petroleum liquids to water; the greater the API gravity, the less dense the material. API gravities are close (but not equivalent) to specific gravities measured in the Baumé scale, which is the more conventional method of representing the density of a liquid. API gravity = (141.5/specific gravity @ 60°F) – 131.5; thus, a petroleum liquid with an API gravity of 10.0 @ 60°F has a specific gravity of 1.0 (which is the same as water). Petroleum liquids with API gravities greater than 10 API gravity degrees have densities less than water and will float; those with API gravities less than 10 will sink. The API gravity scale is calibrated such that most petroleum liquids (crude oils as well as distillate fuels) will have API gravities between 10 and 70 API gravity degrees.

Aquifer: An underground bed or layer of earth, gravel, or porous stone that yields usable quantities of water to a well or spring.

Background noise: Noise from all sources other than a particular source of interest.

Batholith: A large intrusive (plutonic) rock body that has more than 40 square miles of surface exposure and no known floor. The rock becomes exposed as a result of the erosion of the overlying rock.

Benthic: Animals dwelling at the bottom of a water body. These organisms inhabit the sediment of lake, river, or ocean bottoms, as well as the sediment in marshes, tidal flats, and other wetlands.

Big game: Large species of wildlife that are hunted, such as elk, deer, bighorn sheep, and pronghorn antelope.

Biota: The living organisms in a given region.

Borrow pit: A pit or excavation area used for gathering earth materials (borrow) such as sand or gravel.

Browse: Shrubs, trees, and herbs that provide food for wildlife.

Bureau of Land Management (BLM): An agency of the U.S. Department of the Interior that is responsible for managing public lands.

Bureau of Land Management (BLM) "Gold Book": Comprehensive guidance on the design, construction, maintenance, and reclamation of sites and access roads. The guidance can apply to this PEIS to reduce environment impacts.

Cathodic protection: Any of several electrochemical methods employed to prevent the corrosion of metallic objects, especially those buried in soil such as iron pipelines. Two methods predominate: "sacrificial anode" and "impressed current." Sacrificial anode methods electrically bond (connect) an anode made of a metal that corrodes more readily than the metallic object to be protected (e.g., attaching an anode made of zinc or magnesium to an iron pipeline), allowing the metal of lesser value to corrode in preference to the metal being preserved. Impressed current systems use anodes buried in the soil very near to the object being protected to introduce a current in the soil that flows from the anode to the protected object, counteracting the current that would result from the corrosion of that object (e.g., the oxidation of zero-valent metallic iron to iron (I) or iron (II) with the release of one or two electrons, respectively).

City gate station: In natural gas pipeline systems, the city gate station facility typically is owned and operated by a municipality or local gas utility company and interconnects the long-distance interstate pipeline with a local distribution network. City gate stations are composed of a complex array of valves, pipes, and pressure reduction devices designed to meter the gas and reduce its pressure so that it can be delivered safely to customers through distribution networks consisting of local gas mains, smaller-diameter service lines, and individual customer meters.

Clean Water Act (CWA): This Act requires National Pollutant Discharge Elimination System permits for discharges of effluents to surface waters, permits for stormwater discharges related to industrial activity, and notification of oil discharges to navigable waters of the United States.

Clearcut: (1) To remove or cut all trees in a tract of timber at one time; (2) an area of forest land from which all merchantable trees have recently been harvested.

Code of Federal Regulations **(CFR):** A compilation of the general and permanent rules published in the *Federal Register* by the executive departments and agencies of the United States. It is divided into 50 titles that represent broad areas subject to federal regulation. Each volume of the CFR is updated once each calendar year and is issued on a quarterly basis.

Colluvium: A heterogeneous mixture of material that, as a result of gravitational action, has moved down a slope and settled at its base. Avalanches, mudslides, and landslides are processes that deposit colluvium.

Colocated/colocation: Colocated points are close to each other or at the same location.

Corona/corona noise: The electrical breakdown of air into charged particles caused by the electrical field at the surface of conductors. The phenomenon appears as a bluish-purple glow on the surface of and adjacent to a conductor when the voltage gradient exceeds a certain critical value, thereby producing light, audible noise (described as crackling or hissing), and ozone.

Cover: Any form of environmental protection that helps an animal stay alive (mainly shelter from weather and concealment from predators).

Criteria air pollutants: Six air pollutants for which the EPA has established primary (health-related) and secondary (welfare-related) standards, the National Ambient Air Quality Standards (NAAQS), expressed as the maximum concentration of each criteria pollutant in ambient air. NAAQS have been established for carbon monoxide, lead, nitrogen dioxide, particulate mater with aerodynamic diameters less than 2.5 microns ($PM_{2.5}$), ozone, and sulfur oxides.

Critical habitat: The specific area within the geographical area occupied by the species at the time it is listed as an endangered, threatened, or other special status species. The area in which physical or biological features essential to the conservation of the species are found. These areas may require special management or protection.

Crucial habitat: Any particular range or habitat component (often winter or winter/yearlong range) that is the determining factor in a population's ability to maintain and reproduce itself at a certain level over the long term.

Crucial winter range: The portion of the winter range to which a wildlife species is confined during periods of heaviest snow cover.

Cultural resource/cultural property: A definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups.

Decibel (dB): A standard unit of sound measurement. In general, a sound doubles in loudness with every increase of 10 decibels.

Decibel, A-weighted (dBA): A measurement of sound approximating the sensitivity of the human ear and used to characterize the intensity or loudness of a sound.

Decommissioning: All activities necessary to take out of service and dispose of a facility after its useful life.

Direct current (DC): Electric current that flows in one direction only.

Ecoregion: A geographically distinct area of land that is characterized by a distinctive climate, ecological features, and plant and animal communities.

Electromagnetic fields (EMFs): Fields that surround both large power lines that distribute power and the smaller electric lines in homes and appliances. Generated when charged particles (e.g., electrons) are accelerated. Charged particles in motion produce magnetic fields. Electromagnetic fields are typically generated by alternating current in electrical conductors. They may also be referred to as EM fields.

Endangered species: Any species that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species Act of 1973 (ESA): This Act requires consultation with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service to determine if endangered, threatened, or other special status species or their habitats will be impacted by a proposed activity and what, if any, mitigation measures are needed to address the impacts.

Energy Policy Act of 2005 (EPAct): A bill passed by the 109th Congress in August 2005 that includes various initiatives directed at securing the nation's energy future, which include authorizing the DOE in collaboration with federal land management agencies to designate corridors for energy transmission on federal lands within the 11 contiguous western states.

Environmental assessment (EA): A concise public document that a federal agency prepares under the National Environmental Policy Act to provide sufficient evidence and analysis to determine whether a proposed action requires preparation of an environmental impact statement or whether a Finding of No Significant Impact can be issued. An environmental assessment must include brief discussions on the need for the proposal, the alternatives, the environmental impacts of the proposed action and alternatives, and a list of the agencies and persons consulted.

Environmental Impact Statement: A document required of federal agencies by the National Environmental Policy Act for major proposals or legislation that will or could significantly affect the environment.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short time after, precipitation events. Ephemeral stream beds are located above the water table year-round; groundwater is not a source of water for the stream. Many desert streams are ephemeral.

Evapotranspiration: Loss of water from the soil both by evaporation and by transpiration from plants.

Extirpation: The elimination of a species or subspecies from a particular area, but not from its entire range.

Fault line: Line determined by the intersection of a geological fault and the Earth's surface.

Federal Cave Resources Protection Act: This Act allows the collection and removal of resources from federal caves only when a permit has been authorized by the Secretary of Agriculture or the Secretary of the Interior.

Federal Energy Regulatory Commission (FERC): A U.S. government agency created by Congress in 1977 to regulate and oversee energy industries in the economic, environmental, and safety interests of the American public.

Federal Land Policy and Management Act of 1976 (FLPMA): This Act requires the Secretary of the Interior to issue regulations to manage public lands and the property located on those lands for the long term.

Floodplain: Flat land along a river or stream that may become submerged during floods, when the river or stream overflows its banks.

Fluvial: Pertaining to river or stream-related features or processes. Fluvial sediments are deposited by rivers or streams.

Forage: All browse and herbaceous foods available to grazing animals that may be grazed or harvested for feeding.

Fugitive dust: Particulate air pollution released to the ambient air from ground-disturbing activities related to construction, manufacturing, or transportation (i.e., the discharges are not released through a confined stream such as a stack, chimney, vent, or other functionally equivalent opening).

Fur-bearing animal: Badger, beaver, bobcat, marten, mink, muskrat, and weasel.

Gallinaceous birds: A term used for birds of the order Galliformes. They are heavy-bodied, largely ground-feeding domestic or game birds that include chickens, pheasant, turkeys, grouse, partridges, and quail.

Game birds: Grouse, partridge, pheasant, ptarmigan, quail, wild turkey, and migratory game birds.

Granitic rock: A light-colored, coarse-grained igneous (plutonic) rock.

Groundwater: Subsurface water that is in the zone of saturation, usually in porous rocks, fractures of rocks, or underground caves.

Habitat: A specific set of physical conditions that surround a species, group of species, or a large community. In wildlife management, the major constituents of habitat are considered to be food, water, cover, and living space.

Herbaceous: Pertaining to or characteristic of an herb (fleshy-stem plant) as distinguished from the woody tissue of shrubs and trees.

Herd management area (HMA): An area that has been designated for continuing management of wild horses.

Hogan: A one-room Navajo structure used as a dwelling or for ceremonial purposes.

Home range: The area in which an animal travels in the scope of its natural activities.

Homestead Act of 1862: Law passed by the federal government setting liberal terms for the acquisition of land by people who agreed to settle on the land.

Hypolimnetic: The deeper, cooler portions of a reservoir or lake that result from stratification.

Igneous rock: A rock that cooled and solidified from molten or partly molten material (magma). Igneous rock includes volcanic rock (rock solidified near the earth surface) and plutonic rock (rock solidified at considerable depth).

Impermeable soil: A soil through which water has difficulty flowing.

Impoundments: (1) Structures which remove land of the foreshore or seabed from the influence of tides; (2) human-engineered and dammed lakes, ponds, and reservoirs.

Inactive raptor nests: Any nest site that has been monitored in 6 of the last 10 years and documented as being unoccupied each time it was monitored.

Infrastructure: The basic facilities, services, and utilities needed for the functions of an industrial facility or site.

Interagency operating practice (IOP): A practice or combination of practices that are determined to provide the most effective, environmentally sound, and economically feasible means of managing an activity and mitigating its impacts.

Intermittent streams: A stream that ceases to flow in very dry periods.

Intermontane: Between or surrounded by mountains.

Introduced species: A non-native species that was intentionally or unintentionally brought into an area by humans.

Invasive species: A species that is not native (or is alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

Jacal: Construction using walls of close-set wooden stakes plastered with mud and roofed with straw, rushes, or other materials. Related to adobe.

Karst: A distinctive landscape (topography) that can develop where underlying bedrock, usually limestone, is partially dissolved by surface water or groundwater.

Kiva: A Pueblo ceremonial chamber often built below ground and frequently detached from habitation rooms.

Lacustrine: Pertaining to a lake. Lacustrine sediments are deposited in lakes.

Landslide: Downhill movements of geologic material by gravity force. Landslide-prone areas generally are high, steep, rugged terrains that experience high levels of precipitation.

Lattice towers: A freestanding steel framework tower that is used as pylon, especially for voltages above 100 kilovolts.

Laydown area: An area that has been cleared for the temporary storage of equipment and supplies. Laydown areas are usually covered with rock and/or gravel to ensure accessibility and safe maneuverability for transport and off-loading of vehicles.

L_{dn}: The day-night average A-weighted sound level, averaged over a 24-hour period after the addition of 10 dB to sound levels from 10:00 p.m. to 7:00 a.m. to account for increased annoyance from nighttime noise.

Lead (Pb): A gray-white metal that is listed as a criteria air pollutant. Health effects from exposure to lead include brain and kidney damage and learning disabilities. Sources include leaded gasoline and metal refineries.

Lek: A traditional courtship display area attended by male greater sage-grouse in or adjacent to sagebrush-dominated habitat. Designation of the site as a lek requires the observation of two or more male sage-grouse engaged in courtship displays.

L_{eq}: Equivalent/continuous sound level. L_{eq} is the steady sound level that would contain the same total sound energy as the time-varying sound over a given time.

Liquefaction: Changing a solid into a liquid.

Liquefied natural gas (LNG): Liquefied natural gas is natural gas that has been processed to remove impurities and heavy hydrocarbons; it is then condensed into a liquid at atmospheric pressure and stored in specially designed tanks. The volume of LNG is about 1/600th that of natural gas in standard atmospheric conditions, making it much more cost-efficient to transport over very long distances.

Liquid petroleum: Includes crude oil, crude or partially refined bitumen and shale oils, partially refined petroleum feedstock, and refined petroleum distillates that are routinely transported by pipeline, including but not limited to fuel oils, gasoline, diesel fuel, jet fuel, and kerosene. Liquid petroleum also includes liquefied petroleum gas (LPG).

Listed species: Any species of fish, wildlife, or plant that has been determined, through the full, formal Endangered Species Act listing process, to be either threatened or endangered.

Meandering: Following a winding or intricate course.

Metamorphic rock: Any rock derived from preexisting rocks by mineralogical, chemical, and/or structural changes in response to marked changes in temperature, stress, and chemical environment, generally occurring deep in the Earth's crust.

Migratory Bird Treaty Act of 1918 (MBTA): Act that requires that the U.S. Fish and Wildlife Service be consulted to determine the effects of a proposed activity on migratory birds and requires that opportunities to minimize the effects be considered.

Mitigation: A method or process by which impacts from actions can be made less injurious to the environment through appropriate protective measures. Also called mitigative measure.

Moraine: Landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level "till" plains to rough end-moraine landscapes.

Nanotechnology: Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale. At the nanoscale, the physical, chemical, and biological properties of materials differ in fundamental and valuable ways from the properties of individual atoms and molecules or bulk matter. Nanotechnology R&D is directed toward understanding and creating improved materials, devices, and systems that exploit these new properties.

National Ambient Air Quality Standards (NAAQS): Air quality standards set by the EPA for the six criteria pollutants. There are two standards for particulate matter: PM_{10} and $PM_{2.5}$. The primary National Ambient Air Quality Standards specify maximum outdoor air concentrations of criteria pollutants that would protect the public health within an adequate margin of safety. The secondary National Ambient Air Quality Standards specify maximum concentrations that would protect the public welfare from any known or anticipated adverse effects of a pollutant.

National conservation area (NCA): Areas designated by Congress to provide for the conservation, use, enjoyment, and enhancement of certain natural, recreational, paleontological, and other resources, including fish and wildlife habitat.

National Environmental Policy Act of 1969 (NEPA): This Act requires federal agencies to prepare a detailed statement on the environmental impacts of their proposed major actions significantly affecting the quality of the human environment.

National Historic Preservation Act of 1996, as Amended (NHPA): This Act requires federal agencies to take into account the effects of their actions on historical and archaeological resources and consider opportunities to minimize their impacts.

National historic trails: These trails are designated by Congress under the National Trails System Act of 1968 and follow, as closely as possible, the original trails or routes of travel on federal land that have national historic significance.

National Landscape Conservation System: Created by the BLM in June 2000 to increase public awareness of BLM lands with scientific, cultural, educational, ecological, and other values. It consists of national conservation areas, national monuments, wilderness areas, wilderness study areas, wild and scenic rivers, and national historic and scenic trails.

National Park Service (NPS): Founded in 1916, NPS is an agency of the U.S. Department of the Interior and is responsible for the national parks.

National Register of Historic Places **(NRHP):** A list maintained by the Secretary of the Interior as the official list of historic properties (districts, sites, buildings, structures, and objects) deserving preservation because of their local, state, or national significance in American history, architecture, archaeology, engineering, and culture. Properties listed on or eligible for the *National Register* are protected by the

National Historic Preservation Act of 1966, as amended.

National wilderness areas: Areas designated by Congress and defined by the Wilderness Act of 1964 as places "where the earth and its community are untrammeled by man, where man himself is a visitor who does not remain." Designation is aimed at ensuring that these lands are preserved and protected in their natural condition.

Native American Graves Protection and Repatriation Act of 1990 (NAGPRA): Requires federal agencies to consult with the appropriate Native American Tribes prior to the intentional excavation of human remains and funerary objects. It requires the patriation of human remains found on the agencies' land.

Native species: A species that, other than as a result of an introduction, historically occurred or currently occurs in an ecosystem (Executive Order 13112).

Nitrogen dioxide (NO_2): A toxic, reddish-brown, oxidizing gas with the chemical formula NO_2 that is produced during the combustion of fossil fuels. Together with other nitrogen oxides, nitrogen dioxide reacts with volatile organic chemicals in the atmosphere to form ozone, a primary constituent of photochemical smog, and also plays a major role in the formation of acid rain and visibility-impairing aerosols. Nitrogen dioxide is one of six criteria air pollutants for which the EPA has established primary and secondary National Ambient Air Quality Standards (NAAQSs) for maximum concentrations in ambient air to protect human health and welfare, respectively.

Nitrogen oxides (NO_x): Various compounds of nitrogen and oxygen, including primarily nitrogen dioxide (NO_2), nitric oxide (NO), and nitrous oxide (N_2O), which are formed from the combustion of fossil fuels. Once released into the atmosphere, nitrogen oxides react with volatile organic chemicals (VOCs) in reactions catalyzed by ultraviolet light to form ozone, a primary component of photochemical smog. Nitrogen oxides are also precursors to acid rain. Nitrogen dioxide is one of six criteria pollutants for which National Ambient Air Quality Standards (NAAQS) have been developed.

Noise: Unwanted sound.

Nonattainment area: The U.S. Environmental Protection Agency's designation of an area in which the ambient air concentrations of one or more criteria pollutants exceed National Ambient Air Quality Standards or contribute to such exceedances in a nearby area.

Noxious weed: Any living stage (including but not limited to seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely spread or prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation or navigation or the fish or wildlife resources of the United States or the public health (Federal Noxious Weed Act of 1974).

Occupied lek: A lek that has been active during at least one strutting season within the last 10 years.

Oil sand: See tar sand.

Oil shale: A fine-grained sedimentary rock that contains various inorganic minerals and the organic material kerogen, which, when subjected to heating, pyrolyzes to form raw shale oil that can be further processed into synthetic crude oil. Oil shale is classified as terrestrial, lacustrine, or marine, based on the type and location of the decaying organic matter from which it originated. Oil shale is often codeposited with minerals such as nahcolite (sodium bicarbonate), alum, and dawsonite, and with metals such as copper, zinc, and uranium.

Orogeny: A period of mountain building; also, a major mountain-building episode in geologic history.

Outwash plain: A smooth plain covered by deposits from water flowing from glaciers.

Ozone (O_3): A chemically reactive, corrosive gas, ozone is formed from natural processes (e.g., by lightning) and also by the ultraviolet light-catalyzed reaction of nitrogen oxides with volatile organic chemicals in the atmosphere. When formed in the troposphere (that portion of the earth's atmosphere closest to the Earth's surface), ozone acts as the primary constituent of photochemical smog. When present in the stratosphere, however, ozone provides essential protection for all life on Earth by filtering harmful levels of ultraviolet radiation.

Paleontological resources: The fossil remains of ancient life-forms, their imprints, or behavioral traces (e.g., tracks, burrows, residues) and the rocks in which they are preserved. These are distinct from human remains and artifacts, which are considered archaeological or historical materials.

Paleontology: The study of plant and animal life that existed in former geologic times, particularly through the study of fossils.

Particulate matter: Fine particles of solids or liquids such as dust, smoke, mist, fumes, or smog. When released into the atmosphere, particulates can adversely impact human health or quality of life. Particulate matter with aerodynamic diameters of 2.5 micrometers or less (where one micrometer is one-millionth of a meter) are defined by the EPA as a criteria pollutant for which both primary and secondary National Ambient Air Quality Standards (NAAQS) have been established to protect human health and welfare, respectively.

Parturition areas: Birthing areas commonly used by more than a few female members of a population. Generally used when referring to ungulates, such as elk and mule deer.

Passerines: Perching birds or songbirds of the order Passeriformes.

Peak electrical demand: Determines the minimum amount of generating capacity and the corresponding amount of transmission and distribution facilities required to maintain a reliable electric system. The peak demand is expressed in units of power (kilowatts, megawatts) and the maximum instantaneous requirement for electricity that occurs during a specified time period. The electric load corresponds to a maximum level of electric demand in a specified time period.

Percolation: The downward movement of water through soil.

Perennial stream: Streams that flow continuously.

Permeable soil: A soil through which water can flow easily.

Petroglyph: A design scratched, pecked, or scraped into a rock surface.

Physiographic (physiography): The physical geography of an area or the description of its physical features.

Pictograph: A design drawn in pigment upon an unprepared or ground rock surface.

Pigging facilities: Facilities positioned within a pipeline network to launch and recover "pigs," which are devices inserted into a pipeline to clean the inner walls of the pipe and monitor for critical conditions that could compromise pipeline integrity or operational efficiency, such as cracks, corrosion, or pipe deformations. Pigging can be accomplished without interruption of pipeline operation, with the pig carried through the pipe by the commodity being transported.

Pigs: Devices routinely introduced into pipelines to clean the inner walls of the pipe and monitor for critical conditions that could compromise the integrity or efficiency of the pipeline, such as cracks, corrosion, and pipe deformations.

Playa/playa lake: Playa is a dry, barren area in the lowest part of an undrained desert basin, underlain by clay, silt, or sand and commonly by soluble salts. Playa lake is a shallow, intermittent lake in an arid region, occupying a playa in the wet season but drying up in summer and leaving mineral deposits (evaporites) behind.

Plutonic rock: A rock crystallized from molten material (magma) at considerable depth; typically coarse-grained.

Potential Fossil Yield Classification (PFYC): Initially developed by the U.S. Forest Service and the Region 2 Paleo Initiative in May 1996, the PFYC system provides baseline guidance for assessing the relative occurrence of important paleontological resources and the need for mitigation. Specifically, it is used to classify geologic units, at the formation or member level, according to the probability that they could yield paleontological resources of concern to land managers.

$PM_{2.5}$: Particulate matter with a mean aerodynamic diameter of 2.5 micrometers (0.00010 inch) or less. $PM_{2.5}$ is regulated as a criteria pollutant under Title I of the Clear Air Act.

PM_{10}: Particulate matter with a mean aerodynamic diameter of 10 micrometers (0.00039 inch) or less. Particles with this diameter (or smaller) are small enough to be deposited in the lungs. PM_{10} is regulated as a criteria pollutant under Title I of the Clean Air Act.

Population: A group of organisms, all of the same species, which occupies a particular area. The term is used to refer to the number of individuals of a species within an ecosystem or of any group of like individuals.

Prevention of Significant Deterioration (PSD) Program: An air pollution-permitting program for major new and modified existing sources that limits increases in pollution levels caused by sources and their associated development.

Proposed for listing: Species that have been formally proposed for listing by the USFWS by a notice in the *Federal Register*.

Pueblitos: A small town (Spanish).

Radon: Chemically inert radioactive gas formed from the radioactive decay of naturally occurring "parent elements" such as uranium and thorium and the subsequent radioactive decay of some of their radioactive "daughters," such as radium. Radon emits alpha radiation with a half-life of approximately 3.8 days and is a health hazard, especially if inhaled; it is one of the leading causes of lung cancer in America.

Raptor: Bird of prey, such as hawks, owls, vultures, and eagles, with sharp talons and strongly curved beaks.

Receptor: A human or ecological entity potentially at risk of exposure to an environmental stressor.

Recharge: The addition of water to an aquifer by natural infiltration (e.g., rainfall that seeps into the ground) or by artificial injection through wells.

Reliability: Refers to the ability of the transmission system to deliver energy (especially electrical energy) when needed under a set of accepted standards and that avoids disruptions or outages.

Rhyolitic rock: A light-colored, fine-grained igneous (volcanic) rock chemically equivalent to granite.

Right-of-way (ROW): Public land authorized to be used or occupied pursuant to a right-of-way grant. A right-of-way grant authorizes the use of a right-of-way over, upon, under, or through public lands for construction, operation, maintenance, and termination of a project.

Riparian: Relating to, living in, or located on the bank of a river, lake, or tidewater.

Rip-rap: A combination of large stones, cobbles, and boulders used to line channels, stabilize banks, reduce runoff velocities, or filter out sediment.

Sage grouse nesting/early brood-rearing habitat: Nesting habitat for sage grouse is generally described as sagebrush that has canopy cover between 15 and 30% and heights between 11 and 32 inches. Herbaceous plant height (6 inches or greater) and canopy cover (>15%) provide important cover and food for sage grouse using these habitats. Early brood-rearing habitat generally has 10 to 25% sagebrush canopy cover and has slightly higher canopy cover of grasses and forbs than nesting habitat. Early brood-rearing habitat is generally used by sage grouse hens with chicks when the chicks range from 1 to 21 days in age. Variations in plant height and percent cover may occur among states.

Sage grouse winter habitats: During winter, sage grouse feed almost exclusively on sagebrush leaves and buds. For winter habitat to be suitable, there must be sagebrush above the snow. Sage grouse tend to select wintering sites where sagebrush is 10 to 14 inches above the snow. Sagebrush canopy cover used by sage grouse above the snow may range from 10 to 30%. Foraging areas tend to be on flat to generally southwest-facing slopes and windswept ridges.

Savannah: A flat grassland of tropical and subtropical regions usually having distinct periods of dry and wet weather.

Scour: Soil erosion when it occurs underwater, as in the case of a streambed.

Sediment: Solid fragmental material transported and deposited by wind, water, or ice; chemically precipitated from solution; or secreted by organisms.

Sedimentary rock: A rock resulting from the consolidation of sediment.

Seeps: Wet areas, normally not flowing, arising from an underground water source. Any place where liquid has oozed from the ground to the surface.

Seismic: Pertaining to any earth vibration, especially that of an earthquake.

Silt: Sedimentary material consisting of fine particles that are intermediate in size between sand and clay.

Sinks: Natural systems (for example, forests and wetlands) that absorb and store greenhouse gases; also, a reservoir that uptakes a chemical element or compound from another part of its cycle.

Slash: Any tree tops, limbs, bark, abandoned forest products, windfalls, or other debris left on the land after timber or other forest products have been cut.

Slurry: A thick mixture of a liquid and any of several finely divided substances; most typically, an emulsion of insoluble solids in water. Slurry pipelines are used to transport a variety of materials, including coal, copper, iron, and phosphate ores; limestone; and tar sands.

Soluble: Capable of being dissolved.

Special status species: Special status species include both plant and animal species that are officially listed as threatened or endangered or are proposed or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act; also, those listed by a state in a category such as threatened or endangered, implying potential endangerment or extinction; and those designated as sensitive by individual BLM state directors.

State historic preservation officer (SHPO): The state officer charged with identifying and protecting prehistoric and historic resources in accordance with the National Historic Preservation Act.

State implementation plans (SIPs): EPA-approved state plans that contain the regulations and other materials for meeting air standards and other requirements of the Clean Air Act.

Strutting ground: An area used by sage grouse in early spring for elaborate, ritualized courtship displays (also see lek).

Subduction: The process by which one tectonic plate moves beneath another.

Sulfur oxides: Sulfur oxides are pungent, colorless gases that are formed primarily by fossil fuel combustion. Sulfur oxides may damage the human respiratory tract and also plants and trees. SO_2 is regulated as a criteria pollutant under Title I of the Clean Air Act.

Surface water: Water on the Earth's surface that is directly exposed to the atmosphere, as distinguished from water in the ground (groundwater).

Tar sand: Also referred to as "oil sand" or "bituminous sand," tar sand is a sedimentary material composed primarily of sand, clay, water (in some deposits), and organic constituents known as bitumen. Processing of tar sand involves separating the bitumen fraction from the inorganic materials and subsequently upgrading the bitumen through a series of reactions to produce a synthetic crude oil feedstock that is suitable for further refining into distillate fuels in conventional refineries.

Tectonic: Forces or conditions within the Earth that cause movements of the crust, such as earthquakes, folds, and faults.

Terrace: A former floodplain underlain by sediment deposited by a stream when the stream was flowing at a higher level; typically forms a relatively level bench along the side of a valley adjacent to a recent floodplain.

Terrestrial: Belonging to or living on land.

Threatened species: Any species that is likely to become endangered within the foreseeable future throughout all or a significant part of its range.

Tiering: The coverage of general matters in broader documents with subsequent narrower statements or environmental analyses.

Total suspended solids (TSS): A measure of the amount of small, particulate solid pollutants that are suspended in natural water or wastewater.

Tuff: Volcanic rock made up of rock, glass, and/or mineral fragments in a volcanic ash matrix.

Turbidity: A measure of the cloudiness or opaqueness of water. Typically, the higher the concentration of suspended material, the greater the turbidity.

Ungulates: Hoofed animals, including ruminants but also horses, tapirs, elephants, rhinoceroses, and swine.

Viewshed: A physiographic area composed of land, water, and biotic and cultural elements that may be viewed and mapped from one or more viewpoints and that have inherent scenic qualities and/or aesthetic values as determined by those who view it.

Viscosity: The resistance of a liquid to flow.

Visual resources: Refers to all objects (man-made and natural, moving and stationary) and features such as landforms and water bodies that are visible on a landscape.

Volatile organic compounds (VOCs): A wide variety of organic compounds, typically liquids, that share the physical property of readily evaporating into the gas phase at normal temperatures and pressures. Sources include industrial solvents and petrochemical feedstocks (e.g., benzene); common vehicle fuels (e.g., gasoline); and some industrial degreasing, cleaning, and stripping agents (e.g., methylene chloride). Once released into the atmosphere, some VOCs are photochemically reactive, undergoing ultraviolet light-catalyzed reactions with nitrogen oxides to produce ozone, a primary constituent of photochemical smog. Regulations promulgated under the Clean Air Act establish limits for the release to the atmosphere of VOCs, especially those that exhibit hazardous properties (hazardous air pollutants [HAPs]), although VOCs are not a criteria pollutant. They are defined for air quality regulatory purposes by the EPA's definition in 40 CFR 51.100(s).

Volcanic rocks: An igneous rock that cools and solidifies at the Earth's surface; typically fine-grained.

Voltage: The electrical potential difference between two points expressed in volts.

Western electricity transmission grid: West-wide interconnected network of transmission lines encompassing parts of 14 western states, two Canadian provinces, and northwestern Mexico. The grid provides for the long-distance transmission of electricity between these areas in response to electricity demand and supply.

West-wide Energy Corridor PEIS: Considers 11 contiguous western states for the possible construction, operation, maintenance, and decommissioning and dismantling of energy infrastructure such as oil and gas pipelines and electric transmission lines; the states considered are Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Construction, operation, maintenance, and decommissioning and dismantling of pipelines, transmission lines, and energy infrastructure would affect groundwater and surface water resources. The areas constitute the affected environment.

Wetlands: Areas that are soaked or flooded by surface or groundwater frequently enough or long enough to support plants, birds, animals, and aquatic life. Wetlands generally include swamps, marshes, bogs, estuaries, and other inland and coastal areas and are federally protected.

Wild and scenic river: According to the Wild and Scenic River Act, wild and scenic rivers are wild, scenic, or recreational rivers designated by Congress or by the legislature of the state through which they flow. A river so designated, together with related adjacent lands, possesses remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, preserved in a free-flowing condition.

Wild Free-Roaming Horses and Burros Act: Act passed by Congress in 1971 gives BLM the responsibility to protect, manage, and control wild horse and burro populations.

Wild Horse and Burro Adoption Program: BLM program that offers excess animals for adoption to qualified people. After caring for an animal for 1 year, the adopter is eligible to receive title, or ownership, from the federal government.

Wild horses and burros: Unbranded and unclaimed horses or burros roaming free on public lands in the western United States and protected by the Wild Free-Roaming Horse and Burro Act of 1971. They are descendants of animals that were turned loose by or escaped from ranchers, prospectors, Indian Tribes, and the U.S. cavalry from the late 1800s through the 1930s.

Wild Horse Herd Management Area (WHHMA or HMA): An area that has been designated for continuing management of wild horses.

Wilderness study area: Areas designated by a federal land management agency as having wilderness characteristics, which make them worthy of being considered by Congress for wilderness designation.

Wind farm: One or more wind turbines operating within a contiguous area for the purpose of generating electricity.

Wind rose: A graphical representation of wind speed, direction, and frequency averaged over a specific time interval. Direction is represented by radial bars oriented from the center of the circular graph in each of the directions from which the wind has originated over the time interval being represented. The strengths of the winds are represented by the thickness of the radial bars and the lengths of each segment of different thickness; the frequency of occurrence of the wind in each direction is represented by the extent to which each bar extends from the center of the graph to concentric circles, which represent increasing frequencies as the circles expand from the center of the graph.

Xeric: Low in moisture.

2 WHAT ARE THE ALTERNATIVES EVALUATED IN THIS PEIS?

This chapter describes the two alternatives that are analyzed in detail in the PEIS: (1) *No Action*: no land would be designated as a Section 368 energy corridor, and (2) *Proposed Action*: designation of Section 368 energy corridors and amendment of land use plans on federal land. Under the Proposed Action, more than 6,000 miles of Section 368 energy corridors would be designated within federal lands in the 11 western states as identified by environmental, engineering, and land use screening criteria to reduce potential environmental and land use conflicts. This chapter also details the process taken to site the corridors that would be designated under the Proposed Action Alternative. Other alternatives that were considered but eliminated from detailed study in accordance with the implementing regulations of NEPA are also described. A summary comparison of the environmental consequences of the analyzed alternatives is presented.

2.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, Section 368 energy corridors would not be designated on federal lands in the West, although the siting and development of energy transport projects would continue. In general, all public lands, unless otherwise designated, segregated, or withdrawn, are available for ROW authorization under the Federal Land Policy and Management Act of 1976 (FLMPA) by the appropriate land management agency. Current federal agency practices for permitting energy transport ROWs and ensuring maximum consistency with existing land use plans would be followed for each proposed ROW. Applicants for ROWs would continue to identify and evaluate ROW alternatives following current federal and state regulations, policies, and permitting processes and requirements. There are currently about 32,000 miles of large oil and gas pipelines and 49,000 miles of large (230 kV and greater) electricity transmission lines on federal and nonfederal lands in the West. There would be relatively little West-wide coordination for siting and permitting energy transport projects on federal lands in order to meet current and future energy needs in the 11 western states.

Text Box 2.1-1
Miles of Existing Electricity Transmission Lines and Pipelines in the 11 Western States (federal and nonfederal lands combined)

Transmission lines (>230 kV)	49,430 miles
Natural gas pipelines (>16-inch diameter)	27,451 miles
Crude oil pipelines (>12-inch diameter)	5,507 miles

Under current permitting processes and procedures, applicants identify their preferred project-specific ROWs crossing federal and nonfederal lands. Affected federal land managers evaluate the ROW proposals and work with the applicants to identify an acceptable ROW route across the affected land management unit either based on consistency with approved land use plans or through a potential plan amendment. In addition, there are numerous energy corridors that have been designated on federal lands by individual BLM field offices and FS national forests that may be used for future energy transport projects. For large projects affecting more than one federal land management agency, a joint permitting approach is often used, with a lead agency identified to be in charge of the NEPA analysis and documentation. Individual land use decisions, necessary plan amendments, and ROW authorizations are then processed by each agency.

Under the No Action Alternative, future energy transport projects would likely not cross federal and nonfederal lands within common, shared energy transport corridors. For example, many of the corridor locations proposed during public scoping (see Figure 2.1-1) were ROWs for individual potential future projects. Few if any of these proposed corridors, which total more than 61,550 miles in length, are colocated (located together within a shared ROW or in adjacent ROWs), and if developed under the No Action Alternative would result in a proliferation of widely spaced project-specific ROWs crossing the federal and nonfederal landscape. Exceptions would occur in locations (1) where physical constraints (such as mountain passes) would act to bring individual project ROWs together for relatively short distances, (2) where there is an opportunity for corridors to parallel existing ROWs, and (3) where energy corridors that could accommodate multiple projects have been previously designated on federal lands by local federal land managers in individual land use plans.

Development of future energy transport projects would be required to comply with current agency-specific ROW authorizing and permitting processes and requirements regarding environmental review, construction, operation, and decommissioning. Project siting and design must be consistent with land use plans. Future energy transport projects would continue to be evaluated on an individual, project-by-project basis, and applicants would need to identify and evaluate alternative ROW locations as part of the authorization and permitting processes. Amendment of land use plans to incorporate project-specific ROWs would similarly be conducted on a project-by-project and agency-by-agency basis, and there would be no assurance of consistency in siting and evaluation of proposed energy transport projects crossing federal lands.

2.2 PROPOSED ACTION ALTERNATIVE: DESIGNATE SECTION 368 ENERGY CORRIDORS AND AMEND LAND USE PLANS ON FEDERAL LANDS

Under the Proposed Action Alternative, there would be approximately 6,055 miles of Section 368 energy corridors designated in the West (Figure 2.2-1; see Volume III of this PEIS for detailed Proposed Action corridor maps). These corridors would occur in all 11 western states and would be designated for multimodal energy transport with a width of 3,500 feet, unless specified otherwise because of environmental or management constraints or local designations. Energy corridor widths proposed during scoping ranged from as narrow as 60 feet to more than 5 miles (Text Box 2.2-1). The smaller suggested widths would be able to support little more than a single energy project, while the larger widths would be difficult to apply throughout the West because of environmental, physical, and/or regulatory constraints.

Text Box 2.2-1
Proposed Energy Corridor Widths Received during Scoping

Electricity transmission	200 feet to >5 miles
Oil and gas pipelines	60 feet to 2 miles
Combined corridors	1 to 5 miles

A corridor width of 3,500 feet was selected by the Agencies for the Section 368 energy corridors (Text Box 2.2-2). This width would provide sufficient room to support multiple energy transport systems. For example, assuming an operational ROW width of 400 feet, about 9 individual 500-kV transmission

Text Box 2.2-2
Proposed 3,500-foot Corridor Width

- Provides sufficient width to accommodate the construction and operation of multiple projects and their supporting infrastructure.
- Provides flexibility within a corridor to route project-specific ROWs around important resources that may be encountered during project-specific analyses.

lines could be supported within a 3,500-foot-wide corridor. Alternately, as many as 35 liquid petroleum pipelines (each consisting of a 32-inch-diameter pipe and a 100-foot construction ROW) or 29 natural gas pipelines (42-inch-diameter pipe and 120-foot construction ROW) could be supported within a 3,500-foot-wide corridor.

While such development is unrealistic, these examples illustrate the capacity of a 3,500-foot-wide corridor to support multiple energy transport projects. A more plausible development is presented in Appendix E, which describes a hypothetical corridor development consisting of three 500-kV transmission lines and four pipelines. The ROWs of this hypothetical development would account for less than half of the 3,500-foot corridor width. Even with the topographic, environmental, or regulatory constraints encountered during the corridor siting process (see Section 2.2.1), a 3,500-foot width could be placed on most federal lands while avoiding many sensitive resources and areas. A 3,500-foot corridor width would also provide additional project siting flexibility within corridors for technical or engineering reasons or for routing project-specific ROWs around important resources that may be identified during project-specific analyses within the corridors.

Table 2.2-1 presents the total lengths and acreages of the corridors that would be

TABLE 2.2-1 Total Linear Miles and Acres of Federal Energy Corridors Designated under Section 368 as the Proposed Action

State	Miles of Corridors	Corridor Area (acres)	Miles Incorporating Existing Utility ROWs[a]	Miles Incorporating Existing Transportation ROWs[a]	Percentage of Length Incorporating Existing Utility and Transportation ROWs
Arizona	644	360,836	391	59	70
California	814	287,657	357	267	77
Colorado	420	261,839	230	72	72
Idaho	410	161,503	133	66	48
Montana	102	42,047	12	83	94
Nevada	1,630	925,051	349	401	46
New Mexico	314	129,929	185	33	70
Oregon	591	238,200	276	90	62
Utah	640	355,941	215	133	54
Washington	54	6,929	37	13	93
Wyoming	438	185,592	231	80	71
Total	6,055[b]	2,955,526[b]	2,416	1,297	61[b]

[a] Miles of corridors that would be designated under the Proposed Action that follow or incorporate existing ROWs.

[b] Slight difference between indicated total and the sum of the stated entries is due to rounding.

designated under the Proposed Action in each of the 11 western states. Appendix F lists the lengths, widths, and compatible energy transport uses for each corridor segment under the Proposed Action. The vast majority of the proposed corridors in each state fall on lands managed by BLM except in Washington where 53 of the 54 miles of proposed corridors would occur on lands managed by the FS; no proposed corridors would fall on lands managed by DOE. The distribution of the proposed corridors on federal lands is presented in Table 2.2-2. The proposed corridors have a total surface area of about 2.9 million acres, and approximately 61% (3,713 miles) of the total miles (6,055 miles) of proposed corridors follow or incorporate existing transportation or utility ROWs.

The Proposed Action incorporates locally designated energy corridors (or portions of these corridors) that are currently identified in federal land use plans (Figure 2.2-2). Some BLM field offices and FS national forests have currently "locally designated" energy corridors. These corridors are designated within their respective land management plans for use by energy transport projects proposed for those specific lands, and some of these local corridors currently have one or more energy transport projects and ROWs. While these local energy corridors are designated for use by energy transport projects, in many cases, these corridors were not designated to address the reliability, redundancy, or congestion of the western electricity grid, nor to enhance energy transport across and within the western United States. In many cases, these local corridor designations do not identify compatible energy transport uses of the corridors, and in some cases, the widths are not identified. Under the Proposed Action, there would be approximately 6,055 miles of energy corridors designated in the 11 western states.

TABLE 2.2-2 Distribution of Proposed Energy Corridors on Federal Land, by Managing Federal Agency

		Miles of Proposed Corridors on Federal Land, by Managing Federal Agency					
State	Total Miles of Proposed Corridors	BLM	FS	USFWS	BOR[a]	DOD	NPS[a]
Arizona	644	444	178	1	0	10	10
California	814	590	222	0	1	0	0
Colorado	420	308	110	2	0	0	0
Idaho	410	384	26	0	0	0	0
Montana	102	59	42	0	0	0	0
Nevada	1,630	1,554	28	25	9	8	5
New Mexico	314	309	0	4	0	1	0
Oregon	591	446	145	0	0	0	0
Utah	640	581	58	1	0	0	0
Washington	54	1	53	0	0	0	0
Wyoming	438	419	3	0	16	0	0
Total	6,055[b]	5,095	866[b]	34[b]	27[b]	19	14[b]

[a] BOR = Bureau of Reclamation; NPS = National Park Service.

[b] Slight difference between indicated total and the sum of the stated entries is due to rounding.

About 2,359 miles (39%) of these energy corridors would incorporate existing, locally designated corridors (Table 2.2-3).

No locally designated corridors are incorporated into the corridors proposed for Wyoming. Among the other 10 states, the contribution of locally designated corridors to the total miles of proposed energy corridors ranges from as little as 7% in New Mexico to as much as 89% of the corridors proposed for Washington. For proposed Section 368 energy corridors on specific, federally managed lands, the contribution of locally designated energy corridors to the total miles of the proposed Section 368 energy corridors ranges from as much as 86% on National Park Service (NPS)-managed lands to as little as 5% on DOD-managed lands. The miles of locally designated energy corridors incorporated into the total miles of Section 368 proposed corridors, by state and federal agency, on federally managed lands is presented in Table 2.2-4.

Not all of the locally designated corridors used in the Proposed Action Alternative have widths of 3,500 feet or are designated for multimodal use, as some of the locally designated corridors are specified for only one type of energy transport (e.g., pipeline only, electricity transmission only). Some locally designated corridors have specified widths greater than, and others less than, the preferred 3,500-foot width. For locally designated corridors with widths greater than 3,500 foot, the greater width was retained for the Proposed Action. Where possible, the widths of narrow locally designated corridors were expanded to 3,500 feet (as allowable) and given multimodal use. For example, an energy corridor may be locally designated only for gas pipelines and have a width of only 1,000 feet. If possible, under the Proposed Action, the width of this locally designated corridor would be expanded to 3,500 feet and the corridor would be designated to provide for multimodal energy transport use. In some cases, the corridor width

TABLE 2.2-3 Contribution of Locally Designated Corridors to the Miles of Corridors Proposed for Designation under the Proposed Action

State	Total Miles of Proposed Corridors	Miles of Locally Designated Corridor Incorporated by the Proposed Corridors	Percentage of Proposed Corridor Mileage Incorporating Locally Designated Corridors
Arizona	644	471	73
California	814	139	17
Colorado	420	224	53
Idaho	410	59	14
Montana	102	58	57
Nevada	1,630	821	50
New Mexico	314	21	7
Oregon	591	348	59
Utah	640	171	27
Washington	54	48	89
Wyoming	438	0	0
Total	6,055[a]	2,359[a]	39[a]

[a] Slight difference between indicated total and the sum of the stated entries is due to rounding.

TABLE 2.2-4 Miles of Locally Designated Energy Corridors Incorporated into the Proposed Section 368 Energy Corridors on Federal Land, by State and Federal Agency

State	Miles of Locally Designated Energy Corridors (total miles of proposed Section 368 energy corridors in parentheses)					
	BLM	FS	USFWS	BOR	DOD	NPS
Arizona	298 (444)	166 (178)	0 (1)	0 (0)	0 (10)	7 (10)
California	1 (590)	137 (222)	0 (0)	0 (1)	0 (0)	0 (0)
Colorado	186 (308)	36 (110)	1 (2)	0 (0)	0 (0)	0 (0)
Idaho	49 (384)	11 (26)	0 (0)	0 (0)	0 (0)	0 (0)
Montana	42 (59)	16 (42)	0 (0)	0 (0)	0 (0)	0 (0)
Nevada	812 (1,554)	1 (28)	0 (25)	2 (9)	1 (8)	5 (5)
New Mexico	21 (309)	0 (0)	0 (4)	0 (0)	0 (1)	0 (0)
Oregon	348 (446)	0 (145)	0 (0)	0 (0)	0 (0)	0 (0)
Utah	145 (581)	25 (58)	0 (1)	0 (0)	0 (0)	0 (0)
Washington	0 (1)	48 (53)	0 (0)	0 (0)	0 (0)	0 (0)
Wyoming	0 (419)	0 (3)	0 (0)	0 (16)	0 (0)	0 (0)
Total	1,903 (5,095)[a]	440 (866)[a]	1 (34)[a]	2 (27)[a]	1 (19)	12 (14)[a]

[a] Slight difference between indicated total and the sum of the stated entries is due to rounding.

could not be increased to 3,500 feet, nor could additional energy transport types be allowed, because of conflicting management needs or due to a resource or topographic constraint. In such cases, the smaller width and/or locally designated compatible use were adopted into the Proposed Action. Table 2.2-5 presents the total miles, by corridor width, of proposed energy corridors in each of the 11 western states. Appendix F lists the lengths, widths, and compatible energy transport uses for each corridor segment that would be designated under the Proposed Action.

The siting of the proposed Section 368 energy corridors was conducted to avoid sensitive resources (such as national parks, wilderness areas, and historic trails) to the extent practicable (see Section 2.2.1 for a description of the corridor siting process). However, because of the great variety and abundance of sensitive resources on federal lands in the West, the proposed energy corridors would intersect some of these resources. Table 2.2.6 summarizes the major sensitive areas that would be intersected by the proposed Section 368 energy corridors, while each specific crossing is identified in Appendix G. In all instances, the intersections were located with extensive input and direction from the appropriate agency managers for the specific resources involved (see Section 2.2.1.3), and intersections were placed in areas so that potential impacts from any future development and operation of energy transport projects would be minimized to the extent practicable. For example, proposed Section 368 energy corridors would cross national parks or monuments only at locations were energy transmission and/or transportation ROWs and infrastructure currently exist or where energy transport corridors are currently designated.

Designation of the proposed energy corridors would require the amendment of as many as 165 land management plans for the federal lands where the corridors are located.

TABLE 2.2-5 Total Linear Miles of Proposed Action Energy Corridors, by Width, in the 11 Western States

Corridor Width[a] (feet)	Miles of Proposed Corridors											
	Arizona	California	Colorado	Idaho	Montana	Nevada	New Mexico	Oregon	Utah	Washington	Wyoming	Total
200			5									5
500		35	1							39		75
600				11	0							11
900			5									5
1,000		51	4	20		23		5				104
1,320		111				1		15				127
1,500	2	1					4	358	9		1	376
1,660	7					5						12
2,000		25	2			16		5	65			112
2,400						12						12
2,500			3									3
2,640				0	44	360			2			406
3,500	383	569	264	379	57	906	310	206	485	6	437	4,001
4,300			0									0
5,280	193		35			9			13			250
10,500		11										11
10,560	42		6			201						249
15,840				0		86						86
21,120			7									7
26,400			22									22
500–3,500		11										11
1,000–3,500								2				2
1,950–3,200										9		9
2,000–3,500						11						11
2,250–10,500			41									41
2,300–16,000									3			3
2,900–16,300	16											16

TABLE 2.2-5 (Cont.)

Corridor Width[a] (feet)	Miles of Proposed Corridor											
	Arizona	California	Colorado	Idaho	Montana	Nevada	New Mexico	Oregon	Utah	Washington	Wyoming	Total
3,500–5,800									1			1
3,500–9,000			26									26
4,300–11,500									16			16
5,000–27,700									29			29
17,000–28,800									17			17
Total	644	814	420	410	102	1,630	314	591	640	54	438	6,055

a Most corridors have a constant width for the entire length of the corridor. However, for some corridors, the widths vary extensively due to physical and/or land use constraints. For such corridors, the width is presented as a range.

TABLE 2.2-6 Major Sensitive Resource Areas That Would Be Intersected by the Centerlines of the Proposed Energy Corridors under the Proposed Action

State	National Parks[a]	National Monuments[b]	National Recreation Areas[c]	Other National Park Service Areas[d]	National Natural or Historic Landmarks	National Scenic Trails	National Historic Trails[e]	National Scenic Areas	National Scenic Research Areas	National Wild and Scenic Rivers	Wilderness Areas	Roadless Areas	National Wildlife Refuges	State Totals
Arizona	0	1	2	0	0	NA[f]	2	NA	NA	0	0	0	1	6
California	0	0	1	1	0	1	3	0	NA	1	0	3	0[g]	11
Colorado	0	0	1	0	0	1	1	NA	NA	0	0	1	0	4
Idaho	0	1	0	0	0	1	2	NA	NA	0	0	0	0	4
Montana	0	0	0	0	0	1	1	0	NA	0	0	1	0	3
Nevada	0	NA	1	0	0	NA	3	NA	NA	NA	0	4	1	8
New Mexico	0	0	0	0	0	1	2	NA	NA	0	0	0	1	4
Oregon	0	0	0	0	0	1	2	0	0	3	0	2	0	8
Utah	1	1	0	0	0	NA	3	NA	0	NA	0	5	0	10
Washington	0	0	0	0	0	1	0	0	NA	0	0	0	0	1
Wyoming	0	0	1	0	0	1	4	NA	NA	0	0	1	0	7
Total	1	3	6	1	0	8	23	0	0	4	0	17	3	66

a Does not include national historic parks or national historical parks.

b Includes national monuments managed by the NPS, FS, BLM, and USFWS.

c Includes national recreation areas managed by the NPS and FS.

d Includes national historic parks, national historical parks, national preserves, national reserves, national seashores, national historic sites, national battlefields, national memorials, national memorial parkways, and the San Francisco Presidio.

e National historic trails are typically long, linear features of various condition. In some cases, there may be little or no obvious indication of the presence of a historic trail, and its location is largely identified only on maps or by signage. Alternately, some historic trails or portions thereof include features such as wagon wheel ruts, campgrounds, and other features that are directly associated with historic use of the trail and are clearly visible. Trails exhibiting these latter traits are often well marked and preserved. Some landscapes associated with historic trails are also considered important because they are largely unchanged in appearance from the time that the trail was used. Trial crossings by the proposed corridors were selected to avoid these more visible and historically important portions of the trails to the fullest extent possible. Historic trail crossings account for 35% of the major sensitive areas that would be crossed by the proposed corridors.

f NA = not applicable; feature type does not occur in the state.

g Havaso National Wildlife Refuge occurs almost exclusively in Arizona. A very small portion occurs in California and is intersected by a portion of a proposed corridor buffer. This intersection is not counted for California.

Text Box 2.2-3
Corridor Designation and Sensitive Resources

There is no intent to designate Section 368 energy transport corridors on protected lands or resources (such as designated wilderness or roadless areas), or to imply that construction of energy transport facilities would be authorized on those lands. However, unintentional intersections of portions of some corridors with federal lands identified by the management agencies as protected from certain uses may have occurred, for several reasons:

- The programmatic nature of the PEIS;
- Limitations in the PEIS GIS database, which was compiled using many smaller GIS databases from multiple sources and multiple scales;
- Efforts to use existing ROWs associated with electricity transmission lines, pipelines, highways, roads, and locally-designated corridors; and
- Corridor widths ranging from as little as 200 feet to as much as 5.5 miles.

Rather than authorize future construction without further review, a designated Section 368 energy transport corridor becomes a pathway within which project-specific ROW applications with precise project-specific centerlines and widths, land ownership descriptions, and proposed development plans will be considered. The availability of more accurate site-specific information will enable the appropriate land management agencies to ensure that protected lands would be fully considered when granting ROWs and authorizing energy transport project construction and operation within designated corridors.

Land use plan amendments are discussed in Section 2.3.

Environmental analyses of energy transport projects proposed for the corridors designated under the Proposed Action would tier to this PEIS for their environmental analyses, and project applicants would be required to do additional project-specific environmental analyses as required by NEPA and other applicable laws. There would be no requirement under the Proposed Action for any proposed energy transport projects to use the designated corridors. If project applicants wished to use other federal lands, they would be free to request ROW authorization on those other lands, as they would under No Action. In such instances, the project applicant would not receive the benefit of a more efficient application process associated with the use of a Section 368 corridor (see Section 1.4).

2.2.1 How Were the Proposed Section 368 Energy Corridor Locations Sited?

Energy corridors were located to provide for the West-wide transport and distribution of energy (electricity, oil, natural gas, and hydrogen) between supply and demand areas in the 11 western states while avoiding sensitive resources and land use and regulatory constraints to the fullest extent possible. If developed with energy transport projects, the corridors would also aid in alleviating congestion problems associated with electricity transmission in the West. Energy corridor locations were selected using a systematic three-step siting process (Figure 2.2-3).

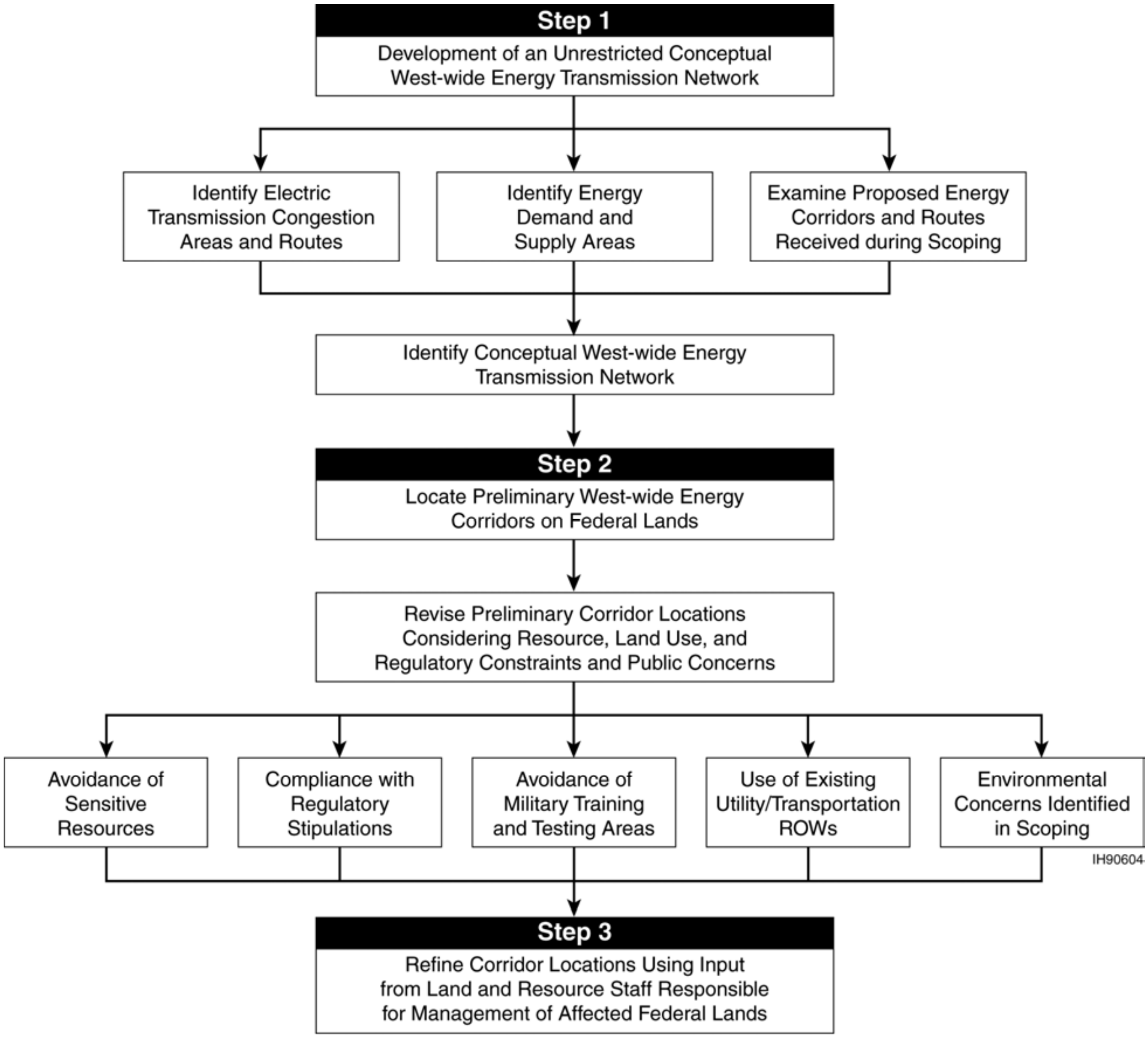


FIGURE 2.2-3 Three-Step Corridor Siting Process for Identifying Section 368 Energy Corridor Locations

These steps are summarized below.

1. First, the Agencies developed an "unrestricted" conceptual West-wide network of energy transport paths that addressed the need to connect energy supply areas (regardless of energy type) with demand centers and provide for the long-distance transport of energy, and that also could meet the requirements and objectives of Section 368, regardless of land ownership or environmental or regulatory issues.

2. Next, the locations of individual segments of the conceptual network defined in Step 1 were examined and revised to avoid major known environmental, land use, and regulatory constraints (such as topography, wilderness areas, cultural resources, military test and training areas, and

Text Box 2.2-4
Tiering

The Council on Environmental Quality (CEQ) defines tiering as (40 CFR 1508.28):

"…the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basin-wide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on issues specific to the statement subsequently prepared."

When a broad NEPA document such as an EIS or environmental assessment has been prepared, any subsequent site-specific assessment or evaluation can summarize (and include by reference) the issues discussed in the broader document, and thus the site-specific assessment can focus its analyses on the project-specific issues of the Proposed Action (40 CFR 1502.20).

Text Box 2.2-5
Overview of the Process
for Siting Energy Corridor Locations

Step 1. Develop an unrestricted conceptual energy transport network that addresses energy supply and demand and transport congestion, with no consideration of regulatory or environmental restrictions or constraints.

Step 2. Locate preliminary corridors on federal lands such that major known, sensitive, or important resources and land uses are avoided.

Step 3. Refine preliminary corridor locations so they are consistent with local federal land management responsibilities and further avoid sensitive resources to the fullest extent possible.

Tribal and state natural and cultural resource areas, etc.). This revision of corridor locations was based on an analysis of geographic information system (GIS)-based data (see Appendix H) from multiple sources (BLM, FS, USFWS, State Historic Preservation Offices, U.S. Geological Survey [USGS], DOE, and DOD). The revision resulted in a preliminary West-wide energy corridor network that avoided private, state, and Tribal lands, many important known natural and cultural resources, and many areas incompatible with energy transport corridors because of regulatory or land use constraints while meeting the requirements and objectives of Section 368.

3. Lastly, the locations of the Section 368 corridors developed in Step 2 were further adjusted using corridor-specific input from local federal land managers and staff. These managers and staff evaluated the preliminary corridor locations on their respective administrative units and adjusted the corridor locations to further avoid important or sensitive resources and to ensure consistency with resource management objectives described in each unit's land use plans, while meeting the requirements and objectives of Section 368.

While this siting process considered all current and expected forms of energy (e.g., electricity, oil, natural gas, hydrogen), energy generation (e.g., coal-fired power plants, hydropower, solar and wind generation), and energy transport system (e.g., pipelines, electricity transmission lines), additional emphasis was given to electricity transmission because of the interconnected nature of the electricity transmission and congestion issues currently facing the West. Throughout the corridor siting process, comments received from the public on corridor locations were considered with regard to both the need for energy corridors in specific locations and the desire to avoid or minimize impacts to environmental resources.

2.2.1.1 Step 1 – Develop an Unrestricted Conceptual West-wide Energy Transport Network

The first step in identifying potential energy corridors was the development of an "unrestricted" conceptual West-wide energy transport network. This network represents an interconnected set of paths along which energy could theoretically move throughout the western states. This network was developed considering (1) the need to transport energy from supply areas to demand areas; (2) the need to improve reliability, relieve congestion, and enhance the transmission capability of the western electric grid; and (3) the need to evaluate the locations of corridors suggested by the public and other stakeholders. Development of this network did not, however, consider physical, environmental, or regulatory constraints to siting energy corridors, nor was land ownership considered.

Where Are the Energy Demand and Supply Areas? Energy demand areas were considered to be the major metropolitan centers in each of the 11 western states, such as San Diego, Los Angeles, San Francisco, Las Vegas, Phoenix, Albuquerque, Denver, Salt Lake City, Seattle, Portland, Boise, Helena, and Cheyenne. These cities represent not only current locations of high energy demand, but also locations expected to grow in population, and thus in energy demand in the foreseeable future.

Energy supply areas were considered to include areas with existing high or growing electricity generating capacity, such as areas with numerous small-capacity or several high-capacity electricity generating units, and current natural gas facilities (Figure 1.1-1); areas with potential renewable energy (such as wind, geothermal, and solar energy) development (Figure 2.2-4); and areas of known coal, oil, and natural gas reserves or production (including energy resources in oil shale and tar sand deposits) that could be developed in the future (Figure 2.2-4).

Where Are the Major Electricity Transmission Constraints and Congestion Areas in the West? Section 368 directs the Agencies to take into account the need for upgraded and new electricity transmission and distribution facilities to relieve congestion of the national electricity grid (see Section 1.1.1 and Appendix E for details on the grid and congestion). Congestion of the grid can be relieved, in part, by locating electricity transmission projects in locations that would provide additional paths around or through electricity transmission bottlenecks (i.e., congestion points). Development of the unrestricted conceptual West-wide energy transport network took into account the locations of current and future transmission constraints and congestion paths identified in the *National Electric Transmission Congestion Study* (Figure 1.1-2) (DOE 2006a; conducted pursuant to Section 1221(a) of EPAct) and identified potential paths where new projects could help facilitate current and future electricity transmission.

What Energy Corridor Locations Were Suggested by the Public? During public scoping, approximately 210 individuals and organizations provided comments on the scope of the PEIS. The comments were received from a variety of sources, including individual energy transport or generation companies; municipalities; and state, regional, and national energy transport organizations that have been examining energy supply, demand, and transport issues in the West. Numerous comments were also received from individual members of the public. The public scoping process is described in more detail in Section 1.9.1, and a scoping summary report (DOE 2006b) is provided in Appendix B. Many comments requested that specific existing or planned energy transport project ROWs be designated as Section 368 energy corridors; these suggested corridors range in length from relatively short corridors of less than 100 miles to ones that are hundreds of miles in length and cross one or more states. The majority of the commentors were concerned with electricity transmission; fewer were concerned with natural gas, oil, or hydrogen transport. Several commentors discussed the need for electricity transmission corridors that would support renewable energy projects. In addition to the comments received during the scoping period (September 28 to November 28, 2005), the Agencies also received comments on maps of preliminary corridor routes that were made publicly available in June 2006. The proposed energy corridors, totaling more than 61,550 miles in length, received from the public are shown in Figure 2.1-1. These proposed corridors suggest where energy transport paths may be needed within the 11 western states.

Text Box 2.2-6
Corridor Siting Step 1

Step 1 developed an unrestricted conceptual network of energy transmission paths linking energy supply and demand areas in the West while considering:

- Electricity congestion concerns of the national electricity grid, and
- Corridor suggestions received from the public.

Development of the unrestricted conceptual network did not consider environmental or regulatory constraints or land ownership.

What Was the Outcome of Step 1? An unrestricted conceptual energy transport network was developed for the 11 western states, following an examination of the locations of (1) energy demand and supply centers, (2) transmission constraints and congestion areas and paths in the national electricity grid, and (3) energy transport corridors identified during and after public scoping, as well as corridor locations previously developed by the energy transport industry, regional energy planning entities, and state agencies. For example, during scoping, 12 proposed energy corridors between the Salt Lake City and Las Vegas areas were identified (Figure 2.1-1). The large number of corridor suggestions indicates an underlying need for additional energy transport capacity to connect energy production areas in southwestern Wyoming with the high energy demand areas of Las Vegas and southern California.

The unrestricted conceptual West-wide (Figure 2.2-5) energy transport network identifies general paths or directions of energy transport that could connect current and future areas of energy supply and demand (Figure 2.2-6) and, if developed for energy transport, could alleviate current and future congestion of the western electricity transmission grid (Figure 2.2-7). This corridor network is considered to be unrestricted because it does not incorporate considerations of land ownership, nor any environmental or regulatory constraints. For example, the corridors in this unrestricted network cross 29 national parks, monuments, and recreation areas, 15 national wildlife refuges, and 58 wilderness areas.[1] This unrestricted network also did not consider topographic features, such as mountain passes and river gorges, which could affect the siting and construction of energy transport projects.

2.2.1.2 Step 2 – Identify the Preliminary Energy Corridors on Federal Lands

How Were the Preliminary Energy Corridors Identified? The unrestricted conceptual West-wide energy transport network developed in Step 1 (Figure 2.2-5) does not consider physical, environmental, or regulatory constraints, or land ownership. Because Section 368 specifies the designation of energy transport corridors only on federal land, Step 2 focused on identifying potential corridors that would:

1 Federal lands designated by Congress under the Wilderness Act of 1964 for protection from human disturbance.

> **Text Box 2.2-7**
> **What about Nonfederal Lands?**
>
> A number of scoping comments identified concerns about designation of federal energy corridors and their impacts on nonfederal lands. As specified by Section 368, the federal energy corridors would be designated only on federal land. Furthermore, designation of the federal corridors does not require utilities to use the corridors, and it would be up to each project applicant to identify its preferred, project-specific route across federal and nonfederal lands and to secure access across those lands. Project applicants would secure ROWs across nonfederal lands in the same manner that they currently obtain such access, independent of federal energy corridor designations. Each project would undergo a project-specific NEPA evaluation to determine potential project impacts to federal and nonfederal lands.

1. Be consistent with the unrestricted conceptual West-wide energy transport network, and thus provide paths for connecting current and future energy supply and demand areas that could, if used by future electricity transmission projects, improve reliability, relieve congestion, and enhance the capability of the national grid to deliver electricity; and

2. Meet the Section 368 requirement of designating corridors only on federal land.

The identification of preliminary energy corridors also took into account several "location" factors that affected where a corridor may or may not be located on federal land. These factors (Table 2.2-7) included (1) locations of important natural and cultural resources, (2) locations of military training and testing areas, (3) DOD restricted airspace, (4) regulatory stipulations preventing siting of certain activities or infrastructure on specific lands, and (5) environmental concerns identified during scoping (see Appendix B). Corridors were located to avoid these areas, resources, and lands to the maximum extent possible, although not all important or sensitive resources could be avoided.

Preliminary energy corridors were identified by examining each of the unrestricted conceptual West-wide energy transport network corridors and adjusting corridor locations to avoid conflicts with applicable location factors (Table 2.2-7) to the maximum extent possible. For example, the number of national parks, monuments, and recreation areas crossed by the unrestricted conceptual network decreased from 29 to 15 following Step 2; the number of national wildlife refuges crossed decreased from 15 to 12; and the number of wilderness areas crossed decreased from 58 to 27. In addition, existing ROWs (including those for energy transport and roads and highways) in the vicinity of the conceptual energy transport network were identified and examined for possible use in locating Section 368 corridors. Consideration of existing ROWs can expedite the siting and designation of Section 368 energy corridors because for many of these ROWs, project-specific impact analyses and amendments to land use plans have already been completed. The unrestricted conceptual energy transport network corridors were moved, where possible, to take advantage of existing ROWs that could be expanded to accommodate federal energy corridors without conflicting with other location factors.

> **Text Box 2.2-8**
> **Use of Existing ROWs**
>
> Existing ROWs, such as those for electricity transmission systems, roads, and highways, near the conceptual West-wide energy transport network corridors were identified and examined for possible colocation of Section 368 corridors.

What Was the Outcome of Step 2? At the conclusion of Step 2, a preliminary set of energy corridors was identified on federal lands. These corridors would meet the needs of Section 368

TABLE 2.2-7 Location Factors, Lands, and Resources Receiving Special Consideration during Preliminary Siting of Section 368 Energy Corridors on Federal Lands

Location Factor	Type of Area or Resource to Be Avoided
Existing federal statutes, regulations, and policies (e.g., Wilderness Act of 1964)	Federally and state designated wilderness areas, wild and scenic rivers, national parks, national monuments, national recreation areas, national wildlife refuges, roadless areas, and national natural landmarks
Resources that are ecologically, culturally, scientifically, educationally, and/or recreationally important	Wilderness study areas, national conservation areas, areas of critical environmental concern, national parks, national monuments, national recreation areas, national wildlife refuges, special recreation management areas, national historic trails and national scenic trails, important cultural and historic properties, national natural and historic landmarks, world heritage sites, research natural areas, experimental forests, and important paleontological resources
Military installations and training and testing areas	Military bases, military training and testing areas, DOD special-use airspace
Public concerns raised during scoping	All of the above except military bases, training and testing areas, and special-use airspace
Tribal lands	Tribal lands and cultural resources[a]

[a] Section 368 energy corridors are not proposed for designation on Tribal lands. However, ROWs can be obtained on Tribal lands following the processes set out in 25 USC 323, 25 CFR 169, and 25 USC 3504. Some energy projects developed using proposed Section 368 energy corridors could also cross Tribal lands, but the Agencies did not designate corridors for such crossings.

Text Box 2.2-9
Energy Corridor Siting Step 2

In Step 2, the unrestricted conceptual corridor network paths were relocated to avoid to the extent practicable environmental and regulatory constraints and address public concerns to the maximum extent possible, while still providing paths connecting energy supply and demand areas and addressing electricity congestion issues. These relocated paths represent preliminary energy corridors on federal lands in the West.

with regard to designation of energy corridors on federal lands and enhancement of the national electricity grid, while avoiding many sensitive resources and areas to the extent practicable, complying with most statutory and regulatory provisions, avoiding military training and testing areas and restricted airspace, avoiding Tribal lands, and being responsive to concerns raised in public scoping. These preliminary energy corridors are shown in Figure 2.2-8. Additional adjustments in corridor locations to further avoid sensitive resources and areas were made during Step 3 of the corridor siting process.

2.2.1.3 Step 3 – Refine the Section 368 Energy Corridor Locations

Following identification of preliminary energy corridors on federal lands, agency personnel involved with the management of federal lands that would be crossed by the preliminary corridors were asked to examine the corridor locations and identify any additional location adjustments that would further avoid important resources or areas, and to confirm that the corridor locations would be consistent with the specific management needs of each land management unit (such as a BLM field office or a FS national forest).

Text Box 2.2-10
Energy Corridor Siting Step 3

In Step 3, the preliminary corridor network was examined by local federal land managers and their staff, and corridor locations were moved as practicable to further avoid important environmental and regulatory constraints and ensure that corridor locations and characteristics were consistent with management responsibilities on the federal lands.

Corridor data in a geographical information system (GIS) database was provided to approximately 55 FS national forests, 74 BLM district and field offices, and 17 DOD facilities that could be crossed by the preliminary corridors. In addition, this information was also provided to the national office of the USFWS for its use in examining preliminary corridors that may be crossing national wildlife refuges or other USFWS-managed areas. The managers and staff of these federal lands were asked to use this information, together with their unique, site-specific knowledge of sensitive resources, management activities, and compatible land uses, to provide (together with detailed supporting rationale) corridor location adjustments to further minimize potential conflicts with management responsibilities, important resources, and other location factors while providing consistency with current land use plans. As part of this activity, more than 50 Web-based meetings (Appendix I) were held with staff from the affected agencies, during which resource-specific issues (such as concern for important fossil beds or avoidance of wilderness areas) were discussed and corridor locations adjusted to best address those issues. Adjustment to the locations of the preliminary corridors also considered public and Tribal comments received after the close of the scoping period (see Section 1.9.1).

2.2.2 Where Are the Proposed Energy Corridors?

In some cases, the corridor adjustments proposed by managers and staff from adjacent federal land management units resulted in discontinuities in corridor alignments between adjacent federal lands (e.g., proposed energy corridors did not line up between adjacent BLM and FS lands). In these circumstances, one or more additional meetings with the land managers and their staffs were conducted to reach siting resolution. The outcome of this refinement was a set of more realistic, potential West-wide energy corridors on federal lands (Figure 2.2-1). In many areas, there was relatively little adjustment to the corridor locations between Steps 2 and 3 of the siting process. In other areas, major changes were required in corridor location (for example, compare corridor locations in southwestern Wyoming and in western Colorado between Figures 2.2-8 and 2.2-1). In these areas, corridor locations, characteristics, and compatible uses were revised to address concerns related to wildlife habitat, wildfire concerns, and avoidance of the Seedskadee and Cokeville Meadows National Wildlife Refuges. As a result of these additional corridor location evaluations and adjustments, the number of national parks, monuments, and recreation areas crossed by energy corridors decreased from 15 after Step 2 to 12 after Step 3; national wildlife refuge crossings dropped from 12 to 3; and wilderness area crossings decreased from 27 to 0 (Table 2.2-6).

2.3 WHAT LAND USE PLAN AMENDMENTS AND INTERAGENCY PERMITTING COORDINATION WOULD BE REQUIRED UNDER THE PROPOSED ACTION?

Designation of Section 368 energy corridors under the Proposed Action would require the amendment of agency-specific land use plans to incorporate the designated corridors. Affected plans would be those for federal administrative units crossed by the Section 368 energy corridors. Plan amendments may also be required for administrative units crossed by future energy transport projects developed under the No Action Alternative. Analyses conducted in this PEIS would support the amendment of approved land use plans for federal lands where Section 368 energy corridors would be designated.

The plan amendments for the Proposed Action would include (1) the identification of specific Section 368 energy corridors by centerline, width, and compatible energy uses and restrictions (such as pipeline only or electricity transmission with a restricted tower height); and (2) the adoption of interagency operating procedures (IOPs; see Section 2.4) that would be selected on a corridor- and project-specific basis. Only those land use plans where Section 368 energy corridors would be located would be amended. Corridor-related amendments would be applied to approved existing land use plans when the ROD for this PEIS is signed. Land use plans that are currently undergoing revision for other reasons (not related to Section 368), but not scheduled for completion until after the ROD is signed, would incorporate the corridor designations into their ongoing plan revisions. Plans that are currently being revised for other reasons and would be completed before the ROD is signed would need to undergo further amendment when the ROD is signed. Plans that could be amended under the Proposed Action and the proposed amendments to each plan are presented in Appendix A.

Section 368 calls for the Secretaries to ensure that additional corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on federal land are promptly identified and designated, as necessary. Thus, additional Section 368 energy corridors may be designated, together with additional land use plan amendments, to address future energy transport and distribution needs. Neither No Action nor the Proposed Action would preclude the Agencies from designating Section 368 energy corridors in the future. The Agencies anticipate that the analyses contained in this PEIS would be reviewed and, as appropriate, incorporated into those amendments and revisions.

2.4 HOW WOULD THE AGENCIES EVALUATE AND OVERSEE THE USE AND OCCUPANCY OF ENERGY CORRIDORS?

Text Box 2.4-1
What Are IOPs?

IOPs include interagency planning and implementation considerations intended to guide the development of ROW applications.

The Agencies would adopt appropriate IOPs when evaluating a ROW application within a Section 368 energy corridor. The IOPs would assist the Agencies, project applicants, and others in evaluating applications for using the corridors. Consideration of information generated by implementation of the IOPs would help ensure that energy transport projects within the Section 368 energy corridors are planned, implemented, operated, and eventually removed in a manner that protects and enhances environmental resources. In addition, the adoption of applicable IOPs and regulatory requirements, such as the Endangered Species Act of 1973, are mandatory and would be required for all proposed projects at all corridor locations. Other IOPs, such as those dealing with stream crossings, would only apply for projects in certain locations, as appropriate.

The IOPs would be considered during the application and permitting process as well as during project construction and operation. Where appropriate, specific management controls and performance standards would accompany a ROW authorization. These would be identified on the basis of the project-specific application and supporting site-specific environmental evaluations.

2.4.1 What Would Be the IOPs for Project Planning?

1. The appropriate agency, assisted by the applicant, must conduct project-specific NEPA analyses in compliance with Section 102 of NEPA. The scope, content, and type of analysis shall be determined on a project-by-project basis.

2. The appropriate agency, assisted by the project applicant, must consult with the USFWS and the NMFS as required by Section 7 of the Endangered Species Act of 1973. The specific consultation requirements would be determined on a project-by-project basis.

3. The appropriate agency, assisted by the project applicant, must comply with all aspects of Section 106 of the NHPA on a project-by-project basis. When such compliance results in adverse effects to historic properties that cannot be avoided or mitigated within the designated corridors, the agency may consider alternative development routes to avoid, minimize, or mitigate adverse effects.

4. The appropriate agency, assisted by the project applicant, must coordinate and consult with NMFS regarding potential impacts to essential fish habitat (EFH) as required by the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

5. All project applications must comply with applicable findings, mitigation, and/or standards contained in regional land management plans, such as the Northwest Forest Plan, when such regional plans have been incorporated into agency planning guidelines and requirements.

6. Applicants seeking to develop energy transport projects with above-ground infrastructure within corridors located on or near DOD facilities or flight training areas (see Appendix J) must, early in the planning process and in conjunction with the appropriate agency staff, inform and coordinate with the DOD regarding the characteristics and locations of the anticipated infrastructure.

7. In those instances where corridors cross National Wildlife Refuge System lands, the National Wildlife System Administration Act and other relevant laws and policies pertinent to national wildlife refuges shall apply.

8. Applicants should locate desired projects within energy corridors to promote effective use of the corridors by subsequent applicants and to avoid the elimination of use or encumbrance of use of the corridors by ROW holders. Proposed projects should be compatible with identified energy transport modes and avoid conflicts with other land uses within a corridor.

9. Applicants should identify important, sensitive, or unique habitats in the vicinity of proposed projects and, to the extent feasible, design the project to minimize or mitigate impacts to these habitats.

10. The applicant should prepare an access road siting and management plan that incorporates relevant agency standards

regarding road design, construction, maintenance, and decommissioning.

11. Applicants should develop an integrated vegetation management plan consistent with agency policies for the control of unwanted vegetation, noxious weeds, and invasive species.

12. The vegetation management plan should address monitoring, education of personnel on weed identification, the manner in which weeds spread, and the methods for treating infestations. The use of certified weed-free mulching and the cleaning of vehicles to avoid the introduction of invasive weeds may be required.

13. To restore disturbed habitats, the applicant should prepare a habitat restoration plan. The plan should expedite the recovery to natural habitats and require restoration to occur as soon as practicable after completion of construction, minimizing the habitat converted at any one time.

14. Applicants should prepare a visual resource management plan. In developing this plan, viewshed mapping should be used to determine the potential visibility of proposed project facilities, and visual impact simulations should be prepared to create spatially accurate depictions of the appearance of proposed facilities. Simulations should depict proposed project appearance from sensitive/scenic locations as well as more typical viewing locations. Transmission towers, compressor stations, valves, and other above-ground infrastructure should be integrated with the surrounding landscape.

15. If paleontological resources are known to be present in the project area, or if areas with a high potential to contain paleontological material have been identified, the applicant should prepare a paleontological resources management and mitigation plan. If adverse impacts to paleontological resources cannot be avoided or mitigated within the designated corridors, the agency may consider alternative development routes to avoid, minimize, or mitigate adverse effects.

16. Applicants should follow the best management practices of the states in which the proposed project would be located.

17. Applicants seeking to develop an electricity transmission project will develop a project-specific plan of development (POD). The POD should display the location of the project infrastructure (i.e., towers, power lines) and identify areas of short- and long-term land and resource impacts and the mitigation measures for site-specific and resource-specific environmental impacts. The POD should also include notification of project termination and decommissioning to the agencies at a time period specified by the agencies.

18. For electricity transmission projects, the applicant should notify the Federal Aviation Administration (FAA) as early as practicable in the planning process in order to identify appropriate aircraft safety requirements.

19. An electricity transmission project should be planned by the applicant to comply with FAA regulations, including lighting regulations, and to avoid potential safety issues associated with proximity to airports, military bases or training areas, or landing strips.

20. Corridors are to be efficiently used. The applicant, assisted by the appropriate agency, should 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.

21. The applicant should 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 adverse 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.

22. Applicants should 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.

23. Applicants for petroleum pipelines should develop a spill prevention and response plan identifying spill prevention measures to be implemented, training requirements, appropriate spill response actions, and procedures for making timely notifications to authorities.

24. A health and safety program should 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, Occupational Safety and Health Administration [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.

25. The health and safety program should 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 facilities.

26. Applicants should develop a fire management strategy to implement measures to minimize the potential for a human-caused fire. 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.

27. The appropriate agency, assisted by the project applicant, must initiate government-to-government consultation with affected Tribes at the outset of project planning and shall continue consultation throughout all phases of the project, as necessary. The agency POC may require the project proponent to prepare an ethnographic study when consultation indicates the need.

28. The appropriate agency, with assistance by the project applicant, must consult with State Historic Preservation Officers (SHPOs) and other appropriate parties as per regulations (36 CFR 800) early in project planning and continue consultation throughout project development as necessary.

29. The project applicant may, with the approval of the agency POC, assign a Cultural Resource and/or Tribal Coordinator to facilitate and coordinate cultural resource compliance and consultation with multiple laws and regulations, agencies and other entities, jurisdictions, and Tribes, in order to ensure consistency and timeliness in the compliance and consultation process. Alternatively, the agency POC may assign such coordinators, to be paid for through project cost-recovery funds. The agencies, through the POC, remain responsible for consultation.

30. Project proponents should develop a cultural resources management plan (CRMP) to provide guidance for compliance with applicable cultural resource laws throughout the life of the project. CRMPs should meet the specifications of the agency POC and should and include the following as appropriate: identification of long- and short-term management goals for cultural resources within the Area of Potential Effect (APE) of the project; the definition of the APE; appropriate procedures for inventory, evaluation, and mitigation of adverse effects to historic properties; procedures for inadvertent discovery; monitoring needs and plans; curation procedures; anticipated personnel requirements and qualifications; public outreach and interpretation plans; and discussion of other concerns as appropriate. CRMPs should specify procedures that would be followed for compliance with cultural resource laws, should the project change during the course of implementation.

31. CRMPs should be based on the current state of knowledge. Where corridors are subject to sequential projects, CRMPs should incorporate information and lessons learned from previous projects, to adjust and update cultural resource management goals and consequent management strategies.

32. When concurrent development projects are proposed and implemented within a corridor, the agency POCs should coordinate among projects to ensure consistency with regard to Section 106 compliance and consultation, and to avoid duplication of effort.

33. The agency POC should coordinate compliance with existing Programmatic Agreements (PAs) and Memoranda of Agreement (MOAs) that pertain to agency responsibilities for cultural resources. The POC shall develop any other necessary PAs or MOAs that pertain to project-specific compliance. Where the proponent or the POC has designated a Cultural Resource and/or Tribal Coordinator, that person may assist with these and other tasks.

34. Project applicants should provide cultural resources training for project personnel on the laws protecting cultural resources, appropriate conduct in the field (such as procedures for the

inadvertent discovery of human remains), and other project-specific issues identified in the CRMP. Training plans should be part of the CRMP and should be subject to the approval of the POC.

35. The APE for Section 106 compliance should be defined in the CRMP and should include a reasonable construction buffer zone on either side of the ROW, including all areas of anticipated development such as staging areas, laydown areas, access routes, borrow source areas, and any other places of potential impact associated with all phases of project development. The APE shall include consideration of potential visual, audible, and atmospheric impacts.

36. Cultural resources management services and individuals providing those services shall meet the Secretary of the Interior's Standards for Archaeology and Historic Preservation.

37. As directed by the agency POC, projects should include a public education and outreach component regarding cultural resources such as a public presentation, news article, publication, or display.

38. A protocol for unexpected discoveries should be developed. Unexpected discovery of cultural resources during construction should be brought to the immediate attention of the responsible federal agency's authorized officer. Work should be halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.

39. A protocol must be developed for inadvertent discovery of Native American bones and funerary items to comply with the Native American Graves Protection and Repatriation Act (NAGPRA). Unexpected discovery of such items during construction must be brought to the immediate attention of the responsible federal agency's authorized officer. Work must be halted in the vicinity of the find of Native American graves and funerary items to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.

2.4.2 What Would Be the IOPs for Project Construction?

1. All control and mitigation measures established for the project in the POD and other required plans should be maintained and implemented by the applicant throughout construction. Necessary adjustments may be made with the concurrence of the appropriate agency.

2. Applicants should salvage, safeguard, and reapply topsoil from all excavations and construction activities during restoration.

3. All areas of disturbed soil should be restored by the applicant using weed-free native grasses, forbs, and shrubs as directed by the agency. Restoration may not be unnecessarily delayed. If native species are not available, noninvasive vegetation recommended by agency specialists may be used.

4. The applicant should not create excessive slopes during excavation. Areas of steep slopes, biological soil crusts, erodible soil, and stream channel crossings would often require site-specific and specialized construction techniques by the applicant. These specialized construction techniques

should be implemented by adequately trained and experienced employees.

5. The applicant should implement erosion controls complying with county, state, and federal standards, such as jute netting, silt fences, and check dams.

6. The applicant should 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.

7. To avoid conflict with federal and nonfederal operations, the applicant should be aware of liabilities pertaining to environmental hazards, safety standards, and military flying areas.

8. Applicants should not alter existing drainage systems and should give particular care to sensitive areas such as erodible soils or steep slopes. Soil erosion should be reduced at culvert outlets by appropriate structures. Catch basins, roadway ditches, and culverts should be cleaned and maintained.

9. Applicants should not create hydrologic conduits between aquifers.

10. The applicant should backfill foundations and trenches with originally excavated material as much as possible. Excess excavation materials should be disposed of by the applicant only in approved areas.

11. The applicant should obtain borrow material only from authorized sites. Existing sites should be used in preference to new sites.

12. The applicant should prepare an explosives use plan that specifies the times when explosives would be used and specifies minimum distances from sensitive vegetation and wildlife or streams and lakes where the use of explosives would be allowed.

13. If blasting or other noisy activities are required during the construction period, the applicant should notify nearby residents in advance.

14. Any wastewater generated by the applicant in association with temporary, portable sanitary facilities should be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews should be adequate to support expected on-site personnel and should be removed at completion of construction activities.

15. The applicant should cover construction materials and stockpiled soils if these are sources of fugitive dust.

16. The applicant should water land before and during surface clearing or excavation activities. Areas where blasting would occur should be covered with mats.

17. The applicant should 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.

18. The applicant should 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.

19. The applicant should locate all stationary construction equipment

(i.e., compressors and generators) as far as practicable from nearby residences.

20. Project applicants should provide all cultural resources reports and data in an approved electronic format that is integrated across jurisdictional boundaries, that meets current standards, and that is compatible with SHPO systems. Project proponents should submit cultural resources data on a regular basis to ensure that SHPO systems are kept up to date for reference as the different phases of the project proceed. Paper records may also be required by the agency.

21. Cultural resources inventory procedures should include development of a project research design sufficient to support the evaluation of cultural resources encountered in the APE.

22. All cultural resources discovered during the inventory process shall be evaluated for eligibility to the *National Register of Historic Places* (NRHP).

23. When an area is identified as having a high potential for cultural resources but none are found during a field survey, a professionally qualified cultural resources specialist may be required to monitor ground-disturbing activities during project construction, and to complete a report when the activities are finished.

24. Cultural resources inventory, evaluation, and mitigation practices should incorporate modeling and sampling strategies to the extent practicable, in concurrence with SHPOs and other relevant parties, and as approved by the agency POC.

25. When human remains, funerary objects, sacred objects, or objects of cultural patrimony are inadvertently discovered, the provisions of NAGPRA shall apply.

2.4.3 What Would Be the IOPs for Project Operation?

1. All control and mitigation measures established for the project should be maintained and implemented by the applicant throughout the operation of the project. Necessary adjustments may be made with the concurrence of the appropriate agency.

2. Applicants should review existing information regarding plant and animal species and their habitats in the vicinity of the project area and identify potential impacts to the applicable agencies.

3. Project staff should avoid harassment or disturbance of wildlife, especially during reproductive courtship, migratory, and nesting seasons.

4. Observations by project staff of potential wildlife problems, including wildlife mortality, should be immediately reported to the applicable agency authorized officer.

5. If pesticides are used, the applicant should ensure that pesticide applications as specified in the integrated vegetation management plan are conducted within the framework of agency policies and entail only the use of U.S. Environmental Protection Agency (EPA)-registered pesticides and are applied in a manner consistent with state pesticide regulations. Pesticide use should be limited to nonpersistent immobile pesticides and may be applied only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

6. The applicant should provide secondary containment for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) should be a temporary activity occurring only for as long as needed to support construction and decommissioning activities.

7. The applicant should ensure that wastes are properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.

8. In the event of an accidental release to the environment, the applicant should initiate spill cleanup procedures and document the event, including a cause analysis; appropriate corrective actions taken; and a characterization of the resulting environmental or health and safety impacts. Documentation of the event should be provided to the agency's authorized officer and other federal and state agencies, as required.

9. Dust abatement techniques (e.g., water spraying) may 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.

10. The applicant should ensure that all equipment has sound-control devices no less effective than those provided on the original equipment.

2.5 WERE OTHER ALTERNATIVES CONSIDERED FOR DETAILED STUDY?

The NOI for this PEIS identified four alternatives: (1) No Action Alternative, (2) Increased Utilization Alternative, (3) New Corridor Alternative, and (4) Optimization Criteria Alternative. Among these, the Increased Utilization and New Corridor Alternatives were eliminated from further study. The Optimization Criteria Alternative is included in the Proposed Action Alternative, designation of EPAct Section 368 energy corridors and amendment of land use plans.

A number of alternatives for energy corridor designation were suggested during scoping (see Section 2.1). These alternatives are:

- Designating all existing energy corridors and ROWs in the 11 western states as federal energy corridors;
- Upgrading existing energy transport facilities within existing energy corridors and ROWs for greater transport capacity or efficiency, before new federal energy corridors are designated;
- Locating designated energy corridors only in areas adjacent to federal highways and major state and municipal roads;
- Designating energy corridors on national park lands and DOD facilities;
- Designating as energy corridors existing, under way, or planned energy transport project ROWs (as identified by energy providers), including individual inter- and intrastate corridors connecting very specific supply and demand area locations throughout the West;
- Environmentally friendly alternatives that called for increasing energy efficiency or conservation by energy users instead of designating corridors; and
- Preliminary corridors identified in the corridor siting process.

These alternatives, which were considered but eliminated from further study, were each examined with regard to how well they would meet the purpose and need of Section 368, how well they would support designation of federal energy corridors, and how they would address the energy transmission issues of the electricity transmission grid in the West.

2.5.1 Increased Utilization Alternative

While this alternative was initially identified in the NOI for this PEIS, examination during the corridor siting process of existing energy corridors and ROWs and their associated facilities revealed that adding more energy transport projects to an existing ROW or increasing the energy transport capabilities of existing facilities within an ROW is not possible in many locations. Many of the existing ROWs are only wide enough for the individual energy transport project that they serve, and the addition of multiple transport projects could only be accomplished by widening the ROW. While an electricity transmission line may be upgraded to carry greater current (e.g., from 250 kV to 500 kV), this type of upgrade could require new infrastructure (such as higher transmission towers) that could conflict with other land use activities (such as low-level military flight training activities). Furthermore, Section 368 does not authorize the agencies to require energy transport facility owners to upgrade their transport systems within existing energy corridors or ROWs on federal lands. The Proposed Action does include the potential for upgrading existing transport infrastructure when present in a proposed energy corridor. Some corridor segments are restricted to “upgrade only” due to technical, physical, resource, or land management constraints that preclude widening the corridor to accommodate additional energy transport projects.

2.5.2 New Corridor Alternative

As corridors were being located during the corridor siting process (see Section 2.2.1), it became apparent that in many locations locally designated energy corridors existed that had already been evaluated for their compatibility with the land management responsibilities of the local federal landowner. After development of a preliminary corridor network (the unrestricted conceptual energy corridor network developed in Step 1 of the corridor siting process [see Section 2.2.1]), it became apparent that by incorporating portions of these existing energy corridors into the Proposed Action corridors, the objectives of Section 368 could be met while limiting the proliferation of energy ROWs (and associated project-specific construction and operation impacts) on the federal landscape.

2.5.3 Alternatives That Would Designate All Existing Energy Transport ROWs and Corridors as Federal Energy Corridors

The designation of all existing corridors and ROWs in the 11 western states as federal energy corridors was removed from further study for a number of reasons. Many of the existing corridors and ROWs have relatively small transport systems (e.g., less than 250-kV electricity transmission lines, less than 8-inch-diameter pipes) and could not support additional transport systems due to a variety of reasons ranging from topographic restrictions, sensitive resources, and federal land use restrictions. Expanding the width of existing corridors and ROWs to accommodate additional transport facilities would not be feasible in many of these areas. Thus, the designation of all existing energy ROWs and corridors as Section 368 energy corridors would not necessarily provide for the enhancement of energy delivery nor reliability, nor address congestion concerns in the western electricity grid, as required by Section 368. However, some existing energy corridors and ROWs could be expanded to support additional energy transport projects, and existing facilities could be upgraded to increase the efficiency and capacity of energy transport. Approximately 60% of the corridors that would be designated under the Proposed Action incorporate existing corridors and/or ROWs, and in some locations the existing widths are proposed for expansion up to 3,500 feet where possible.

2.5.4 Alternatives That Would Upgrade Existing Corridors and ROWs before Designating New Corridors

Upgrading energy transport infrastructure in all existing corridors and ROWs before new federal energy corridors are designated could provide increased energy delivery throughout the West and address reliability and congestion issues of the electricity transmission grid in the West. However, not all existing corridors or ROWs and associated infrastructure could be upgraded. For example, an electricity transmission line may be upgraded to carry greater current (e.g., from 250 kV to 500 kV). This type of upgrade would require higher support towers than currently present, which could conflict with low-level military training activities in the area. The Proposed Action includes the potential for upgrading existing transport infrastructure when present in the proposed corridor location. Some corridor segments are restricted to "upgrade only" due to technical, physical, resource, or land management constraints. Furthermore, Section 368 does not authorize the agencies to require facility owners to upgrade their transport systems within existing corridors or ROWs on federal lands.

2.5.5 Alternatives Designating Corridors Only in Areas Adjacent to Major Transportation Routes

Locating newly designated federal energy corridors only adjacent to federal highways and major state and municipal roads was considered during alternative development. In fact, some of the corridor segments that comprise the Proposed Action do parallel or make use of existing transportation routes. Because of the limited amount of federal land available adjacent to many transportation routes, locating designated corridors only along transportation routes would result in a limited set of federal energy corridors. Existing transportation ROWs were considered during the corridor siting process. The Proposed Action makes use of such ROWs where possible (Table 2.2-1), and existing transportation ROWs are utilized in 9–81% of the corridors that would be designated under the Proposed Action within any one state.

2.5.6 Alternatives Designating Corridors on DOD Installations and Lands Managed by the National Park Service

During scoping, a number of commentors requested that energy corridors be designated to specifically cross some national parks and military reservations. Alternatives that would designate federal energy corridors on national parks and DOD facilities were, in general, removed from further study because such designations would conflict with the management requirements of the NPS and with the training, testing, and security needs of DOD. No corridors may be situated on DOD lands if the corridors could degrade military forces training, testing, or security needs. However, a very limited amount of land managed by the NPS and DOD is included in the Proposed Action because there were no alternate locations for the corridors in the general area of these federal lands and because some of these federal lands had preexisting ROWs and energy transport facilities. Many of these corridors are restricted to "upgrade only" use because of land management restrictions and military training requirements (such as low-level flights) and the corridors that would cross NPS-managed lands utilize preexisting utility ROWs.

2.5.7 Alternatives Designating Existing, Under Way, or Planned Transport Projects as Energy Corridors

A number of existing, under way, or planned project ROWs were suggested during scoping for designation as Section 368 energy corridors (see Figure 2.1-1). These specific, publicly proposed corridors were eliminated from further study because of one or more of the following factors:

- The publicly proposed corridors did not take into account regulatory (e.g., avoidance of federally designated wilderness areas) or environmental constraints;
- The publicly proposed corridors were located on little or no federal land;
- The publicly proposed corridors would provide only for local energy delivery, and would not address West-wide energy transport issues, including the reliability and congestion of the national electricity grid; or
- The publicly proposed corridors would not support the development of multiple energy transport systems (the proposed corridors would have project-specific ROWs that would be only wide enough for the specific project).

While these individual, project-specific publicly proposed corridors were eliminated from further study, the locations of all these corridors were considered in the development of the unrestricted conceptual West-wide energy transport network (during Step 1 of the corridor siting process; see Section 2.2.1). For example, 12 corridors were proposed during and after scoping for designation as Section 368 energy corridors between the Salt Lake City area and Las Vegas, while seven corridors were similarly proposed between Elko, Nevada, and Las Vegas (see Figure 2.1-1). The locations of these corridors indicated a need for one or more corridors along these paths, and this need was considered in the development of the unrestricted conceptual West-wide energy transport network (Section 2.2.1.1). Further evaluation of this network was conducted during Steps 2 and 3 of the corridor siting process. Because the energy corridors identified in the Proposed Action connect many of the start and endpoints of the publicly proposed corridors and could support multiple projects, the Proposed Action corridors could meet the energy transport needs of many of the publicly proposed corridors.

2.5.8 Alternatives That Would Increase Energy Efficiency and Conservation

Section 368 specifically calls for the designation of federal energy corridors and does not authorize the agencies to direct energy users to be more efficient and effective in their use of energy. Alternatives calling only for increased energy efficiency of existing transport facilities and energy conservation by users could help alleviate concerns related to congestion and increased energy demand in the West. However, these alternatives would not meet the requirements of Section 368, which specify the need to identify corridor centerlines and widths. Increasing energy efficiency of energy transport, specifically through the use of new technologies, such as conversion of electricity transmission lines from alternating-current to direct-current operation, would be possible under No Action and under the Proposed Action where the proposed corridor routes include existing transport facilities. Only increased energy conservation by energy users (which is independent of energy corridor designation) could reduce the demand for energy in the West and lessen congestion of the western electricity grid; it is unlikely that conservation could be implemented at a scale great enough to reduce energy demand to a level where additional transmission routes would not be necessary.

2.5.9 Preliminary Corridors Identified during the Siting Process

During Step 2 of the corridor siting process (see Section 2.2.1.2), preliminary energy corridors were identified in each of the 11 western states (Figure 2.2-8). Further evaluation of these preliminary corridors with regard to further avoiding sensitive resources and conflicting land uses (see Table 2.2-7) was conducted by appropriate federal land managers and their staff during Step 3 of the corridor siting process (see Section 2.2.1.3). As a result of this evaluation, some corridor segments were removed from further consideration and evaluation in this PEIS. For example, in Step 2, preliminary corridors were identified in north-central Montana and north-central Washington (Figure 2.2-8). During Step 3, these corridors were eliminated because they consisted of relatively small corridor segments on largely isolated federal lands; thus their designation under the Proposed Action would do little to meet the needs of Section 368. The Step 3 evaluation also relocated portions of some of the Step 2 preliminary corridors in response to, or at the direction of, local land manager concerns regarding sensitive resources and their intersection by the Step 2 corridors.

2.6 HOW DO THE ALTERNATIVES COMPARE?

The Proposed Action and No Action Alternatives were evaluated in this PEIS for potential environmental impacts associated with the designation of energy corridors on federal lands and the amendment of land use plans to incorporate the corridor designations. In addition, the types of potential impacts that may occur from the development of future energy transport projects were also identified. Because the Proposed Action is the designation of corridors and not the construction and operation of any energy transport projects, only a generic, qualitative evaluation is provided of the types of impacts that could result from development of an energy transport project regardless of project location. More quantitative impact analyses, including the identification of the magnitude and extent of potential impacts to specific social, cultural, economic, and natural resources, can only be conducted at the project level. This would be done in the future if an application to use a designated corridor were received by the Agencies.

No direct environmental impacts are expected to occur as a result of corridor designation and land use plan amendment. Corridor designation could result in effects to land use or property values on nonfederal lands adjacent to or between corridor segments. The type and magnitude of effect would depend on the current and anticipated future land use in these areas. Corridor designation and the amendment of land use plans under the Proposed Action do not authorize the development of projects within the corridors, or require the use of a designated corridor. Project applicants could continue to request project-specific ROWs elsewhere on federal and nonfederal lands to meet their specific energy transport objectives, just as they currently do and would continue to do under the No Action Alternative. In such instances, the project applicant would not receive the benefit of an expedited application and permitting process associated with the use of a Section 368 energy corridor (see Section 1.4).

Corridor designation could result in effects to land use on nonfederal lands adjacent to or between corridor segments. The type and magnitude of effect would depend on the current and anticipated future land use in these areas.

2.6.1 How Do the Physical Characteristics of the Corridors Compare between the Alternatives?

Under the No Action Alternative, there would be no Section 368 federal energy corridors designated on federal lands. Existing locally designated corridors would remain, and new corridors may continue to be locally designated. Under the Proposed Action, approximately 6,055 miles of such corridors would be designated on federal lands. Approximately 63% of the proposed corridors follow or include existing utility and/or transportation ROWs. There are 166 corridor segments that comprise the Proposed Action corridors. These segments have an average length of 37.3 miles.

2.6.2 Do the Alternatives Meet the Goals and Objectives of Section 368?

Section 368 calls for the designation on federal lands of corridors for energy transport facilities and directs the Secretaries to develop procedures to expedite applications to construct pipelines and electricity transmission and distribution facilities. In carrying out Section 368, the Secretaries are directed to also consider improving the reliability, reducing congestion, and enhancing the capability of the national electricity grid to deliver electricity.

Under the No Action Alternative, no Section 368 energy corridors would be designated on federal land; thus the goals and objectives of Section 368 would not be met. In contrast, approximately 6,055 miles of Section 368 energy corridors would be designated on federal lands under the Proposed Action. Thus, the Proposed Action would meet the requirements of Section 368 of designating energy transport corridors on federal lands in the West.

While project applicants would not be required to locate projects within the Section 368 energy corridors, applicants using the corridors could take advantage of an expedited application and permitting process (Section 1.4), which would include:

- IOPs that assist in the preparation and evaluation of ROW applications;
- A single POC for each individual ROW application;
- Tiering from the PEIS for project-specific environmental data;
- No need to identify and evaluate alternative locations for those portions of project ROWs proposed for a designated corridor, although the identification and evaluation of alternative ROWs within a designated corridor may be necessary to avoid or preclude conflicts with any existing or future ROWs within the corridor or any currently unknown sensitive resources.
- Focusing project-specific data collection on project-specific issues within the project ROW and the corridor;
- Project-specific engineering that can focus on corridor-specific issues and not alternative corridor locations; and
- Knowledge early in the authorization and permitting process of the IOPs that would be required for the applicant to follow during the permitting process and project development and operation.

These benefits could expedite the application, authorization and permitting, and construction of energy transport and distribution projects, as directed by Section 368.

Under the No Action Alternative, the locations of future energy transport project ROWs would be identified by the project applicants, and the development of transmission projects at these locations may or may not improve reliability, reduce congestion, or enhance the capability of the western portion of national electricity transmission grid to deliver electricity. In contrast, the Section 368 energy corridors that comprise the Proposed Action were sited, in part, considering the need to address reliability and congestion, and to enhance the capability to deliver electricity of the western portion of the grid (see Section 2.2.1.1). Thus, use of the designated corridors by electricity transmission projects could improve reliability, reduce congestion, and enhance the capability of the national grid to deliver electricity, as directed by Section 368.

2.6.3 How Could the Alternatives Affect the Locations of Future Energy Transport Projects in the 11 Western States?

Neither of the alternatives evaluated in this PEIS includes authorization of energy transport projects. The corridors designated under the Proposed Action would be sited on federal land in areas that have been determined to be suitable for supporting future energy transport projects. Under the No Action Alternative, there would be no such Section 368 corridors. While the number and types of projects that may be expected to be developed in the foreseeable future are unknown, the corridor suggestions received from the public identify a potential for many energy transport projects to be developed throughout the West (Figure 2.1-1). These suggested corridor locations came largely from individual utilities or energy industry planning groups, and many were specific to potential individual projects.

Assuming these proposed corridors represent possible future energy transport projects, under the No Action Alternative, individual projects could be widely distributed across federal and nonfederal lands and thus result in a proliferation of energy transport ROWs. For example, Figure 2.6-1A, C, and E show the possible distribution of proposed projects in southwestern Wyoming, southern Nevada, and southwestern Arizona as they might be located under the No Action Alternative. Under the Proposed Action, however, portions of the ROWs for these same projects could be colocated within the designated corridors (Figure 2.6-1, B, D, and F), and would not be spread out over the federal landscape. The location of those portions of these projects on nonfederal lands would depend on the project, the length, the ROW locations preferred by the individual project applicants, and the applicants' ability to secure access to those locations.

2.6.4 What Types of Impacts Might Be Expected with the Development of Energy Transport Projects under the Alternatives?

The construction and operation of energy transport projects under both alternatives would result in environmental impacts on federal and nonfederal lands. The types of potential impacts would vary by project phase (i.e., construction, operation). The specific nature, magnitude, and extent of possible project-specific impacts would be determined by the project type (transmission line, pipeline) and its length and location on federal and nonfederal lands. Potential direct impacts typical of project construction and operation include the use of geologic and water resources; soil disturbance and erosion; degradation of water resources; localized generation of fugitive dust and air emissions from construction and operational equipment; noise generation; disturbance or loss of paleontological and cultural resources and traditional cultural properties; degradation or loss of fish and wildlife habitat; disturbance of resident and migratory fish and wildlife species, including protected species; degradation or loss of plant communities; increased opportunity for invasive vegetation establishment; alteration of visual resources; land use changes; accidental release of hazardous substances; and increased human health and safety hazards. Project development under either of the alternatives could also affect populations in the vicinity of the projects on both federal and nonfederal land as well as local and regional economies. The location, nature, magnitude, and extent of potential impacts to populations and economies would depend on the type, length, and location of the energy transport project, and thus can only be evaluated at the project level.

For multiple projects, environmental impacts from project construction and operation would likely be dispersed over a larger area under No Action than under the Proposed Action (e.g., compare differences in project ROW locations shown in Figure 2.6-1). Under No Action, multiple project ROWs could share locally designated corridors but outside of these areas could be more widely dispersed on other federal and nonfederal lands. Under the Proposed Action, these same project ROWs could share about 6,055 miles of designated corridor where project impacts would be localized.

The extent and magnitude of these impacts would depend on the project type, length, and location. Under both alternatives, potential project impacts could be avoided or minimized through the implementation of appropriate mitigation measures and policies, practices, and procedures that are currently specified by the agencies that would grant permits for the projects to proceed (e.g., FERC, DOE, BLM, FS). Projects will also be required to follow each state's best management practices during project construction, operation, and maintenance. Potential project impacts that may occur with development in the energy corridors designated under the Proposed Action could be further reduced or avoided with the implementation of applicable mitigation measures and IOPs identified in this PEIS and incorporated into affected land management plans by the ROD. Table 2.6-1 summarizes the impacts of designating Section 368 energy corridors on federal lands and amending land use plans. Also summarized are the types of environmental impacts (identified in Chapter 3 of this PEIS) that could occur as a result of the construction and operation of individual energy transport projects on federal and nonfederal lands under both alternatives.

TABLE 2.6-1 Summary of Potential Environmental Impacts of Designating Section 368 Energy Corridors on Federal Lands and Amending Federal Land Use Plans, and Generic Environmental Impacts of Constructing and Operating Energy Transport Projects under the Two Alternatives

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Land use	There would be no direct land use impacts on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to land use on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to land use from the construction and operation of energy transport projects in the absence of designated corridors. Land use could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. ROW clearing would result in permanent loss of timber production within and adjacent to the ROW in areas designated for that use. Recreation, livestock grazing, oil and gas leasing, and wildlife habitat conservation could experience short-term disturbance during construction activities. Project development and operation could limit oil and gas production and mineral extraction directly within the ROW. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of impacts from project construction and operation would be similar to those identified for No Action. Corridor designation could affect land use within and adjacent to the designated corridors, as well as along other federal and nonfederal lands that may be crossed by project ROWs. About 61% of the proposed corridors currently include utility and/or transportation ROWs, and current land uses would continue within and along the designated corridors until development of specific energy transport projects were to occur. For multiple projects, land use could be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact land use.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Geologic resources	There would be no direct impacts to geologic resources on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to geologic resources on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to geologic resources from the construction and operation of energy transport projects in the absence of designated corridors. Geologic resources could be affected on federal land wherever energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Construction impacts may include disturbance of surface soils and soil erosion from grading, foundation construction, and trenching activities, and removal of geologic materials (gravel, stone) from borrow areas. Soils could be affected by accidental spills of hazardous materials during project operations. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of project impacts would be similar to those identified for No Action, but could occur within the Proposed Action corridors and on other federal and nonfederal land that would be crossed by individual projects. About 61% of the designated corridors would occur along existing utility and transportation ROWs where geologic resources have been previously disturbed. For multiple projects, potential impacts would occur at fewer locations and within a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact geologic resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Paleontologic resources	There would be no direct impacts to paleontologic resources on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to paleontologic resources on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to paleontological resources from the construction and operation of energy transport projects in the absence of designated corridors. Paleontological resources could be affected on federal and nonfederal lands wherever energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Ground-disturbing construction activities may damage fossils and destroy scientific context within project-specific ROWs. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects. Increased accessibility to an area may also expose fossils to vandalism or theft, the magnitude and extent of which would depend on the type, location, and design of the individual projects.	Potential types of project impacts would be similar to those identified for No Action. About 204 geologic units with high fossil yield potential occur within 2,000 feet of the proposed corridor centerlines. Ground-disturbing construction activities could damage fossils and destroy scientific context within the designated corridors as well as on other federal and nonfederal lands. About 61% of the designed corridors include existing utility and transportation ROWs where paleontological resources, if present, may have been previously disturbed. Increased accessibility to an area may also expose fossils to vandalism or theft, the magnitude and extent of which would depend on the type, location, and design of the individual projects. For multiple projects, potential project impacts may occur at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact paleontological resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Water resources	There would be no direct impacts to water resources or 100-year floodplains on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to water resources or 100-year floodplains on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to water resources from the construction and operation of energy transport projects in the absence of designated corridors. Water resources and floodplains could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Groundwater could be impacted if project development affects aquifer recharge or water quality is affected by an accidental release of a hazardous substance. Surface water could be impacted by soil erosion and runoff from construction areas, alteration of stream flow and morphology at ROW crossings, and by an accidental release of hazardous materials. Floodplain capacity could be affected by placement of structures or excavated materials. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of project impacts would be similar to those identified for No Action. Projects developed within designated corridors would cross about 285 named perennial and intermittent streams and man-made channels, 26 lakes and reservoirs, and 4 wild and scenic rivers, totaling 390 linear miles of surface water crossed by the corridors; additional surface waters could be crossed on other federal and nonfederal lands crossed by the projects. Aquifers on federal and nonfederal lands crossed by projects could be affected by project construction and operation. About 33 miles of floodplains could be crossed by projects within designated corridors. Additional floodplain areas could be crossed on other federal and nonfederal lands. About 61% of the designated corridors include existing utility and transportation ROWs where water resources and floodplains may have been previously disturbed. For multiple projects, water resources and floodplains would be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact water resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Air quality	There would be no direct impacts to air quality on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to air resources on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to air quality from the construction and operation of energy transport projects in the absence of designated corridors. Air quality could be affected on federal and nonfederal land where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Air quality impacts would be associated with fugitive dust, construction equipment emissions, and operation of compressor stations. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of impacts to air quality would be similar to those identified for No Action. Energy transport project development and operation could affect air quality along the designated corridors. Similar impacts could also occur along project ROWs on other federal and nonfederal lands that could be crossed by individual projects. About 61% of the designated corridors would occur along existing utility and transportation ROWs where air resources may have been (and may continue to be) affected. For multiple projects, air quality could be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact air quality.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Noise	There would be no direct noise impacts on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct noise impacts on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to ambient noise levels from the construction and operation of energy transport projects in the absence of designated corridors. Ambient noise levels could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Noise impacts would be associated with construction equipment, blasting, compressor/pump station operations, corona discharge, and transformer and switchgear operations. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential impacts to ambient noise levels would be similar to those identified for No Action. Project development could affect noise levels along the proposed corridors. Similar impacts could also occur along project ROWs on other federal and nonfederal lands. About 61% of the designated corridors would occur along existing utility and transportation ROWs where ambient noise levels may have been (and may continue to be) affected. For multiple projects, ambient noise levels would be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact noise levels.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Ecological resources	There would be no direct impacts to ecological resources on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to ecological resources on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to ecological resources from the construction and operation of energy transport projects in the absence of designated corridors. Ecological resources could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those currently experienced from energy transport project development and operation on federal and nonfederal lands. Impacts from project development may include habitat fragmentation, wildlife disturbance, habitat loss and modification, exposure to accidental releases of hazardous materials, and the loss or injury of biota within physically disturbed portions of the project ROWs. Construction and operation activities, together with physically disturbed habitats at the ROWs, could lead to the spread or establishment of invasive species. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of impacts to ecological resources would be similar to those identified for No Action. Projects utilizing the designated corridors could cross or intersect about 390 linear miles of surface waters with associated wetlands and aquatic habitats, and additional aquatic habitats could be affected along the project ROWs on other federal and nonfederal lands adjacent to the designated corridor. Projects developed and operated within the corridors could affect wildlife habitat on and adjacent to land present within the corridors, although about 61% of the proposed corridors would occur along existing transportation and utility ROWs where biota and their habitats have been previously disturbed. For multiple projects, ecological resources could be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact ecological resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Visual resources	There would be no direct impacts to visual resources on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to visual resources on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to visual resources from the construction and operation of energy transport projects in the absence of designated corridors. Visual resources could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Visual resources could be affected by ROW clearing, project construction, and operation. Potential impacts would be associated with construction equipment and activity, cleared project ROWs, and the type and visibility of individual project structures such as compressor stations and electricity transmission towers. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of impacts to visual resources would be similar to those identified for No Action. Visually sensitive areas crossed by or occurring within 5 miles of the proposed corridor centerlines and that could be affected by project development and operation include 31 national parks, national monuments, and recreation areas; 13 wild and scenic rivers; 33 national scenic or historic trails; 11 national historic landmarks and national natural landmarks; 23 national wildlife refuges; and 25 national scenic highways. Additional visually sensitive resources may be expected to occur on other federal and nonfederal lands that could be crossed by project ROWs. About 61% of the proposed corridors would occur along existing transportation or utility ROWs, and visual resources in these areas may currently be impacted to some extent. For multiple projects, visual resources could be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact visual resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Cultural resources	There would be no direct impacts to cultural resources on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct impacts to cultural resources on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to cultural resources from the construction and operation of energy transport projects in the absence of designated corridors. Cultural resources could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Cultural resources could be impacted during project construction, and there could be an increased potential for vandalism or looting due to increased accessibility of sites from project ROWs in previously inaccessible locations. Development of energy transport projects would include consultations with appropriate SHPOs. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of impacts from project construction and operation to cultural resources would be similar to those identified for No Action. Cultural resources may be expected to occur in most project ROWs within the designated corridors, as well as on other federal and nonfederal lands that would be crossed by the project ROWs. About 61% of the proposed corridors would occur along existing transportation or utility ROWs, and the cultural resources near these areas may have previously been disturbed. Development of energy transport projects would include consultations with appropriate SHPOs. For multiple projects, cultural resources could be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact cultural resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Tribal traditional cultural resources	There would be no direct impacts to resources on federal and nonfederal lands of particular interest to Tribes from not designating Section 368 energy corridors on federal land and amending land use plans. The following are the potential impacts to resources of interest to Tribes from the construction and operation of energy transport projects in the absence of designated corridors. Resources could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Tribal resources could be impacted during project construction, and there could be an increased potential for looting due to increased accessibility of sites from project ROWs through previously inaccessible locations. Development of energy transport projects would include consultations with the appropriate Tribal Historic Preservation Office. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	There would be no direct impacts to resources on federal and nonfederal lands of particular interest to Tribes from designating Section 368 energy corridors on federal land and amending land use plans. Potential types of impacts from project construction and operation to resources of interest to Tribes would be similar to those identified for No Action. Tribal resources may be expected to occur in most project ROWs within the designated corridors, as well as on other federal and nonfederal lands that would be crossed by the project ROWs. About 61% of the proposed corridors would occur along existing transportation or utility ROWs, and Tribal resources near these areas may have previously been disturbed. Development of energy transport projects would include consultations with the appropriate Tribal Historic Preservation Office. For multiple projects, Tribal resources could be affected at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact Tribal resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Socioeconomic resources	There would be no direct social or economic impacts on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans. The following are the potential impacts to socioeconomic resources from the construction and operation of energy transport projects in the absence of designated corridors. Socioeconomic resources could be affected on federal and nonfederal lands where energy transport projects are developed and operated as well as in conjunction with project development and operation. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Development of energy transport projects could result in positive impacts to local and state tax revenues, state employment rates, personal income, and the rental housing market. Land use royalties and property values may be adversely affected within and near project ROWs. Project development could also reduce land prices in areas near the project ROWs. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	There would be no direct socioeconomic impacts on federal lands from designating Section 368 energy corridors on federal land and amending land use plans. Corridor designation could have effects on property values and future land use on nonfederal lands adjacent to or between the designated corridors on federal lands. The nature of the effects would depend on the current and future land use of the nonfederal lands. Potential types of project impacts would be similar to those identified for No Action. These impacts could occur not only for areas associated with the designated corridors, but also at other federal and nonfederal lands that the project ROWs might also cross. About 61% of the designated corridors include existing utility and transportation ROWs where socioeconomic resources may have been previously affected. For multiple projects, socioeconomic impacts could occur at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact socioeconomic resources.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Environmental justice	There would be no direct impacts, including no disproportionately high or adverse impacts, to minority or low-income populations on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans. The following are the potential impacts to environmental justice from the construction and operation of energy transport projects in the absence of designated corridors. Minority and low-income populations could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Project impacts would be similar to those from current energy transport project development and operation on federal and nonfederal lands. Project development and operation could affect some minority and low-income populations as a result of impacts to visual resources and local economic conditions. The likelihood of disproportionately high impacts can only be evaluated at the project level. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	There would be no direct impacts, including no disproportionately high or adverse impacts, to minority or low-income populations on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans. Corridor designation could have effects on property values and future land use on nonfederal lands adjacent to or between the designated corridors on federal land, which could affect minority or low-income populations. The nature and magnitude of any effects on minority or low-income populations would depend on the populations that occur in the vicinity of a proposed corridor as well as the current and future land use and property values of the nonfederal lands. Potential types of project impacts would be similar to those identified for No Action. These impacts could occur not only for areas associated with the designated corridors, but also at other federal and nonfederal lands that the project ROWs might also cross. About 61% of the proposed corridors would occur along existing utility and transportation ROWs and where minority and low-income populations may have been previously affected. For multiple projects, potential impacts, including disproportionately high impacts, could occur at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact environmental justice.

TABLE 2.6-1 (Cont.)

Resource	No Action Alternative: No Action on Federal Lands	Proposed Action Alternative: Designate New Section 368 Corridors
Health and safety	There would be no direct health and safety impacts on federal and nonfederal lands from not designating Section 368 energy corridors on federal land and amending land use plans.	There would be no direct health and safety impacts on federal and nonfederal lands from designating Section 368 energy corridors on federal land and amending land use plans.
	The following are the potential impacts to health and safety from the construction and operation of energy transport projects in the absence of designated corridors. Health and safety could be affected on federal and nonfederal lands where energy transport projects are developed and operated. Impacts are not expected to differ from those of current energy transport project development and operation on federal and nonfederal lands. Primary concerns are associated with worker safety during project construction and operation, public safety from accidents, and fire incidence. The nature, magnitude, and extent of project-related impacts would depend on the type, location, length, and design of the individual projects.	Potential types of impacts from project construction and operation would be similar to those identified for No Action. About 61% of the designated corridors include existing utility and transportation ROWs where health and safety concerns related to worker safety, public safety, and fire incidence currently may exist. For multiple projects, health and safety concerns, including concerns for increased fire hazard, would occur at fewer locations and over a smaller geographic area than under No Action. However, multiple projects developed at the same or nearby locations over a period of time could cumulatively impact health and safety.

3 WHAT ARE THE POTENTIAL ENVIRONMENTAL CONSEQUENCES OF CORRIDOR DESIGNATION AND LAND USE PLAN AMENDMENT?

3.1 INTRODUCTION

3.1.1 Evaluation of the Environmental Consequences of Corridor Designation and Land Use Plan Amendment

The PEIS evaluates two alternatives: the No Action Alternative and the Proposed Action Alternative. The Proposed Action will designate energy transport corridors on federal lands. The corridors will be designated through amendment of land use plans by the affected federal agencies.

Chapter 3 describes the nature and condition of potentially affected resources in the 11 western states as well as descriptions of the types of impacts that are typical during the construction, operation, and decommissioning of energy transport projects, regardless of project location. This analysis is therefore applicable not only to the federal lands within the corridors, but to federal and nonfederal lands that might also be affected by any specific ROW project that extends beyond the designated corridors, or by ROWs proposed under the No Action Alternative.

The decision to designate specific corridors and to amend land use plans has no identifiable impacts on the environment. There would be no requirement to locate energy transport projects within these designated corridors, and future energy transport projects may be proposed to cross federal lands in ROWs that are outside of any designated corridor. The subsequent analysis of environmental impacts to the corridors would be conducted with implementation of specific proposals for energy transport projects within the corridors.

Because it is not possible to identify specific impacts from the decision to designate corridors and amend land use plans, the evaluation of environmental consequences has focused on those resources most likely to be affected during future energy transport projects. Since project specifics are not known at this time, this analysis takes a programmatic approach.

An overview of the energy transport technologies that could be developed and implemented in the future, regardless of the alternatives, is presented in Appendix E. This appendix also presents an example of a hypothetical set of energy transport projects that could be developed within a 3,500-foot wide Section 368 energy corridor. This example provides information on the design parameters for constructing, operating, and decommissioning several different types of energy transport projects. It gives the reader an idea of what future development might look like within a designated corridor and within individual ROWs.

The programmatic presentation of potential impacts to the environment provides the public and the agencies with useful information for considering the effects of project development under each of the alternatives. The analyses also identify the types of project activities and resources that would be considered and evaluated at the project level during permitting and authorization (including project-specific NEPA), construction, and operation, and prepares those involved to address these issues. In addition, these analyses provide reference materials for later implementation-level studies and provide standard mitigation measures that may be used as appropriate during future development.

3.1.2 Organization of Chapter 3

Information regarding each of the resources evaluated in this PEIS is presented as follows. Each resource is presented separately. For each resource, a description is presented of the resource in the 11 western states that could be associated with the two alternatives considered in this PEIS. Next, a description is provided of the methods used to identify the extent to which the resource would be associated with each of the alternatives. Next, qualitative and quantitative descriptions are provided of the nature and magnitude of the resource that would be directly associated with each alternative and thus may be affected by future project development. A description is then provided of the generic impacts that could be incurred by the resource from the construction and operation of an energy transport project. Resource-specific mitigation measures that could be used to minimize, avoid, or compensate for project-specific impacts are also presented.

3.2 LAND USE

3.2.1 What Are the Federal and Nonfederal Uses of Land in the 11 Western States?

3.2.1.1 Federal Lands Overview

The federal government owns about 653.3 million acres (about 28%) of the land in the United States (GSA 2005). The majority of this land is administered by four federal agencies: the BLM (261.8 million acres, or 40.1%), the FS (192.7 million acres, or 29.5%), the USFWS (96.3 million acres, or 14.7%), and the NPS (79.0 million acres, or 12.1%) (BLM 2006h; FS 2006a; USFWS 2006a; NPS 2006b). The DOD manages most of the remainder (about 29.2 million acres) (DOD 2006). In the western states, the federal government's ownership of land is much higher, averaging about one-half of the land (Table 3.2-1). Tables 3.2-2 and 3.2-3 present the total acreage and percentage of acreage, respectively, that are managed by the BLM, FS, NPS, USFWS, and DOD in the 11 western states as of FY2005. Maps showing federal land ownership for the 11 western states are provided in the State Base Map Series (Volume II, Part 2, of this document). A complete listing of sites for each of the 11 western states is presented by agency in Appendix K.

Each of the federal agencies manages its lands and resources according to its mission and responsibilities. BLM and FS lands are managed for recreation, timber harvesting, livestock grazing, oil and gas production, mining, wilderness protection (e.g., water and wildlife habitat), and other purposes. The NPS manages lands for the conservation, preservation, protection, and interpretation of the nation's natural, cultural, and historic resources. The USFWS manages its lands for the conservation and protection of fish and wildlife and their habitats (GAO 1996). The DOD manages its land to provide realistic test and training environments for military operations as required by Title 10 (Armed Forces) of the USC.

The designation of energy corridors and land use plan amendments under Section 368 could affect land use on federal lands. The acreages and land uses that could be affected are discussed in Section 3.2.3.

BLM. The BLM was created in 1946 by merging two agencies, the General Land Office and the U.S. Grazing Service. The agency currently manages 261.8 million acres of land, about 11% of the U.S. land area. Lands managed include grasslands, forests, high mountains, Arctic tundra, and deserts. These lands are often intermingled with other federal or private lands. The BLM also manages the 700 million acres of subsurface mineral resources on these federal lands and supervises the mineral operations on about 56 million acres of Indian Trust land. The agency is responsible for wildland fire management and suppression on about 370 million acres of DOI, other federal, and certain nonfederal land (BLM 2006h; Vincent et al. 2001).

TABLE 3.2-1 Acreage and Percentage of Public Lands for the 11 Western States as of FY2005

State	Total State Acreage[a]	Public Land Acreage[b]	Percent Land Federally Owned
Arizona	72,688,000	34,527,965	47.5
California	100,206,720	48,736,912	48.6
Colorado	66,485,760	24,241,592	36.5
Idaho	52,933,120	33,181,787	62.7
Montana	93,271,040	29,567,499	31.7
Nevada	70,264,320	59,564,427	89.8
New Mexico	77,766,400	27,076,008	34.8
Oregon	61,598,720	32,758,177	53.2
Utah	52,696,960	33,813,808	64.2
Washington	42,693,760	13,204,049	30.9
Wyoming	62,343,040	28,100,863	45.1
Total	752,947,840	364,773,087	48.4

[a] State acreages from GSA (2005).

[b] Tallies include land managed by BLM, FS, NPS, USFWS, and DOD.

Sources: BLM (2006h); GSA (2005); NPS (2006b); FS (2006a); USFWS (2006a); DOD (2006).

The BLM manages a variety of lands within the 11 western states, including rangelands, forests, wetlands, and lakes (Table 3.2-4). Land uses include livestock grazing; fish and wildlife development and utilization; oil, gas, and mineral exploration and development; ROWs; outdoor recreation; and timber production. These uses are managed within a framework of numerous laws, the most comprehensive of which is the FLPMA. The FLPMA established the "multiple use" management framework for public lands, so that "public lands and their various resource values … are utilized in the combination that will best meet the present and future needs of the American people" (from Section 103(c) of FLPMA). The FLPMA ensures there is no predominant or single use that overrides the multiple-use concept on any of the lands managed by the BLM. Multiple uses of BLM-administered lands (and resources) are described as follows:

- *Domestic livestock grazing.* The BLM issued 17,940 grazing permits and leases in FY2005, primarily for cattle and sheep. It also issued permits for domestic horses, burros, sheep, goats, bison, and reindeer. Livestock grazing is managed on about 90% of the BLM-administered public lands (about 158.9 million acres) in the 11 western states (BLM 2005f, 2006h).

- *Fish and wildlife development and utilization.* Fish and wildlife habitat spans all of the lands and waterways managed by the BLM. In FY2005, about 39.12 million acres of BLM land were managed as conservation lands under the National Landscape Conservation System (NLCS) in the 11 western states; another 10.37 million acres were classified as Areas of Critical

TABLE 3.2-2 Acreage of Public Lands Administered by the BLM, FS, NPS, USFWS, and DOD in the 11 Western States as of FY2005

State	BLM	FS	NPS	USFWS	DOD[a]
Arizona	12,218,180	11,263,640	4,760,422[b]	1,725,611	4,560,112
California	15,230,638	20,785,483	8,212,968[c]	468,263	4,039,560
Colorado	8,363,916	14,504,625	727,616[d]	163,130	482,305
Idaho	12,001,817	20,464,466	486,043	92,057	137,404
Montana	7,963,511	16,932,604	3,356,804[e]	1,277,498	37,082
Nevada	47,824,624	5,841,209	77,180	2,416,909	3,404,005
New Mexico	13,372,014	9,420,432	391,029	385,052	3,507,481
Oregon	16,135,761	15,726,114	199,230	578,109	118,963
Utah	22,858,179	8,194,426	855,550	112,482	1,793,171
Washington	408,580	9,279,134	1,965,133	344,963	1,206,239
Wyoming	18,366,584	9,239,172	344,150	102,680	48,277
Total	174,743,804	141,651,305	21,376,125	7,666,752	19,334,599

[a] Numbers represent total acreages of installations that meet the criteria of at least 10 acres in size and a plant replacement value (PRV) of at least $10 million (in some cases, only a portion of the acreage is owned by DOD; see Appendix K).

[b] Includes land shared with Utah and Nevada.

[c] Includes land shared with Nevada.

[d] Includes land shared with Utah.

[e] Includes land shared with North Dakota, Idaho, and Wyoming.

Sources: BLM (2006h); DOD (2006); FS (2006a); NPS (2006b); USFWS (2006a).

Environmental Concern (ACECs). The agency works with state wildlife management agencies that are responsible for managing fish and wildlife populations on its lands. It funds many fish- and wildlife-related projects annually and plays an important role in the development and implementation of conservation plans for at-risk species (BLM 2005f, 2006h).

- *Mineral exploration, development, and production.* Energy and mineral resources have the highest economic production values among commercial uses for surface lands and subsurface estates administered by the BLM in the 11 western states (the acreage totals for these resources are summarized in Table 3.2-5). These economic production values include exploration, development, and production of oil and natural gas and the ROWs for oil and gas pipelines; and locatable, leasable, and salable solid minerals. Locatable minerals, defined under the General Mining Law of 1972, can be obtained by locating a mining claim; they include both metallic (e.g., gold, silver, and lead) and nonmetallic (e.g., gemstones, fluorspar, and mica) materials. Leasable minerals are subject to the Mining Leasing Act of 1920 (MLA) and include energy (e.g., coal) and nonenergy (e.g., sodium, phosphate) resources; leases to these resources are obtained through a competitive bidding process. Salable minerals include basic natural

TABLE 3.2-3 Percentage of State Acreage Administered by the BLM, FS, NPS, USFWS, and DOD in the 11 Western States as of FY2005

State	BLM	FS	NPS	USFWS	DOD
Arizona	16.8	15.5	6.5[a]	2.4	6.3
California	15.2	20.7	8.2[b]	0.47	4.0
Colorado	12.6	21.8	1.1[c]	0.25	0.73
Idaho	22.7	38.7	0.92	0.17	0.26
Montana	8.5	18.2	3.6[d]	1.4	0.040
Nevada	68.1	8.3	0.11	3.4	4.8
New Mexico	17.2	12.1	0.50	0.50	4.5
Oregon	26.2	25.5	0.32	0.94	0.19
Utah	43.4	15.6	1.6	0.21	3.4
Washington	1.0	21.7	4.6[e]	0.81	2.8
Wyoming	29.5	14.8	0.55	0.16	0.077

[a] Includes land shared with Utah and Nevada.

[b] Includes land shared with Nevada.

[c] Includes land shared with Utah.

[d] Includes land shared with North Dakota, Idaho, and Wyoming.

[e] Includes land shared with Alaska.

Sources: Calculated from numbers provided in BLM (2006h); DOD (2006); FS (2006a); NPS (2006b); USFWS (2006a). State acreages from GSA (2005).

resources such as sand and gravel that the BLM sells to the public at fair market value. The BLM may also grant free-use leases to states, counties, or other government entities for public projects (BLM 2005f).

- *Rights-of-way.* ROWs consist of any easement, lease, permit, or license to occupy, use, or traverse public lands. The BLM has been granted the authority by the FLPMA and MLA to grant, issue, or renew ROWs for reservoirs, pipelines, transmission lines, and transportation routes (e.g., roads, highways, trails, and railways). In FY2005, the BLM had a total of 88,729 ROWs covering an area of about 5.5 million acres in the 11 western states (BLM 2005f, 2006h).

- *Outdoor recreation.* The vast majority of the American public's interaction with BLM-managed lands is through outdoor recreational activities. In FY2005, more than 50 million visitors participated in activities such as rafting, hiking, biking, hunting, fishing, and camping. Other activities include visits to heritage sites, national monuments, wild and scenic rivers, wilderness areas, national trails, and national conservation areas (BLM 2005f).

- *Timber production.* About 55 million acres of BLM land fall under the categories of forests (20%) and woodlands (80%). In the 11 western states, about 26.8 million acres of BLM land are considered forest (22%) and woodlands (78%) (Table 3.2-4). BLM

TABLE 3.2-4 Types of Lands Managed by BLM in the 11 Western States

	Types of Land							
States	Rangelands[a] (acres)	Forests (acres)	Woodlands (acres)	Wetlands (acres)	Lakes (acres)	Reservoirs (acres)	Riparian Areas (miles)	Fishable Streams (miles)
Arizona	11,500,045	20,000	1,054,000	22,260	1,164	10,160	882	160
California	8,150,165	204,000	2,004,000	15,081	129	65	2,492	1,071
Colorado	7,732,687	1,069,000	3,041,000	9,818	561	18,149	4,344	2,934
Idaho	11,789,170	512,000	380,000	3,842	687	36,924	4,213	3,350
Montana	8,120,526[b]	783,000	27,000	13,165	3,500	34,000	4,134	1,234
Nevada	45,824,954	5,000	6,269,000	18,655	24,570	11,300	2,614	2,381
New Mexico	12,558,882[c]	44,000	941,000	3,674	21	1,131	458	278
Oregon	13,601,477[d]	2,410,000	931,000	149,913[d]	59,375[d]	14,146[d]	7,856[d]	3,534[d]
Utah	22,089,791	338,000	5,735,000	17,711	2,906	24,828	5,067	2,644
Washington	–[d]	36,000	14,000	–[d]	–[d]	–[d]	–[d]	–[d]
Wyoming	17,494,288	474,000	530,000	14,921	3,573	33,181	4,508	2,475
Total	158,861,985	5,895,000	20,926,000	269,040	96,486	183,884	36,568	20,061

[a] Acreage of rangelands is estimated from the acreage of grazing allotments granted by the BLM.

[b] Includes North Dakota and South Dakota acreage.

[c] Includes Oklahoma acreage.

[d] Washington acreage included with the Oregon tally.

Sources: BLM (2005f); Stamm (2004).

TABLE 3.2-5 Surface and Subsurface Mineral Lands Managed by BLM within the 11 Western States (in millions of acres)

State	Surface Land[a]	Subsurface Mineral Estates Underlying Federal Surface Lands[b]	Tribal Lands Where the BLM Has Trust Responsibility for Mineral Operations[b]	Subsurface Mineral Estates Underlying Private or State Trust Land[b]
Arizona	12.2	33.0	20.7	3.0
California	15.2	47.0	0.59	2.5
Colorado	8.4	27.1	0.80	5.9
Idaho	12.0	37.0	0.59	1.8
Montana	8.0	27.5	5.5	11.7
Nevada	47.8	56.1	1.2	0.25
New Mexico	13.4	36.0	8.4	9.5
Oregon	16.1	34.2	0.78	1.7
Utah	22.9	33.9	2.3	1.2
Washington	0.41	11.6	2.6	0.28
Wyoming	18.4	30.9	1.9	12.2
Total	174.8	374.3	45.4	50.0

[a] Data from BLM (2006h).

[b] Data from FY2002; BLM (2003 a-j).

Sources: BLM (2003a-j, 2006h).

defines forests as lands with 10% or greater stocking in tree species used in commercially processed wood products (e.g., lumber, plywood, and paper). Woodlands are lands with 10% or greater stocking in tree species not typically used in commercial wood products (such as pinyon pine, juniper, and black spruce). Timber production is just one aspect of the BLM's forest management program. Most of the productive forests managed by BLM are in Oregon, with about 496,000 acres available to be managed for timber production (BLM 2005f).

Table 3.2-6 summarizes the best available information on the acreage used for commercial activities on BLM-administered lands within each of the 11 western states. Other commercial uses occur on BLM-administered lands (e.g., guides and outfitters and special uses such as filming); however, statistics on these uses are not available.

FS. Congress established the FS in 1905 to provide quality water and timber for the nation's benefit. Its mission is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations. The National Forest System (NFS), which consists of 155 national forests (188.0 million acres) and 20 national grasslands (3.8 million acres), makes up most of the lands managed by the FS. The NFS encompasses aquatic and terrestrial ecosystems, including tropical and boreal forests, grasslands, and important wetlands. Other lands, including purchase units, research and experimental areas, and land utilization projects, make up the remainder (884,919 acres) for a total throughout

TABLE 3.2-6 Commercial Use Activity on BLM-Administered Lands in the 11 Western States

	Commercial Use Activity						
State	Grazing Allotments (acres)[a]	Timber Harvest (acres)[b]	Oil and Gas Leasing (acres in producing status)[c]	Geothermal Production (acres in producing leases)[d]	Coal Production (acres in producing leases)[d]	Nonenergy Leasables (acres under lease)[b]	ROWs (acres)[b]
Arizona	11,500,045	–[e]	0	2,084	–	4	315,522
California	8,150,165	318	70,339	90,397	–	36,772	216,410
Colorado	7,732,687	27	1,340,546	–	79,050	21,762	181,916
Idaho	11,789,170	1,973	–	2,465	–	43,274	285,082
Montana	8,120,526[f]	674	736,958	–	34,635	1,409	243,382
Nevada	45,824,954	–	15,498	322,239	–	1,560	624,861
New Mexico	12,558,882	–	3,769,487	4,581	25,272	136,396	402,266
Oregon	13,601,477[g]	23,993[g]	–	54,151	–	–	2,504,191[g]
Utah	22,089,791	–	916,106	8,047	106,514	87,117	392,048
Washington	(g)	(g)	0	–	521	–	(g)
Wyoming	17,494,288[d]	–	3,719,919	–	174,746	84,286	316,073
Total	158,861,985	26,985	10,568,853	483,964	420,738	412,580	5,481,751

a Data from FY2004.

b Data from FY2002.

c Data from FY2004.

d Data from FY2005.

e A dash indicates no activity.

f Includes North Dakota and South Dakota acreage.

g Washington acreage included with the Oregon tally.

Sources: BLM (2003a-j, 2005f,g, 2006h); Stamm (2004).

the United States of about 192.7 million acres. More than 70% (about 141.7 million acres) of lands administered by the FS are in the West (FS 2006a, 2006b; Vincent et al. 2001). Another 39.7 million acres (classified as "other acreage") not owned or managed by the FS occur within the boundaries of the NFS. About 14.8 million acres are classified as "other" in the 11 western states.

Table 3.2-7 provides a breakdown of the types of lands managed by the FS in the 11 western states. These include:

- *National forests.* A unit of land formally established and permanently set aside and reserved for national forest purposes (e.g., as rangeland, timberland, and recreation land).

- *National grasslands.* A unit of land designated by the Secretary of Agriculture and permanently held by the Department of Agriculture Title III of the Bankhead-Jones Farm Tenant Act (1937).

- *Land utilization projects.* A unit of land designated by the Secretary of Agriculture for conservation and utilization under Title III of the Bankhead-Jones Farm Tenant Act (1937).

- *Purchase units.* A unit of land designated by the Secretary of Agriculture or previously approved by the National Forest Reservation Commission for purposes of Weeks Law acquisition.

- *Research and experimental areas.* A unit of land reserved and dedicated by the Secretary of Agriculture for forest and range research and experimentation.

TABLE 3.2-7 Types of Lands Managed by the FS in the 11 Western States

	Types of Land (acres)						
State	National Forests	National Grasslands	Land Utilization Projects	Purchase Units	Research and Experimental Areas	National Preserves	Other
Arizona	11,263,640	–[a]	–	–	–	–	–
California	20,752,006	18,425	–	3,996	4,783	–	6,273
Colorado	13,868,484	636,141	–	–	–	–	–
Idaho	20,416,313	47,790	–	363	–	–	–
Montana	16,932,447	–	–	–	–	–	157
Nevada	5,841,209	–	–	–	–	–	–
New Mexico	9,091,897	136,417	240	–	–	89,716	102,162
Oregon	15,548,851	112,357	856	4,982	–	–	59,068
Utah	8,138,796	–	–	–	55,630	–	–
Washington	9,276,196	–	738	2,200	–	–	–
Wyoming	8,691,370	547,802	–	–	–	–	–
Total	139,821,209	1,498,932	1,834	11,541	60,413	89,716	167,660

[a] A dash indicates no acreage.

Source: FS (2006a).

- *National preserves.* A unit of land established to protect and preserve scientific, scenic, geologic, watershed, fish, wildlife, historic, cultural, and recreational values, and to provide for multiple use and sustained yield of its renewable resources.

The FS uses a multiple-use land management approach based on the principles outlined in the National Forest Management Act (NFMA) to sustain healthy ecosystems, repair damaged ecosystems, and address the need for resources and commodities. Multiple uses include:

- Administering and managing recreation, wilderness, and heritage areas and other congressionally designated areas (e.g., wild and scenic rivers and national recreation areas);

- Restoring, recovering, conserving, and enhancing fish and wildlife and their habitats;

- Managing forest, rangeland, minerals, and water resources in a sustainable manner;

- Conducting resource inventories and assessments of NFS lands; and

- Providing a safe environment for the public and for FS employees (FS 2003).

The agency authorizes and administers the use of public lands by individuals, companies, organized groups, other federal agencies, and state or local levels of government to protect natural resource values and public health and safety. The following are some of the land uses authorized by the FS's Lands and Realty Management Program that relate to infrastructure for generating and transmitting energy resources:

- Electricity transmission facilities,

- Oil and gas pipelines,

- Hydropower facilities, and

- Wind and solar facilities (FS 2004).

The FS also authorizes land uses pertaining to communications, commerce, public health and safety, and homeland security. These include:

- Fiber-optic and wireless telecommunica-tions,

- Water development systems, and

- Federal, state, and local highways (FS 2004).

NPS. The NPS was created in 1916 to protect the national parks and monuments managed by the DOI (35 at that time) and those yet to be established. The agency currently manages a network of about 390 natural, cultural, and recreational sites across the United States, covering about 79 million acres of federal land, including national parks, national monuments, battlefields, military parks, historical parks, historical sites, lakeshores, seashores, recreation areas, reserves, preserves, and scenic rivers and trails. The agency also manages about 5.5 million acres of nonfederal land across the United States, for a total of 84.5 million acres managed, of which about a quarter are located in the West (NPS 2006b,c; Vincent et al. 2001). Of the 21.38 million acres managed in the 11 western states, about 13.67 million acres (64%) are national parks (Table 3.2-8).

USFWS. The USFWS was established in 1934 with the passage of the Fish and Wildlife Coordination Act, which provided for the acquisition and management of lands associated with water use projects as mitigation and enhancement of fish and wildlife. The Bankhead-Jones Farm Tenant Act, passed in

TABLE 3.2-8 Designated Lands (both Federal and Nonfederal) Managed by the NPS in the 11 Western States[a]

State	National Historic Park	National Historic Site	National Monument	National Memorial	National Park	National Recreation Area	National Seashore	National Preserve	National Reserve	National Battlefield	Other	Total
	Designated Land (acres)											
Arizona	360	1,160	473,907	4,750	1,530,464	2,749,781[b]	–[c]	–	–	–	–	4,760,422
California	195	1,201	74,553	–	6,258,572[d]	275,897[e]	71,070	1,531,480	–	–	–	8,212,968
Colorado	–	13,382	237,628[f]	–	362,197	41,972[g]	–	41,686	–	–	30,750	727,616
Idaho	3,208	–	53,644	–			–	410,733	14,107	–	4,351	486,043
Montana	–	1,618		–	3,233,113[h]	120,296[i]	–	–	–	1,776	–	3,356,804
Nevada	–	–		–	77,180		–	–	–	–	–	77,180
New Mexico	40,630	–	303,633	–	46,766		–	–	–	–	–	391,029
Oregon	1,574	–	14,432	–	183,224		–	–	–	–	–	199,230
Utah	–	2,735	14,201	–			–	838,614	–	–	–	855,550
Washington	1,752	333		–	1,663,813	279,912[j]	–	–	19,324	–	–	1,965,133
Wyoming	–	833	9,545	–	309,995		–	–	–	–	23,777	344,150
Total	47,719	21,262	1,181,543	4,750	13,665,324	3,467,858	71,070	2,822,513	33,431	1,776	58,878	21,376,125

[a] Designated lands are those lands authorized by the U.S. Congress to be managed by the NPS, beginning with the Act of March 1, 1872, that established Yellowstone National Park. Additions to the National Park System are generally made through acts of Congress; however, the President has the authority under the Antiquities Act of 1906 to proclaim national monuments on lands already under federal jurisdiction.

[b] Acreage includes Lake Mead National Recreation Area (NRA), which is partially in Nevada, and Glen Canyon NRA, which is partially in Utah.

[c] A dash indicates no acreage.

[d] Includes Death Valley National Park (NP), which is partially in Nevada.

[e] Includes only NPS portions of Whiskeytown NRA, which is administered by the FS.

[f] Includes Dinosaur and Hovenweep National Monuments (NMs), which are partially in Utah.

[g] Includes the Curecanti NRA, which is administered under a cooperative agreement with other federal agencies.

[h] Includes Yellowstone NP, which is partially in Idaho and Wyoming.

[i] Includes Bighorn NRA, which is partially in Wyoming.

[j] Includes the Lake Roosevelt NRA, which is administered under a cooperative agreement with other federal agencies.

Source: NPS (2006b).

1937, was the authority used for establishing a number of wildlife refuges across the United States. Today, the National Wildlife Refuge System (NWRS) makes up about 96% (7.4 million acres) of the lands managed by the USFWS in the 11 western states (Table 3.2-9). Other lands, including waterfowl production areas, coordination areas, administrative sites, and national fish hatcheries, make up the remainder for a total throughout the United States of 96.3 million acres (USFWS 2006a,b). These categories are defined by the USFWS as follows:

- *National wildlife refuge.* Any area of the NWRS, excluding coordination areas and waterfowl production areas. Includes wilderness areas (service land managed in accordance with the terms of the Wilderness Act of 1964) and migratory waterfowl refuges (service land managed for the benefit of migrating waterfowl and other wildlife under the Fish and Wildlife Coordination Act).

- *Waterfowl production area.* Any wetland or pothole area acquired pursuant to the Migratory Bird Huntingand Conservation Stamp Act or other statutory authority and administered as part of the NWRS and identified by county designation.

- *Coordination area.* Any area administered as part of the NWRS and managed by the state under cooperative agreements between the USFWS and the state's fish and wildlife agency.

- *National fish hatchery*. A facility where fish are raised. Hatchery objectives are to replenish depleted stocks, mitigate federal water projects, assist with the management of fishery resources on federal (primarily USFWS) and Tribal

TABLE 3.2-9 Types of Lands Managed by the USFWS in the 11 Western States

	Types of Land (acres)				
State	National Wildlife Refuges	Waterfowl Production Areas	Coordination Areas	National Fish Hatcheries	Administrative Sites
Arizona	1,718,543	–[a]	6,896	161	11
California	466,521	–	1,250	491	–
Colorado	158,726	–	1,153	3,207	44
Idaho	83,973	1,878	5,790	416	–
Montana	1,186,385	173,897	6,693	416	–
Nevada	2,352,546	–	63,544	818	–
New Mexico	384,290	–	–	760	2
Oregon	570,080	–	7,169	845	14
Utah	105,185	–	6,765	532	–
Washington	324,980	–	17,522	2,461	0.83
Wyoming	86,269	–	16,291	120	–
Total	7,437,498	175,775	133,073	10,227	72

[a] A dash indicates no acreage.

Source: USFWS (2006a).

lands, and enhance recreational fisheries.

- *Administrative sites.* Land used to support administrative programs, such as maintenance facilities or offices and off-site visitor centers.

DOD. The DOD owns and manages 3,748 sites, covering nearly 30 million acres worldwide, of which about 79% are located in the United States or U.S. territories. Sites range in size from the very small, such as unoccupied locations supporting an Air Force navigational aid on less than one-half acre of land, to the very large, including the Army's White Sands Missile Range in New Mexico with more than 2.3 million acres. The majority of the land controlled by the DOD is government-owned or withdrawn public land (about 80%). The Army manages the largest percentage of the DOD's land (52%); the Air Force manages about 33%. In the 11 western states, the DOD owns and manages 611 installations over 19.3 million acres, with the greatest acreages in Arizona, California, New Mexico, and Nevada (DOD 2006). Table 3.2-10 shows a breakdown in the number of installations by military service. The total acreages of military-owned land in each of the 11 western states are provided in Table 3.2-2.

Other Federally Owned Land. The DOE owns and manages about 3.06 million acres in 35 states across the United States. The majority of the land controlled by the DOE is "ingrant" acreage, including withdrawn public land (73%); owned (834,674 acres) and leased (488 acres) acreages make up the remainder (DOE 2006b). Ingrant properties are those acquired for DOE use by lease, license, or permit. There are currently 25 DOE facilities in 8 of the 11 western states, as shown in Table 3.2-11. The largest DOE acreages are in Idaho and Nevada (DOE 2006b).

The Department of the Interior's (DOI's) Bureau of Reclamation (BOR) manages a number of federal facilities, including

TABLE 3.2-10 Number of DOD Facilities by Military Service in the 11 Western States in FY2005

	Military Service[a]				
State	Army	Navy	Air Force	Marine Corps	Total
Arizona	11	4	16	2	33
California	70	101	57	15	243
Colorado	14	2	15	0	31
Idaho	8	5	39	0	52
Montana	13	2	14	0	29
Nevada	4	7	21	0	32
New Mexico	12	3	21	0	36
Oregon	10	5	6	0	21
Utah	19	2	13	0	34
Washington	21	43	24	1	89
Wyoming	2	1	8	0	11
Total	184	175	234	18	611

[a] Numbers represent small, medium, and large installations with plant replacement values greater than zero.

Source: DOD (2006).

TABLE 3.2-11 Land under DOE Administrative Control in the 11 Western States

State	DOE Facility Name	Location
Arizona	–[a]	–
California	Area IV of Santa Susana Field Laboratory	Santa Susana
	General Electric Vallecitos	Pleasanton
	Laboratory for Energy-Related Health Research	Davis
	Laboratory of Biomedical and Environmental Sciences	Los Angeles
	Lawrence Berkeley National Laboratory	Berkeley
	Lawrence Livermore National Laboratory	Livermore
	Sandia National Laboratories – Livermore	Livermore
	Stanford Linear Accelerator Center	Palo Alto
Colorado	Grand Junction Operations Office	Grand Junction
	Rocky Flats Plant	Golden
Idaho	Idaho National Laboratory	Scoville
Montana	–	–
Nevada	Nevada Site Office	North Las Vegas
	Nevada Test Site	Mercury
	Tonopah Test Range	Tonopah
	Yucca Mountain Site Characterization Project	Yucca Mountain
New Mexico	National Nuclear Security Administration Service Center	Albuquerque
	Los Alamos National Laboratory	Los Alamos
	Lovelace Respiratory Research Institute	Albuquerque
	Project Gasbuggy Nuclear Explosion Site (Remediation)	Farmington
	Sandia National Laboratories	Albuquerque
	Waste Isolation Pilot Plant	Carlsbad
	Carlsbad Field Office	Carlsbad
	Los Alamos Site Office	Los Alamos
Oregon	Albany Research Center	Albany
Utah	Moab Uranium Mill Tailings Site	Moab
Washington	Hanford Site	Richland
	Pacific Northwest National Laboratory	Richland
Wyoming	Navel Petroleum Reserve	Casper

[a] A dash indicates no facilities present.

Source: DOE (2006b).

348 reservoirs (with a storage capacity of 245 million acre-feet of water), 58 hydroelectric power plants, and more than 300 recreation sites, most of which are in the western states. The agency provides water for about 10 million acres of irrigation land in the western region (DOI 2005b).

3.2.1.2 Federal Lands Managed for Conservation

Of the 345.4 million acres managed by the BLM, FS, USFWS, and NPS in the 11 western states, about half are managed primarily for conservation. These lands include national parks, national wildlife refuges, wilderness and wilderness study areas, wild and scenic rivers, areas of critical environmental concern, and roadless areas (GAO 1996). Table 3.2-12 summarizes the number and percentage of acres managed by the four agencies for conservation for each of the 11 western states. The values in this table represent all of the lands managed by the USFWS and the NPS and portions of the lands managed by the BLM and FS.

The BLM's NLCS was established to provide a national framework for managing Congressionally and Presidentially designated special management areas on public lands. The conservation system includes all of BLM's national monuments, national conservation areas, wilderness areas, wilderness study areas, national wild and scenic rivers, national historic and scenic trails, and other sites like the Yaquina Head Outstanding Natural Area in Oregon. These areas encompass 867 units on about

TABLE 3.2-12 Number and Percentage of Acres Managed for Conservation by the BLM, FS, USFWS, and NPS for the 11 Western States as of FY2005

State	Public Land Acreage	Acreage Managed for Conservation	Percentage of Acreage Managed for Conservation
Arizona	29,967,853	15,544,102	51.9
California	44,697,352	40,042,374	89.6
Colorado	23,759,287	10,809,636	45.5
Idaho	33,044,383	18,224,937	55.2
Montana	29,530,417	15,713,485	53.2
Nevada	56,159,922	29,742,976	53.0
New Mexico	23,568,527	5,860,174	24.9
Oregon	32,639,214	12,703,951	38.9
Utah	32,020,637	14,728,428	46.0
Washington	11,997,810	7,082,144	59.0
Wyoming	28,052,586	14,744,185	52.6
Total	345,437,988	180,419,828[a]	52.2[a]

[a] Total and percentage corrected for 4.8 million acres of overlap among BLM lands designated for conservation. State totals are not corrected; as a result, the calculated total and percentage of acreages managed for conservation for each state may be slightly higher than the actual values.

Sources: Based on data provided in BLM (2006h); FS (2006a); NPS (2006b); USFWS (2006a).

39.12 million acres in the 11 western states (Table 3.2-13).

Other special management areas (non-NLCS) are managed by the BLM to preserve and protect threatened and endangered species; wild free-roaming horses and burros; significant archaeological, paleontological, and historical sites; and ACECs. These areas encompass 1,302 units on about 40.57 million acres in the 11 western states (Table 3.2-14). The acreages presented in Tables 3.2-13 and 3.2-14 overlap with about 56,500 acres of lands designated as globally important bird areas (e.g., Yaquina Head National Outstanding Natural Area). In total, about 74.91 million acres (the total of 79.69 million acres less 4.78 million acres of overlap), or 43%, of BLM lands are managed for conservation purposes (BLM 2005f,g).

The FS's conservation system includes all areas within the NFS designated as national wilderness areas; national scenic areas; national volcanic monument areas; national protection areas; national monument areas; national primitive areas; national recreation areas; national game refuges and wildlife preserves; national scenic research areas; national wild, scenic, and recreation rivers; recreation management areas; special management areas; and scenic recreation areas (Table 3.2-15). These areas encompass about 34.69 million acres of land in the 11 western states. An additional 41.78 million acres of the NFS fall under the special conservation classification of "roadless area" (Table 3.2-16). Roadless areas contain critical watersheds, wildlife habitat, and unique ecosystems and are protected by an administrative rule known as the Roadless Area Conservation Rule, issued by the FS in January 2001. In total, about 76.47 million acres, or 54%, of FS lands are managed for conservation purposes (FS 2006c; NRDC 2006).

3.2.1.3 Recreation on Federal Lands

Federal and state government agencies manage a diversity of recreation areas in the 11 western states. Table 3.2-17 lists the number of recreation areas managed by federal agencies for each state; these include national parks and monuments, historic sites, memorials, scenic areas, wild and scenic rivers, scenic and historic trails, and various types of conservation areas (e.g., wildlife refuges, wilderness areas, preserves, primitive areas). The greatest number of recreation sites are managed by the BLM (39.9%), FS (9.4%), NPS (10.2%), USFWS (10.8%), and BOR (17.2%). Many of these sites overlap with the conservation sites discussed in Section 3.2.1.2. Table 3.2-18 lists the number of state parks and recreation areas managed by the states; these include historic sites, monuments, and natural areas.

The number of recreation visits on lands administered by the BLM, FS, NPS, and USFWS for each of the 11 western states are presented in Table 3.2-19; the number of recreation visits on lands administered by the FS (by region) are provided in Table 3.2-20. Visitor statistics for lands administered by the BOR are not available.

Recreation and leisure activities on BLM-administered lands center around unstructured recreation and tourism. In FY2005, camping and picnicking accounted for about 43% of recreation and leisure activities on BLM lands. Other important activities included off-highway travel, 10%; non-motorized travel, 10%; water-based activities (e.g., boating, fishing, and swimming), 9%; specialized sports and events, 8%; hunting, 8%; and resource viewing, 4%. Snow-based activities (e.g., snowmobiling) accounted for the smallest percentage of the total, at less than 1% (BLM 2006h).

TABLE 3.2-13 Special Management Areas Managed by the BLM for Conservation under the National Landscape Conservation System in the 11 Western States as of FY2005

	Special Management Area (acres)							
State	National Monuments	National Conservation Areas	Wilderness Areas	Wilderness Study Areas	National Wild, Scenic, and Recreational Rivers[a]	Other[b]	National Historic and Scenic Trails[c]	Totals[d]
Arizona	1,775,017	121,277	1,396,466	63,930	–[e]	–	1,003	3,356,690
California	291,390	10,729,231	3,552,665	974,769	24,800	7,472	1,690	15,580,327
Colorado	163,892	185,773[f]	139,524	621,737	–	–	–	1,110,926
Idaho	274,800	484,034	802	1,341,709	–	–	1,472	2,101,345
Montana	375,027	–	6,000	450,823	89,300	–	–	921,150
Nevada	–	1,043,422[g]	1,758,613	2,877,917	–	–	711	5,679,952
New Mexico	4,124	227,100	139,281	970,532	22,720	–	60	1,363,757
Oregon	52,947	–	186,723	2,337,762	254,438	428,256	–	3,260,126
Utah	1,870,800	–	27,720	3,260,120	–	–	–	5,158,640
Washington	–	–	7,140	5,518	–	–	–	12,658
Wyoming	–		0	575,841	–	–	213	575,841
Total	4,807,997	12,790,837	7,214,934	13,480,658	391,258	435,728	5,149	39,121,412

[a] See Figure 3.5-5 for locations of wild and scenic rivers in the 11 western states. Appendix M (Table M-2) provides a list of wild and scenic rivers by state.

[b] Includes Steen's Mountain Cooperative Management and Protection Area (Oregon), Yaquina Head Outstanding Natural Area (Oregon), and Headwaters Forest Preserve (California).

[c] Values presented are in units of miles and are, therefore, not included in the totals for each state. Historic and scenic trails cross many states; values are assigned to the first state listed for each trail in Table 5-7 in the source document (BLM 2006h).

[d] Totals include double counted areas; e.g., some wilderness areas are included within a national monument or national conservation area. As a result, the sum total of conservation acres managed is greater than the actual number of acres managed. There are an estimated 4.8 million acres falling in more than one conservation category (BLM 2005f). Also, totals include BLM-administered lands only; excluded are other federal lands, state lands, and private lands within any given special management area.

[e] A dash indicates no acreage.

Footnotes continued on next page.

TABLE 3.2-13 (Cont.)

[f] Acreage includes land in Utah.

[g] Acreage includes land in California.

Source: BLM (2006h).

TABLE 3.2-14 Other Special Management Areas (non-National Landscape Conservation System) Managed by BLM for Conservation in the 11 Western States as of FY2004

	Special Management Area (acres)				
State	Herd Management Areas	Areas of Environmental Concern[a]	National Natural Landmarks	Research Natural Areas	Total
Arizona	1,727,669	638,110	4,398	14,056	2,384,233
California	2,330,943	3,441,407	76,997	43,512	5,892,859
Colorado	364,467	648,166	1,036	4,665	1,018,334
Idaho	397,190	580,973	212,640	45,181	1,235,984
Montana	28,255	248,576	14,227	–[b]	291,058
Nevada	15,827,077	1,358,234	9,600	–	17,194,911
New Mexico	32,701	595,001	9,927	27,852	665,481
Oregon	2,712,172	894,135	600	143,486	3,750,393
Utah	2,413,952	1,267,389	33,760	6,453	3,721,554
Washington	–	–	6,114	–	6,114
Wyoming	3,664,002	696,894	48,130	–	4,409,026
Total	29,498,428	10,368,885	417,429	285,205[c]	40,569,947

[a] Values for areas of environmental concern are from FY2005, as reported in BLM (2006h).

[b] A dash indicates no acreage.

[c] Total reported for FY2005 had increased to 323,350 acres.

Sources: BLM (2005f, 2006h).

Between 2000 and 2003, the top five recreation and leisure activities on NFS lands administered by the FS were viewing natural features, general relaxation, hiking, viewing wildlife, and driving for pleasure. In the West, most forest visits occurred in Regions 2, 5, and 6, which include the states of Wyoming, Colorado, Washington, Oregon, and California. Downhill skiing is a very popular activity, especially in Region 2, which hosted over 9.5 million skier visits each year. The White River National Forest in Colorado received the most national forest visits (9.7 million), 67% of which were skier visits. Excluding skier visits, the Arapaho Roosevelt National Forest (Colorado) and Tonto National Forest (Arizona) received the most visits during this time (FS 2006d).

Recreation and leisure activities on NPS-administered lands center around outdoor visits to national parks and natural areas. In FY2005, well over 60% of recreation visits to NPS lands in the 11 western states took place at national parks. Other sites most often visited include national recreation areas (16%), national preserves (13%), and national monuments (6%) (NPS 2006b).

A national survey of recreation and leisure activities on USFWS-administered lands found that about 21.1 million visitors (U.S. residents 16 years old and older) participated in wildlife-related recreation activities in the 11 western states in 2001; about 7.5 million people fished, 2.1 million hunted, and 16.8 million participated

TABLE 3.2-15 Conservation Areas Managed by the FS in the 11 Western States as of FY2005

State	Conservation Area (acres)											
	National Wilderness Area	National Scenic Areas	National Volcanic Monument Area	National Protection Area	National Monument Areas	National Primitive Area	National Recreation Areas	National Game Refuge & Wildlife Preserves	National Scenic Research Area	National Wild, Scenic, and Recreation Rivers[a]	Other[b]	Total
Arizona	1,345,008	–[c]	–	–	–	173,762	–	612,736	–	11,600	–	2,143,146
California	4,430,849	–	–	–	392,169	–	481,536	18,910	–	148,493	–	5,471,957
Colorado	3,146,310	–	–	27,600	–	–	32,414	–	–	15,141	135,165	3,356,630
Idaho	3,961,709	–	–	–	–	–	866,213	–	–	159,586	–	4,987,508
Montana	3,372,503	–	–	–	–	–	59,119	–	–	38,353	–	3,469,975
Nevada	873,657	–	–	–	–	–	314,367	–	–	–	–	1,188,024
New Mexico	1,388,262	–	–	–	–	–	57,000	–	–	12,593	–	1,457,855
Oregon	2,086,504	43,377	54,822	–	–	–	428,206	–	6,637	318,902	12,645	2,951,093
Utah	772,894	–	–	–	–	–	94,308	–	–	–	–	867,202
Washington	2,569,391	27,225	112,605	–	–	–	8,473	–	–	20,582	–	2,738,276
Wyoming	3,111,232	–	–	–	–	–	2,912,576	22,075	–	9,605	–	6,055,488
Total	27,058,319	70,602	167,427	27,600	392,169	173,762	5,254,212	653,721	6,637	734,895	147,810	34,687,154

[a] See Figure 3.5-5 for locations of wild and scenic rivers in the 11 western states. Appendix M (Table M-2) provides a list of wild and scenic rivers by state.

[b] "Other" includes recreation management areas, special management areas, and scenic recreation areas.

[c] A dash indicates no acreage.

Source: FS (2006a).

TABLE 3.2-16 Roadless Areas within the National Forest System as of FY2005

	Roadless Areas (acres)		
State	Total Areas within NFS	Areas Allowing Road Construction and Reconstruction[a]	Areas Not Allowing Road Construction and Reconstruction
Arizona	1,174,000	699,000	476,000
California	4,416,000	2,527,000	1,890,000
Colorado	4,433,000	3,498,000	936,000
Idaho	9,322,000	5,666,000	3,656,000
Montana	6,397,000	3,844,000	2,553,000
Nevada	3,186,000	3,166,000	20,000
New Mexico	1,597,000	430,000	1,167,000
Oregon	1,965,000	1,168,000	797,000
Utah	4,013,000	3,567,000	446,000
Washington	2,015,000	716,000	1,299,000
Wyoming	3,257,000	3,085,000	171,000
Total	41,775,000	28,366,000	13,411,000

[a] Includes 2,530,000 million acres recommended as wilderness in regional forest plans.

Source: FS (2006c).

TABLE 3.2-17 Number of Recreation Areas Managed by Federal Agencies within the 11 Western States

	Managing Agency[a]										
State	BLM	FS	NPS	USFWS	BOR	DOT	USACE	NOS	SIAP	NARA	Total
Arizona	55	16	22	10	7	1	1	0	10	0	122
California	54	26	27	26	34	3	23	6	14	3	216
Colorado	21	7	12	8	33	6	5	0	2	1	95
Idaho	54	10	5	7	20	0	3	0	1	0	100
Montana	7	10	6	18	14	0	2	0	2	0	59
Nevada	38	1	3	6	3	2	0	0	7	0	60
New Mexico	60	7	16	8	11	4	7	0	4	0	117
Oregon	52	18	4	13	22	6	19	1	0	0	135
Utah	94	6	13	6	27	2	0	0	0	0	148
Washington	11	10	11	21	19	2	9	2	2	1	88
Wyoming	41	4	6	9	20	0	0	0	0	0	80

[a] Abbreviations: BLM = Bureau of Land Management, BOR = Bureau of Reclamation, DOT = U.S. Department of Transportation, FS = U.S. Forest Service, NARA = National Archives and Records Administration, NOS = National Ocean Service, NPS = National Park Service, SIAP = Smithsonian Institution Affiliations Program, USACE = U.S. Army Corps of Engineers, USFWS = U.S. Fish and Wildlife Service.

Source: Recreation.gov (2006).

TABLE 3.2-18 Number of State Parks, Recreation Areas, Historic Sites, Monuments, and Natural Areas Located within the 11 Western States and Related Web Sites for Each State

State	Number of State Parks	Web Site
Arizona	29	http://www.pr.state.az.us/parks/parklist.html
California	280	http://www.parks.ca.gov/parkindex/results.asp
Colorado	43	http://parks.state.co.us/parksquickfind
Idaho	26	http://www.idahoparks.org/parks/index.aspx
Montana	50	http://fwp.mt.gov/lands/searchparks.aspx
Nevada	24	http://www.parks.nv.gov/parkmap.htm
New Mexico	34	http://www.emnrd.state.nm.us/PRD/index.htm
Oregon	181	http://www.oregonstateparks.org/search_urban.php
Utah	40	http://www.stateparks.utah.gov/visiting/tour.htm
Washington	120	http://www.parks.wa.gov/
Wyoming	34	http://wyoparks.state.wy.us/find_parkshistory.htm

TABLE 3.2-19 Number of Recreation Visits to BLM-, NPS-, and USFWS-Administered Lands in the 11 Western States, FY2005

	Recreation Visits, FY2005			
State	BLM	FS	NPS	USFWS[a]
Arizona	5,557,000	14,309,000	10,799,429	1,720,000
California	9,604,000	29,786,000	33,400,604	7,231,000
Colorado	5,746,000	25,728,000	5,352,839	2,138,000
Idaho	5,870,000	7,043,000	446,507	868,000
Montana	4,093,000	8,657,000	3,877,478	871,000
Nevada	6,183,000	7,188,000	5,847,070	657,000
New Mexico	2,384,000	2,912,000	1,650,441	884,000
Oregon	7,190,000	17,196,000	901,254	2,051,000
Utah	6,208,000	10,620,000	8,046,646	1,091,000
Washington	–[b]	7,935,000	7,091,427	2,970,000
Wyoming	2,050,000	5,094,000	5,453,845	662,000
Total	54,885,000	138,689,000	82,867,540	21,143,000

[a] USFWS data are for calendar year 2001.

[b] Washington visits included with the Oregon tally.

Sources: BLM (2006h); NPS (2006b); USFWS (2002).

TABLE 3.2-20 Number of Recreation Visits to FS-Administered Lands by Region, FY2005

	National Forest Lands (millions)			
Region[a]	National Forest	National Forest Site	Wilderness Area	Viewing Corridor
1 (Northern)	13.2	14.9	0.5	2.8
2 (Rocky Mountain)	32.5	38.4	1.2	42.7
3 (Southwest)	20.5	23.8	1.9	23.7
4 (Intermountain)	23.3	26.2	1.0	12.0
5 (Pacific Southwest)	30.7	38.7	1.0	27.0
6 (Pacific Northwest)	28.2	35.1	1.5	25.7
Total[b]	148.4	177.1	7.1	133.9

[a] States covered by each region are as follows: Region 1 = Northern Idaho, Montana, and North Dakota; Region 2 = Central and Eastern Wyoming, Colorado, South Dakota, Nebraska, and Kansas; Region 3 = Arizona and New Mexico; Region 4 = Nevada, Southern Idaho, Utah, and Western Wyoming; Region 5 = California; Region 6 = Washington and Oregon.

[b] Totals do not reflect overlap in visits to the forest lands listed.

Source: FS (2006d).

in at least one type of wildlife-watching activity (observing, feeding, or photographing). The survey found considerable overlap in these activities; in general, about 27% of anglers hunted, 58% of anglers and 62% of hunters also participated in wildlife-watching activities, and 33% of all wildlife watchers also participated in hunting and fishing during the year (USFWS 2002). Table 3.2-21 presents a breakdown of the number of participants by recreation activity on USFWS lands for each of the 11 western states.

Recreation and leisure activities on BOR-administered lands center around the agency's many reservoirs and dam facilities. Although visitor statistics are not available by state, the BOR estimates that nationwide about 90 million visitors participate in water-based recreation activities on BOR lands and waters each year (DOI 2005b).

3.2.1.4 Nonfederal Lands

Nonfederal lands in the United States include privately owned lands, Tribal and trust lands, and lands controlled by state and local governments. According to the USDA's National Resources Inventory (NRI), about 1.4 billion acres (71%) of land in the contiguous 48 states have a nonfederal, rural land use classification. These lands are predominantly forest land (406 million acres), rangeland (405 million acres), cropland (368 million acres), and pasture land (117 million acres) (NRCS 2007a). A subset of these lands (about 330 million acres) is defined as prime farmland, i.e., lands with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops and are also available for these uses (NRCS 2003). These lands are subject to protection under the Farmland Protection Policy Act (FPPA; P.L. 97–98, 7 USC 4201 et seq.).

TABLE 3.2-21 Number of Participants by Recreation Activity on USFWS-Administered Land in 2001

	Number of Participants[a]		
State	Fishing	Hunting	Wildlife Watching
Arizona	419,000	148,000	1,465,000
California	2,444,000	274,000	5,720,000
Colorado	917,000	281,000	1,552,000
Idaho	416,000	197,000	643,000
Montana	349,000	229,000	687,000
Nevada	172,000	47,000	543,000
New Mexico	314,000	130,000	671,000
Oregon	687,000	248,000	1,680,000
Utah	517,000	198,000	806,000
Washington	938,000	227,000	2,496,000
Wyoming	293,000	133,000	498,000
Total	7,466,000	2,112,000	16,761,000

[a] Numbers of participants by activity do not add up to the totals presented in Table 3.2-19 because of considerable overlap in activities.

Source: USFWS (2002).

A breakdown of the nonfederal rural lands in the 11 western states, based on the 2003 NRI, is provided in Table 3.2-22. There are about 54.95 million acres of cropland, of which about 71% falls under the category “cultivated,” with the highest total acreages occurring in Montana (14.5 million acres), California (9.5 million acres), and Colorado (8.3 million acres). About 261.6 million acres are designated for grazing (as cropland, rangeland, and grazed forest land), with the highest total acreages occurring in New Mexico (44.9 million acres), Montana (43.5 million acres), Wyoming (29.4 million acres), and Colorado (27.8 million acres). Forest land (including grazed forest land) covers about 64.8 million acres of the nonfederal rural West, with the highest acreages occurring in California (13.9 million acres), Oregon (12.7 million acres), and Washington (12.7 million acres). The remainder is comprised of developed land (18.4 million acres), other rural land (18.1 million acres), water areas (9.2 million acres), and Conservation Reserve Program (CRP) land (9.1 million acres). Lands under the CRP land use category are private lands undergoing conversion from highly erodible cropland to vegetative cover under a federal program established by the Food Security Act of 1985 (NRCS 2007b).

Prime farmland covers about 19.7 million acres of nonfederal rural land in the 11 western states, with the highest acreages occurring in California (5.5 million acres), Oregon (3.5 million acres), Idaho (3.3 million acres), and Washington (2.3 million acres). Table 3.2-23 shows the breakdown of prime farmland by land use for 1997 (the latest date for which state figures are available). Between 1982 and 2001, prime farmland acreage has declined by about 3.5% nationwide (NRCS 2003).

The Bureau of Indian Affairs (BIA) holds in trust and administers about 55.7 million acres of land across the United States; of this total, about 45 million acres are Tribally owned and 10 million acres are individually owned, held in trust status. Another 205,521 acres are “stewardship lands” administered for recreation, conservation, and functions vital to the culture and livelihood of the American Indians. Forests cover about 18 million acres of Indian trust land across 26 states (BIA 2006).

There are about 275 Tribal land areas administered as Indian reservations; the largest of these is the 15.6 million acres Navajo reservation and trust lands in Arizona, New Mexico, and Utah (U.S. Bureau of the Census 2006d). Table 3.2-24 provides a summary of the acreages of Indian reservations and trust lands for each of the 11 western states; maps showing their locations by state are provided in the State Base Map Series (Volume III, Part 2 of this document). A complete listing of reservations and trust lands for each state is presented in Appendix K.

TABLE 3.2-22 Breakdown of Nonfederal Rural Lands in the 11 Western States

State	Cropland (acres)[a]		Total Grazing Land (acres)[b]			Forest Land (acres)[c]
	Cultivated	Noncultivated	Pastureland	Rangeland	Grazed Forest Land	
Arizona	704,200	229,700	82,000	32,254,700	3,800,800	4,141,400
California	4,892,900	4,575,300	1,188,600	17,758,000	5,315,700	13,903,200
Colorado	6,945,300	1,402,700	1,001,800	24,790,600	2,039,800	3,289,000
Idaho	4,149,800	1,302,800	1,316,600	6,420,700	1,766,900	4,006,900
Montana	11,408,800	3,117,800	3,594,400	36,697,900	3,190,400	5,402,000
Nevada	105,400	530,700	269,500	8,276,600	238,600	314,000
New Mexico	1,125,200	423,500	232,100	39,955,500	4,751,600	5,477,600
Oregon	2,443,900	1,257,100	1,761,300	9,379,400	3,262,100	12,733,600
Utah	922,600	759,500	722,400	10,666,900	1,395,500	1,875,600
Washington	5,407,200	1,086,600	1,080,100	5,861,000	3,128,900	12,707,100
Wyoming	851,600	1,309,500	1,081,000	27,535,500	774,700	948,600
Total	38,956,900	15,995,200	12,329,800	219,596,800	29,665,000	64,799,000

[a] Cropland is an NRI land use category that includes areas used for the production of adapted crops for harvest. Cultivated cropland comprises land in row crops or close-grown crops and other cultivated cropland (e.g., hay land or pastureland) that is in rotation with row or close-grown crops. Noncultivated cropland includes permanent hay land and horticultural cropland.

[b] Total grazing land is comprised of pastureland, rangeland, and portions of forest land designated for grazing. Pastureland is an NRI land use category of land managed primarily for the production of introduced forage plants for livestock grazing; it may consist of a single species in a pure stand, a grass mixture, or a grass-legume mixture. For the NRI, pastureland includes land that has a vegetative cover of grasses, legumes, and/or forbs, regardless of whether or not it is being grazed by livestock. Rangeland is an NRI land use category on which the plant cover is composed mainly of native grasses, grass-like plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities of low forbs and shrubs, such as mesquite, chaparral, mountain shrub, and pinyon-juniper, are also included as rangeland. Forested grazing land consists mainly of forest, brush-grown pasture, arid woodlands, and other areas within forested areas that have grass or other forage growth. Estimates of forested grazed land include significant areas grazed only lightly or sporadically.

[c] Forest land is an NRI land use category that is at least 10% stocked by single-stemmed woody species of any size that will be at least 13 feet tall at maturity. Also included is land bearing evidence of natural regeneration of tree cover (cut over forest or abandoned farmland) and not currently developed for nonforest use. The minimum area for classification as forest land is 1 acre, and the area must be at least 100 feet wide.

Source: NRCS (2007a).

TABLE 3.2-23 Breakdown of Prime Farmland Acreage by Land Use in the 11 Western States[a]

State	Cropland	CRP Land	Pastureland	Rangeland	Forest Land	Other Rural Land	State Totals
Arizona	901,000	0	34,500	0	0	0	935,500
California	5,095,800	0	232,800	112,900	11,000	66,000	5,518,500
Colorado	1,572,900	2,000	94,600	5,000	0	3,800	1,678,300
Idaho	2,816,800	100,300	229,100	63,000	30,900	26,100	3,266,200
Montana	836,900	0	117,700	7,300	3,600	19,600	985,100
Nevada	246,300	0	15,300	0	0	0	261,600
New Mexico	124,700	0	19,800	0	0	0	144,500
Oregon	2,171,000	189,000	545,700	252,400	257,400	100,500	3,516,000
Utah	702,600	4,200	93,000	3,500	300	4,500	808,100
Washington	1,293,000	38,800	327,100	28,000	503,200	95,800	2,285,900
Wyoming	306,900	4,000	11,900	6,300	0	700	329,800
Total	16,067,900	338,300	1,721,500	478,400	806,400	317,000	19,729,500

[a] Prime farmland is designated independently of current land use, but it cannot be in areas of water or urban or built-up land as defined by the NRI. Maps showing areas of prime farmland and related data and statistics can be accessed at NRCS's National Cartography and Geospatial Center (http://www.ncgc.nrcs.usda.gov/products/nri/index.html) and the Farmland Information Center (http://www.farmlandinfo.org/farmland_technical_resources).

Source: NRCS (2000).

TABLE 3.2-24 Acreage of Tribal Lands in the 11 Western States

State	Acreage
Arizona	9,755,136
Arizona–California	320,704
Arizona–California–Nevada	32,768
Arizona–New Mexico	2,049,664
Arizona–New Mexico–Utah	14,001,792
California	620,928
Colorado	677,504
Colorado–New Mexico–Utah	568,896
Idaho	1,669,184
Montana	8,364,736
Montana–South Dakota	2,048
Nevada	1,148,992
Nevada–Oregon	34,944
Nevada–Utah	113,536
New Mexico	3,649,280
Oregon	851,584
Utah	4,389,952
Washington	4,579,712
Wyoming	2,221,696
Total	55,053,056

Source: U.S. Bureau of the Census (2006d).

3.2.1.5 Aviation Considerations

Because of air navigation concerns associated with tall structures and structures built near airports, the locations of airports (and their related airspaces) and the flight patterns of various aircraft need to be taken into account when siting infrastructure (e.g., electricity transmission towers) along energy corridors. The FAA must be contacted for any proposed construction or alteration of objects within navigable airspace under the following categories:

- Proposed objects more than 200 feet above ground level at the structure's proposed location;
- Within 20,000 feet of an airport or seaplane base that has at least one runway longer than 3,200 feet, and the proposed object would exceed a slope of 100:1 horizontally from the closest point of the nearest runway;
- Within 10,000 feet of an airport or seaplane base that does not have a runway more than 3,200 feet in length, and the proposed object would exceed a 50:1 horizontal slope from the closest point of the nearest runway; and/or
- Within 5,000 feet of a heliport, and the proposed object would exceed a 25:1 horizontal slope from the nearest landing and takeoff area of that heliport (FAA 2000).

The FAA could recommend marking and/or lighting a structure that does not exceed 200 feet above ground level, or that is not within the distances from airports or heliports mentioned above, because of its particular location (FAA 2000).

The numbers of public airports that occur in each of the 11 western states are as follows: Arizona, 81; California, 261; Colorado, 77; Idaho, 120; Montana, 122; Nevada, 52; New Mexico, 59; Oregon, 98; Utah, 47; Washington, 140; and Wyoming, 41 (AirNav.com 2006). These numbers do not include the numerous private and military-use facilities that occur in these states.

The U.S. military uses airspace for its operations, some of which occur at low elevations (from 1,000 feet to as low as ground surface). Airspace restrictions under the designations Military Training Routes (MTRs) and Special Use Airspace (SUA), which include Military Operating Areas (MOAs), cover about 41% of federal land in the 11 western states (with about 6% overlap between them). MTRs have the greatest coverages in New Mexico (52%) and Nevada (48%) and the least coverages in Wyoming (0%) and Oregon (2%). SUAs also have the greatest coverages in Nevada (33%) and New Mexico (27%) and the least coverages in Wyoming and Colorado (both at 5%). The overlap between MTRs and SUAs in New Mexico and Nevada is 12% and 17%, respectively.

Figure 3.2-1 shows the extent of military airspace restrictions at elevations of 1,000 feet or less (excluding areas that extend offshore). Military operations could be adversely affected by energy transport facilities if they were to penetrate the floor (i.e., the lowest elevation) of a designated restricted airspace. The corridor specifications and proposed land use plan amendments presented in Appendixes F and A, respectively, are based on siting constraints that take into account military airspace restrictions, including those less than 1,000 feet.

Another important consideration is the aircraft operations of BLM's National Office of Aviation and the FS's Office of Fire and Aviation Management, which provide aircraft support for wildfire suppression and resource management missions on public lands.

3.2.1.6 Regional Plan Considerations

Project activities along energy corridors would take into account the goals and monitoring requirements set forth in various regional plans covering federal lands in the 11 western states. As an example, the Northwest Forest Plan (NWFP) was created to facilitate the production of timber products from forests on federal land in the Northwest while at the same time outlining interagency management strategies to protect the northern spotted owl. The NWFP covers 24.5 million acres in Oregon, Washington, and northern California. Most of this land is managed by the FS (79%). The BLM (11%), NPS (9%), and USFWS (<1%) also manage land addressed by the plan (Regional Ecosystem Office 2007).

Other interagency regional plans to consider include (but are not limited to) the following:

- *The California Desert Conservation Plan (BLM 1980)* – which regulates the use of federal desert land;
- *The Arizona Interagency Desert Tortoise Team* – which was created to protect the desert tortoise species and its natural habitat in Arizona (Arizona Game and Fish 2007); and
- *The DOD Sustainable Ranges Initiative, Western Regional Partnering* – which coordinates activities on military training and testing ranges in the western states while providing good stewardship of the land (DOD 2007).

3.2.2 How Were the Potential Effects of Corridor Designation to Land Use Evaluated?

Potential impacts on land use were evaluated for each alternative by examining the location and area of land that would be designated as an energy corridor, the current use of that land, and the compatibility of current land use designations with a proposed energy corridor land use. Because no energy corridors as specified by Section 368 would be designated under the No Action Alternative, land use impacts were evaluated by examining the compatibility of energy transport system ROWs with designated land uses on federal lands. The analysis also considered potential land use impacts that could be incurred during the construction, operation, and decommissioning of projects under each alternative.

3.2.3 What Are the Potential Impacts Associated with Corridor Designation?

Environmental consequences from the designation of Section 368 energy corridors on federal lands and land use plan amendments include a change in the designated use of the federal lands that fall within the boundaries of the proposed corridors. Additional impacts to land use would occur under both alternatives as a result of energy transport project development within designated corridors or within No Action ROWs. Because the designation of Section 368 energy corridors does not include project authorization, project-related impacts to land use would not occur until project development occurs.

As discussed in Section 3.2.1, the BLM and the FS manage their lands within a "multiple use" framework to facilitate resource management in a way that best meets the needs of the American people. Therefore, for this general analysis, the construction, operation, and decommissioning of an energy corridor would be considered to have a potential impact on land use only if it:

- Conflicts with existing land use plans and community goals;
- Conflicts with existing recreational, educational, religious, scientific, or other uses of the area;
- Conflicts with conservation goals for the area; or
- Requires a conversion of the existing commercial land use of the area (e.g., mineral extraction).
-

Current land uses and public concerns were taken into account during the siting of the proposed corridors and corridor segments, as described in Section 2.2, to minimize these conflicts at the outset. Table 3.2-25 provides a summary of the proposed corridor lengths and acreages for each of the 11 western states under the Proposed Action. Potential impacts to land use are discussed in the following sections.

3.2.3.1 No Action Alternative

Under No Action, federal energy corridors as specified by Section 368 would not be designated on federal lands in the West, although the siting and development of energy transport projects would continue. In general, all public lands unless otherwise classified, segregated, or withdrawn are available for ROW authorization under FLPMA or the MLA by the appropriate land management agency. Current federal agency practices for permitting energy transport ROWs and ensuring maximum consistency with existing land use plans would be followed for each project ROW.

Clearing of a ROW would result in the permanent loss of timber production within and adjacent to the ROW in areas designated for that use. Recreation, livestock grazing, oil and gas leasing, and wildlife habitat conservation could experience short-term disturbance during construction activities. Following completion of the project, the project and its ROW generally would not preclude resumption of many of those activities, although an oil or gas pipeline project might limit oil and gas production and mineral extraction directly within the ROW. Degradation in the quality of the visual landscape for recreational users and tourists as well as changes in accessibility could also occur in some areas (Section 3.9).

In the absence of designated corridors that could support colocated projects, development of energy transport projects may occur independently, with little or no colocation of ROWs. As a result, each transport project would have its own ROW. These individual ROWs could be sited in any number of locations, and each would result in long- and short-term impacts to land use.

TABLE 3.2-25 Corridor Lengths and Acreage under the Proposed Action

	Locally Designated Corridors		Designated Corridors Under the Proposed Action (Total)[a]	
State	Length (miles)	Area (acres)[b]	Length (miles)	Area (acres)[c]
Arizona	471	265,544	172	95,292
California	139	56,521	676	231,137
Colorado	224	181,312	196	80,527
Idaho	59	21,440	351	140,063
Montana	58	20,386	44	21,661
New Mexico	21	8,944	293	120,986
Nevada	821	588,238	809	336,814
Oregon	348	63,548	243	174,652
Utah	171	69,788	469	286,153
Washington	48	4,449	6	2,479
Wyoming	0	35	438	185,557
Total	2,359	1,280,205	3,696	1,675,320

[a] Values include both locally designated corridors (existing) and corridors not previously designated at the local level for energy transport.

[b] Values take into account a range of corridor widths.

[c] Values are based on an assumed width of 3,500 feet.

3.2.3.2 The Proposed Action

Under the Proposed Action, corridor designation could indirectly affect current land use on about 1.68 million acres along 3,696 miles of federal land not previously designated at the local level for energy transport (Tables 3.2-25 and 3.2-26). Land use and property values on nonfederal land (i.e., privately owned land, Tribal and trust land, and land controlled by state and local governments) could also be affected by the corridor designations under this alternative, either as a result of being adjacent to federal land on which a corridor has been designated or as a consequence of being a nonfederal land “gap” that would connect projects on designated corridors if they were to be built.

An additional 1.28 million acres along 2,359 miles of federal land that are locally designated for energy transport may also be affected, especially in areas where a locally designated corridor width was expanded for Section 368 energy corridor designation. Approximately 43% of the proposed corridor acreage is associated with existing utility or transportation ROWs and infrastructure.

As with No Action, current land uses on federal land could continue until initiation of an energy transport project. Initiation of any transport project would result in land use impacts within and adjacent to the energy corridors similar in nature and duration as those identified for No Action. However, once outside the designated corridor, individual projects may

TABLE 3.2-26 Acreages and Percentages of Public Lands Crossed by Proposed Corridors in the 11 Western States under the Proposed Action, by Agency

	BLM		FS		NPS		USFWS		DOD	
State	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Arizona	203,307	1.66	77,159	0.69	2,652	0.059	494	0.029	10,170	0.23
California	220,216	1.45	87,652	0.42	0	0.00	249	0.053	1,780	0.045
Colorado	226,310	2.71	36,183	0.25	596	0.084	5,130	3.14	27	0.0056
Idaho	174,071	1.45	6,125	0.030	0	0.00	0	0.00	0	0.00
Montana	28,095	0.35	24,591	0.15	0	0.00	0	0.00	0	0.00
Nevada	1,028,136	2.15	11,893	0.20	992	1.29	20,828	0.86	9,138	0.27
New Mexico	126,819	0.95	0	0.00	0	0.00	1,569	0.41	2,424	0.070
Oregon	187,763	1.16	52,414	0.33	0	0.00	0	0.00	0	0.00
Utah	326,323	1.43	32,542	0.40	10	0.00	964	0.86	4,191	0.24
Washington	607	0.15	6,756	0.073	0	0.00	0	0.00	509	0.053
Wyoming	179,376	0.98	7,981	0.086	0	0.00	0	0.00	0	0.00
Total	2,701,023	1.55	343,296	0.24	4,250	0.021	29,234	0.38	28,239	0.15

or may not remain colocated as they continue to cross other federal and nonfederal lands. If the project locations diverge into separate project-specific ROWs, land use along these ROWs would be similarly affected.

As discussed in Section 2.1, the siting of potential Section 368 energy corridors considered military requirements; as a result, the corridor designations under the Proposed Action are not expected to affect military training or testing activities or areas. Under the Proposed Action, corridor segments are located across or within close proximity of military facilities in five states: Arizona (Yuma Proving Ground), California (Sierra Army Depot, Edwards Air Force Base, the Naval Air Weapons Station at China Lake, and Twentynine Palms Marine Corps Base), Nevada (Nellis Air Force Base, Nellis Test and Training Range, and Hawthorn Army Ammunition Depot), New Mexico (White Sands Missile Range), and Utah (Tooele Army Depot).

The siting of the proposed energy corridors also considered the locations of sensitive areas (i.e., conservation lands) on federal lands to minimize corridor crossings in these areas. Of the 11 western states, California has the greatest area of conservation lands affected (184,571 acres) by the corridor designations under the Proposed Action, with most of the acreage occurring on BLM and FS lands (Table 3.2-27).

Corridor segments cross BLM conservation lands in every state but Washington. FS conservation lands affected include national forests, national wildlife refuges, and roadless areas. National forests are crossed or bordered by proposed energy corridors in eight states: Arizona (Tonto and Coronado), California (Trinity and Shasta), Colorado (Arapaho and Uncompahgre), Idaho (St. Joe and Coeur d'Alene), Nevada (Humboldt), Oregon (Mt. Hood and Fremont), Utah (Uinta and Dixie), and Washington (Wenatchee). National wildlife refuges are crossed in two states: New Mexico (Sevilleta) and Nevada (Desert). Roadless areas are crossed by the proposed corridors in California, Colorado, Montana, Nevada, Oregon, Utah, and Wyoming (see Appendix G).

Text Box 3.2-1
Related Roadless Area Impacts

Generally, roadless areas (as designated by the FS and BLM) would not contain designated energy corridors due to restrictions on road construction, road reconstruction, and timber harvesting. Some roadless areas already contain existing ROWs, structures, and roads that are allowed under existing regulations. Typically, a ROW may be authorized within a roadless area only if it is consistent with applicable laws and regulations. If a proposed corridor becomes an established corridor in a roadless area, the lands within the corridor boundaries can be used only when authorized.

Where a proposed corridor is located in a roadless area in this PEIS, it is because:

- There is already an existing energy ROW;
- The width of a proposed corridor has some portion of its footprint in a roadless area; or
- The scale of mapping in this PEIS is not yet sufficiently detailed to clearly identify the boundaries of a roadless area.

Corridor segments cross NPS land in three states — the Lake Mead Recreational Area, which spans the Nevada–Arizona border southeast of Las Vegas, and the Curecanti National Recreational Area and Dinosaur National Monument in Colorado. Corridors also run alongside of (but do not cross) the northern and southern borders of the Mojave National Preserve and the southern border of Joshua Tree National Park (California). USFWS land is affected in six states: Arizona and California (Havasu National Wildlife Refuge), Colorado and Utah (Colorado River Wildlife Management Area), Nevada (Desert National Wildlife Refuge), and New Mexico (Sevilleta National Wildlife Refuge).

Short-term impacts to recreational land use within and adjacent to the designated corridors could occur as a result of vegetation removal, road construction, noise, and fugitive dust and air emissions generated during energy transport project construction. People engaged in activities such as hiking, camping, birding, and hunting would be most affected by construction activities, but impacts could also be long-term in some places depending on the level of noise, vehicle use, and lights associated with the operations of a particular project. Degradation in the quality of the visual landscape would likely also occur in some areas. Short- and long-term impacts associated with visual resources are addressed in Section 3.9. Following development of projects within

TABLE 3.2-27 Total Acreage of Conservation Lands Crossed in the 11 Western States by Proposed Corridors under the Proposed Action, by Agency

State	BLM	FS	NPS	USFWS
Arizona	12,773	11	2,600	239
California	180,606	3,889	0	76
Colorado	1,122	155	28	4,274
Idaho	1,982	1	0	0
Montana	281	640	0	0
Nevada	53,805	3,290	992	13,028
New Mexico	6,640	0	0	670
Oregon	1,088	1,717	0	0
Utah	22,294	10,539	0	550
Washington	0	3,537	0	0
Wyoming	10,206	615	0	0
Total	290,797	24,394	3,620	18,838

designated corridors, some areas may become more accessible, with increased opportunities for recreational activities in previously inaccessible (or less accessible) areas, while other areas may become less accessible.

3.2.4 Following Corridor Designation, What Types of Impacts Could Result to Land Use with Project Development, and How Could They Be Minimized, Avoided, or Compensated?

3.2.4.1 What Are the Usual Impacts to Land Use of Building and Operating Energy Transport Projects?

The designation of energy corridors or ROWs may affect land use if the corridor or ROW conflicts with existing land use plans; conflicts with existing recreational (including visual quality), educational, religious, scientific, military, or other uses of the area; or affects the existing commercial land use (e.g., mineral production or timber harvest) of the area. The nature, magnitude, and extent of the land use impacts depend directly on the existing land use in the project area and its compatibility with the nature of the proposed corridor or ROW and its associated project.

Energy transport projects with above-ground structures (such as electricity transmission towers) could affect military training and testing operations that may occur at low altitudes (e.g., military training routes), and may also result in aircraft radar interference. However, the IOPs outlined in Section 2.4 of this PEIS for granting ROW authorizations take into account potential conflicts with military operations, and in the absence of suitable mitigation alternatives, ROW authorization may be denied.

3.2.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Land Use?

The previous evaluations identified potential land use impacts that could be incurred during the construction, operation, and decommissioning of energy infrastructure within designated corridors under both alternatives. The nature, extent, and magnitude of these potential impacts would vary on a site-specific basis and with the specific phase of the project (e.g., construction or operation). The greatest potential for land use impacts would occur as a result of decisions made during the design and siting phases of an authorized project. A variety of mitigation measures could be incorporated, as stipulations, into the design and development of energy corridors to reduce potential land use impacts. However, it may not be possible to mitigate all impacts of a given project (e.g., the development of access roads needed by the project but deemed undesirable by some users). The mitigation measures include:

- Planning projects to mitigate or minimize impacts to other land uses;

- Contacting federal and state agencies, property owners, and other stakeholders as early as possible in the planning process to identify potentially sensitive land uses and issues, rules that govern energy development locally, and land use concepts specific to the region;

- Consulting with the DOD to evaluate the potential impact of a proposed project on military operations in order to identify and address any DOD concerns;

- Limiting the height of corridor towers and other utility infrastructure to no higher than existing infrastructure or below the floor of military low-level airspace;
- Preparing the FAA-required notice of proposed construction as early in the process as possible to identify any air safety issues and required mitigation measures;
- Siting projects on already altered landscapes, when feasible;
- Consolidating infrastructure, taking into account current transport and market access, to optimize the efficiency of land use; and
- Developing restoration plans to ensure that all temporary use areas are restored.

3.3 GEOLOGIC RESOURCES

3.3.1 What Are the Geologic Conditions in the 11 Western States?

3.3.1.1 Geologic Setting

The federal lands in the western 11 states reside in several physiographic provinces (Burchfiel et al. 1992), which are areas having generally similar terrain texture, rock types, and geologic structure and history. From west to east, these physiographic areas include the (1) Pacific Border province, (2) Cascade-Sierra Mountains province, (3) Columbia Plateau, Snake River Plain, Basin and Range, and Colorado Plateaus provinces, (4) Rocky Mountain provinces and Wyoming Basin, and (5) Great Plains province (Figure 3.3-1). Characteristics of the physiographic provinces are summarized in Table 3.3-1.

3.3.1.2 Geologic Resources

Soil Resources. The soils in the 11 western states are diverse because of various climates, parent materials, landforms, vegetation, and the age of the surface materials. All of these factors affect soil formation processes. For the purpose of this PEIS, soil orders (the highest category of soil taxonomy used by Natural Resources Conservation Service [NRCS]) are used to describe the soils in the western states (BLM 2005a; NRCS 1999, 2006a). These soil orders, their distributions in the 11 western states, and general characteristics are described in Table 3.3-2 in order of decreasing predominance.

Sand, Gravel, and Crushed Stone Resources. Sand, gravel, and crushed stone suitable for use in construction occur throughout the western states. These resources are generally mined in river valleys, glacial outwash areas, quarries, and alluvial fans close to project sites.

3.3.1.3 Hazardous Geologic Features

The presence of volcanoes, earthquakes, active faults, and potential liquefaction and landslide areas in the 11 western states can threaten the integrity of an energy transport system, which may include electricity transmission lines and hydrogen, oil, and gas pipelines. Any spills or leaks caused by these geologic hazards would, in turn, affect the environment. See Section 3.14 for an expanded discussion of the potential impacts of these natural events.

In the following sections, the geologic hazardous areas are discussed with respect to their locations in the 11 western states. It is important to note that the scales of the accompanying maps are small, as the maps are used to show the general major locations of the

TABLE 3.3-1 Physiographic Provinces in the 11 Western States

Physiographic Provinces	Physiographic Regions	Geographic Location	General Terrain	Rock Types
Pacific Border Province	Pacific Coast Ranges	Coastal mountains and plains bordering the Pacific Ocean, including Olympic Mountains, the Coast Ranges, and the Klamath Mountains in Washington, Oregon, and northern California; narrow coastal plains along much of the California coast, and lowlands such as the Puget Trough in Washington	A geologically active area with rough mountains with elevations ranging from sea level to more than 11,483 feet. Extreme climate contrasts. Earth flows and complex landslides are active in mountainous areas.	Folded and faulted formations of sedimentary, igneous, and metamorphic bedrock are common.
	Great Valley	In central California bounded by the Klamath and Cascade Mountains to the north, the Sierra Nevada Mountains to the east, and the California Coastal Mountains to the west	A flat, geological trough with elevations ranging from sea level to more than 1,000 feet. The region receives sediments derived primarily from the erosion of the Sierra Nevada, Klamath, and Cascade Mountains.	Thick sequence of marine and terrestrial sediments spanning from the Triassic to the Holocene Ages.
Cascade-Sierra Mountains Province	Northern Cascade Mountains	Northern Washington	Many high non-volcanic mountains that receive heavy snowfall and have been glaciated. Resulted from crust uplifted and faulted since late Cretaceous Period.	Characterized by sedimentary, igneous, and metamorphic rocks.
	Western Cascade Mountains	Southern Washington and Oregon	Best known for their high, snow-capped volcanoes. The mountains are part of the circum-Pacific volcanic belt extending from Washington to northeastern California with older and more inactive volcanic mountains.	Volcanic, sedimentary, and metamorphic rocks.
	High Cascade Mountains	Southern Washington, Oregon, and northern California	Best known for their high, snow-capped volcanoes. The mountains are part of the circum-Pacific volcanic belt characterized by younger, active volcanoes (such as Mount St. Helens, Mount Rainer, and Glacier Peak).	Volcanic, sedimentary, and metamorphic rocks.

TABLE 3.3-1 (Cont.)

Physiographic Provinces	Physiographic Regions	Geographic Location	General Terrain	Rock Types
Cascade-Sierra Mountains Province (Cont.)	Sierra Nevada Mountains	Eastern California east of the California Trough	Located near a geologic plate boundary in the Mesozoic Era and evolved from sedimentation, volcanism, granitic intrusions, uplifts, and erosion over geologic time.	Primarily granitic rocks with some older metamorphic rock. Some volcanic rocks in eastern Sierra Nevada Mountains.
Columbia Plateau, Snake River Plain, Basin and Range, and Colorado Plateau Provinces	Columbia Plateau	Southeastern Washington and northern Oregon, bounded by the Cascade Mountain to the west and the Rocky Mountains to the east	A basin-like structure with beds of basaltic rock and sediments. The eastern Columbia Plateau is commonly covered by loess.	Characterized by late Cenozoic basaltic lava, sediments, and loess.
	Snake River Plain	Southern Idaho	A geomorphically featureless area surrounded by mountains and highlands.	The eastern Plain is characterized by rhyolitic volcanic rocks covered by basaltic lava, and the western Plain is a basin filled with sedimentary deposits over a thick slab of basalt.
	Basin and Range	South of the Columbia Plateau, extending from southern Idaho and Oregon through most of Nevada and parts of western Utah, eastern California, western and southern Arizona, southwestern New Mexico, and northern Mexico	Has more than 400 evenly spaced, nearly parallel mountain ranges and intervening basins. The mountain ranges are generally abrupt, steeply sloping, and deeply dissected with relief between 3,000 and 5,000 feet above the intermountain basins. The basins are typically broad, gently sloping, and largely undissected with altitudes from below sea level to about 5,000 feet above sea level. The Basin and Range can be divided into the Great Basin in the north and the Salton Trough, Mojave-Sonoran Desert, Mexican Highlands, and Sacramento Mountains in the south. The province experienced extensional faulting in the middle to late Cenozoic (Dohrenwend 1987).	Complexly deformed Precambrian and Paleozoic rocks. Mesozoic granitic rocks are found in the western province. Cenozoic volcanic rocks are widespread.

TABLE 3.3-1 (Cont.)

Physiographic Provinces	Physiographic Regions	Geographic Location	General Terrain	Rock Types
Columbia Plateau, Snake River Plain, Basin and Range, and Colorado Plateau Provinces (Cont.)	Colorado Plateau	Intersection of Colorado, Utah, Arizona, and New Mexico	Separated from neighboring provinces by sharply defined boundaries such as faults, various rock types, and topography, the Plateau can be divided into several sections, each with its own geologic and geomorphologic characteristics. The centrally located Canyon section is dominated by gently folded sedimentary rocks; the Navajo section is largely a sedimentary platform with isolated buttes, mesas, folded mountains, and volcanic plugs. The western High Plateaus section has widespread accumulations of volcanic material. The Uinta Basin section in the north and the Grand Canyon and Datil sections in the south have mountains, cliffs, and dissected terrain (Graf et al. 1987).	Mostly sedimentary rocks. Volcanic rocks and volcanic plugs are common in some areas.
Rocky Mountains Province	Northern Rockies	Western Montana and northern Idaho	The Rocky Mountains include fault-bounded uplifts, folded mountains, and highlands formed by volcanism as a result of the Laramide mountain-building period that occurred between the middle Cretaceous and late Eocene Periods. The uplift also set the stage for the geomorphic evolution of the Rocky Mountains, producing ridges and plateaus high enough to be glaciated, as well as many of the streams and canyons of the region. The Northern Rockies are characterized by low mountains with summits between 6,900 and 7,874 feet above sea level. Block faulting is common.	Precambrian sedimentary rocks dominate. Mesozoic igneous intrusive rocks are common in central Idaho.

TABLE 3.3-1 (Cont.)

Physiographic Provinces	Physiographic Regions	Geographic Location	General Terrain	Rock Types
Rocky Mountains Province (Cont.)	Middle and Southern Rockies	Northwestern Wyoming and Colorado	Before the Laramide mountain-building period, the Middle and Southern Rockies were part of a stable platform composed of Precambrian crystalline rocks. The platform received sediments that were transformed into sedimentary rocks, which were then uplifted and eroded during the mountain-building period. Later, volcanic activities produced mountains and high plateaus in many places. Separated from the Middle Rockies by the Wyoming Basin in Wyoming, the Southern Rockies have high summits between 10,827 and 14,436 feet (Madole et al. 1987).	Sedimentary, metamorphic, and volcanic rocks.
Great Plains	Great Plains	Located east of the Rocky Mountains and the Basin and Range in the eastern parts of Montana, Wyoming, Colorado, and New Mexico	Except for northern Montana, where it has been glaciated, the Great Plains is a large region of generally low relief sloping eastward from the Rocky Mountains. Near the base of the Rocky Mountains, a few basins, such as the Williston, Powder River, and Denver-Julesburg Basins, received sediments from the Rockies during the Laramide mountain-building period.	Glacial deposits in northern Montana and Cretaceous and Tertiary sediments in most of the Great Plains. Some older bedrock is found in small areas in central Montana and the Black Hills in eastern Wyoming (Wayne et al. 1991).

Sources: Burchfiel et al. (1992); Dohrenwend (1987); Wayne et al. (1991).

TABLE 3.3-2 Soil Orders in the 11 Western States in Order of Decreasing Predominence

Soil Order	Geographic Area	Characteristics
Aridisols	Arizona, southeastern California, Colorado, southern Idaho, Nevada, New Mexico, Utah, and central Wyoming.	Low in organic material and light in color. Subsurface accumulations of soluble calcium carbonate, salts, and gypsum result in hardpans that impede water infiltration.
Mollisols	Arizona, western California, Colorado, eastern Oregon and Washington, central Idaho, Montana, New Mexico, Utah, and Wyoming.	Have a very dark brown to black surface horizon, mostly formed under grass or savanna vegetation. In eastern Oregon and Washington and Idaho, the soils are developed on basalt and loess parent material.
Entisols	Extensively distributed in Arizona, southern California, Colorado, eastern Montana, Nevada, New Mexico, eastern Utah, and Wyoming.	Young soils with little or no development of diagnostic soil horizons. Found in young alluvium, sands, and soils on steep slopes and in basins of arid and semiarid environments.
Alfisols	Primarily in the mountains of western Montana, Colorado, and California in semiarid to moist areas.	A layer of clay minerals and other constituents leached from a surface layer into the subsoil. Formed under forest or savanna vegetation.
Inceptisols	In Arizona, northern California, Colorado, northern Idaho, Montana, New Mexico, and western Washington and Oregon.	Soils occurred in a wide variety of climates and generally exhibit only moderate degrees of soil weathering and development.
Andisols	Distribution limited to areas in northern California and Idaho, Oregon, and Washington.	Formed mostly in volcanic glass in cool areas with moderate to high precipitation. Soils dominated by minerals that have very little orderly crystalline structure.
Vertisols	Scattered in Arizona, California, Montana, New Mexico, and southeastern Oregon.	Soils have high content of expanding clay minerals and slickenslide texture. Develop deep, wide cracks when dry.
Spodosols	Distributed in western Oregon and Washington.	With a characteristic soil B-horizon consisting of an accumulation of black or reddish amorphous material of organic matter combined with aluminum and iron.
Ultisols	Scattered in northern California and western Oregon and Washington.	Show intensive leaching of clay minerals and other constituents, resulting in a clay-enriched subsoil dominated by quartz, kaolinite, and iron oxides.

Sources: BLM (2005a); NRCS (1999).

hazardous areas. These locations are closely related to the physiographic provinces described in Section 3.3.1.1.

Volcanoes. Major volcanoes or volcanic fields are distributed primarily in the Western Cascade, High Cascade, and Sierra Nevada Mountains physiographic regions (Figure 3.3-1 shows volcanoes in the western states), following the volcanic belt formed between the geologic North American plate and the Pacific plate. Other volcanoes occur sporadically in the southern Columbia Plateau, southern Colorado Plateau, and the Basin and Range provinces within the North American plate. The volcanoes and volcanic fields in the western states that are younger than 10,000 years old are listed in Table 3.3-3.

Earthquake-Prone Areas. Earthquake-prone areas are subject to various earthquake hazards, such as ground shaking, liquefaction, landslides, soil compaction, and surface fault rupture. The ground-shaking risk of the western states is shown in Figure 3.3-2 (ground acceleration of the 11 western states). The peak horizontal ground acceleration ranges from 0 g (insignificant ground-shaking risk) to 1 g (strong ground-shaking risk). The highest ground-shaking risk (0.4 to 1 g) occurs in the Coastal Range physiographic province (Figure 3.3-1) in western and southern California. Moderate ground-shaking risk (0.2 to 0.4 g) occurs in the Coastal Range province (in the western coasts of Washington, Oregon, and California), the Cascade and Sierra Mountains (in southern Oregon and eastern and southern California), and the Rocky Mountains near eastern Idaho and Salt Lake City. The majority of the eastern part of the 11 western states has low ground-shaking risk (less than 0.1 g).

Soils can become liquefied due to intensive ground shaking and lose their support capacity. Liquefaction occurs mostly in saturated loose sediments. A ground-shaking map (Figure 3.3-2) combined with a USGS surficial geology map revealed the major areas with liquefaction potential depicted in Figure 3.3-3. Areas with high liquefaction potential are located near the Bay Area of San Francisco, where ground-shaking risk is high and bay sediments are present. Areas with moderate liquefaction potential are found on the west coasts of California, Oregon, and Washington and along several major river valleys (e.g., the Sacramento River and San Joaquin River valleys in California and the Columbia River valley in Oregon). Areas with low liquefaction potential disperse in various states, such as in the valleys of the Columbia River and Willamette River in Oregon, the Central Valley and Klamath River Valley in California, the Salt Lake Valley in Utah, the Rio Grande Valley in New Mexico, and some major river valleys in the Rocky Mountain region.

Earthquakes can cause movements across faults. Major surface fault lines younger than the late Pleistocene age (i.e., up to 130,000 years before the present) are shown in Figure 3.3-4. Most of the fault lines are located in the Coastal Range province in California and the Basin and Range province in Nevada and Utah. The faults in California are in areas close to the boundary of the Northern American plate and the Pacific plate. The faults in the Basin and Range province reflect the tension in the Earth’s crust there.

Landslide-Prone Areas. Landslide-prone areas are generally closely related to high, steep, rugged terrain and high precipitation. In the 11 western states, high landslide incidence and/or susceptibility are mostly found in the west coast of California, central Montana, western Wyoming, western Colorado, and New Mexico (Figure 3.3-5), coinciding with the Coastal Ranges and Rocky Mountains physiographic provinces (Figure 3.3-1). Moderate landslide susceptibility and incidence occur adjacent to the high landslide susceptibility and incidence areas. It is important

TABLE 3.3-3 Volcanoes and Volcanic Fields Younger than 10,000 Years Old in the Western States

State	Name
Arizona	Sunset Crater
	Uinkaret Field
California	Amboy
	Big Cave
	Brushy Butte
	Clear Lake
	Coso Volcanic Field
	Eagle Lake Field
	Golden Trout Creek
	Lassen Volcanic Center
	Lavic Lake
	Long Valley
	Medicine Lake
	Mono Craters
	Mono Lake Volcanic Fields
	Red Cones
	Shasta
	Twin Buttes
	Trumble Buttes
	Ubehebe Craters
Colorado	Dotsero
Idaho	Craters of the Moon
	Hell’s Half Acre
	Shoshone Lava Field
	Wapi Lava Field
Nevada	Steamboat Springs
New Mexico	Carrizozo
	Valles Caldera
	Zuni-Bandera
Oregon	Belknap
	Blue Lake Crater
	Cinnamon Butte
	Crater Lake
	Devils Garden
	Davis Lake
	Diamond Craters (Peak)
	Four Craters Lava Field
	Jackies Butte
	Jordan Craters
	Mount Bachelor
	Mount Hood
	Mount Jefferson
	Mount Washington
	Newberry Caldera
	North Sister Field
	Saddle Butte
	Sand Mountain Field
	South Sister
	Squaw Ridge Lava Field
Utah	Bald Knoll
	Black Rock Desert
	Markagunt Plateau
	Santa Clara
Washington	Glacier Peak
	Indian Heaven
	Mount Adams
	Mount Baker
	Mount Rainier
	Mount St. Helens
	West Crater
Wyoming	Yellowstone

Source: National Atlas (2006).

to note that many alluvial fans proximal to mountain ranges also have high landslide susceptibility, which the map in Figure 3.3-5 does not show because of its small scale. These fan deposits are common in the Basin and Range province (Figure 3.3-1).

3.3.2 How Were the Potential Effects of Corridor Designation and Land Use Plan Amendment to the Geologic Resources and Hazardous Geologic Features Evaluated?

Neither corridor designation nor land use plan amendment would involve any ground-disturbing activities and removal and uses of sand and gravel. Impacts to geologic resources would occur only with the development of specific energy transport projects. Similarly, geologic hazards could affect project construction and operation only with the development of specific projects. Therefore, evaluating potential effects of corridor designation and land use plan amendment involves the identification of the geologic resources and geologic hazards within or in the vicinity of the project ROWs, whether within Section 368 energy corridors or elsewhere (as under the No Action Alternative).

3.3.2.1 Identifying Geologic Resources

Sand and gravel deposits and rocks suitable for use in the 11 western states are plentiful. Information on their distribution is limited. Therefore, the identification of these resources should be made at the project level. Generally, fluvial and outwash deposits are good sources for sand and gravel deposits. Bedrock exposures are good locations for sources of crush rock.

Soils when disturbed become more erodible, regardless their location. However, their erodibility potential varies widely and depends on local climate, topography, surface cover, and engineering practices (USDA 1996). The identification of soil erosion potential can only be evaluated at the project level.

3.3.2.2 Identifying Geologic Hazards

Geologic hazards depend on the geological setting. Regional geologic hazard maps are available in GIS format for the 11 western states. To identify geologic hazards that could be present in the vicinity of the proposed Section 368 energy corridors, the proposed corridor locations were overlain with the geologic hazard maps to identify various geologic hazards that may be associated with the proposed corridor locations.

Volcanic Hazards. All volcanoes and volcanic fields with eruption records during Holocene geologic time (<10,000 years old) in the 11 western states (Figure 3.3-1) were identified (National Atlas 2006). Among these volcanoes, only those within a certain distance of the energy corridors are likely to have health and safety concerns for potential projects, should they be developed. The distance used in this PEIS is 20 miles. The 20 miles is a distance within which the areas would most likely be affected by various volcanic hazards, including debris flows and tephra falls (Wolfe and Pierson 1995; Miller 1989), although it is important to note that past debris flows, such as those measured at Mount St. Helens have traveled as far as 60 miles (Wolfe and Pierson 1995).

Seismic Hazards. Ground shaking and ground displacement are two major seismic hazards. The hazard of ground shaking is caused by the transient strain in the ground during the traveling of a seismic wave. The damage from ground shaking may occur over a large area, but with relatively low damage rates. Ground displacement is caused by permanent ground deformation induced by earthquakes, such as dislocation across fault lines, liquefaction, and landslides. Ground displacement damage typically occurs in isolated areas of ground failure and has a high damage rate. As landslides can be triggered by other causes besides earthquakes, they are described separately in next subsection.

Ground-shaking potential was calculated using the locations of faults from historical earthquake records, the soil conditions near earthquake sources, and the assumption that seismic waves attenuate with distance, resulting in seismic hazard maps that depict the risk of estimated ground-shaking magnitude (or ground acceleration). This PEIS uses the peak horizontal ground accelerations with a 10% probability of being exceeded in 50 years (National Atlas 2006). In evaluating the ground shaking, the Section 368 energy corridors were superimposed onto the seismic hazard maps, and the areas of various ground-shaking magnitudes crossed by the corridors were calculated using GIS tools. It should be noted that seismic hazards can exist on both federal and nonfederal lands, if an energy transport project crosses seismic hazard zones.

To identify potential liquefaction areas crossed by the corridors, areas were identified having saturated, loose sediments and anticipated earthquake peak ground accelerations of 0.1 g or greater with a 10% probability of exceedance in 50 years (SCEC 1999). Saturated, loose sediments are expected to be near low-lying, perennial surface water bodies, such as river, lake, and coastal areas. Data on alluvial and bay sediments were obtained from the surficial geologic maps prepared by the USGS (National Atlas 2006), and this dataset was superimposed on the seismic hazard maps to identify areas of high, intermediate, and low liquefaction potential. High liquefaction potential was assigned to areas with alluvial and bay sediments and with a ground-shaking risk of between >0.40 and 1 g, while the intermediate potential was assigned where the ground-shaking risk is between >0.2 and 0.4 g. Areas characterized by low ground-shaking risk (>0.1 to 0.2 g) were assigned to low liquefaction potential. Other areas with a ground-shaking risk of less than 0.1 g were considered to have insignificant liquefaction potential.

To evaluate the potential for seismic hazards caused by ground displacement, this PEIS relied on the Quaternary faults data collected by the USGS (National Atlas 2006). These Quaternary faults are believed to be the sources of significant earthquakes with magnitudes of 6.0 or greater during the past 1.6 million years. The data are appropriate for display on maps at a scale of 1:250,000 or less. In evaluating the surface fault rupture hazards for this PEIS, a subset of faults that are less than 130,000 years old (Holocene and Late Quaternary) was used. These younger faults are more likely to be reactivated than older ones if earthquakes occur (Christenson et al. 2003). Using GIS tools, maps were created to identify those faults lying within the energy corridors.

Landslide Hazards. A landslide overview map compiled by the USGS National Landslide Hazards Program (National Atlas 2006) was used to identify potential landslide areas associated with the proposed Section 368 energy corridors designated under the Proposed Action. It should be noted that energy transport projects that lie outside the corridors, whether on federal or nonfederal lands, could be exposed to landslide hazards if they are located in landslide-prone areas.

The USGS map shows areas of landslides and areas that are susceptible to potential landsliding (Radbruch-Hall et al. 1982). Landslides considered in the map include the falling, sliding, or flowing of rock and/or soil, but exclude debris flows that occurred in alluvial fans in arid regions. Areas identified in the map with high and medium landslide incidence (i.e., more than 15% of a map area involved in landsliding and 1.5 to 15% involved in landsliding, respectively) and susceptibility to landsliding were used in the evaluation. The susceptibility to landsliding is defined by the probable degree (in terms of percentage) of landsliding when an area is subjected to natural or artificial cutting or loading of slopes or anomalously high precipitation. The landslide overview map showed that the Coast Ranges of California, the Southern Rocky Mountains, and the Colorado Plateau in the western states contain the most slide-prone terrains in the United States (Radbruch-Hall et al. 1982). It is important to note that the scale of the landslide delineation on the map is 1:2,500,000, and generalization has been made. Assigning areas any designation other than high and medium landslide incidence or susceptibility to landsliding does not imply that the areas have no existing landslides or no susceptibility to landsliding (Radbruch-Hall et al. 1982), because of the small scale of the USGS map. In addition, the map does not show alluvial fans proximal to mountains, which are potential landslide areas.

To identify landslide areas along the corridors, the areas with high and medium landslide incidence/susceptibility were superimposed onto the areas crossed by the corridors using GIS tools. The total areas of various categories of landslide risk could then be calculated. GIS maps presented the locations of the various landslide risks along the corridors.

Additional discussion of various geologic hazards is provided in Section 3.14.

3.3.3 What Geologic Resources Would Be Associated with the Alternatives, and How Do They Compare?

3.3.3.1 No Action Alternative

Under the No Action Alternative, no Section 368 energy corridors would be designated on federal land and there would be no impact from the decision. Under this alternative, future energy transport projects would be sited in a manner similar to that currently used. Project applicants would identify potential project ROWs for crossing federal and nonfederal lands. Geologic resources associated with the selected and authorized ROWs would be most likely to be affected by project development and operation. In the absence of known ROW locations, it is not possible to identify those geologic resources.

3.3.3.2 The Proposed Action

The designation of energy corridors and land use plan amendment under the Proposed Action are not expected to affect geologic resources. These resources would be affected with the development of specific energy transport projects following corridor designation. Under the Proposed Action, about 3 million acres of designated corridor footprint would lie on federal land. The total miles and acreage that would be occupied by project-specific ROWs with the corridors and their associated access roads, staging areas, construction sites, and infrastructure are not known. Because soil, gravel, and crushed stone resources have not been mapped completely for the 11 western states, affected environments and future project-specific impacts will need to be addressed at the project level. Soil erosion potential is location-specific and varies dramatically over short distances. Evaluation of the potential is not appropriate at the programmatic level in this PEIS. It should be addressed at the project level.

Geologic hazards are related to safety issues. Their evaluations are presented in Section 3.14.

3.3.4 What Types of Impacts Could Result under Each Alternative to Geological Resources and Hazardous Geologic Features with Project Development, and How Could Potential Impacts Be Minimized, Avoided, or Compensated?

3.3.4.1 What Are the Usual Impacts to Geologic Resources of Building and Operating Energy Transport Projects?

Any type of construction or industrial activity requires the use of sand and gravel and/or crushed rock, including building the infrastructure of energy transport projects. The materials are used in access roads, ROWs, staging areas, stream banks, and other construction sites and are for concrete, gravel pads, road beds, stream bank protection, and building materials. These materials are normally mined in areas close to the corridors to reduce construction cost.

Under either alternative, geologic resources could be affected by the construction, operation, maintenance, and decommissioning of energy infrastructures within the energy corridor ROWs. Impacts originate in the extraction and placement of the geologic material and ground disturbance. Sand and gravel are commonly mined from alluvium in river or stream valleys. When the quality of sand and gravel does not meet requirements, suitable stone is mined from quarries and crushed to proper size for use. Mining operations would disturb the ground surface, and runoff would erode fine-grained soils, increasing the sediment load farther down in streams and/or rivers. Mining on steep slopes and/or on unstable terrain without appropriate engineering measures increases the landslide potential in the mining areas.

Sand, gravel, and crushed stone would be obtained from borrow pits and quarries located up to tens of miles from access roads and construction sites. Large volumes of sand, gravel, and crushed stone would be needed to meet the construction needs of energy transport projects. These materials would also be needed for river bank protection during the construction and maintenance phase of a project. In the decommissioning phase, the used geologic material may be recycled or disposed of near the infrastructures. Since construction material is plentiful in the 11 western states, the volumes of sand, gravel, and crushed rock needed would be easily met. Locally, the location, quality, and potential competing uses for these materials should be analyzed at the project level.

Applying sand and gravel on land alters the drainage near where the material is used. The size of the area affected can range from a few hundred square feet (for a transport tower foundation) to a few hundred acres (for an access road). The impact on the natural surface drainage, therefore, depends on the size of the areas affected, local terrain rain patterns and amounts, and mitigation measures. This operation would impact the water quality of the surface water body downstream from the affected area.

Ground disturbance is unavoidable during land development and construction. The disturbance comes from clearing, grading, trenching, drilling, or blasting to construct transport towers, underground pipelines, and associated facilities, and from heavy equipment traffic near staging areas, access roads, and ROWs. The disturbance is intense during the construction phase and is expected to be temporary and local, assuming that best management practices and mitigation measures (see Section 3.3.4.2) are applied. Much less impact is expected during the operation phase.

The ground disturbance can increase soil erosion and affect the water quality of the surface water downstream from the disturbed areas, affecting both sediment load and dissolved salt content in the waters. The former is important in sloped areas, while the latter becomes an important issue in arid or semiarid environments and in areas where bedrock has a high content of soluble salts. The surface soils in arid environments generally are rich in soluble salts, and intermittent and ephemeral streams dominate there. This is exemplified by the Colorado Basin across the states of Wyoming, Colorado, Utah, Arizona, and California. The salt loading in streams and rivers within the basin is a major management issue for the Colorado River (DOI 2005a).

Soil erosion would occur along individual project sites. The erosion would be visible during the construction and decommissioning phases of a project when clearing, excavation, and fill operations are most intense. The erosion occurs in most of the related areas (e.g., borrow pits, ROWs, access roads, river crossings, staging areas, and construction sites) of the project until vegetation is reestablished. Depending on the development schedules of the energy transport projects, some parts of the project-specific ROWs within the designated corridors as well as the corridors on nonfederal lands that have not been designated may be redisturbed to install different infrastructure. Soil erosion would therefore be reactivated on the disturbed sites, creating another cycle of soil erosion and stabilization. The impacts would be localized and limited in extent and magnitude, if appropriate mitigation measures are implemented.

In the operation and maintenance phase of a project, the soil erosion near the access roads (especially in sloped areas) would continue, as drainage water is channeled to nearby surface water bodies. Buried pipes and/or control valves may need to be excavated and exposed for repair. Heavy equipment traffic also would damage the protective vegetation covers. The magnitude of the soil erosion impacts would be substantially lower than what would occur during the construction and decommissioning phases. Pesticide and herbicide use is expected for ROW maintenance, creating the potential for soil contamination. The use of pesticides and herbicides and unintentional spills would potentially cause soil contamination.

The impacts on soil erosion and potential soil contamination would be localized and limited in extent and magnitude, if appropriate mitigation measures are implemented. The impacts would occur near project sites.

The usual impacts to hazardous geologic features of building and operating energy transport projects are described in Section 3.14.

3.3.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Geological Resources?

The potential for impacts to geologic resources would occur primarily during construction and decommissioning. Impacts due to maintenance vehicle traffic also can be lower during the operation and maintenance phase of the projects. To reduce the impacts, mitigation measures for both planning and field operations should be used at the project implementation level. These measures may be incorporated into the management plans of responsible agencies.

DOI and USDA (2006) contains standards and guidelines for oil and gas exploration and development (commonly referred to as the Gold Book). The Gold Book offers comprehensive guidance on the design, construction, maintenance, and reclamation of sites and access roads. Additional guidance (e.g., FS 2000) on the more complex issues of oil and gas exploration, as well as newer state-of-the-art methods, will apply to future projects. Combined, the guidances would apply to this PEIS to reduce environmental impacts in the 11-state area.

Mitigation measures would be applied in the field to mitigate the impacts on soil; specific measures would be selected after considering factors that cause soil erosion, such as rainfall characteristics, runoff, soil erodibility, slope length, slope steepness, and vegetation cover

(USDA 1996; FS 2000). Potential mitigation measures to reduce impacts for No Action and the Proposed Action are listed below:

- Soil experts should identify soils with high potential of erosion and/or soluble salt content such that precautionary measures can be planned and implemented.

- Do not excavate earthen material from, or store excavated earthen material in, any stream, swale, lake, or wetland.

- Maintain long-term ground cover and soil structure:

  - Topsoil removed during construction should be salvaged and reapplied during reclamation, and plant debris should be left on-site to serve as mulch. Disturbed soils should be reclaimed as quickly as possible, or protective covers should be applied.

  - When feasible, keep roads and trails out of wetlands. If roads or trails must enter wetlands, use bridges or raised prisms with diffuse drainage to sustain flow patterns. Set crossing bottoms at natural levels of channel beds and wet meadow surfaces. Avoid actions that may dewater or reduce water budgets in wetlands.

  - Design all ditches, canals, and pipes with at least an 80% chance of passing high flows and remaining stable during their life.

  - Foundations and trenches should be backfilled with originally excavated materials as much as possible, and excavation material should be disposed of only in approved areas, to control soil erosion and to minimize leaching of hazardous constituents. If suitable, excess excavation materials may be stockpiled for use in reclamation activities.

- Limit roads and other disturbed sites to the minimum feasible number, width, and total length consistent with the purpose of specific operations, local topography, and climate:

  - Use existing roads and borrow pits as much as possible. Borrow material should be obtained only from authorized and permitted sites.

  - Construct roads on ridge tops, stable upper slopes, or wide valley terraces, if feasible. Stabilize soils on-site. End-haul soil if full-bench construction is used. Avoid slopes steeper than 70%.

  - Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restrictions to protect soil and water.

  - Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain. Revegetate using certified local native plants, as feasible; avoid persistent or invasive exotic plants.

  - Where feasible, construct roads with rolling grades instead of ditches and culverts.

  - Retain stabilizing vegetation on unstable soils. Avoid new roads or heavy equipment use on unstable or highly erodible soils.

- Use existing roads unless other options will produce less long-term sediment. Reconstruct for long-term soil and drainage stability.

- Avoid ground skidding with blades lowered or on highly erodible slopes steeper than 40%. Conduct logging to disperse runoff, as feasible.

- Special construction techniques should be used, where applicable, in areas of steep slopes, erodible soil, and stream channel/wash crossings.

• Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes, and wetlands:

- Design all roads, trails, and other soil disturbances to the minimum standard for their use and to “roll” with the terrain, as feasible. Slope hill cuts should be minimized.

- Erosion controls should be applied that comply with county, state, and federal standards, and practices should be implemented such as erecting jute netting, silt fences, and check dams near disturbed areas.

- Use filter strips and sediment traps, if needed, to keep all sand-sized sediment on the land and disconnect disturbed soil from streams, lakes, and wetlands. Disperse runoff into filter strips.

- Key sediment traps into the ground. Clean them out when 80% full. Remove sediment to a stable gentle upland site and revegetate.

- Keep heavy equipment out of filter strips except to do restoration work or build hardened stream or lake approaches. Yard logs out of each filter strip with minimum disturbance of ground cover.

- Design road ditches and cross drains to limit flow to ditch capacity and prevent ditch erosion and failure.

• Stabilize and maintain roads and other disturbed sites during and after construction to control erosion:

- Do not encroach fills or introduce soil into streams, swales, lakes, or wetlands.

- Properly compact fills and keep woody debris out of them. Revegetate cuts and fills upon final shaping to restore ground cover using certified local native plants, as feasible; avoid persistent or invasive exotic plants. Provide sediment control until erosion control is permanent.

- Do not disturb ditches during maintenance unless needed to restore drainage capacity or repair damage. Do not undercut the cut slope.

- Space cross drains from no more than 120 feet in highly erodible soils on steep grades to no more than 1,000 feet in resistant soils on flat grades. Do not divert water from one stream to another.

- Empty cross drains onto stable slopes that disperse runoff into filter strips. On soils that may gully, armor outlets to disperse runoff. Tighten cross-drain spacing so gullies are not created.

- Harden rolling dips as needed to prevent rutting damage. Ensure that road maintenance provides stable surfaces and drainage.

   - Where berms must be used, construct and maintain them to protect the road surface, drainage features, and slope integrity while also providing user safety.

- Reclaim roads and other disturbed sites when use ends, as needed to prevent resource damage:

   - Site-prepare, drain, revegetate, and close temporary and intermittent use roads and other disturbed sites within one year after use ends. Provide natural drainage that disperses runoff into filter strips and maintains stable fills. Do this work concurrently. Use native vegetation as feasible.

   - Remove all temporary stream crossings (including all fill material in the active channel), restore the channel geometry, and revegetate the channel banks using native revegetation, as feasible.

- Maintain or improve long-term levels of organic matter and nutrients on all lands:

   - On soils with topsoil thinner than 1 inch, topsoil organic matter less than 2%, or effective rooting depth less than 15 inches, retain 90% or more of the fine (less than 3 inches in diameter) logging slash in the stand after each clearcut and seed-tree harvest, and retain 50% or more of such slash in the stand after each shelterwood and group-selection harvest, considering existing and projected levels of fine slash.

   - If machine piling of slash is done, conduct piling to leave topsoil in place to avoid displacing soil into piles or windrows.

- Place new sources of chemical and pathogenic pollutants where such pollutants will not reach surface or ground water:

   - Put pack and riding stock sites, sanitary sites, and well drill pads outside the water influence zone (WIZ).

   - Put vehicle service and fuel areas, chemical storage and use areas, and waste dumps on gentle upland sites. Do mixing, loading, and cleaning on gentle upland sites. Dispose of chemicals and containers in state-certified disposal areas.

- Apply runoff controls to disconnect new pollutant sources from surface and ground water. Install contour berms and trenches around vehicle service and refueling areas, chemical storage and use areas, and waste dumps to fully contain spills. Use liners as needed to prevent seepage into ground water.

- Apply chemicals using methods that minimize risk of entry to surface and ground water:

   - The BLM's standard operating procedures (SOPs) (BLM 2005a) should be followed when using pesticides and herbicides to minimize unintended impacts to soil. Common practices include, but are not limited to: (1) minimizing the use of pesticides and herbicides in areas with sandy soils near sensitive areas, (2) minimizing the use of pesticides and herbicides in areas with high soil mobility, and (3) evaluating soil characteristics prior to application, to assess the likelihood for pesticide and herbicide transport in soil.

- Favor pesticides with half-lives of 3 months or less. Apply at lowest effective rates as large droplets or pellets. Follow label directions. Favor selective treatment. Use only aquatic-labeled chemicals in the WIZ.

- Use nontoxic, nonhazardous drilling fluids, when feasible.

The mitigation measures to reduce potential project impacts related to geologic hazardous are described in Section 3.14.

3.4 PALEONTOLOGICAL RESOURCES

3.4.1 What Are the Paleontological Resources in the 11 Western States?

Paleontological resources are the fossilized remains of ancient life forms, their imprints, or behavioral traces (e.g., tracks, burrows, residues), and the rocks in which they are preserved. These are distinct from human remains and artifacts, which are considered archaeological or historical materials. Fossil energy resources, such as coal or oil, are also generally excluded from the definition of paleontological resources.

Fossils have scientific and educational value because they are important in understanding the history of life on Earth and the biodiversity of the past, and in developing new ideas about ecology and evolution. On public lands, vertebrate and uncommon invertebrate and plant paleontological resources may only be collected for scientific and educational purposes under a permit. Common invertebrate and plant fossils may be collected for recreational use, but cannot be bartered or sold. Petrified wood is a mineral material that may be collected recreationally in limited amounts, or collected commercially under a mineral material contract.

Various statutes, regulations, and policies govern the management of paleontological resources on public lands. Primary statutes for management and protection include the FLPMA (Public Law [P.L.] 94–579, codified at 43 USC 1701–1782) for the BLM; the Organic Act of 1897 (16 USC 551) for the FS; and 18 USC 641, which penalizes the theft or degradation of property of the U.S. government. Other federal acts, the Federal Cave Resources Protection Act (P.L. 100–691, 102 Stat. 4546; codified at 16 USC 4301) and the Archaeological Resources Protection Act (16 USC 470(aa) et seq.), protect fossils found in significant caves and/or in association with archeological resources. Recently, legislators have proposed a bill to establish a national policy for preserving and managing paleontological resources on federal lands (Library of Congress 2006). A complete listing of the statutes and regulations that federal agencies use to manage fossils on the lands they administer can be found in Appendix D.

Significant paleontological resources on public lands in the western United States are predominantly associated with geologic units (formations) from the Mesozoic and Cenozoic Eras (Table 3.4-1). Fossiliferous formations of the Mesozoic Era, particularly of the Jurassic and Cretaceous Periods (65 to 206 million years ago), are found in the Rocky Mountains and along canyons of the Colorado Plateau. The geologic units are of marine and nonmarine origin, representing alternating episodes of marine transgression and regression. They yield important vertebrate fossils, including fish, frogs, salamanders, turtles, crocodiles, pterosaurs, mammals, birds, and dinosaurs, and generally have a high Potential Fossil Yield Classification (PFYC) ranking which, on a scale of Class 1 to Class 5, indicates a higher fossil yield potential and greater sensitivity to adverse impacts (see Table 3.4-2, Section 3.4.2). Invertebrate fossils (e.g., ammonites) are also abundant.

TABLE 3.4-1 Geologic Time Scale

Era	Period (Ma)[a]	Epoch (Ma)[a]	Distinctive Fossils[b]	Examples of Geologic Units in the Study Area (PFYC Class)
Cenozoic	Quaternary (0–1.8)	Holocene (0–0.01)		Alluvium and colluvium (3) Dune sand (3) Eolian deposits (loess) (3) Lacustrine and playa deposits (3) Mud and salt flats (3) Terrace and flood gravels (3)
		Pleistocene (0.01–1.8)	Mammoths Bison and cows Horses Deer Squirrels and rabbits Invertebrates	Alluvium and colluvium (3) Dune sand (3) Eolian deposits (loess) (3) Glaciofluvial deposits (3) Lacustrine and playa deposits (3) Mud and salt flats (3) Terrace and flood gravels (3)
	Tertiary (1.8–65.0)	Pliocene (1.8–5.3)	Mammals Birds (eggs) Warm climate plankton (marine) Invertebrates	Ogallala Formation (5) Idaho Group (3)
		Miocene (5.3–23.8)	Mammals (rodents) Birds (eggs) Invertebrates	Browns Park Formation (5) Dry Union Formation (5) Muddy Creek Formation (3) Ogallala Formation (5) Wagontongue Formation (5)
		Oligocene (23.8–33.7)	Mammals (early horses, primates, marsupials, carnivores) Crocodilians, alligators Lizards and turtles Amphibians and fish Invertebrates Birds (eggs) Plants and pollen	Bishop Conglomerate (3) Duchesne River Formation (5)

TABLE 3.4-1 (Cont.)

Era	Period (Ma)[a]	Epoch (Ma)[a]	Distinctive Fossils[b]	Examples of Geologic Units in the Study Area (PFYC Class)
Cenozoic (Cont.)		Eocene (33.7–54.8)	Mammals (early horses, primates, marsupials, carnivores, grazers) Crocodilians, alligators Lizards and turtles Amphibians and fish Invertebrates Birds (eggs) Plants and pollen	Bridger Formation (5) Duchesne River Formation (5) Green River Formation (5) Uinta Formation (5) Wasatch Formation (5) Wind River Formation (5)
		Paleocene (54.8–65.0)	Small mammals Reptiles Amphibians and fish Birds (eggs) Insects Plants and pollen	Beaverhead Conglomerate (3) Currant Creek Formation (5) Fort Union Formation (3) Nacimiento Formation (5) Ojo Alamo Formation (5)
Mesozoic	Cretaceous (65.0–144)		Terrestrial flora and fauna: – dinosaurs – birds – early mammals – diverse insects – flowering plants – freshwater fish and invertebrates Marine flora and fauna: – plankton and diatoms – cephalopods (ammonites, belemnites) – marine reptiles – fish – sharks and rays	Burro Canyon Formation (5) Castlegate Formation (2) Cliff House Sandstone (5) Lewis Shale (5) Mowry Shale (3) Niobrara Formation (5) Various volcanic units (1)

TABLE 3.4-1 (Cont.)

Era	Period (Ma)[a]	Epoch (Ma)[a]	Distinctive Fossils[b]	Examples of Geologic Units in the Study Area (PFYC Class)
Mesozoic (Cont.)	Jurassic (144–206)		Terrestrial flora and fauna: – dinosaurs – early mammals – seed plants – ferns Marine flora and fauna: – plankton – cephalopods (ammonites) – marine reptiles – fish – sharks and rays	Kayenta Formation (5) Moenave Formation (5) Morrison Formation (5) Navajo Sandstone (5) Summerville Formation (5)
	Triassic (206–248)		Terrestrial flora and fauna: – dinosaurs – early mammals – seed plants – conifers	Chinle Formation (5) Chugwater Formation (3) Moenkopi Formation (3) Thaynes Limestone (2) Wingate Formation (5)
Paleozoic	Permian (248–290)		Terrestrial flora and fauna dominate: – anapsids (turtles) – diapsids – archosaurs – gymnosperms (conifers)	Coconino Sandstone (3) Kaibab Formation (2) San Andres Formation (5) Satanka Shale (2) Toroweap Formation (3)
	Carboniferous	Pennsylvanian (290–323)	Terrestrial flora and fauna dominate: – freshwater clams – seedless plants – ferns – winged insects (dragonflies) – amniote species (lizards) – diapsids (reptiles, snakes) – archosaurs (crocodiles, dinosaurs, birds)	Beldon Formation (2) Hermit Shale (2) Minturn Formation (2) Morgan Formation (2) Oquirrh Formation (2)
	Carboniferous	Mississippian (323–354)	Marine invertebrates (e.g., bryozoans and braciopods) dominate: – foraminifera – modern fish fauna	Brazer Formation (2) Deseret Limestone (2) Humbug Formation (2) Madison Formation (3) Redwall Limestone (2)

TABLE 3.4-1 (Cont.)

Era	Period (Ma)[a]	Epoch (Ma)[a]	Distinctive Fossils[b]	Examples of Geologic Units in the Study Area (PFYC Class)
Paleozoic (Cont.)	Devonian (354–417)		Terrestrial plants (ferns, seed plants, trees) Terrestrial insects and spiders Diverse freshwater fish Marine vertebrates and invertebrates (see below)	Jefferson Limestone (2) Madison Formation (3) Temple Butte Formation (2)
	Silurian (417–443)		Coral reefs Marine invertebrates (see below) Marine fish Freshwater fish Terrestrial plants	
	Ordovician (443–490)		Marine invertebrates: – red and green algae – bryozoans – crinoids, blastoids – corals – graptolites – trilobites – brachiopods, snails, clams – cephalopods – archaeocyathids (sponges) Marine vertebrates: – ostraderms (jawless, armored fish) Conodonts (early vertebrates) Terrestrial plants	Bighorn Dolomite (2) Fishhaven Dolomite (2) Garden City Limestone (2)
	Cambrian (490–543)		Marine invertebrates: – red and green algae – trilobites – brachiopods – echinoderms – archaeocyathids (sponges)	Bright Angel Shale (2) Park Shale (2) Meagher Limestone (2) Pilgrim Limestone (2) Tapeats Sandstone (2) Wolsey Shale (2)
Precambrian	Proterozoic (543–2,500)		Soft bodied fauna Carbon film Microbial mats (stromatolites)	Various igneous and metamorphic units (1)

TABLE 3.4-1 (Cont.)

Era	Period (Ma)[a]	Epoch (Ma)[a]	Distinctive Fossils[b]	Examples of Geologic Units in the Study Area (PFYC Class)
Precambrian (Cont.)	Archean (2,500–3,800?)		None	Various igneous and metamorphic units (1)

[a] Ma = millions of years before the present.

[b] Distinctive fossils are those characteristic of the geologic period listed and may or may not be present in the geologic units (formations) in the study area.

Sources: Adapted from Palmer and Geissman (1999) and the University of California Museum of Paleontology (2007).

Fossiliferous formations of the Cenozoic era, particularly from the Tertiary Period (1.8 to 65 million years ago), are found in the many sedimentary basins across the West (e.g., in the Big Horn, Green River, and Uinta Basins). These formations contain important vertebrate fossils, including mammals, birds, reptiles, amphibians, and fish. Plants and invertebrates may also be important at some localities.

3.4.2 How Were the Potential Effects of Corridor Designation to Paleontological Resources Evaluated?

The analysis presented in this section evaluates the paleontological resources potentially affected by the corridor development under the alternatives described in Chapter 2. Because the occurrences of paleontological resources closely correlate with the geologic units that contain them, the potential for finding important paleontological resources can be broadly predicted by the presence of particular geologic units at or near the surface. Therefore, for this analysis, geologic mapping is used as a proxy for assessing the likeliness of occurrence of important paleontological resources in a given location, assuming that the potential for impacts to paleontological resources would be proportional to the number and extent of geologic units with high fossil-yielding potential that are intersected by the proposed corridor or corridor segments. However, actual impacts would need to be assessed on the basis of on-the-ground surveys in the proposed areas of disturbance.

The BLM and FS use the PFYC system, which was developed in 1996 by the FS's Paleontology Center of Excellence and the Region 2 Paleo Initiative to promote consistency throughout and among agencies (FS 1996). The PFYC system provides baseline guidance for assessing the relative occurrence of important paleontological resources and the need for mitigation. Specifically, it is used to classify geologic units at the formation or member level according to the probability of yielding paleontological resources of concern to land managers.

Under the PFYC system, geologic units are classified from Class 1 to Class 5 based on the relative abundance of vertebrate fossils or uncommon invertebrate or plant fossils and their sensitivity to adverse impacts. A higher classification number indicates a higher fossil yield potential and greater sensitivity to adverse impacts. Table 3.4-2 provides a description of the five PFYC classes and the corollary management direction indicated for each class.

TABLE 3.4-2 Potential Fossil Yield Classification Descriptions

Class	Description	Basis	Management Direction
1	Geologic units that are not likely to contain recognizable fossil remains, including igneous and metamorphic units (excluding tuffs) and units that are Precambrian in age or older (i.e., older than 540 million years before present).	The potential for impacting any fossils is negligible. The occurrence of significant fossils is nonexistent or extremely rare. No assessment or mitigation of paleontological resources is needed.	Land manager’s concern for paleontological resources is negligible or not applicable. No assessment or mitigation needed except in very rare cases.
2	Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate fossils. These include geologic units in which vertebrate fossils or uncommon invertebrate or plant fossils are unknown or very rare, units that are younger than the Pleistocene Epoch (10,000 years before present), aeolian deposits, and units exhibiting significant diagenetic alteration.	The potential for impacting vertebrate fossils or uncommon invertebrate or plant fossils is low. Localities containing important resources may exist, but would be rare and would not influence the classification. Management actions are not likely to be needed.	Land manager’s concern for paleontological resources is low. No assessment or mitigation needed except in rare cases.
3	Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential. These include units in which vertebrate fossils and uncommon invertebrate or plant fossils are known to occur inconsistently (i.e., predictability is low), units of marine origin with sporadic known occurrences of vertebrate fossils, and poorly studied or poorly documented units (i.e., potential yield cannot be assessed without ground reconnaissance).	This classification encompasses a broad range of potential impacts, including geologic units of unknown potential and units of moderate or infrequent fossil occurrence.	Land manager’s concern for paleontological resources is moderate, or cannot be determined from existing data. Surface-disturbing activities may require field assessment to determine a further course of action.

TABLE 3.4-2 (Cont.)

Class	Description	Basis	Management Direction
4	Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils or uncommon invertebrate or plant fossils (as in Class 5), but have lowered risks of human-caused adverse impacts or natural degradation. These include units with extensive soil or vegetative cover or with limited bedrock exposures, areas in which exposed outcrop is less than 2 contiguous acres, and areas in which exposed outcrops form cliffs of sufficient height and slope to minimize impacts.	The potential for impacting vertebrate fossils or uncommon invertebrate or plant fossils is moderate to high and is dependent on the proposed action. The geologic unit is considered a Class 5, but the risk of potential impacts is reduced by the presence of a protective layer of soil, thin alluvial material, or other mitigating circumstance.	Land manager's concern for paleontological resources is moderate to high, depending on the proposed action. A field survey and assessment by a qualified paleontologist are often needed to assess local conditions. Approval from the authorized officer is required for project to proceed. Resource preservation and conservation through controlled access or special management designation should be considered. Mitigation may be necessary before and/or during these actions. On-site monitoring may also be necessary during construction activities.
5	Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils or uncommon invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation. Vertebrate fossils or uncommon invertebrate or plant fossils are known and documented to occur consistently, predictably, or abundantly. Units are exposed, with little or no soil or vegetative cover. Outcrop areas are extensive; exposed bedrock areas are larger than 2 contiguous acres.	The potential for impacting significant fossils is high. Vertebrate fossils or uncommon invertebrate or plant fossils are known or can reasonably be expected to occur.	Land manager's concern for paleontological resources is high. A field survey and assessment by a qualified paleontologist is required in advance of surface-disturbing activities or land tenure adjustments. Approval from the authorized officer is required for project to proceed. Resource preservation and conservation through controlled access or special management designation may be appropriate. Mitigation will often be necessary before and/or during these actions. On-site monitoring may also be necessary during construction activities.

Source: Hanson (2006).

For this analysis, the PFYC system was applied to geologic units intersecting and adjacent to the proposed corridors to identify units with a high fossil yield potential and therefore a potential for adverse impacts. Geologic formations with a PFYC class of 3, 4, or 5, or other known significant localities that occur within 2,000 feet of the centerlines of the proposed corridors or corridor segments, were identified as areas of potentially adverse impacts. For purposes of this initial assessment, all Quaternary sediments (alluvium, colluvium, etc.) were assigned to Class 3 since their fossil potential is unknown. Quaternary age sediments should be assessed on the ground to determine their source and potential for bearing fossils, once a specific project is under way. Areas designated as Class 3, 4, or 5 may warrant a paleontological field survey and/or mitigation measures (see Section 3.4.4.2).

Appendix L presents the PFYC classifications for geological formations intersecting or adjacent to the proposed corridors in each of the 11 western states.

3.4.3 What Are the Paleontological Resources and Potential Impacts Associated with Corridor Designation?

3.4.3.1 No Action Alternative

Under the No Action Alternative, energy transport projects would likely be implemented independently within individual, widely spaced, and project-specific ROWs. As a consequence, the potential for adverse impacts to paleontological resources on federally administered lands could be greater than would be expected if the projects were colocated within a single ROW. Potential impacts to paleontological resources largely would be associated with construction activities, and could include any of the common impacts identified in Section 3.4.4.1. Although all managing agencies have procedures and policies for reducing or mitigating impacts to paleontological resources on a project-specific basis, the benefits of an expedited approach (e.g., consistency of environmental analyses and mitigation requirements) may not be realized under No Action.

3.4.3.2 The Proposed Action

For this analysis, geologic units with a high fossil yield potential that fall within the corridors under the Proposed Action represent areas where development within a designated energy corridor has the potential to encounter and impact fossils. Table 3.4-3 lists the number of geologic formations for each PFYC class that occur within 2,000 feet of the centerlines of the proposed corridors in each of the 11 western states on the basis of the tables presented in Appendix L. It is important to note that the numbers in the tables represent the number of formations potentially affected for a given state and not the number of formation exposures.[1] The numbers in the tables are also affected by the scale and level of differentiation of geologic formations on the state geologic maps used for this analysis; therefore, those states having a high level of differentiation relative to other states may also have higher numbers of formations (and percentages) of geologic formations in the PFYC classes reported.

All 11 states have formations in each of the PFYC class categories, except Class 4, as shown in Table 3.4-3. The PFYC system ranks the highest potential fossil yielding formations as Class 4 or Class 5, but assigns the lower rank (Class 4) to those formations for which potential impacts are reduced by the presence of a protective layer of soil or other mitigating circumstance. For this assessment, formations

---

[1] A geologic formation may be exposed at the surface at more than one location; therefore, the number of exposures of any formation is usually expected to be greater than one. For this analysis, only the number of formations potentially affected are counted, since the number of formation exposures can only be determined in the field.

TABLE 3.4-3 Number (and Percentage) by State of PFYC Classes for Formations Intersecting the Proposed Corridors under the Proposed Action[a]

States	Class 1	Class 2	Class 3	Class 4	Class 5
Arizona	6 (21)	7 (24)	7 (28)	0	8 (28)
California	12 (63)	0	7 (37)	0	0
Colorado	3 (10)	5 (17)	13 (43)	0	9 (30)
Idaho	4 (14)	5 (18)	19 (68)	0	0
Montana	7 (24)	12 (41)	8 (28)	0	2 (7)
Nevada	11 (46)	9 (38)	4 (17)	0	0
New Mexico	1 (5)	0	7 (33)	0	13 (62)
Oregon	31 (53)	11 (19)	17 (29)	0	0
Utah	6 (11)	7 (13)	26 (49)	0	14 (26)
Washington	4 (44)	0	5 (56)	0	0
Wyoming	0	10 (18)	28 (51)	0	17 (31)
Totals	85 (24)	66 (19)	141 (40)	0	63 (18)

[a] The numbers shown represent formations only. Formation outcrops may occur in more than one area; therefore, the number of exposures (or potential impact areas) could be higher than the number shown. Numbers in parentheses represent the percentage of a class assignment (e.g., Class 5) relative to other class assignments for formations in that state.

with the highest potential fossil yield were assigned to the higher rank (Class 5); however, some of these may be downgraded to Class 4 once the project-specific potential for disturbance can be assessed.

There are at least 63 geologic units (18% of the total) that fall in the PFYC Class 5 category within the corridors proposed under the Proposed Action. One state, New Mexico, has a higher percentage of PFYC Class 5 formations relative to other PFYC classes. This is mainly the result of the high occurrence of formations dating from Jurassic to Cretaceous ages, which contain such vertebrates as dinosaurs, lizards and other reptiles, birds, mammals, and fish; and formations of Tertiary age, which contain lizards, small crocodiles, turtles, bats, birds, mammals, and fish. Arizona, Colorado, Montana, Utah, and Wyoming also have corridors or corridor segments crossing important PFYC Class 5 formations. For projects intersecting the PFYC Class 5 formations, resource preservation and conservation may necessitate mitigation and on-site monitoring during project activities. Other states, including California, Idaho, Nevada, Oregon, and Washington, have no PFYC Class 5 formations intersecting the corridors under the Proposed Action.

About 141 geologic units (40% of the total) fall in the PFYC Class 3 category under the Proposed Action. Four states have a higher percentage of PFYC Class 3 formations relative to other classes; these include Colorado, Idaho, Utah, and Wyoming (Washington has an equal percentage of PFYC Class 3 and 1 formations). This is most often because of the placement of corridors and corridor segments in river valleys and sedimentary basins or deserts. Examples include the corridor segments that stretch across the Snake River Plain in southern Idaho and the corridor segment in northwestern Utah that extends across the Great Salt Lake Desert. Another corridor segment in California extends south from near Mono Lake through Owens Valley along the eastern edge of the Sierra Nevada Range. PFYC Class 3 formations in these states may be fossiliferous but vary locally, or their potential to yield significant fossils is not currently known. Class 3 formations generally require additional field assessment to determine the next course of action at the project level.

A total of 151 geologic units (43% of the total) fall in either PFYC Class 1 or 2 under the Proposed Action. Five of the states have a higher percentage of PFYC Class 1 and 2 formations relative to other classes; these are Arizona, California, Montana, Nevada, and Oregon (Washington has an equal percentage of PFYC Class 1 and 3 formations). The high percentage of PFYC Class 1 and 2 formations in these states can be attributed to the high occurrence of igneous (intrusives and volcanic flows and tuffs) and metamorphic units.

Important fossils on nonfederal land (i.e., privately owned land, Tribal and trust land, and land controlled by state and local governments) may also be affected by ground-disturbing activities associated with corridor development if they are present within a land "gap" that would connect projects on designated corridors if they were to be built. The analysis of impacts to fossil resources on nonfederal land would be conducted at the time such a project is proposed.

3.4.4 Following Corridor Designation, What Types of Impacts Could Result to Paleontological Resources with Project Development, and How Could They Be Minimized, Avoided, or Compensated?

3.4.4.1 What Are the Usual Impacts of Building and Operating Energy Transport Projects to Paleontological Resources?

Ground-disturbing activities associated with ROW clearing and construction of the transport systems and required infrastructure (e.g., access roads, compressor stations) and increased accessibility on public lands via new access roads and ROWs can impact paleontological resources. Direct adverse impacts common to all ground-disturbing activities, such as drilling rock to set transport tower footings or excavating to install underground transport pipelines, include the potential damage or destruction of fossil remains or the disruption of the context in which they are found.

Indirect adverse impacts may occur as a result of the increased accessibility to an area (associated with project-related access roads or trails and vegetation-clearing activities), which may lead to an increased risk of theft or vandalism. Increased accessibility may also occur if ground-disturbing or vegetation-clearing activities accelerate erosional processes over time and expose paleontological resources, leaving them vulnerable to theft or vandalism. Agents of erosion include wind, water, ice, downslope movement, animals and/or people walking in the area, and vehicles.

3.4.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Paleontological Resources?

The need for mitigation to protect paleontological resources would be determined on a project-specific basis, after appropriate assessments have been completed and before any construction activities associated with the proposed project begin. This approach should be based on the current fossil management practices and policy goals of the BLM, FS, NPS, USFWS, and BOR as presented in the document entitled *Collection, Storage, Preservation, and Scientific Study of Fossils from Federal and Indian Lands* (DOI 1999); and from procedures set forth in agency manuals and handbooks (e.g., BLM 1998a,b; FS 1996; NPS 2006a). Potential mitigation measures may include:

- An initial scoping assessment conducted in coordination with the appropriate agency's paleontology specialist. The assessment would determine whether the construction activities associated with the proposed project would disturb sedimentary bedrock or fossil-yielding alluvium that may contain significant paleontological resources. If the scoping assessment finds that the proposed project would not disturb sedimentary bedrock or potentially fossil-yielding alluvium, there would be no need for further analysis.

- If the scoping assessment were to find that construction activities may disturb sedimentary bedrock or potentially fossil-yielding alluvium, an analysis would be conducted of existing data, such as geologic maps, classifications of geologic units (formations), and other data (including aerial photos, GIS-based locality data, soils maps, and scientific literature). At this stage, the PFYC system or an equivalent system in use by other agencies would be used to categorize the potential for geologic units to contain important fossils within the area of the proposed project. The PFYC system categories could assist in determining the appropriate level of mitigation that may be necessary for approval of a project.

- If the analysis of existing data determines that a proposed project would disturb only geologic units (formations) with a PFYC Class 1 or 2 and no significant fossil localities are known to occur in the area, the project file would be documented and no additional characterization work would be necessary.

- An analysis of existing data that determines that a proposed project has the potential to disturb geologic units (formations) with a PFYC Class 3, 4, or 5, or potentially fossil-bearing alluvium, or other known significant fossil localities would warrant additional field surveys and/or mitigation measures. Mitigation measures could include altering the location or scope of the proposed project, conducting a field survey prior to authorizing activities, and conducting on-site monitoring to properly document and recover any fossil material and data found. The preferred course of action should be to avoid the potential impact by moving or rerouting the site of construction or removing or reducing the need for surface disturbance. When avoidance is not possible, excavation or collection (data recovery) and stabilization measures should be implemented, such as erecting protective barriers and signs or taking other physical and administrative protection measures.

- A paleontologist within the appropriate federal agency or a project paleontologist holding a valid permit granted from the appropriate federal agency should conduct all field surveys. Small projects (generally less than 10 acres or 5 miles, if linear) should be surveyed at a very intense level, focusing on the areas likely to produce fossils (PFYC Class 4 and 5) within 200 feet of the proposed construction project location. Large projects (generally greater than 10 acres or 5 miles, if linear) should be surveyed at a lower intensity level and should include a 5 to 15% sampling of lower probability exposures (PFYC Class 3 and 4) within 200 feet of the proposed construction project.

- After completion of the field survey, the project paleontologist should file a written report with the appropriate agency for approval. The report should summarize the results of the survey with supporting geological and paleontological information. The report should also make recommendations for on-site monitoring or other mitigation (e.g., rerouting). If on-site monitoring is recommended, the project paleontologist should identify the specific locations to be monitored and the level of monitoring or sampling to be conducted.

- If fossil materials are discovered during project construction, all surface-disturbing activities in the vicinity of the find must cease until notification to proceed by the authorized officer. The site must be protected to reduce the risk of damage to fossils and context. Appropriate measures to mitigate adverse effects to significant paleontological resources would be determined by the authorized officer after consulting with the operator.

- All paleontological specimens found on federal lands remain the property of the U.S. government. Specimens, therefore, may only be collected by a qualified paleontologist under a permit issued by the appropriate federal agency and curated in an approved repository.

3.5 WATER RESOURCES

3.5.1 What Are the Groundwater and Surface Water Resources in the 11 Western States?

3.5.1.1 Groundwater Resources

There are about 26 major aquifer systems in the 11 contiguous western states (Figure 3.5-1). Each of these aquifers is unique in that the source, volume, and quality of water flowing through it depends on hydrogeological conditions present within the aquifer (e.g. hydraulic conductivity, effective porosity, and hydraulic gradient) and external factors, such as the rates of precipitation, recharge, evaporation, and transpiration; the location and hydrologic connection with streams, rivers, springs, reservoirs, and wetlands; and overlaying human activities. Table 3.5-1 lists the potentially affected aquifers and summarizes their distributions in different hydrologic regions (see Section 3.5.1.2) and geographic areas, and their water quality and uses.

In addition to the 26 major aquifer systems discussed above, the study area for this PEIS also includes sole-source aquifers (Table 3.5-2). Sole-source aquifers are federally designated groundwater resources. The EPA defines a sole- or principal-source aquifer as one that supplies at least 50% of the drinking water consumed in the area overlying the aquifer. EPA's criteria for sole-source aquifer designation also provide that the area have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water (EPA 2007a). The EPA's Sole Source Aquifer Program was established under Section 1424(e) of the U.S. Safe Drinking Water Act (SDWA). Determination of sole-source aquifer boundaries can be difficult because the designated area includes the surface area above the aquifer and its recharge area. Depending on their extent, some sole-source aquifers can extend across state boundaries.

If designated as a sole-source aquifer, proposed federal projects that are financially assisted and that have the potential to contaminate the aquifer are subject to EPA review. In many cases, MOUs have been established by the EPA with other agencies (e.g., the Federal Highway Administration, the Department of Housing and Urban Development, and the U.S. Department of Agriculture Rural Development in Wyoming) to establish a review of responsibilities under the Sole Source Aquifer Protection Program and to list categories of projects that should or should not be referred to the EPA for review. MOUs help ensure that projects that pose serious threats to groundwater quality are referred to the EPA.

TABLE 3.5-1 Groundwater Resources in the 11 Western States

Hydrologic Region	Geographic Area	Principal Aquifer Systems	Aquifer Types	Major Water Uses	General Groundwater Quality
Pacific Northwest	Coastal areas of Oregon and Washington; semiarid Columbia Plateau in eastern Washington, Oregon, and southern Idaho	Columbia Plateau basaltic-rock and basin-fill aquifers, Pacific Northwest basaltic-rock and basin-fill aquifers, Snake River Plain basaltic-rock and basin-fill aquifers, Willamette Lowland basin-fill aquifers, Northern Rocky Mountains Intermontane Basins aquifer system, and the Puget Sound aquifer system	Bedrock and basin sediments	Domestic and irrigation	Generally good water quality. Elevated levels of nitrates and pesticides have been detected in some aquifers in Snake River Basin and the Columbia Plateau.
California	Entire state of California and parts of southern Oregon	Basin and Range basin-fill aquifers and carbonate-rock aquifers, California Coastal Basin aquifers, and Central Valley aquifer system	Sedimentary rocks (including carbonate rock) and basin sediments	Main source of water for domestic consumption and agricultural irrigation	Elevated TDS (total dissolved solids) levels from evaporate beds in southern California. Agricultural practices in central California combined with a high evaporation rate have resulted in elevated nitrates and pesticides in shallow groundwater systems and substantial declines in shallow groundwater tables.

TABLE 3.5-1 (Cont.)

Hydrologic Region	Geographic Area	Principal Aquifer Systems	Aquifer Types	Major Water Uses	General Ground Water Quality
Upper Colorado	Colorado Plateau in southern Wyoming, western Colorado, eastern Utah, northern Arizona, and New Mexico	Colorado Plateau aquifers, Denver Basin aquifer system, High Plains aquifer, and the Northern Rocky Mountains Intermontane Basins aquifer system	Sedimentary rocks	Major source of water for domestic and municipal uses	Groundwater quality is influenced by the nature of the bedrock. Elevated levels of TDS in areas of sedimentary rock. Mining may cause metal contamination in local groundwater.
Lower Colorado	Most of Arizona and portions of western New Mexico, southern Nevada, and southeastern California	Pecos River Basin alluvial aquifer, Rio Grande aquifer system, Roswell Basin aquifer system, Basin and Range basin-fill and carbonate-rock aquifers, and the Colorado Plateau aquifers	Basin sediments and bedrock	Main source of water for domestic consumption and agricultural irrigation	Groundwater quality is influenced by the nature of the bedrock. Elevated TDS and salinity in alluvium or in areas with Late Tertiary sedimentary bedrock. Elevated metals in groundwater in mining areas. Good water quality in deep, carbonate aquifers. Irrigation and mine dewatering lowered the water levels in shallow groundwater in Arizona.
Rio Grande	Central New Mexico	Rio Grande aquifer system, Colorado Plateau aquifers, and the High Plains aquifer	Basin sediments	Irrigation, livestock watering, and domestic uses	Elevated nitrate in agricultural areas such as the San Luis and Rincon Valleys. Pesticides detected in agricultural and urban areas.

TABLE 3.5-1 (Cont.)

Hydrologic Region	Geographic Area	Principal Aquifer Systems	Aquifer Types	Major Water Uses	General Ground Water Quality
Missouri	Most of Montana, northern and eastern Wyoming, and northeastern Colorado	Northern Rocky Mountains Intermontane Basins aquifer system, Colorado Plateau aquifers, and the High Plains aquifer	Igneous rocks and basin sediments	Primarily for irrigation. Other uses include municipal and domestic water supplies	Generally good water quality. Elevated levels of sulfate and metals found in local groundwater near mining areas. Elevated concentrations of nutrients and pesticides in shallow alluvial groundwater near agricultural areas.
Great Basin	Central and northern Nevada and western Utah	Basin and Range basin-fill and carbonate-rock aquifers, Colorado Plateau aquifers, and the southern Nevada volcanic-rock aquifers	Basin sediments and bedrock	Domestic consumption, irrigation, and power plant cooling	Groundwater quality is influenced by the nature of the bedrock. Good water quality in carbonate rock and sandstone aquifers. Elevated levels of salts and TDS in the central parts of basins; elevated metal concentrations in historic mining areas; and elevated nitrate and pesticide concentrations in shallow groundwater in agricultural areas.
Arkansas White-Red	Colorado, New Mexico	High Plains	Basin sediments	Irrigation	Generally good. Dissolved solid concentrations less than 250 mg/L are found in northeastern Colorado and are the result of relatively large recharge rates in areas of sandy soil that contains few soluble minerals.
Texas-Gulf	New Mexico	High Plains	Basin sediments	Irrigation	Not known.[a]

Footnote on following page.

TABLE 3.5-1 (Cont.)

[a] Data for the Texas-Gulf hydrologic region is incomplete (Jantzen 2005).

Source: BLM (2005a).

TABLE 3.5-2 Sole-Source Aquifers in the 11 Western States

Sole-Source Aquifer	Location
Spokane Valley-Rathdrum Prairie Aquifer	WA/ID
Camano Island Aquifer	WA
Whidbey Island Aquifer	WA
Cross Valley Aquifer	WA
Newberg Area Aquifer	WA
Troutdale Aquifer System	WA
North Florence Dunal Aquifer	OR
Cedar Valley Aquifer	WA
Lewiston Basin Aquifer	WA/ID
Eastern Snake River Plain Aquifer	ID/WY
Central Pierce County Aquifer System	WA
Marrowstone Island Aquifer System	WA
Vashon-Maury Island Aquifer System	WA
Guemes Island Aquifer System	WA
Upper Santa Cruz & Avra Basin Aquifer	AZ
Bisbee-Naco Aquifer	AZ
Fresno County Aquifer	CA
Santa Margarita Aquifer, Scotts Valley	CA
Campo/Cottonwood Creek	CA
Ocotillo-Coyote Wells Aquifer	CA
Glen Canyon Aquifer	UT
Castle Valley Aquifer	UT
Western Unita Arch Paleozoic Aquifer System	UT
Missoula Valley Aquifer	MT
Elk Mountain Aquifer	WY

Sources: EPA (2006, 2007a,b,c,d).

Most projects referred to the EPA for review meet all federal, state, and local groundwater protection standards and are approved without imposing additional conditions. Occasionally, site- or project-specific concerns for groundwater quality protection lead to specific recommendations or additional pollution prevention requirements as a condition of funding. In rare cases, federal funding has been denied when the applicant has been either unwilling or unable to modify the project.

In general, groundwater is found near the surface in the vicinity of substantial surface water bodies. In other areas (e.g., mountainous regions), groundwater can occur at great depths. When located at a shallow depth (i.e., on the order of tens of feet), groundwater is more susceptible to adverse impacts associated with construction, maintenance, and dismantling activities; surface spills; and changes in recharge.

3.5.1.2 Surface Water Resources

Surface Water Availability and Quality. There are nine hydrologic regions identified in the 11 contiguous western states: Pacific Northwest, California, Upper Colorado, Lower Colorado, Rio Grande, Missouri, Great Basin, Arkansas-White-Red, and Texas-Gulf (BLM 2005a). These regions are shown in Figure 3.5-2 and described in Table 3.5-3. The

TABLE 3.5-3 Hydrologic Regions and Surface Water Conditions in the 11 Western States

Hydrologic Region	Geographic Area	Major River Systems	Typical Stream Types and Common HLRs[a]	Precipitation and Recharge	General Surface Water Quality
Pacific Northwest	Oregon, Washington, most of Idaho, and northwestern Montana; very small portions of northern Nevada and northwestern Wyoming	Columbia River, Willamette River, Snake River	Mountainous areas: stream Types A and G; HLRs 19 and 20 Coastal areas: stream Types C, E, and F; HLR 2	Areas west of the Cascade Mountains have medium to high rainfalls. Precipitation decreases east of the Cascades, and stream flow is driven primarily by snowmelt or groundwater discharge.	Agricultural areas degraded by nutrients (nitrates and phosphates) and pesticides from agricultural and grazing practices. Aquaculture has also contributed to elevated nutrients in Washington.
California	Most of California and very small portions of southern Washington and western Nevada	Sacramento River, San Joaquin River	Stream Types B, C, D, E, F, and G; HLRs 11, 14, and 16	Precipitation occurs primarily in winter, with prolonged summer periods of little rainfall. Stream flow derived primarily from spring snowmelt.	Elevated TDS levels from high salinity due to irrigation practices and arid climate. Agricultural practices in central California have resulted in elevated nutrients and pesticides.
Upper Colorado	Southwestern Wyoming, western and southwestern Colorado, eastern Utah, northeastern Arizona, and northwestern New Mexico	Upper Colorado River	Stream Types B, C, D, E, F, and G; HLRs 12, 14, 16, and 18	Precipitation varies with elevation and includes winter snow storms and heavy fall rainstorms, with most stream flow dominated by snowmelt in the mountains.	Generally good water quality except in historic mining areas and in agricultural areas. Areas of sedimentary rock may have high levels of TDS, radon, uranium, and other metals.
Lower Colorado	Most of Arizona and portions of western New Mexico, southern Nevada, and southeastern California	Lower Colorado River	Stream Types B, C, D, E, F, and G; HLRs 11, 12, 14, and 18	This region is arid, with precipitation limited to winter months and periods of heavy storms. Stream flow is largely absent except in winter or after major storms. High erosion rates common in areas with grazing livestock.	Elevated TDS in areas with agriculture and grazing, and metals in mining areas.

TABLE 3.5-3 (Cont.)

Hydrologic Region	Geographic Area	Major River Systems	Typical Stream Types and Common HLRs[a]	Precipitation and Recharge	General Surface Water Quality
Rio Grande	Central New Mexico and a portion of south-central Colorado	Rio Grande River, Pecos River	Stream Types B, C, D, E, F, and G; HLRs 12, 14, and 18	An arid region with precipitation limited to winter months and periods of heavy storms. Stream flow derived from spring snowmelt and summer monsoon thunderstorms.	Elevated TDS, and nutrient and pesticide contamination in agriculture areas. Upper reaches of the Rio Grande have elevated levels of metals in mining areas attributed to the Creede mining district of southern Colorado.
Missouri	Most of Montana, northern and eastern Wyoming, and northeastern Colorado	Missouri River, Platte River	Stream Types B, C, D, E, F, and G; HLRs 8, 12, 13, and 18	Precipitation generally sparse in summer and fall, with stream flow derived from snowmelt in mountainous areas, and in summer and fall from groundwater discharge.	Good water quality in high Rocky Mountains. Quality degrades as streams enter plains and valleys, where agricultural practices and urban runoff impact water quality. Mining and oil extraction make locally increased TDS and metals concentrations, while grazing contributes sediments and nutrients.
Great Basin	Central and northern Nevada, western Utah, and very small portions of southwestern Wyoming; southeastern Idaho, southeastern Oregon	Humbolt River, Truckee River	Stream Types B, C, E, F, and G; HLRs 14, 15, and 18	Arid region located in rain shadow of the Sierra Nevada Mountains. Surface water flow in basins derived from rain and snow falling in mountain areas.	Poor water quality in areas near urban centers; elevated metal concentrations in historic mining areas. Near-surface rocks naturally contribute arsenic, uranium, and radon to surface waters.
Arkansas White-Red	Colorado, New Mexico	Arkansas, Canadian, and Red River	Stream types B, C, D, E, F, and G; HLRs 3, 6, 8, 10, 12, 13, 14, and 17	Sparse in summer and fall. Stream flow derived from snowmelt in the mountainous areas.	Surface water quality is typically moderate in this region, and poor in areas with extensive agricultural or livestock production.

TABLE 3.5-3 (Cont.)

Hydrologic Region	Geographic Area	Major River Systems	Typical Stream Types and Common HLRs[a]	Precipitation and Recharge	General Surface Water Quality
Texas-Gulf	New Mexico	Running Water Draw, Black Water Draw, Yellow House Draw, Lost Draw, Sulphur Springs Draw, Mustang Draw, Monument-Seminole Draw[b]	Stream types B, C, D, E, F, and G; HLRs 5 and 10	An arid region with precipitation limited to winter months and periods of heavy storms. Stream flow derived from spring snowmelt and summer monsoon thunderstorms.	Not known.[c]

[a] HLRs: 2 = humid plains with highly permeable soils and permeable bedrock; 5 = arid plains with permeable soils and bedrock; 6 = subhumid plains with impermeable soils and bedrock; 8 = semiarid plains with impermeable soils and bedrock; 10 = arid plateaus with impermeable soils and permeable bedrock; 11 = humid plateaus with impermeable soils and bedrock; 12 = semiarid plateaus with permeable soils and impermeable bedrock; 13 = semiarid plateaus with impermeable soils and bedrock; 14 = arid playas with permeable soils and bedrock; 15 = semiarid mountains with impermeable soils and permeable bedrock; 16 = humid (low relief) mountains with permeable soils and impermeable bedrock; 17 = semiarid mountains with impermeable soils and bedrock; 18 = semiarid mountains with permeable soils and impermeable bedrock; 19 = very humid mountains with permeable soils and impermeable bedrock; 20 = humid (high-relief) mountains with permeable soils and impermeable bedrock (USGS 2006).

See Section 3.5.2.2 for a description of stream types.

[b] Source: New Mexico State University (2007).

[c] Data for the Texas-Gulf hydrologic region is incomplete (Jantzen 2005).

hydrologic landscape regions (HLRs) of each region are shown in Figure 3.5-3. HLRs are used by the USGS to group watersheds in the United States according to their similarity in landscape and climatic characteristics (USGS 2006). Additional details on HLRs are found in Section 3.5.2.2.

The quality of surface water is as important as its quantity. The quality of surface water is primarily influenced by the presence of sediment, microbes, pesticides, nutrients, metals, and radionuclides (BLM 2005a). Surface water quality is also affected by solar radiation and shade-producing vegetation that affect water temperature, flow, total suspended solids (TSS), TDS, turbidity, and changes in dissolved oxygen, salinity, and acidity. Because of the spatial extent of the affected environment, water quality can vary considerably within the 11 contiguous western states. Figure 3.5-4 shows a map of water quality on BLM lands in the West, and Table 3.5-3 summarizes water quality within each hydrologic region of the 11 western states.

Susceptibility of Surface Water Resources to Change. Surface water resources can be described in general terms regarding the susceptibility or sensitivity of the resources to changes in channel morphology or quality. The sensitivity of a surface water resource can be characterized by combining information provided by HLR data and the Rosgen classification system (EPA 1996). The Rosgen classification system describes stream types using three parameters: Valley Type, Level I classification, and Level II classification. Classifying streams using this system aids the understanding of stream conditions and potential behavior under the influence of different types of changes, such as those that would occur during construction, operation, maintenance, and decommissioning and dismantling of energy infrastructures such as oil and gas pipelines, electricity transmission lines, and other energy infrastructures.

The Rosgen classification system can be used to provide insight into the susceptibility of surface water resources to changes in channel morphology produced by future construction, maintenance, and decommissioning of energy transport projects. In general, stream types C, D, E, F, and G are the most susceptible to change (e.g., changes in stream morphology, rates of bed and bank erosion and aggradation, etc.). These stream types are often found in Valley Types 3 through 11 (Table 3.5-4). Stream Type G is also found in Valley Types 1 and 2. Additional details on the Rosgen classification system are discussed in Section 3.5.2.2.

Surface water features that are both susceptible to change and are classified as wild and scenic rivers are of particular concern with regard to impacts. The Wild and Scenic Rivers Act (P.L. 90–542 as amended; 16 USC 1271–1287) established a method for providing federal protection to certain of the country's remaining free-flowing rivers, preserving them and their immediate environments for the use and enjoyment of present and future generations. Rivers (or river segments) are included in the system so that they may benefit from the protective management and control of development provided by the Act. Figure 3.5-5 shows a map of wild and scenic river segments within the 11 contiguous western states; these rivers and segments are listed in Tables M-1 and M-2 in Appendix M. Table M-2 identifies the specific classifications (wild, scenic, and recreational) for each designated river segment.

Floodplains and Ephemeral Streams. Surface water resources of the affected environment also include numerous floodplains and ephemeral streams (i.e., streams that carry water only briefly in direct response to precipitation). Floodplain maps are usually prepared for populated areas that can experience flooding. These maps are generally prepared by the Federal Emergency Management Agency (FEMA) for floods that statistically have a 1%

TABLE 3.5-4 Valley Types for Stream Classification

Valley Type	Characteristics	Level I Stream Types
1	V-shaped, confined, and often structurally controlled and/or associated with faults. Elevation relief is high, valley floor slopes are greater than 2%, and landforms may be steep, glacially scoured lands and/or highly dissected fluvial slopes.	Aa^+, A, and G
2	Moderate relief, relatively stable, moderate side slope gradients, and valley floor slopes that are often less than 4% with soils developed from parent material (residual soils), alluvium, and colluvium.	B (sometimes G in transition)
3	Debris-colluvial or alluvial fan landforms, and valley-floor slopes that are moderately steep or greater than 2%.	A, B, G, and D
4	Classic meandering, entrenched, or deeply incised and confined landforms directly observed as canyons and gorges with gentle elevation relief and valley-floor gradients often less than 2%.	F and C
5	Product of a glacial scouring process in which the resultant trough is now a wide, "U"-shaped valley, with valley-floor slopes generally less than 4%.	C, D, and G
6	Termed a fault-line valley, is structurally controlled and dominated by colluvial slope-building processes. The valley-floor gradients are moderate, often less than 4%.	B, C, F, and G
7	Steep to moderately steep landform, with highly dissected fluvial slopes, high drainage density, and a very high sediment supply. Streams characteristically are deeply incised in either colluvium and alluvium or residual soils.	A and G
8	Presence of multiple river terraces positioned laterally along broad valleys with gentle, down-valley elevation relief. Alluvial terraces and floodplains are the predominant depositional landforms, which produce a high sediment supply.	C and E
9	Glacial outwash plains and/or dunes, where soils are derived from glacial, alluvial, and/or aeolian deposits.	C and D
10	Very wide, with very gentle elevation relief. Mostly constructed with alluvial materials originating from both riverine and lacustrine deposition processes.	C, E, and DA
11	A unique series of landforms consisting of large river deltas and tidal flats constructed of fine alluvial materials originating from riverine and estuarine depositional processes.	DA and D

Source: EPA (1996).

chance of occurring each year (i.e., 100-year flood events). Such maps are used for property insurance purposes (FEMA 2006). Because the 11 western states under study in this PEIS have large areas that have not been evaluated for 100-year flood potential, affected environments and future project-specific impacts will need to be addressed during site-specific project work. As with floodplains, stream channels for ephemeral surface water resources have not been mapped completely for the 11 western states.

3.5.2 How Were the Potential Effects of Corridor Designation on Water Resources Evaluated?

3.5.2.1 How Were Potential Groundwater Effects Evaluated?

The first step used to evaluate potential impacts to groundwater resources was to identify groundwater resources (aquifers) in the 11 western States (Section 3.5.1.1). This identification was made at a regional scale using USGS data available in Anderson and Woosley (2005) and a USGS database (USGS 2003). Next, aquifers that would be crossed by the designated energy corridors under the Proposed Action were identified by overlaying the designated corridors onto the aquifer locations. Intercepts for the groundwater resources were performed only for the 26 major aquifer systems discussed in Section 3.5.1.1. Intercepts with sole-source aquifers in the western states were not identified because maps showing the extent of sole-source aquifers and their recharge areas were not available for all of the states concerned.

The analysis performed for this PEIS identified which aquifers would underlay the proposed corridors and could thus be potentially affected by surface activities associated with the development of energy transport systems in the corridors. In addition, the analysis estimated the area of each aquifer that would be affected. The potential area of impact is an important metric for each aquifer because it can be used as a measure of potential contamination produced by surface activities. Under the No Action Alternative, transport project ROWs might be located throughout the West; it is, therefore, not possible at the programmatic level to identify specific aquifer systems that would be crossed by future project ROWs.

Next, impacting factors were determined for three general corridor development activities: construction (e.g., groundwater extraction, land disturbance caused by trenching operations, clearing operations, compaction produced by vehicular traffic, material storage, accidental spills, etc.), normal operations and maintenance (including unintentional spills), and decommissioning and dismantling. To provide conservative results (i.e., impacts that would be greater than those under actual field conditions), all potential projects were assumed to occur at the same time.

The potential effects of corridor development on groundwater resources were then qualitatively evaluated for each of the alternatives. Quantitative evaluations of impacts to groundwater were not possible for this PEIS because such evaluations would require site-specific and project-specific information that would be obtainable only during an associated project phase. It should be noted that energy transport projects might cross federal and nonfederal lands that are not designated in the Proposed Action. Potential impacts from these areas are not evaluated in this PEIS because their locations have not been determined. They should be evaluated at the project level.

3.5.2.2 How Were Surface Water Impacts Evaluated?

As with the groundwater analysis, the first step used to evaluate impacts to surface water was to identify surface water resources that would occur within the designated corridors under the Proposed Action. These surface water resources were identified by using hydrologic region information available from the BLM

(BLM 2005a) and other appropriate databases (ESRI 2004). As with groundwater resources discussed in Section 3.5.2.1, energy transport projects might cross federal and nonfederal lands that are not designated in the Proposed Action. Potential impacts from these areas are not evaluated in this PEIS because their locations have not been determined. They should be evaluated at the project level.

HLRs (Wolock et al. 2004; USGS 2006) were used to identify surface water resources in the 11 western states that have similar characteristics. The USGS (USGS 2006) has used HLRs to classify landforms on the basis of land-surface form, geologic texture, and climate. The 20 HLRs in the 11 western states are shown in Figure 3.5-3.

Surface water resources can be further delineated using the Rosgen stream type classification system to evaluate the susceptibility of the resources to change (EPA 1996). The Rosgen system describes stream types with three designators: valley type, Level I classification, and Level II classification. Only the first two designators were used in this study. Level II identifiers within the Rosgen classification system provide more detailed morphological descriptions of stream types from field measurements of channel form and bed composition. Level II classifications are better suited for project-specific analyses that would be used for future project development work.

Valley type, the first Rosgen identifier, is based on the physical characteristics of a valley including such parameters as relief, valley-floor slope, scouring, drainage, and soil type. There are 11 valley types defined in the Rosgen stream type classification system (EPA 1996). Valley type can provide a basis for an initial indication of river morphology within a valley. Table 3.5-4 lists the 11 valley types in the Rosgen stream type classification system and their identifying characteristics.

The second identifier in the Rosgen stream type classification system is Level I. The Level I characterization is based on stream characteristics that result from relief (i.e., topography), landform, and valley morphology. Nine major stream categories are included in the Level I classification. These stream types are shown in Figure 3.5-6 and linked to valley types in Table 3.5-4.

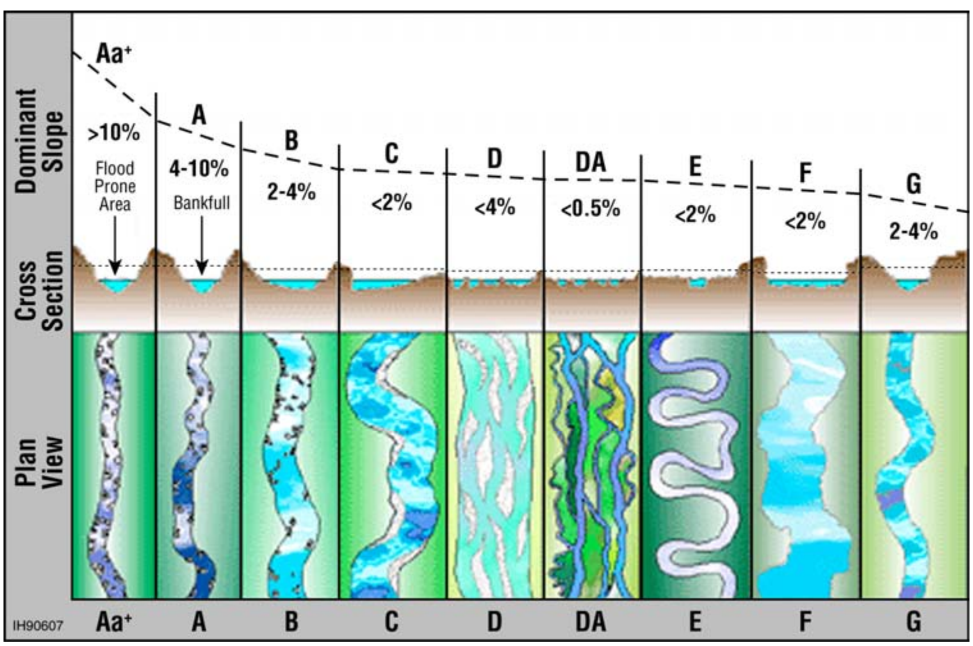


FIGURE 3.5-6 Nine Categories of Level I Streams (Source: EPA 1996)

Stream types Aa^+, A, and B are relatively stable with respect to changes in aggradation (i.e., build up in bed or bank material due to deposition of sediment) and erosion. The channel aggradation/degradation and lateral extension processes, notably active in C-type streams, depend inherently on the natural stability of stream banks, the existing upstream watershed conditions, and the flow and sediment regime. C-type channels can be significantly altered and rapidly destabilized when the effects of imposed changes in bank stability, watershed condition, or flow regime are combined to cause an exceedance of a channel stability threshold. In D-type streams, bank erosion rates are characteristically high, and meander width ratios are very low.

Sediment supply is generally unlimited, and bed features are the result of a convergence/ divergence process of local bed scour and sediment deposition. Aggradation and lateral extension are dominant channel adjustment processes occurring within a range of landscapes from desert to glacial outwash plains. The DA stream type is a multiple-thread channel system that has a very low stream gradient and a bank-full width that is very variable. Such stream types are not seen often. DA stream banks are frequently composed of fine-grained cohesive materials, support dense-rooted vegetation species, and are extremely stable. Channel slopes are very gentle, commonly found to be at or less than 0.0001. Lateral migration rates of the individual channels are very low except for infrequent avulsion. Relative to the D stream type, the DA stream type is considered to be a stable system composed of multiple channels. E-type streams (i.e., evolutionary) are considered highly stable systems, provided that the floodplain and low channel width/depth characteristics are maintained; they are very sensitive to disturbance and can rapidly adjust and convert to other stream types in relatively short time periods.

F-type stream channels can develop very high bank erosion rates, lateral extension rates, significant bar deposition, and accelerated channel aggradation and/or degradation while providing for very high sediment supply and storage capacities. The G-type streams (i.e., gullies) have very high bank erosion rates and a high sediment supply. Channel degradation and side slope rejuvenation processes are typical.

Next, streams and other surface water features that would be crossed by federal energy corridors under the Proposed Action were identified by overlaying the proposed corridors onto the locations of the surface water features. This analysis identified those surface water features that would fall within the proposed corridors and thus could be affected by energy transport systems in the corridors, should such development occur (e.g., Tables 3.5-6 and 3.5-7). A second overlay was made to identify the associated HLR at the point of stream interception (e.g., Appendix M, Table M-3). Because under No Action, ROWs may be located throughout the West, it is not possible at the programmatic level to identify which surface waters could be crossed by potential project ROWs.

Given the HLR at the point of stream interception, potential stream types can be approximately estimated combining information presented in Table 3.5-3 and the crossing streams (e.g., Table M-3 under the Proposed Action). Stability characteristics for the streams can then be characterized and used to assess potential impacts of construction, operation, maintenance, and decommissioning and dismantling of energy infrastructure in Section 368 energy corridors in the 11 contiguous western states. More accurate results could be obtained if Rosgen valley type and Level I classification were made for the point of stream interception. Presently, no detailed maps are available at the scale needed to make such evaluations. However, such analyses should be incorporated for project-specific analyses that would be used for future project development work.

Next, impacting factors were determined for activities that could occur, should an energy transport project be developed within a designated corridor. These activities include construction (e.g., land disturbance caused by trenching operations, clearing operations, channelization, water extraction, inter/intra-basin water transfer, river bank structures, in-stream structures, compaction produced by vehicular traffic, material storage, accidental spills, etc.), normal operations and maintenance (including unintentional spills), and decommissioning and dismantling. To provide conservative results (i.e., impacts that would be greater than those under actual field conditions), all potential projects were assumed to occur at the same time.

The effects of potential corridor development on surface water resources were qualitatively evaluated, as described in the previous three paragraphs. It should be noted that the effects might extend to areas near energy transport project sites on federal and nonfederal lands that are not designated in the alternatives. Quantitative evaluations of impacts to surface water were not conducted, because such evaluations would require project- and site-specific information that would be obtainable only during an associated project phase.

3.5.3 What Are the Potential Effects on Water Resources of the Alternatives, and How Do They Compare?

3.5.3.1 Potential Impacts to Water Resources Due to the No Action Alternative

Under No Action, there would be no impacts to water resources on federal or nonfederal lands from not designating Section 368 energy corridors on federal land.

If energy transport projects were developed and operated under No Action, water resources could be affected on federal and nonfederal lands where energy transport project-specific ROWs may be sited. Environmental impacts would be evaluated by each federal agency on an individual, case-by-case basis. The current application-permitting processes on federal lands would still require conducting environmental analyses to identify potential environmental impacts and developing mitigation measures that address any identified adverse impacts.

Groundwater. Under No Action, energy transport projects and their ROWs, if implemented, could occur throughout the 11 contiguous western states. Each project could adversely impact associated groundwater resources. A number of common impacts (Section 3.5.1) could occur along each individual project ROW as a result of construction (e.g., groundwater extraction, land disturbance caused by trenching and clearing operations, compaction produced by vehicular traffic, material storage, waste disposal, accidental spills, etc.), normal operations and maintenance (including unintentional spills), and decommissioning and dismantling. These activities could affect recharge to underlying aquifers, groundwater flow direction and volume, depth to groundwater, and degradation of groundwater quality in the event of inadvertent chemical spills or accidental pipeline releases of hazardous liquids.

In general, these impacts would be expected to be small, local, and temporary on the scale of this PEIS. However, impacts from a large hazardous material spill could produce groundwater impacts of greater magnitude and duration. The identification of the potential impacts would require site-specific analyses at the project level.

Surface Water. Implementation of each project under No Action could adversely impact surface water resources. Construction, normal operations and maintenance, and decommissioning and dismantling activities associated with each hypothetical project ROW could affect the volumetric flow of nearby surface water features; alter stream hydrographs (i.e., time-dependent flow patterns); increase channelization, erosion aggradation, and avulsion; and degrade water quality (e.g., by causing increases or decreases in sediment load, introducing soluble contaminants, causing changes in temperature, etc.). In general, these impacts would be expected to be small, local, and temporary on the scale of this PEIS. A large spill could result in impacts with a greater extent and magnitude, but identification of the impacts would require site-specific analyses at the project level.

3.5.3.2 Potential Impacts to Water Resources Due to the Proposed Action

The designation of energy corridors under the Proposed Action is not expected to affect water resources in the 11 western states, although water resources could be impacted by development of energy transport projects within designated corridors. The following impact discussion addresses potential impacts to water resources from project development within the proposed corridors at the programmatic level. Potential impacts to water resources from future energy transport projects, if developed, would be addressed in detail in project-specific environmental analyses, and are outside the scope of this PEIS. It should be noted that energy transport project sites that are not designated in the Proposed Action might exist on federal and nonfederal lands. Potential impacts from these project sites are not evaluated in this PEIS because their locations have not been determined. They should be evaluated at the project level.

Groundwater. The energy corridors designated under the Proposed Action would overlay approximately 4,620 square miles of major aquifer systems on the 11 western states (Table 3.5-5). This area represents about 0.45% of total aquifer area in the 11 western states. The percentage of aquifers falling within the footprint of the corridors designated under the Proposed Action varies by state (Table 3.5-5), ranging from 0.01% of Paleozoic aquifers in Montana to about 2.89% of the Basin and Range basin-fill aquifers in Oregon. Because groundwater resources and characteristics beneath the corridors designated under the Proposed Action are very variable, potential impacts to groundwater resources from the development of the projects can be quantified only at the project-specific level.

In general, the generic impacts that could occur with the construction activities, normal operations and maintenance, and decommissioning of the projects under the Proposed Action would be expected to be small, local, and temporary on the scale of this PEIS and similar to impacts experienced previously during similar construction activities on federal lands. However, impacts from a large accidental pipeline spill of hazardous liquids could be large and long-lasting.

Surface Water. Surface water resources that could be intersected by the energy corridors designated under the Proposed Action include perennial rivers and streams, man-made canals (e.g., the Los Angeles Aqueduct and the All American and Coachella Canals in California), lakes, reservoirs, ephemeral streams, and associated floodplains.

Under the Proposed Action, there could be 285 individual streams, rivers, man-made channels, and intermittent streams intersected by the energy corridors (Table 3.5-6). These intercepts are noncontiguous and can be widely spaced. All surface water intercepts could encompass about 390 linear miles of surface water features (Table 3.5-6). The greatest number of intercepted miles would occur in Nevada (98 linear miles); the least would occur in Washington (5 linear miles).

TABLE 3.5-5 Major Western Aquifer Systems Intersected by Proposed Section 368 Energy Corridors

Major Aquifers of the 11 Western States	State	In-State Aquifer Area (square miles)	Area (square miles) of Aquifer within the Proposed Corridor Footprint	Percentage of In-State Aquifer Area within the Proposed Corridor Footprint
Basin and Range basin-fill aquifers	Arizona	37,673	273.2	0.73
	California	26,320	226.9	0.86
	Idaho	1,236	6.5	0.53
	Nevada	55,625	1,043.8	1.88
	Oregon	947	27.4	2.89
	Utah	24,453	159.7	0.65
Basin and Range carbonate-rock aquifers	Arizona	550	8.0	1.46
	California	861	2.0	0.24
	Nevada	9,777	77.8	0.80
	Utah	3,969	13.5	0.34
California Coastal Basin aquifers	California	10,165	1.3	0.01
Colorado Plateaus aquifers	Arizona	27,818	40.8	0.15
	Colorado	27,573	322.9	1.17
	New Mexico	24,617	52.5	0.21
	Utah	42,830	317.6	0.74
	Wyoming	18,634	173.4	0.93
Columbia Plateau basaltic-rock aquifers	Oregon	11,577	7.3	0.06
Lower Cretaceous aquifers	Montana	2,723	0.8	0.03
	Wyoming	4,924	2.1	0.04
Lower Tertiary aquifers	Wyoming	22,409	72.1	0.32
Northern Rocky Mountains Intermontane Basins aquifer system	Idaho	6,380	9.7	0.15
	Montana	8,632	9.5	0.11
Pacific Northwest basaltic-rock aquifers	California	6,584	45.3	0.69
	Idaho	13,943	47.0	0.34
	Nevada	2,541	22.6	0.89
	Oregon	41,964	250.5	0.60
Pacific Northwest basin-fill aquifers	California	3,899	17.3	0.44
	Idaho	5,598	9.8	0.17
	Nevada	380	1.0	0.27
	Oregon	9,913	35.3	0.36
	Washington	5,640	1.6	0.03

TABLE 3.5-5 (Cont.)

Major Aquifers of the 11 Western States	State	In-State Aquifer Area (square miles)	Area (square miles) of Aquifer within the Proposed Corridor Footprint	Percentage of In-State Aquifer Area within the Proposed Corridor Footprint
Paleozoic aquifers	Montana	3,274	0.4	0.01
	Wyoming	4,290	2.2	0.05
Pecos River Basin alluvial aquifer	New Mexico	512	1.9	0.37
Rio Grande aquifer system	New Mexico	21,546	88.2	0.41
Snake River Plain basaltic-rock aquifers	Idaho	9,488	88.7	0.93
	Oregon	96	0.02	0.02
Snake River Plain basin-fill aquifers	Idaho	4,732	75.7	1.60
Upper Cretaceous aquifers	Wyoming	4,818	12.6	0.26
Willamette Lowland basin-fill aquifers	Oregon	3,393	1.0	0.03
Other rocks	Arizona	47,951	242.0	0.50
	California	89,846	156.8	0.17
	Colorado	51,611	86.4	0.17
	Idaho	38,145	15.0	0.04
	Montana	92,051	55.1	0.06
	Nevada	40,285	300.5	0.75
	New Mexico	61,889	60.5	0.10
	Oregon	25,589	50.7	0.20
	Utah	13,331	65.5	0.49
	Washington	28,900	9.2	0.03
	Wyoming	30,615	27.8	0.09

In addition to streams, rivers, and man-made canals, 26 lakes or reservoirs would be directly intercepted by the proposed corridor footprints (Table 3.5-7). Of these lakes and reservoirs, one potential intercept is in Arizona (Bartlett Reservoir), six are in California, one in Colorado (Blue Mesa Reservoir), one in Idaho, one each in Montana and New Mexico, seven in Nevada, three in Oregon, four in Utah, and one in Wyoming (Flaming Gorge Reservoir).

Crossings of designated wild and scenic rivers by proposed energy corridors are of particular concern. The national wild and scenic rivers are classified and administered as one of the following (P.L. 90–542, as amended, 16 USC 1271–1287):

1. *Wild river areas.* Those rivers or sections of rivers that are free of impoundments and generally

TABLE 3.5-6 Named Streams and Canals Intersected by the Proposed Energy Corridors[a]

State	No. of Streams Crossed	Streams Crossed	Total Stream Length (miles)
AZ	37	Agua Fria R., Beaver Dam Wash, Big Bug Cr., Big Sandy R., Boulder Cr., Buck Mountain Wash, Burro Cr., Castanada Wash, Castle Dome Wash, Centennial Wash, Chevelon Canyon, Clayhole Wash, Colorado R., Copper Wash, Crozier Wash, Detrital Wash, Dutchman Draw, Fourth of July Wash, Hassayampa R., Hualapai Wash, Hurricane Wash, Jackrabbit Wash, Johnson Wash, Kanab Cr., Miller Wash, Red Horse Wash, Sacramento Wash, Sycamore Cr., Tonto Cr., Tyson Wash, Vekol Wash, Verde R., Waterman Wash, West Chevelon Canyon, White Sage Wash, Willow Cr.	55
CA	20	All American Canal, Bear R., Coachella Canal, Cottonwood Cr., Coyote Wash, Deep Cr., Homer Wash, Jenny Cr., La Posta Cr., Little Dixie Wash, Long Valley Cr., Los Angeles Aqueduct, Mad R., Mojave R., Owens R., Piute Wash, Sacramento R., Secret Cr., South Fork Trinity R., Woods Wash	36
CO	41	Arkansas R., Badger Cr., Beaver Cr., Big Blue Cr., Blue R., Cebolla Cr., Cedar Cr., Clear Cr., Colorado R., Cottonwood Cr., Crooked Wash, Currant Cr., Deception Cr., Deep Channel Cr., Dolores R., Dripping Rock Cr., Dry Cr., Dry Fork Piceance Cr., East Fork Dry Cr., Fourmile Cr., Gunnison R., Hamilton Cr., Little Snake R., Lost Canyon Cr., Morapos Cr., Naturita Cr., Piceance Cr., Plateau Cr., Red Wash, Roan Cr., Rock Cr., Roubideau Cr., San Miguel R., South Arkansas Cr., Spring Cr., Stinking Water Cr., West Mancos R., White R., Williams Fork, Willow Cr., Wolf Cr.	52
ID	21	Beaver Cr., Bennett Cr., Birch Cr., Canyon Cr., Catherine Cr., Coeur d'Alene R., Deep Cr., Little Canyon Cr., Medicine Lodge Cr., Milner Gooding Canal, North Cottonwood Cr., Picket Cr., Pot Hole Cr., Rabbit Cr., Sailor Cr., Salmon Falls Cr., Sinker Cr., Snake R., South Fork Coeur d'Alene R., Squaw Cr., X Canal	15
MT	15	Big Beaver Cr., Big Hole R., Big Pipestone Cr., Boulder R., Cabin Cr., Clark Fork, Deadman Cr., Frying Pan Gulch, Grasshopper Cr., Medicine Lodge Cr., Moose Cr., Ninemile Cr., Prickly Pear Cr., Saint Regis R., Willow Cr.	31
NM	12	Betonnie Tsosie Wash, Burro Cienaga, Burro Draw, Cow Springs Draw, Escavada Wash, Farmington Glade, Nogal Canyon, Pecos R., Rio Puerco, Rio Salado, San Jose Arroyo	6
NV	45	Amargosa R., Big Spring Wash, Boulder Cr., California Wash, Carson R., Coal Mine Cr., Cottonwood Cr., Coyote Cr., Coyote Wash, Deer Cr., Duck Cr., Ellison Cr., Fortymile Wash, Granite Spring Wash, Gypsum Wash, Humboldt R., Jackson Wash, Jumbo Wash, Kane Springs Wash, Lava Beds Cr., Marys R., McDermitt Cr., Muddy R., Nelson Cr., Pahranagat Wash, Quinn R., Ragan Cr., Rock Cr., Rock Valley Wash, Salmon Falls Cr., Secret Cr., Spring Cr., Steptoe Cr., Susie Cr., Tabor Cr., Topopah Wash, Toquop Wash, Town Cr., Truckee Canal, Truckee R., Washburn Cr., White R., Willow Cr.	98

TABLE 3.5-6 (Cont.)

State	No. of Streams Crossed	Streams Crossed	Total Stream Length (miles)
UT	32	Bear Cr., Beaver R., Browns Wash, Brush Cr., Cliff Cr., Cottonwood Wash, East Canyon Wash, Floy Wash, Grassy Trail Cr., Green R., Hatch Wash, Kaibab Gulch, Little Grand Wash, Lost Spring Wash, Mill Cr., Moody Wash, Mud Spring Wash, Old Channel Sevier R., Pack Cr., Paria R., Pine Valley Wash, Price R., Saleratus Wash, Sevier R., Soldier Cr., Spanish Fork, Big Wash, Thompson Wash, Virgin R., Wah Wah Wash, Willow Cr.	44
WA	7	Beckler R., Deception Cr., Entiat R., Nason Cr., South Fork Skykomish R., Tye R., Yakima R.	5
WY	37	Alkali Cr., Barrel Springs Draw, Bitter Cr., Black Butte Cr., Black Rock Cr., Blacks Fork, Bridger Cr., Casper Cr., Currant Cr., Deadman Wash, Dry Cr., East Fork Nowater Cr., Fivemile Cr., Foster Gulch, Greasewood Wash, Green R., Greybull R., Killpecker Cr., Kirby Cr., Little Bitter Cr., Medicine Bow R., Muddy Cr., North Barrel Springs Draw, Nowater Cr., Saint Marys Cr., Salt Sage Cr., Salt Wells Cr., Sand Cr., Sand Spring Cr., Separation Cr., Sevenmile Gulch, Smiths Fork, South Fork Casper Cr., South Fork Powder R., Sugar Cr., West Branch Willow Cr.	34
Totals	285	NA[b]	390

[a] Unnamed streams are not listed. Includes perennial and intermittent streams and canals completely crossed by a corridor as well as those that may occur within the 3,500-foot corridor width but do not cross the corridor centerline.

[b] NA = not applicable.

inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

2. *Scenic river areas.* Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

3. *Recreational river areas.* Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past. Under the Federal Power Act (41 Stat. 1063), as amended (16 USC 791a et seq.), the FERC shall not license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works on or directly affecting any river that is designated as a wild and scenic river.

Four such crossings would occur under the Proposed Action (Figure 3.5-7). Three crossings would occur in Oregon (the Clackamas River, a scenic river; the Deschutes River, a recreational river; and the Sycan River, a Scenic river) and one in California (South Fork Trinity River, a Wild river). In Oregon, the total length of the

TABLE 3.5-7 Lakes and Reservoirs Intercepted by the Proposed Energy Corridors

State	Feature Name	Acres Intercepted
Arizona	Bartlett Reservoir	102
California	Ivanpah Lake	774
	Loveland Reservoir	11
	Rollins Reservoir	4
	Shasta Lake	331
	Stampede Reservoir	13
	Troy Lake	536
Colorado	Blue Mesa Reservoir	204
Idaho	Coeur d'Alene Lake	33
Montana	Clark Canyon Reservoir	63
Nevada	Colorado River	40
	Delamar Lake	484
	Dry Lake	777
	Lahontan Reservoir	289
	Unnamed Dry Lake	195
	Walker Lake	745
	Winnemucca Lake	43
New Mexico	Unnamed Dry Lake	1,300
Oregon	Clear Lake	6
	Guano Lake	602
	Warm Springs Reservoir	68
Utah	Great Salt Lake	8
	Great Salt Lake Desert	8,867
	Pruess Lake	3
	Unnamed Intermittent Lake	1,838
Wyoming	Flaming Gorge Reservoir	139

wild and scenic rivers to be crossed would be about 2 miles, including about 0.53, 0.73, and 0.76 miles on the Deschutes, Clackamas, and Sycan Rivers, respectively. In California, the length of the South Fork Trinity River to be crossed would be 2.07 miles. Except for the Deschutes River, the other three wild and scenic river crossings are not in locally designated corridors. The South Fork Trinity River crossing is along a California scenic road (Highway 36).

Surface water bodies intercepted by the proposed corridor footprints could be subject to adverse impacts due to construction, operation, maintenance, and decommissioning and dismantling activities of any future projects. The degree of impact would be determined by existing conditions within the surface water body, the level classification and valley type for the stream, and the magnitude and type of impact resulting from the activity. Appropriate mitigation measures should be employed to ensure that impacts to any wild and scenic river segments are minimized to the extent possible.

Under the Proposed Action, 287 potential intercepts of rivers, streams, man-made canals, and intermittent streams and another 26 intercepts of lakes and reservoirs would occur. These interceptions occur in a wide range of locations that have differing hydrologic, topographic, and physical properties, in addition to a number of different HLRs (see Appendix M). As shown in Figure 3.5-3, five HLRs dominate stream intercepts in the 11 continuous western states: 12 semiarid plateaus with permeable soils and impermeable bedrock — about 14%, 14 arid playas with permeable soils and bedrock — approximately 29%, 15 semiarid mountains with impermeable soils and permeable bedrock — about 9%, 17 semiarid mountains with permeable soils and bedrock — about 18%, and 18 semiarid mountains with permeable soils and impermeable bedrock — approximately 18%. The five HLRs are generally located in semiarid/arid and/or moderate to steep relief (plateaus to mountains) terrains. Potential Level 1 stream types for these HLRs include B, C, D, E, F, and G. Of these stream types, C, D, E, F, and G are sensitive to change and can be impacted by activities in the energy transport corridor.

The magnitudes of potential impacts that could be incurred with development of the projects in the proposed corridors would be related to the existing characteristics of the surface water resource affected, its sensitivity to change, the size of the change made to runoff, and the magnitude of installation activities. For similar properties and without implementing any mitigation measures, the largest areas of disturbance would produce the largest impacts. The lengths of the potential disturbed areas (that a river intercepts the proposed corridor including its buffer zone) under the Proposed Action range from less than 10 feet for the Carson River in Nevada to about 20 miles for the All American Canal in California (see Appendix M).

Surface water quality could also be affected during operation of the projects within the proposed corridors. Contaminants from surface spills, improperly stored material, and wastewater discharge could enter nearby surface waters and adversely affect their quality. In addition, sediment load in the receiving water could be affected by increases in runoff, and water temperatures could be altered by modified runoff characteristics and land-clearing operations.

The magnitudes of the impacts would be related to the types of constituents present in runoff water, their toxicity, preexisting concentrations in the receiving water, the quantity spilled or transported to the nearby surface water body, the flow in the receiving body of water, the types and quantities of bed and bank material present, and the effectiveness and timeliness of remediation activities. In general, impacts would be greatest in streams that have a small flow, streams that have little transverse and vertical mixing, and streams that have existing contamination levels that are near threshold values for environmental concern. In general, these impacts would be expected to be small, local, and temporary on the scale of this PEIS and similar to impacts observed previously from similar construction activities on federal lands. However, impacts from a large hazardous liquid spill could be large and long-lasting.

3.5.4 Following Corridor Designation, What Types of Impacts to Water Resources Could Be Produced by Project Development, and How Could These Impacts Be Minimized, Avoided, or Compensated?

3.5.4.1 What Are the Generic Impacts to Water Resources from Building and Operating Energy Transport Projects?

Groundwater and surface water resources could be similarly affected in the future following implementation of either of the two alternatives, by the construction, normal operation, maintenance, and decommissioning and dismantling of energy infrastructures within the energy corridors designated under the Proposed Action and the No Action ROWs.

Groundwater Resources. The development of energy transport projects within the energy corridors or the No Action ROWs could affect groundwater as a result of changes in the physical characteristics of affected aquifers and changes in the quality of the groundwater. Shallow groundwater (i.e., water on the order of tens of feet deep) would be affected most; deep groundwater would be affected least. Physical changes to groundwater are directly linked with the amount of recharge that an aquifer receives. Decreasing an aquifer's recharge could increase the depth of its water table (i.e., the top of the zone of saturation), change the direction of flow of the groundwater by altering the hydraulic head available, and change the volume of water flowing in the system. Similarly, increasing recharge to an aquifer could decrease the depth of the water table and change the direction and magnitude of flow in the system. The magnitudes of the impacts would be related to the hydrogeological characteristics of the aquifer (e.g., hydraulic conductivity, aquifer thickness, effective porosity [i.e., degree of connection between void spaces in the aquifer], heterogeneity, anisotropy [i.e., aquifer property that produces directionally dependent flow, etc.]), the site-specific values of recharge, and the size of the change made to the existing recharge.

Project-specific activities might also affect the quality of water in an aquifer. Dissolved contaminants from surface spills, improperly stored material, and wastewater discharge could percolate downward with infiltrating water and adversely affect underlying water quality. The magnitudes of the impacts would be related to the types and toxicity of dissolved constituents present in the infiltrating water, preexisting water quality in the aquifer, the quantity of liquids spilled, the geochemical makeup of the aquifer, and the effectiveness and timeliness of spill-control and cleanup activities. The last factor is especially important if a large spill caused by pipeline ruptures occurs.

In general, physical and chemical impacts to groundwater resources would be directly associated with the size of the disturbance. Larger impacts would be expected to be produced by corridors that have a larger footprint (i.e., area overlying the potentially affected aquifer) and a longer region of interception.

Surface Water. Surface water resources could be affected by the future development of energy transport projects within designated corridors or No Action ROWs by changes in the physical characteristics of surface water features and changes in water quality.

Physical changes to surface water resources from future project development are directly linked with runoff from the land surface. An increase in surface runoff to an unstable stream or river could produce the following impacts:

- An increase in downstream flow,
- An increase in channel width or depth,
- Erosion of the stream's bed (e.g., armoring, that is, the removal of fine material by moving water that leaves more coarse material on the stream's bed),
- Erosion of the stream's banks (e.g., bank slumping),
- Alteration of the channel morphology (e.g., avulsion, that is, a sudden change in the course of a stream or river),
- Changes in the stream's hydrograph (i.e., time-dependent flow history), and

- Changes in downstream aggradation (i.e., build up of sediment in a stream or in its banks).

Similarly, a decrease in surface runoff would decrease downstream flow, channel width, and depth; alter the stream's hydrograph; and increase downstream aggradation.

Physical changes to surface water could also be produced by directly disturbing a stream's bed. These changes could include erosion of the stream bed, alteration of the channel's morphology, and modification to downstream aggradation. Such disturbance would occur if direct burial of a pipeline occurred in the stream or could occur during directional boring at a stream crossing. The magnitude of an impact would be related to the physical characteristics of the surface water resource affected (e.g., width, depth, bed and bank materials, existing flow, stream morphology, and existing stability), the size of the change made to the existing runoff, and the degree of disturbance produced by installation activities.

Surface activities associated with the development, operation, and decommissioning of an energy transport project could also affect the quality of water in a surface water feature. Contaminants from surface spills (both particulate and dissolved), improperly stored material, and wastewater discharge could enter nearby surface waters, adversely affecting their quality. In addition, increases in runoff could affect sediment load in the receiving water, and modified runoff characteristics could alter water temperatures. The magnitudes of the impacts would be related to the types of constituents present in runoff water, their toxicity, preexisting concentrations in the receiving water, the quantity spilled or transported to the nearby surface water body, the type and quantity of bed and bank material present, and the effectiveness and timeliness of remediation activities.

The construction and placement of some pipelines, electricity transmission line support structures, and access roads, along with the establishment of temporary work areas, could occur within 100-year floodplains. E.O. 11988 requires all federal agencies to restore and preserve the natural and beneficial values served by floodplains. Permanent facilities, such as pump stations, compressor stations, or substations, would likely be located outside of floodplains. The presence of support structures and excavated soils from footings would result in the displacement of a small amount of floodplain volume and flood storage capacity of 100-year floodplains. A further assessment of potential impacts to floodplains is included in Appendix N.

As with groundwater resources, physical and chemical impacts to surface water resources would be directly associated with the size of the disturbance. Larger impacts would be expected to be produced by corridors that have a larger footprint (i.e., area intercepting surface water resources) and a longer region of interception.

3.5.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Water Resources?

Except for accidental spills, most project-specific impacts to groundwater and surface water resources would be produced by construction and dismantling activities regardless of the alternative under which a project is developed. The FERC regulates the construction of hazardous liquid pipelines within the United States; federal regulatory approval is required for developing such pipelines if they cross federal lands. Minimum standards for construction have been established to minimize impacts to the affected environment (PHMSA 2006). Similarly, mitigation measures for construction have been defined by individual states to minimize impacts to both groundwater and surface water resources from construction activities. Often, stormwater construction permits and/or pollution prevention plans must be developed prior to construction.

Some possible mitigation measures are listed below. Mitigation measures should be selected with care, particularly when potential impacts are to wild and scenic river segments or sole-source aquifers. For the wild and scenic rivers, mitigation measures should include both the measures specified in the management plans of the managing agency and the measures described below. The measures provided in the management plans address the protection and enhancement of the free-flowing nature of the wild and scenic river segment and its outstandingly remarkable values (ORVs) that represent rare, unique, or exemplary qualities that set it apart from all other rivers in the nation. They can relate to scenic, recreational, geologic, fish, wildlife, historic, cultural, or other similar features. The ORVs are river-related and site-specific values that make the river segment unique and worthy of special protection. The river-administering agency works with its partners to identify and resolve any activities adversely affecting the ORVs through a management plan. For sole-source aquifers, protection of the aquifers from being contaminated is emphasized.

The selection of mitigation measures for specific energy transport projects would be determined by specialists of the land managing agency who will be using site-specific information. The selection process should consider such factors as mitigation effectiveness, cost, availability, feasibility, and suitability for the site. Important site conditions to consider in the selection process include the amount of soil disturbance expected, anticipated weather conditions, soil type and erodibility, flow path length, the slope of the exposed soil, and conditions in the receiving waters (SCGC 2002). The mitigation measures listed here could be used to mitigate adverse impacts under No Action and the Proposed Action:

- Silt fences could be used along edges of streams and wetlands to prevent erosion and transport of disturbed soil, including spoil piles (TVA 2002). Silt fences are made of a filter fabric that has been entrenched and attached to supporting poles (and sometimes is backed by a plastic or wire mesh for support). Silt fences detain sediment-laden water and promote sedimentation behind the fence (CASQA 2003).

- Synthetic membranes or other material could be placed at the bottom of spoil piles to prevent or minimize infiltration of possibly contaminated water to underlying aquifers (PHMSA 2006).

- Removal of desirable vegetation should be minimized near residential and domestic water sources (BLM 2006a).

- Equipment or vehicles should not be washed in streams and wetlands, as doing so increases their sediment loads (BLM 2006a).

- When an herbicide/pesticide is used to control vegetation, the climate, soil type, slope, and vegetation type should be considered in determining the risk of herbicide/pesticide contamination (BLM 2006d).

- Herbicide/pesticide spray tanks should not be rinsed in or near water bodies, as doing so would contaminate the water (BLM 2006d).

- Herbicide/pesticide pellets should not be broadcast/distributed where there is danger of contaminating water supplies (BLM 2006d).

- Herbicide/pesticide treatment of areas with a high risk for groundwater contamination should be minimized (BLM 2006d).

- Appropriate herbicide-free/pesticide-free buffer zones should be used for herbicides not labeled for aquatic use, based on BLM/FS risk assessment guidance, which has minimum widths of

100 feet for aerial applications, 25 feet for applications dispersed by vehicle, and 10 feet for hand-spray applications (BLM 2006d).

- Federal regulations require that hazardous liquid pipelines be buried at least 30 inches below the surface in rural areas and deeper in more populated areas. In addition, pipelines must be buried deeper in some locations, such as at road crossings and crossings of bodies of water, and may be buried less deeply in other locations, such as when being installed in consolidated rock. The depth of burial of the line must be in accordance with federal pipeline safety regulations (PHMSA 2006).

- Cathodic protection systems should be installed along the pipeline to mitigate pipeline corrosion that could produce future environmental spills contaminating surface and/or ground water. Corrosion can be a major source of pipeline failure. The cathodic protection system imparts a current to the pipeline to offset natural soil and moisture corrosion potential. Cathodic protection systems should be inspected to ensure proper operating conditions for corrosion mitigation (TVA 2002).

- Entry and exit pits should be constructed to trap sediments from entering into streams at stream crossings. Prerequisites to excavating the entry and exit pits should include:

  – Locating the entry and exit pits far enough from stream banks and at a sufficient elevation to avoid inundation by storm flow stream levels and to minimize excessive migration of groundwater into the entry or exit pits.

  – Isolating the excavation for the entry and exit pits from the surface water by using silt fencing to avoid sediment transport by stormwater.

  – Isolating the spoils storage resulting from excavation of the entry and exit pits by using silt fencing to avoid sediment transport by stormwater.

- Sandbag trench plugs should be constructed uphill of each stream bank in the pipeline trench to prevent stormwater sediment transport from the upland trenches to the stream.

- Pipeline crossings of perennial, intermittent, and ephemeral stream channels should be constructed to withstand floods of extreme magnitude to prevent breakage and accidental contamination of runoff during high-flow events. Surface crossings must be constructed high enough to remain above the highest possible stream flows at each crossing. At a minimum, pipelines must be located above the 100-year flood elevation, and preferably above the 500-year flood elevation. Subsurface crossings must be buried deep enough to remain undisturbed by scour throughout passage of peak flows (BLM 2005b).

- Vegetated buffers on slopes could be used to trap sediment and promote groundwater recharge. The buffer width that is needed to maintain water quality ranges from 15 to 100 feet. On gradual slopes, most of the filtering occurs within the first 30 feet. Steeper slopes require a greater width of vegetative buffer to provide water quality benefits (CASQA 2003).

- Riparian vegetation could be planted and used to stabilize stream banks by increasing the tensile strength in the soil. The presence of vegetation modifies the moisture condition of slopes (i.e., infiltration, evapotranspiration, interception) and increases bank stability. Similarly, hydroseeding of banks could be used to stabilize stream banks (CASQA 2003).

- Geotextiles and mats could be used to stabilize disturbed channels and stream banks (CASQA 2003).

- Earth dikes, swales, and lined ditches could be used to divert work-site runoff that would otherwise enter a disturbed stream (CASQA 2003).

- Fiber rolls could be installed along slopes above the high-water level to intercept runoff, reduce flow velocity, release the runoff as sheet flow, and remove sediment from the runoff (CASQA 2003).

- Certified weed-free straw bale barriers could be installed to control sediment in runoff water. Straw bale barriers should only be installed where sediment-laden water can pond, thus allowing the sediment to settle out (CASQA 2003).

- Check dams (i.e., small barriers constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products) could be placed across a constructed swale or drainage ditch to reduce the velocity of flowing water, allowing sediment to settle and reducing erosion (CASQA 2003).

- Padding could be placed in a stream below the work site to trap some solids that are deposited in the stream during construction. After work is done, the padding is removed from the stream and placed on the bank to assist in revegetation (CASQA 2003).

- Clean, washed gravel could be used in construction activities to reduce solid suspension in adjacent surface waters (CASQA 2003).

- Non-stormwater management IOPs should be adopted, which are source control actions that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with stormwater. These practices involve day-to-day operations of the construction site and are usually under the control of the contractor. These IOPs are also referred to as "good housekeeping practices," which involve keeping a clean, orderly construction site (NDOT 2004).

- Waste management should be adopted for handling, storing, and disposing of wastes generated by a construction project to prevent the release of waste materials into stormwater discharges. Waste management includes the following IOPs: spill prevention and control, construction debris and litter management, concrete waste management, sanitary/septic waste management, and liquid waste management (NDOT 2004).

- Successful reclamation could ensure that construction and dismantling impacts are not permanent. During the life of the development, all disturbed areas not needed for active support of production operations should undergo "interim" reclamation in order to minimize the environmental impacts of development on other resources and uses. At final abandonment, pipelines, compressors, powerlines, and access roads must undergo "final" reclamation so that the character and productivity of the land and water are restored (DOI and USDA 2006).

3.6 AIR QUALITY

3.6.1 What Air Quality Resources Are Associated with Section 368 Energy Corridors in the 11 Western States?

3.6.1.1 What Is the Existing Climate and Meteorology?

Climate varies substantially across the 11-state area, influenced by variations in elevation, topographic features, latitude, and proximity to the ocean. In Arizona, the average number of days with measurable precipitation per year varies from nearly 70 in the Flagstaff area to 15 at Yuma. A large portion of Arizona is classed as semiarid, and long periods often occur with little or no precipitation. Humidity is low, compared to most other states. Cold air from Canada can penetrate into Arizona, bringing temperatures well below zero in the high plateau and mountainous regions in the central and northern areas of the state (WRCC 2006b).

In California, the easternmost mountain chains protect much of the state from the extremely cold air of the Great Basin. The westernmost coastal ranges offer some protection to the interior from the strong flow from the Pacific Ocean. Thus, the precipitation is heavy on the western sides of the Coast Range and the Sierra Nevada and lighter on the eastern sides. Between the eastern and western mountain chains, hot summers and moderate-to-cold winters are the rule. There are wide variations in climate along the coast. Temperatures have been recorded as low as –45°F and as high as 134°F. Annual precipitation exceeding 161 inches has been recorded, while other locations have gone for more than a year with no rain (WRCC 2006c).

Colorado has an inland continental location, and most of the state has a cool highland or mountain continental climate. In the western portion of the state, local climates are heavily influenced by elevation, and there can be wide variations within short distances. In the eastern plains, the climate is fairly uniform with low humidity, sunshine, light rain, and a large daily temperature range. Daily highs of 95 to 100°F have been recoded throughout the region, and temperatures can exceed 115°F. Usual winter extremes range from 0°F to –15°F. The rugged topography of western Colorado precludes climatic generalizations. Temperatures on snow-covered mountain tops and valleys can reach –50°F and may exceed 90°F in the summer (WRCC 2006d).

The pattern of average annual temperatures in Idaho shows the effect of both latitude and altitude. The highest annual averages occur at lower elevations in river basins. At Swan Falls, the annual mean is 55°F, highest in the state, while at Obsidian, at an elevation of 6,780 feet, the lowest annual mean is 35.4°F. Precipitation patterns are complex and generally heavier in the north than in the south. Sizeable areas receive an average of 40 to 50 inches/year, while other large areas receive less than 10 inches annually (WRCC 2006e).

The Continental Divide cuts through the western half of Montana in a north-south direction and exerts a strong influence on the climates of adjacent areas. To the west of the Divide, the climate is similar to that on the north Pacific Coast; in the west, the climate is continental. To the west, winters are milder, precipitation more evenly distributed throughout the year, summers cooler, and winds lighter than to the east. The west also has more cloudiness and higher humidity. Cold waves cover northeast parts of the state 6 to 12 times per winter, with temperatures reaching to –50°F (with a –70°F record). Summers can be hot in the eastern part of the state with temperatures over 100°F at lower elevations (with a record of 117°F). However, nights are generally cool. Precipitation varies widely and is influenced by topography. Areas near mountains tend to be wettest, but there are exceptions. The west tends to be wettest, and the north-central area the driest (WRCC 2006f).

Nevada lies on the eastern, lee side of the Sierra Nevada Range, causing its air to be warm and dry. Daily temperature ranges are caused by strong surface heating during the day and rapid nighttime cooling, due to its dry air and a temperature range between about 30 and 35°F. Summers are short and hot in the northeast with long, cold winters. Summers are short and hot with moderately cold winters in the west. In the south, summers are long and hot, and winters short and mild. Extreme cold is rare because mountains east and north of the state prevent intrusions of cold Arctic air. Summer temperatures above 100°F occur frequently in the south, and temperature extremes have ranged from 120°F to –50°F. Precipitation is lightest in the west, opposite California's Death Valley northward to Idaho. In valleys in this area, annual precipitation is less than 5 inches and reaches about 40 inches in the Sierra Nevada (WRCC 2006g).

New Mexico is divided into three major areas by mountains and highlands running generally north-south. Mean annual temperatures range from 64°F in the extreme southeast to 40°F or lower in the high mountains and valleys of the north; elevation has a greater impact on temperature than location. During the summer, daytime temperatures often exceed 100°F at elevations below 5,000 feet and range from 70 to 90°F at higher elevations. Minimum temperatures below freezing are common throughout the state during the winter; subzero temperatures are rare except in the mountains. The lowest recorded temperature was –50°F, and the highest was 116°F. Annual precipitation ranges from less than 10 inches over much of the southern desert and Rio Grande and San Juan valleys to more than 20 inches at higher elevations. Annual extremes range from 3 to 34 inches (WRCC 2006h).

The most important geographic feature affecting Oregon's climate is the Pacific Ocean on its western border. Temperatures are moderated by the presence of the ocean, which also provides abundant moisture for heavy rainfall in western Oregon and the higher elevations of the western portion of the state. Mountain ranges such as the Coast Range and Cascades also exert a strong influence on the climate. Despite moderating influences, temperature extremes have ranged form –54°F to 119°F. However, these extremes are seldom approached. In half of the years studied, no temperatures above 110°F were recorded. In January, the average temperature is 45°F, only 15°F below that of July. Average annual rainfall varies from less than 8 inches in drier plateau regions to as much as 200 inches at places along the western slopes of the Coast Range (WRCC 2006i).

Text Box 3.6-1
Wind Rose

A *wind rose* summarizes wind speed and direction graphically as a series of bars pointing in different directions. The direction of each bar shows the direction *from* which the wind blows. Each bar is divided into segments. Each segment represents wind speeds in a given range, for example, 10 to 12 miles/hour. The length of a segment represents the percentage of the summarized hours that winds blew from the indicated direction with a speed in the given range.

The topography of Utah is extremely varied, with most of the state being mountainous. Mountains run generally north-south through the middle of the state, and the Uinta Mountains run east-west through the northeast portion of the state. Mountains in the western United States result in dry air reaching Utah, resulting in light precipitation over most of the state. Temperatures vary with altitude and latitude. Temperatures below zero are uncommon in most of the state, and long extremely cold spells are rare. The lowest recorded temperature is –50°F. Daily temperature ranges widely, resulting from strong daytime insolation and rapid nocturnal cooling. Precipitation varies greatly from less than 5 inches annually west of the Great Salt Lake to more than 40 inches in some parts of the Wasatch Mountains. Areas in the south of the state below an elevation of 4,000 feet receive less than 10 inches of precipitation annually (WRCC 2006j).

Washington's location on the windward coast produces a predominantly marine climate west of the Cascade Mountains, where the climate possesses continental and marine characteristics. West of the Cascades, summers are cool and dry, and winters are mild, wet, and cloudy. The average number of clear or partly cloudy days each month varies from four to eight in winter to 15 to 20 in summer. The percent of possible sunshine received each month ranges from about 25% in winter to 60% in summer. The annual precipitation ranges from approximately 20 inches in an area northeast of the Olympic Mountains to 150 inches along the southwestern slopes of these mountains. Eastern Washington is part of the large inland basin between the Cascade and Rocky Mountains. East of the Cascades, summers are warmer, winters cooler, and precipitation less than in western Washington. The average number of clear or partly cloudy days each month varies from five to ten in winter to 20 to 28 in summer. The percent of possible sunshine received each month ranges from 20 to 30% in winter to 80 to 85% in summer. Annual precipitation ranges from 7 to 9 inches near the confluence of the Snake and Columbia Rivers to 70 to 90 inches near the summit of the Cascades (WRCC 2006k).

The Continental Divide splits Wyoming from near its northwest corner to the center of its southern border. The state's outstanding topographic features are mountains and high plains. The mountains generally run in a north-south direction, perpendicular to the prevailing westerlies; the state is semiarid east of the mountains. The state has an average elevation of 6,700 feet, and 6,000 feet excluding the mountains. Because of its elevation, Wyoming has a relatively cool climate. Above 6,000 feet, temperatures rarely exceed 100°F. The warmest portions of the state are at lower elevations. The highest recorded temperature is 114°F, while for most of the state, the mean maximum temperatures in July range between 85 and 95°F. At elevations above 9,000 feet, some places have July average maxima close to 70°F. In January, minimum temperatures range mostly from 5 to 10°F. The record low is –66°F. Precipitation varies greatly and is greater over the mountain ranges and at higher elevations. In

Text Box 3.6-2
Air Quality Terms

A *State Implementation Plan (SIP)* is developed by a state to demonstrate how it will attain and maintain the NAAQS. SIPs include the regulations, programs, and schedules that a state will impose on sources and must demonstrate to the EPA that the NAAQS will be attained and maintained. An area where air quality is above NAAQS levels is called a nonattainment area. Previously nonattaining areas where air quality has improved to meet the NAAQS are redesignated maintenance areas and are subject to an air quality maintenance plan.

Particulate matter (PM) is dust, smoke, and other solid particles and liquid droplets in the air. The size of the particulate is important and is measured in micrometers (μm). A micrometer is 1 millionth of a meter (0.000039 inch).

PM_{10} is PM with an aerodynamic diameter less than or equal to 10 μm, and $PM_{2.5}$ is PM with an aerodynamic diameter less than or equal to 2.5 μm. The EPA has set standards for PM_{10} and $PM_{2.5}$ designed to protect human health and welfare.

Criteria pollutants are pollutants for which the EPA has prepared documents detailing health and welfare impacts and set standards specifying the air concentrations that avoid these impacts. The criteria pollutants are sulfur oxides, nitrogen dioxide, carbon monoxide, PM_{10}, $PM_{2.5}$, lead, and ozone.

Volatile organic compounds (VOCs) are organic vapors in the air that can react with other substances, principally nitrogen oxides, to form ozone in the presence of sunlight.

A *glide path* is a uniform rate of visibility progress needed to attain natural visibility conditions by the year 2064.

the southwest at elevations between 6,500 and 8,500 feet, annual averages are 7 to 10 inches. At lower elevations along the eastern border at elevations between 4,000 and 5,500 feet, annual averages are from 12 to 16 inches. The driest portion of the state has an annual mean precipitation of 4 to 8 inches, and only a few locations receive as much as 40 inches per year (WRCC 2006l).

Temperature and precipitation in the region vary widely with elevation, latitude, season, and time of day. Table 3.6-1 presents historical average temperatures and precipitation at selected locations throughout the 11-state area (WRCC 2006a). Temperature extremes range from a low of 9.0°F in Sheridan, Wyoming, to a high of 105.4°F in Phoenix, Arizona. Phoenix has no recorded snowfall, while Salt Lake City, Utah, has more than 5 feet. Las Vegas, Nevada, averages only 4 inches of precipitation each year, compared to more than 3 feet in Seattle, Washington.

The predominant prevailing wind aloft is from the southwest, as in most of the United States. However, surface winds are greatly modified by local terrain and ground cover. The wind roses in Figure 3.6-1 demonstrate the variation in surface winds at heights ranging from 20 to 33 feet over a 9-state area. As shown in the figure, the prevailing wind directions vary from site to site, and the distribution of wind frequencies between the various directions is also highly site-dependent. The figure shows a wide variation in prevailing wind direction between sites, as well as substantial variation in wind speeds. Low wind speeds or calms are associated with conditions of poor atmospheric dispersion. Of the nine stations shown, three — Portland, Oregon; Sacramento, California; and Phoenix, Arizona — have calms over 10% of the time. Billings, Montana, on the other hand, has calms less than 3% of the time.

3.6.1.2 What Are Air Pollutant Levels?

Table 3.6-2 presents statewide criteria pollutant and volatile organic compound (VOC) emissions for the 11-state area (WRAP 2006). The data upon which the table is based represent six source categories: point, area, on-road vehicles, nonroad vehicles, biogenic sources, and fire. Fire sources include wildfires, prescribed burning, and agricultural burning. Biogenic emissions are naturally occurring emissions from vegetation.

What Are the Applicable Ambient Air Quality Standards? The EPA has set National Ambient Air Quality Standards (NAAQS) for criteria pollutants. Primary NAAQS specify maximum ambient (outdoor air) concentration levels of the criteria pollutants with the aim of protecting public health with an adequate margin of safety. Secondary NAAQS specify maximum concentration levels with the aim of protecting public welfare. The NAAQS specify different averaging times as well as maximum concentrations. Some of the NAAQS for averaging times of 24 hours or less allow the standard values to be exceeded a limited number of times per year, and others specify other procedures for determining compliance. Each of the 11 western states has its own State Ambient Air Quality Standards (SAAQS). If a state has no standard corresponding to one of the NAAQS, the NAAQS apply. Table 3.6-3 presents the NAAQS and the SAAQS for criteria pollutants.

The standards for criteria pollutant lead have not been included, as lead has ceased to be an issue except in localized areas, with the elimination of lead from gasoline. Several of the states have standards for additional pollutants, which have not been tabulated. Most of the state standards are identical to or more stringent than

TABLE 3.6-1 Temperature and Precipitation Summaries at Selected Meteorological Stations in and around the West-wide Energy Corridors Area[a]

		Temperature (°F)			Precipitation (inches)	
Station	State	Lowest Minimum[b]	Highest Maximum[b]	Mean[c]	Water Equivalent	Snowfall
Phoenix	AZ	41.9	105.4	74.2	7.53	0.0
Tucson	AZ	38.7	99.6	68.7	11.39	1.2
Bakersfield	CA	38.5	98.6	65.0	6.23	0.1
Los Angeles	CA	47.9	78.2	63.3	13.46	0.0
Sacramento	CA	37.9	92.8	61.1	17.30	0.0
San Diego	CA	48.0	76.3	64.4	10.26	0.0
San Francisco	CA	42.4	73.4	57.3	20.25	0.0
Denver	CO	16.9	88.1	50.1	15.50	59.8
Grand Junction	CO	16.0	92.7	51.8	8.70	21.6
Pueblo	CO	13.9	92.8	51.7	11.82	29.8
Boise	ID	22.2	90.5	51.9	11.76	19.7
Pocatello	ID	15.1	88.4	46.5	11.53	40.4
Billings	MT	13.9	86.4	47.4	14.29	57.3
Helena	MT	11.2	82.8	44.0	11.91	50.7
Albuquerque	NM	23.4	91.7	56.8	8.68	9.7
Roswell	NM	26.5	94.3	60.8	13.01	11.8
Las Vegas	NV	34.3	104.5	68.1	4.27	0.9
Reno	NV	20.5	91.4	51.3	7.32	23.1
Medford	OR	30.6	90.1	54.4	19.08	6.9
Portland	OR	33.9	79.8	53.5	37.49	6.6
Salt Lake City	UT	20.4	92.6	52.0	15.71	60.3
St. George	UT	25.8	101.7	63.2	8.27	3.2
Seattle	WA	34.9	75.1	52.3	38.04	11.8
Spokane	WA	21.6	83.9	47.3	16.06	41.0
Casper	WY	12.8	87.6	44.9	11.88	77.3
Cheyenne	WY	15.6	82.6	44.9	15.17	55.2
Sheridan	WY	9.0	86.4	44.5	14.63	71.7

[a] Summary data presented in the table are based on the period of record from inception of the meteorological station to Dec. 31, 2005.

[b] "Lowest Minimum" denotes the lowest monthly average of daily minimum during the period of record, which normally occurs in January. "Highest Maximum" denotes the highest monthly average of daily maximum during the period of record, which normally occurs in July.

[c] National Climatic Data Center (NCDC) 1971 to 2000 monthly normals.

Source: WRCC (2006a).

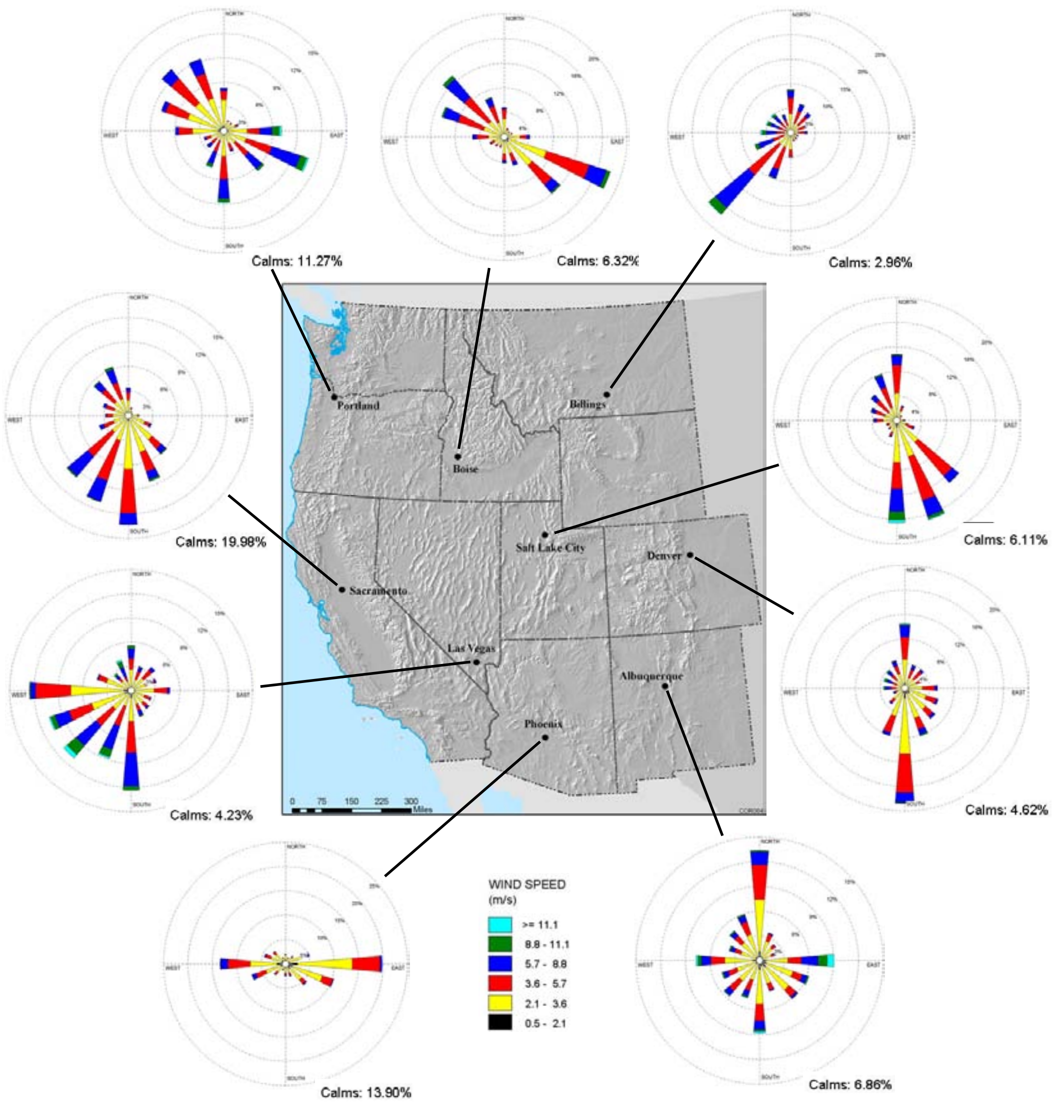


FIGURE 3.6-1 Wind Roses for Selected Meteorological Stations in and around the West-wide Energy Corridors Area, 1990 to 1995 (Source: NCDC 1997)

NAAQS. Arizona, California, Colorado, Montana, Nevada, Oregon, and Washington have retained some form of a 1-hour ozone standard, most of them being identical to the old ozone NAAQS. California, Montana, and New Mexico also have short-term (1- or 24-hour) nitrogen dioxide (NO_2) standards for which there are no corresponding NAAQS. Three of the states have sulfur oxide standards for averaging times without corresponding NAAQS.

Where Are Ambient Air Quality Standards Not Being Attained? Parts of the 11-state area have not yet attained the NAAQS. Figures 3.6-2 to 3.6-6 show these nonattainment areas except for lead and 1-hour ozone. (Montana had a lead nonattainment area, but the source causing the problem has closed, and the area is expected to be redesignated as an attainment area.) There are currently no nonattainment areas for the annual NO_2 NAAQS

TABLE 3.6-2 Statewide Criteria Pollutant and VOC Emissions

	Statewide Emissions (10^3 tons/year)					
State	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO
Arizona	2,984	417	138	319	178	3,687
California	5,441	1,112	108	361	224	8,702
Colorado	1,619	412	118	349	173	3,474
Idaho	1,724	133	27	137	44	1,110
Montana	1,874	209	475	798	152	1,006
Nevada	1,445	151	66	97	28	878
New Mexico	1,928	375	84	166	60	1,287
Oregon	2,643	291	579	616	373	5,205
Utah	1,324	245	59	953	498	1,600
Washington	1,705	372	34	408	149	3,016
Wyoming	1,077	286	147	111	60	856

Source: WRAP (2006).

in the United States.[2] One area in Colorado is still subject to the old 1-hour ozone NAAQS. This area will be become subject to the current 8-hour ozone standard by the end of 2007. PM_{10} accounts for more nonattainment areas than any other criteria pollutant. Washington has no nonattainment areas, while Montana has nonattainment areas for four criteria pollutants (PM_{10}/$PM_{2.5}$, CO, SO_2, and Pb).

What Is General Conformity? Federal departments and agencies are prohibited from taking actions in nonattainment and maintenance areas unless they first demonstrate that the actions would conform to the SIP as it applies to criteria pollutants. Transportation-related projects are subject to requirements for transportation conformity. Permitting, approving, and funding are among the covered actions and are subject to requirements for general conformity. A BLM grant of a lease and the conditioning of emissions-producing activities in a lease would require addressing conformity for sources located in nonattainment and maintenance areas. Conformity addresses only those criteria pollutants for which the area is nonattainment or maintenance (VOCs and NO_x for ozone). If annual source emissions[3] are below specified threshold levels, no conformity determination is required. If the emissions exceed the threshold, a conformity determination must be undertaken to demonstrate how the action will conform to the SIP. The demonstration process includes public notification and response and may require extensive analysis.

2 Nitrogen oxides (NO_x), an ozone precursor, are primarily emitted from vehicles and fuel combustion. Ozone (O_3) is produced in the atmosphere as a result of chemical reactions involving NO_x and VOCs. Conditions conducive to high ozone concentrations include high temperatures, low wind speeds, intense sunlight, and an absence of precipitation. Urban centers tend to be NO_x-rich/VOC-limited (adding VOC may increase ozone whereas adding NO_x may not). Most other areas in the United States tend to be NO_x-limited/VOC-rich (adding NO_x may increase O_3 levels whereas adding VOC may not).

3 The annual emissions of the pollutant of interest must include both direct and indirect emissions such as worker traffic.

TABLE 3.6-3 National Ambient Air Quality Standards (NAAQS) and State Ambient Air Quality Standards (SAAQS) for Criteria Pollutants[a]

Pollutant	Averaging Time	NAAQS[b] Primary	NAAQS[b] Secondary	Arizona Primary	Arizona Secondary	California	Colorado	Idaho Primary	Idaho Secondary
CO	8-hour	9 ppm (10 mg/m^3)	–[c]	9 ppm (10 mg/m^3)	–[c]	9.0 ppm (10 mg/m^3) 6 ppm (7 mg/m^3)[d]	10 mg/m^3	9 ppm (10 mg/m^3)	–[c]
	1-hour	35 ppm (40 mg/m^3)	–	35 ppm (40 mg/m^3)	–	20 ppm (23 mg/m^3)	40 mg/m^3	35 ppm (40 mg/m^3)	–
NO_2	Annual	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	0.030 ppm (56 μg/m^3)	100 μg/m^3	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)
	24-hour	–	–	–	–	–	–	–	–
	1-hour	–	–	–	–	0.18 ppm (338 μg/m^3)	–	–	–
PM_{10}	Annual	–	–	–	–	20 μg/m^3	50 μg/m^3	–	–
	24-hour	150 μg/m^3	150 μg/m^3	150 μg/m^3	150 μg/m^3	50 μg/m^3	150 μg/m^3	150 μg/m^3	150 μg/m^3
$PM_{2.5}$	Annual	15.0 μg/m^3	15.0 μg/m^3	15.0 μg/m^3	15.0 μg/m^3	12 μg/m^3	–	15.0 μg/m^3	15.0 μg/m^3
	24-hour	35 μg/m^3	35 μg/m^3	35 μg/m^3	35 μg/m^3	–	–	35 μg/m^3	35 μg/m^3
Ozone	8-hour	0.08 ppm (235 μg/m^3)	0.08 ppm (235 μg/m^3)	0.08 ppm (235 μg/m^3)	0.08 ppm (235 μg/m^3)	0.070 ppm (137 μg/m^3)	–	0.08 ppm (235 μg/m^3)	0.08 ppm (235 μg/m^3)
	1-hour	0.12 ppm (157 μg/m^3)	0.12 ppm (157 μg/m^3)	0.12 ppm (157 μg/m^3)	0.12 ppm (157 μg/m^3)	0.09 ppm (180 μg/m^3)	235 μg/m^3	0.12 ppm (157 μg/m^3)	0.12 ppm (157 μg/m^3)
Sulfur oxides	Annual	0.03 ppm (80 μg/m^3)	–	0.03 ppm (80 μg/m^3)	–	–	–[e]	0.03 ppm (80 μg/m^3)	–
	24-hour	0.14 ppm (365 μg/m^3)	–	0.14 ppm (365 μg/m^3)	–	0.04 ppm (105 μg/m^3)	–[e]	0.14 ppm (365 μg/m^3)	–
	3-hour	–	0.5 ppm (1,300 μg/m^3)	–	0.5 ppm (1,300 μg/m^3)	–	700 μg/m^3 [e]	–	0.5 ppm (1,300 μg/m^3)
	1-hour	–	–	–	–	0.25 ppm (655 μg/m^3)	–	–	–

TABLE 3.6-3 (Cont.)

Pollutant	Averaging Time	Montana	Nevada	New Mexico	Oregon	Utah	Washington	Wyoming
CO	8-hour	9 ppm	10,000 μg/m^3 (9 ppm)[f] 6,670 μg/m^3 (6 ppm)[g]	8.7 ppm	9 ppm	9 ppm	9 ppm	10 mg/m^3 (9 ppm)
	1-hour	23 ppm	40,000 μg/m^3 (35 ppm)	13.1 ppm	35 ppm	35 ppm	35 ppm	40 mg/m^3 (35 ppm)
NO_2	Annual	0.05 ppm	100 μg/m^3 (0.05 ppm)	0.05 ppm	0.053 ppm	0.053 ppm	0.05 ppm	100 μg/m^3 (0.05 ppm)
	24-hour	–	–	0.01 ppm	–	–	–	–
	1-hour	0.30 ppm	–	–	–	–	–	–
PM_{10}	Annual	50 μg/m^3	50 μg/m^3	–	–	50 μg/m^3	50 μg/m^3	50 μg/m^3
	24-hour	150 μg/m^3	150 μg/m^3	–	150 μg/m^3	150 μg/m^3	150 μg/m^3	150 μg/m^3
$PM_{2.5}$	Annual	–	–	–	–	15 μg/m^3	15 μg/m^3	15 μg/m^3
	24-hour	–	–	–	–	65 μg/m^3	65 μg/m^3	65 μg/m^3
Ozone	8-hour	–	–	–	–	0.08 ppm	–	0.08 ppm
	1-hour	0.10 ppm	235 μg/m^3 (0.12 ppm) 195 μg/m^3 (0.10 ppm)[h]	–	0.12 ppm	–	0.12 ppm	–
Sulfur oxides	Annual	0.02 ppm	80 μg/m^3 (0.03 ppm)	0.02 ppm[i]	0.02 ppm	0.03 ppm	0.02 ppm	60 μg/m^3 (0.02 ppm)
	24-hour	0.10 ppm	365 μg/m^3 (0.14 ppm)	0.10 ppm[i]	0.10 ppm	0.14 ppm	0.1 ppm	260 μg/m^3 (0.10 ppm)
	3-hour	–	1,300 μg/m^3 (0.5 ppm)	–[i]	0.50 ppm	0.5 ppm	–	1,300 μg/m^3 (0.50 ppm)
	1-hour	0.50 ppm	–	–	–	–	0.4 ppm	–

Footnotes on next page.

TABLE 3.6-3 (Cont.)

---

[a] Attainment determination criteria for each state are similar to those for the NAAQS. For simplicity, attainment determination criteria for NAAQS are presented only in footnote b. For detailed attainment determination criteria for a state of interest, refer to references below used in developing this table. Several of states have the standards for additional pollutants (e.g., H_2S for Wyoming), that have not been presented in this table; also refer to the references below for additional pollutants for each state of interest.

[b] Short-term (≤ 24-hour) standards for CO and SO_2 are not to be exceeded more than once per year, and annual averages for NO_2 and SO_2 are not to be exceeded in a calendar year. For PM_{10}, the 24-hour standard is attained when the expected number of exceedances is less than or equal to one per year on average over 3 years. For annual-average $PM_{2.5}$, the standard is attained when the 3-year average of the weighted annual mean concentrations from single or multiple community-oriented monitors does not exceed the standard. For 24-hour average $PM_{2.5}$, the standard is attained when the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area do not exceed the standard. For 8-hour O_3, the standard is attained when the 3-year average of the fourth-highest daily maximum 8-hour average concentrations measured at each monitor within an area over each year do not exceed the standard. For 1-hour O_3, the standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is less than or equal to one. As of June 15, 2005, the EPA revoked the 1-hour O_3 standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) Areas, one of which includes Denver and its surrounding counties only in the WWEC area. These areas will need to comply with the 8-hour ozone standards by the end of 2007. Note that, effective December 17, 2006, the EPA revoked the annual-average PM_{10} standard of 50 $\mu g/m^3$ and revised the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.

[c] Unless otherwise indicated, dash = no standard.

[d] Lake Tahoe.

[e] Colorado has also established increments limiting the allowable increase in ambient concentrations over an established baseline.

[f] Below 5,000 feet above sea level.

[g] Above 5,000 feet above sea level.

[h] Lake Tahoe Basin.

[i] Different standards apply within 3.5 miles of the Chino Mines Company smelter furnace stack at Hurley (0.03 ppm annual; 0.14 ppm 24-hour; 0.50 ppm 3-hour).

Sources: Arizona Department of Environmental Quality (2007); California Air Resources Board (2007); Colorado Department of Public Health and Environment (2007); EPA (2006a); Idaho Department of Environmental Quality (2007); Montana Department of Environmental Quality (2007); Nevada Division of Environmental Protection (2007); New Mexico Environmental Department (2007); Oregon Department of Environmental Quality (2007);Utah Department of Environmental Quality (2007); Washington Department of Ecology (2007); Wyoming Department of Environmental Quality (2007).

What Is Prevention of Significant Deterioration (PSD)? While the NAAQS (and SAAQS) place upper limits on the levels of air pollution, PSD regulations applying to attainment areas place limits on the total increase in ambient pollution levels above established baseline levels for SO_2, NO_2, and PM_{10}, thus preventing "polluting up to the standard" (see Table 3.6-4). These allowable increases are smallest in Class I areas such as national parks and wilderness areas. The rest of the country is subject to larger Class II increments. States can choose a less stringent set of Class III increments, but none have done so. Major (large) new and modified stationary sources must meet the requirements for the area in which they are locating and any areas they impact. Thus, a source locating in a Class II area near a Class I area would need to meet the more stringent Class I increment in the Class I area and the Class II increment elsewhere, as well as any other applicable requirements.

TABLE 3.6-4 Federal PSD Increments

Pollutant	Averaging Time	PSD Increment (μg/m^3) Class I	Class II
SO_2	3 hours	25	512
	24 hours	5	91
	Annual	2	20
NO_2	Annual	2.5	25
PM_{10}	24 hours	8	30
	Annual	4	17

Source: 40 CFR 52.21.

In addition to capping increases in criteria pollutant concentrations below the levels set by the NAAQS, the PSD program mandates stringent control technology requirements for new and modified major sources. In Class I areas, federal land managers (FLMs) are responsible for protecting the areas' air quality-related values (AQRVs), such as scenic, cultural, biological, and recreational resources. As stated in the Clean Air Act (CAA), the AQRVs test requires the FLM to evaluate whether the proposed project will have an adverse impact on the AQRVs, including visibility. Even if PSD increments are met, if the FLM determines that there is an impact to an AQRV, the permit may not be issued. Figure 3.6-7 shows the locations of Class I PSD areas in the 11 western states.

How Is Visibility Protected? Visibility was singled out for particular emphasis in the Clean Air Act Amendments (CAAA) of 1977. Visibility in a Class I area is protected under two sections of the CAA. Section 165 provides for the PSD program (described above) for new sources. Section 169(A), for older sources, describes requirements for both reasonably attributable single sources and regional haze requirements which address multiple sources. FLMs have a particular responsibility to protect visibility in Class I areas. Even sources locating outside a Class I area may need to obtain a permit that assures no adverse impact on visibility within the Class I area, and existing sources may need to retrofit controls.

In 1999, EPA issued the final Regional Haze Rule. This rule sets a national visibility goal for preventing future and remedying existing impairment to visibility in Class I areas. The rule is designed to reduce visibility impairment from existing sources and limit visibility impairment from new sources. States with Class I areas or states affecting visibility in Class I areas must revise their SIPs by 2007, prepare emission reduction strategies to reduce regional haze, and establish glide paths for each Class I area. States are required to periodically review where they fall within the glide path to determine whether they are making reasonable progress toward meeting the goal of natural conditions by 2064.

The Interagency Monitoring of PROtected Visual Environments (IMPROVE) program was established in 1985 to aid in the development of federal and state plans for protection of visibility in Class I areas. The IMPROVE data are also used to help determine the glide path, and will continue to be used to evaluate reasonable progress. Visibility in some of the Class I areas in the 11 western states is the best in the coterminous United States, with areas such as Bryce Canyon, Yellowstone, Crater Lake, and Canyonlands having mid-range visibilities reaching 100 miles. That this area enjoys some of the best visibility conditions in the country makes it more sensitive to changes in visibility than anywhere else.

3.6.2 How Were the Potential Impacts to Air Resources of Corridor Designation Evaluated?

Impacts would not be expected as a result of corridor designation and land use plan amendments. Rather, impacts would occur only with the construction, operation, and decommissioning of specific energy transport projects. Potential air resource impacts of specific projects need to be assessed on the basis of local air quality and the anticipated extent and duration of construction, operation, and decommissioning. Additionally, all project-specific activities need to be carried out in compliance with the applicable SIP, the leasing stipulations, and other applicable regulations.

Specific projects will be subject to air impact analyses under the NEPA and state regulations when they are proposed.

3.6.3 What Are the Potential Impacts to Air Resources of the Alternatives, and How Do They Compare?

Air resources in the western states are not expected to be impacted by the designation of energy corridors on federal lands or by amendment of land use plans. Air resources would be affected by the construction, operation, and decommissioning of specific energy transport projects. The following discussions address potential air resource impacts that could be incurred with the development of energy transport projects under each of the alternatives evaluated in this PEIS. Detailed air analyses would be conducted as part of project-specific environmental assessments, and are outside the scope of this PEIS.

3.6.3.1 What Are the Potential Impacts of the No Action Alternative?

The principal air impacts of concern are associated with the operation of natural gas compressor stations powered by gas turbines or reciprocating engines. Under No Action, impacts associated with compressor stations, as well as many of the other generic air impacts identified for the construction (such as fugitive dust) and operation of energy transport systems, would occur for each individual project and along project-specific designated energy corridors and project-specific ROWs on both federal and nonfederal lands.

Under No Action, individual project proponents may be expected to independently identify preferred routes and project designs, and implementation of projects would likely not occur within a single energy corridor, but rather along multiple, widely spaced energy transport ROWs. Without colocation, individual project ROWs and associated infrastructure (such as compressor stations) may be expected to be more widely spaced from one another than if colocated within a single energy corridor. All other factors being equal, reducing the spacing between similar air emission sources would generally increase the maximum air quality impacts. Thus, the wider separation of the individually sited energy transport projects that could occur under No Action could result in lower air quality impacts (all other factors being equal) than the impacts of the projects colocated within a single energy corridor. Alternatively, the wider separation of individual projects that could occur under No Action could increase the total area impacted.

In the absence of dedicated West-wide energy corridors and an associated expedited permitting process, there could be increased siting of energy transport ROWs on nonfederal lands and a concomitant shift of potential impacts to air quality associated with the ROWs on those lands. If increased use of nonfederal lands occurs, a greater number of compressor stations could be located on nonfederal lands with a corresponding shift in air quality impacts.

3.6.3.2 What Are the Potential Impacts of the Proposed Action?

Designation of Section 368 energy corridors and land use plan amendments under the Proposed Action are not expected to impact air resources within or adjacent to the designated energy corridors or ROWs on nonfederal or other federal lands. Air resources would only be affected with the construction, operation, and decommissioning of specific energy transport projects within designated corridors on federal lands and ROWs on other federal and nonfederal lands.

3.6.3.3 How Do the Potential Impacts Compare among the Alternatives?

The impacts to air resources under No Action would be the usual impacts associated with the construction, operation, and decommissioning of individual energy transport projects as described in Section 3.6.4.1.

Designating Section 368 energy corridors and land use plan amendments under the Proposed Action would result in no impacts to air resources.

3.6.3.4 What Mitigation Measures Might Be Applied to Reduce Impacts to Air Resources if Section 368 Corridors Are Designated?

The mitigation measures described in Section 3.6.4.2 would be available to reduce impacts to air resources caused by individual energy transport projects on federal and nonfederal lands as required to comply with applicable regulations or leasing requirements.

Since there are no impacts to air resources, no mitigation measures would be required for designating Section 368 energy corridors under the Proposed Action.

3.6.4 Following Corridor Designation, What Types of Impacts Could Result to Air Resources with Project Development, and How Could They Be Minimized, Avoided, or Compensated?

The construction, operation, and decommissioning of energy transport projects would affect air resources regardless of project location. The following sections discuss the types of project development activities that would affect air resources on both federal and nonfederal lands and the mitigation measures that might be applied to minimize, avoid, or compensate for potential air impacts from energy transport projects.

3.6.4.1 What Are the Usual Impacts to Air Resources of Building, Operating, and Decommissioning Energy Transport Projects?

The following sections describe the usual impacts to air resources of building, operating, and decommissioning energy transport projects. Discussions of potential impacts that could result from projects in designated corridors follow the discussions of the usual impacts.

How Can Construction of Energy Transport Projects Affect Air Resources? Before beginning a construction project, a construction permit from the state or local air agency is generally required. Most jurisdictions do not require modeling of air quality impacts, since the air impacts of construction projects are temporary and local. Instead, agencies condition the permit to require that certain mitigation practices be conducted. The cognizant agency should be contacted prior to beginning construction or any on-site activities, including testing and decommissioning. Agencies may also have special regulations for temporary, portable concrete batch plants that might be used during construction of tower footers or pads for compressors and pump stations.

Certain activities are common to most or all phases of the construction of transmission lines, liquid pipelines, and gas pipelines whether in designated corridors or ROWs. Table 3.6-5 identifies these generic activities and the pollutants they produce. Text Box 3.6-3 focuses on vehicle emissions.

Text Box 3.6-3
Vehicle Emissions

Vehicles include both light-duty vehicles, such as cars, vans, and pickups, and heavy-duty vehicles, such as trucks, and construction equipment, such as bulldozers. Vehicles can be powered by either gasoline or diesel engines. There are two sources of emissions associated with vehicles: tailpipe emissions and emissions from dust that becomes airborne as the vehicle passes, so-called fugitive dust or reentrained road dust. Tailpipe emissions include CO, NO_x, PM_{10}/$PM_{2.5}$, SO_2, and VOCs. The reentrained dust is primarily PM_{10}. On dirt roads, the reentrained dust exceeds the tailpipe emissions.

Table 3.6-6 lists the principal tasks associated with the construction of an electricity transmission line and a liquid or gas pipeline. Many of the activities are similar, the differences being in scope and intensity. Excavation for transport towers and pipeline trenching are similar in that both involve earthmoving and can produce similar pollutants,

TABLE 3.6-5 Emissions from Generic Activities Associated with Construction

Activity	Pollutants
Vehicular traffic (from tailpipe)	CO, NO_x, particulates (PM_{10}/$PM_{2.5}$), SO_2, and VOCs
Vehicle fugitive dust from roads	Particulates
Construction fugitive dust from earthmoving activities	Particulates
Construction equipment exhaust	CO, NO_x, particulates, SO_2, and VOCs
Concrete batch plant[a]	Particulates
Emergency generators[a]	CO, NO_x, particulates, SO_2, and VOCs

[a] May not be present in all designated corridors or ROWs.

Source: EPA (2004b).

TABLE 3.6-6 Major Tasks Associated with Construction of an Energy Transport System

Electricity Transmission Line	Pipeline
Surveying	Surveying
Develop staging areas	Develop storage and staging areas
Material storage	Material storage
Develop access roads	Develop access roads
Clear sites for structures	Clearing and grading
Excavation for tower foundations	Trenching
Tower assembly	Pipe stringing, bending, and welding
String conductors	Lower assembled pipe and backfill
Construct substations	Construct pump or compressor stations

Sources: ANL (2007a,b).

primarily particulates. Tower assembly and pipe stringing, bending, and welding are unique to their associated energy transport systems. The following activities and emissions are associated with these activities (EPA 2004b):

- Vehicle traffic on access roads (tailpipe emissions and reentrained road dust);
- Removal of vegetative cover from corridors and ROWs, staging areas, and storage areas (primarily NO_x, CO, and VOCs from power equipment and mowers);
- Vehicle traffic for delivery of tower sections, pump station components, and compressor station components (diesel tailpipe emissions and fugitive road dust);
- Construction of access roads involving excavation, moving soils, and grading (primarily tailpipe emissions from diesel- and gasoline-powered construction equipment; fugitive dust from earthmoving);
- Excavation of soils (primarily tailpipe emissions from diesel-powered construction equipment; fugitive dust from earthmoving);
- Storage of removed topsoil, subsurface soil, required construction materials, and fuels in storage piles, yards, and tanks (primarily particulates from storage piles of loose, unconsolidated materials and VOCs from fuel storage);
- Grading within the corridor or ROW (primarily tailpipe emissions from diesel-powered construction equipment; fugitive dust from earthmoving);
- Operation of construction equipment including loaders, graders, trucks, dozers, cranes, and rippers (primarily tailpipe emissions from diesel- and gasoline-powered construction equipment; fugitive dust from earthmoving);
- Boring, and possibly pile driving, for foundations (primarily tailpipe emissions from diesel-powered construction equipment; fugitive dust from boring operations);
- Blasting, if required in rocky ground (small amounts of CO, NO_x, and particulates);
- Construction of laydown areas, staging areas, and storage areas (primarily

tailpipe emissions from diesel- and gasoline-powered construction equipment; fugitive dust from earthmoving);

- Possible installation and operation of portable concrete batch plants and preparation of the associated storage areas for sand, cement, and aggregate (construction emissions as noted above and fugitive particulates from storage piles and concrete truck travel);

- Backfilling of tower bases and trenches with powered construction equipment (primarily tailpipe emissions from diesel- and gasoline-powered construction equipment; fugitive dust from earthmoving);

- Possible use of on-site generators (primarily CO, NO_x, $PM_{10}/PM_{2.5}$, VOC);

- Pouring concrete, including the operation of ancillary equipment such as mixers, vibrators, and concrete pumps by small, portable generating units (CO, NO_x, $PM_{10}/PM_{2.5}$, VOC); and

- Construction of ancillary facilities such as substations, compressor stations, and pump stations (all emissions associated with the foregoing construction activities).

The pollutant of greatest concern from construction is particulate from fugitive dust caused by soil handling and by soil disturbances by vehicular traffic and construction equipment on bare soil surfaces. Windblown dust is also a concern at construction sites. Most air pollution control requirements attached to construction permits call for measures to control particulate emissions, primarily fugitives from earthmoving activities. Diesel equipment is the greatest source of tailpipe emissions. On-site power from diesel- and gasoline-powered generators would result in emissions of the same pollutants as tailpipe emissions but in smaller quantities.

What Might Be the Potential Construction Impacts of Specific Projects under the Proposed Action? The usual air quality impacts just discussed would be incurred during potential construction in corridors designated under Section 368. Construction emissions and their impacts could occur anywhere along up to 6,055 miles of the proposed corridor segments and ROWs on other federal and nonfederal lands. At the level of this PEIS, total emissions could not be estimated. Construction emissions would depend upon the lengths of pipelines and transmission lines and the numbers of pump and compressor stations built. Impacts would depend on the timing of multiple projects colocated in the same corridor segment and the types of energy transport systems being built. Construction impacts on nonfederal and other federal lands would be similar.

How Can Operation of Energy Transport Projects Affect Air Resources? Two approaches were used to assess the air impacts of energy transport system operations: dispersion modeling and a determination of the proximity to special areas where air quality and AQRVs need to be protected. Since detailed site-specific data and specific locations were not available at the programmatic level for this PEIS, modeling was conducted for representative compressors using simplified assumptions. Proximity analyses were conducted for designated corridors to determine the lengths of corridors which run through or near nonattainment and PSD Class I areas, respectively.

Impacts were assessed for the gas compressors at the compressor stations on gaseous fuel pipelines. The pumps at liquid fuel pumping stations would be powered by electric motors that were not considered air emissions sources. Other sources at the stations could be neglected in a programmatic assessment but would be included in a detailed site-specific analysis or permit application. Transmission of electricity produces no emissions except for a small amount of ozone from corona discharge.

Air quality impact estimates that could be compared with standard concentration levels were calculated using the AERMOD model (EPA 2004a), which is currently EPA's preferred model for use in situations such as compressor stations (Appendix W – "Guideline on Air Quality Models," 40 CFR 51, Nov. 9, 2005). Two compressors generally operate simultaneously at a pump station and were assumed to operate continuously throughout the year. Flat terrain was assumed. Emissions and stack or release data were based on ANL (2007b). Meteorological data for Salt Lake City, Utah, were used (NCDC 1997; WebMET.com 2006).

The values specified in the NAAQS and the PSD increments represent impacts of potential concern, with the NAAQS representing potential human health and welfare impacts and the PSD increments representing pollution increases above existing levels. Concentrations from operating compressors were compared to the NAAQS and PSD levels to assess their air quality impacts.

Major sources[4] are subject to stringent PSD requirements and even more stringent requirements if located in areas where air quality is above national standards (nonattainment areas). Whether compressor stations would constitute major sources cannot be determined without specific information about their locations and configurations. In this PEIS, a proximity analysis was conducted to determine whether corridors pass close to or through nonattainment areas (NAAs) or PSD Class I areas. Proximity to these areas would indicate the need for special attention and perhaps additional mitigating requirements even if the stations were not major. (If a station was major, it would need to satisfy PSD requirements under existing permit programs.)

Potential impacts associated with NAAs were assessed using a GIS analysis to find the lengths of corridors on federal lands that pass through NAAs in each state. Stringent emission and offset requirements apply in NAAs and lead to additional siting constraints in these areas.

Potential impacts associated with PSD areas were assessed using a GIS analysis to find the lengths of corridors on federal lands that pass within 1.5 miles of any Class I area. Stringent limitations on increases in pollutant concentrations apply in PSD Class I areas and may lead to additional siting constraints for sources impacting these areas.

The 1.5-mile distance was chosen by modeling the distances from an uncontrolled operating compressor station at which the PSD Class I increments would be met. The greatest distance was somewhat less than 1.5 miles for the NO_2 increment. This estimate may be a worst case, as emission controls will probably be required on compressor engines. However, the full increment may not be available in a specific location, as other nearby sources may consume part of the increment and part of it may be reserved for future growth.

Table 3.6-7 compares the results of the air impact modeling with the values specified in the NAAQS and PSD Class I increments. None of the maximum concentrations exceed the

---

4 Roughly speaking, a major source is one that "has the potential to" emit 250 tons/year (100 tons/year for specified sources) or more of regulated pollutants. An entire compressor station with three compressors and the associated equipment would probably be considered a source. Whether such a station would be major is a site-specific consideration depending upon many factors including the type of engines chosen to power the compressors, emission controls, if any, and the conditions under which the "potential to emit" is determined. The two compressor engines considered in this PEIS are close to, but below, the major source size for NO_x.

TABLE 3.6-7 Modeled Air Quality Impacts of Compressor Stations

Averaging Time	Maximum Concentration (μg/m³)[a]					Percentage of NAAQS[b]					Percentage of PSD Class I Increments[c,d]		
	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	PM_{10}
1 hour	–[e]	–	–	–	38.3	–	–	–	–	0.1	–	–	–
3 hours	–	1.0	–	–	–	–	0.08	–	–	–	–	4.2	–
8 hours	–	–	–	–	32.7	–	–	–	–	0.3	–	–	–
24 hours	–	0.74	4.8	4.8	–	–	0.2	3.2	13.7	–	–	14.8	60
Annual	10.3	0.07	–	0.90	–	10.3	0.09	–	6.0	–	412	3.5	11

[a] Modeled for two operating compressors, using meteorological data from Salt Lake City and assuming flat terrain and no building downwash.

[b] Table 3.6-3 presents the NAAQS.

[c] Table 3.6-4 presents the federal PSD increments.

[d] No modeled concentrations exceeded the federal PSD Class II increment values.

[e] – = no corresponding standard or increment value.

NAAQS values or the PSD Class II increment values. However, annual NO_x concentrations exceed the PSD Class I increment values. Examination of all calculated concentrations indicates that NO_x concentrations would fall below the increment value within 1.1 miles of the source. There is thus an indication that compressor stations might have difficulty locating within 1 to 2 miles of a PSD Class I area and that NO_x impacts deserve close scrutiny when compressor stations are within that distance of Class I areas. This estimate may be a worst case estimate, as emission controls will probably be required on compressor engines. However, the full increment may not be available in a specific location, as other nearby sources may consume part of the increment and part of it may be reserved for future growth.

What Might Be the Potential Operations Impacts of Specific Projects under the Proposed Action? Operational emissions would depend upon the mix of technologies deployed and on the proximity of the emission sources if multiple transport systems were deployed in the same corridor segment or ROW. Under the Proposed Action, these impacts could occur anywhere along up to 6,055 miles of designated corridor segments on federal lands and in ROWs on other federal and nonfederal lands.

Table 3.6-8 presents the results of the PSD and nonattainment analyses for the Proposed Action. No corridor segments in Colorado, Montana, New Mexico, Oregon, Washington, or Wyoming would cross nonattainment areas. Nevada would be the only state with more than a mile of corridor segments in SO_2 nonattainment areas. Five states would have corridor segments in PM_{10} nonattainment areas. Three states would have corridor segments in ozone nonattainment areas. NO_x emissions from a specific project (e.g., natural gas combustion) could contribute to O_3 formation, especially in remote areas characterized by VOC-rich/NO_x-limited environments. Depending on the VOC/NO_x ratio in the ambient air, a specific energy transport project could either impede a shift from nonattainment to attainment or, less probably, foster a shift from attainment to nonattainment.

No detailed information on specific projects is available at this PEIS level, and thus a quantitative analysis including regional-scale ozone modeling was not undertaken. However, when detailed information is available, O_3 impact analyses should be undertaken in conjunction with site-specific Environmental Impact Statements (EISs) for specific projects.

Six states would have corridor segments within 1.5 miles of a Class I PSD area under the Proposed Action.

Without specific proposed routes, a similar analysis could not be conducted for energy transport projects in ROWs on nonfederal and other federal lands.

How Can Decommissioning of Energy Transport Projects Affect Air Resources? Decommissioning is essentially the reverse of construction, and its impacts were addressed based on the construction results. However, no emission estimates were made, as emissions would be reduced and of shorter duration than emissions associated with construction.

What Might Be the Potential Air Resource Impacts of Decommissioning Specific Projects under the Proposed Action? Activities for decommissioning would be similar to those used for construction but on a more limited scale and duration (see discussion of potential construction impacts above). Impacts would be correspondingly less. Leaving buried pipelines in place would reduce the amount of trenching and soil disturbance required for decommissioning and contribute to reduced impacts relative to construction. Under the Proposed Action, these impacts could occur anywhere along up to 6,055 miles of designated corridor segments on federal lands and in ROWs on other federal and nonfederal lands.

TABLE 3.6-8 Length of Corridor Segments in Nonattainment Areas and near PSD Class I Areas under the Proposed Action

State	Length of Corridor Segments in Nonattainment Areas (miles)				Length of Corridor Segments within 1.5 Miles of PSD Class I Areas (miles)
	Pollutant				
	PM_{10}	SO_2	CO	8-hour O_3	
Arizona	45	0	0	50	3.4
California	426	0	39	265	3.8
Colorado	0	0	0	0	0
Idaho	2.0	0	0	0	8.0
Montana	0	0	0	0	0
Nevada	66	45	66	170	0
New Mexico	0	0	0	0	0
Oregon	0	0	0	0	2.6
Utah	24	0	0	0	5.0
Washington	0	0	0	0	10
Wyoming	0	0	0	0	0

3.6.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Air Resources?

What Mitigation Measures Might Be Applied during Project Construction? As already noted, generation of fugitive particulate emissions from vehicle traffic and earthmoving activities would be the greatest cause for concern with construction. These emissions would need to be controlled through lease stipulations and the permitting process. Specifying potential mitigation measures involved identifying measures applicable to the principal tasks and activities involved in the construction of electricity transmission lines and pipelines and their associated air emissions (see Section 3.6.4.1 for construction tasks and activities). Applying each of these measures could potentially mitigate the air impacts associated with construction projects under either the alternative.

Typical measures that can be implemented to control particulates and other emissions are given below (ABC Wind Company, LLC undated; PBS&J 2002; DOI and USDA 2006; State of Nevada 2006).

General mitigation measures for fugitive dust:

- Install wind fences.
- Cease operations when winds make control of fugitive dust difficult.

Mitigation measures for areas subject to vehicle travel:

- Limit access to the construction site and staging areas to authorized vehicles;
- Establish antitracking stations of 2- to 4-inch rock base at egress points to control dirt carryout by trucks;
- Access roads and on-site roads should be surfaced with aggregate, wherever appropriate.

- Dust abatement techniques such a watering should be used on unpaved, unvegetated surfaces to minimize airborne dust.

- Speed limits (a maximum of 25 mph; 15 mph is preferred) should be posted and enforced to reduce airborne fugitive dust.

Mitigation measures for filling, compacting, and grading:

- A dedicated water truck should be available to moisten material before loading, unloading, compacting, filling, or grading.

- Operators at these operations should:

  – Lower bucket height before releasing loads,
  – Release loads slowly,
  – Keep vehicle speed under 15 mph, and
  – Minimize disturbed areas.

Mitigation measures for soil and material storage and handling:

- Prohibit outside mixing of construction materials such as sand and cement powder on days when the wind speed exceeds 15 mph.

- Train workers to handle unconsolidated construction materials so as to reduce fugitive emissions.

- Cover stockpiled materials with a tarpaulin or geotextiles, if they are sources of fugitive dust.

- Periodically spray storage piles of fill materials from other sites and stored material from the construction site to form a crust on the outside of the piles.

- Cover storage piles at concrete batch plants, if they are sources of fugitive dust.

Mitigation measures for clearing and disturbing the land:

- When practical, construction should be staged, to limit the area of land exposed at any time.

- Minimize disturbed area.

- Apply dust abatement techniques such as watering prior to clearing.

Mitigation measures for earthmoving:

- Use dust abatement techniques such as watering before earthmoving activities such as excavating, backfilling, compacting, and grading.

- Use dust abatement techniques such as watering as earthmoving activities proceed.

- Revegetate disturbed areas as soon as possible after disturbance.

Mitigation measures for material loading and transport:

- Soil should be moist while being loaded into dump trucks.

- Loads should be kept below the freeboard of the truck.

- Drop heights should be minimized when loaders dump materials into trucks.

- Gate seals should be tight on dump trucks.

- Dump trucks should be covered while traveling on public roads.

Mitigation measures for vehicles:

- Require routine maintenance of automobiles, trucks, construction equipment, on-site generators, and portable power units that are routinely on-site to ensure efficient combustion and minimum emissions.

- Limit idling of diesel equipment to no more than 15 minutes unless idle must be maintained for proper operation; for example, drilling, hoisting, and trenching.

Mitigation measure for blasting:

- Use dust abatement techniques such as coverage with blasting mats during blasting.

What Mitigation Measures Might Be Applied during Project Operation? Emissions of NO_X would provide the greatest potential concern during the operation of natural gas compressors on pipelines. NO_X emissions can vary widely depending on the choice of motive power, such as gas turbine or reciprocating engine, and the specific design parameters of the unit. A new compressor station, whether a major source or not, would require a permit from the state or local agency with jurisdiction over the proposed station location. In addition, gas compressor stations would need a FERC permit, which requires, in part, a demonstration that the proposed facility complies with applicable state and federal air quality requirements. These existing requirements should ensure adequate protection for air quality. Additional mitigation should not be needed. The following measures would ensure that the permitting process addresses the air issues of concern:

- Require that emissions from all compressors be properly quantified using procedures approved by the EPA or the state/local agency.

- Require that all appropriate permits for operation have been applied for and obtained prior to final lease approval. If federal approval is involved, require proof that approval has been obtained.

- If the source is locating near a Class I area, discuss relocation with the proponent to reduce impacts in that area.

- If compressor stations are located in close proximity, discuss relocation with the proponent to reduce air impacts.

What Mitigation Measures Might Be Applied during Project Decommissioning? The same mitigation measures could be applied to decommissioning as could be applied to construction. For pipelines, the scale and extent of decommissioning activities, and hence the associated mitigation measures, would be reduced in comparison to construction, particularly if underground sections of pipeline were left in place.

3.7 NOISE

3.7.1 What Are the Noise Levels Associated with Section 368 Energy Corridors in the 11 Western States?

This section briefly discusses basic sound concepts, outdoor sound propagation, noise standards and guidelines, and current background noise levels.

3.7.1.1 What Are the Fundamentals of Sound and Noise?

Any variation of air pressure detectable by the human ear may be considered as sound. Noise is defined as unwanted sound.

Sound pressure levels are measured in units of decibels (dB).[5] The perceived pitch of a sound, which is a psychological property characterized by the highness or lowness of the sound, is determined by its frequency, and the normal audible range of frequencies that a healthy young person can hear is approximately 20 cycles per second (Hz) to 20,000 Hz.

Various scales are used to measure sound, but only sounds in the range of human hearing are of interest. The A-weighted scale, denoted by dBA, approximates the range of human hearing and correlates well with subjective judgments as to the loudness of sounds. A-weighting gives greater emphasis to the sounds in the frequency bands of human speech (1,000 to 4,000 Hz with the greatest sensitivity at 3,000 Hz) and less emphasis to the lower and higher frequencies. A-weighting is widely used in noise standards, guidelines, and ordinances, and is almost universally accepted in analyzing noise and its effects on people.

Sound levels encountered in daily life vary over a wide range. Table 3.7-1 provides sound pressure levels associated with some familiar sources. In general, 0 dB is the quietest sound that can be heard by an average person, called the "threshold of hearing," and 130 dB is so loud as to cause pain, and is called the "threshold of pain."

TABLE 3.7-1 Sound Pressure Levels of Some Familiar Sound Sources

Source	Pressure Level (dBA)
Jet engine (at 82 feet)	140
Rock concert	120
Jointer/planer	100
Heavy truck traffic	80
Business office	70
Normal conversation	60
Library	50
Bedroom	40
Secluded woods	30
Whisper	20

Source: MPCA (1999).

Sound levels generally vary with time, and people's reactions to sounds or noise vary with the time of day. The equivalent continuous sound level (L_{eq}) is a sound level that if maintained continuously during a specific time period would contain the same total energy as sound that varied over that time. For example, L_{eq}(24 hour) is the 24-hour equivalent continuous sound level. The day-night average sound level (L_{dn} or DNL) is the average A-weighted sound level over a 24-hour period with a 10-dB penalty added for nighttime hours (10:00 p.m. to 7:00 a.m.) to account for the fact that people are engaged in more noise-sensitive activities such as sleep during this time. To describe the time-varying characteristics of environmental noise (e.g., traffic noises), statistical noise descriptors, such as L_{10}, L_{50}, and L_{90}, are most commonly used. They are A-weighted noise levels that are exceeded for specified fractions of a defined time period. For example, L_{10} is the sound level that is exceeded 10% of the time (e.g., 6 minutes out of 1 hour), and is considered as the intrusive noise level. L_{50} represents the median noise level, and L_{90} is commonly used as the background level. In addition, "C-weighting" (expressed as dBC) gives equal emphasis over the normal hearing range. It is used when evaluating very loud or

5 The decibel scale is logarithmic, meaning that a 100-fold increase in sound energy corresponds to an increase of 20 dB, not 100 dB. A logarithmic scale uses the logarithm of a physical quantity instead of the quantity itself and is useful for representing quantities like sound levels that can vary over a large range. For example, two measurements of 10 units and 1,000,000,000 units might correspond to values of 1 and 9, respectively, on a logarithmic scale. Logarithmic units also add differently than linear units. For example, if one object is 6 feet long and a second is twice as long, the second object is 12 feet long. For sounds, however, if one sound level is 50 dB and a second is twice as loud, the second sound level is 60 dB, not 100 (2×50) dB.

very low frequency sounds such as impulsive noises.

Noise effects on people fall into three categories (NWCC 1998):

- Subjective effects such as annoyance, nuisance, and dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as anxiety, tinnitus, or hearing loss.

Identifying a noise as objectionable depends upon several factors. Discrete tones (tonal noise) are more noticeable and annoying than broadband noise at the same loudness level because they stand out against ambient noises. Impulsive noises such as blasting also tend to be considered particularly objectionable. The circumstances and individual sensitivity of a hearer are also important. The more new noises that exceed the previously existing ambient noise level, the less acceptable they are generally deemed by hearers.

People's responses to changes in sound levels generally exhibit the following characteristics (NWCC 1998; MPCA 1999):

- Except under laboratory conditions, a 1-dB change in sound level is not perceptible,
- A 3-dB change in sound level is considered barely noticeable,
- A 5-dB change in sound level typically results in a noticeable community response, and
- A 10-dB change in sound level (considered a doubling in loudness) will almost certainly cause an adverse community response.

3.7.1.2 How Does Sound Propagate?

Text Box 3.7-1 provides some simple rules governing sound levels. In general, however, prediction of noise levels at a particular location depends on a complex combination of source characteristics and site-specific factors (Anderson and Kurze 1992):

- Source characteristics (geometry and type) such as sound power, directivity, and configuration;
- Geometric spreading (geometric divergence) as the sound moves away from the source, which does not depend on frequency; that is, all frequencies of sound are attenuated at the same rate;
- Absorption of the sound in the atmosphere (air absorption), which depends strongly on the sound frequency and relative humidity, less strongly on temperature, and slightly on pressure;
- Ground attenuation (ground effect) due to sound reflected by ground surfaces interfering with the sound propagating directly from the source to the receptor;
- The topography, structures, and other natural or man-made barriers between the source and the receptor (screening); and
- Meteorological factors (meteorological effects) such as turbulence and variations in vertical wind speed and temperature.

In many screening applications, only geometric spreading is considered when predicting noise levels. A refined analysis would employ a sound propagation model that integrates most of the sound attenuation mechanisms noted above. Such an analysis

Text Box 3.7-1
Sound-Related Rules of Thumb

1. A subjective doubling of loudness corresponds to a 10-dB increase in sound level. For example, 65 dB is perceived as being twice as loud as 55 dB.

2. When the distance from a point source (a source having small spatial extent) is doubled, the sound level drops 6 dB. For example, if the sound level is 65 dB at 50 feet, then it is 59 dB at 100 feet and 53 dB at 200 feet.

3. When the distance from a line source (a long thin source like a road) is doubled, the sound level drops 3 dB. For example, if the sound level is 65 dB at 50 feet from a road, then it is 62 dB at 100 feet and 59 dB at 200 feet.

4. A doubling of sound energy increases the sound level by 3 dB. For example, if one source produces a noise level of 60 dB, the noise level from two identical sources would be 63 dB.

5. If the sound levels from two sources differ by 10 dB, the louder source will predominate. For example, if two sources are producing noise levels of 70 dB and 60 dB at a location, the noise level from both sources is 70.4 dB, largely due to the louder source.

The 6-dB and 3-dB rules (Items 2 and 3) are based on only the geometric spreading of sound energy as the sound propagates away form the source. If other attenuation mechanisms such as air absorption or ground effects contribute, more decreases of sound levels would occur.

would generally require detailed source characteristics and site-specific data, such as ground cover, topography, meteorological data, etc. The following discussion considers the effects of vertical wind and temperature gradients (refraction).

At short distances less than 160 feet, the wind has a minor influence on the sound level. At longer distances, the wind effect becomes appreciably greater. Wind speed generally increases with height, and this variation "focuses" it in the downwind direction and creates a "shadow" in the upwind direction. As a result, upwind sound levels will be lower and downwind levels higher than if there were no wind.

Temperature changes with height also play a major role in sound propagation. During the day, air temperature usually decreases with height. In contrast, on a clear night, a "temperature inversion" often exists, in which the air temperature increases with height. In this case, the speed of sound increases with increasing air temperature and with height. During the day, sound bends (refracts) upward as it propagates; during the night, it bends downward under a temperature inversion. Thus, for a particular source and receptor, sound levels would be lower during the day than at night. At night, the noise of distant trains can be heard that would otherwise be indiscernible at daytime. These refractive effects due to temperature are uniform in all directions and differ from those due to wind, which affect mostly the upwind-downwind direction.

3.7.1.3 What Regulations, Standards, and Guidelines Apply to Noise?

At the federal level, the Noise Control Act of 1972 and subsequent amendments (Quiet Communities Act of 1978, 42 USC 4901–4918) delegate the authority to regulate noise to the states and direct government agencies to comply with local noise regulations. Gas pipelines are subject to noise limitations under the FERC.

Of the 11 states in the study area, five states (California, Colorado, Nevada, Oregon, and Washington) have statutes dealing specifically with noise. Of these, California and Nevada do not have regulatory standards limiting noise levels from sources associated with energy corridor construction and operation.

Tables 3.7-2 to 3.7-4 list the noise limits for Colorado, Oregon, and Washington, respectively. Many local governments have enacted noise ordinances to manage community noise levels. These noise limits typically define noise sources and specify maximum permissible noise levels. They are commonly enforced by police, but may also be enforced by the agency issuing development permits.

EPA guidelines recommend an L_{dn} of 55 dBA as sufficient to protect the public from the effects of broadband environmental noise in quiet outdoor settings and residential neighborhoods (EPA 1974). The guideline recommends an L_{eq} of 70 dBA or less over a 40-year period to protect the general population against hearing loss from nonimpulsive noise. The FAA and the Federal Interagency Committee on Urban Noise have issued land use compatibility guidelines indicating that a yearly L_{dn} of less than 65 dBA is compatible with residential land uses and that, if a community determines it is necessary, levels up to 75 dBA may be compatible with residential uses and transient lodgings (but not mobile homes), if such structures incorporate noise-reduction features (14 CFR 150, Appendix A).

FERC requires natural gas pipelines to demonstrate that stations with compressors will not exceed an L_{dn} of 55 dBA in noise-sensitive areas such as schools, hospitals, and residences (18 CFR 380.12(k)(4)(v)(A)).

TABLE 3.7-2 Colorado Limits on Maximum Permissible Noise Levels

	Maximum Permissible Noise Level (dBA)[a]	
Zone	7 a.m. to 7 p.m.[b]	7 p.m. to 7 a.m.
Residential	55	50
Commercial	60	55
Light industrial	70	65
Industrial	80	75

[a] At a distance of 25 feet or more from the property line. Periodic, impulsive, or shrill noises are considered a public nuisance at a level 5 dBA less than those tabulated.

[b] The tabulated noise levels may be exceeded by 10 dBA for a period not to exceed 15 minutes in any 1-hour period.

Source: Colorado Revised Statutes, Title 25 “Health: Environmental Control,” Article 12 “Noise Abatement.” Available at http://198.187.128.12/colorado/lpext.dll?f=templates&fn=fs-main.htm&2.0.

TABLE 3.7-3 Oregon Limits on Maximum Permissible Noise Levels from Industrial and Commercial Noise Sources[a,b]

		Allowable Statistical Noise Level[c]	
Source	Descriptor	7 a.m. to 10 p.m.	10 p.m. to 7 a.m.
All[d]	L_{50}	55 dBA	50 dBA
	L_{10}	60 dBA	55 dBA
	L_1	75 dBA	60 dBA
In quiet areas[e]	L_{50}	50 dBA	45 dBA
	L_{10}	55 dBA	50 dBA
	L_1	60 dBA	55 dBA
Impulsive: blasting[f]	Slow response	98 dBC	93 dBC
Impulsive: other[f]	Peak response	100 dB	80 dB

a All standards are applied to noise-sensitive properties: schools, churches, hospitals, libraries, or properties normally used for sleeping. They are to be measured 25 feet from the sensitive building or at the sensitive property line, whichever is farther from the noise source.

b The environmental director may require that sources meet octave-band and discrete-tone regulations, if these tabulated standards do not provide sufficient protection.

c The statistical noise level specifies the noise level that may be exceeded a stated percentage of the time in any hour. For example, L_{10} = 65 dBA means that in any 1 hour, the noise level can equal or exceed 65 dBA up to 10% of the time, or for 6 minutes.

d In addition, new sources locating on previously unused sites cannot increase the ambient L_{10} or L_{50} level by more than 10 dBA.

e Quiet areas correspond to land or facilities designated as areas where quiet is of extraordinary significance.

f The limits for impulsive noise are specified in the C-weighted scale, which is used for loud sounds. Other specifications also apply to impulsive sounds.

Source: Oregon Department of Environmental Quality, Oregon Administrative Rules, Chapter 340, Division 35 “Noise Control Regulations.” Available at http://www.deq.state.or.us/about/rules.htm.

3.7.1.4 What Is the Existing Acoustic Environment?

Background noise is noise from all sources other than the source of interest. The background noise level can vary considerably depending on the location, season, and time of day. Background noise levels in a noisy urban setting can be as high as 75 dBA during the day. In isolated outdoor locations with no wind, animals, or running water, background noise may be under 10 dBA. Typical noise levels in rural settings are about 40 dBA during the day and 30 dBA during the night, and in wilderness areas, they are on the order of 20 dBA (Bishop and Schomer 1991). In areas of low population density, DNLs for noise are generally at 35-40 dBA (Miller 2002).

TABLE 3.7-4 Washington Maximum Permissible Environmental Noise Levels (dBA)[a]

EDNA of Noise Source	EDNA of Receptor Property[b]		
	Class A[c]	Class B	Class C
Class A	55	57	60
Class B	57	60	65
Class C	60	65	70

[a] These standards may be exceeded by no more than:
5 dBA for 15 minutes,
10 dBA for 5 minutes, or
15 dBA for 1.5 minutes in any 1-hour period.

[b] Environmental Designation for Noise Abatement (EDNA):
Class A: lands where humans reside and sleep,
Class B: lands requiring protection against noise interference with speech, and
Class C: lands involving economic activity where higher noise levels would normally be expected.

[c] Between the hours of 10 p.m. and 7 a.m., the noise limitations in the table shall be reduced by 10 dBA for receiving properties within Class A EDNAs.

Source: Washington Administrative Code, Chapter 173-60 "Maximum Environmental Noise Levels." Available at http://usgovinfo.about.com/gi/dynamic/offsite.htm?site=http://www.leg.wa.gov/.

While no information is available providing existing noise levels on federally administered land in areas of potential energy corridor designation, these areas are largely undeveloped, sparsely populated, and remote and would be expected to have background noise DNLs of about 35 dBA or less. In addition to natural background, noise sources could include agricultural activities, oil and gas development, coal mining, trains, low-density traffic on rural roads, recreational activities, and aircraft overflights. The identification of specific noise sources, noise levels, and sensitive receptors such as residences, schools, and hospitals must be accomplished during site-specific analyses.

3.7.2 How Were Potential Noise Impacts of Corridor Designation Evaluated?

Noise impacts would not be expected to occur as a result of corridor designation or land use plan amendments. Rather, impacts would occur only with the construction, operation, and decommissioning of specific energy transport projects. Potential noise impacts of specific projects need to be assessed on the basis of existing noise levels and the anticipated extent and duration of project activities. Additionally, all project-specific activities need to be carried out in compliance with applicable laws, regulations, and leasing stipulations.

Specific projects will be subject to noise impact analyses under the NEPA and state regulations when they are proposed.

Text Box 3.7-2
Sensitive Receptors for Noise

There is no standard definition of sensitive noise receptors. Typically included among sensitive receptors are schools, churches, hospitals, libraries, residences, transient lodgings, and/or sleeping areas. In remote or rural areas, Tribal cultural properties and sacred sites and special and sensitive wildlife areas should be considered among noise-sensitive locations at which noise impacts should be assessed.

3.7.3 What Are the Potential Noise Impacts of the Alternatives, and How Do They Compare?

Noise levels in the western states are not expected to be impacted by the designation of energy corridors on federal lands or by amendment of land use plans. Noise levels would be affected by the construction, operation, and decommissioning of specific energy transport projects. The following discussions address potential noise impacts that could be incurred with the development of energy transport projects under each of the alternatives evaluated in this PEIS. Detailed noise analyses would be conducted as part of project-specific environmental assessments, and are outside the scope of this PEIS.

3.7.3.1 What Are the Potential Noise Impacts of the No Action Alternative?

Under No Action, there would be no designation of Section 368 energy corridors on federal lands. Should energy transport projects be proposed to cross federal lands, they would not be expected to be colocated within a single energy corridor, but rather along several widely spaced and project-specific ROWs. Multiple ROWs could have a greater potential of passing near and impacting a greater number of sensitive receptors than might be affected by a single corridor with colocated energy transport projects.

On the other hand, the wider separation of the individually sited energy transport projects that could occur under No Action could result in less noise impacts than the impacts of developing multiple projects within a single energy corridor because, all other factors being equal, reducing the spacing between similar noise sources would generally increase the maximum noise impacts, while increasing the spacing between noise sources would decrease noise impacts.

Under No Action, individually sited projects would likely have minimal buffer zones between nearby sensitive receptors and the noise sources of an energy transport system and its associated facilities (such as substations, pump stations, and compressor stations). Wider buffer zones, which could occur in a single energy corridor on federal or nonfederal lands with colocated projects, would reduce noise impacts on nearby sensitive receptors. In the absence of wider buffer zones, sensitive receptors would be at greater risk of being affected by noise generated during the construction and operation of colocated projects.

In the absence of dedicated West-wide energy corridors and an associated expedited permitting process, there could be increased siting of energy transport system ROWs (or portions thereof) on nonfederal lands, with a concomitant shift of potential noise impacts to those lands.

3.7.3.2 What Are the Potential Impacts of the Proposed Action?

Designation of Section 368 energy corridors and land use plan amendments under the Proposed Action is not expected to impact ambient noise within or adjacent to the designated corridors. Ambient noise levels would only be affected with the construction, operation, and decommissioning of specific energy transport projects within designated corridors on ROWs on other federal and nonfederal lands.

3.7.3.3 How Do the Potential Noise Impacts Compare between the Alternatives?

The noise impacts under No Action would be those associated with the construction, operation, and decommissioning of individual energy transport projects, as described in Section 3.7.4.1.

Designating Section 368 energy corridors and land use plan amendments under the Proposed Action would result in no noise impacts.

3.7.3.4 What Mitigation Measures Might Be Applied to Reduce Noise Impacts if Section 368 Energy Corridors Are Designated?

The mitigation measures described in Section 3.7.4.2 would be available to reduce noise impacts caused by individual energy transport projects on federal and nonfederal lands as required to comply with applicable regulations or leasing requirements.

Since there are no noise impacts, no mitigation measures would be required for designating Section 368 energy corridors under the Proposed Action.

3.7.4 Following Corridor Designation, What Types of Noise Impacts Could Result with Project Development, and How Could They Be Minimized, Avoided, or Compensated?

The construction, operation, and decommissioning of energy transport projects would affect ambient noise levels regardless of project location. The following sections discuss the types of project development activities that would affect ambient noise levels on both federal and nonfederal lands and mitigation measures that might be applied to minimize, avoid, or compensate for potential noise impacts from energy transport projects.

3.7.4.1 What Are the Usual Noise Impacts of Building, Operating, and Decommissioning Energy Transport Projects?

Noise impacts involved in construction, operation, and decommissioning of actual energy transport systems would vary from location to location. However, no detailed information on actual energy transport systems was available at the programmatic level for this PEIS. For this analysis, source noise levels for equipment typically associated with activities of interest were taken from standard reference sources (e.g., Hanson et al. 2006) or the open literature.

Factors such as topography, land use, vegetation, and meteorology determine noise propagation and would vary from site to site. Furthermore, a refined analysis would employ an outdoor sound propagation model that integrates most of the sound attenuation mechanisms discussed in Section 3.7.1.2. Such an analysis would require detailed noise source characteristics and site-specific data, which are not available at this time.

Geometric spreading and ground effects due to vegetation and land use over flat terrain and acoustically soft grounds were taken into account in predicting noise levels. Due to geometric spreading, noise levels decrease about 6 dB and 3 dB per doubling of distance from a point and line noise source, respectively. Sound levels can also change because of the character of the ground between the source and receiver. This "ground effect" is a relatively complex acoustic phenomenon, which is a function of ground characteristics, source-to-receiver geometry, and the spectral characteristics of the source. A commonly used rule of thumb for propagation over soft ground (e.g., grass) is that ground effects account for about a 1.5 dB decrease per doubling of distance.

Noise-generating activities for the construction, operation, and decommissioning of the gas/liquid pipelines and electricity transmission lines were identified. Noise levels from these activities were estimated using the source noise level at a reference distance from a noise source and simple sound attenuation formulas that consider geometric spreading and ground effects (Hanson et al. 2006). These estimated noise levels were then compared with applicable noise standards or guidelines.

The following sections describe the usual noise impacts of building, operating, and decommissioning energy transport projects. Discussions of potential impacts that could result from projects in designated corridors and ROWs follow the discussions of the usual impacts.

How Can Construction of Energy Transport Projects Affect Noise Levels? The noise levels created by construction equipment depend on factors such as the type of equipment used, including the specific model; the operation being performed; and the condition of the equipment. This PEIS adopted a simplified approach to estimating construction noise. It assumed that the two noisiest pieces of equipment would operate simultaneously in estimating noise levels at sensitive receptors (Hanson et al. 2006).

At a construction site, the dominant noise sources are generally diesel engines (especially unmuffled engines) operating near a fixed location or with limited movement. In addition, vehicular traffic generates intermittent noise around a construction site and on nearby roads. However, the noise contribution from such intermittent sources is limited to the immediate vicinity of the traffic route and is minor in comparison with the contribution from continuous noise sources, unless it results from heavy traffic.

In areas where mechanical equipment could not break up or loosen the bedrock (e.g., tower foundations or pipeline trenches), explosive blasting would be required. Blasting creates shock waves and ground vibration. If helicopter operation were opted for in remote areas, helicopter noise would be a major source for tower transport and erection. However, these activities are expected to occur infrequently and would mostly occur in uninhabited areas, so no analysis for these activities was made.

Different phases of pipeline construction (e.g., trenching at one location and welding at the other location) would occur simultaneously, and noise sources would be spaced along the segment under construction, so that their impacts would be much lower at nearby receptor locations than if all sources were colocated. At more distant receptor locations, potential impacts from each source would be more nearly equal, but the cumulative noise levels from all activities would be considerably attenuated.

What Might Be the Usual Construction Impacts? In general, construction procedures for gas and liquid pipelines are almost the same. Standard pipeline construction is composed of specific activities including survey and staking of the ROW; site preparation (including clearing, grading, and compacting); trenching; pipe stringing, bending, welding, and lowering-in; backfilling; hydrostatic testing; and cleanup. In addition, construction of the compressor/pump stations would involve site preparation for concrete foundations for buildings and concrete supports for skid-mounted equipment, followed by erection of compressor enclosures. Construction of meter and regulator stations, mainline valves, and pig launcher/receiver facilities not colocated with the compressor stations would generally be similar to the construction of compressor station sites described above, and would entail site preparation, installation and erection of facilities, hydrostatic pressure testing, cleanup and stabilization, and installation of security fencing around the facilities.

The general sequence of construction activities for electricity transmission lines involves surveying; construction of access roads; ROW clearing; and support structure installation, framing, and stringing. After site preparation, the support structures would be assembled on the ground and erected by a crane. Modification of existing substations or construction of new substations would also be included. As in construction of gas/liquid pipelines, the major noise sources would be heavy equipment such as dozers or graders to level the foundation area and vehicular traffic such as heavy trucks. Helicopters are typically used in rugged, mountainous terrain to transport sections of steel lattice towers and/or poles. If helicopter operation were used, then helicopter noise would occur during tower transport and erection.

For gas/liquid pipelines and electricity transmission lines, some blasting might be required if bedrock occurred at structure locations or, more rarely, to break up or move large boulders that restricted access by construction equipment.

During site preparation, the noisiest activities would involve the use of heavy earthmoving equipment during the first phase of construction. For this analysis, potential noise impacts were estimated for the site preparation phase of compressor/pump stations, which were assumed to occupy 20 acres.

Average noise levels for typical construction equipment range from 74 dBA for a roller to 101 dBA for a pile driver at a distance of 50 feet (Hanson et al. 2006). Most construction equipment used for site preparation (such as dozers, graders, compactors, shovels, and trucks) have noise levels within the range of 80 to 90 dBA at 50 feet. In the analysis, a dozer and a heavy truck producing noise levels of 85 and 88 dBA at 50 feet, respectively, were assumed to operate continuously near a single location, giving a combined noise level of about 90 dBA at a distance of 50 feet.

Activities during site preparation of a pump or compressor station would produce estimated noise levels of about 49–53 dBA at ¼ mile and 43–45 dBA at ½ mile from the construction site boundary. Assuming a construction period of 10 hours per day and rural background noise levels, DNLs would be about 46–49 dBA and 43–44 dBA at ¼ mile and ½ mile, respectively, from the construction site boundary. These levels are well below the EPA guideline of 55 dBA for residential zones (EPA 1974). The 55-dBA limit is estimated to occur about 800 feet from the construction site boundary.

Most construction activities would occur during the day, when noise is better tolerated than at night, because of the masking effects of background noise. In addition, potential noise impacts from construction activities are expected to be temporary and local in nature (up to 120 days or less for the site preparation phase) for compressor and pump stations. No unusual or significant noise impact such as impulsive noise (except for the possibility of blasting, as discussed below) is anticipated from construction activities.

Environmental issues (e.g., disruption of sensitive areas) and rugged terrain may make helicopter use in tower placement cost-effective compared to conventional methods. If helicopters were used for electricity transmission tower construction, noise from these sources operated on a regular basis would be audible at staging areas, tower construction sites, and along flight paths. The helicopters would pick up the towers from the staging areas and place them at each location. With helicopters, tower placement would be performed in a relatively short time, with an average flying time of 4 to 6 minutes between two sites. For example, 24 towers for 230-kV transmission lines were constructed over a 6-mile span in a 2- to 3-day period (DOE and DOI 2004).

Helicopter noise levels range from 77 to 84 dBA during takeoff and from 72 to 77 dBA during landing (distance not provided) (Golden 1979). Sound pressure levels for a helicopter in level flight and traveling at an altitude 500 feet with an airspeed of about 60 knots would range from about 77 to 94 dBA during 4 seconds before and after passing directly overhead (Raney and Cawthorn 1991). Exposure to increased noise intensity, frequency, and duration from helicopter overflights results in increased annoyance. Since helicopters would be used only in relatively remote undeveloped areas, the potential for disturbance to large numbers of residences is small. Because helicopter operations would be infrequent and of short duration, impacts would be limited to staging areas, construction sites, and along flight paths, and would be temporary in nature.

If used, blasting would create a compressional wave in the air, the audible portion of which would be manifested as noise. Blasting activities between the hours of 7 a.m. and 10 p.m. are specifically exempt from noise regulation in some states (for example, Washington). Potential impacts to the closest sensitive receptors could be determined; however, most sensitive receptors probably would be located a considerable distance from the site, given the remote nature of most potential development locations on federal lands.

What Might Be the Potential Construction Impacts of Specific Projects under the Proposed Action? The usual noise impacts just discussed would be incurred during potential construction in corridors designated under Section 368. Under the Proposed Action, construction noise would be generated along 6,055 miles of designated corridor segments on federal lands and ROWs on other federal and nonfederal lands in which gas and liquid pipelines and electricity transmission lines could be constructed. Additional impacts would be caused by the construction of ancillary compressor stations, pump stations, and electric substations and would be associated with similar construction activities on nonfederal and other federal lands. Construction impacts would be similar on both federal and nonfederal lands.

How Can Operation of Energy Transport Projects Affect Noise Levels? Noise impacts were analyzed for continuous and/or widespread operational impacts: compressor/pump station noise for pipelines and corona discharge and substation transformer noise for transmission lines.

Noise sources associated with operation of the energy transport systems would include repair and maintenance activities involving vehicular traffic and/or heavy equipment. Surveillance activities would involve conventional vehicles on established access roads. Often, fixed-wing aircraft or helicopters would provide year-round aerial surveillance, and their noise impacts would be audible in the immediate vicinity of flight paths. Potential noise impacts from these activities would be temporary and limited to areas near the activities.

What Might Be the Usual Operations Impacts? The primary noise sources in a corridor would come from compressor/pump operations. Noise sources associated with operation of transmission lines would be corona effects and substations. Repair and maintenance activities would involve light- or medium-duty vehicular traffic and heavy equipment. The anticipated level of noise from these activities would be far lower and of shorter duration than that from construction. More noisy activities (e.g., mowing, grading, use of chainsaws) for vegetation management within the corridor, whether on federal or nonfederal land, would be infrequent, localized, and of short duration. Traditionally, gas/oil pipelines have been inspected visually by personnel walking along the line or patrolling the pipeline route via light truck or aircraft.

A natural gas compressor station generates noise on a continuous basis during operation. Data were not available for pump station noise, so pump stations were assumed to generate the same level of noise as compressor stations. Internal combustion engines would be the loudest sources at compressor stations. The electric motors driving pumps are expected to be quieter, so this assumption should be conservative.

A typical noise level from compressor stations associated with coal-bed methane development in Colorado was found to be about 50 dBA at 375 feet from the property boundary (La Plata County 2002). Measured noise levels are available for compressor stations located along natural gas pipelines in the State of Washington (FERC 2005). Measured

L_{eq}(24 hour)[6] noise levels at locations ranging from 1,250 to 1,800 feet away from one existing compressor station ranged between 42.5 and 44.6 dBA, while those at a 450- to 800-foot distance from another existing compressor were between 38.1 and 47.0 dBA. The noise level at a distance of 50 feet from gas compressor facilities related to federal fluid minerals (oil, gas, and geothermal) leasing in south-central New Mexico was 89 dBA (BLM 2000), which is the highest noise level among available noise levels, and thus is used for this analysis.

Estimated noise levels from a single pump/compressor at ¼ mile and ½ mile from the property boundary would be about 50 and 44 dBA, respectively. Assuming continuous operation, the corresponding DNLs would be about 57 dBA and 51 dBA, respectively. The DNL increases from the estimated sound level due to a nighttime 10-dBA penalty added for the nighttime hours (10:00 p.m. to 7:00 a.m.) to account for the fact that people are engaged in more noise-sensitive activities such as sleep during this time (see Section 3.7.1.1). Receptor locations within approximately 1,700 feet (0.3 miles) could experience noise levels in excess of the EPA’s 55-dBA guideline for residential zones (EPA 1974).

Noises from compressor stations could become an issue. Accordingly, the compressor equipment (e.g., air intake, exhaust stack) and buildings must be designed to keep noise to a minimum. As noted in ANL (2007b), this noise can be mitigated to meet EPA guideline with appropriate acoustical design. For example, noise mitigation may include construction of noise barriers and/or berms around the facilities or planting of vegetation screens.

If fixed-wing aircraft or helicopters were used for surveillance and monitoring of electricity transmission lines or pipelines, noise from these sources operated on a regular basis would be audible at locations close to the pipeline. Some disturbances of wildlife have been observed as a result of air traffic, particularly helicopters, during pipeline surveillance overflights (BLM 2002).

Noise levels from fixed-wing aircraft during takeoff and landing would be similar to those from helicopters, as discussed previously (Golden 1979).

There is a potential for noise impacts from corona discharge associated with the operation of transmission lines, which relates to the electrical breakdown of air into charged particles caused by the electrical field at the surface of electrical conductors. Corona-generated audible noise from transmission lines is generally characterized as having a crackling or hissing sound. Modern transmission lines are designed, constructed, and maintained so that they operate below the corona-inception voltage during dry conditions, meaning that the lines generate a minimum of corona-related noise. During dry weather conditions, noise from transmission lines is generally indistinguishable from background noise at locations beyond the edge of the ROW (Lee et al. 1996). During rainfall events, the noise level at 100 feet from the center of a 500-kV transmission line tower would be less than 47 dBA (Lee et al. 1996), which is typical of the noise level in a library. And the noise level at a distance of 300 feet is about 42 dBA, which is typical of the noise level in a bedroom.

If a transmission line were located next to the edge of the ROW corridor, whether on federal or nonfederal land, the sound level at the edge of the ROW (200 feet from the transmission line) would be about 44 dBA and would fall to 35 dBA at ¼ mile from the edge. If a transmission line were located in the center of a 3,500-foot designated energy corridor on federal land, the sound level would be about 35 dBA at the edge of the corridor and 32 dBA at ¼ mile from the edge.

---

[6] In general, compressor stations are operated around the clock, so L_{eq}(24 hour) is almost the same as the instantaneous sound level.

A preliminary study by Pearsons et al. (1979) indicated that corona noise needed to be 10 dBA lower in intensity than other environmental noises to be judged equally as annoying, due to its high-frequency components. Thus, 44 dBA at the edge of a corridor would correspond to the same level of annoyance as 54 dBA for other noise sources. However, at large distances, noise attenuation by air absorption would be significant, especially at high frequencies, so corona noise would tend to decrease faster than other environmental noise. Accordingly, corona noise is easily lost in background noise within short distances from transmission lines.

In arid regions of the 11 western states, corona-generated audible noise would occur infrequently, as most of the areas adjacent to the proposed corridors on federal lands are undeveloped and sparsely populated. Whether occurring on federal or nonfederal land, corona noise would be scarcely discernible within ¼ mile or less from the center of the nearest transmission tower.

There are basically two sources of noise associated with substations: transformer noise and switchgear noise. Each has a characteristic noise spectrum and pattern of occurrence. A transformer produces a constant low-frequency humming noise, primarily because of the vibration of its core. The core's tonal noise would be continuous and uniform in all directions. The average A-weighted core sound level at a distance of 492 feet from a transformer would be about 49 dBA for a 500-million volt-ampere (MVA) transformer (corresponding to about 400 MW, assuming a power factor of 80%) (Wood 1992). For a 500-MVA transformer (assumed to occupy a 10-acre substation), noise levels at distances of ¼ mile and ½ mile from the site boundary would be about 35 and 29 dBA, respectively, ranging between typical daytime and nighttime background levels in a rural environment (Section 3.7.1.4).

Assuming a rural environment and 24-hour operation of a transformer leads to estimated DNLs of about 44 and 41 dBA at ¼ mile and ½ mile, respectively. These values are well below the EPA guideline of 55 dBA for residential zones. Current transformer designs have shown decreases in noise levels. The cooling fans and oil pumps at large transformers produce broadband noise only when additional cooling is required; in general, this noise is less noticeable than tonal noise.

Switchgear noise is generated by the operation of circuit breakers used to break high-voltage connections at 132 kV and above. An arc formed between the separating contacts must be "blown out" using a blast of high-pressure gas. The resultant noise is impulsive in character (that is, loud and of very short duration). The industry is moving toward more modern circuit breakers that use a dielectric gas to extinguish the arc and generate significantly less noise. The frequency of switchgear activities, such as regular testing, maintenance, and rerouting, is governed by the operational practices of the utility companies. During an electrical fault due to line overloads, the switch would open to isolate the fault and thereby protect the equipment. However, these operations would occur infrequently, and, accordingly, potential impacts of switchgear noise would be temporary and minor in nature.

What Might Be the Potential Operations Impacts of Specific Projects under the Proposed Action? The usual noise impacts just discussed would be incurred during potential operations in corridors designated under Section 368. Under the Proposed Action, these impacts would be associated primarily with the operation of compressor stations, pump stations, and electric substations along the 6,055 miles of designated energy corridors as well as transport ROWs on nonfederal and other federal lands.

How Can Decommissioning of Energy Transport Projects Affect Noise Levels? Decommissioning is construction in reverse, but potential noise impacts from decommissioning activities may be lower than those from construction activities. For example, a buried pipeline that has reached the end of its service life might be cleaned and sealed without being removed. Accordingly, potential noise impacts associated with decommissioning activities are expected to be lower than or equal to those associated with construction activities, and thus were not explicitly analyzed.

What Might Be the Usual Decommissioning Impacts? Decommissioning activities would be similar to those used for construction but would be of more limited scale and of shorter duration. Potential noise impacts from decommissioning would thus be correspondingly less than those from construction. The above-ground pipeline at compressor and meter stations would be completely removed, including all related above-ground equipment and foundations, and the station sites restored to as near original condition as possible. However, leaving buried pipelines in place would reduce the amount of trenching and soil disturbance required for decommissioning and contribute to reduced impacts relative to construction. In sum, potential noise impacts from decommissioning activities would be less than or equal to those from construction.

What Might Be the Potential Noise Impacts of Decommissioning Projects under the Proposed Action? As discussed above, the usual impacts of decommissioning an energy transport project would be similar to but less than the impacts during construction of the project. Similarly, the noise impacts of potential decommissioning activities of a specific project in corridors designated under the Proposed Action would be similar to but less than those during construction of the project and could occur anywhere along up to 6,055 miles of designated corridors on federal lands and ROWs on other federal and nonfederal lands.

3.7.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Noise Impacts of Potential Energy Transport Projects?

The following mitigation measures are recommended as ways to reduce potential noise impacts, should development and operation of energy transport projects occur either on federal or nonfederal lands.

For construction-related noise impacts:

- Schedule construction activities and route construction traffic to minimize disruption to nearby residents and existing operations surrounding the project areas.
- Noisy construction activities (including blasting) should be limited to the least noise-sensitive times of day (daytime only between 7 a.m. and 10 p.m.) and to weekdays. In sensitive wildlife areas, they should be limited to between 1.5 hours after sunrise and 1.5 hours before sunset.
- Erect temporary wooden noise barriers around areas where construction equipment would disturb sensitive receptors.
- To the extent possible, locate noisy equipment away from sensitive receptors.
- Whenever feasible, schedule noisy activities to occur at the same time, since additional sources of noise generally do not add noise. That is, less-frequent noisy activities would be less annoying than frequent less-noisy activities.

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

For operations-related noise impacts:

- If possible, minimize trips for surveillance and monitoring of pipelines and/or transmission lines by the energy transport system operating companies.

- Design compressor equipment (including the air intake and exhaust stack) and the enclosing building to incorporate noise attenuation measures or features, such as being lined with sound-absorptive material.

- Require compressor stations, pump stations, and electric substations to demonstrate compliance with applicable state and local noise regulations and ordinances (including EPA's 55-dBA guideline) at the nearest human sensitive receptors. Sensitive wildlife receptors should also be considered. In special areas where quiet or solitude has been identified as a value of concern, require a demonstration that a lower noise level would be met.

For both construction- and operations-related impacts:

- Install suitable mufflers on all internal combustion engines and certain compressor components (DOI and USDA 2006).

- Site compressors/pump stations and/or electric substations as far as practically possible from sensitive human receptors and/or wildlife areas.

- Noise-reduction measures to consider include siting compressors/pump stations and roads to take advantage of topography and distance and constructing engineered sound barriers and/or berms or sound-insulated buildings, if needed, to reduce potential noise impacts at nearby sensitive receptors (DOI and USDA 2006).

3.8 ECOLOGICAL RESOURCES

3.8.1 What Are the Ecological Resources Associated with Section 368 Energy Corridors in the 11 Western States?

This section provides general descriptions of ecological resources in the 11-state area through which the West-wide federal energy corridors could be designated.

3.8.1.1 Vegetation and Wetlands in the Affected Area

Vegetative communities occurring within the 11 states of the study area span a great variety of ecosystems, from arid deserts to coastal coniferous forests. Each vegetative community is unique in species composition, richness, diversity, and structure. A wide range of environmental factors, including climate, elevation, aspect, precipitation, and soil type, influence the presence and development of various types of vegetation throughout the region comprising the 11 western states. Because of the great variety and the complexity of vegetation occurring within this area, the area can best be represented by ecoregions.

An ecoregion is an area having general similarity in ecosystems and is characterized by the spatial patterning and composition of biotic and abiotic features, including vegetation, wildlife, geology, physiography, climate, soils, land use, and hydrology, such that within an ecoregion, there is a similarity in the type, quality, and quantity of environmental resources present (EPA 2006b). Ecoregions of North America have been mapped in a hierarchy of four levels, with Level I being the coarsest. Each level consists of subdivisions of the previous (next highest) level. Level IV ecoregions have not been developed for all of the 11 western states. The Level III ecoregion classification includes 34 ecoregions covering the 11-state area (Figure 3.8-1). Ecoregion descriptions and maps that overlay the energy corridor segments with the ecosystems in each state are presented in Appendix O.

Wetlands occurring within these ecoregions are also extremely varied, and include a number of wetland types such as marshes, bogs, vernal pools, and forested wetlands. Wetland areas are typically inundated or have saturated soils for a portion of the growing season, and support plant communities that are adapted to saturated soil conditions. Streambeds, mudflats, gravel beaches, and rocky shores are wetland areas that may not be vegetated (Cowardin et al. 1979).

Over much of the 11-state area, riparian habitats are important features on the landscape. Riparian vegetation communities occur along rivers, perennial and intermittent streams, lakes, reservoirs, and at springs. These communities generally form a vegetation zone along the margin, which is distinct from the adjacent upland area in species composition and density. Riparian communities are dependent on the stream flows or reservoir levels and are strongly influenced by the hydrologic regime, which affects the frequency, depth, and duration of flooding or soil saturation. Riparian communities may include wetlands; however, the upper margins of riparian zones may be only infrequently inundated. Wetlands are often associated with perennial water sources, such as springs, perennial segments of streams, or lakes and ponds. Riparian areas and wetlands are valued because of the important services they provide within the landscape, such as providing fish and wildlife habitats and maintaining water quality and flood control. The total wetland areas present within each of the 11 western states, based on estimates from the 1980s, range from about 236,350 acres in Nevada to 1,393,900 acres in Oregon (Table 3.8-1). These estimates represent less than 2.5% of the total surface area of any of the 11 states, and less than 1% of the total state surface area for six of the states.

The FS identifies and selects plant and animal species whose population changes are believed to reflect the effects of management activities. These species are referred to as management indicator species, and are identified in the Land and Resource Management Plans of each national forest. They are considered to represent a broader group of species or habitats that occur within the national forest and are considered sensitive to FS management activities. Impacts to these species would be considered in project-specific assessments prepared prior to project development.

3.8.1.2 Aquatic Biota in the Affected Area

Within the 11 western states considered in this PEIS, BLM, FS, and DOE administer lands containing or adjacent to more than 100,000 miles of fish-bearing streams and millions of acres of reservoirs and natural lakes. Aquatic habitats on these lands range from isolated desert springs of the arid Southwest to large interior rivers and their numerous tributaries. This section provides a general description of freshwater aquatic organisms and habitats in the major USGS water resource regions that coincide with the 11-state area where West-wide federal energy corridors could be designated (Figure 3.5-2).

The plant and animal species whose population changes are believed to reflect the effects of management activities are referred to as the management indicator species of each national forest. They are considered to represent a broader group of species or habitats that occur within the national forest and are considered sensitive to FS management activities. Impacts to these species would be considered in project-specific assessments prepared prior to project development.

TABLE 3.8-1 Wetland Areas in the 11 Western States, 1980s Estimates

State	Wetland Area (acres)	Percent of Surface Area
Arizona	600,000	0.8
California	454,000	0.4
Colorado	1,000,000	1.5
Idaho	385,700	0.7
Montana	840,300	0.9
Nevada	236,350	0.3
New Mexico	481,900	0.6
Oregon	1,393,900	2.2
Utah	558,000	1.0
Washington	938,000	2.1
Wyoming	1,250,000	2.0

Source: Dahl (1990).

Pacific Northwest Hydrologic Region. The Pacific Northwest hydrologic region encompasses the states of Washington, Oregon, Idaho, and portions of Montana. In terms of ecological, cultural, and commercial importance, fishes in the family Salmonidae make up the most important group of native fishes found in this hydrologic region. This group of fishes, which includes salmon (e.g., *Oncorhynchus* and *Salmo* spp.), trout (e.g., *Oncorhynchus*, *Salvelinus*, and *Salmo* spp.), Arctic grayling (*Thymallus arcticus*), and whitefish (*Prosopium* spp.), require relatively clear and cold freshwater habitats during part or all of their life cycles, and as such depend greatly on the conditions of surrounding forests and rangelands to ensure their survival (Meehan 1991). General factors that determine the suitability of aquatic habitat for salmonids include flow regime, water quality, habitat structure, food (energy) source, and biotic interactions.

Some species of salmon within this hydrologic region are anadromous (i.e., they spawn in fresh water but spend part of their life cycle at sea). These species require large stream and river systems with direct ocean access. In the Pacific Northwest, streams that support important stocks of anadromous salmon within public lands include those within the Columbia and Snake River basins, as well as a large number of small coastal streams. Because of their need to migrate between ocean and freshwater environments in order to reproduce and become adults, one of the major factors that have affected the distribution and survival of salmon stocks in recent decades is the construction of obstacles to migration (such as dams) in streams and rivers used by these species. Anadromous salmon in the Pacific Northwest Hydrologic Region are managed, in part, under a federal fishery management plan (Pacific Fishery Management Council 2003). Essential fish habitat (EFH; see Text Box 3.8-1) for anadromous salmon in the Pacific Northwest hydrologic region has been identified in more than 100 freshwater stream and river systems within Washington, Oregon, and Idaho (Pacific Fishery Management Council 2000).

Various fish species have been introduced into aquatic systems throughout the Pacific Northwest. Most of these non-native species have been introduced to promote sportfishing opportunities. Introduced salmonids (such as brook [*Salvelinus fontinalis*], brown [*Salmo trutta*], lake [*Salvelinus namaycush*], and rainbow [*Oncorhynchus mykiss*] trout), sunfishes and basses (family Centrachidae), and walleye (*Sander vitreus*) now support much, if not most, of the non-native sportfishing opportunities within the Pacific Northwest and other western hydrologic regions (Mills 1994).

A variety of aquatic invertebrates occur in aquatic habitats of the Pacific Northwest. These species can be affected by instream activity (e.g., removal of large woody debris) or disturbances in riparian zones. The diversity of aquatic insects is naturally low in glacier-fed streams, whereas streams flowing through coniferous forests typically support a diverse aquatic invertebrate fauna, including many types of mayflies, stoneflies, and caddisflies (Whittier et al. 1988). The diversity of freshwater mollusks is usually highest in montane spring-fed streams and pools (Forest Ecosystem Management Assessment Team 1993).

Text Box 3.8-1
Essential Fish Habitat and the Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a federal fisheries management plan. Under the Act, EFH is defined as those waters and substrates necessary for spawning, breeding, feeding, or growth to maturity of managed species. For the purpose of interpreting the definition of EFH, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110). The MSA requires federal agencies to consult with NOAA fisheries on actions or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (MSA '305(b) (2)). Under the Act, adverse effects on EFH can include any impact that reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption); indirect (e.g., loss of prey or reduction in species fecundity); or site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

The mandate for federal agencies to evaluate potential effects on EFH applies to all species managed under a federal fishery management plan (FMP). The FMP for commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California (Pacific Fishery Management Council 2003) is the only FMP applicable to the areas that would be traversed by the West-wide energy corridors that are considered in this PEIS. Amendment 14 of the Pacific Coast Salmon Plan (Pacific Fishery Management Council 2000) contains a complete identification and description of Pacific coast salmon fishery EFH, along with an assessment of actions that could result in adverse impacts and actions to encourage conservation and enhancement of EFH. The Pacific coast salmon fishery EFH includes those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. In estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (200 nautical miles) offshore of Washington, Oregon, and California north of Point Conception. In freshwater, EFH for anadromous salmon includes all those streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon (except above certain impassable natural barriers) in Washington, Oregon, Idaho, and California.

Upper Colorado River Hydrologic Region. The Colorado River Basin falls within two hydrologic basins: the Upper and Lower Colorado River hydrologic basins, with a dividing line near Lee's Ferry, Arizona. The Upper Colorado River hydrologic basin is predominantly within a subarid to arid region that includes portions of Wyoming, Colorado, Utah, Arizona, and New Mexico. Falling primarily between the Wasatch Mountains in Utah and the Rocky Mountains in Colorado, this hydrologic region is composed of three major subbasins: the Green River subbasin, the Upper Colorado River subbasin, and the San Juan-Colorado River subbasin.

Three distinct aquatic zones have been identified in the Upper Colorado River Basin (Joseph et al. 1977). The upper (headwater) zone is characterized by cold and clear water, a high gradient, and a rocky or gravel substrate. An intermediate zone occurs as the streams flow out of the upper zone. Within the intermediate zone, water discharge rates and summer water temperatures increase, and water is turbid during spring runoff and after heavy rainfall. The substrate is generally rocky with occasional expanses of sand. The lower (large-river) zone has warm water, meandering sections, and a low gradient in flat terrain.

Coldwater assemblages in the Upper Colorado River hydrologic region typically include salmonids, such as mountain whitefish (*Prosopium willliamsoni*) or trout. Conditions that support such species are usually found in ponds, lakes, or reservoirs at higher elevations and in the headwaters of selected rivers and streams. Because hypolimnetic releases from dams on some large, deep reservoirs can introduce cold clear waters into rivers, coldwater assemblages have also become established in historically warmwater sections of some rivers, such as the portions of the Green River located immediately downstream of Fontenelle and Flaming Gorge Dams (i.e., tailwaters). Warmwater assemblages typically occur at lower elevations, where waters tend to be warmer and more turbid. Warmwater fish communities within the Upper Colorado River Basin normally include species such as minnows (family Cyprinidae), suckers (family Catostomidae), sunfishes and basses, and catfishes (family Ictaluridae).

Historically, only 12 species of fish were native to the Upper Colorado River Basin, including five minnow species, four sucker species, two salmonids, and the mottled sculpin (*Cottus bairdii*). Four of these native species (humpback chub [*Gila cypha*], bonytail [*Gila elegans*], Colorado pikeminnow [*Ptychocheilus lucius*], and razorback sucker [*Xyrauchen texanus*]) are now federally listed as endangered, and critical habitat for these species has been designated within the Upper Colorado River Basin (Section 3.8.1.4). Water depletions from any portion of the Upper Colorado River drainage basin upstream of Lake Powell are considered to jeopardize the four resident endangered fish species and must be evaluated with regard to the criteria described in the Upper Colorado River Endangered Fish Recovery Program.

In addition to native fish species, more than 25 non-native fish species are present in the basin, often as a result of intentional introductions (e.g., for establishment of sport fisheries). While most of the trout species found within the Upper Colorado River Basin are introduced non-natives (e.g., rainbow, brown, and some strains of cutthroat trout [*Oncorhynchus clarkii*]), mountain whitefish and Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) are native to the basin. Although it was once common within the Upper Green River and Upper Colorado River watersheds, the Colorado River cutthroat trout is now found only in isolated subdrainages in Colorado, Utah, and Wyoming (Behnke 1992; Hirsch et al. 2006).

Lower Colorado, Rio Grande, and Great Basin Hydrologic Regions. The Lower Colorado River, Rio Grande, and Great Basin hydrologic regions include arid areas in most of New Mexico, Arizona, Nevada, and western Utah, and small sections of the eastern edge of California, southeastern Oregon, southeastern Idaho, southern Colorado, and southwestern Wyoming (Figure 3.5-2). The natural hydrologies of southwestern desert rivers and streams are highly variable and episodic, with hydrologic inputs typically occurring in pulses of short duration (Rinne and Stefferud 1997). These natural flow regimes have been considered optimum for sustaining the existing native fish populations (Poff et al. 1997).

Springs occur throughout the desert ecosystem within these hydrologic regions, ranging from quiet pools or seeps to active aquifers. Many larger springs discharge warm water, with temperatures above the mean annual air temperature, and range from fresh to highly mineralized, carrying large amounts of dissolved materials or extremely low dissolved oxygen levels (Naiman 1981). Although there may be relatively few species occurring within these springs and pools, many of the native species that occur are specially adapted to such conditions and are endemic (i.e., native to only a single locality). Some endemic species in springs may not be known, due to a lack of detailed studies within some of these habitats.

Numerous fish species have been introduced, intentionally and accidentally, into these hydrologic regions. Overall, non-native fish species in these hydrologic regions now outnumber natives in terms of numbers of species, population densities, and often biomass at many localities (Griffith and Tiersch 1989; Douglas et al. 1994; Starnes 1995).

Grasses and shrubs cover large expanses of these hydrologic regions, and this vegetation helps to reduce runoff and erosion during the rainy season. Livestock grazing in the region has reduced the quality of vegetative communities in some areas, resulting in increased runoff into some streams during heavy rainfall and localized lowering of water tables (Naiman 1981; Rinne and Minckley 1991).

The native fish community within the Lower Colorado River hydrologic region is dominated by fishes within the minnow and sucker families. The Lower Colorado River itself was historically a warm, turbid, and swift river. Construction of dams and reservoirs within the region has now altered habitat conditions and changed flow regimes by creating a series of cold, clear impoundments. These changes, along with the introduction of non-native fishes and a variety of other anthropogenic influences, have resulted in declines in native fish populations throughout much of the Lower Colorado River Basin. A variety of sensitive native fish species occur within the basin, including the endangered humpback chub and razorback sucker (Section 3.8.1.4).

The Rio Grande River originates in the Rocky Mountains of southwestern Colorado and meanders approximately 1,900 miles across Colorado, New Mexico, and Texas before terminating at the Gulf of Mexico. Public lands within the Rio Grande hydrologic region are limited to the upper and middle reaches of this drainage. Most precipitation in the basin falls as snow near its headwaters or as rain near its mouth, while little water is contributed to the system along the middle reaches of this river. Historically, riparian woodlands in the Rio Grande River Valley were a mosaic of various-aged stands dominated by cottonwood and willow (Cassell 1999). However, conversion of much of this land to residential and agricultural uses has modified this floodplain area, significantly reducing the quantity and quality of wetland and riparian habitats (Levings et al. 1998; Cassell 1999).

Prior to the construction of dams such as the Cochiti Dam, the Rio Grande River had characteristics similar to the Colorado River, with warm water and a high sediment load (Scurlock 1998). Dams, and the resulting reservoirs, have resulted in slower, clearer, and colder water. Modifications of stream habitats within the Rio Grande River Basin due to impoundments, water diversion for agriculture, stream channelization, and the introduction of non-native fishes have affected the abundance and distribution of the Rio Grande silvery minnow (*Hybognathus amarus*), a species that was once widely distributed in the Pecos River, but is now federally listed as endangered. Currently, 157 miles of the Rio Grande River is designated as critical habitat for this species by the USFWS (Section 3.8.1.4).

The Great Basin hydrologic region covers an arid expanse of approximately 190,000 square miles and provides internal drainage between the Wasatch Mountains of Utah and the Sierra Nevada Range in California and Nevada. Streams in this area never reach the ocean, but instead drain toward the interior of the basin, resulting in terminal lakes such as Mono Lake and the Great Salt Lake, marshes, or sinks that are warm and saline (Moyle 1976).

Many Great Basin fish are adapted to extreme conditions. Trout are predominantly found in lakes and streams at higher elevations within the basin (Behnke 1992). Bonneville cutthroat trout (*Oncorhynchus clarki utah*) have persisted in the isolated, cool mountain streams of the eastern Great Basin, while Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*) populations occupy small, isolated habitats throughout the basin. These trout species can tolerate high temperatures (greater than 80°F) for short periods of time and can tolerate daily fluctuations in temperatures of 25 to 35°F. They are also quite tolerant of high alkalinity and dissolved solids (Behnke 1992; Coffin and Cowan 1995).

Water diversions, subsistence harvest, and stocking with non-native fish have caused the extirpation of the Bonneville cutthroat trout from most of its range within the Great Basin. Lahontan cutthroat trout, which were once common in desert lakes and large rivers, such as Humboldt River, Truckee River, and Walker River, have declined in numbers overall and have disappeared in many areas (USFWS 1994). Various native and non-native minnows are common throughout streams and lakes of the Great Basin. Native pupfish (family Cyprinodontidae) species, which are tolerant of high-temperature ranges compared to many other fish species, occur in thermal artesian springs and some streams in portions of Nevada (Feldmeth 1981).

California Hydrologic Region. Primarily composed of areas within the state of California, the California hydrologic region can be divided into distinct northern and southern freshwater fish habitat regions. The northern region extends from the Oregon border south to Sacramento (the southernmost extent of anadromous salmon distribution in North America). This region includes rain-fed coastal streams, snow-fed streams of western Sierra Nevada, and the Central and San Joaquin Valleys. Habitat characteristics and the associated fish assemblages are relatively similar to those observed in the western portion of the Pacific Northwest hydrologic region. The northern portion of the California hydrologic region also contains EFH for anadromous Pacific salmon (Text Box 3.8-1).

Freshwater fish habitats within the southern portion of the California hydrologic region are located predominantly within the arid southeastern portion of the state and include numerous rivers and lakes. As described above for the Lower Colorado River and Great Basin hydrologic regions, native fish communities, including pupfish and minnow species, occur in the lower elevations, and cutthroat trout populations occur in the mountainous regions.

Missouri River Basin Hydrologic Region. Within the 11-state area considered in this PEIS, the Missouri River Basin hydrologic region includes portions of Montana, Wyoming, and Colorado. Historically, the Missouri River carried a heavy silt load, collected from tributaries in the northern part of its drainage. Its wide and diverging channel created shifting sandy islands, spits, and pools, resulting in fish species suited to its turbid and dynamic conditions. Many of the fish communities within the upper reaches of the Missouri River are considered benthic fishes, and include sturgeon (family Acipenseridae) and minnows (Duffy et al. 1996; Pegg and Pierce 2002).

Public lands in Montana occur predominantly in the northeastern portion of the state in the Milk River Basin subsection of the Missouri River Basin. This area has relatively high densities of depressional wetlands, often called prairie potholes, as they are dominated by shortgrass prairies. The upper reaches of the Missouri River and its major tributaries maintain the healthiest fish populations in the basin (White and Bramblett 1993). However, dams built along the mainstem of the Missouri River in Montana, such as the Fort Peck Dam, have altered flows and sediment transport and impede fish migration patterns. These changes have contributed to the decline of many native mainstem species, including paddlefish (*Polyodon spathula*), sturgeon, and several species of chub (family Cyprinidae).

Introduced species, such as rainbow trout, have been stocked throughout Montana. Rainbow trout have adapted well to the wide range of habitats available within the basin. The species has successfully integrated into this aquatic system, and has caused a severe reduction in the range of native cutthroat trout through hybridization and competition. Other introduced species that have adapted well to the modifications of the Missouri River drainage in Montana include smallmouth bass (*Micropterus dolomieu*), walleye, and white crappie (*Pomoxis annularis*).

Portions of Wyoming east of the Continental Divide are drained by the Missouri River Basin, while southwest portions of the state drain into the Upper Colorado River Basin. Native and introduced salmonids such as rainbow, brook, and cutthroat trout dominate fish communities within these areas. Streams flowing through the arid desert plains of Wyoming are characterized by low gradients and meandering or braided channels with sand and gravel substrates. Riparian vegetation in this area is dominated by cottonwoods, willows, shrubs, and grasses. Central and northern Wyoming are considered high cold desert. Native and non-native minnows and suckers dominate fish communities in these areas.

3.8.1.3 Wildlife in the Affected Area

As discussed in Section 3.8.1.1, the various ecoregions encompassed in the 11-state region include a diversity of plant communities and species that provide a wide range of habitats that support diverse assemblages of terrestrial wildlife (including wild horses [*Equus caballus*] and burros [*E. asinus*]).[7] Table 3.8-2 lists the number of wildlife species that occur within the 11 western states. Due to the spatial extent of the West-wide energy corridor segments within the western states, many of the ecosystems occurring in these states would contain one or more segment. (See Appendix O for maps that overlay the energy corridor segments with the ecosystems in each state.) Therefore, many of the wildlife species that occur within these states may be expected to occur within or near a corridor segment or associated ancillary facilities. The wildlife species that may be associated with any particular segment would depend on the plant communities and habitats present within the corridor segment.

The BLM and FS have active wildlife management programs within each of their field or district offices. Wildlife management programs are largely aimed at habitat protection and improvement. The general objectives of wildlife management are to (1) maintain, improve, or enhance wildlife species diversity while ensuring healthy ecosystems; and (2) restore disturbed or altered habitat with the objective of obtaining desired native plant communities, while providing for wildlife needs and soil stability. The FS and BLM are primarily responsible for managing habitats, while state agencies (e.g., Colorado Department of Natural Resources, Utah Department of Wildlife Resources, and Wyoming Game and Fish Department) have the responsibility for managing the big game, small game, and nongame wildlife species in cooperation with BLM and FS. The USFWS has oversight of migratory bird species and of all federal threatened, endangered, proposed, or candidate species. BLM and FS guidelines for the management of threatened and endangered species are provided in Section 3.8.1.4.

The FS identifies and selects plant and animal species whose population changes are believed to reflect the effects of management activities. These species are referred to as management indicator species, and are identified in the Land and Resource Management Plans of each national forest. They are considered to represent a broader group of species or habitats that occur within each national forest and are considered sensitive to FS management activities. Impacts to these species would be

[7] Wild horses and burros are not considered to be, nor are they managed as, “wildlife” on BLM-administered lands. They are managed as a separate resource management category under the Wild Free-Roaming Horses and Burros Act (16 USC 1331 et seq.). However, as wild horses and burros would be impacted by construction and operation of ROWs in a similar manner to other large mammals, they are addressed within the wildlife sections for ease of discussion.

TABLE 3.8-2 Number of Wildlife Species in the 11 Western States[a]

State	Amphibians	Reptiles	Mammals[b]	Birds
Arizona	29	112	169	533
California	68	90	182	626
Colorado	18	56	131	478
Idaho	15	24	111	402
Montana	18	17	110	417
Nevada	15	54	125	472
New Mexico	25	96	156	510
Oregon	31	29	137	492
Utah	17	57	136	428
Washington	27	22	116	468
Wyoming	12	27	121	420

[a] Excludes marine species, native species that have been extirpated and not subsequently reintroduced into the wild, and feral domestic species.

[b] Includes wild horses and burros.

Sources: AGFD (2006); American Society of Mammalogists (1999); Burke Museum of Natural History and Culture (2006); CDFG (2006); CDW (2006); Colorado Herpetological Society (2006); Hole (2005); Idaho Fish and Game (2006a,b); Lepage (2006); McLaren (2001); Montana Fish, Wildlife & Parks (undated); NNHP (2002); Titus (undated); UDWR (2006); WGFD (2006).

considered in project-specific assessments prepared prior to project development.

The Wild Free-Roaming Horses and Burros Act (16 USC 1331 et seq.) passed by Congress in 1971 gave BLM the responsibility to protect, manage, and control wild horses and burros. The general management objectives for wild horses are to (1) protect, maintain, and control viable, healthy herds with diverse age structures while retaining their free-roaming nature; (2) provide adequate habitat for wild horses through the principles of multiple use and environmental protection; (3) maintain a thriving natural ecological balance with other resources; (4) provide opportunities for the public to view wild horses; and (5) protect wild horses from unauthorized capture, branding, harassment, or death (BLM 1997, 2005d).

Consumptive and nonconsumptive recreational uses are associated with wildlife within BLM- and FS-administered lands. These include hunting of big game, small game, upland game birds, and waterfowl; fur trapping; wildlife viewing; and antler hunting.

The following discussions present general descriptions of the wildlife species and wild horses and burros that may occur on BLM- and FS-administered lands where energy corridors may be designated.

Amphibians and Reptiles. The 11 western states in which designation of federal energy corridors may occur on BLM- and FS-administered lands support a wide variety of amphibians and reptiles, many of which may occur at or in the vicinity of individual corridor segments. The number of amphibian species reported from these states ranges from as few as 12 species reported from Wyoming to 68 species reported from California. The number of reptile species reported from these states ranges from 17 species in Montana to 112 species in Arizona (Table 3.8-2). The amphibians reported from these states include frogs, toads, and salamanders that occupy a variety of habitats that include forested headwater streams in mountain regions, marshes, and wetlands, and xeric habitats in the desert areas of the Southwest. The reptile species include a wide variety of turtles, snakes, and lizards. Amphibian and reptile species that are threatened or endangered are listed in Table 3.8-5 (Section 3.8.1.4).

Birds. Several hundred species of birds have been reported from the 11 western states where federal energy corridor designation may occur (Table 3.8-2). The number of bird species ranges from 402 in Idaho to 626 in California (Lepage 2006). The coastal states (California, Oregon, and Washington) include oceanic species such as boobies, gannets, frigatebirds, fulmars, and albatrosses that would not be expected to occur in areas where energy corridor designation may occur. Bird species that are threatened or endangered are listed in Table 3.8-5 (Section 3.8.1.4).

Within the 11 western states, a number of important bird areas (IBAs) have been identified by the National Audubon Society. IBAs are locations that provide essential habitats for breeding, wintering, or migrating birds. While these sites can vary in size, they are discrete areas that stand out from the surrounding landscapes. IBAs must support one or more of the following:

- Species of conservation concern (e.g., threatened or endangered species);
- Species with restricted ranges;
- Species that are vulnerable because their populations are concentrated into one general habitat type or ecosystem; or
- Species or groups of similar species (e.g., waterfowl or shorebirds) that are vulnerable because they congregate in high densities.

The IBA program has become a key component of many bird conservation efforts (National Audubon Society 2005). Information on the IBA program and a list of IBAs for each state can be found at: http://www.audubon.org/bird/iba/index.html.

***Migratory Routes*.** Many of the bird species occurring in the 11 western states are seasonal residents within individual states and exhibit seasonal migrations. These birds include waterfowl, shorebirds, raptors, and neotropical songbirds. The 11 western states where energy corridor designation may occur fall within two of the four major North American migration flyways (Lincoln et al. 1998), the Central Flyway and the Pacific Flyway (Figure 3.8-2). These pathways are used in spring by birds migrating north from wintering areas to breeding areas, and in fall by birds migrating southward to wintering areas.

The Central Flyway includes the Great Plains–Rocky Mountain routes (Lincoln et al. 1998). These routes extend from the northwest Arctic coast southward between the Mississippi River and the eastern base of the Rocky Mountains and encompass all or most of the states of Wyoming, Colorado, and New Mexico, and portions of Montana, Idaho, and Utah (Figure 3.8-2). In western Montana, this flyway crosses the Continental Divide and passes through the Great Salt Lake Valley before turning eastward. This flyway is relatively simple, with the majority of birds making relatively direct north and south migrations between northern breeding grounds and southern wintering areas.

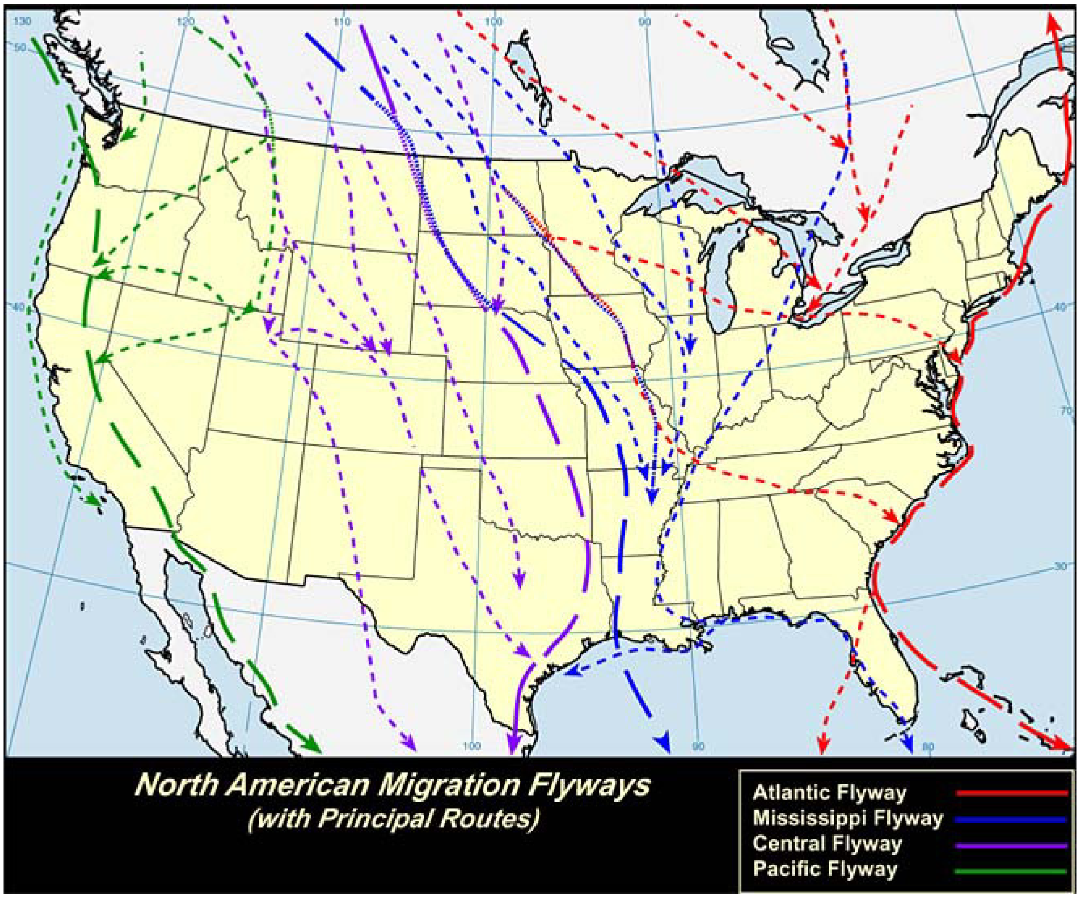


FIGURE 3.8-2 North American Migration Flyways (Source: Birdnature.com [2006], used with permission)

The Pacific Flyway includes the Pacific Coast Route, which occurs between the eastern base of the Rocky Mountains and the Pacific coast of the United States. This flyway encompasses the states of California, Nevada, Oregon, and Washington, and portions of Montana, Idaho, Utah, Wyoming, and Arizona (Figure 3.8-2). Birds migrating from the Alaskan Peninsula follow the coastline to near the mouth of the Columbia River, then travel inland to the Willamette River Valley before continuing southward through interior California (Lincoln et al. 1998). Birds migrating south from Canada pass through portions of Montana and Idaho and then migrate either eastward to enter the Central Flyway, or turn southwest along the Snake and Columbia River valleys and then continue south across central Oregon and the interior valleys of California (Birdnature.com 2006). This route is not as heavily used as some of the other migratory routes in North America (Lincoln et al. 1998).

Waterfowl, Wading Birds, and Shorebirds. Waterfowl (ducks, geese, and swans), wading birds (herons and cranes), and shorebirds (plovers, sandpipers, and similar birds) are among the more abundant groups of birds from the 11 western states. Many of these species exhibit extensive migrations from breeding areas in Alaska and Canada to wintering grounds in Mexico and southward (Lincoln et al. 1998). While many of these species nest in Canada and Alaska, a number of species such as the American avocet (*Recurvirostra americana*), willet (*Catoptrophorus semipalmatus*), spotted sandpiper (*Actitis macularia*), gadwall

(*Anas strepera*), and blue-winged teal (*A. discors*) also nest in suitable habitats in many of the western states (National Geographic Society 1999). Most are ground-level nesters, and many sometimes forage in relatively large flocks on the ground or water. Within the region, migration routes for these birds are often associated with riparian corridors and wetland or lake stopover areas (BLM 2005a).

Major waterfowl species hunted in the 11 western states include the mallard (*Anas platyrhynchos*) and Canada goose (*Branta canadensis*). Other species commonly hunted include gadwall, American widgeon (*A. americana*), teal (*A.* spp.), northern pintail (*A. acuta*), northern shoveler (*A. clypeata*), and snow goose (*Chen caerulescens*) (USFWS 2003). A hunting season also occurs for sandhill cranes (*Grus canadensis*) in some of the states. Various conservation and management plans exist for waterfowl, shorebirds, and waterbirds.

***Neotropical Migrants*.** Songbirds of the order Passeriformes represent the most diverse category of birds, with the warblers and sparrows representing the two most diverse groups of passerines. The passerines exhibit a wide range of seasonal movements, with some species remaining as year-round residents in some areas and migratory in others, and still other species undergoing migrations of hundreds of miles or more (Lincoln et al. 1998). Nesting occurs in vegetation from near ground level to the upper canopy of trees. Some species, such as the thrushes and chickadees, are relatively solitary throughout the year, while others, such as swallows and blackbirds, may occur in small to large flocks at various times of year. Foraging may occur in flight (i.e., swallows and swifts) or on vegetation or the ground (i.e., warblers, finches, and thrushes). Various conservation and management plans exist for neotropical migrants, including the Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004).

The regulatory framework organized to protect the neotropical migrants includes:

- *Migratory Bird Treaty Act.* The Migratory Bird Treaty Act implements a variety of treaties and conventions between the United States, Canada, Mexico, Japan, and Russia. This treaty makes it unlawful to take, kill, or possess migratory birds, as well as their eggs or nests. Most of the bird species reported from the 11 western states are classified as migratory under this act.

- *Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds*. Under this Executive Order, each federal agency that is taking an action that could have, or is likely to have, negative impacts on migratory bird populations must work with the USFWS to develop a MOU to conserve those birds. The MOUs developed by this consultation are intended to guide future agency regulatory actions and policy decisions.

***Birds of Prey*.** The birds of prey include the raptors (hawks, falcons, eagles, kites, and osprey), owls, and vultures, and many of these species represent the top avian predators in many ecosystems. Common raptor and owl species include the red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), northern harrier (*Circus cyaneus*), Swainson’s hawk (*B. swainsoni*), American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*), and burrowing owl (*Athene cunicularia*). The raptors and owls vary considerably among species with regard to their seasonal migrations, with some species being nonmigratory (year-round residents), others being migratory in the northern portions of their ranges and nonmigratory in the southern portions of their ranges, and still other species being migratory throughout their ranges.

The raptors forage on a variety of prey, including small mammals, reptiles, other birds, fish, invertebrates, and, at times, carrion. They typically perch on trees, utility support structures, highway signs, and other high structures that provide a broad view of the surrounding topography, and may soar for extended periods of time at relatively high altitudes. The raptors forage from either a perch or on the wing (depending on the species), and all forage during the day. The owls also perch on elevated structures and forage on a variety of prey, including mammals, birds, and insects. Forest-dwelling species typically forage by diving on a prey item from a perch, while open country species hunt on the wing while flying low over the ground. While generally nocturnal, some owl species may be active during the day (Owl Research Institute 2004).

The vultures are represented by three species: the turkey vulture (*Cathartes aura*), which occurs in each of the western states; the black vulture (*Coragyps atratus*), which is reported from Arizona, California, and New Mexico; and the endangered California condor (*Gymnogyps californianus*), reported from Arizona and California. These birds are large soaring scavengers that feed on carrion.

The bald eagle (*Haliaeetus leucocephalus*) and golden eagle are protected under the Bald and Golden Eagle Protection Act (16 USC 668–668d, 54 Stat. 250, as amended), which prohibits the taking or possession of, or commerce in, bald and golden eagles, with limited exceptions for permitted scientific research and Native American religious purposes. The 1978 amendment authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations. The BLM and FS field or district offices also have specific management guidelines for raptors, including golden eagles.

Upland Game Birds. Upland game birds that are native to the 11 western states include blue grouse (*Dendragapus obscurus*), ruffed grouse (*Bonasa umbellus*), greater sage-grouse (*Centrocercus urophasianus*), Gunnison sage-grouse (*C. minimus*), and mourning doves (*Zenaida macroura*), while introduced species include ring-necked pheasant (*Phasianus colchicus*), chukar (*Alectoris chukar*), gray partridge (*Perdix perdix*), and wild turkey (*Meleagris gallopavo*). All of the upland game bird species within the states are year-round residents. Ring-necked pheasants and greater sage-grouse have experienced long-term declines due to the degradation and loss of important sagebrush-steppe and grassland habitats (BLM 2005d).

Most concerns about upland game birds in the 11 western states have focused on the greater sage-grouse. Greater sage-grouse require contiguous, undisturbed areas of high-quality habitat during their four distinct seasonal periods: (1) breeding, (2) summer-late brooding and rearing, (3) fall, and (4) winter (Connelly et al. 2000). Sagebrush is important to the greater sage-grouse for forage and for roosting cover, and the greater sage-grouse cannot survive where sagebrush does not exist (USFWS 2004). The distance between leks (strutting grounds) and nesting sites can exceed 12.4 miles (Connelly et al. 2000; Bird and Schenk 2005). The annual movements of migratory populations can exceed 60 miles, and migratory populations can have home ranges that exceed 580 square miles (Bird and Schenk 2005). However, the greater sage-grouse has a high fidelity to a seasonal range. They also return to the same nesting areas annually (Connelly et al. 2000, 2004).

Leks are generally areas supported by low, sparse vegetation or open areas surrounded by sagebrush that provide escape, feeding, and cover. They can range in size from small areas of 0.1 to 10 acres to areas of 100 acres or more (Connelly et al. 2000). Nesting generally occurs 1 to 4 miles from lek sites, although it may range up to 11 miles (BLM 2004a). Suitable winter habitat requires sagebrush 10 to 14 inches above snow level with a canopy cover ranging from 10 to 30%. Wintering grounds are potentially the most limiting seasonal habitat for greater sage-grouse (BLM 2004a).

While no single or combination of factors have been proven to have caused the decline in greater sage-grouse numbers over the past half-century, the decline in greater sage-grouse populations is thought to be due to a number of factors including drought, oil and gas wells and their associated infrastructure, powerlines, predators, and a decline in the quality and quantity of sagebrush habitat (due to livestock grazing, range management treatments, and development activities) (Connelly et al. 2000; Crawford et al. 2004). West Nile virus is also a significant stressor of greater sage-grouse (Naugle et al. 2004).

The BLM manages more habitats for greater sage-grouse than any other entity; therefore, it has developed a National Sage-Grouse Habitat Conservation Strategy for BLM-administered public lands to manage public lands in a manner that will maintain, enhance, and restore greater sage-grouse habitat while providing for multiple uses of BLM-administered public lands (BLM 2004e). The strategy is consistent with the individual state sage grouse conservation planning efforts. The purpose of this strategy is to set goals and objectives, assemble guidance and resource materials, and provide more uniform management directions for the BLM's contributions to the multistate sage grouse conservation effort being led by state wildlife agencies (BLM 2004e).

Text Box 3.8-2 (Section 3.8.4.1) addresses the sage grouse in more detail.

Mammals. More than 1,000 species of mammals have been reported from each of the 11 western states (Table 3.8-2), ranging from 110 species in Montana to 182 species in California. These totals include wild horses that occur in all states except Washington and wild burros that occur in Arizona, California, Nevada, Oregon, and Utah (NatureServe 2006). Feral cats (*Felis catus*) and dogs (*Canis familiaris*) also occur in the region. The following discussion emphasizes big game and small mammal species that (1) have key habitats within or near the areas that could be developed for energy transport, (2) are important to humans (e.g., big and small game and furbearer species), and/or (3) are representative of other species that share important habitats. Wild horses and burros are discussed at the end of this section. Threatened and endangered mammal species are discussed in Section 3.8.1.4.

Big game species within the region include elk (*Cervis canadensis*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), moose (*Alces americanus*), American bison (*Bos bison*), American black bear (*Ursus americanus*), and cougar (*Puma concolor*). A number of the big game species make migrations when seasonal changes reduce food availability, when movement within an area becomes difficult (e.g., due to snow pack), or where local conditions are not suitable for calving or fawning. Established migration corridors for these species provide an important transition habitat between seasonal ranges and provide food for the animals during migration (Feeney et al. 2004). Maintaining migration corridors, especially when seasonal ranges are far removed from each other, can be difficult due to the various land ownership mixes that often need to be traversed (Sawyer et al. 2005).

The following presents a generalized overview of the big games species. Table 3.8-3 presents the conservation status (i.e., whether a species is thriving or is rare or declining) for the big games species within the 11 western states.

Elk. Elk are generally migratory between their summer and winter ranges (BLM 2004b), although some herds do not migrate (i.e., occur within the same area year-round) (UDWR 2005). Their summer range occurs at higher elevations. Aspen and conifer woodlands provide security and thermal cover, while upland

TABLE 3.8-3 State Conservation Status Ranks for the Big Game Species in the 11 Western States

	State Conservation Status Rank[a]										
Species	AZ	CA	CO	ID	MT	NM	NV	OR	UT	WA	WY
Elk (*Cervis canadensis*)	U	AS	S	S	S	V	S	S	AS	S	S
Mule deer (*Odocoileus hemionus*)	S	S	S	S	S	S	S	AS	S	S	S
White-tailed deer (*Odocoileus virginianus*)	S	–	S	S	S	AS	–	U	CI	S	S
Pronghorn (*Antilocapra americana*)	S	AS	AS	S	S	S	S	AS	AS	PE	S
Bighorn sheep (*Ovis canadensis*)	AS	V	AS	V	AS	CI	V	I	V	V	V
Moose (*Alces americanus*)	–	–	E	S	S	–	–	–	V	I	S
American bison (*Bos bison*)	E	U	PE	CI	I	U	PE	PE	I	PE	CI
American black bear (*Ursus americanus*)	S	S	S	S	S	AS	AS	AS	V	S	S
Cougar (*Puma concolor*)	AS	S	AS	S	AS	V	S	AS	AS	AS	AS

[a] U (unranked) – conservation status not yet assessed.

AS (apparently secure) – uncommon but not rare, some cause for long-term concern due to declines or other factors.

S (secure) – common, widespread, and abundant.

V (vulnerable) – vulnerable due to a restricted range, relatively few populations (often 80 or fewer), recent or widespread declines, or other factors making it vulnerable to extirpation.

– = the state is not within the species' range.

CI (critically imperiled) – critically imperiled because of extreme rarity (often 5 or fewer occurrences) or because some factors such as very steep declines make it especially vulnerable to extirpation.

PE (presumed extirpated) – assumed that a wild population no longer occurs.

I (imperiled) – imperiled because of rarity due to a very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation.

E (exotic) – non-native, present due to direct or indirect human interaction.

Source: NatureServe (2006).

meadows, sagebrush/mixed grass, and mountain shrub habitats are used for forage. Their winter range occurs at mid-to-lower elevations where they forage in sagebrush/mixed grass, big sagebrush/rabbitbrush, and mountain shrub habitats (BLM 2004c). They are highly mobile within both summer and winter ranges in order to find the best forage conditions. In winter, they congregate into large herds of 50 to more than 200 individuals (BLM 2004b). The crucial winter range is considered to be the part of the local elk range where about 90% of the local population is located during an average of five winters out of ten from the first heavy snowfall to spring green-up (BLM 2005d). Elk calving generally occurs in aspen-sagebrush parkland vegetation and habitat zones during late spring and early summer (BLM 2004b). Calving areas are mostly located where cover, forage, and water are in close proximity (BLM 2005d). They may migrate up to 60 miles annually (NatureServe 2006). Elk are susceptible to chronic wasting disease (BLM 2004b).

Mule Deer. Mule deer occur within most ecosystems within the region, but attain their highest densities in shrublands characterized by rough, broken terrain with abundant browse and cover (BLM 2005d). Home range size can vary from 74 to 593 acres or more, depending on the availability of food, water, and cover (NatureServe 2006). Some populations of mule deer are resident (particularly those that inhabit plains), but those in mountainous areas are generally migratory between their summer and winter ranges (BLM 2004c; NatureServe 2006). In arid regions, they may migrate in response to rainfall patterns (NatureServe 2006). In mountainous regions, they may migrate more than 62 miles between high summer and lower winter ranges (NatureServe 2006). In western Wyoming, mule deer migrate 12.4 to 98.2 miles (Sawyer et al. 2005). Their summer range occurs at higher elevations that contain aspen and conifers and mountain browse vegetation. Fawning occurs during the spring while they are migrating to their summer range. This normally occurs in aspen-mountain browse intermixed vegetation (BLM 2004b).

Mule deer have a high fidelity to specific winter ranges where they congregate within a small area at a high density. Their winter range occurs at lower elevations within sagebrush and pinyon-juniper vegetation. Winter forage is primarily sagebrush, with true mountain mahogany, fourwing saltbush, and antelope bitterbrush also being important. Pinyon-juniper provides emergency forage during severe winters (BLM 2004b). Overall, mule deer habitat is characterized by areas of thick brush or trees (used for cover) interspersed with small openings (for forage and feeding areas); they do best in habitats that are in the early stage of succession (UDWR 2003). Prolonged drought and other factors can limit mule deer populations. Several years of drought can limit forage production, which can substantially reduce animal condition and fawn production and survival. Severe drought conditions were responsible for declines in the population size of mule deer in the 1980s and early 1990s (BLM 2004b). In arid regions, they are seldom found more than 1.0 to 1.5 miles from water (BLM 2004a). Mule deer are also susceptible to chronic wasting disease. When present, up to 3% of a herd's population can be affected by this disease. Some deer herds in Colorado and Wyoming have experienced significant outbreaks of chronic wasting disease (BLM 2004b).

White-tailed Deer. White-tailed deer inhabit a variety of habitats, but are often associated with woodlands and agricultural lands (CDW 2006). Within arid areas, they are mostly associated with riparian zones and montane woodlands that have more mesic conditions. They can also occur within suburban areas. Urban areas and very rugged mountain terrain are unsuitable habitats (NatureServe 2006). White-tailed deer occur in two social groups: (1) adult females and young and (2) adult and occasionally yearling males, although adult males are generally solitary during the breeding season except when with females (NatureServe 2006). The annual home range of sedentary populations can average as high as 1,285 acres, while some populations can undergo annual migrations of up to 31 miles. In some areas, the density of white-tailed deer may exceed 129 per square mile (NatureServe 2006). Snow accumulation can have a major controlling effect on populations (NatureServe 2006). They mostly feed upon agricultural crops, browse, grasses, and forbs, but also consume mushrooms, acorns, fruits, and nuts (CDW 2006; UDWR 2006). They often cause damage when browsing in winter on ornamental plants around homes (NatureServe 2006).

Pronghorn. Pronghorn inhabit non-forested areas such as desert, grassland, and sagebrush habitats (BLM 2005d). Herd size can commonly exceed 100 individuals, especially during winter (BLM 2004b). They consume a variety of forbs, shrubs, and grasses, with shrubs being of most importance in winter (BLM 2004b). Some pronghorn are year-long residents and do not have seasonal ranges. Fawning occurs throughout the species range. However, some seasonal movement within their range occurs in response to factors such as extreme winter conditions and water or forage availability (BLM 2004b,c). Other pronghorn are migratory. Most herds range within an area 5 miles or more in diameter, although the separation between summer and winter ranges has been reported to be as much as 99 miles or more (NatureServe 2006). For example, in western Wyoming, pronghorn migrate 72 to 160.3 miles between seasonal ranges (Sawyer et al. 2005). Pronghorn populations have been adversely impacted in some areas by historic range degradation and habitat loss and by periodic drought conditions (BLM 2005d).

Bighorn Sheep. Rocky Mountain bighorn sheep (*Ovis c. canadensis*) and desert bighorn sheep (*O. canadensis nelsoni*) are considered to be year-long residents within their ranges; they do not make seasonal migrations like elk and mule deer (BLM 2004b). However, they do make vertical migrations in response to an increasing abundance of vegetative growth at higher elevations in the spring and summer and when snow accumulation occurs in high-elevation summer ranges (NatureServe 2006). Also, ewes move to reliable watercourses or water sources during the lambing season, with lambing occurring on steep talus slopes within 1 to 2 miles of water (BLM 2004b). Bighorn sheep prefer open vegetation such as low shrub, grassland, and other treeless areas with steep talus and rubble slopes (BLM 2004c). Unsuitable habitats include open water, wetlands, dense forests, and other areas without grass understory (NatureServe 2006).

The distribution of the bighorn sheep within the 11 western states is mostly within the central north-to-south band of states. Their diet consists of shrubs, forbs, and grasses (BLM 2004b). In the early 1900s, bighorn sheep experienced significant declines due to disease, habitat degradation, and hunting (BLM 2005d). Threats to bighorn sheep include habitat changes due to fire suppression, interactions with feral and domestic animals, and human encroachment (NatureServe 2006). Bighorn sheep are very vulnerable to viral and bacterial diseases carried by livestock, particularly domestic sheep. Therefore, BLM has adopted specific guidelines regarding domestic sheep grazing in or near bighorn sheep habitat (BLM 2004b). In appropriate habitats, reintroduction efforts, coupled with water and vegetation improvements, have been conducted to restore bighorn sheep to their native habitat (BLM 2005d).

Moose. Although moose range widely among habitat types, they prefer forest habitats where there is a mixture of wooded and open areas near wetlands and lakes (UDWR 2006). They are primarily browsers upon trees and shrubs such as willow, fir, and quaking aspen, although grasses, forbs, and aquatic vegetation are also consumed during spring, summer, and fall (BLM 2005d; CDW 2006). They generally occur singly or in small groups. Moose are active throughout day and night, but the peak periods of activity are near dawn and dusk (UDWR 2006). Some moose make short elevational or horizontal migrations between summer and winter habitats (NatureServe 2006). They breed in late summer to early fall, with calving occurring in late spring (UDWR 2006). Moose habitat is thought to be improved by annual flooding and habitat management techniques such as prescribed burning (BLM 2005d). In addition to predation by wolves and bears, snow accumulation may have a controlling effect on moose populations. Habitat degradation due to high numbers of moose can lead to population crashes (NatureServe 2006).

American Bison. The American bison inhabits grasslands, semidesert shrublands, pinyon-juniper woodlands, and alpine tundra (CDW 2006). They are grazers, with grasses, sedges, and rushes comprising most of their diet (CDW 2006). American bison are diurnal, being especially active during early morning and late afternoon. They have several grazing periods that are interspersed with periods of loafing and ruminating (NatureServe 2006). Within the 11 western states, American bison are often found in managed herds that are often closely confined (CDW 2006). Only a few remnant wild populations occur in U.S. and Canadian national parks (NatureServe 2006). Pre-1900 herds migrated up to several hundred miles between summer and winter ranges, but herds that currently exist either make short migrations or do not migrate (UDWR 2006).

Cougar. Cougars (also known as mountain lions) inhabit most ecosystems in the 11 western states, but are most common in the rough, broken terrain of foothills and canyons, often in association with montane forests, shrublands, and pinyon-juniper woodlands (CDW 2006). They mostly occur in remote and inaccessible areas (NatureServe 2006). Their annual home range can be more than 560 square miles, while densities are usually not more than 10 adults per 100 square miles (NatureServe 2006). The mountain lion is generally found where its prey species (especially mule deer) are located. In addition to deer, they prey upon most other mammals (which sometimes include domestic livestock) and some insects, birds, fishes, and berries (CDW 2006). They are active year-round. Their peak periods of activity are within 2 hours of sunset and sunrise, although their activity peaks after sunset when they are near humans (NatureServe 2006; UDWR 2006). They are hunted on a limited and closely monitored basis in some states (BLM 2004b; NatureServe 2006).

American Black Bear. American black bears are found mostly within forested or brushy mountain environments and woody riparian corridors (BLM 2005d; UDWR 2006). They are omnivorous. Depending upon seasonal availability, they will feed on forbs and grasses, fruits and acorns, insects, small vertebrates, and carrion (CDW 2006). Breeding occurs in June or July, with young born in January or February (UDWR 2006). American black bears are generally nocturnal, and have a period of winter dormancy (BLM 2005a; UDWR 2006). They are locally threatened by habitat loss and disturbance by humans (NatureServe 2006). The home range size of American black bears varies depending on area and gender and has been reported to be from about 1,250 to nearly 32,200 acres (NatureServe 2006).

Small Mammals. Small mammals include small game, furbearers, and nongame species. Small game species that occur within the 11 western states include black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), mountain cottontail (*S. nuttallii*), squirrels (*Sciurus* spp.), snowshoe hare (*L. americanus*), white-tailed jackrabbit (*L. townsendii*), and yellow-bellied marmot (*Marmota flaviventris*). Common furbearers include American badger (*Taxidea taxus*), American marten (*Martes americana*), American beaver (*Castor canadensis*), bobcat (*Lynx rufus*), common muskrat (*Ondatra zibethicus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), and least weasel (*M. nivalis*). Nongame species includes bats, shrews, mice, voles, chipmunks, and many of the other rodent species.

Wild Horses and Burros. The BLM, in conjunction with the FS, manages wild horses and burros on BLM- and FS-administered lands through the Wild Free Roaming Horse and Burro Act of 1971. Animals are managed within 199 herd management areas (HMAs) with the goal of maintaining the natural ecological balance of public lands as well as the ability to support multiple herds (BLM 2006f). Herd population management is important for balancing herd numbers with forage resources and with other uses of the public and adjacent private lands (BLM 2004a,b). Wild horses that are found outside of HMAs are considered excess and are subject to annual removal (BLM 2004a). On average, a herd of 10 wild horses or burros uses about 3,600 acres, with most herd management areas occupying 10,000 to 100,000 acres or more (BLM 2006f). Annual home range is less than 6,178 acres but may be as large as 74,132 acres (NatureServe 2006).

As wild horse numbers within a herd can increase up to 25% annually, they can affect the condition of their range and increase competitive pressure among wild horses, livestock, and wildlife. Therefore, wild horse and burro herd size is maintained through gathers that are preformed every 3 to 5 years. A gather is a roundup of wild horses and burros, usually conducted by helicopter. Once gathered, a specialist loads the animals onto trucks for transport to a holding area at the gather site where determinations are made about which animals will be returned to the range and which will be sent to a BLM preparation facility. Gathered horses and burros sent to the BLM preparation facility are placed for adoption through the Wild Horse and Burro Adoption Program or otherwise placed in long-term holding facilities. The BLM is currently researching the use of immuno-contraceptives to slow the reproductive rate of wild horses and burros (BLM 2004b).

Issues that make wild horse and burro management difficult include:

- Competition between elk and horses,
- Herd management areas located within areas where critical soils (i.e., soils that pose salinity problems and/or are very susceptible to erosion) make up more than 50% of the area,
- Competition with livestock, and
- Illegal chasing, capturing, and harassment (BLM 2004b).

Wild horses generally occur in common social groups of several females that are led by a dominant male. Young males are expelled from the social group when they are 1 to 3 years old and form bachelor groups (NatureServe 2006). They feed on grass and grass-like plants, and also browse on shrubs in winter. They visit watering holes daily, and may dig to water in dry river beds (NatureServe 2006). Wild horses also tend to dominate water sources, driving wildlife away (BLM 2004c). They are sometimes regarded as a pest because they can foul water, compete with livestock, or displace native ungulates such as pronghorn and bighorn sheep (NatureServe 2006).

Table 3.8-4 summarizes the wild horse and burro statistics for the 11 western states for fiscal year 2006. Ten of the 11 western states (there are no herds in Washington) have a total of 31,201 wild horses and burros, although the appropriate management level (i.e., the maximum number of animals sustainable on a year-long basis) is just 27,512 animals (BLM 2006f).

TABLE 3.8-4 Wild Horse and Burro Statistics for the Western United States, FY2006

	Herd Area[b]			Herd Management Area[c]				Populations			
State[a]	BLM Acres	Other[b,d] Acres	Total Acres	No. HMAs	BLM Acres	Other[d] Acres	Total Acres	Horses	Burros	Total	Total[e] AML
Arizona	2,019,932	1,617,998	3,637,930	7	1,756,086	1,327,777	3,083,863	230	1,542	1,772	1,570
California	5,112,778	1,851,661	6,964,439	22	1,946,590	471,855	2,418,445	3,166	889	4,055	2,199
Colorado	658,119	76,572	734,691	4	366,098	38,656	404,754	884	0	884	812
Idaho	428,421	49,235	477,656	6	377,907	40,287	418,194	594	0	594	617
Montana	104,361	119,242	223,603	1	28,282	8,865	37,147	159	0	159	105
Nevada	19,593,299	3,088,027	22,681,326	102	15,778,284	1,695,925	17,474,209	13,384	834	14,218	13,535
New Mexico	88,653	37,874	126,527	2	24,505	4,107	28,612	62	0	62	83
Oregon	3,559,935	785,250	4,345,185	18	2,703,409	259,726	2,963,135	2,113	15	2,128	2,715
Utah	3,236,178	689,176	3,925,354	21	2,462,726	374,614	2,837,340	2,545	169	2,714	2,151
Wyoming	7,297,778	3,030,010	10,327,788	16	3,638,330	1,137,121	4,775,451	4,615	0	4,615	3,725
Total	42,099,454	11,345,045	53,444,499	199	29,082,217	5,358,933	34,441,150	27,752	3,449	31,201	27,512

[a] No herds or herd management areas in Washington.

[b] Herd area is the geographic area identified as having been used by wild horse or burro herds as their habitat in 1971.

[c] Herd management area is the herd area or portion of the herd area that has been designated for special management emphasizing the maintenance of an established wild horse or burro herd.

[d] Other acres include other federally administered lands (e.g., FS, DOD, NPS) and private lands.

[e] AML = appropriate management level. Number listed is the maximum number of animals sustainable on a year-long basis.

Source: BLM (2006f).

3.8.1.4 Threatened, Endangered, and Other Special Status Species in the Affected Area

Table 3.8-5 presents species listed under the Endangered Species Act (ESA) that occur in the 11 western states where energy corridors could be designated. Species that are proposed for listing or candidates for listing under the ESA are also included in the table. The large area within which corridors could be designated, and the large number of species that could be present in the vicinity of project areas, preclude detailed species-specific and alternative-specific evaluations. Project-specific assessments and consultations with the USFWS and NMFS would be conducted to comply with Section 7 of the ESA prior to approval of ground-disturbing activities and project development.

The following definitions are applicable to the species listing categories under the ESA:

- *Endangered*: any species that is in danger of extinction throughout all or a significant portion of its range.
- *Threatened*: any species that is likely to become endangered within the foreseeable future throughout all or a significant part of its range.
- *Proposed for listing*: species that have been formally proposed for listing by the USFWS or NMFS by notice in the *Federal Register*.[8]
- *Candidate*: species for which the USFWS or NMFS has sufficient information on their biological status and threats to propose them as threatened or endangered under the ESA but for which development of a proposed listing regulation is precluded by other higher priority listing actions.
- *Critical habitat*: specific areas within the geographical area occupied by the species at the time it is listed, on which are found physical or biological features essential to the conservation of the species and which may require special management considerations or protection. Except when designated, critical habitat does not include the entire geographical area that can be occupied by the threatened, endangered, or other special status species.

The number of federally listed species that occur in each of the 11 western states (excluding those found only on coastal islands) is presented in Table 3.8-6. California has the largest number of listed species (271), whereas Montana and Wyoming have the fewest (18 each). In the 11 western states, there are 264 plant species that are federally listed as threatened or endangered, proposed for listing, or candidates for listing under the ESA. There are 230 animal species occurring in the 11 western states that are federally listed as threatened or endangered, proposed for listing, or candidates for listing under the ESA. Included in the total number are 23 species of mollusks, 42 species of arthropods, 72 species of fishes, 12 species of amphibians, 9 species of reptiles, 25 species of birds, and 47 species of mammals. Critical habitat has been designated for 151 species in the 11-state region, and recovery plans have been developed for 331 species that must be followed where federal projects might affect those species (Table 3.8-5).

BLM has established a policy, as specified in BLM Manual 6840, *Special Status Species Management* (BLM 2001b), that directs the agency "to take actions to conserve listed

---

[8] Within one year of a listing proposal, the USFWS or NMFS must take one of three possible courses of action: (1) finalize the listing rule (as proposed or revised); (2) withdraw the proposal if the biological information on hand does not support the listing; or (3) extend the proposal for up to an additional 6 months because, at the end of 1 year, there is substantial disagreement within the scientific community concerning the biological appropriateness of the listing. After the extension, the USFWS or NMFS must make a decision on whether to list the species on the basis of the best scientific information available.

TABLE 3.8-5 Species Listed, Proposed for Listing, or Candidates for Listing under the Endangered Species Act That Occur in the 11 Western States Where West-wide Energy Corridors Could Be Designated

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Plants					
Abronia alpina	Ramshaw Meadows sand-verbena	C	CA	N	N
Acanthomintha ilicifolia	San Diego thornmint	T	CA	N	N
Acanthomintha obovata duttonii	San Mateo thornmint	E	CA	N	Y
Allium munzii	Munz's onion	E	CA	N	N
Alopecurus aequalis var. *sonomensis*	Sonoma alopecurus	E	CA	N	N
Ambrosia pumila	San Diego ambrosia	E	CA	N	N
Amsinckia grandiflora	Large-flowered fiddleneck	E	CA	Y	Y
Amsonia kearneyana	Kearney's blue-star	E	AZ	N	Y
Arabis mcdonaldiana	McDonald's rock-cress	E	CA	N	Y
Arctomecon humilis	Dwarf bear-poppy	E	UT	N	Y
Arctostaphylos glandulosa crassifolia	Del Mar manzanita	E	CA	N	N
Arctostaphylos hookeri var. *ravenii*	Presidio manzanita	E	CA	N	Y
Arctostaphylos morroensis	Morro manzanita	T	CA	N	Y
Arctostaphylos myrtifolia	Ione manzanita	T	CA	N	N
Arctostaphylos pallida	Pallid manzanita	T	CA	N	Y
Arenaria paludicola	Marsh sandwort	E	CA	N	Y
Arenaria ursina	Bear Valley sandwort	T	CA	N	N
Argemone pleiacantha pinnatisecta	Sacramento prickly poppy	E	NM	N	Y
Artemisia campestris var. *wormskioldii*	Northern wormwood	C	OR, WA	N	N
Asclepias welshii	Welsh's milkweed	T	AZ, UT	Y	Y
Astragalus albens	Cushenbury milk-vetch	E	CA	Y	Y
Astragalus ampullarioides	Shivwits milk-vetch	E	UT	Y	Y
Astragalus applegatei	Applegate's milk-vetch	E	OR	N	Y
Astragalus brauntonii	Braunton's milk-vetch	E	CA	Y	Y
Astragalus clarianus	Clara Hunt's milk-vetch	E	CA	N	N
Astragalus cremnophylax var. *cremnophylax*	Sentry milk-vetch	E	AZ	N	Y
Astragalus desereticus	Deseret milk-vetch	T	UT	N	N
Astragalus holmgreniorum	Holmgren milk-vetch	E	AZ, UT	Y	Y
Astragalus humillimus	Mancos milk-vetch	E	CO, NM	N	Y
Astragalus jaegerianus	Lane Mountain milk-vetch	E	CA	Y	N
Astragalus lentiginosus var. *coachellae*	Coachella valley milk-vetch	E	CA	Y	N
Astragalus lentiginosus var. *piscinensis*	Fish Slough milk-vetch	T	CA	N	Y
Astragalus magdalenae var. *peirsonii*	Peirson's milk-vetch	T	CA	Y	N
Astragalus montii	Heliotrope milk-vetch	T	UT	N	Y
Astragalus osterhoutii	Osterhout milk-vetch	E	CO	N	Y
Astragalus phoenix	Ash Meadows milk-vetch	T	NV	Y	Y
Astragalus pycnostachyus var. *lanosissimus*	Ventura Marsh milk-vetch	E	CA	Y	N

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Astragalus tener var. *titi*	Coastal dunes milk-vetch	E	CA	N	Y
Astragalus tortipes	Sleeping Ute milk-vetch	C	CO	N	N
Astragalus tricarinatus	Triple-ribbed milk-vetch	E	CA	N	N
Atriplex coronata var. *notatior*	San Jacinto Valley crownscale	E	CA	N	N
Baccharis vanessae	Encinitas baccharis	T	CA	N	N
Berberis nevinii	Nevin's barberry	E	CA	N	N
Blennosperma bakeri	Sonoma sunshine	E	CA	N	N
Botrychium lineare	Slender moonwort	C	CA, CO, ID, MT, OR, WA, WY	N	N
Brodiaea filifolia	Thread-leaved brodiaea	T	CA	Y	Y
Brodiaea pallida	Chinese Camp brodiaea	T	CA	N	N
Calochortus persistens	Siskiyou mariposa lily	C	CA	N	N
Calochortus tiburonensis	Tiburon mariposa lily	T	CA	N	Y
Calyptridium pulchellum	Mariposa pussypaws	T	CA	N	N
Calystegia stebbinsii	Stebbins' morning-glory	E	CA	N	Y
Camissonia benitensis	San Benito evening-primrose	T	CA	N	Y
Carex albida	White sedge	E	CA	N	N
Carex specuicola	Navajo sedge	T	AZ, UT	Y	Y
Castilleja affinis neglecta	Tiburon paintbrush	E	CA	N	Y
Castilleja campestris succulenta	Fleshy owl's-clover	T	CA	Y	Y
Castilleja christii	Christ's paintbrush	C	ID	N	N
Castilleja cinerea	Ash-grey paintbrush	T	CA	N	N
Castilleja levisecta	Golden paintbrush	T	WA	N	Y
Castilleja mollis	Soft-leaved paintbrush	E	CA	N	Y
Caulanthus californicus	California jewelflower	E	CA	N	Y
Ceanothus ferrisae	Coyote ceanothus	E	CA	N	Y
Ceanothus ophiochilus	Vail Lake ceanothus	T	CA	N	N
Ceanothus roderickii	Pine Hill ceanothus	E	CA	N	Y
Centaurium namophilum	Spring-loving centaury	T	CA, NV	Y	Y
Chamaesyce hooveri	Hoover's spurge	T	CA	Y	N
Chlorogalum purpureum	Purple amole	T	CA	Y	N
Chorizanthe howellii	Howell's spineflower	E	CA	N	Y
Chorizanthe orcuttiana	Orcutt's spineflower	E	CA	N	N
Chorizanthe parryi var. *fernandina*	San Fernando Valley spineflower	C	CA	N	N
Chorizanthe pungens var. *hartwegiana*	Ben Lomond spineflower	E	CA	N	Y
Chorizanthe pungens var. *pungens*	Monterey spineflower	T	CA	Y	Y
Chorizanthe robusta	Robust spineflower	E	CA	Y	Y
Chorizanthe valida	Sonoma spineflower	E	CA	N	Y
Cirsium fontinale var. *fontinale*	Fountain thistle	E	CA	N	Y
Cirsium fontinale var. *obispoense*	Chorro Creek bog thistle	E	CA	N	Y
Cirsium hydrophilum var. *hydrophilum*	Suisun thistle	E	CA	Y	N
Cirsium loncholepis	La Graciosa thistle	E	CA	Y	N
Cirsium vinaceum	Sacramento Mountains thistle	T	NM	N	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Clarkia franciscana	Presidio clarkia	E	CA	N	Y
Clarkia imbricata	Vine Hill clarkia	E	CA	N	N
Clarkia speciosa immaculata	Pismo clarkia	E	CA	N	Y
Clarkia springvillensis	Springville clarkia	T	CA	N	N
Cordylanthus maritimus maritimus	Salt marsh bird's-beak	E	CA	N	Y
Cordylanthus mollis mollis	Soft bird's-beak	E	CA	Y	Y
Cordylanthus palmatus	Palmate-bracted bird's beak	E	CA	N	Y
Cordylanthus tenuis capillaris	Pennell's bird's-beak	E	CA	N	Y
Coryphantha robbinsorum	Cochise pincushion cactus	T	AZ	N	Y
Coryphantha scheeri var. *robustispina*	Pima pineapple cactus	E	AZ	N	N
Coryphantha sneedii var. *leei*	Lee pincushion cactus	T	NM	N	Y
Coryphantha sneedii var. *sneedii*	Sneed pincushion cactus	E	NM	N	Y
Cupressus abramsiana	Santa Cruz cypress	E	CA	N	Y
Cupressus goveniana goveniana	Gowen cypress	T	CA	N	Y
Cycladenia jonesii	Jones cycladenia	T	AZ, UT	N	Y
Deinandra conjugens	Otay tarplant	T	CA	Y	Y
Deinandra increscens villosa	Gaviota tarplant	E	CA	Y	N
Delphinium bakeri	Baker's larkspur	E	CA	Y	N
Delphinium luteum	Yellow larkspur	E	CA	Y	N
Dodecahema leptoceras	Slender-horned spineflower	E	CA	N	N
Dudleya abramsii parva	Conejo dudleya	T	CA	N	Y
Dudleya cymosa. marcescens	Marcescent dudleya	T	CA	N	Y
Dudleya cymosa. ovatifolia	Santa Monica Mountains dudleyea	T	CA	N	Y
Dudleya setchellii	Santa Clara Valley dudleya	E	CA	N	Y
Dudleya stolonifera	Laguna Beach liveforever	T	CA	N	N
Dudleya verityi	Verity's dudleya	T	CA	N	Y
Echinocactus horizonthalonius var. *nicholii*	Nichol's Turk's head cactus	E	AZ	N	Y
Echinocereus fendleri var. *kuenzleri*	Kuenzler hedgehog cactus	E	NM	N	Y
Echinocereus triglochidiatus var. *arizonicus*	Arizona hedgehog cactus	E	AZ	N	Y
Echinomastus erectocentrus var. *acunensis*	Acuna cactus	C	AZ	N	N
Enceliopsis nudicaulis var. *corrugata*	Ash Meadows sunray	T	NV	Y	N
Eremalche kernensis	Kern mallow	E	CA	N	Y
Eriastrum densifolium sanctorum	Santa Ana river woolly-star	E	CA	N	N
Erigeron basalticus	Basalt daisy	C	WA	N	N
Erigeron decumbens var. *decumbens*	Willamette daisy	E	OR	N	N
Erigeron lemmonii	Lemmon fleabane	C	AZ	N	N
Erigeron maguirei	Maguire daisy	T	UT	N	Y
Erigeron parishii	Parish's daisy	T	CA	Y	Y
Erigeron rhizomatus	Zuni fleabane	T	AZ, NM	N	Y
Eriodictyon altissimum	Indian Knob Mountain balm	E	CA	N	Y
Eriodictyon capitatum	Lompoc yerba santa	E	CA	Y	N

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Eriogonum apricum	Ione buckwheat	E	CA	N	N
Eriogonum codium	Umtanum desert buckwheat	C	WA	N	N
Eriogonum diatomaceum	Churchill Narrows buckwheat	C	NV	N	N
Eriogonum gypsophilum	Gypsum wild-buckwheat	T	NM	Y	Y
Eriogonum kelloggii	Red Mountain buckwheat	C	CA	N	N
Eriogonum kennedyi var. *austromontanum*	Southern mountain wild-buckwheat	T	CA	N	N
Eriogonum ovalifolium var. *vineum*	Cushenbury buckwheat	E	CA	Y	Y
Eriogonum ovalifolium var. *williamsiae*	Steamboat buckwheat	E	NV	N	Y
Eriogonum pelinophilum	Clay-loving wild-buckwheat	E	CO	Y	Y
Eriophyllum latilobum	San Mateo woolly sunflower	E	CA	N	Y
Eryngium aristulatum var. *parishii*	San Diego button-celery	E	CA	N	Y
Eryngium constancei	Loch Lomond coyote thistle	E	CA	N	Y
Erysimum capitatum var. *angustatum*	Contra Costa wallflower	E	CA	Y	Y
Erysimum menziesii	Menzies' wallflower	E	CA	N	Y
Erysimum teretifolium	Ben Lomond wallflower	E	CA	N	Y
Eutrema penlandii	Penland alpine fen mustard	T	CO	N	N
Fremontodendron californicum decumbens	Pine Hill flannelbush	E	CA	N	Y
Fremontodendron mexicanum	Mexican flannelbush	E	CA	N	N
Fritillaria gentneri	Gentner's fritillary	E	OR	N	Y
Galium californicum sierrae	El Dorado bedstraw	E	CA	N	Y
Gaura neomexicana var. *coloradensis*	Colorado butterfly plant	T	CO, WY	Y	N
Gilia tenuiflora arenaria	Monterey gilia	E	CA	N	Y
Gilia tenuiflora hoffmannii	Hoffmann's slender-flowered gilia	E	CA	N	Y
Grindelia fraxino-pratensis	Ash Meadows gumplant	T	CA, NV	Y	Y
Hackelia venusta	Showy stickseed	E	WA	N	Y
Hazardia orcuttii	Orcutt's hazardia	C	CA	N	N
Hedeoma todsenii	Todsen's pennyroyal	E	NM	Y	Y
Helianthus paradoxus	Pecos sunflower	T	NM	N	Y
Hesperolinon congestum	Marin dwarf-flax	T	CA	N	Y
Holocarpha macradenia	Santa Cruz tarplant	T	CA	Y	N
Howellia aquatilis	Water howellia	T	CA, ID, MT, OR, WA	N	Y
Ipomopsis polyantha	Pagosa skyrocket	C	CO	N	N
Ipomopsis sancti-spiritus	Holy Ghost ipomopsis	E	NM	N	Y
Ivesia kingii var. *eremica*	Ash Meadows ivesia	T	NV	Y	Y
Ivesia webberi	Webber ivesia	C	CA, NV	N	N
Lasthenia burkei	Burke's goldfields	E	CA	N	N
Lasthenia conjugens	Contra Costa goldfields	E	CA	Y	Y
Layia carnosa	Beach layia	E	CA	N	Y
Lepidium barnebyanum	Barneby ridge-cress	E	UT	N	Y
Lesquerella congesta	Dudley Bluffs bladderpod	T	CO	N	N
Lesquerella kingii bernardina	San Bernardino Mountains bladderpod	E	CA	Y	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Lesquerella tumulosa	Kodachrome bladderpod	E	UT	N	Y
Lessingia germanorum	San Francisco lessingia	E	CA	N	Y
Lilaeopsis schaffneriana var. *recurva*	Huachuca water-umbel	E	AZ	Y	N
Lilium occidentale	Western lily	E	CA, OR	N	Y
Lilium pardalinum pitkinense	Pitkin marsh lily	E	CA	N	Y
Limnanthes floccosa californica	Butte County meadowfoam	E	CA	Y	Y
Limnanthes floccosa grandiflora	Large-flowered woolly meadowfoam	E	OR	N	Y
Limnanthes vinculans	Sebastopol meadowfoam	E	CA	N	Y
Lomatium bradshawii	Bradshaw's desert-parsley	E	OR, WA	N	Y
Lomatium cookii	Cook's lomatium	E	OR	N	Y
Lupinus nipomensis	Nipomo Mesa lupine	E	CA	N	N
Lupinus sulphureus kincaidii	Kincaid's lupine	T	OR, WA	N	N
Lupinus tidestromii	Clover lupine	E	CA	N	Y
Mentzelia leucophylla	Ash Meadows blazingstar	T	NV	Y	Y
Mirabilis macfarlanei	Macfarlane's four-o'clock	T	ID, OR	N	Y
Monardella linoides viminea	Willowy monardella	E	CA	N	N
Monolopia congdonii	San Joaquin wooly-threads	E	CA	N	Y
Navarretia fossalis	Spreading navarretia	T	CA	N	Y
Navarretia leucocephala pauciflora	Few-flowered navarretia	E	CA	N	Y
Navarretia leucocephala plieantha	Many-flowered navarretia	E	CA	N	Y
Neostapfia colusana	Colusa grass	T	CA	Y	Y
Nitrophila mohavensis	Amargosa niterwort	E	CA, NV	Y	Y
Oenothera avita eurekensis	Eureka Valley evening-primrose	E	CA	N	Y
Oenothera deltoides howellii	Antioch Dunes evening-primrose	E	CA	Y	Y
Opuntia treleasei	Bakersfield cactus	E	CA	N	Y
Orcuttia californica	California orcutt grass	E	CA	N	Y
Orcuttia inaequalis	San Joaquin orcutt grass	T	CA	Y	Y
Orcuttia pilosa	Hairy orcutt grass	E	CA	Y	Y
Orcuttia tenuis	Slender orcutt grass	T	CA	Y	Y
Orcuttia viscida	Sacramento orcutt grass	E	CA	Y	Y
Oxytheca parishii var. *goodmaniana*	Cushenbury oxytheca	E	CA	Y	Y
Parvisedum leiocarpum	Lake County stonecrop	E	CA	N	Y
Pediocactus bradyi	Brady pincushion cactus	E	AZ	N	Y
Pediocactus despainii	San Rafael cactus	E	UT	N	Y
Pediocactus knowltonii	Knowlton cactus	E	CO, NM	N	Y
Pediocactus peeblesianus peeblesianus	Peebles Navajo cactus	E	AZ	N	Y
Pediocactus peeblesianus fickeiseniae	Fickeisen plains cactus	C	AZ	N	N
Pediocactus sileri	Siler pincushion cactus	T	AZ, UT	N	Y
Pediocactus winkleri	Winkler cactus	T	UT	N	Y
Penstemon debilis	Parachute beardtongue	C	CO	N	N
Penstemon penlandii	Penland beardtongue	E	CO	N	Y
Penstemon scariosus albifluvis	White River beardtongue	C	CO, UT	N	N
Pentachaeta bellidiflora	White-rayed pentachaeta	E	CA	N	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Pentachaeta lyonii	Lyon's pentachaeta	E	CA	Y	Y
Phacelia argillacea	Clay phacelia	E	UT	N	Y
Phacelia formosula	North Park phacelia	E	CO	N	Y
Phacelia stellaris	Brand's phacelia	C	CA	N	N
Phacelia submutica	Debeque phacelia	C	CO	N	N
Phlox hirsuta	Yreka phlox	E	CA	N	Y
Physaria obcordata	Dudley Bluffs twinpod	T	CO	N	Y
Physaria tuplashensis	White Bluffs bladderpod	C	WA	N	N
Piperia yadonii	Yadon's piperia	E	CA	N	Y
Plagiobothrys hirtus	Rough popcornflower	E	OR	N	Y
Plagiobothrys strictus	Calistoga allocarya	E	CA	N	N
Poa atropurpurea	San Bernardino bluegrass	E	CA	N	N
Poa napensis	Napa bluegrass	E	CA	N	N
Pogogyne abramsii	San Diego mesa-mint	E	CA	N	Y
Pogogyne nudiuscula	Otay mesa-mint	E	CA	N	Y
Polygonum hickmanii	Scotts Valley polygonum	E	CA	Y	N
Potentilla basaltica	Soldier Meadows cinquefoil	C	NV	N	N
Potentilla hickmanii	Hickman's potentilla	E	CA	N	Y
Primula maguirei	Maguire primrose	T	UT	N	Y
Pseudobahia bahiifolia	Hartweg's golden sunburst	E	CA	N	N
Pseudobahia peirsonii	San Joaquin adobe sunburst	T	CA	N	N
Purshia subintegra	Arizona cliff-rose	E	AZ	N	Y
Ranunculus aestivalis	Autumn buttercup	E	UT	N	Y
Rorippa gambellii	Gambel's watercress	E	CA	N	Y
Rorippa subumbellata	Tahoe yellow cress	C	CA, NV	N	N
Schoenocrambe argillacea	Clay reed-mustard	T	UT	N	Y
Schoenocrambe barnebyi	Barneby reed-mustard	E	UT	N	Y
Schoenocrambe suffrutescens	Shrubby reed-mustard	E	UT	N	Y
Sclerocactus glaucus	Uinta Basin hookless cactus	T	CO, UT	N	Y
Sclerocactus mesae-verdae	Mesa Verde cactus	T	CO, NM	N	Y
Sclerocactus wrightiae	Wright fishhook cactus	E	UT	N	Y
Sedum eastwoodiae	Red Mountain stonecrop	C	CA	N	N
Senecio franciscanus	San Francisco Peaks groundsel	T	AZ	Y	Y
Senecio layneae	Layne's butterweed	T	CA	N	Y
Sidalcea keckii	Keck's checker-mallow	E	CA	Y	N
Sidalcea nelsoniana	Nelson's checker-mallow	T	OR, WA	N	Y
Sidalcea oregana valida	Kenwood marsh checker-mallow	E	CA	N	N
Sidalcea oregana var. *calva*	Wenatchee Mountains checker-mallow	E	WA	Y	Y
Sidalcea pedata	Pedate checker-mallow	E	CA	N	Y
Silene spaldingii	Spalding's catchfly	T	ID, MT, OR, WA	N	Y
Spiranthes delitescens	Canelo hills ladies'-tresses	E	AZ	N	N
Spiranthes diluvialis	Ute ladies'-tresses	T	CO, ID, MT, NV, UT, WA, WY	N	Y
Stephanomeria malheurensis	Malheur wire-lettuce	E	OR	Y	Y
Streptanthus albidus albidus	Metcalf Canyon jewelflower	E	CA	N	Y
Streptanthus niger	Tiburon jewelflower	E	CA	N	Y
Suaeda californica	California seablite	E	CA	N	N

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Swallenia alexandrae	Eureka dune grass	E	CA	N	Y
Taraxacum californicum	California taraxacum	E	CA	N	N
Thelypodium howellii spectabilis	Howell's spectacular thelypody	T	OR	N	Y
Thelypodium stenopetalum	Slender-petaled mustard	E	CA	N	Y
Thlaspi californicum	Kneeland Prairie penny-cress	E	CA	Y	Y
Townsendia aprica	Last chance townsendia	T	UT	N	Y
Trichostema austromontanum compactum	Hidden Lake bluecurls	T	CA	N	N
Trifolium amoenum	Showy Indian clover	E	CA	N	N
Trifolium trichocalyx	Monterey clover	E	CA	N	Y
Tuctoria greenei	Greene's tuctoria	E	CA	Y	Y
Tuctoria mucronata	Solano grass	E	CA	Y	Y
Verbena californica	Red Hills vervain	T	CA	N	N
Verbesina dissita	Big-leaved crownbeard	T	CA	N	N
Yermo xanthocephalus	Desert yellowhead	T	WY	Y	N
Mollusks					
Assiminea pecos	Pecos assiminea snail	E	NM	Y	N
Haliotis sorenseni	White abalone	E	CA	N	N
Helminthoglypta walkeriana	Morro shoulderband snail	E	CA	Y	Y
Juturnia kosteri	Koster's springsnail	E	NM	N	N
Lanx sp.	Banbury springs limpet	E	ID	N	Y
Oreohelix peripherica wasatchensis	Ogden mountainsnail	C	UT	N	N
Oxyloma haydeni kanabensis	Kanab ambersnail	E	AZ, UT	N	Y
Physa natricina	Snake River physa snail	E	ID	N	Y
Popenaias popei	Texas hornshell	C	NM	N	N
Pyrgulopsis bruneauensis	Bruneau hot springsnail	E	ID	N	Y
Pyrgulopsis chupaderae	Chupadera springsnail	C	NM	N	N
Pyrgulopsis gilae	Gila springsnail	C	NM	N	N
Pyrgulopsis idahoensis	Idaho springsnail	E	ID	N	Y
Pyrgulopsis morrisoni	Page springsnail	C	AZ	N	N
Pyrgulopsis neomexicana	Socorro springsnail	E	NM	N	Y
Pyrgulopsis roswellensis	Roswell springsnail	E	NM	N	N
Pyrgulopsis thermalis	New Mexico springsnail	C	NM	N	N
Pyrgulopsis thompsoni	Huachuca springsnail	C	AZ	N	N
Pyrgulopsis trivialis	Three Forks springsnail	C	AZ	N	N
Stagnicola bonnevillensis	Bonneville pondsnail	C	UT	N	N
Taylorconcha serpenticola	Bliss rapids snail	T	ID	N	Y
Tryonia alamosae	Alamosa springsnail	E	NM	N	Y
Valvata utahensis	Utah valvata snail	E	ID	N	Y
Arthropods					
Ambrysus amargosus	Ash Meadows naucorid	T	NV	Y	Y
Ambrysus funebris	Nevares Spring naucorid bug	C	CA	N	N
Apodemia mormo langei	Lange's metalmark butterfly	E	CA	N	Y
Boloria acrocnema	Uncompahgre fritillary butterfly	E	CO	N	Y
Branchinecta conservatio	Conservancy fairy shrimp	E	CA	Y	Y
Branchinecta longiantenna	Longhorn fairy shrimp	E	CA	Y	Y
Branchinecta lynchi	Vernal pool fairy shrimp	T	CA, OR	Y	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Branchinecta sandiegonensis	San Diego fairy shrimp	E	CA	Y	Y
Callophrys mossii bayensis	San Bruno elfin butterfly	E	CA	N	Y
Cicindela limbata albissima	Coral pink sand dunes tiger beetle	C	UT	N	N
Cicindela ohlone	Ohlone tiger beetle	E	CA	N	N
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	T	CA	Y	Y
Elaphrus viridis	Delta green ground beetle	T	CA	Y	Y
Euphilotes battoides allyni	El Segundo blue butterfly	E	CA	N	Y
Euphilotes enoptes smithi	Smith's blue butterfly	E	CA	N	Y
Euphydryas editha bayensis	Bay checkerspot butterfly	T	CA	Y	Y
Euphydryas editha quino	Quino checkerspot butterfly	E	CA	Y	Y
Euphydryas editha taylori	Taylor's checkerspot	C	OR, WA	N	N
Euproserpinus euterpe	Kern primrose sphinx moth	T	CA	N	Y
Gammarus desperatus	Noel's amphipod	E	NM	N	N
Glaucopsyche lygdamus palosverdesensis	Palos Verdes blue butterfly	E	CA	Y	Y
Hesperia leonardus montana	Pawnee montane skipper	T	CO	N	Y
Heterelmis stephani	Stephan's riffle beetle	C	AZ	N	N
Icaricia icarioides fenderi	Fender's blue butterfly	E	OR	N	N
Icaricia icarioides missionensis	Mission blue butterfly	E	CA	N	Y
Lepidurus packardi	Vernal pool tadpole shrimp	E	CA	Y	Y
Lycaeides argyrognomon lotis	Lotis blue butterfly	E	CA	N	Y
Pacifastacus fortis	Shasta crayfish	E	CA	N	Y
Polites mardon	Mardon skipper	C	CA, OR, WA	N	N
Polyphylla barbata	Mount Hermon june beetle	E	CA	N	Y
Pseudocopaeodes eunus obscurus	Carson wandering skipper	E	CA, NV	N	Y
Pyrgus ruralis lagunae	Laguna Mountains skipper	E	CA	Y	N
Rhaphiomidas terminatus abdominalis	Delhi sands flower-loving fly	E	CA	N	Y
Speyeria callippe callippe	Callippe silverspot butterfly	E	CA	N	N
Speyeria zerene behrensii	Behren's silverspot butterfly	E	CA	N	Y
Speyeria zerene hippolyta	Oregon silverspot butterfly	T	CA, OR, WA	Y	Y
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	E	CA	N	Y
Streptocephalus woottoni	Riverside fairy shrimp	E	CA	Y	Y
Syncaris pacifica	California freshwater shrimp	E	CA	N	Y
Thermosphaeroma thermophilus	Socorro isopod	E	NM	N	Y
Trimerotropis infantilis	Zayante band-winged grasshopper	E	CA	Y	Y
Zaitzevia thermae	Warm Springs zaitzevian riffle beetle	C	MT	N	N
Fishes					
Acipenser transmontanus	White sturgeon	E	ID, MT	Y	Y
Catostomus discobolus yarrowi	Zuni bluehead sucker	C	AZ, NM	N	N
Catostomus microps	Modoc sucker	E	CA	Y	Y
Catostomus santaanae	Santa Ana sucker	T	CA	Y	N
Catostomus warnerensis	Warner sucker	T	OR	Y	Y
Chasmistes brevirostris	Shortnose sucker	E	CA, OR	N	Y
Chasmistes cujus	Cui-ui	E	NV	N	Y
Chasmistes liorus	June sucker	E	UT	Y	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Crenichthys baileyi baileyi	White River springfish	E	NV	Y	Y
Crenichthys baileyi grandis	Hiko White River springfish	E	NV	Y	Y
Crenichthys nevadae	Railroad Valley springfish	T	NV	Y	Y
Cyprinella formosa	Beautiful shiner	T	AZ, NM	Y	Y
Cyprinodon diabolis	Devils Hole pupfish	E	NV	N	Y
Cyprinodon macularius	Desert pupfish	E	AZ, CA	Y	Y
Cyprinodon nevadensis mionectes	Ash Meadows amargosa pupfish	E	NV	Y	Y
Cyprinodon nevadensis pectoralis	Warm Springs pupfish	E	NV	N	Y
Cyprinodon radiosus	Owens pupfish	E	CA	N	Y
Deltistes luxatus	Lost River sucker	E	CA, OR	N	Y
Empetrichthys latos	Pahrump poolfish	E	NV	N	Y
Eremichthys acros	Desert dace	T	NV	Y	Y
Etheostoma cragini	Arkansas darter	C	CO	N	N
Eucyclogobius newberryi	Tidewater goby	E	CA	Y	Y
Gambusia nobilis	Pecos gambusia	E	NM	N	Y
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	E	CA	N	Y
Gila bicolor mohavensis	Mohave tui chub	E	CA	N	Y
Gila bicolor snyderi	Owens tui chub	E	CA	Y	Y
Gila bicolor ssp.	Hutton tui chub	T	OR	N	Y
Gila boraxobius	Borax Lake chub	E	OR	Y	Y
Gila cypha	Humpback chub	E	AZ, CO, UT, WY	Y	Y
Gila ditaenia	Sonora chub	T	AZ	Y	Y
Gila elegans	Bonytail chub	E	AZ, CA, CO, NV, UT, WY	Y	Y
Gila intermedia	Gila chub	E	AZ, NM	Y	N
Gila nigra	Headwater chub	C	AZ, NM	N	N
Gila nigrescens	Chihuahua chub	T	NM	N	Y
Gila purpurea	Yaqui chub	E	AZ	Y	Y
Gila robusta jordani	Pahranagat roundtail chub	E	NV	N	Y
Gila seminuda	Virgin River chub	E	AZ, NV, UT	Y	Y
Hybognathus amarus	Rio Grande silvery minnow	E	NM	Y	Y
Hypomesus transpacificus	Delta smelt	T	CA	Y	Y
Ictalurus pricei	Yaqui catfish	T	AZ	Y	Y
Lepidomeda albivallis	White River spinedace	E	NV	Y	Y
Lepidomeda mollispinis pratensis	Big Spring spinedace	T	NV	Y	Y
Lepidomeda vittata	Little Colorado spinedace	T	AZ	Y	Y
Meda fulgida	Spikedace	T	AZ, NM	Y	Y
Moapa coriacea	Moapa dace	E	NV	Y	Y
Notropis girardi	Arkansas River shiner	T	NM	Y	N
Notropis simus pecosensis	Pecos bluntnose shiner	T	NM	Y	Y
Oncorhynchus aguabonita whitei	Little Kern golden trout	T	CA	Y	Y
Oncorhynchus apache	Apache trout	T	AZ	N	Y
Oncorhynchus clarkii henshawi	Lahontan cutthroat trout	T	CA, NV, OR, UT	N	Y
Oncorhynchus clarkii seleniris	Paiute cutthroat trout	T	CA	N	Y
Oncorhynchus clarkii stomias	Greenback cutthroat trout	T	CO	N	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Oncorhynchus gilae	Gila trout	T	AZ, NM	N	Y
Oncorhynchus keta	Chum salmon[b]	T	OR, WA	Y	N
Oncorhynchus kisutch	Coho salmon[b]	PT, T, E[c]	CA, OR, WA	Y	N
Oncorhynchus mykiss	Steelhead[b]	T, E[c]	CA, ID, OR, WA	Y	N
Oncorhynchus nerka	Sockeye salmon[b]	E	ID, WA	Y	N
Oncorhynchus tshawytscha	Chinook salmon[b]	T, E[c]	CA, ID, OR, WA	Y	N
Oregonichthys crameri	Oregon chub	E	OR	N	Y
Plagopterus argentissimus	Woundfin	E	AZ, UT	Y	Y
Poeciliopsis occidentalis	Gila topminnow	E	AZ, NM	N	Y
Ptychocheilus lucius	Colorado pikeminnow	E	AZ, CA, CO, NM, NV, UT, WY	Y	Y
Rhinichthys osculus lethoporus	Independence Valley speckled dace	E	NV	N	Y
Rhinichthys osculus nevadensis	Ash Meadows speckled dace	E	NV	Y	Y
Rhinichthys osculus oligoporus	Clover Valley speckled dace	E	NV	N	Y
Rhinichthys osculus ssp.	Foskett speckled dace	T	OR	N	Y
Rhinichthys osculus thermalis	Kendall Warm Springs dace	E	WY	N	Y
Salvelinus confluentus	Bull trout	T	ID, MT, NV, OR, WA	Y	Y
Scaphirhynchus albus	Pallid sturgeon	E	MT	N	Y
Thymallus arcticus	Fluvial Arctic grayling	C	MT, WY	N	N
Tiaroga cobitis	Loach minnow	T	AZ, NM	Y	Y
Xyrauchen texanus	Razorback sucker	E	AZ, CA, CO, NM, NV, UT, WY	Y	Y
Amphibians					
Ambystoma californiense	California tiger salamander	T, E[c]	CA	Y	N
Ambystoma tigrinum stebbinsi	Sonora tiger salamander	E	AZ	Y	Y
Batrachoseps aridus	Desert slender salamander	E	CA	N	Y
Bufo baxteri	Wyoming toad	E	WY	N	Y
Bufo californicus	Arroyo toad	E	CA	Y	Y
Bufo canorus	Yosemite toad	C	CA	N	N
Rana aurora draytonii	California red-legged frog	T	CA	Y	Y
Rana chiricahuensis	Chiricahua leopard frog	T	AZ, NM	N	Y
Rana luteiventris	Columbia Spotted frog	C	NV	N	N
Rana muscosa	Mountain yellow-legged frog	E, C[c]	CA, NV	Y	N
Rana onca	Relict leopard frog	C	AZ, NV, UT	N	N
Rana pretiosa	Oregon spotted frog	C	CA, OR, WA	N	N
Reptiles					
Crotalus willardi obscurus	New Mexican ridge-nosed rattlesnake	T	AZ, NM	Y	Y
Gambelia silus	Blunt-nosed leopard lizard	E	CA	N	Y
Gopherus agassizii	Desert tortoise	T	AZ, CA, NV, UT	Y	Y
Kinosternon sonoriense longifemorale	Sonoyta mud turtle	C	AZ	N	N

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Masticophis lateralis euryxanthus	Alameda whipsnake	T	CA	Y	Y
Sceloporus arenicolus	Sand dune lizard	C	NM	N	N
Thamnophis gigas	Giant garter snake	T	CA	N	Y
Thamnophis sirtalis tetrataenia	San Francisco garter snake	E	CA	N	Y
Uma inornata	Coachella Valley fringe-toed lizard	T	CA	Y	Y
Birds					
Brachyramphus marmoratus	Marbled murrelet	T	CA, OR, WA	Y	Y
Centrocercus urophasianus	Greater sage-grouse	C	OR, WA	N	N
Charadrius alexandrinus nivosus	Western snowy plover	T	CA, OR, WA	Y	Y
Charadrius melodus	Piping plover	T	CO, MT	Y	Y
Coccyzus americanus	Western yellow-billed cuckoo	C	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY	N	N
Colinus virginianus ridgwayi	Masked bobwhite	E	AZ	N	Y
Empidonax traillii extimus	Southwestern willow flycatcher	E	AZ, CA, CO, NM, UT	Y	Y
Eremophila alpestris strigata	Streaked horned lark	C	OR, WA	N	N
Falco femoralis septentrionalis	Northern Aplomado falcon	E	NM	N	Y
Grus americana	Whooping crane	E	CO, MT	Y	Y
Gymnogyps californianus	California condor	E	AZ, CA, UT	Y	Y
Numenius borealis	Eskimo curlew	E	MT, NM, NV, OR, UT, WA, WY	N	N
Pelecanus occidentalis	Brown pelican	E	CA, OR, WA	N	Y
Pipilo crissalis eremophilus	Inyo California towhee	T	CA	Y	Y
Polioptila californica californica	Coastal California gnatcatcher	T	CA	Y	N
Rallus longirostris levipes	Light-footed clapper rail	E	CA	N	Y
Rallus longirostris obsoletus	California clapper rail	E	CA	N	Y
Rallus longirostris yumanensis	Yuma clapper rail	E	AZ, CA	N	Y
Sterna antillarum	Interior least tern	E	CO, MT, NM	N	Y
Sterna antillarum browni	California least tern	E	CA	N	Y
Strix occidentalis caurina	Northern spotted owl	T	CA, OR, WA	Y	Y
Strix occidentalis lucida	Mexican spotted owl	T	AZ, CO, NM, UT	Y	Y
Synthliboramphus hypoleucus	Xantus's murrelet	C	CA	N	N
Tympanuchus pallidicinctus	Lesser prairie-chicken	C	CO, NM	N	N
Vireo bellii pusillus	Least Bell's vireo	E	CA	Y	N
Mammals					
Antilocapra americana sonoriensis	Sonoran pronghorn	E	AZ	N	N
Aplodontia rufa nigra	Point Arena mountain beaver	E	CA	N	N
Brachylagus idahoensis	Pygmy rabbit	E	OR, WA	N	N
Canis lupus	Gray wolf	E	AZ, CO, ID, MT, NM, NV, OR, UT, WA, WY	Y	Y

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Cynomys parvidens	Utah prairie dog	T	UT	N	Y
Dipodomys heermanni morroensis	Morro Bay kangaroo rat	E	CA	Y	Y
Dipodomys ingens	Giant kangaroo rat	E	CA	N	Y
Dipodomys merriami parvus	San Bernardino Merriam's kangaroo rat	E	CA	Y	N
Dipodomys nitratoides exilis	Fresno kangaroo rat	E	CA	Y	Y
Dipodomys nitratoides nitratoides	Tipton kangaroo rat	E	CA	N	Y
Dipodomys stephensi	Stephens' kangaroo rat	E	CA	N	Y
Eumetopias jubatus	Steller sea-lion	T	CA, OR	Y	N
Herpailurus yagouaroundi tolteca	Sinaloan jaguarundi	E	AZ	N	Y
Leopardus pardalis	Ocelot	E	AZ	N	Y
Leptonycteris curasoae yerbabuenae	Lesser long-nosed bat	E	AZ, NM	N	Y
Leptonycteris nivalis	Mexican long-nosed bat	E	NM	N	Y
Lynx canadensis	Canada lynx	T	CO, ID, MT, OR, UT, WA, WY	Y	N
Martes pennanti	West coast fisher	C	CA, OR, WA	N	Y
Microtus californicus scirpensis	Amargosa vole	E	CA	N	Y
Microtus mexicanus hualpaiensis	Hualapai Mexican vole	E	AZ	N	Y
Mustela nigripes	Black-footed ferret	E	AZ, CO, MT, UT, WY	N	Y
Neotoma fuscipes riparia	Riparian woodrat	E	CA	N	Y
Odocoileus virginianus leucurus	Columbian white-tailed deer	E	OR, WA	N	Y
Ovis canadensis	Peninsular bighorn sheep	E	CA	Y	Y
Ovis canadensis californiana	Sierra Nevada bighorn sheep	E	CA	N	Y
Panthera onca	Jaguar	E	AZ, NM	N	Y
Perognathus longimembris pacificus	Pacific pocket mouse	E	CA	N	Y
Rangifer tarandus caribou	Woodland caribou	E	ID, WA	N	Y
Reithrodontomys raviventris	Salt marsh harvest mouse	E	CA	N	Y
Sorex ornatus relictus	Buena Vista Lake ornate shrew	E	CA	Y	Y
Spermophilus brunneus brunneus	Northern Idaho ground squirrel	T	ID	N	Y
Spermophilus brunneus endemicus	Southern Idaho ground squirrel	C	ID	N	N
Spermophilus tereticaudus chlorus	Palm Springs round-tailed ground squirrel	C	CA	N	N
Spermophilus washingtoni	Washington ground squirrel	C	OR, WA	N	N
Sylvilagus bachmani riparius	Riparian brush rabbit	E	CA	N	Y
Tamiasciurus hudsonicus grahamensis	Mount Graham red squirrel	E	AZ	Y	Y
Thomomys mazama glacialis	Roy Prairie pocket gopher	C	WA	N	N
Thomomys mazama louiei	Louie's western pocket gopher	C	WA	N	N
Thomomys mazama melanops	Olympic pocket gopher	C	WA	N	N

TABLE 3.8-5 (Cont.)

Scientific Name	Common Name	Listing Status[a]	State in Which Species Could Occur	Designated Critical Habitat (Y/N)	Recovery Plan (Y/N)
Thomomys mazama pugetensis	Olympia pocket gopher	C	WA	N	N
Thomomys mazama couchi	Shelton pocket gopher	C	WA	N	N
Thomomys mazama tacomensis	Tacoma western pocket gopher	C	WA	N	N
Thomomys mazama tumuli	Tenino pocket gopher	C	WA	N	N
Thomomys mazama yelmensis	Yelm pocket gopher	C	WA	N	N
Ursus arctos horribilis	Grizzly bear	T[d]	ID, MT, NM, NV, OR, UT, WA, WY	N	Y
Vulpes macrotis mutica	San Joaquin kit fox	E	CA	N	Y
Zapus hudsonius preblei	Preble's meadow jumping mouse	T	CO, WY	Y	N

[a] C = candidate for listing, E = listed as endangered, PT = proposed for listing as threatened, T = listed as threatened.

[b] Includes one or more "evolutionarily significant units" that spawn in different river basins or at different times of year and that have been assigned separate listing status.

[c] More than one listing category indicates that the species has different status in different states.

[d] Grizzley bears in the Yellowstone District Population Segment in Idaho, Montana, and Wyoming are considered recovered and have been delisted.

species and the ecosystems on which they depend," and "to ensure that actions requiring authorization or approval by the BLM are consistent with the conservation needs of special status species and do not contribute to the need to list any special status species, either under provisions of the ESA or other provisions of this policy." In this case, special status species are those species that are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the ESA; those species listed by a state in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by each BLM state director as sensitive. Each BLM state director maintains a list of sensitive species, and impact to these species would have to be considered in project-specific assessments developed prior to project development.

The FS has a comparable policy that is specified in Forest Service Manual 2600, *Wildlife, Fish, and Sensitive Plant Habitat Management* (FS 1995b). In Section 2670.22, the FS identifies these objectives related to sensitive species management: (1) develop and implement management practices to ensure that species do not become threatened or endangered because of FS actions; (2) maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands; and (3) develop and implement management objectives for populations and/or habitat of sensitive species. Sensitive species are those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by (a) significant current or predicted downward trends in population numbers or density, or (b) significant current or predicted

TABLE 3.8-6 The Number of Species Listed, Proposed for Listing, or Candidates for Listing under the Endangered Species Act That Occur in the 11 Western States Where West-wide Energy Corridors Could Be Designated

	Taxonomic Group								
State	Plants	Mollusks	Arthropods	Fishes	Amphibians	Reptiles	Birds	Mammals	Total
Arizona	21	4	1	20	3	3	6	10	69
California	170	2	32	20	7	6	15	19	272
Colorado	19	0	2	6	0	0	7	4	39
Idaho	6	6	0	5	0	0	1	6	25
Montana	4	0	1	4	0	0	5	4	19
Nevada	13	0	2	22	3	1	2	2	46
New Mexico	13	9	2	15	1	2	7	5	55
Oregon	17	0	5	13	1	0	8	8	53
Utah	25	3	1	8	1	1	5	5	50
Washington	14	0	3	6	1	0	8	16	50
Wyoming	4	0	0	6	1	0	2	5	19
All states[a]	264	23	42	72	12	9	25	47	495

[a] Number does not equal the sum of the column because some species occur in more than one state.

Source: USFWS (2007).

downward trends in habitat capability that would reduce a species' existing distribution. Each regional forester maintains a list of sensitive species (FS 2005a), and impacts to these species would have to be considered in project-specific assessments prepared prior to project development.

Each of the 11 western states has also identified species that are of concern in the state. Each state differs in the listing status designations they use and their regulations for protecting these species. Many of these species are also included in BLM and FS sensitive species lists, and some are also listed under the ESA. Project-specific assessments would consider impacts to these species prior to project development.

3.8.2 How Were the Potential Effects of Corridor Designation and Project Development to Ecological Resources Evaluated?

This section describes the methodologies used to determine the possible impacts of designating and developing energy corridors on ecological resources.

3.8.2.1 Evaluating Potential Effects to Vegetation and Wetlands

The designation of energy corridors does not affect vegetation or wetlands. These resources could be affected only with development of specific projects within a designated corridor.

The analysis of potential impacts from project development to terrestrial vegetation and wetlands considers direct impacts of facility construction, routine operation, and spills, as well as indirect effects. Impacts to these resources that would be expected to occur under either of the alternatives are discussed in Section 3.8.4.1. The impacts that are evaluated are associated with both the elimination of habitat and the degradation of habitat from activities occurring in adjacent areas or, in the case of wetlands, activities occurring within the watershed. The implementation of mitigation measures to reduce or eliminate the impacting factors described in Section 3.8.4.1 would help to limit the potential impacts to vegetation and wetlands. These measures are described in Section 3.8.4.2.

The evaluation of impacts to vegetation under the Proposed Action is based on the ecoregions that occur within the 11 western states in which energy corridors would be established. These ecoregions are described in Appendix O. The potential for impacts to various types of vegetation was assumed to be proportional to the degree to which their respective ecoregions intersect with the energy corridors. Figure 3.8-3 shows the energy corridors in relation to the ecoregions. The length and area of corridor crossing each ecoregion in each state are presented in Section 3.8.3.2 for the Proposed Action.

As described in Section 3.8.1.1, many types of wetlands occur within the 11-state area. However, wetlands throughout the region are frequently associated with intermittent and perennial streams, including floodplains and riparian wetlands, and the seeps and springs that feed these streams. The total lengths of perennial streams and rivers and the surface areas of ponds and lakes that occur within the corridors in each state are presented in Sections 3.8.3.2. Wetlands that are associated with intermittent streams would be expected to occur along the tributaries of these perennial streams and rivers. Springs supporting wetlands may occur along either the perennial or intermittent streams. The degree of impacts to wetlands would depend on the specific type of energy transport project crossing the wetlands; the degree of wetland development along the identified perennial streams, lakes, and ponds; the presence of tributaries associated with wetland habitats; other wetlands within the corridor segments; and the degree to which wetlands can be avoided during ROW construction.

3.8.2.2 Evaluating Potential Effects to Aquatic Biota and Habitats

As with vegetation and wetlands, corridor designation is not expected to impact aquatic biota. These resources would only be affected if an energy transport project were developed following corridor designation or ROW approval.

The analysis of impacts to aquatic biota from project development considers direct impacts of facility construction, routine operations, and spills, as well as indirect effects. Impacts to these resources that would be expected to occur under either of the alternatives are discussed in Section 3.8.4.1. The impacts evaluated are associated with both the elimination of habitat and the degradation of habitat from activities occurring in adjacent areas. The implementation of mitigation measures to reduce or eliminate the impacting factors described in Section 3.8.4.1 would help to limit the potential impacts to aquatic biota. These mitigation measures are described in Section 3.8.4.2.

Aquatic habitats within the proposed corridor segments were identified using GIS hydrological coverage with respect to the proposed corridor segments. It was assumed that the potential for impacts on aquatic habitats and the associated aquatic biota would be proportional to the number and extent of aquatic habitats intersected by the corridor segments, as well as the type of project proposed for development within a corridor, and the design of that project (including mitigation measures). In addition to the numbers of water bodies potentially affected, the areal extents (for ponds, lakes, and reservoirs) and lengths (for rivers and streams) of the water bodies associated with corridor segments were also identified (Tables 3.5-6 and 3.5-7; Appendix M).

3.8.2.3 Evaluating Potential Effects to Wildlife

Corridor designation is not expected to affect wildlife. Impacts to wildlife would only result with the development of an energy transport project within a designated corridor or ROW.

The analysis of impacts from project development to wildlife, including wild horses and burros, considers direct and indirect impacts of project construction, routine operation, maintenance, and spills. Impacts that could occur under either alternative (i.e., generic impacts) are discussed in Section 3.8.4.1. The impacts of the construction of energy transport systems and their associated facilities (e.g., access roads, pump stations, and substations) are related to habitat disturbance, introduction of invasive species, injury or mortality, erosion, dust, noise, contaminant exposure, and interference with behavior. Impacts resulting from operation and maintenance include electrocution and exposure to electromagnetic fields, noise, collisions, maintenance activities (including herbicide use), contaminants (including oil spills), disturbance (including habitat disturbance and interference with animal behavior), and fire effects (e.g., an indirect effect of the project could be an increase in the potential for fires).

Although detailed evaluations are not possible until a more precise project definition is available, broad differences among alternatives are discussed in Sections 3.8.3.1 and 3.8.3.2. The evaluation of wildlife impacts under the Proposed Action is based on important wildlife species (e.g., big game species, raptors, and sage grouse) known to occur within the areas of the 11 western states where the energy transport corridor segments could occur. The potential for direct and indirect impacts from project development was assumed to be proportional to the length and acreage of corridor segments within each state and/or ecoregion and the wildlife species that may occur within those areas.

Because a site-specific and project-specific evaluation cannot be performed at this time, a number of mitigation measures related to wildlife protection during major project phases (preconstruction planning, construction, restoration, operation, and maintenance) are identified in Section 3.8.4.2. With these mitigation measures in place, many impacts to wildlife species from project development can be avoided or minimized.

3.8.2.4 Evaluating Potential Effects to Threatened, Endangered, and Other Special Status Species

Designation of federal energy corridors is expected to have no direct effect on threatened, endangered, and other special status species. Federally and state-listed threatened and endangered species, species that are proposed for listing or that are candidates for listing, BLM sensitive species, FS sensitive species, and species of special concern listed by individual status could be affected by development of energy transport projects within designated corridors or ROWs. Impacts to these species would be considered in project-specific NEPA evaluations and ESA consultations prior to the start of any construction activities. Those evaluations would take into consideration the specific design alternatives being considered and the exact locations of project facilities. The evaluation in this PEIS can evaluate impacts from project development (following corridor designation) to threatened, endangered, and other special status species in only a general fashion.

The impacts of construction of energy transport systems and support facilities such as access roads, pump stations, and substations are evaluated on a non-site-specific level and are related to the amount of land disturbance, the duration and timing of construction periods, and the habitats crossed by the corridors. Indirect effects, such as impacts resulting from erosion of disturbed land surfaces and disturbance and harassment of animal species, are also considered, but their magnitude is considered proportional to the amount of land disturbance associated with each alternative. Impacts resulting from operations include the amount of land dedicated to facilities, noise from facilities, spread of invasive species, and increased human access. Although detailed evaluations are not possible until a more precise project definition is available, broad differences among the alternatives are discussed in Sections 3.8.3.1 and 3.8.3.2.

Because a site-specific and project-specific evaluation cannot be performed at this time, a number of general mitigation measures related to threatened and endangered species protection are identified in Section 3.8.4.2. With these mitigation measures in place, many impacts to threatened, endangered, and other special status species can be avoided or minimized.

3.8.3 What Are the Potential Effects to Ecological Resources of the Alternatives, and How Do They Compare?

This section presents the relative impacts of the two alternatives under consideration — No Action and the Proposed Action (designate new and locally approved corridors). These alternatives are described in Chapter 2. An important consideration in evaluating the relative impacts of these two alternatives is the fact that neither of the alternatives specifies corridors with energy transport projects.

Thus, to a large extent the relative comparison of impacts depends on whether or not corridors are specified in the alternative. For the most part, it is assumed that the specificity of corridors for the Proposed Action would minimize impacts to ecological resources, because it would afford a greater degree of colocation of facilities and a reduction in redundancy, thus minimizing the total amount of land impacted by corridor development. The same area could be affected several times under the Proposed Action as new transport or transmission projects are added to a corridor. This could increase the temporal extent of impacts and make restoration after construction more difficult.

Impacts to ecological resources associated with construction and operation of energy transport projects are presented in Section 3.8.4.1. The impacts described in that section are more dependent on siting decisions and project design and are less dependent on the alternative chosen. The remainder of this section presents the expected differences in energy transport project development impacts among the alternatives.

3.8.3.1 Possible Effects of the No Action Alternative on Ecological Resources

Under No Action, Section 368 energy corridors would not be designated and corridor planning and development would proceed without coordination or integrated systematic planning. The colocation of energy transport projects that would occur under the Proposed Action is less likely to occur under No Action because individual project proponents would identify preferred routes and project designs independently. In addition, more ancillary facilities, such as access roads, pumping stations, and electrical substations (with greater amounts of land disturbance), would likely be developed if transport projects are not colocated.

Consequently, there is the possibility that there would be more land area affected by corridor development under the No Action Alternative with greater impacts to vegetation, wetlands, aquatic biota, wildlife, and threatened, endangered, and other special status species. Impacts would include both construction impacts (e.g., habitat destruction or alteration, wetland disturbance, erosion and sedimentation to aquatic systems, wildlife displacement or harassment, and impacts to protected species) and operational impacts (e.g., vegetation management, invasive plant establishment and dispersal, impacts to wildlife movement patterns, and bird collisions). Impacts associated with corridor development in general are discussed in Section 3.8.4.1.

Although the impacts on ecological resources from developing energy transport projects under No Action are generally greater than those under the Proposed Action, as described above, some of the impacts of No Action could be less. Full development of an energy corridor would result in a wider corridor and more concentrated infrastructure at a given location and could pose a more formidable barrier to wildlife movements. Colocated transmission towers could be more difficult for birds to avoid, thus increasing the probability of collision. If fully developed, the wider energy corridors could make dispersal of plant propagules across the designated corridor more difficult than for an individual project ROW. In addition, under the Proposed Action, the same area could be affected several times as new transport or transmission projects are added to a designated corridor. This could increase the temporal extent of impacts and make restoration after construction more difficult relative to the No Action Alternative.

3.8.3.2 Possible Effects of the Proposed Action on Ecological Resources

Designation of energy corridors under the Proposed Action would not directly affect ecological resources. These resources could be affected with development of energy transport projects within the designated corridors. Under the Proposed Action, locally approved corridors and additional corridor segments would be designated as Section 368 energy corridors.

Development of energy projects within corridors designated under the Proposed Action is expected to have less impact than similar project development under No Action because there would be a greater likelihood for colocation of energy transport projects and fewer overall corridors or ROWs on other federal lands. There would likely also be fewer ancillary facilities such as access roads, pumping stations, and electrical substations (with greater amounts of land disturbance) developed if corridors were colocated. Consequently, it is anticipated that there could be less total land disturbance under the Proposed Action than under No Action with less impact to vegetation, wetlands, aquatic biota, wildlife, and threatened, endangered, and other special status species.

However, under the Proposed Action, land within designated energy corridors could be disturbed multiple times as new energy transport facilities are added through time. Thus, although the total amount of land disturbed may be less under the Proposed Action, the duration of disturbance may be greater. Despite this, the overall levels of impacts under the Proposed Action are expected to be lower than under the No Action Alternative because less area would be affected.

Development of energy corridors under the Proposed Action would result in a wider area of locally disturbed land and more concentrated infrastructure than under No Action. These wider developed corridors could pose a formidable barrier to movement of some wildlife species and plant propagules. Thus, in these instances, the wider proposed energy corridors could result in a greater degree of population segregation than under No Action. Colocated transmission towers could be more difficult for birds to avoid, thus increasing the probability of collision.

More detailed descriptions of the anticipated impacts of project development under the Proposed Action to vegetation and wetlands, aquatic biota, wildlife, and threatened and endangered species are provided in the remainder of this section.

Vegetation and Wetlands. Terrestrial vegetation communities would be impacted by the construction and maintenance of energy transport projects, if they become authorized, within designated corridors throughout the 11 western states. The types of vegetation that would be included within the corridors in each state would depend on local conditions along the corridor route, including elevation, precipitation, aspect, slope, and soil type. The types of vegetation that are associated with the ecoregions occurring along the corridor routes are described in Appendix O. The ecoregions crossed by energy corridors under the Proposed Action, along with the lengths and areas of intersection, are presented in Table 3.8-7. Avoidance of sensitive or especially high-quality habitats was considered during corridor routing.

Wetlands would also be crossed by corridor segments under the Proposed Action. The wetland types associated with the ecoregions identified in Table 3.8-7 for each state would be potentially affected by energy project development. However, avoidance of wetland concentration areas, as well as other sensitive ecological resources, was considered during corridor routing. Across much of the 11-state region, riparian zones along rivers and streams represent important and sensitive habitats. The perennial streams crossed by the corridor segments in each of the 11 western states are presented in Table 3.5-6. The stream lengths represent the total lengths of perennial streams lying within the corridor segments. Riparian habitats are also located along many of the intermittent streams that are tributaries of these water bodies. Under the Proposed Action, at least 285 streams and canals would be crossed (some would be crossed multiple times) for a total stream length of about 390 miles. Additional stream crossings would be expected to occur within the ROWs that would be constructed between these corridor segments.

Aquatic Biota. Under the Proposed Action, Section 368 energy corridors would be designated on federal lands. Thus, compared to No Action, there would be additional multiuse corridors within which energy transport projects could be located. As a consequence, it is assumed that there would be a reduced impetus

TABLE 3.8-7 Ecoregions Crossed by Corridors under the Proposed Action and Locally Designated Corridors[a,b]

Ecoregion	State											Total
	AZ	CA	CO	ID	MT	NV	NM	OR	UT	WA	WY	
Coast Range								0; 5/ 0; 2,147				0; 5/ 0; 2,147
Willamette Valley								3; 3/ 801; 1,896				3; 3/ 801; 1,896
Cascades		0; 6/ 0; 1,316						2; 63/ 718; 23,582		0; 2/ 0; 1,115		2; 71/ 718; 26,013
Sierra Nevada		23; 26/ 9,206; 10,664										23; 26/ 9,206; 10,664
Southern and Central California Chaparral and Oak Woodlands		7; 28/ 1,823; 5,255										7; 28/ 1,823; 5,255
Southern California Mountains		41; 41/ 16,485; 16,485										41; 41/ 16,485; 16,485
Eastern Cascades Slopes and Foothills		66; 120/ 27,775; 36,904						11; 103/ 1,900; 39,505				77; 223/ 29,675; 76,408
Columbia Plateau								3; 3/ 510; 1,106		<1; 1/ 15.7; 301		3; 4/ 526; 1,407
Blue Mountains								51; 69/ 9,036; 28,154				51; 69/ 9,036; 28,154
Snake River Plain				49; 267/ 20,608; 105,735				<1; 6/ 17; 2,312				49; 273/ 20,624; 108,046

TABLE 3.8-7 (Cont.)

	State											
Ecoregion	AZ	CA	CO	ID	MT	NV	NM	OR	UT	WA	WY	Total
Central Basin and Range		0; 84/ 0; 17,239		0; 8/ 0; 3,598		667; 1,037/ 486,507; 642,217			134; 309/ 50,548; 139,919			802; 1,438/ 537,056; 802,973
Mojave Basin and Range	91; 103/ 49,508; 53,920	0; 338/ 0; 128,448				73; 470/ 21,835; 185,109			28; 28/ 14,652; 14,660			192; 939/ 85,995; 382,137
Northern Rockies				0; 12/ 0; 5,467	0; 26/ 0; 12,772							0; 38/ 0; 18,240
Middle Rockies				11; 39/ 784; 11,721	58; 71/ 20,386; 26,530							68; 109/ 21,169; 38,250
Wyoming Basin			28; 36/ 11,073; 14,580		0; 4/ 0; 2,034				0; 18/ 0; 7,802		<1; 422/ 35; 178,393	28; 481/ 11,108; 202,808
Wasatch and Uinta Mountains									9; 94/ 4,588; 40,146			9; 94/ 4,588; 40,146
Colorado Plateaus	53; 60/ 32,378; 35,256		105; 219/ 126,291; 174,331				0; 10/ 0; 3,890		0; 191/ 0; 153,414			157; 479/ 158,669; 366,891
Southern Rockies			90; 164/ 43,625; 72,605								0; 7/ 0; 3,298	90; 171/ 43,625; 75,904
Arizona/New Mexico Plateau	6; 6/ 2,977; 2,977						21; 99/ 8,944; 40,646					26; 104/ 11,920; 43,622
Arizona/New Mexico Mountains	165; 190/ 69,825; 90,034						0; <1/ 0; 153					165; 190/ 69,825; 90,187

TABLE 3.8-7 (Cont.)

	State											
Ecoregion	AZ	CA	CO	ID	MT	NV	NM	OR	UT	WA	WY	Total
Chihuahuan Deserts	5; 5/ 2,193; 2,198						0; 177/ 0; 74,132					5; 182/ 2,193; 76,330
High Plains							0; 27/ 0; 11,109					0; 27/ 0; 11,109
Southwestern Tablelands			1; 1/ 324; 324									1; 1/ 324; 324
Northwestern Great Plains					0; 1/ 0; 712						0; 8/ 0; 3,901	0; 9/ 0; 4,612
North Cascades										48; 51/ 4,434; 5,514		48; 51/ 4,434; 5,514
Klamath Mountains		2; 36/ 1,081; 14,559						19; 20/ 3,466; 8,858				21; 56/ 4,547; 23,417
Madrean Archipelago	1; 15/ 645; 6,486											1; 15/ 645; 6,486
Northern Basin and Range		0; 31/ 0; 12,185		<1; 84/ 49; 34,982		80; 122/ 79,895; 97,725		259; 318/ 47,100; 130,641				339; 555/ 127,044; 275,533
Sonoran Basin and Range	150; 264/ 108,018; 169,965	<1; 105/ 151; 44,602										150; 370/ 108,170; 214,568

[a] Locally designated corridors length (miles); Proposed Action corridors length (miles)/locally designated corridors area (acres); Proposed Action corridors area (acres).

[b] Proposed Action corridors include locally designated corridors.

to develop multiple additional single-use project ROWs across some parcels of federal land compared to No Action. The causes and types of impacts that could occur to aquatic habitats under this alternative would be the same as those under No Action (see Section 3.8.4.1 for a description of generic impacts).

It is anticipated that the total amount of stream bottom and shoreline (i.e., riparian) areas disturbed by corridor construction and maintenance activities under the Proposed Action would be less than or equal to the area disturbed under No Action. Even though the total footprint of corridor crossings within a given stream might be the same between No Action and the Proposed Action, the total stream areas affected by sediment deposition from multiple narrower corridors may be greater than the area affected by a single wider corridor as described in Section 3.8.4.1. Consequently, it is anticipated that the overall impacts on streams from sediment under the Proposed Action would be less than the overall impacts under No Action.

Because the amount of shoreline that would be affected by corridor development under the Proposed Action would be less than or equal to the amount affected under No Action, it is anticipated that the thermal effects on aquatic habitats of the Proposed Action would also be less than or equal to the effects under No Action.

Assuming that the types and numbers of pipelines and the types of maintenance activities that occur in the vicinity of water body crossings and along corridors are the same under both alternatives, it is anticipated that the likelihood or magnitude of spills under the Proposed Action and No Action would also be similar. Consequently, potential impacts from spills would be similar under both alternatives.

Because of the greater numbers of individual corridors that could exist under No Action, it is anticipated that there would be less public access provided to water bodies under the Proposed Action than under No Action. Therefore, the potential for impacts to aquatic ecosystems due to increased fishing pressure or recreational activities would likely be lower under the Proposed Action than under No Action.

Under the Proposed Action, it is estimated that at least 285 individual streams and canals would be crossed (some would be crossed multiple times) and approximately 390 miles of stream habitat would occur within the proposed Section 368 energy corridor segments in the 11 western states (Table 3.5-6). While an unquantifiable amount of additional stream crossings would occur on federal, state, Tribal, and private lands in order to join the Section 368 energy corridor segments, it is anticipated that the overall number of crossings under the Proposed Action would be smaller than the number of crossings under No Action.

In the Pacific Northwest and in the northern portion of the California hydrologic region, approximately 12 stream and river systems with designated EFH for anadromous Pacific salmon would be intersected by Section 368 energy corridor segments. Potential effects on EFH for anadromous Pacific coast salmon in freshwater habitats from development activities would be similar in nature to impacts described for other aquatic resources.

Wildlife. The general causes and types of impacts that can occur to wildlife from construction, operation, and maintenance of energy transport facilities are presented in Section 3.8.2.3. This section presents the relative impacts to wildlife from project development with the Proposed Action corridors. Impacts to wildlife would be related to the type, length, and amount of habitat within which the project would be developed. Table 3.8-7 summarizes the ecosystems that would be crossed under the Proposed Action. It is anticipated that the overall impacts of project development within the Proposed Action corridors would be less than from similar project development within No Action corridors because there would be a greater likelihood for colocation of energy transport systems and fewer ROWs and ancillary facilities overall. Consequently, there could be less total development under the Proposed Action than under No Action.

The energy corridors within the 11 western states for the Proposed Action total 6,055 miles with an area of 2,955,526 acres. Habitat disturbance would also occur within additional areas where ancillary facilities would be located (e.g., access roads, pump stations, and substations). Also, as discussed in Section 3.8.4.1, areas adjacent to disturbed ROWs within the designated corridors would incur an effective loss of habitat because of wildlife avoidance of these areas. (Also, many additional miles and acres of corridor segments on federal, state, Tribal, and private lands would be required to connect the Section 368 energy corridor segments.)

Other construction-related impacts to wildlife (see Table 3.8-8) would also be expected to be less for the Proposed Action than for No Action because of the potential for a greater distance of colocated projects and fewer ancillary facilities, particularly access roads. Similarly, overall impacts from operation and maintenance for the Proposed Action would be less than for No Action, except with the possible exception of collisions of birds with transmission lines for reasons discussed above.

Overall, it is anticipated that the impacts on wildlife species from the development of energy projects within the proposed corridors would be less than the impacts from similar project development within the No Action corridors, as described in the introduction to this section. However, the actual magnitude of those impacts cannot be determined until there is more specificity regarding the location of facilities and project design. Thorough evaluations would be developed in project-specific NEPA evaluations prior to approval of applications for development.

Threatened, Endangered, and Other Special Status Species. The designation of energy corridors under the Proposed Action would have no direct effect on threatened, endangered, and other special status species. However, development of energy transport projects under the Proposed Action could affect these resources, should such development occur. The impacts of construction and operation of energy transport facilities on these species would be very site- and project-specific. For purposes of this evaluation, all of the species presented in Section 3.8.1.4 could be affected by project development within the proposed corridors. Potential impacts to these species are described in Section 3.8.4.1. It is anticipated that the overall impacts of the Proposed Action on threatened, endangered, and other special status species would be less than the impacts of No Action as described in the introduction to this section. However, the actual magnitude of those impacts cannot be determined until there is more specificity regarding the location of facilities and project design. These actions would be the subject of project-specific NEPA evaluations and ESA consultations that would be conducted prior to approval of applications for development.

3.8.3.3 Comparison of the Alternatives

Under No Action, the colocation of energy-transport projects is less likely to occur than under the Proposed Action. More ROW corridors and ancillary facilities, such as access roads, with greater amounts of land disturbance, would likely be developed. Thus, there is the possibility that there would be more land area affected by corridor development under No Action with greater impacts to vegetation, wetlands, aquatic biota, wildlife, and threatened, endangered, and other special status species. There is a greater likelihood that more lands under nonfederal jurisdiction would be crossed, and projects would possibly undergo less or inconsistent scrutiny with a subsequent increase in impacts to ecological resources.

The designation of corridors under the Proposed Action would have no direct effect on

TABLE 3.8-8 Potential Energy Transport Facility Construction Effects on Wildlife

Ecological Stressor	Associated Project Activity or Feature	Potential Effect	Effect Extent and Duration
Habitat disturbance	Site clearing and grading; tower construction; pipeline trenching; access road and ancillary facility construction; construction equipment travel.	Reduction or alteration of habitat.	Long-term habitat reduction within tower, building, and access road footprints; long-term reduction, modification, and fragmentation of habitat in corridor segments.
Invasive vegetation	Site clearing and grading; corridor, access road, and support facility construction; construction equipment travel.	Reduced habitat quality.	Long-term, if established in areas where corridors, support facilities, and access roads are situated.
Injury or mortality	Site clearing and grading; corridor, access road, and support facility construction; construction equipment travel.	Destruction and injury of wildlife, mostly those with limited mobility.	Ongoing potential within construction areas and along access roads.
Erosion and runoff	Site clearing and grading; corridor, access road, and support facility construction; construction equipment travel.	Reduced reproductive success of amphibians using on-site surface waters; drinking water supplies may be affected.	Short-term; may extend beyond site boundaries.
Fugitive dust	Site clearing and grading; corridor, access road, and support facility construction; construction equipment travel.	Respiratory impairment; forage less palatable.	Short-term and localized.
Noise	Site clearing and grading; corridor, access road, and support facility construction; construction equipment travel.	Disturbance of foraging and reproductive behaviors; habitat avoidance.	Short-term and localized.
Exposure to contaminants	Accidental spill during equipment refueling; accidental release of stored fuel or hazardous materials.	Exposure may affect survival, reproduction, development, or growth.	Short-term and localized to spill area.
Interference with behavioral activities	Site clearing and grading; corridor, access road, and support facility construction; construction equipment travel.	Disturbance of migratory movements, foraging, and reproductive behaviors; avoidance of construction areas by some species.	Short-term for some species; long-term for other species that may completely abandon the disturbed habitats and adjacent areas.

ecological resources. However, development of energy transport projects within and between the designated corridors under the Proposed Action could affect ecological resources, should such development occur. Avoidance of sensitive ecological resources, such as wetland concentration areas, however, was considered during corridor routing. Project development under the Proposed Action is expected to have less impact on vegetation, wetlands, aquatic biota, wildlife, and threatened, endangered, and other special status species than under No Action because there would be a greater likelihood for colocation of energy transport facilities and potentially fewer corridors, fewer ancillary facilities, and thus less total development overall. Corridor designation under the Proposed Action would minimize impacts to ecological resources, because it would afford a greater degree of colocation of facilities and a reduction in redundancy, thus minimizing the total amount of land impacted by ROW development.

The corridor segments for the Proposed Action total 6,055 miles with an area of 2,955,526 acres. Within the proposed corridors, the effects of habitat fragmentation (particularly edge effects), behavioral impacts to wildlife, effects from accidental chemical spills, and potential for the spread of invasive species would be less than under No Action. However, full development of the corridors would result in a wider corridor and more concentrated infrastructure at a given location, potentially creating a greater barrier to wildlife movements and dispersal of plant propagules, and a greater risk of collision for birds. Under the Proposed Action, at least 297 streams and canals would be crossed (some crossed multiple times) for a total stream length of about 400 miles.

The total amount of stream bottom and shoreline (i.e., riparian) areas disturbed under the Proposed Action would be less than or equal to the area disturbed under No Action, with less or equal thermal effects on aquatic habitats. The total area affected by sedimentation downstream of multiple narrower corridors, as under No Action, may well be greater than the area affected by a single wider corridor, however, potential impacts from spills would be similar under both alternatives. There would also be lower potential for impacts to aquatic ecosystems due to increased fishing pressures or recreational activities under the Proposed Action than under No Action because of less public access to water bodies. However, under the Proposed Action, the same area could be affected several times as new transport or transmission projects are added to a designated corridor. This could increase the temporal extent of impacts and make restoration after construction more difficult relative to the No Action Alternative.

3.8.4 Following Corridor Designation, What Types of Impacts Could Result to Ecological Resources with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

This section describes the impacts associated with construction and operation of energy transport facilities regardless of the alternative chosen. Both direct and indirect impacts to vegetation and wetlands, aquatic biota, wildlife, and threatened, endangered, and other special status species are presented. Mitigation measures, as described in Section 3.8.4.2, would minimize or mitigate the adverse impacts described in this section.

3.8.4.1 What Are the Usual Impacts to Ecological Resources of Building and Operating Energy Transport Projects?

How Could Vegetation and Wetlands Be Affected by Project Development? Terrestrial vegetation communities would be affected by the construction of energy transport systems, including the construction of pipelines and electricity transmission lines, as well as support facilities and access roads. Impacts to wetlands from construction activities may also occur. Routine operations and accidental spills may also result in impacts to terrestrial vegetation and wetlands. Impacts to wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corp of Engineers will be required for each project that disturbs wetlands under its jurisdiction, both within and outside of corridors. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. DOE implementation of this E.O. is included in 10 CFR 1022.

Terrestrial plant communities provide habitats for numerous wildlife species and contribute to the hydrologic inflow to wetlands within their watershed through surface drainage or groundwater recharge. Wetlands provide a number of valuable functions within the landscape (NRC 1995). Surface water storage in wetlands provides for the absorption of stormwater flows, maintaining water tables as well as reducing downstream flood peaks and subsequent damage from floodwaters. Wetlands help maintain water quality by retaining and removing dissolved substances, sediments, and contaminants. The transformation and cycling of elements in wetlands maintain nutrient levels. Many fish and wildlife species depend on wetlands for habitat.

Ground-disturbing activities, including excavation, grading, and clearing of vegetation, during the construction of ROWs would result in direct impacts on plant communities. Vegetation types that are associated with the ecoregions occurring along the corridor routes are described in Appendix O. Direct impacts occur generally at the time and location of the impacting factor, while indirect effects are generally separated in time and/or space from the impacting factor. Construction would require the removal or cutting of some vegetation within the area of the ROW, as well as the cutting of tall trees adjacent to electricity transmission line ROWs and the disturbance of substrates (e.g., soil, rocks). Excavation for the construction of buried pipelines would eliminate existing vegetation over the area of the trenches and the adjacent areas where the excavated soils would be placed. The construction of facility components would require the permanent removal of vegetation and replacement with facilities and gravel yards. In addition to vegetation clearing within the ROWs, the construction of access roads and the establishment of support facilities would require the clearing of vegetation, in some cases outside of the ROW. A minimal amount of grading would occur in material laydown areas and staging areas.

Areas from which vegetation is removed would be replanted, except where permanent facilities or access roads are located. However, the reestablishment of some natural communities, such as those in alpine or very arid locations, may be very difficult. Old growth habitats, which may have never been physically disturbed by activities such as logging and typically contain centuries-old trees or other plants, could not be reestablished and would be permanently lost. Losses of such habitats would be considered a greater impact than losses of previously disturbed habitats. However, avoidance of sensitive or especially high quality habitats, such as old growth, was generally considered during corridor routing. Operation of heavy equipment during construction may result in injury or destruction of existing vegetation and the compaction and disturbance of soils. Soil aeration, infiltration rates, and moisture content could be impacted.

All these factors could affect the rate or success of vegetation reestablishment. Some replanted areas over buried pipelines may continue over the long term to support vegetative communities different from surrounding natural communities, due to the slow reestablishment of native species and continued differences in substrate characteristics, such as soil moisture levels, organic material, and, in rocky soils, the amount of fine soil particles (BLM 2002).

Invasive plant species are present in many of the areas where corridors would be located. Seeds or other propagules of such species typically become easily dispersed, and seed germination and seedling growth and survival of these species generally tolerate disturbed conditions. Invasive plant species typically develop a high population density and tend to exclude most other plant species, reducing species and structural diversity. Diversity in faunal assemblages utilizing that habitat may also subsequently be reduced. Soil disturbed by clearing or excavation could provide opportunities for non-native species or invasive species to become established, resulting in potential long-term indirect effects.

Replanting of disturbed areas with non-native species may result in introduction of those species into nearby natural areas, including other federal and nonfederal land. ROWs, such as energy transport corridors or roads, can provide routes for the spread of invasive species into new, uninfested areas. These corridors can facilitate the dispersal of invasive species by altering existing habitat conditions, stressing or removing native species, and allowing easier movement by wild or human vectors (Trombulak and Frissell 2000). Because they are typically linear projects, they have the potential for widespread, landscape-scale promotion of invasive species.

In addition to reducing species diversity through competition, invasive species may alter ecological processes, such as fire regimes. Long-term effects may include an increase in the frequency and intensity of wildfires, particularly from the establishment of annual grasses (such as cheatgrass [*Bromus tectorum*]), which produce large amounts of easily ignitable fuel over large contiguous areas. Native species, particularly shrubs, in habitats not adapted to frequent or intense fires may be adversely affected, and their populations may be greatly reduced in affected areas, creating opportunities for greater increases in invasive species populations. Vehicle traffic along ROWs can promote the incidence of fires in affected areas by the contact of lot exhaust systems with ignitable plant material.

Removal of tall mature trees in or near wetlands could result in an increase in growth of shrubs and herbaceous species present there due to the increased availability of light. Tree removal from wetlands may initially result in indirect wetland impacts, such as reductions in soil moisture, erosion of exposed substrates, increase in water temperatures, or sedimentation of downgradient wetland areas, including streams. Such impacts may affect the type of a native plant community able to become established, including species composition and community structure. These communities may consist of species tolerant of disturbed conditions.

Areas of tree removal would become vegetated with shrub and herbaceous species. Where trees are allowed to reestablish, such as in portions of electricity transmission line ROWs, early successional stages of forests or woodlands may become established as the permanent vegetation cover, depending on the reduction of mature trees by ROW maintenance programs. However, some forested wetlands within the ROWs could permanently change to scrub-shrub or emergent wetlands, depending on the density of shrub and herbaceous species present and the presence of species that naturally occur in local nonforested wetlands. The eventual permanent vegetation on any area disturbed during ROW construction would depend on the species present on and outside the ROW, the degree of disturbance to vegetation and substrates, and vegetation management practices implemented. The placement or disposal into wetlands of slash or debris from cutting could affect wetland communities by covering existing vegetation or blocking water flow.

Additional indirect impacts of construction may include habitat fragmentation and isolation of terrestrial habitats or wetland areas. In addition to habitats crossed by corridor segments, habitat remnants between future ROWs, such as those that would connect segments, would be affected by factors associated with habitat fragmentation. Dispersal of pollen or seeds between isolated habitat patches may be difficult, resulting in eventual declines in biodiversity. Removal of trees within or along forest or woodland areas would potentially result in an indirect disturbance to forest or woodland interior areas, through changes in light and moisture conditions and introduction of nonforest or nonwoodland species, including potentially invasive species. In addition, trees remaining along the margin of the construction area may decline as a result of stress induced by altered conditions. Disturbance of surface soils near trees could also adversely affect trees along the margin. Root disturbance, soil compaction, topsoil loss, reduced soil moisture or reduced aeration, or altered drainage patterns may contribute to tree losses in addition to those removed during land clearing. Biodiversity may be reduced in fragmented or isolated habitats, including the diversity of plant and animal species. Effects on wildlife are discussed later in this section.

In areas where loose soils such as sand dunes occur, erosion along excavations, such as for pipelines burial, may occur due to stormwater runoff, wind erosion, or sloughing of unstable slopes, in addition to direct habitat losses from vegetation and soil removal. Stabilization of slope margins may be difficult, and establishment of vegetative cover may be slow, possibly resulting in prolonged habitat losses near construction areas. If a corridor is widened or otherwise used for additional projects, vegetative cover may not be reestablished before it is removed again, resulting in even more prolonged habitat losses.

Fugitive dust from exposed soil surfaces or gravel roadways may result in reduced photosynthesis and primary production in adjacent terrestrial and wetland habitats. Impacts may include reduced growth and density of vegetation and changes in community composition to more tolerant species.

The construction of facilities and access roads could potentially result in the direct loss of wetlands from the placement of fill material. Construction of pipeline stream crossings, where directional drilling is not used, and access road bridges could also result in losses of wetland habitat. Wetland losses could result in the localized reduction or loss of wetland functions. Soils excavated for placement of electricity transmission towers and support anchors could cover wetland vegetation and other biota. Subsoils left on the surface may not be colonized readily by native wetland species and may provide the opportunity for establishment of non-native invasive plant species.

The construction of pipelines through wetlands would result in direct losses of wetland habitat due to excavation. Additional losses could occur along pipeline routes as a result of widening from continued erosion of wetland substrates in locations where strong currents or waves or ice movements in winter are present and subsequent conversion of vegetated wetland areas to open water.

Impacts to wetlands from heavy equipment operation may include reductions in vegetation and the compaction and disturbance of substrates, such as rutting, resulting in long-term impacts to wetlands. Such disturbances may alter local hydrologic conditions, such as changes in inundation. Seedling establishment and the survival of plants of native species with low tolerances to disturbance may subsequently be affected. These impacts may reduce the success of the reestablishment of wetland plant communities. Soil compaction may also convert some areas of vegetated wetlands to open water or to communities of submerged vegetation.

Large amounts of gravel may be required for pipeline construction, road construction, or for the construction of gravel yards for new facilities. If gravel is excavated from river floodplains near the construction site, such activities may impact wetland communities on those floodplains. Wetland areas may be destroyed by gravel excavation.

Wetlands may be indirectly impacted by a number of factors associated with construction activities occurring within the wetland or in adjacent areas within the watershed. Altered hydrology, sedimentation, and the introduction of contaminants may impact wetlands, including wetlands on other federal as well as nonfederal land. In addition, elevated temperatures of runoff from impervious surfaces may adversely affect wetland biota. The changes resulting in wetlands affected by these factors may include changes in plant community structure, reduction of biodiversity, and the establishment and predominance of invasive plant species. Many native wetland species indicative of high-quality habitats are sensitive to disturbance and may be displaced by species more tolerant of disturbance or by invasive non-native species, reducing biodiversity.

The alteration of soils and vegetative communities and the construction of impervious surfaces within wetland watersheds could result in an altered hydrology. Hydrologic alteration of wetlands may result in a change in the quantity of surface or groundwater inflow to the wetland and increased variability in flow and water surface elevations in wetlands. Impacts may be associated with a change in water source (surface or groundwater), reduced infiltration and increased runoff, or an increase or decrease in the frequency, duration, depth, or extent of soil saturation or inundation. Hydrologic changes may result in a change in the wetland biotic community as in the replacement of one wetland community for another (such as by dewatering or ponding), or hydrologic changes may promote wetland losses by conversion to upland communities or conversion of wetland vegetative communities to open water.

Hydrologic changes can result from changes in surface drainage patterns or isolation of wetland areas from water sources, such as from blocking natural surface flows, which can result in flooding or dewatering and could have long-term effects. Land surface changes that affect stormwater flows may redirect water away from wetland watersheds. A depletion of inflow to wetlands, both as surface flow and shallow groundwater flow, could result in a reduction in wetland surface area and reduced water depth, frequency of inundation, and duration of inundation. Wetlands supported by surface water flows may experience changes to inflow or outflow rates or patterns, or changes in streamflow velocity. Water removal or disposal may also alter wetland hydrology.

Construction of impervious or compacted surfaces can increase the degree of fluctuation of water surface elevations in relation to precipitation events in wetlands within the watershed. Such changes may result in greater extremes of high and low water levels, including the reduction of streambase flows and increases in flood flows. Wetland types that are typically supported by groundwater flows may be greatly affected by increases in surface water flows or altered surface drainage patterns. In addition, they may experience a reduction in groundwater inflow if a high degree of development occurs within the recharge area.

Soil disturbance and compaction resulting from construction on upland areas adjacent to wetlands may reduce infiltration rates and increase surface water runoff rates. The presence of facilities within the watershed could potentially result in an increase in surface runoff of precipitation. Increased runoff potentially results in greater variability in inflow and more rapid changes in water surface elevation within wetlands following storm events, as well as more rapid reductions in water levels during low precipitation periods. Increased fluctuations may impact wetland biotic communities, as species less tolerant of disturbance are replaced by tolerant species.

Degradation of water quality as a result of construction may also impact wetlands. Wetland impacts associated with degraded water quality could include sedimentation and turbidity and the introduction of contaminants in stormwater runoff. Persistent toxins, heavy sedimentation, or contaminants that are frequently introduced may result in the elimination of wetland biota in affected areas, including aquatic invertebrates and vegetation.

Sedimentation can adversely impact wetland biota and decrease biodiversity. The erosion of exposed or disturbed soils or insufficiently stabilized soils and unstable slopes that follows site grading may result in sediment inputs and turbidity in wetlands receiving stormwater runoff. Runoff from areas of heavy accumulations of fugitive dust may result in sediment inputs to wetlands. Shoreline erosion of exposed soils and unstable slopes may occur at pipeline stream or lake crossings. Wetland vegetation and other biota could also be impacted by sedimentation and increased turbidity by disturbance of bottom sediments, such as during trench excavation in wetlands and backfilling. Excavated sediments may cover areas adjacent to the trench, impacting wetland biota. Sediment impacts to local streams near the Pacific Coast could affect coastal wetlands. Moderate sedimentation may reduce photosynthesis, and therefore productivity, in submerged plants. Other effects of sedimentation can include a decrease in the abundance of plants and animals or the displacement of sensitive species by more tolerant species, which may occur in high-quality undisturbed wetlands. Heavy sedimentation may cover vegetation, resulting in reduced growth or mortality.

Contaminants could be introduced into wetlands if contaminants migrate into groundwater or enter stormwater that flows into wetlands. Organic compounds, such as petroleum products and coolants, metals, and other contaminants, such as salts, may be found in runoff from parking areas and roadways and can adversely affect wetland biota. The introduction of contaminants may promote the establishment and predominance of invasive plant species.

Increased access along ROWs may result in an increase in the disturbance of terrestrial vegetation communities, streams, ponds, or other wetland or riparian areas. The spread of invasive plant species may also be promoted by increased access. Disturbances may be associated with recreational activities, such as off-road vehicle (ORV) use, or access by livestock and wildlife.

Routine maintenance of the ROWs, monitoring of facilities, and repairs may result in continued impacts to terrestrial vegetation and wetlands. Repairs to pipelines or electricity transmission lines could have localized impacts similar to the original construction impacts. Maintenance of access roads could introduce sediments into downstream wetlands. Vehicle use for monitoring or maintenance may result in an ongoing impact to vegetation. Vegetation management programs would generally result in continued existence of disturbed vegetative communities within the ROWs. Continued cutting or removal of woody species, such as over pipelines, would maintain habitats as herbaceous communities or altered shrub communities. Cutting of trees below electricity transmission lines would continue to allow higher light levels in previously forested areas, with associated effects on soils and vegetation. Herbicides used for vegetation management could impact nontarget plants or other organisms. The vegetation communities along the corridors would be expected to be different from those in nearby undisturbed natural areas throughout the life of the corridors.

Spills of oil or other toxic compounds such as diesel fuel or fuel oil may result from pipeline leaks or other accidental spills along the ROWs. Petroleum spilled onto ground surfaces would likely result in direct injury and mortality of plants and other biota in terrestrial or wetland habitats, and migration through the soil may make recovery and restoration difficult.

Spilled oil may penetrate into subsurface layers or enter burrows or crevices. Permeable substrates could increase oil penetration, especially that of light oils and petroleum products. Habitats with highly permeable soils may experience rapid migration of contaminants through the root zone. Some contaminants may migrate to shallow groundwater and subsequently enter the root zone of nearby vegetation in the path of groundwater movement. Spills on upland soils may impact wetlands that receive shallow groundwater inputs, such as riparian wetlands and wetlands supported by seeps and springs. Oil spilled on uplands could potentially flow into a nearby stream. Vegetation along the path of the spill would be injured or killed, including wetland vegetation along the stream. Impacted wetlands may be located at considerable distances from the location of the spill. Wetlands in river deltas and estuaries could be impacted by oil spilled in upstream areas. Oil reaching the coastline may persist for extended periods of time and slow or reduce vegetation recovery.

Effects may range from a short-term reduction in photosynthesis to extensive vegetation injury or mortality. Vegetation may resprout and recover following an oil spill. However, long-term impacts may include reduced stem density, lower biomass, poor regrowth, and reduced reproduction. Spills can cause changes in community structure and dynamics. Effects of spills could include a change in plant community composition or the displacement of sensitive species by more tolerant species. Toxic compounds in oil may selectively remove the more sensitive organisms, and opportunistic species may colonize affected areas, resulting in a long-term shift in species composition. Impacts to soil microbial communities might result in long-term wetland effects, and wetland recovery would likely be slowed.

Various factors influence the degree of impacts to wetlands and length of recovery. Impacts would depend on site-specific factors at the location and time of the spill. Factors include the quantity of the spill (lightly or heavily oiled substrates), the oil type and degree of weathering, time of year, extent and duration of the exposure of biota, plant species affected, percent of plant surface oiled, substrate type and moisture level, and degree of substrate contamination and subsurface penetration (Hayes et al. 1992; Hoff 1995; NOAA 1994, 1998). The most acutely toxic components of crude oil are rapidly lost through weathering. Higher mortality and poorer recovery of vegetation generally result from spills of lighter petroleum products (such as diesel fuel), heavy deposits of oil, spills during the growing season, contact with sensitive plant species, completely oiled plants, and deep penetration and accumulation of oil in substrates. Where oil spills occur in flooded areas or on saturated soils, recovery of vegetation is generally better than that on unsaturated soils (BLM 2002).

Spill cleanup may require the excavation and removal of soils and biota. Spilled oil that remains following cleanup degrades naturally by weathering and biodegradation by soil microbial communities. However, biodegradation would likely be slow in areas with cool temperatures and a short growing season. Oil could remain in some wetland substrates for decades, particularly in sheltered areas, even if it was cleaned from the surface, persisting as a long-term source of exposure. Full recovery of wetlands might require more than 10 years, depending on site and spill characteristics (Hoff 1995). Spill cleanup actions might damage wetlands through trampling of vegetation and other biota and incorporation of oil deeper into substrates from foot traffic and equipment, which could have long-term effects and delay or prevent recovery from oil spills (Hoff 1995; NOAA 1994, 2000). Where soils are excavated, increased erosion and lowered substrate elevation may result in wetland loss by conversion to open water. Spill cleanup operations might adversely impact shorelines if the removal of contaminated substrates affects shoreline stability and results in accelerated shoreline erosion. Effective low-impact cleanup actions may include bioremediation, low-pressure flushing, or use of chemical cleaners (Hoff 1995; Proffitt 1998; Mendelssohn and Lin 2003).

How Could Aquatic Biota Be Affected by Project Development? Potential construction impacts of corridor development on aquatic biota would result primarily from ground disturbance, vegetation removal, and excavation during clearing of the ROWs and from installation of access roads and structures (e.g., transmission line towers, substations, or pipelines) near or in water bodies. Potential impacts could include changes in water surface flow patterns, deposition of sediment in surface water bodies, changes in water quality or temperature regimes, loss of riparian vegetation, introduction of toxic materials, restrictions to fish movements, and changes in human access to water bodies. The severity of impacts would depend upon such factors as the type of aquatic habitat, season of construction, size of the aquatic habitat, corridor width to be cleared, construction procedures used, and the quality of the existing habitat.

During construction, ground disturbance and direct disturbance of stream bottoms could result in increased suspended sediment loads both during construction activities and for a limited period of time after construction activities cease. Thus, it can be anticipated that pulses of suspended sediment occur throughout the construction period. These suspended sediments typically settle to the bottom within some distance downstream of the construction area, with that distance depending upon factors such as the size of sediment particles and water velocity in the receiving body of water. The overall area of aquatic habitat affected by a particular construction activity would then include the footprint of the disturbed area plus an area downstream of the activity.

Characteristics of surface water runoff, such as flow direction and flow rates following rain events, are controlled, in part, by local topography and vegetation cover. As a consequence, construction activities that affect the terrain and vegetation during corridor development could alter the water flow patterns. Impacts to aquatic ecosystems could result if these alterations affect the amount, timing, or flashiness of runoff entering a particular water body. Generally, attempts are made to control or reduce such impacts on aquatic ecosystems by ensuring that the overall grade of a corridor remains similar to the grade present prior to construction, by maintaining some vegetative cover in corridors, and by maintaining a relatively unaltered buffer of vegetation along the margins of water bodies.

Turbidity and sedimentation from erosion are part of the natural cycle of physical processes in water bodies, and most populations of aquatic organisms have adapted to short-term changes in these parameters. However, if sediment loads are unusually high or last for extended periods of time compared to natural conditions, adverse impacts can occur (Waters 1995). Increased sediment loads can suffocate aquatic vegetation, invertebrates, and fish; decrease the rate of photosynthesis in plants and phytoplankton; decrease fish feeding efficiency; decrease the levels of invertebrate prey; reduce fish spawning success; and adversely affect the survival of incubating fish eggs, larvae, and fry. In addition, some migratory fishes may avoid streams that contain excessive levels of suspended sediments (Waters 1995).

The level of effects from increased sediment loads depend on the natural condition of the receiving waters and the timing of sediment inputs. Whereas most aquatic systems might be expected to be impacted by large increases in levels of suspended and deposited sediments, aquatic habitats in which waters are normally turbid may be less sensitive to small to moderate increases in suspended sediment loads than habitats that normally have clear waters. Similarly, increased sedimentation during periods of the year in which sediment levels might naturally be elevated (e.g., during wet parts of the year) may have smaller impacts compared to sediment impacts that occur during periods in which natural sediment levels would be expected to be lower.

In addition to potentially resulting in increased sediment loads, the removal of riparian vegetation, especially tall trees, can affect the temperature regime in aquatic systems by altering the amount of solar radiation that reaches the water surface. This thermal effect would be most pronounced in small stream habitats, where a substantial portion of the stream channel may be shaded by vegetation. As water temperature increases, the level of dissolved oxygen in the water decreases. As a consequence, changes in temperature regimes of aquatic habitats can affect the ability of some species to survive within the affected areas, especially during periods of elevated temperatures. For a stream to support coldwater species, such as trout, the water temperature should not exceed about 68°F for more than short periods of time or distances. In some warmwater habitats, water temperatures during summer periods may sometimes approach temperatures that are lethal to resident species under natural conditions, and alterations to the environment that increase water temperatures by even a few degrees could result in fish kills during such periods.

Fish exposed to stressful temperatures generally move along the temperature gradient until acceptable temperatures are encountered. Fish typically avoid elevated temperatures by swimming to areas of groundwater inflow, to deep holes, or to shaded areas. As long as the proportion of a water body's riparian area affected by vegetation clearing is not excessive, fish will likely be able to find temporary refuge in nearby areas. The level of thermal impact associated with the clearing of riparian vegetation would be expected to increase as the amount of affected shoreline increases.

During operation of the corridors, aquatic systems could be adversely affected by maintenance activities, especially vegetation control. For most transmission line corridors, vegetation control in a particular area is relatively infrequent (generally no more often than once every 3 to 4 years) and the amount of vegetation disturbed is much less than would occur during construction. Selected trees might be removed or trimmed if they are considered likely to pose a risk to the transmission system. If control of vegetation along shorelines can be accomplished using manual techniques, the erosion of stream banks from maintenance activities would be expected to be relatively minor.

The potential exists for toxic materials (e.g., fuel, lubricants, and herbicides) to be accidentally introduced into waterways during construction and maintenance activities or as a result of leaks from pipelines. The level of impacts from releases of toxicants would depend on the type and volume of chemicals entering the waterway, the location of the release, the nature of the water body (e.g., size, volume, and flow rates), and the types and life stages of organisms present in the waterway. In general, lubricants and fuel would not be expected to enter waterways as long as heavy machinery is not used near waterways, fueling locations for construction and maintenance equipment are located away from the waterway, and measures are taken to control potential spills. Mitigation measures for development and maintenance of corridors generally restrict the use of machinery near waterways. Similarly, mitigation measures generally place restrictions on the application methods, quantities, and types of herbicides that are used in the vicinity of waterways in order to limit the potential for impacts on aquatic ecosystems.

In areas where corridors cross streams, obstructions to fish movement could occur if culverts, low-water crossings, or buried pipelines are not properly installed, sized, or maintained. During periods of low water, vehicular traffic can result in rutting and accumulation of cobbles in some crossings that can interfere with fish passage. In streams with low flows, flow could become discontinuous if disturbance of the stream bed during construction of the corridor or due to pipeline burial results in increased porosity or if alteration of the channel spreads flow across a wider area. Restrictions to fish movement would likely be most significant if they occur in streams that support migratory fishes, such as anadromous salmon species, that need to reach upstream spawning areas in order to reproduce.

In addition to the potential for the direct impacts identified above, indirect impacts on fisheries could occur as a result of increased public access to remote areas via ROWs and associated access roads. Fisheries could be impacted by increased fishing pressure, and other human activities (e.g., all-terrain vehicle [ATV] use) could disturb vegetation and soils, resulting in erosion and sediment-related impacts on water bodies, as discussed above. Such impacts would likely be smaller in locations where the corridor segments would be colocated with roads or existing ROWs, or where they would be located close to existing features (e.g., trails or logging roads) that already provide access to waterways. Nevertheless, construction of the additional corridors would likely add access points to waterways.

The overall impact of corridor development and maintenance activities on aquatic resources would depend on the type and amount of aquatic habitat that would be disturbed, the nature of the disturbance, and the aquatic biota that occupy the project site and surrounding areas.

How Could Wildlife Be Affected by Project Development?

Construction Impacts. Wildlife, including wild horses and burros, may be affected during construction of energy transport facilities. The wildlife species that could be affected would depend on the ecoregion within which each corridor segment would be located (Section 3.8.1.3) and the nature and extent of the habitats within each corridor segment and its surrounding vicinity.

Construction of the West-wide energy corridor system may adversely affect wildlife through (1) habitat reduction, alteration, or fragmentation; (2) introduction of invasive species, particularly vegetation; (3) injury or mortality of wildlife; (4) erosion and runoff; (5) fugitive dust; (6) noise; (7) exposure to contaminants; and (8) interference with behavioral activities (Table 3.8-8). The overall impact of construction activities on wildlife populations would depend on:

- The type and amount of wildlife habitat that would be disturbed;
- The nature of the disturbance (e.g., complete, permanent reduction because of support structure placement; complete, permanent alteration due to pipeline placement; or temporary disturbance in construction support areas);
- The wildlife that occupy the project site and surrounding areas; and
- The timing of construction activities relative to crucial life stages (e.g., breeding season).

Habitat Disturbance. The reduction, alteration, or fragmentation of habitat would result in a major construction-related impact to wildlife. Habitat within the construction footprints of the transmission line and pipeline ROWs, support facilities, and access road corridors would be disturbed. The amount of habitat that would be disturbed would be a function of the current degree of disturbance already present in the project site area and the width of the corridor. The construction of a corridor project would not only result in the direct reduction or alteration of wildlife habitat within the project footprint but could also affect the diversity and abundance of area wildlife through the fragmentation of habitat.

Effects from habitat reduction, disturbance, or fragmentation would be related to the type and abundance of the habitats affected and the wildlife species that occur in those habitats. For example, habitat disturbance in forested areas could cause an impact to local wildlife populations, especially to those species whose affected habitats are uncommon and not well represented in the surrounding landscape. In contrast, few population-level impacts would be expected where corridor segments would be located on currently disturbed or modified lands such as existing ROWs and rangelands. Wildlife species least likely to be affected by the energy transport facilities would be habitat generalists.

Fragmentation can separate wildlife populations into smaller populations that are more susceptible to extirpation from random events such as drought, disease, introduction of exotic predators, and so forth. It can also make movement between habitat fragments more difficult during periods when resources are limited. Habitat fragmentation can degrade the unique habitat characteristics of large, unbroken habitat tracts; the characteristics include accessible migration corridors, cover and forage that are free from disturbance, and areas isolated from hunting and predators (BLM 2005d).

Where the transport corridor segments would be routed through forested areas, the primary impact on wildlife would be a change in species using the ROW segments from those favoring forested habitats to those using edge and more open habitats. Open-land habitat species such as the red-tailed hawk, American kestrel, osprey (*Pandion haliaetus*), brown-headed cowbird (*Molothrus ater*), and yellow warbler (*Dendroica petechia*) may increase in numbers. An increase in brown-headed cowbird populations could adversely affect other bird species since it is a brood parasite, laying its eggs in the nests of other species, especially warblers, vireos, and sparrows.

Many neotropical migrants have characteristics that make them especially susceptible to brood parasitism and nest predation (e.g., open cup nests, nest placement near or on the ground, lack of defense mechanisms against brood parasites, and generally producing only one small clutch per season) (Rich et al. 1994). Nests along the forest edge could also be more vulnerable to predators such as raccoons and jays. Predators such as coyote and foxes commonly use ROWs for hunting due to the increase in small mammals that prefer open areas. The cleared ROW segments may also encourage population expansion of invasive bird species, such as the house sparrow (*Passer domesticus*) and European starling (*Sturnus vulgaris*), which compete with many native species. Wild horses and burros compete with big game for available forage. This competition could lead to adverse impacts on big game species in areas where habitat loss or modification occurs.

Although most fragmentation research has focused on forested areas, similar ecological impacts have been reported for the more arid and semiarid landscapes of the western United States, particularly shrub-steppe habitats that are dominated by sagebrush or salt desert scrub communities. For example, habitat fragmentation, combined with habitat degradation, has been shown to be largely responsible for the decline in sage grouse throughout most of its range (Strittholt et al. 2000; see also Text Box 3.8-2 on age grouse later in this section). The loss of forest habitat and the creation of early successional and edge habitats can decrease the quality of habitat for forest interior species for distances up to 100 to 300 feet from the edge of the ROW (Anderson et al. 1977). This may reduce the density and diversity of forest interior species in a much wider area than that of the actual cleared ROW segment.

The creation of edge habitat can (1) increase predation and parasitism of vulnerable forest interior animals in the vicinity of edges; (2) have negative consequences for wildlife by modifying their distribution and dispersal patterns; (3) be detrimental to species requiring large undisturbed areas, because increases in edges are generally associated with concomitant reductions in habitat size and possible isolation

Text Box 3.8-2
Compatibility of Energy Transport Facilities and Sage Grouse

Most concerns about the effects of development on sage grouse have focused on potential impacts associated with the reduction, fragmentation, and modification of grassland and shrubland habitats. The Gunnison sage-grouse (*Centrocercus minimus*) and, particularly, the greater sage-grouse (*C. urophasianus*) are of concern relative to reduction and fragmentation of sagebrush habitat within the 11 western states. Within the 11 western states, the Gunnison sage-grouse is restricted to southwestern Colorado and southeastern Utah, while the greater sage-grouse occurs in all the states except Arizona and New Mexico, where they are extirpated (Bird and Schenk 2005; NatureServe 2006). The life history and habitat requirements of both species are similar (Bird and Schenk 2005); therefore, the following discussion emphasizes the more widely distributed greater sage-grouse.

Populations of greater sage-grouse can vary from nonmigratory to migratory (having either one-stage or two-stage migrations) and can occupy an area that exceeds 1,040 square miles on an annual basis. The distance between leks (strutting grounds) and nesting sites can exceed 12.4 miles (Connelly et al. 2000; Bird and Schenk 2005). Nonmigratory populations can move 5 to 6 miles between seasonal habitats and have home ranges up to 40 square miles. The distance between summer and winter ranges for one-stage migrants can be 9 to 30 miles apart. Two-stage migrant populations make movements between breeding habitat, summer range, and winter range. Their annual movements can exceed 60 miles. The migratory populations can have home ranges that exceed 580 square miles (Bird and Schenk 2005). However, the greater sage-grouse has a high fidelity to a seasonal range. They also return to the same nesting areas annually (Connelly et al. 2000, 2004).

The greater sage-grouse needs contiguous, undisturbed areas of high-quality habitat during its four distinct seasonal periods: (1) breeding, (2) summer-late brooding and rearing, (3) fall, and (4) winter (Connelly et al. 2000). The greater sage-grouse occurs at elevations ranging from 4,000 to 9,000 feet. They are omnivorous and consume primarily sagebrush and insects. Over 99% of their diet in winter consists of sagebrush leaves and buds. Sagebrush is also important as roosting cover, and the greater sage-grouse cannot survive where sagebrush does not exist (USFWS 2004).

Leks are generally areas supported by low, sparse vegetation or open areas surrounded by sagebrush that provide escape, feeding, and cover. They can range in size from small areas of 0.1 to 10 acres to areas of 100 acres or more (Connelly et al. 2000). The lek/breeding period occurs March through May, with peak breeding occurring from early to mid-April. Nesting generally occurs 1 to 4 miles from lek sites, although it may range up to 11 miles (BLM 2004a). The nesting/early brood-rearing period occurs from March through July. Sagebrush at nesting/early brood-rearing habitat is 12 to 32 inches above ground with 15 to 25% canopy cover. Tall, dense grass combined with tall shrubs at nest sites decreases the likelihood of nest depredation. Hens have a strong year-to-year fidelity to nesting areas (BLM 2004a). The late brood-rearing period occurs from July through October. Sagebrush at late brood-rearing habitat is 12 to 32 inches tall with a canopy cover of 10 to 25% (BLM 2004a). The greater sage-grouse occupies winter habitat from November through March. Suitable winter habitat requires sagebrush 10 to 14 inches above snow level with a canopy cover ranging from 10 to 30%. Wintering grounds are potentially the most limiting seasonal habitat for greater sage-grouse (BLM 2004a).

While no single or combination of factors have been proven to have caused the decline in greater sage-grouse numbers over the past half-century, the decline in greater sage-grouse populations is thought to be due to a number of factors including drought, oil and gas wells and their associated infrastructure, powerlines, predators, and a decline in the quality and quantity of sagebrush habitat (due to livestock grazing, range management treatments, and development activities) (Connelly et al. 2000; Crawford et al. 2004). West Nile virus is also a significant stressor of greater sage-grouse (Naugle et al. 2004).

Text Box 3.8-2 (Cont.)
Compatibility of the Energy Transport Facilities and Sage Grouse

Loud, unusual sounds and noise from construction and human activities disturb gallinaceous birds, cause birds to avoid traditional use areas, and reduce sage grouse use of leks (Young 2003). Disturbance at leks appears to limit reproductive opportunities and may result in regional population declines. Most observed nest abandonment is related to human activity (NatureServe 2006). Thus, site construction, operation, and site-maintenance activities could be a source of auditory and visual disturbance to sage grouse.

Transmission lines, pipelines, and access roads may adversely affect habitats important to gallinaceous birds by causing fragmentation, reducing habitat value, or reducing the amount of habitat available (Braun 1998). Transmission lines, pipelines, and other structures can also provide perches and nesting areas for raptors and ravens that may prey upon gallinaceous birds.

Measures that have been suggested for management of sage grouse and their habitats (e.g., Paige and Ritter 1999; Connelly et al. 2000; Montana Sage Grouse Work Group 2005) that have pertinence to energy transport facilities include:

- Identify and avoid both local (daily) and seasonal migration routes.
- Consider sage grouse and sage habitat when designing, constructing, and utilizing project access roads and trails.
- Avoid, when possible, siting energy developments in breeding habitats.
- Adjust the timing of activities to minimize disturbance to sage grouse during critical periods.
- When possible, locate energy-related facilities away from active leks or near other sage grouse habitat.
- When possible, restrict noise levels to 10 dB above background noise levels at lek sites.
- Minimize nearby human activities when birds are near or on leks.
- As practicable, do not conduct surface-use activities within crucial sage grouse wintering areas from December 1 through March 15.
- Maintain sagebrush communities on a landscape scale.
- Provide compensatory habitat restoration for impacted sagebrush habitat.
- Avoid the use of pesticides at sage grouse breeding habitat during the brood-rearing season.
- Develop and implement appropriate measures to prevent the introduction or dispersal of noxious weeds.
- Avoid creating attractions for raptors and mammalian predators in sage grouse habitat.
- Consider measures to mitigate impacts at off-site locations to offset unavoidable sage grouse habitat alteration and reduction at the project site.

The BLM manages more sage grouse habitat than any other entity; therefore, it has developed a National Sage Grouse Habitat Conservation Strategy for BLM-administered public lands to manage public lands in a manner that will maintain, enhance, and restore sage grouse habitat while providing for multiple uses of BLM-administered public lands (BLM 2004e). The strategy is consistent with the individual state sage grouse conservation planning efforts. The purpose of this strategy is to set goals and objectives, assemble guidance and resource materials, and provide more uniform management directions for the BLM’s contributions to the multistate sage grouse conservation effort being led by state wildlife agencies (BLM 2004e). The BLM strategy includes guidance for (1) addressing sagebrush habitat conservation in BLM land use plans, and (2) managing sagebrush plant communities for sage grouse conservation. This guidance is designed to support and promote the rangewide conservation of sagebrush habitats for sage grouse and other sagebrush-obligate wildlife species on public lands administered by the BLM, and presents a number of suggested management practices (SMPs). These SMPs include management or restoration activities, restrictions, or treatments that are designed to

Text Box 3.8-2 (Cont.)
Compatibility of the Energy Transport Facilities and Sage Grouse

enhance or restore sagebrush habitats. The SMPs are divided into two categories: (1) those that will help maintain sagebrush habitats (e.g., practices or treatments to minimize unwanted disturbances while maintaining the integrity of the sagebrush communities), and (2) those that will enhance sagebrush habitat components that have been reduced or altered (BLM 2004e).

SMPs that are or may be pertinent to energy transport facilities include:

- Development of monitoring programs and adaptive management strategies,
- Control of invasive species,
- Prohibition or restriction of ATV activity,
- Consideration of sage-grouse habitat needs when developing restoration plans,
- Avoidance of placing facilities in or next to sensitive habitats such as leks and wintering habitat,
- Location or construction of facilities so that facility noise does not disturb grouse activities or leks,
- Consolidation of facilities as much as possible,
- Initiation of restoration practices as quickly as possible following land disturbance,
- Installation of antiperching devices on existing or new power lines in occupied sage grouse habitat, and
- Design of facilities to reduce habitat fragmentations and mortality to sage grouse.

In addition to BLM's National Sage Grouse Habitat Conservation Strategy, the Western Assocation of Fish and Wildlife Agencies has produced two documents that together comprise a Conservation Assessment for Greater Sage Grouse. The first is the *Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats* (Connelly et al. 2004). The second document is the *Greater Sage-Grouse Comprehensive Conservation Strategy* (Stiver et al. 2006). Additionally, a Gunnison Sage-Grouse Rangewide Conservation Plan has been prepared (Gunnison Sage-grouse Rangewide Steering Committee 2005).

of habitat patches and corridors (habitat fragmentation); or (4) increase local wildlife diversity and abundance.

Direct effects of edge creation can include (1) physical disturbance of vegetation and soil; (2) changes in abiotic components such as light, wind, and moisture; and (3) increased access for organisms, material (e.g., pollen, seeds, contaminants), and energy (Harper et al. 2005). The ecological importance of the edge largely depends on how different it is from the regional landscape. For example, the influence of the edge would be less ecologically important where the landscape has a high degree of heterogeneity. Also, edge influence would be less ecologically important in a forest with a more open and diverse canopy (Harper et al. 2005). Landscapes with a patchy composition (e.g., tree-, shrub-, and grass-dominated cover) may already contain edge-adapted species that make the influence of a created edge less likely (Harper et al. 2005).

The density of several forest-dwelling bird species can increase within a forest stand soon after the onset of fragmentation, as a result of displaced individuals packing into remaining habitats (Hagan et al. 1996). The habitats within which displaced animals would move would be subject to some degree of overuse and degradation. This overcrowding may also cause an increase in competition for space and forage, an increase in the animals' stress, and a decrease in the animals' physical conditions. The pairing success of ovenbirds (*Seiurus aurocapilla*) was found to be lower in the fragments, possibly due to behavioral dysfunction resulting from high densities. The duration and extent of increased densities following onset of fragmentation depend on many factors, including the sensitivity of a species to edge and area effects, the duration and rate of habitat loss and fragmentation, and the proximity of a forest stand to the disturbance (Hagan et al. 1996).

Fragmentation of forests into small patches is detrimental to many migrant songbird species (Parker et al. 2005). In a study of four corridors varying in widths from 40 to 300 feet through a forest in Tennessee, the narrowest corridors provided the least change from a forest-bird community, while the wide corridors tended to contain grassland communities of birds (Anderson et al. 1977). Nevertheless, corridor widths as narrow as 26 feet were found to produce forest fragmentation effects in New Jersey, in part by attracting brown-headed cowbirds and nest predators to corridors and adjacent forest interiors (Rich et al. 1994).

Although habitats adjacent to facilities may remain unaffected, wildlife tend to make less use of these areas. Road avoidance by wildlife could be greater in open landscapes compared to forested landscapes (Thomson et al. 2005). The effective habitat (amount of habitat actually available to wildlife) loss due to roads was reported to be 2.5 to 3.5 times as great as actual habitat loss (Reed et al. 1996). Those individuals that make use of these areas can be subjected to increased physiological stress. This combination of avoidance and stress reduces the capability of wildlife to use habitat effectively (WGFD 2004).

A pipeline ROW through undisturbed forest habitats in Alberta was found to be beneficial to ungulates such as moose, elk, and deer, mainly due to increased browse availability. However, the immediate benefit of a ROW depends on the rate of establishment of woody browse species (Lunseth 1988). Long-term displacement of elk, mule deer, pronghorn, or other species from critical (crucial) habitat or parturition areas due to habitat disturbance would be considered significant (BLM 2004a). For example, activities around parturition areas have the potential to decrease the usability of these areas for calving and fawning. A corridor segment through a crucial winter area could directly reduce the amount of habitat available to the local population. This could force individuals to use suboptimal habitat, which could lead to debilitating stress and possibly to population-level effects.

The energy transport ROW segments, particularly the pipeline portions, would reduce the amount of suitable winter cover available to deer and other ungulates. While not an absolute barrier, a cleared ROW may also limit travel by wildlife species between areas on either side of the ROW. Studies have shown that deer will cross an open ROW as wide as 450 feet in winter (Doucet et al. 1981, 1987). Habitat specificity, seasonal changes in microclimate, and population pressures may all influence the extent and rate at which small mammals may cross a cleared area. The white-footed mouse (*Peromyscus leucopus*) and short-tailed shrew (*Blarina brevicauda*) were found to cross transmission line corridors with a width up to 340 feet. However, it is not known if such species would cross wider corridors associated with more lines or higher voltage lines (Schreiber and Graves 1977).

Migration corridors are vulnerable, particularly at pinch points where physiographic constrictions force herds through relatively narrow corridors (Berger 2004). Loss of habitat continuity along migration routes would severely restrict the seasonal movements necessary to maintain healthy big game populations (Sawyer and Lindzey 2001; Thomson et al. 2005). As summarized by Strittholt et al. (2000), roads have been shown to impede the movements of invertebrates, reptiles, and small and large mammals.

Rock piles inhabited by reptiles may be impacted by clearing for access roads, support tower sites, pipeline ROWs, substations, and other ancillary facilities.

Specified distance limits on surface disturbance would be applied for big game parturition areas, raptor nesting areas, and greater sage-grouse winter concentration areas and leks. Construction restrictions (e.g., buffer zones and seasonal restrictions) would lessen the potential for inadvertent loss of migratory bird nests during the avian breeding season.

Introduction of Invasive Vegetation. Fragmentation can facilitate the spread and introduction of invasive plant species (a more thorough discussion of effects on vegetation is found earlier in this section). Roads (and other corridors) can facilitate the dispersal of invasive species by altering existing habitat conditions, stressing or removing native species, and allowing easier movement by wild or human vectors (Trombulak and Frissell 2000). Wildlife habitat could also be impacted if invasive vegetation becomes established in the construction-disturbed areas and adjacent off-site habitats. The establishment of invasive vegetation could reduce habitat quality for wildlife and locally affect wildlife occurrence and abundance. The introduction or spread of non-native plants such as cheatgrass (*Bromus tectorum*), salt-cedar (*Tamarix ramosissima*), and Russian olive (*Elaeagnus angustifolia*) would be detrimental to wildlife such as neotropical migrants and sage grouse. Invasion of exotic species on public lands has been estimated at more than 5,000 acres/day. Cheatgrass is expected to dominate or completely convert more than half of the native sagebrush habitat in the United States (Strittholt et al. 2000).

Wildlife Injury or Mortality. Clearing, grading, and trenching activities would result in the direct injury or death of wildlife that are not mobile enough to avoid construction operations (e.g., reptiles, small mammals), that utilize burrows (e.g., ground squirrels and burrowing owls), or that are defending nest sites (such as ground-nesting birds). Although more mobile wildlife species, such as deer and adult birds, may avoid the initial clearing activity by moving into habitats in adjacent areas, it is conservatively assumed that adjacent habitats are at carrying capacity for the species that live there and could not support additional biota from the construction areas. The subsequent competition for resources in adjacent habitats would likely preclude the incorporation of the displaced individuals into the resident populations.

Corridor and access road development increases use by recreationists and other users of public lands, increasing the amount of human presence and the potential for harassment and legal or illegal taking of wildlife. This may include the collection of live animals, particularly reptiles and amphibians, for pets. Direct mortality from snowmobiles and ATVs may occur due to crushing or suffocation of small mammals occupying subnivean spaces and from increased access to predators over compacted vehicular trails (Gaines et al. 2003).

Collision with vehicles can be a source of wildlife mortality, especially in wildlife concentration areas or travel corridors. Sage grouse are susceptible to vehicular collision along dirt roads because they are sometimes attracted to them to take dust baths (Strittholt et al. 2000). However, access roads not needed for maintenance would be removed following construction, and as public use of these access roads would be restricted, roadkills would not be expected to result in a significant impact from a wildlife population perspective.

Erosion and Runoff. Construction activities may result in increased erosion and runoff from freshly cleared and graded sites. This erosion and runoff could reduce water quality in on-site and surrounding water bodies that are used by amphibians, thereby affecting reproduction, growth, and survival. The potential for water quality impacts during construction would be short-term for the duration of construction activities and post-construction soil stabilization (e.g., reestablishment of natural or man-made ground cover). Any impacts to amphibian populations would be localized to the surface waters receiving site runoff. Although the potential for runoff would be temporary, pending the completion of construction activities and the stabilization of disturbed areas with vegetative cover, erosion could result in significant impacts to local amphibian populations if an entire recruitment class is eliminated (e.g., complete recruitment failure for a given year because of siltation of eggs or mortality of aquatic larvae).

Fugitive Dust. Little information is available regarding the effects of fugitive dust on wildlife; however, if exposure is of sufficient magnitude and duration, the effects may be similar to the respiratory effects identified for humans (e.g., breathing and respiratory symptoms). A more probable effect would be the dusting of plants, which could make forage less palatable. Fugitive dust from vehicle use settles on forage adjacent to access roads, making it unpalatable for wildlife and wild horses, which could increase competition for remaining forage. This effect would be short-term and would generally coincide with the displacement of and stress to wildlife and wild horses from human activity (BLM 2004d).

Fugitive dust generation during construction activities is expected to be short-term and localized to the immediate construction area and is not expected to result in any long-term individual or population-level effects.

Noise. Principal sources of noise during construction activities would include truck and aircraft traffic, the operation of heavy machinery, and blasting (if necessary). The most adverse impacts associated with construction noise could occur if critical life-cycle activities were disrupted (e.g., mating and nesting). If birds were disturbed sufficiently during the nesting season to cause displacement, then nest or brood abandonment might occur, and the eggs and young of displaced birds would be more susceptible to cold or predators.

On the basis of the types of construction equipment that would likely be employed (such as bulldozers and graders), the noise levels associated with the equipment would range from about 80 to 90 dBA within 50 feet; site preparation noise would be at the mid-40-dB level approximately 0.25 miles from the site (Section 3.7.4.1).

Much of the research on wildlife-related noise effects has focused on birds. This research has shown that noise may affect territory selection; territorial defense, dispersal, foraging success, fledging success; and song learning (e.g., Reijnen and Foppen 1994; Foppen and Reijnen 1994; Larkin 1996). Several studies have examined the effects of continuous noise on bird populations, including the effects of traffic noise, coronal discharge along electricity transmission lines, and gas compressors. Several studies (Foppen and Reijnen 1994; Reijnen and Foppen 1994, 1995; Reijnen et al. 1995, 1996, 1997) have shown reduced densities of some species in forest (26 of 43 species) and grassland (7 of 12 species) habitats adjacent to roads, with effects detectable from 66 to 11,581 feet from the roads. On the basis of these studies, Reijnen et al. (1996) identified a threshold effect sound level of 47 dBA for all species combined and 42 dBA for the most sensitive species; the observed reductions in population density were attributed to a reduction in habitat quality caused by elevated noise levels. This threshold sound level of 42 to 47 dBA (which is somewhat below the EPA-recommended limit for residential areas) is at or below the sound levels generated by truck traffic that would likely occur at distances of 250 feet or more from the construction area or access roads, or the levels generated by typical construction equipment at distances of 2,500 feet or more from the construction site.

Blast noise (e.g., from military activities or construction blasting) has been found to elicit a variety of effects on wildlife (Manci et al. 1988; Larkin 1996). Brattstrom and Bondello (1983) reported that peak sound pressure levels reaching 95 dB resulted in a temporary shift in hearing sensitivity in kangaroo rats that required at least 3 weeks for the recovery of hearing thresholds. The authors postulated that such hearing shifts could affect the ability of the kangaroo rat to avoid approaching predators. A variety of adverse effects of noise on raptors have been demonstrated, but in many cases, the effects were temporary and the raptors became habituated to the noise (Brown et al. 1999; Delaney et al. 1999).

Exposure to Contaminants. Accidental fuel spills or releases of hazardous materials could result in the exposure of wildlife at the project site. Potential impacts to wildlife would vary according to the material spilled, the volume of the spill, the location of the spill, and the species that could be exposed. Spills could contaminate soils and surface water and could affect wildlife associated with these media. A spill would be expected to have a population-level adverse impact only if the spill was very large or contaminated a crucial habitat area where a large number of individual animals were concentrated. The potential for either event is very unlikely. Because the amounts of fuels and hazardous materials are expected to be small, an uncontained spill would affect only a limited area (much less than 1 acre). In addition, wildlife use of the area during construction would be very minor or nonexistent, thus greatly reducing the potential for exposure (BLM 2005c).

Interference with Behavioral Activities. The location and timing of construction activities may also affect the migratory and other behavioral activities of some species. Construction activities could affect local wildlife by disturbing normal behavioral activities such as foraging, mating, and nesting. Wildlife may cease foraging, mating, or nesting or vacate active nest sites in areas where construction is occurring; some species may permanently abandon the disturbed areas and adjacent habitats. In addition, active construction may also affect movements of some birds and mammals; for example, they may avoid a localized migratory route because of ongoing construction (BLM 2005c).

Disturbed wildlife can incur a physiological cost either through excitement (i.e., preparation for exertion) or locomotion. A fleeing or displaced animal incurs additional costs through loss of food intake and potential displacement to poorer (lower) quality habitat. If the disturbance becomes chronic or continuous, these costs can result in reduced animal fitness and reproductive potential (BLM 2004d). Factors that influence displacement distance include:

- Inherent species-specific characteristics,
- Seasonally changing thresholds of sensitivity as a result of reproductive and nutritional status,
- Type of habitat (e.g., longer disturbance distances in open habitats),
- Specific experiences of the individual or group,
- Weather (e.g., adverse weather such as wind or fog may decrease the disturbance),
- Time of day (e.g., animals are generally more tolerant during dawn and dusk), and
- Social structure of the animals (e.g., groups are generally more tolerant than solitary individuals) (BLM 2004c).

Operation and Maintenance Impacts. Once established, a transmission line or pipeline corridor can have the following functions, serving as a:

- Specialized habitat for some species;
- Travel lane that enhances species movement;
- Barrier to the movement of species, energy, or nutrients (i.e., due to fragmenting existing habitat); and
- Source of biotic and abiotic effects on the forest matrix.

The degree to which an energy corridor carries out these functions would depend on the wildlife species evaluated, the size of the corridor and matrix, and the habitat contrast between them (Williams 1995).

Operational impacts to wildlife and wild horses and burros would generally be less intense than during construction. Nevertheless, wildlife may still be affected by the reduction in habitat quality associated with habitat fragmentation due to the presence of the corridor segment ROWs, support facilities, and access roads. During the operation and maintenance of the energy transport system, wildlife may be affected by (1) electrocution and electromagnetic field exposure from transmission lines; (2) noise; (3) collisions with transmission lines and other above-ground facilities; (4) maintenance activities, such as mowing; (5) exposure to contaminants; (6) disturbance associated with the workforce; (7) interference with migratory behavior; and (8) increased potential for fire (Table 3.8-8).

Additionally, the transmission lines, above-ground portions of the pipelines, and other facility structures would provide additional perch sites for raptors, thereby increasing predatory levels on other wildlife (such as small mammals and birds). These facilities enable birds such as the golden eagle, great-horned owl, red-tailed hawk, ferruginous hawk (*Buteo regalis*), common raven (*Corvus corax*), prairie falcon (*Falco mexicanus*), American kestrel, and osprey to nest in otherwise treeless landscapes (BirdLife International 2003; Fernie and Reynolds 2005). Conversely, a transmission line may lead to a loss of usable feeding areas for species (e.g., Arctic-breeding geese) that avoid the close proximity of these facilities (BirdLife International 2003).

Transmission support structures can also protect some bird species from mammalian predators, range fires, and heat (Steenhof et al. 1993). However, high winds can cause nest failure for birds that utilize transmission line support structures. Entanglement in tower stanchions may be another hazard (Steenhof et al. 1993).

Wildlife may also be affected by human activities that are not directly associated with the energy transport facilities or their workforces but that are instead associated with the potentially increased access to BLM- and FS-administered lands that had previously received little use. Potential impacts associated with increased access include the disturbance of wildlife from human activities, an increase in legal and illegal take, an increase of invasive vegetation, and an increase in the incidence of fires (Table 3.8-9).

Electrocution and Electromagnetic Effects. No electrocution of raptors would be expected when they are on the transmission line structures because the spacing between the conductors and between a conductor and ground wire or other grounding structure would exceed the wing span of the California condor (the largest raptor to occur in the 11-state project area). However, while it is a rare event, electrocution can occur to flocks of small birds (e.g., house sparrows, European starlings, and thrushes) that cross a line; it can also happen when several roosting birds take off simultaneously, because of current arcing. This is most likely to occur in humid weather conditions (Bevanger 1998; BirdLife International 2003). Arcing can also occur as a result of the urination jets of large birds roosting

TABLE 3.8-9 Potential West-wide Energy Transport Facility Operation and Non-Facility-Related Human Activity Effects on Wildlife

Ecological Stressor	Activity or Facility	Potential Effect and Likely Wildlife Affected	Effect Extent and Duration
Operations and Maintenance			
Electrocution and electromagnetic field effects	Electricity transmission lines.	Mortality of birds from electrocution; health effects from electromagnetic field exposure.	Very low magnitude, but long-term potential.
Noise	Corona, support machinery, vehicles and aircraft, and mowing equipment.	Disturbance of foraging and reproductive behaviors; habitat avoidance.	Short- and long-term; greatest effect in highest noise areas.
Collision with transmission lines and other above-ground facilities	Presence of transmission lines, communication towers, and buildings.	Injury or mortality of birds.	Low magnitude but long-term for many species; population effects possible for rare species.
Predation	Transmission lines, above-ground portion of pipelines, ancillary facilities.	Increase in avian predators due to more perch sites for foraging; may decrease local prey populations.	Long-term; may be of high magnitude for some prey species.
Mowing	Mowing along corridor segments and at support buildings.	Injury and/or mortality of less mobile wildlife: reptiles, small mammals, ground-nesting birds.	Infrequent, but repetitive over the life of the project.
Exposure to contaminants	Herbicide use; accidental spill or release of oil, herbicides, fuel, or other hazardous materials.	Exposure may affect survival, reproduction, development, or growth.	Short- or long-term; localized to spill locations.
Workforce presence	Daily human and vehicle activities.	Disturbance of nearby wildlife behavior; habitat avoidance.	Short- or long-term; localized and of low magnitude.
Decreased aquatic habitat quality	Erosion and runoff from poorly stabilized surface soils.	Reduced reproductive success of amphibians; wildlife drinking water supplies may be affected.	Short-or long-term; localized.
Interference with behavioral activities	Presence of energy transport corridors and support structures.	Migratory mammals may avoid previously used migration routes, potentially affecting condition and survival.	Long-term; localized to populations directly affected by the presence of the project.

TABLE 3.8-9 (Cont.)

Ecological Stressor	Activity or Facility	Potential Effect and Likely Wildlife Affected	Effect Extent and Duration
Operations and Maintenance (Cont.)			
Interference with behavioral activities (Cont.)	Presence of energy transport corridors and support structures.	Species may avoid areas surrounding the support facilities, including foraging and nesting habitats.	Long-term for species that completely abandon adjacent areas; population-level effects possible for some species.
Non-Facility-Related Human Activity			
Disturbance of nearby biota	Access to surrounding areas by people, including unauthorized vehicles, along facility access roads and corridor segments.	Impacts to wildlife habitats by foot and vehicle traffic; disturbance of foraging and reproductive behaviors.	Short- or long-term in areas within and adjacent to the corridor segments.
Legal and illegal take of wildlife	Access to surrounding areas.	Reduced abundance and/or distribution of some wildlife.	Short- or long-term, depending on species affected and magnitude of take.
Invasive vegetation	Access to surrounding areas by people, including unauthorized vehicles, along facility access roads and corridor segments.	Establishment of invasive vegetation resulting in reduced wildlife habitat quality.	Long-term, off-site.
Fire	Access to surrounding areas by people, including unauthorized vehicles, along facility access roads and corridor segments.	Some mortality of wildlife; reduction in habitat quality due to loss of vegetation and introduction and establishment of invasive vegetation.	Long-term.

on the crossarms above insulators (BirdLife International 2003).

Electromagnetic field exposure can potentially alter the behavior, physiology, endocrine systems, and immune functions of birds, which, in theory, could result in negative repercussions on their reproduction or development. However, the reproductive success of some wild bird species, such as ospreys, does not appear to be compromised by electromagnetic field conditions (Fernie and Reynolds 2005).

Noise. The activities associated with the energy transport facility operations that could generate noise include transmission lines (corona), trucks and maintenance equipment, and aircraft overflights. The magnitude and duration of noise associated with trucks and maintenance equipment are expected to result in only minor annoyance of wildlife at the site and not result in any long-term adverse effects. The response of wildlife to this disturbance would vary by species; physiological or reproductive condition; distance; and type, intensity, and duration of the disturbance (BLM 2002).

Wildlife response can include avoidance, habituation, or attraction.

The results of various studies suggest that the densities of bird populations may be reduced near transmission lines and other facility equipment if continuous noise levels are 40 dBA or higher. A study of the effects of gas well compressor noise on breeding bird populations in New Mexico found the response to noise varied among species (LaGory et al. 2001). Lower numbers of some species were associated with noise levels greater than 40 dBA. The greatest reductions were found in areas where species were exposed to sound pressure levels of 50 dBA or greater (areas within 150 feet of a compressor).

The highest noise levels would be associated with vehicle and aircraft use, while noise during activities such as hiking would be primarily associated with speech. Eighty-five percent of helicopter flights within 1,640 feet of mountain goats (*Oreamnos americanus*) caused the goats to move more than 328 feet, while 9% of flights within 4,921 feet caused similar movements. Helicopter flights caused the disintegration of social groups on some occasions and resulted in one case of severe injury to an adult (Cote 1996). Bighorn sheep have been reported to respond at a distance of 1,640 feet from roads with more than one vehicle per day, while deer and elk response occurs at a distance of 3,280 feet or more (Gaines et al. 2003). Snowmobile traffic was found to affect the behavior of moose located within 984 feet of a trail and displaced them to less favorable habitats (Colescott and Gillingham 1998).

Displaced animals could have lower reproductive success if they would be displaced to areas already occupied by others of their species (Riffell et al. 1996). If birds are disturbed sufficiently during the nesting season to cause displacement, then nest or brood abandonment might occur and the eggs and young of displaced birds would be more susceptible to cold or predators (BLM 2002). Regular or periodic disturbance at energy transport facilities could cause adjacent habitats to be less attractive to wildlife and result in a long-term reduction of wildlife use in areas exposed to repeated visual disturbances and noise (BLM 2002). Repeated human intrusion has the potential to cause impacts that accumulate over time, which may result in progressive declines in avian richness and abundance (Riffell et al. 1996).

***Collisions with Transmission Lines and Other Facilities*.** The presence of the energy transport facilities (e.g., transmission lines, elevated portions of the pipelines, pump stations, communication antennas, and other ancillary facilities) creates a physical hazard to some wildlife. In particular, birds may collide with transmission lines, communication antennas, and buildings, while mammals may collide with fences. The potential for bird collisions with a transmission line depends on variables such as habitat, relation of the line to migratory flyways and feeding flight patterns, migratory and resident bird species, and structural characteristics of the line (Beaulaurier et al. 1984). Waterfowl, wading birds, shorebirds, and passerines are most vulnerable to colliding with transmission lines near wetlands, while in habitats away from wetlands, raptors and passerines are most susceptible (Faanes 1987). Highest concern for bird collisions are where lines span flight paths, including river valleys, wetland areas, lakes, areas between waterfowl feeding and roosting areas, and narrow corridors (e.g., passes that connect two valleys). A disturbance that leads to a panic flight can increase the risk of collision with transmission lines (BirdLife International 2003).

The shield wire is often the cause of bird losses involving higher voltage lines because birds fly over the more visible conductor bundles only to collide with the relatively invisible, thin shield wire (Thompson 1978; Faanes 1987). Young inexperienced birds, as well as migrants in unfamiliar terrain, appear to be more vulnerable to wire strikes than resident breeders. Also, many species appear to be most highly susceptible to collisions when alarmed, pursued, searching for food while flying, engaged in courtship, taking off, landing, when otherwise preoccupied and not paying attention to where they are going, and during night and inclement weather (Thompson 1978). Sage grouse and other upland game birds are vulnerable to colliding with transmission lines because they lack good acuity and because they are generally poor flyers (Bevanger 1995).

Meyer and Lee (1981) concluded that, while waterfowl (in Oregon and Washington) were especially susceptible to colliding with transmission lines, no adverse population or ecological results occurred because all species affected were common and because collisions occurred in less than 1% of all flight observations. A similar conclusion was reached by Stout and Cornwell (1976), who suggested that less than 0.1% of all nonhunting waterfowl mortality nationwide was due to collisions with transmission lines. The potential for waterfowl and wading birds to collide with the transmission lines could be assumed to be related to the extent of preferred habitats crossed by the lines and the extent of other waterfowl and wading bird habitats within the immediate area.

Raptors have several attributes that decrease their susceptibility to collisions with transmission lines: (1) they have keen eyesight; (2) they soar or use relatively slow flapping flight; (3) they are generally maneuverable while in flight; (4) they learn to use utility poles and structures as hunting perches or nests and become conditioned to the presence of lines; and (5) they do not fly in groups (like waterfowl), so their position and altitude are not determined by other birds. Therefore, raptors are not as likely to collide with transmission lines unless distracted (e.g., while pursuing prey) or when other environmental factors (e.g., weather) contribute to increased susceptibility (Olendorff and Lehman 1986).

The best method to minimize avian collisions with transmission lines is to avoid siting them in sensitive areas. Where this cannot be done, marking power lines has been proven to appreciably reduce mortality (e.g., by more than 40%, with reductions as high as 89% having been reported) (Brown and Drewien 1995). Transmission lines designed with conductor bundles arranged at one height (single-level arrangement) rather than at different heights (multilevel arrangement) also pose a reduced risk to birds (BirdLife International 2003).

Site Maintenance. During the operational period, vegetation clearing would be required every few years (e.g., as often as every 3 to 5 years for the transmission lines and yearly for the underground portions of the pipelines). Because of the temporary nature of maintenance activities, disturbance from noise and human presence would be localized and of short duration. The most notable impact would be from habitat modification. During vegetation clearing operations, wildlife would be displaced to adjacent undisturbed habitats; however, less mobile individuals may be destroyed. Impacts on local wildlife populations would likely be minor, because the quality and carrying capacity of the maintained habitats are likely to be limited.

Periodic brush cutting to maintain a ROW in forested areas would maintain those sections of the ROW in an early stage of plant community succession that could benefit small mammals that use such habitats (e.g., hares) and their predators (e.g., bobcat [*Lynx rufus*]). Temporary growth of willows and other trees following brush cutting could benefit moose and other ungulates that use browse. Conversely, habitat maintenance would have localized adverse effects on species such as the red squirrel (*Tamiasciurus hudsonicus*), southern red-backed vole (*Myodes gapperi*), and American marten, that prefer late-successional or forested habitats (BLM 2002). Except where annual vegetation maintenance may be required over the pipelines to facilitate periodic corrosion and leak surveys, routine vegetation maintenance within a ROW segment done once every 3 to 4 years would lessen impacts to migratory bird species and other wildlife species that may make permanent use of the ROW segments.

The response of wildlife to herbicide use is attributable more to habitat changes resulting from treatment rather than direct toxic effects of the applied herbicide on wildlife. Herbicide treatment reduced structural and floral complexity of vegetation on clearcuts in Maine, resulting in lower overall abundance of birds and small mammals due to a decrease in invertebrate and plant foods and cover associated with decreased habitat complexity (Santillo et al. 1989a,b). However, some researchers have found increases in small mammal numbers due to increases in species that use grassy habitats (particularly small rodents such as voles or lemmings). Nevertheless, small mammal communities rapidly returned to pretreatment numbers (e.g., within a 2-year period) due to regrowth of vegetation damaged by herbicides (Anthony and Morrison 1985). Moose tended to avoid herbicide-treated areas of clearcuts since browse was less available for 2 years of posttreatment. When they did feed in treated clearcuts, they fed heavily in areas that were inadvertently skipped by spraying (Santillo 1994; Eschholtz et al. 1996).

Wildlife can be exposed to herbicides by being sprayed directly, inhaling spray mist or vapors, drinking contaminated water, feeding on or otherwise coming in contact with treated vegetation or animals that have been contaminated, and directly consuming the chemical if it is applied in granular form (DOE 2000). Raptors, small herbivorous mammals, medium-sized omnivorous mammals, and birds that feed on insects are more susceptible to herbicide exposure, as they either feed directly on vegetation that might have been treated or feed on animals that feed on the vegetation. The potential for toxic effects would depend on the toxicity of the herbicide and the amount of exposure to the chemical. Generally, smaller animals are at greater risk, since less substance is required for them to be affected (DOE 2000).

Many of the herbicides currently used on federally administered lands pose some risks to wildlife (BLM 2005d). Direct effects to animals could include death, damage to vital organs, decrease in growth, decrease in reproductive output and the condition of offspring, and increased susceptibility to predation. Indirect adverse effects following application would include a reduction in plant diversity and availability of preferred forage, habitat, and breeding areas; decrease in wildlife population densities as a result of limited regeneration; habitat and range disruption because wildlife may avoid sprayed areas following treatment; and increase in predation of small mammals due to loss of ground cover (BLM 2005d). Generally, the main risk of herbicide use to wildlife would occur from habitat modification. However, harm at the population level to unlisted species is unlikely because of the size and distribution of treated areas relative to the dispersal of wildlife populations and the foraging area and behavior of individual animals (BLM 2005d).

Wildlife species that consume grass (e.g., deer, elk, rabbits and hares, chukar, quail, and geese) are at potentially higher risk from herbicides than species that feed on other vegetation and seeds because herbicide residue tends to be higher on grass. However, harmful effects are not likely unless the animal forages exclusively within the treated area shortly after application. Similarly, bats, shrews, and numerous bird species that feed on herbicide-contaminated insects could be at risk (BLM 2005d).

Herbicide vegetation management could affect wild horses and burros though exposure to chemicals (e.g., death, damage to vital organs, decrease in growth, decrease in reproductive output and the condition of offspring, and increased susceptibility to predation) or through changes in vegetation that could positively or negatively alter the carrying capacity of the herd management areas through improving or decreasing, respectively, the amount and quality of forage (BLM 2005d). The potential for adverse impacts from direct exposure to herbicides would be minimal when herbicides are applied according to label instructions and under other standard operating procedures established for herbicide use (BLM 2005d).

The licensed use of herbicides would not be expected to adversely affect local wildlife populations. Applications of these materials would be conducted by following label directions and in accordance with applicable permits and licenses. However, accidental spills or releases of these materials could impact exposed wildlife. Potential effects of such exposures are discussed below.

Exposure to Contaminants. During operation of the energy transport system, wildlife may be exposed to accidental spills or releases of oil, herbicides, fuel, or other hazardous materials. Exposures to these materials could affect reproduction, growth, development, or survival of exposed individuals. If the magnitude and extent of a spill and subsequent exposure are sufficient, population-level effects may be incurred. However, such exposures are not expected under normal operations. Except for a large oil spill from a pipeline, only small amounts of these materials would be expected to be present at any facility, and spill response plans would be in place to address any accidental spills or releases. Furthermore, given the small area potentially affected by a spill (much less than 1 acre), a land-based spill would affect relatively few individual animals and a relatively limited portion of the habitat or food resources for large-ranging mammal species (e.g., deer or elk) (BLM 2005c).

The impacts to wildlife from an oil spill would depend on such factors as the time of year and volume of the spill, the type and extent of habitat affected, and the home range and density of the wildlife species. For example, as the size of a species' home range increases, the effects of an oil spill would generally decrease (Irons et al. 2000). Generally, small mammals and other species that have small home ranges and/or high densities per acre would be most affected by a land-based oil spill.

The potential effects to wildlife from oil spills could occur from direct contamination of individual animals, contamination of habitats, and contamination of food resources. Acute (short-term) effects generally occur from direct oiling of animals; chronic (long-term) effects usually occur from such factors as accumulation of contaminants from food items and environmental media (Irons et al. 2000). Moderate to heavy contact with oil is most often fatal to wildlife. In aquatic habitats, death occurs from hypothermia, shock, or drowning. In birds, chronic oil exposure can reduce reproduction, cause pathological conditions, reduce chick growth, and reduce hatching success (BLM 2002). The reduction or contamination of food resources from an oil spill could also reduce survival and reproductive rates. Oil ingestion during preening or feeding may impair endocrine and liver functions, reduce breeding success, and reduce growth of offspring (BLM 2002).

A land-based oil spill would contaminate a limited area. Therefore, an oil spill would affect relatively few individual animals and a relatively limited portion of the habitat or food resources for large-ranging species (e.g., moose, mule deer, pronghorn, elk, and American black bear). It would be unlikely that a land-based spill would cause significant impacts to movement (e.g., block migration) or foraging activities at the population (herd) level, largely because of the vast amount of surrounding habitat that would remain unaffected (BLM 2002). An oil spill would be expected to have a population-level adverse impact only if the spill was very large or contaminated a crucial habitat area where a large number of individual animals were concentrated. The potential for either event to occur is very unlikely.

Human presence and activities associated with response to spills of oil and other hazardous substances would also disturb wildlife in the vicinity of the spill site and spill-response staging areas. Such activities could be more intensive and prolonged than normal pipeline maintenance and operation and could disturb and displace larger numbers of animals. In addition to displacing wildlife from areas undergoing oil cleanup activities, habitat damage could also occur from cleanup activities (BLM 2002). Avoidance of contaminated areas by wildlife during cleanup due to disturbance would minimize the potential for wildlife to be exposed to oil before site cleanup is completed.

Disturbance of Wildlife. During project operation and maintenance, wildlife both on- and off-site could be disturbed by vehicles, workers, and project machinery. The response of wildlife to such disturbance is highly variable and depends on species; distance; and type, intensity, and duration of the disturbance. Some species may temporarily move from the area, while others may permanently move from the area. Wildlife permanently moving from the area may incur high mortality levels if the surrounding habitats are at or near carrying capacity, or have little similar habitat capable of supporting the displaced individuals.

Wildlife may also incur injury or death through collision with vehicles, particularly ATVs. While wildlife may be injured or killed occasionally by a vehicle, most can be expected to respond to the noise of an oncoming vehicle by temporarily fleeing the area or by seeking shelter in a burrow (where they may be smothered) or under rocks. Wildlife may also be impacted if increased access leads to an increase in the legal and illegal take of biota, which could impact local populations of some species.

Text Box 3.8-2 provides information about how sage grouse may be impacted by corridor development, including information about possible measures to mitigate impacts.

Interference with Migratory Behavior. Wildlife may also be affected if a corridor segment and/or ancillary facilities interfere with migratory movements. While migrating, birds are expected to simply fly over the corridor and continue their migratory movement. The presence of a corridor project could disrupt movements of terrestrial wildlife, particularly during migration. Herd animals, such as elk, deer, and pronghorn, could potentially be affected if the corridor segments transect migration paths between winter and summer ranges or in calving areas. The corridor segments would be maintained as areas of low vegetation that may hinder or prevent movements of some wildlife species. It is foreseeable that corridor segments may be used for travel routes by big game if they lead in the direction of their normal migrations.

Fire. Increased human activity, including increased vehicle access that can access the modified vegetation within the ROWs, also increases the potential for fires. Fire may affect wildlife through direct mortality and through a reduction of habitat or habitat quality. In general, short-term and long-term fire effects on wildlife are related to fire impacts on vegetation, which in turn affect habitat quality and quantity, including the availability of forage or shelter (Hedlund and Rickard 1981; Groves and Steenhof 1988; Knick and Dyer 1996; Schooley et al. 1996; Watts and Knick 1996; Sharpe and Van Horne 1998; Lyon et al. 2000b; USDA 2002a,b,c).

Wildlife may survive fires by either seeking underground or above-ground refuge within the fire or by moving away from it (Ford et al. 1999; Lyon et al. 2000a). While individuals caught in a fire could incur increased mortality, depending on how quickly the fire spreads, most wildlife would be expected to escape by either outrunning the fire or seeking safety in burrows. Some mortality of burrowing mammals from asphyxiation in their burrows during fire has been reported (Erwin and Stasiak 1979). Burrowing kangaroo rats were reported as the only rodents to survive a chaparral fire, probably because the burrows protected them from the fire (Lyon et al. 2000b).

In the absence of long-term vegetation changes, rodents in grasslands usually show a decrease in density after a fire, but they often recover to achieve densities similar to or greater than preburn levels (Beck and Vogel 1972; Lyon et al. 2000b; USDA 2002d). Long-term changes in vegetation from a fire (such as loss of sagebrush or the invasion or increase of non-native annual grasses) may affect food availability and quality and habitat availability for wildlife; the changes could also increase the risk from predation for some species (Hedlund and Rickard 1981; Groves and Steenhof 1988; Schooley et al. 1996; Watts and Knick 1996; Knick and Dyer 1997; Lyon et al. 2000b; USDA 2002b,c).

Raptor populations generally are unaffected by, or respond favorably to, burned habitat (Lyon et al. 2000b). Fires may benefit raptors by reducing cover and exposing prey; raptors may also benefit if prey species increase in response to post-fire increases in forage (Lyon et al. 2000b; USDA 2002d). Direct mortality of raptors from fire is rare (Lehmen and Allendorf 1989), although fire-related mortality of burrowing owls has been documented (USDA 2002d). Most adult birds can be expected to escape fire, while fire during nesting (prior to fledging) may kill young birds, especially of ground-nesting species (USDA 2002d).

How Could Threatened, Endangered, and Other Special Status Species Be Affected by Project Development? Threatened, endangered, and other special status species could be affected by future development of energy transport projects, whether this occurs within a designated corridor or within a ROW elsewhere on federal or nonfederal land. These development actions would be the subject of future project-specific consultations that would identify and evaluate project-specific impacts. This section describes the impacts associated with construction and operation of energy transport facilities regardless of the alternative chosen or project location.

Impacts of future development projects on threatened, endangered, and other special status species are fundamentally similar to or the same as those described for impacts to vegetation, aquatic biota, and wildlife discussed earlier in this section. The most important difference from these impacts is the potential consequence of the impacts. Threatened, endangered, and other special status species are far more vulnerable to impacts because of their low population sizes compared to the more common and widespread species. This low population size makes them more vulnerable to the effects of habitat fragmentation, habitat alteration, habitat degradation, human disturbance and harassment, mortality of individuals, and loss of genetic diversity. This places great importance on the successful implementation of the mitigation measures described in Section 3.8.4.2.

Impacts to threatened, endangered, and other special status species, including listed plants and animals, could result from:

- Habitat destruction or degradation resulting from clearing of a ROW, construction of energy transport facilities and associated infrastructure, alteration of topography, alteration of hydrologic patterns, removal of soils, erosion of soils, fugitive dust, sedimentation of adjacent habitats, oil or other contaminant spills, and the spread of invasive plant species.

- Habitat and population fragmentation resulting from establishment of energy transport corridors through intact habitat patches and populations, preventing the free movement of organisms within the entire population area.

- Disturbance of animals resulting from noise and human activities during construction and operations. Disturbance during the breeding season generally would have the largest adverse effects and could result in animals abandoning traditional breeding grounds and nest sites.

- Increases in human access (including ATV use) and subsequent disturbance or mortality resulting from establishment of corridors through otherwise intact and/or difficult-to-reach habitats.

- Localized increases in predator populations (and subsequent increased mortality of vulnerable listed species) resulting from increased access afforded by corridors, attraction to corridor infrastructure for nesting or breeding sites, and attraction to human-occupied sites.

- Aquatic species could be affected by increases in water temperature in areas crossed by transport facilities resulting from the removal of riparian vegetation that would otherwise shade surface water.

The relative magnitude and duration of these impacts to threatened and endangered species that could occur during construction and operation of energy transport facilities are presented in Table 3.8-10. As stated earlier, the impacts described for vegetation, wetlands, aquatic biota, and wildlife species may also be relevant to threatened, endangered, and other special status species.

3.8.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Ecological Resources?

The previous evaluations identified a number of potential impacts that could be incurred if project development would occur within an energy corridor designated under the Proposed Action or within a No Action ROW. A variety of mitigation measures could be implemented during construction and operation to reduce potential ecological impacts at those times, and these are described in this section. In addition, monitoring during the various phases of corridor development could be performed to identify potential concerns and direct actions to address those concerns. Monitoring data could be used to track the condition of ecological resources, identify the onset of impacts, and direct appropriate site management responses to address those impacts.

This section identifies measures to mitigate impacts associated with development of Section 368 energy corridors. In addition to these measures, a variety of federal and state agencies and environmental organizations have identified measures for mitigating the ecological impacts of other human activities. Guidance documents developed by the BLM and the FS also identify measures for mitigating ecological impacts associated with other approved activities on BLM-administered lands, and these mitigation measures may be applicable to the development and operation of the energy corridors (see Section 3.8.4.1).

Mitigation Measures for Vegetation and Wetlands. Potential impacts to terrestrial vegetation communities and wetlands from the development of energy transport projects within the proposed corridors or No Action ROWs could potentially be reduced, minimized, or

TABLE 3.8-10 Potential Impacts on Threatened, Endangered, and Other Special Status Species Associated with Construction and Operation of Energy Transport Facilities

	Impact Magnitude and Duration According to Species Type[a]						
Impact Category	Upland Plants	Wetland and Riparian Plants	Aquatic and Wetland Animals	Terrestrial Invertebrates	Terrestrial Amphibians and Reptiles	Terrestrial Birds	Terrestrial Mammals
Construction							
Alteration of topography	Moderate, short-term	Large, short-term	Large, short-term	Small, short-term	Small, short-term	Small, short-term	Small, short-term
Behavioral disturbance/ harassment	None	None	None	None	Large, short-term	Large, short-term	Large, short-term
Changes in drainage patterns	Moderate, short-term	Large, short-term	Large, short-term	Small, short-term	Small, short-term	Small, short-term	Small, short-term
Erosion	Large, short-term	Large, short-term	Large, short-term	Small, short-term	Small, short-term	Small, short-term	Small, short-term
Fugitive dust	Moderate, short-term	Moderate, short-term	Small, short-term	Small, short-term	Small, short-term	Small, short-term	Small, short-term
Injury or mortality of individuals	Large, short-term	Large, short-term	Large, short-term	Large, short-term	Large, short-term	Large, short-term	Large, short-term
Noise	None	None	Large, short-term	None	Small, short-term	Large, short-term	Large, short-term
Oil and contaminant spills	Moderate, short-term	Large, short-term	Large, short-term	Small, short-term	Large, short-term	Small, short-term	Small, short-term
Sedimentation from runoff	Large, short-term	Large, short-term	Large, short-term	Small, short-term	Small, short-term	Small, short-term	Small, short-term
Soil compaction	Large, long-term	Small, short-term	Small, short-term	Small, short-term	Moderate, short-term	Small, short-term	Small, short-term
Spread of invasive plant species	Large, long-term	Large, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term
Vegetation clearing	Large, short-term	Large, short-term	Small, short-term	Large, short-term	Large, short-term	Large, short-term	Large, short-term
Operations							
Alteration of topography	Moderate, long-term	Large, long-term	Large, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term
Behavioral disturbance/ harassment	None	None	Large, long-term	None	Small, long-term	Large, long-term	Large, long-term
Changes in drainage patterns	Moderate, long-term	Large, long-term	Large, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term

TABLE 3.8-10 (Cont.)

	Impact Magnitude and Duration According to Species Type[a]						
Impact Category	Upland Plants	Wetland and Riparian Plants	Aquatic and Wetland Animals	Terrestrial Invertebrates	Terrestrial Amphibians and Reptiles	Terrestrial Birds	Terrestrial Mammals
Operations (Cont.)							
Collision mortality	None	None	None	None	None	Moderate, long-term	Small, long-term
Habitat alteration	Large, long-term	Large, long-term	Moderate, long-term	Large, long-term	Large, long-term	Large, long-term	Large, long-term
Habitat fragmentation	Moderate, long-term	Moderate, long-term	Small, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term
Injury or mortality of individuals	Moderate, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term	Large, long-term	Moderate, long-term	Moderate, long-term
Increased human access	Moderate, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term	Moderate, long-term	Large, long-term	Large, long-term
Increases in predation rates	None	None	None	None	Moderate, long-term	Moderate, long-term	Moderate, long-term
Movement/dispersal blockage	Moderate, long-term	Moderate, long-term	Large, long-term	Small, long-term	Moderate, long-term	Small, long-term	Moderate, long-term
Noise	None	None	None	None	Small, long-term	Moderate, long-term	Moderate, long-term
Oil and contaminant spills	Small, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term
Sedimentation from runoff	Large, long-term	Large, long-term	Large, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term
Spread of invasive plant species	Large, long-term	Large, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term	Small, long-term
Temperature increases	None	None	Moderate, long-term	None	None	None	None
Vegetation maintenance	Large, long-term	Large, long-term	Large, long-term	Large, long-term	Large, long-term	Large, long-term	Large, long-term

[a] Indicators of potential impact magnitude and duration (without mitigation measures in place) are presented as magnitude/duration with magnitude presented as no effect (None), small, moderate, or large, and duration presented as short-term (construction period) or long-term (beyond construction period). A small impact is one that is limited to the immediate project area, affects a relatively small proportion of the local population (less than 10%), and does not result in a measurable change in carrying capacity or population size in the affected area. A moderate impact could extend beyond the immediate project area, affects an intermediate proportion of the local population, and results in a measurable but moderate change (less than 50%) in carrying capacity or population size in the affected area. A large impact would extend beyond the immediate project area, could affect more than 50% of a local population, and results in a large measurable change (50% or more) in carrying capacity or population size in the affected area.

avoided by the implementation of mitigation measures and IOPs. The following measures would address many of the impacts identified in Section 3.8.4.1. Additional mitigation measures may need to be developed during site-specific NEPA evaluations, for further protection of soils, vegetation, and wetlands.

Mitigation during Construction.

- Operators should conduct surveys to identify wetlands, springs, seeps, streams, 100-year floodplains, ponds, riparian habitat, and rare natural communities in the project vicinity and design the project to avoid (if possible), minimize, or mitigate potential impacts to these resources. Surveys submitted by operators need to be completed by qualified and trained ecologists, botanists, or biologists. Damage to biological soil crusts should be avoided or minimized. The design and siting of the facilities should follow appropriate guidance and requirements from the BLM and other resource agencies, as available and applicable. For example, a number of BLM state offices have policies that are protective of these resources.

- Where avoidance of impacts to wetlands or riparian areas is not possible, compensatory mitigation should be provided. Such mitigation should be developed and approved in coordination with federal, state, and local resource agencies.

- Impacts to wetlands from construction could be minimized by establishing buffer zones of 500 feet around wetlands, streams, springs, seeps, riparian areas, lakes, and ponds. Disturbance, including operation of machinery or vehicles, within these resources or buffer areas should be avoided or minimized.

- The impacts of construction on wetlands could be reduced by the restriction of construction activities, including mechanized tree removal, in or near wetlands to the winter months on frozen ground with snow cover, to support equipment without disturbing soil surface, compaction, or rutting and to avoid disturbance of biota.

- Impacts to wetlands from construction could be minimized by maintaining natural drainage and flow patterns, including those across temporary and permanent access roads. All stream and wetland crossings should be perpendicular to the stream or wetland boundary, or at points of minimum impact.

- Wetlands and streams should be avoided during routing of access roads. Access roads in wetlands should be constructed only when no other practical means for placing structures would be available or when equipment crossing of a wetland could not be conducted during winter when the ground is frozen. No gravel should be placed in wetlands. Access across streams should be provided by temporary equipment bridges, where necessary.

- When temporary access roads were no longer required, the materials used to construct them should be removed from wetlands. The wetlands would then be reclaimed in accordance with a developed reclamation plan and monitored to assess adequate establishment of appropriate vegetation and maintenance of riparian function.

- The implementation of erosion and sedimentation control measures that comply with county, state, and federal standards (such as using hay bales, jute netting, silt fences, check dams, organic berms, and slope breakers) would minimize the likelihood of stormwater impacts to wetlands from sedimentation and contaminants.

- Impacts from turbidity could be reduced by implementing measures to restrict the dispersal of sediments during trenching in wetland or aquatic areas.

- Where a pipeline trench may drain a wetland, trench breakers should be constructed and/or the trench bottom should be sealed to maintain the original wetland hydrology.

- Topsoil and subsoil should be segregated during excavation. Soils should be replaced in reverse order to reestablish original horizons, and original grades should be reestablished.

- Only selective cutting should occur in wetlands and 100-feet buffers and only in conductor security zones. Selective cutting should include only those trees that would encroach into the transmission line security zone within 3 to 4 years.

- Cutting in wetlands or stream and wetland buffers should be conducted by hand or feller-bunchers to minimize disturbance of soil and remaining vegetation.

- Vegetation removal should be designed to avoid formation of new drainage channels in erodible areas.

- Trench dewatering activities should not result in the deposition of sand, silt, or sediment into wetlands, streams, or other water bodies.

- Disposal of material excavated from wetlands for support poles should be addressed by the appropriate surface management agency and included in the operator’s reclamation plan.

- Temporary access roads should be used to minimize stream crossings by equipment during ROW clearing, support structure placement, and transport line stringing.

- Temporary access roads should be developed primarily by the removal of woody vegetation, although temporary timber mats should be used in areas of wet soils.

- The placement of ROW structures should be excluded from streams, floodplains, playas, wetlands, riparian areas, and lakeshores.

- Soil stockpiles should be located and protected to minimize wind and water erosion and maximize reclamation potential.

- Site runoff should be trapped on or near the location with the use of sediment fences and water retention ponds.

- Topsoil should be salvaged and reused on road ditches, cut slopes, and fill slopes.

- Pipelines should not block, dam, or change the natural course of any drainage.

- The area disturbed during the installation of facilities (pipelines, transmission towers, pump stations, substations, laydown areas, assembly areas, access roads) should be kept to a minimum to retain native vegetation and minimize soil disturbance.

- If survey results indicate the presence of wetlands, springs, streams, ponds, or riparian habitats in the project vicinity, project design should locate facilities in areas least likely to impact those habitats.

- Habitat disturbance should be minimized by locating facilities, access roads, stream crossings, and laydown areas in previously disturbed areas.

- New ROWs and access roads should be configured to avoid high-quality terrestrial habitats and minimize habitat fragmentation.

- Site access roads and ROWs should minimize stream crossings.

- To minimize impacts to aquatic habitats from increased erosion, the use of fill ramps rather than stream bank cutting should be designated for all stream crossings by access roads.

- The extent of habitat disturbance should be reduced by keeping vehicles on access roads and prohibiting vehicle or foot traffic through unauthorized areas.

- Dust abatement techniques should be used on unpaved, unvegetated surfaces to minimize airborne dust.

- Erosion and fugitive dust control measures should be inspected and maintained regularly.

- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and soil removal initiated, if needed.

- Operators must develop a plan for control of noxious weeds and invasive plants, which could occur as a result of new surface disturbance activities at the site. The plan should address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations. The use of certified weed-free mulching should be required.

- An inspection and cleaning area must be established to conduct visual inspections, power washing, or (in cold weather) high-pressure air cleaning of trucks and construction equipment arriving at the project area, or leaving if work is in an infested area, to remove and collect seeds that may be adhering to tires and other equipment surfaces to prevent the spread of invasive species.

- Directional drilling for pipeline installation should be used for wetland, stream, water body, and riparian crossings. Stream crossings by buried pipelines using directional drilling should not intersect alluvial aquifers. Trench crossings should be conducted only during no-flow periods on dry substrates.

- Where forest clearing is conducted, trees more than 24 inches in diameter at breast height (dbh) should be preserved. Cut trees should be used to provide large woody debris for stream restoration.

- The removal of trees from riparian habitat should be avoided, particularly trees greater than 8 inches dbh.

- Methods and timing of construction near wetlands should be designed to minimize potential impacts.

- The movement of equipment or materials within areas authorized for construction and support activities within a ROW should be confined as much as possible to a single path. This can be facilitated by constructing road turnouts.

- In areas where vegetation must be cleared (such as in material laydown areas), ground-level vegetation and stumps should be left in place following cutting.

- Wide-tracked or balloon-tired equipment, timber corduroy, or timber mat work areas should be used on wet soils, where wetland or stream crossings are unavoidable and when crossing on frozen ground is not possible in winter. Areas rutted by equipment should be immediately regraded and revegetated. Tower installation should be conducted by airlift helicopter, where necessary, to avoid extensive wetland crossings or highly sensitive areas (such as those identified as rare natural habitats).

- No structures should be located in stream buffer areas, and no soil disturbance or vehicular traffic should be allowed, except to construct temporary equipment crossing bridges.

- Runoff and erosion from access roads and work areas should be prevented by diverting water using structures or techniques such as water bars, silt fences, hay bales, or erosion berms.

- Rock cutters rather than explosives may be used for trench excavations in rocky soils, unless alternative methods are required by law, local regulation, or to protect sensitive high-value habitat.

- Road damage and impacts to adjacent areas caused by operations during periods of saturated soil should be immediately reported to the surface management agency and reclaimed.

- Excavating and filling should be prohibited with frozen soil that would be difficult to restore, or during periods when the soil material is saturated, or when watershed damage is likely to occur.

Mitigation during Site Restoration.

- A habitat restoration and management plan should be developed that identifies vegetation, soil stabilization, and erosion reduction measures and requires that restoration activities be implemented as soon as possible following facility construction activities. The plan must be approved by the applicable resource management agency.

- Restoration should be used to return areas to original contours.

- Weed-free mulch, matting, or other erosion control measures should be used on all exposed soils immediately following seeding, or within 48 hours of disturbance (or before a predicted storm event, if sooner) when not immediately seeded on areas within 300 feet of a wetland, stream, or other water resource.

- Disturbed shoreline and streambank areas should be stabilized and planted with locally native riparian plant species immediately following construction. Streambank and shoreline stabilization should include biodegradable fiber materials, such as erosion mats and rolls.

- Fill materials that originate from areas with known invasive vegetation problems should not be used.

- Road ditches, cut slopes, and fill slopes should be replanted immediately following road construction and covered with mulch or other sediment control measure.

- Disturbed soil should be revegetated immediately following completion of the disturbance. Preparation should include topsoil respreading and actions for seedbed preparation, such as ripping or scarifying on contour.

- Only certified weed-free seed should be used for revegetation of disturbed soil. Locally native species should be used, as directed and approved by the local office of the appropriate agency, with a composition able to restore the previous or potential natural community of the site. Seed mixtures to help reduce the establishment of invasion species may need to be developed. Seed mixes for revegetation projects need to follow guidance in the new directive, *Forest Service Manual (FSM) 2070*, for native plant materials, which provides direction for the use, growth, development, and storage of native plant materials. These seed mixes need to be approved by a local botanist. Reseeding or replanting should be repeated, with fertilizing and mulching, until revegetation is successful. Seeding on slopes should be done by drilling on contour.

- Following the replanting of disturbed areas, monitoring must be conducted to identify the occurrence of non-native/ invasive/noxious weed species. Any plants of such species must be immediately eliminated.

Mitigation during Operation and Maintenance.

- A 500-foot buffer zone should be maintained around wetlands and water bodies where no ground surface disturbance is permitted during maintenance.

- Tree-cutting in stream buffers should only target trees able to grow into a transmission line conductor clearance zone within 3 to 4 years.

- Cutting in wetlands or stream and wetland buffers should be conducted by hand or feller-bunchers to minimize disturbance of soil and remaining vegetation.

- Broadcast spraying of herbicides should not be used for clearing vegetation along a ROW. Herbicides should be applied by qualified personnel and effects on wildlife and nontarget plant species should be considered.

- Pesticide and herbicide use should be limited to nonpersistent, immobile formulations and should only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. Herbicide use to control weed infestations on ROWs where the redevelopment of broadleaf vegetation is desired should be limited to application methods that minimize exposure of non-target vegetation (e.g., spot treatments via ground equipment).

- No herbicides should be used near wetland areas. Vegetation maintenance, if any is needed, should be limited and done mechanically rather than with herbicides.

- Access roads and newly established ROWs should be monitored regularly for invasive species establishment as part of a long-term management program, and weed control measures should be initiated immediately upon evidence of invasive species introduction.

- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and soil removal initiated, if needed.

- Operators should develop a long-term plan for control of noxious weeds and invasive plants, which could occur as a result of new surface disturbance activities at the site. The plan should address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations. The use of certified weed-free mulching should be required.

- ROW management should promote a patchwork or mosaic of native plant communities and successional stages across the landscape to develop a level of habitat and structural diversity similar to native habitats of the region.

- Road maintenance should include dust abatement, ditch cleaning, culvert cleaning, and noxious weed control.

- Management of corridors should the maintain the proper functioning physical condition of watersheds, including their upland, riparian-wetland, and aquatic components; maintain ecological processes in order to support healthy biotic populations and communities; maintain water quality; and maintain or restore habitat for special status species.

Mitigation Measures for Aquatic Biota. Mitigation measures may be considered during project design to ensure that the development of energy transport projects within the proposed corridors or No Action ROWs do not result in unacceptable impacts on ecological resources. This section provides a number of potential mitigation measures that should be employed to limit or avoid potential impacts to aquatic resources.

- Discussions should be held with the field office staff of the appropriate state and federal land management agencies regarding the occurrence of sensitive aquatic species or other valued aquatic resources in the proposed project area. If resources within the project area are not well known, conduct evaluations or surveys to identify important, sensitive, or unique aquatic habitats and biota in the project vicinity. Such evaluations may be especially important for spring habitats, since they are more likely to contain unique or endemic flora and fauna.

- If survey results indicate the presence of important, sensitive, or unique habitats (such as streams supporting native fish assemblages, trout streams, or anadromous salmon streams) in the project vicinity, facility design should attempt to locate stream crossings, roads, and support facilities in areas least likely to impact those habitats.

- Habitat disturbance should be minimized by locating facilities in previously disturbed areas, whenever possible. Existing roads, stream crossings, and utility corridors should be utilized to the maximum extent feasible.

- New access roads and utility corridors should be configured to avoid high quality aquatic habitats and minimize the number of stream crossings within a particular stream or watershed.

- Stream crossings should be designed to provide in-stream conditions that allow for and maintain uninterrupted movement and safe passage of fish during all periods, including under typical low-flow conditions.

- Explosives should be used only at specified safe distances from surface waters to avoid concussive effects on aquatic organisms.

- Erosion controls that comply with county, state, and federal standards should be applied. Practices such as using jute netting, silt fences, and check dams should be applied near disturbed areas. All areas of disturbed soil should be reclaimed using weed-free native grasses, forbs, and shrubs; such reclamation activities should be undertaken as early as possible on disturbed areas.

- Dust abatement techniques should be used on unpaved, unvegetated surfaces to minimize airborne dust that enters aquatic habitats.

- Spill management plans should be developed to address potential fuel spills, and any spills should be immediately addressed by following the appropriate spill management plan.

- Refueling areas should be located away from surface water locations and drainages and should include a temporary berm to limit the spread of any spill. Drip pans should be used during refueling to contain accidental releases and under the fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.

- Pesticide use should be limited to nonpersistent, immobile pesticides and should only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications. Use of pesticides should be avoided within aquatic habitats and riparian areas to avoid introduction of contaminants into surface waters.

- Loss or disturbance of riparian habitats should be minimized.

- When possible, use directional drilling to place pipelines at major river crossings to reduce surface disturbance and to reduce the need for activities in riparian habitat. Ensure that directional drilling does not intercept or degrade alluvial aquifers.

- Any pipelines that cross rivers or streams containing sensitive aquatic species should have block or check valves on both sides of the river to minimize the amount of product that could be released into waterways due to leaks. Pipelines should be constructed of double-walled pipe at river crossings.

- Low-water fords should be used only as a last resort, and then during the driest time of the year. Rocked approaches to fords should be used whenever possible. The preexisting stream channel, including bed and banks, should be restored after the need for a low-water ford has passed.

Mitigation Measures for Wildlife. Potential impacts to wildlife, including wild horses and burros, from construction, operation, and maintenance of energy transport projects within the proposed energy corridors or No Action ROWs could be reduced, minimized, or avoided by the implementation of mitigation measures and IOPs. Many of the mitigation measures listed to minimize impacts to geologic resources (Section 3.3.4.2), water resources (Section 3.5.4.2), vegetation and wetlands (this section), and aquatic biota (this section) would also minimize impacts to wildlife. In addition to these measures, a variety of federal and state agencies and environmental organizations have identified measures for mitigating ecological impacts.

Spanning or routing around important habitat areas, limiting the development or use of access roads and other ancillary facilities, and restricting construction during key periods would be the primary methods to mitigate impacts to wildlife species. The use of marginal habitat areas, to the extent practicable, for substations, pump stations, and other ancillary facilities would also minimize localized impacts to wildlife. The following lists additional measures that would be appropriate for mitigating impacts to wildlife associated with West-wide energy transport systems. The mitigation measures are listed according to project phase (i.e., preconstruction, construction, site restoration, and operation and maintenance). Monitoring, inspection, and enforcement of many of the mitigation measures would be necessary to ensure that they are effective and remain necessary. Once construction starts, there should be routine visits by BLM, FS, USFWS, and appropriate state agencies to ensure compliance with permits and that the mitigation measures are being appropriately applied.

Mitigation during Preconstruction Activities. Mitigation measures may be considered during project design to ensure that the siting of the overall project and individual facility structures, as well as various aspects of the design of individual facility structures, do not result in unacceptable impacts to wildlife resources. Site surveying would generally result in only minimal impacts to wildlife resources. The amount and extent of necessary preproject survey data would be determined on a segment-by-segment basis, based in part on the environmental setting of the proposed segment location. The following mitigation measures may ensure that wildlife impacts during this stage of the project would be minimized:

- Prior to construction, all construction personnel should be instructed on the protection of wildlife resources, including mitigation measures required by federal, state, and local agencies.

- Existing roads should be used to the maximum extent feasible to access a proposed segment.

- If new access roads are necessary, they should be designed and constructed to the appropriate standard, including the ability to close or restrict access. Access roads should be managed consistent with the landowner's or administrator's travel management strategy.

- Existing or new roads should be maintained to the condition needed for facility use, where appropriate, including revegetation of the roadbed and cut/fill slopes.

- Operators should identify important, sensitive, or unique habitat and biota in the project vicinity and site, and design the project to avoid (if possible), minimize, or mitigate potential impacts to these resources. The design and siting of the facility should follow appropriate guidance and requirements from the BLM, FS, and other resource agencies, as available and applicable.

- Appropriate agencies should be contacted early in the planning process to identify potentially sensitive ecological resources that may be present in the area of the corridor segments. For example, areas of important wildlife crossings can be identified by actual observations, telemetry data, or evaluation of habitat conditions. Prior to any clearing or construction in or near these areas, a seasonally appropriate "walkthrough" should be conducted. Attendees at the walkthrough should include representatives of the BLM, FS, USFWS, state natural resource agency, and construction contractor.

- An evaluation of avian use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project area should be conducted by using scientifically rigorous survey methods.

- The project should be planned to avoid (if possible), minimize, or mitigate impacts to wildlife and habitat. For example, unless appropriate easement agreements are received, crucial winter ranges for elk, deer, pronghorn, and other species should be avoided during their periods of use. Set-aside dates can be coordinated with the state wildlife agencies.

- Discussion should be held among the appropriate federal and state agencies regarding the occurrence of valued wildlife resources (both species and habitats) in the proposed project area.

- Existing information on species and habitats in the project area should be reviewed.

- If survey results indicate the presence of important, sensitive, or unique habitats (such as wetlands and sagebrush habitat) in the project vicinity, facility design should locate roads and support facilities in areas least likely to impact those habitats.

- Habitat disturbance should be minimized by locating facilities (such as utility corridors and access roads) in previously disturbed areas (i.e., locate transmission lines within or adjacent to existing powerline corridors).

- New access roads and utility corridors should be configured to avoid high quality habitats and minimize habitat fragmentation.

- A habitat restoration management plan should be developed that identifies vegetation, soil stabilization, and erosion reduction measures and requires that restoration activities be implemented as soon as possible following facility construction activities.

- Individual project facilities should be located to maintain existing stands of quality habitat and continuity between stands.

- The creation of, or increase in, the amount of edge habitat between natural habitats and disturbed lands should be minimized.

- Raptor nest and roost surveys should be conducted each year prior to construction and should implement mitigation (avoidance, screening, and timing of construction) to prevent the project from disrupting any active nests or roosts (generally, nests and roosts are considered active if they are currently in use or have been occupied within the last 2 to 3 years; whereas, inactive raptor nests are those that have been monitored in at least 6 of the last 10 years and were found to be unoccupied each time they were monitored), as per federal or state recommended buffer zones and seasonal restrictions. This would include restrictions on the use of explosives and aircraft.

- Construction activities should be sited as far as possible (up to 0.5 mile from active and inactive raptor nests and sage grouse leks). Buffers may range up to 1 mile (e.g., for the bald eagle). Attempts should also be made to conceal work locations and access roads from the nest using topography. Timing restrictions are also important because not all raptor pairs use the same nest every year within their nesting territory.

- Locations that are heavily utilized by migratory birds should be avoided.

- Transmission line support structures and other facility structures should be designed to discourage their use by raptors for perching or nesting, particularly within 2 miles of sage grouse habitat.

- Prior to construction, environmental training should be provided to contractor personnel whose activities or responsibilities could impact the environment during construction. An environmental compliance officer and other inspectors, the contractor's construction field supervisor(s), and all construction personnel would be expected to play an important role in maintaining strict compliance with all permit conditions to protect wildlife and their habitats to the extent practicable during construction.

Mitigation during Construction. Construction of the West-wide energy transport facilities project could impact wildlife resources. A variety of measures may be implemented to minimize the potential for these impacts (mitigation measures for sage grouse are identified in Text Box 3.8-2):

- Structures should be located to avoid sensitive or crucial habitats. Allow conductors to span the habitats clearly within limits of standard structure design.

- The transmission lines should be designed and constructed in conformance with the *Avian Protection Plan Guidelines* (APLIC and USFWS 2005) to reduce the operational and avian risks that result from avian interactions with electric utility facilities.

- The size of all disturbed areas should be minimized to the extent practicable to meet project needs.

- Existing large stands of sagebrush and continuity between stands should be maintained, wherever possible.

- Snags and brush piles should be retained or increased and rockpiles should be created within or adjacent to the project area to the extent practicable except where they may compromise key wildlife habitat such as breeding and parturition areas.

- To the extent practicable, structures (e.g., buildings, substations, pump houses, and powerlines) should not be located on hilltops and ridgelines.

- Construction activities should be restricted in riparian areas from early March through mid-August to avoid the active nesting and brood-rearing period for bird species, particularly within the more arid areas where riparian areas are a crucial habitat for many migratory birds.

- Outside of riparian areas, if construction must be conducted during the bird breeding season, the construction area should first be surveyed for nests. If a migratory bird nest were to be found with eggs or nestlings present, the area should be avoided, to the extent practicable, until the birds have fledged. E.O. 13186 defines the responsibilities of federal agencies to protect migratory birds. The Migratory Bird Treaty Act of 1918 and subsequent amendments (16 USC 703–711) state that it is unlawful to take, kill, or possess migratory birds. A list of these protected birds is in 50 CFR 10.13. In compliance with this E.O., DOE finalized a MOU with the USFWS on August 3, 2006, that guides future agency regulatory actions and policy decisions.

- To the extent practicable, access roads should be located away from the bottom of drainages, which often provide the most important sources of cover and forage for wildlife.

- Where applicable, the extent of habitat disturbance should be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.

- Shuttle vans or car pooling should be used where feasible to reduce the amount of traffic on access roads.

- Maximum allowable speeds on access roads should be reduced as much as practicable.

- Access roads should be closed to unauthorized vehicular use.

- A removal program for wildlife carcasses along access roads should be implemented. Distribution of carcasses to appropriate areas could be considered to supplement food sources for some raptor species, especially during winter.

- Access roads should be the shortest distance practicable. However, where feasible, access roads should not cross crucial water range and other important wildlife habitats.

- ROW development and construction activities should remain subject to locally established wildlife and/or habitat protection provisions. Exceptions or modifications to spatial buffers or timing limitations should be evaluated on a site-specific/species-specific basis in coordination with the local federal administrator and state wildlife agency.

- All construction employees should be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship, nesting) seasons. In addition, any pets should not be permitted on-site during construction.

- Buffer zones should be established (through agency consultations) around raptor nests and other biota and habitats of concern.

- Noise-reduction devices (e.g., mufflers) should be maintained in good working order on vehicles and construction equipment.

- Explosives should be used only within specified times and at specified distances from sensitive wildlife or surface waters as established by the BLM, FS, or other federal and state agencies.

- As appropriate, the occurrence of flyrock from blasting should be limited by using blasting mats.

- The uncovered pipe that has been placed in the trench should be capped at the end of each workday to prevent animals from entering the pipe.

- Open trenches can impede seasonal big game movements and alter their distribution (e.g., aggravate use of private lands during winter). Therefore, limitations on the length or distribution of open trenches may be imposed by the land owner or administrator.

- Wildlife should be removed from open trenches during construction. Earthen ramps should be used in open trenches to allow wildlife an escape mechanism.

- The use of guy wires should be avoided.

- The movement of equipment and materials within the corridor segments should be confined as much as possible to a single road or travel path.

- All refueling should occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.

- Drip pans should be used during refueling to contain accidental releases.

- Drip pans should be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.

- Spills should be immediately addressed per the appropriate spill management plan, and soil cleanup and soil removal initiated, if needed.

- Water required during construction and subsequent site restoration should be obtained from off-site areas so that natural watering sources for wildlife are not depleted or unnecessarily disturbed.

Mitigation during Site Restoration. Most mitigation measures during site restoration should focus on restoring the landscape, vegetation, and wetlands (earlier in this section). These would also mitigate impacts to wildlife from habitat loss, fragmentation, and disturbance. The following measures may also be implemented to minimize potential impacts to wildlife during site restoration:

- To minimize habitat loss and fragmentation, habitat restoration activities should be initiated as soon as possible after construction activities are completed in a given area.

- Access roads should be reclaimed as soon as they are no longer needed. However, seasonal buffer periods (e.g., nest and brood rearing) should be considered, as appropriate.

Mitigation during Operation and Maintenance. The following measures may be implemented to minimize potential impacts to wildlife from operation and maintenance of energy transport systems in West-wide energy corridors:

- Areas left in a natural condition during construction (e.g., wildlife crossings) should be maintained in as natural a condition as possible within safety and operational constraints.

- Where transmission lines would cross areas where bird collisions are likely (e.g., river crossings, waterfowl staging areas), consideration should be given to marking the shield wires with devices that have been scientifically tested and found to significantly reduce collision potential.

- Remote telemetry on pipeline facilities can reduce the number of maintenance and inspection trips made during critical time periods for wildlife and result in less wildlife disturbance.

- Drip pans should be used during refueling to contain accidental releases.

- Raptor nests should be allowed to remain in place on transmission line support structures unless there is a chance that they would come into contact with a conductor. If there is a risk of arcing or conductor contact, appropriate guidelines for removing nests should be followed. Removal should take place only if the birds are not actively using the nest, particularly during the nesting and brood-rearing period. Nests should be relocated to nesting platforms, when possible; otherwise, they would be destroyed when removed. An annual report on all nests moved or destroyed should be provided to the appropriate federal and/or state agencies.

- Aircraft flight paths (e.g., for corridor inspections) should respect recommended spatial and seasonal buffer zones. Where intrusions within these zones occur, flights should maintain a minimum elevation of 1,000 feet and speed of 30 mph.

- Pesticide use should be limited to nonpersistent, immobile pesticides and herbicides and should be applied only by licensed applicators in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- The typical herbicide application rate should be used rather than the maximum application rate.

- Only herbicides with low toxicity to wildlife and wild horses and burros should be used.

- Herbicides should not be applied during rain.

- Routine vegetation maintenance clearing should not occur between April 15 and August 1, to minimize potential impacts to nesting birds.

- Spills should be addressed immediately per the appropriate spill management plan, and soil cleanup and removal initiated, if needed.

- Optimum height of vegetation to be encouraged (e.g., shrub or grass species) along energy corridors should be determined based, in part, on local wildlife species and their needs. For example, if raptors occur in the area, grasses may be preferred, as such habitat would provide them with better foraging opportunities.

- Observations of potential wildlife problems, including wildlife mortality, should be immediately reported to the BLM and FS authorized officer.

- BLM and FS should maintain an updated database to note important wildlife occurrences and wildlife habitats along the corridor segments. These data would be incorporated into the vegetative maintenance plan, along with any restrictions required to protect these species or their habitats.

Mitigation Measures for Threatened, Endangered, and Other Special Status Species. The mitigation measures described earlier in this section would serve to reduce or avoid impacts to threatened, endangered, and other special status species from development of energy transport projects within the proposed energy corridors or No Action ROWs by generally reducing impacts to the ecological systems on which they depend. In addition to these measures, there are a number of mitigation measures that are specifically related to avoiding impacts to threatened, endangered, and other special status species. These species, by virtue of their small population sizes and over-dispersed populations, are generally far more vulnerable to impacts than other species. Thus, mitigation measures recommended for threatened, endangered, and other special status species focus on avoidance of impacts and habitat areas that support these species.

General Measures. A number of general measures can be incorporated into all phases of activities to reduce impacts to threatened, endangered, and other special status species. These include:

- Surveys for plant and animal species that are listed or proposed for listing as threatened or endangered and their habitats should be conducted in areas proposed for development where these species could potentially occur, following accepted protocols and in consultation with the USFWS or NMFS, as appropriate. Particular care should be taken to avoid disturbing listed species during surveys in any designated critical habitat. If any threatened or endangered species are found, the USFWS should be consulted as required by Section 7 of the

ESA, and an appropriate course of action should be determined to avoid or minimize impacts.

- Activities and their effects on ESA-listed species should be monitored throughout the duration of the project. To ensure desired results are achieved, minimization measures should be evaluated and, if necessary, Section 7 consultation reinitiated.
- Surveys for special status species (e.g., BLM sensitive, FS sensitive, and state-listed species) and their habitats should be conducted in areas proposed for development and in which these species could potentially occur, following accepted protocols developed in consultation with the appropriate state or federal agencies. If such species are found, an appropriate course of action should be taken to avoid or minimize impacts.
- Disturbances to and within suitable habitat of threatened, endangered, and other special status species should be limited by staying on designated routes.
- New access routes created by the project should be limited.
- Nonpermitted access should be prohibited, and gating should be employed, if necessary.
- Dust abatement practices should be implemented near occupied plant habitat.
- All disturbed areas should be revegetated with native species, especially species indigenous to the area.
- Postconstruction monitoring for invasive plant species should be required.
- On-site practices should include implementation of a garbage management plan to reduce scavenger predation on ground-nesting birds and reptiles.
- All areas of surface disturbance within riparian areas and/or adjacent uplands should be revegetated with native species.

Recommendations to Protect Threatened, Endangered, and Other Special Status Plant Species. To avoid or minimize impacts to threatened, endangered, and other special status plant species, the following recommendations can be applied:

- Construction and related activities should be developed to avoid direct disturbance to populations and to individual plants.
- Construction plans and project design should avoid concentrating water flows or sediments into plant-occupied habitat.
- Construction should occur downslope of plants, where feasible. If construction must be sited upslope, buffers of a minimum of 200 feet between surface disturbances and plants should be established. Stabilizing construction techniques should be used on slopes to ensure downslope plants are not affected.
- Where plant populations occur within 200 feet of construction areas, a buffer or fence should be established around individuals or groups during and after construction.
- Areas to avoid should be visually identifiable in the field, for example, by flagging, using temporary fencing or rebar, etc.

Recommendations to Protect Threatened, Endangered, and Other Special Status Animal Species. The following recommendations can be applied to avoid or minimize impacts to special status animal species:

- Activities should be managed to ensure maintenance or enhancement of riparian and wetland habitat.

- Loss or disturbance of riparian and wetland habitats should be avoided.

- For crossings of rivers and major streams, directional drilling should be used to reduce surface disturbance and eliminate activities in riparian habitat. Such directional drilling must not intercept or degrade alluvial aquifers.

- Guidance provided in BLM (2004g) should be followed when pipelines are constructed across streams or rivers that could contain or support threatened, endangered, or other special status fish species.

- Water depletions from any portion of the Upper Colorado River drainage basin upstream of Lake Powell are considered to jeopardize the four resident endangered fish species (bonytail, humpback chub, Colorado pikeminnow, and razorback sucker), and must be evaluated with regard to the criteria described in the Upper Colorado River Endangered Fish Recovery Program (USFWS 2006c). Because portions of the corridors and potential water sources occur within the Upper Colorado River drainage basin, and because construction and hydrostatic testing of pipelines may require water, consultation regarding depletions should be required.

- To avoid impacts to the four endangered Colorado River fish mentioned above, no in-stream work should occur between July 1 and September 30.

- Construction activities should avoid modification of critical habitat for any species.

- Any pipelines crossing rivers with listed aquatic species should have remotely actuated block or check valves on both sides of the river; pipelines should be double-walled pipe at river crossings; and pipelines should have a spill/leak contingency plan, which includes timely notification of the local USFWS ecological service office.

3.9 VISUAL RESOURCES

3.9.1 What Are the Visual Resources Associated with Energy Corridors in the 11 Western States?

Visual resources refer to all objects (man-made and natural, moving and stationary) and features (e.g., landforms and water bodies) that are visible on a landscape. These resources add to or detract from the scenic quality of the landscape, that is, the visual appeal of the landscape. A visual impact is the creation of an intrusion or perceptible contrast that affects the scenic quality of a landscape. A visual impact can be perceived by an individual or group as either positive or negative, depending on a variety of factors or conditions (e.g., personal experience, time of day, and weather/seasonal conditions).

The 11 western states analyzed in this PEIS encompass a wide variety of landscape types, determined by geology, topography, climate, soil type, hydrology, and land use. Included in this vast region encompassing nearly 1.2 million square miles are spectacular landscapes such as the Grand Canyon, Mt. Rainier, and Glacier and Yellowstone National Parks, as well as relatively flat and visually monotonous landscapes such as the Wyoming Basin and High Plains of eastern Colorado. Although much of the region is sparsely populated, human influences have altered much of the visual landscape, especially with respect to land use and land cover, and, in some places, intensive human activities such as mineral extraction and energy development have seriously degraded visual qualities. Large, fast-growing cities such as Las Vegas and Phoenix also contain heavily altered landscapes, with urban sprawl and associated visual blight spreading into what were recently relatively intact landscapes. Nonetheless, the various scenic attractions of the 11-state area help attract millions of tourists to the region each year and contribute to making tourism a major component of some regional and local economies.

Table 3.9-1 summarizes selected scenic resources, such as national parks, monuments, and recreation areas; national historic sites, parks, and landmarks; national memorials and battlefields; national seashores, national wild and scenic rivers, national historic trails, and national scenic highways; and other national scenic areas occurring within the 11-state region by state. In addition, many other scenic resources exist on federal, state, and other nonfederal lands, including traditional cultural properties important to Tribes.

Because scenic resources in a given area are largely determined by geology, topography, climate, soil type, and vegetation, scenic resources are generally homogenous within an ecoregion, defined as an area that has a general similarity in ecosystems and characterized by the spatial pattern and composition of biotic and abiotic features, including vegetation, wildlife, geology, physiography, climate, soils, land use, and hydrology (EPA 2006b). The 11 western states where Section 368 federal energy corridors may be designated encompass 34 ecoregions, each of which contains a diverse set of visual resources. The number of ecoregions within any one state ranges from 5 in Nevada to 12 in California. The areal coverage of an ecoregion within any one state varies greatly among the 11 western states. In some states, ecoregions account for as little as 1 square mile (e.g., the Puget Sound and Colorado Plateau ecoregions in Oregon and New Mexico, respectively). In contrast, the portion of the Central Basin and Range ecoregion within Nevada encompasses about 82,000 square miles. The general environmental setting of the 34 ecoregions and the states in which the ecoregions occur are discussed in Appendix O, and a map of the 34 ecoregions is shown in Figure 3.8-1.

3.9.2 How Were the Potential Effects of Corridor Designation to Visual Resources Evaluated?

The responsibility of the BLM and the FS for managing the visual (scenic) resources of public lands is established by law. The NEPA requires that measures be taken to “assure for all Americans … aesthetically pleasing surroundings.” The FLPMA states that “public lands will be managed in a manner which will protect the quality of scenic values of these lands.” The National Forest Management Act (NFMA) requires that the FS inventory and evaluate visual resources and incorporate visual quality objectives into the planning process. Methods have been developed to assist federal agencies that are responsible for visual resource planning and for assessing visual resource impacts.

The BLM conducts visual inventories and analyses within the guidelines established in its Visual Resource Management (VRM) System (BLM 1984a; 1986a,b). The BLM uses the VRM procedures and methods to support decision making for planning activities and reviews of proposed developments on BLM-administered lands.

The VRM System consists of three phases: (1) inventory of scenic values and assignment of visual resource inventory classes; (2) designation of BLM management classes for all public lands using the Resource Management

TABLE 3.9-1 Summary of Selected Potentially Sensitive Visual Resource Areas within the 11 Western States[a]

State	National Parks[b]	National Monuments[c]	National Recreation Areas (NRA)[d]	Other National Park Service Areas[e]	National Natural Landmarks	National Historic Landmarks	National Scenic Trails	National Historic Trails	National Scenic Highways[f]	National Scenic Areas (NSA)	National Scenic Research Areas (NSRA)	National Wild and Scenic Rivers	National Wildlife Refuges	State Totals
Arizona	3	19	2	4	9	9	0	2	5	0	0	1	9	63
California	8	10	5	9	32	63	1	4	7	1	0	14	35	189
Colorado	4	6	2	3	11	4	1	3	10	0	0	2	7	53
Idaho	1	3	2	2	11	2	1	4	6	0	0	7	7	46
Montana	2	3	2	4	10	5	1	2	1	3	0	2	20	55
Nevada	2	0	2	1	6	2	0	3	3	0	0	0	8	27
New Mexico	2	11	1	2	12	11	1	2	8	0	0	4	7	61
Oregon	1	4	3	3	6	10	1	4	10	1	1	47	22	113
Utah	5	7	2	1	4	4	0	4	7	0	1	0	4	39
Washington	3	2	4	6	16	11	1	2	6	1	0	3	21	76
Wyoming	2	2	2	2	6	7	1	5	1	0	0	1	7	36

[a] Includes features wholly or partly within state boundaries.

[b] Does not include national historic parks or national historical parks.

[c] Includes national monuments managed by the NPS, FS, BLM, and USFWS.

[d] Includes national recreation areas managed by the NPS and FS.

[e] Includes national historic parks, national historical parks, national preserves, national reserves, national seashores, national historic sites, national battlefields, national memorials, national memorial parkways, and the San Francisco Presidio.

[f] Includes all-American roads and national scenic byways.

Plan (RMP) process; and (3) use of the Visual Contrast Rating System to evaluate the compatibility of a proposed project with the existing VRM class for the proposed project location and to determine the nature and extent of visual impacts associated with the project. If the project is subsequently implemented, design considerations and mitigation measures may be used to minimize the visual impacts of the project.

The FS conducts visual inventories and analyses within the guidelines established in its Scenery Management System (SMS) (FS 1995a). The SMS presents a systematic approach for determining the relative value and importance of visual resources. The system is used in the context of ecosystem management to inventory and analyze scenery, establish overall resource goals and objectives, and monitor visual resources.

The SMS consists of two major phases: inventory and implementation. The inventory phase involves several steps: (1) determination of landscape character; (2) analysis of scenic integrity; (3) determination of inherent scenic attractiveness; (4) determination of landscape visibility, including constituent analysis and determination of seen areas and distance zones; and (5) the determination of initial scenic class assignments. In the implementation phase, (1) scenic class assignments are consolidated and mapped; (2) scenic integrity objectives are assigned to management areas; and (3) maps reflecting scenic integrity objectives are created and subsequently used in the planning process to determine the compatibility of proposed actions with the visual quality objectives for the affected lands.

The visual impact analysis conducted for the PEIS assumes that visual impact levels would be proportional to the number of visually sensitive features that would be near a proposed corridor or intersected by it. In most cases, visually sensitive features that would fall within or be located close to a designated corridor would be more likely to be affected by future energy transport project development than those sensitive features farther away from a corridor; however, it should be recognized that a visual impact assessment is highly site- and project-specific, and actual future projects and their locations are not known at this time.

Two GIS-based proximity analyses were performed. The first analysis, hereafter referred to as the intersection analysis, identified locations (primarily on federal lands) where selected visually sensitive features would be intersected by a designated energy corridor, meaning that some portion of the features fell within 1,750 feet of the designated centerline of a proposed corridor. The second analysis, hereafter referred to as the buffer analysis, identified locations where some portion of a sensitive feature fell within 5 miles of a designated corridor centerline. The 5-mile buffer width was selected because it includes the foreground and middleground view ranges specified by the BLM’s and FS’s VRM Systems (BLM 1986a; FS 1995a). The buffer distance thus includes areas where the impacts are most likely to be of concern. It is important to note that it was not possible to perform these analyses for the No Action Alternative because specific ROW locations (centerlines and widths) could not be specified.

For each nearby or intersected visual resource feature, the intersection or closest point of approach between the feature and the corridor’s centerline was identified and mapped. The information is presented both in map (Map Atlas, Part 3) and tabular formats (Appendix P). The tables are organized by state and by feature type.

The list of scenic resources included in the analysis includes:

- National parks, national monuments, national recreation areas, national preserves, national reserves, national seashores, national historic sites, national historic parks, national battlefields, national memorials, national memorial parkways, and the San Francisco Presidio;

- National wild and scenic rivers;
- National scenic trails and national historic trails;
- National historic landmarks and national natural landmarks;
- All-American roads and national scenic byways; and
- National scenic areas and national scenic research areas.

The analysis is limited in terms of both completeness and accuracy. For example, the analysis is limited to data that were available in GIS format at the time of analysis; thus, it is recognized that many additional scenic resources exist at the national, state, and local levels and that impacts may occur on both federal and nonfederal lands, including sensitive traditional cultural properties important to Tribes. In addition, the GIS system, while capable of extremely high spatial accuracy, is limited by the accuracy of the data used in the analysis, since the datasets were obtained from many sources and are subject to error. It should be noted that in addition to the resource types and specific resources analyzed in the PEIS, future site-specific NEPA analyses would include state and local parks, recreation areas, other nonfederal sensitive visual resources, and communities close enough to the corridors to be affected by visual impacts.

3.9.3 What Are the Potential Effects to Visual Resources of the Alternatives, and How Do They Compare?

3.9.3.1 Potential Visual Resources Impacts of the No Action Alternative

Under the No Action Alternative, if energy transport project development occurs, visual impacts may occur on federal and nonfederal lands both within and within sight of the energy transport projects built under the alternative. The magnitude and extent of impacts would depend on the type of project authorized, its location, its total length, and a variety of site-specific factors that are not known at this time but would be addressed by environmental reviews at the project-specific level.

If development occurred under No Action, projects would be less likely to be colocated and would be more likely to occur within multiple, widely spaced energy transport ROWs crossing federal and nonfederal lands, relative to the Proposed Action. Without colocation, ROWs and associated infrastructure (such as roads and compressor stations) would typically be visible from a larger area and might therefore be visible to a larger number of people. In addition, there would be a greater potential for visual impacts because each ROW would require its own infrastructure (e.g., service roads, support structures), some of which might be avoided through colocation (under the Proposed Action). Because there would typically be more ROWs in a given area, the average viewing distance from an observer to the ROW and associated facilities would decrease, and the associated visual impact would therefore increase because the impacts would be viewed from shorter distances. The likelihood of a ROW being visible from a sensitive feature (e.g., a wilderness study area) would also increase, as would the likelihood of seeing more than one ROW from a given viewing point, although site-specific design and mitigation measures might be used to minimize or eliminate some of these situations. In short, noncolocation of ROWs would generally lead to more severe visual impacts for a larger number of viewers over a larger area.

It should be noted that while there is greater potential for visual impacts without the colocation of ROWs, the visual impacts at a given location might actually be reduced in some cases without colocation because a viewer would see fewer transmission lines, pipelines, ROW clearings, and energy transport infrastructures at that location. A given landscape, which might be able to absorb one ROW and associated facilities without serious visual degradation, might be overwhelmed by multiple colocated facilities, especially if the observation point was close to the ROW. This consideration is important for particularly sensitive visual resources such as national historic sites, historic trails, and Tribal cultural properties; site-specific NEPA analyses should identify these situations and specify design and/or mitigation measures to avoid or minimize the associated visual impacts.

Under No Action, in the absence of dedicated energy corridors and an associated expedited permitting process, there could be increased siting of ROWs on nonfederal lands and a concomitant shift of visual impacts associated with the ROWs to those lands, although some ROWs would still be sited on federal lands. This factor could lead to increased visual impacts in some cases, because inconsistent or less thorough environmental analyses might be performed and/or fewer mitigation requirements might be fulfilled on individual projects.

3.9.3.2 Potential Visual Resources Impacts of the Proposed Action

Designation of the proposed energy corridors and land use plan amendments alone are not expected to impact visual resources. Under the Proposed Action, if energy transport project development occurs, visual impacts may occur on federal and nonfederal lands both within and within sight of the energy transport projects built under the alternative. The magnitude and extent of impacts would depend on the type of project authorized, its location, its total length, and a variety of site-specific factors that are not known at this time but would be addressed by environmental reviews at the project-specific level.

If energy transport project development occurs under the Proposed Action, some energy transport projects could be developed in the designated energy corridors, as opposed to being developed on separate ROWs. If projects were colocated within the proposed corridors rather than being built on separate ROWs, it is expected that some project infrastructure, such as the ROW and access and maintenance roads, could be shared among projects, reducing the number of locations where potential visual impacts associated with construction and operation of energy transport projects might occur. Because the overall number of potential impacts would decrease and because the potential impacts would occur within a smaller visible area, visual impacts would decrease in most places away from the designated energy corridors. However, within the corridors, and for areas close to the corridors with direct views of the projects within the corridors, the concentrating effects of colocation could potentially increase overall impact levels in those areas and potentially counteract the decrease in impacts associated with shared facilities. The extent of these effects would vary from site to site and would depend on the number and types of facilities, the extent to which facilities were shared between projects, and the visual absorption capacities of the landscapes in which the projects were sited.

On federal lands outside the proposed corridors, the federal land management agencies would continue to permit energy transport projects on a project-by-project basis and/or designate project-specific ROWs through their normal land use planning process on lands under their jurisdiction. The colocation effects on visual impacts that would result with multiple projects in the proposed corridors would not occur, with the expected result being an increase in the visually affected areas (because of utilizing multiple, physically separated ROWs) and an increase in the number of visual impacts (because facilities would not be shared among projects).

Table 3.9-2 lists the number of selected, potentially sensitive visual resource areas that are intersected by the proposed corridors or are located within 5 miles of a proposed energy corridor for each western state. It should be noted that some features may be near or intersected by corridors at more than one location. These visual resources may be at greatest risk for visual impacts from project development because of their proximity to the corridors. Tables P-1 and P-2 in Appendix P list the individual potentially sensitive visual resource areas that are summarized in Table 3.9-2. Maps showing where corridors designated under the Proposed Action intersect potentially sensitive visual resource areas or pass within 5 miles of a potentially sensitive visual resource area are presented in the Map Atlas, Part 3. It should be noted that it was not possible to perform these analyses for areas where corridors were not designated because specific ROW locations (centerlines and widths) could not be specified.

Table 3.9-3 lists the number of selected, potentially sensitive visual resource areas that are intersected by nonlocally designated portions of corridors proposed under the Preferred Alternative, or are located within 5 miles of nonlocally designated portions of corridors proposed under the Proposed Action Alternative. The table thus summarizes the number of resource areas that may be at greatest risk for visual impacts solely as a result of designation of corridor segments beyond those currently designated by local agency land managers. Those portions of designated corridors that coincide with existing locally designated corridors are indicated on the visual resource analysis maps in the Map Atlas, Part 3.

3.9.3.3 Comparison of Alternatives

Because the No Action Alternative does not designate corridors, if development of energy transport projects occurs under this alternative, it is likely to result in less colocation of energy transport projects than under the Proposed Action, assuming that the same amount of development occurred under both alternatives. The lack of concentrated impacts that result from colocation would be expected to result in a lower overall level of impacts along individual corridors, but because there would be no sharing of ROWs, roads, and other facilities between projects, the No Action Alternative would likely result in a higher number of impacts, spread out over a larger area.

The Proposed Action involves designation of Section 368 federal energy corridors. If development of energy transport projects occurs under this alternative, it is anticipated that the designation of corridors under the Proposed Action would result in greater colocation of energy transport projects than under No Action, assuming that the same amount of development occurred under both alternatives, which would likely lead to sharing of some facilities such as ROWs and roads between projects. Sharing of facilities would reduce the number of visual impacts, but colocation of projects would concentrate the impacts along the energy corridors. Relative to No Action, this could lead to a higher level of visual impacts to federal and nonfederal lands within or within sight of the corridors, but visual impacts farther away from the corridors would likely be smaller because colocation would lead to fewer ROWs and facilities overall.

TABLE 3.9-2 Summary of Selected Potentially Sensitive Visual Resource Areas within or near[a] the Proposed West-wide Energy Corridors[b]

State	National Parks[c]	National Monuments[d]	National Recreation Areas (NRA)[e]	Other National Park Service Areas[f]	National Natural Landmarks	National Historic Landmarks	National Scenic Trails	National Historic Trails	National Scenic Highway[g]	National Scenic Areas (NSA)	National Scenic Research Areas (NSRA)	National Wild and Scenic Rivers	National Wildlife Refuges	State Totals
Arizona	0/0	1/5	2/2	0/1	0/0	0/1	NA[h]	2/2	1/1	NA	NA	0/0	1/1	8/16
California	0/1	0/3	1/1	1/2	0/0	0/1	1/1	3/3	2/2	0/0	NA	1/4	1/6	9/23
Colorado	0/1	0/1	1/1	0/0	0/2	0/0	1/1	1/1	5/5	NA	NA	0/0	0/1	8/13
Idaho	0/0	1/3	0/1	0/0	0/2	0/0	1/1	2/3	0/0	NA	NA	0/0	0/4	4/13
Montana	0/0	0/0	0/1	0/0	0/1	0/1	1/1	1/2	0/0	0/0	NA	0/0	0/1	2/7
Nevada	0/1	NA	1/2	0/0	0/1	0/1	NA	3/3	0/1	NA	NA	NA	0/2	5/11
New Mexico	0/0	0/1	0/0	0/1	0/0	0/0	1/1	2/2	2/5	NA	NA	0/0	1/2	6/12
Oregon	0/0	0/1	0/0	0/0	0/0	0/0	1/1	2/2	1/5	0/0	0/0	3/9	0/3	7/21
Utah	0/1	1/3	0/2	0/0	0/1	0/0	NA	3/3	1/4	NA	0/0	NA	0/2	6/14
Washington	0/0	0/0	0/0	0/0	0/0	0/0	1/1	0/0	1/2	0/0	NA	0/0	0/0	2/3
Wyoming	0/0	0/0	1/1	0/0	0/0	0/0	1/1	4/4	0/0	NA	NA	0/0	0/1	6/7
Totals	0/4	3/17	6/11	1/4	0/7	0/4	8/8	23/25	13/25	0/0	0/0	4/13	3/23	61/141

[a] Includes features within 5 miles of corridor centerline.

[b] Within each cell, the first number indicates the number of features with corridor intersections, and the second number indicates the number of features with proximity events (i.e., corridor passes within 5 miles of feature).

[c] Does not include national historic parks or national historical parks.

[d] Includes national monuments managed by the NPS, FS, BLM, and USFWS.

[e] Includes national recreation areas managed by the NPS and FS.

[f] Includes national historic parks, national historical parks, national preserves, national reserves, national seashores, national historic sites, national battlefields, national memorials, national memorial parkways, and the San Francisco Presidio.

[g] Includes all-American roads and national scenic byways.

[h] NA = not applicable; feature type does not occur in the state.

TABLE 3.9-3 Summary of Selected Potentially Sensitive Visual Resource Areas within or near[a] Nonlocally Designated Portions of the Proposed West-wide Energy Corridors under the Proposed Action[b]

State	National Parks[c]	National Monuments[d]	National Recreation Areas (NRA)[e]	Other National Park Service Areas[f]	National Natural Landmarks	National Historic Landmarks	National Scenic Trails	National Historic Trails	National Scenic Highway[g]	National Scenic Areas (NSA)	National Scenic Research Areas (NSRA)	National Wild and Scenic Rivers	National Wildlife Refuges	State Totals
Arizona	0/0	1/4	1/2	0/1	0/0	0/1	NA[h]	1/1	1/1	NA	NA	0/0	1/1	5/11
California	0/1	0/2	1/1	1/2	0/0	0/0	1/1	3/3	2/2	0/0	NA	1/4	1/4	10/20
Colorado	0/1	0/1	1/1	0/0	0/0	0/0	1/1	1/1	2/2	NA	NA	0/0	0/1	5/8
Idaho	0/0	1/3	0/1	0/0	0/2	0/0	1/1	2/3	0/0	NA	NA	0/0	0/4	4/14
Montana	0/0	0/0	0/1	0/0	0/1	0/1	1/1	0/2	0/0	0/0	NA	0/0	0/1	1/7
Nevada	0/1	NA	1/2	0/0	0/0	0/0	NA	2/3	0/0	NA	NA	NA	0/1	3/7
New Mexico	0/0	0/1	0/0	0/1	0/0	0/0	0/1	2/2	2/4	NA	NA	0/0	1/2	5/11
Oregon	0/0	0/1	0/0	0/0	0/0	0/0	1/1	2/2	1/4	0/0	0/0	3/7	0/3	7/18
Utah	0/1	1/3	0/2	0/0	0/0	0/0	NA	3/3	1/4	NA	0/0	N/A	0/2	5/15
Washington	0/0	0/0	0/0	0/0	0/0	0/0	0/1	0/0	0/1	0/0	NA	0/0	0/0	0/2
Wyoming	0/0	0/0	1/1	0/0	0/0	0/0	1/1	4/4	0/0	NA	NA	0/0	0/1	6/7
Totals	0/4	3/15	5/11	1/4	0/3	0/2	6/8	20/24	9/18	0/0	0/0	4/11	3/20	51/120

[a] Includes features within 5 miles of corridor.

[b] Within each entry, the first number indicates the number of features with corridor intersections, and the second number indicates the number of features with proximity events (i.e., corridor passes within 5 miles of feature).

[c] Does not include national historic parks or national historical parks.

[d] Includes national monuments managed by the NPS, FS, BLM, and USFWS.

[e] Includes national recreation areas managed by the NPS and FS.

[f] Includes national historic parks, national historical parks, national preserves, national reserves, national seashores, national historic sites, national battlefields, national memorials, national memorial parkways, and the San Francisco Presidio.

[g] Includes all-American roads and national scenic byways.

[h] NA = not applicable; feature type does not occur in the state.

3.9.4 Following Corridor Designation, What Types of Impacts Could Result to Visual Resources with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

Designation of corridors and amendment of land use plans alone are not expected to impact visual resources. If energy transport project development occurs under either of the alternatives, visual impacts may occur on federal and nonfederal lands, including Tribal cultural properties, both within and within sight of the energy transport projects built under the alternatives. The magnitude and extent of impacts would depend on the type of project authorized, its location, its total length, and a variety of site-specific factors that are not known at this time but would be addressed by environmental reviews at the project-specific level. Impacts to visual resources that could occur with the development, construction, operation, and decommissioning of an energy transport project (regardless of project location) are discussed in Section 3.9.4.2. These impacts could occur on both federal and nonfederal lands, including traditional cultural properties important to Tribes.

3.9.4.1 What Factors Influence the Evaluation of Visual Impacts?

The construction, operation, and decommissioning of energy transport and distribution facilities may cause a variety of visual impacts. Because of the subjective and experiential nature of human visual perception and cognition, the human response to visual impacts cannot be quantified systematically, even though the impacts of a proposed development can be described specifically. Factors that influence the perception and evaluation of visual impacts include (BLM 1984, 1986a,b; FS 1995a):

- *Visibility factors*. These are factors that affect the visibility of an area of interest to typical viewers. Circumstances or activities that reduce or eliminate views of the impacted feature will reduce the level of perceived visual impact for most viewers.

- *View duration*. Duration affects the perceived visual impact; impacts that are evident for a long period of time are generally judged to be more severe than those that are visible only briefly. Similarly persons residing or working near an affected area may be exposed to more visual impacts over time than one-time or infrequent visitors to the impacted area, such as park users or recreationists.

- *Viewer distance and angle*. Viewer distance from an area is a key factor in determining the level of visual impact, with the perceived impact diminishing as the distance between the viewer and the affected area increases. Viewer angle relative to the impact may also affect the perceived visual impact, as landscapes may be scrutinized more closely (thus increasing the potential for a visual impact) as viewing angles approach 90°.

- *Landscape setting*. Landscape setting plays a key role in determining the level of perceived visual impacts because it provides the context for judging the degree of visual intrusion of a project or activity. The landscape setting includes the perceived scenic value, visual absorption capacity (the degree to which the landscape can absorb visual impacts without serious degradation in perceived scenic quality), scenic integrity, and, in some cases, the unique scenic, cultural, or ecological values of a landscape.

- *Seasonal and lighting conditions*. Because visual contrast is a key factor in determining the visual impact of a proposed project or activity, seasonal and lighting conditions that affect contrast may affect perceived visual impact.

- *Number of viewers*. Impacts are generally more acceptable in areas that are seldom seen; conversely, impacts in areas that are heavily used/viewed are generally less acceptable.

- *Viewer activity, sensitivity, and cultural factors*. The type of activity in which a viewer is engaged when viewing a visual impact may affect his or her perception of impact level. Some individuals and groups may be inherently more sensitive to visual impacts than others as a result of educational and social background, life experiences, and other cultural factors.

3.9.4.2 What Are the Usual Impacts to Visual Resources of Building and Operating Energy Transport Projects?

Direct visual impacts from the construction, operation, and decommissioning of an energy transport project include the temporary impacts associated with activities that occur during the construction and decommissioning phases of a project and the longer-term impacts that result from the presence and operation of the project facilities themselves.

Visual Impacts during Site Construction. Potential visual impacts that could result from construction activities include contrasts in form, line, color, and texture resulting from ROW clearing with associated debris; road building/upgrading; construction and use of staging and laydown areas; mainline and support facility construction; blasting of rock faces and other cavities; vehicular, equipment, and worker presence and activity; and associated vegetation and ground disturbances, dust, and emissions.

ROW Construction. Construction on a ROW requires clearing of vegetation, large rocks, and other objects. The nature and extent of ROW clearing is affected by the ROW requirements of the project, the types of vegetation and other objects to be cleared, and the extent to which a preexisting cleared ROW is being used. Because the construction ROW may be wider than the permanent ROW (see Appendix E), the initial cleared area might be much wider than the permanent ROW and thus potentially result in a greater visual impact. More complete vegetation clearing and topographic grading would be required for the construction of access roads, maintenance roads, and roads to support facilities (e.g., electric substations or pump stations). Typically, vegetation-clearing activities would create visual impacts if refuse materials are not either disposed of off-site, mulched, or otherwise concealed. Related activities could include bracing and cutting existing fences and constructing new fences to contain livestock; providing temporary walks, passageways, fences, or other structures to prevent interference with traffic; and providing lighting in areas where work might be conducted at night.

Establishment of multiple ROWs within one corridor could increase visual impacts associated with clearing, but because roads and, in some cases, support structures could potentially be shared between facilities, the level of impacts would not necessarily increase in a linear fashion. The preexistence of a cleared ROW at a given location might also reduce visual impacts, because less clearing would be required.

Road Building/Upgrading. As noted above, construction of new temporary and permanent access roads and/or upgrading of existing roads to support project construction and maintenance activities will be required. Road development may introduce strong visual contrasts to the landscape, depending on the routes relative to surface contours and the widths, lengths, and surface treatments of the roads. Construction of access roads would have some associated residual impacts (e.g., vegetation disturbance) that could be evident for some years afterward, with a gradual diminishing of impacts over time.

Staging and Laydown Areas. Construction of new energy transport facilities in either a new or existing ROW would require staging areas for stockpiling and storage of equipment and materials needed during construction. For electricity transmission lines, staging areas are generally 1 to 3 acres in size and typically located every 8 to 10 miles along the line (see Appendix E). Staging areas for pipelines could be 15 to 30 acres in size and might also include a 10- to 30-acre construction yard that serves as an assembly point for construction crews and includes offices, storage trailers, and fuel tanks. Laydown areas are used for temporary stockpiling and storage of equipment and materials during construction and are normally located adjacent to but not within the ROW. Laydown areas may be located every 8 to 10 miles along the ROW and may be several acres in size. The nature and extent of visual impacts associated with these areas would depend in part on the size of the area and the nature of required clearing and grading, whether the area was an existing or newly constructed site, and on the types and amounts of materials stored at the staging areas. Some newly constructed staging areas could be converted into permanent facilities for facility maintenance, while laydown areas would be reclaimed immediately after completion of construction.

Construction of Mainline Facilities. Large, cleared, and generally level areas are required for electricity transmission line tower construction and assembly, as well as cable-pulling sites (which may be located on existing laydown areas); these areas would be reclaimed after construction. Smaller areas are generally required for pipeline trenching and related construction activities. Because both types of facilities are linear, construction activities generally proceed as a "rolling assembly line," with a work crew gradually moving through an area at varying rates depending on circumstances. Transmission line construction activities include clearing, leveling, and excavating at tower sites, as well as the assembly and erection of towers followed by cable pulling (see Figure 3.9-1). Pipeline mainline construction activities include clearing, leveling, trenching, and laying of pipe (see Figure 3.9-2). Both electric and pipeline mainline construction activities would have potentially substantial but temporary visual impacts.

FIGURE 3.9-1 Towers under Construction

FIGURE 3.9-2 Trenching in Preparation for Installation of Gas Pipeline

Construction of Support Facilities. Construction of a variety of support facilities would also be required when constructing an electricity transmission line or pipelines. Support structures for electricity transmission and distribution systems include substations, while pipelines require pumping stations, metering facilities, city gate stations, and pigging facilities. Construction activities associated with these facilities include clearing, grading, soil compacting, and surfacing, in addition to constructing buildings and fences. Substation construction typically requires 6 to 9 months and covers approximately 10 to 15 acres for the fenced station plus 3 acres for construction support. Natural gas compressor station facilities are generally sited on 15 to 22 acres of land, while pump stations for petroleum product pipelines occupy roughly 25 acres.

Blasting of Rock Faces and Other Cavities. A number of the construction activities associated with ROW clearing, road building, and facilities construction could sometimes involve blasting of rock faces, trenches, and cavities for transmission tower foundations. In all cases, there are potentially temporary visual impacts from dust, smoke, and debris associated with blasting. Subsurface blasting impacts would not be visible after remediation; however, rock face blasting typically would permanently alter the form of the affected area, although alterations to color may gradually diminish over a long period of time.

Workers, Vehicles, and Equipment. The various construction activities described above require work crews, vehicles, and equipment that would add to visual impacts during construction. Small-vehicle traffic for worker access and large-equipment traffic (trucks, graders, excavators, and cranes) would be expected for road construction, site preparation, and tower/pipeline installation. Both kinds of traffic would produce visible activity and dust in dry soils. Suspension and visibility of dust would be influenced by vehicle speeds, road surface materials, and weather conditions. Temporary parking for vehicles would be needed at or near work locations. Unplanned and unmonitored parking could likely expand these areas, producing visual contrast by suspended dust and loss of vegetation. Construction activities would proceed in phases, with several crews moving through a given area in succession, giving rise to brief periods of intense construction activity (and associated visual impacts), followed by periods of inactivity. There would be the temporary presence of large cranes to erect transmission towers as well as possible helicopter use for particularly remote or rugged terrain. Cranes and other construction equipment would produce emissions while in operation and may thus create visible exhaust plumes.

Other Visual Impacts from Construction. Ground disturbance would result in visual impacts that produce contrasts of color, form, texture, and line. Excavating for tower foundations and ancillary structures, trenching to bury pipelines, grading and surfacing roads, clearing and leveling staging areas, and stockpiling soil and spoils (if not removed) would (1) damage or remove vegetation, (2) expose bare soil, and (3) suspend dust. Soil stockpiles could be visible for the duration of construction. Soil scars, exposed slope faces, eroded areas, and areas of compacted soil could result from excavation, leveling, and equipment/vehicle movement. Invasive species may colonize disturbed and stockpiled soils and compacted areas. These species may be introduced naturally; in seeds, plants, or soils introduced for intermediate restoration; or by vehicles. In some situations, the presence of invasive species may introduce contrasts with naturally occurring vegetation, primarily in color and texture. The presence of workers and construction activities could also result in litter and debris that could create negative visual impacts within and around work sites. Site monitoring and restoration activities could reduce many of these impacts.

Visual Impacts during Site Operation. The operation and maintenance of pipelines or electricity transmission lines and their associated facilities, roads, and ROWs would have potentially substantial long-term visual effects. Some impacts are common to transmission lines and pipelines; however, the mainline structures are fundamentally different in terms of visual impacts, with electricity transmission lines generally having larger visual impacts than pipelines. In the following discussion, impacts that are similar between the two energy transport projects are discussed together, while impacts that are significantly different are discussed separately.

ROW. The width of cleared area for the permanent ROW for a given project would be determined at a project-specific level, but in general, it would be expected to be substantially wider for electricity transmission line projects than for pipeline projects (see Appendix E). Visual impacts associated with ROW clearing include the potential loss of vegetative screening that would result in the opening of views, especially down the length of the ROW; potentially significant changes in form, line, color, and texture for viewers close to the ROW; and potentially significant changes in line and color for viewers with distant views of the ROW. In general, the impacts would be greater in forested areas, where vegetation-clearing impacts are more conspicuous, particularly in areas where there are strong color contrasts between understory and overstory vegetation. The presence of snow cover might accentuate color contrasts. In nonforested areas, visual impacts from ROW clearing would typically be expected to be less, both because there would normally be less vegetation removal and also because there are generally fewer contrast issues associated with vegetation removal in nonforested areas.

While the opening of views for viewers close to a cleared ROW might be a positive visual impact in some circumstances, the introduction of strong linear and color contrasts in middle ground and background views as a result of clearing ROWs can create large negative visual impacts, particularly in forested areas where either the viewer or the ROW is elevated in such a way that long stretches of ROW are visible. Viewing angle can also be an important factor in determining the perceived visual impact in these settings. In worst-case situations, the impacts can be visible for many miles. Various design and mitigation measures can be used to avoid or reduce impacts in these situations (see Section 3.9.4.3).

Where areas of bare soils are exposed (generally associated with construction activities, e.g., pipeline trenching), reclamation efforts would include reseeding these areas. Good mitigation practice would dictate reseeding with native plants, which would minimize visual contrasts, but depending on circumstances, a number of years might pass before contrasts between reseeded and uncleared areas would no longer be noticeable. If non-native plants were used for reseeding or if a lack of proper management led to the growth of invasive species in the reseeded areas, noticeable color and texture contrasts might remain indefinitely. The unsuccessful reclamation of cleared areas may result in soil erosion, ruts, gullies, or blowouts and could cause long-term negative visual impacts.

Other cleared areas would include maintenance roads and facility access roads (e.g., electric substations or pump stations). Some support facilities would be surrounded by cleared areas. Visual impacts associated with these cleared areas would include the potential loss of vegetative screening that would result in the opening of views and potentially significant changes in form, line, color, and texture for viewers close to the cleared area. Clearing for roads might be subject to some of the linear contrast concerns mentioned above for ROWs, but impacts would normally be far less severe; mainline facility maintenance roads would generally be within the cleared ROW and, in most cases, would not add substantially to the impact, while access roads would generally be shorter. In both cases, the cleared area would be relatively narrow, especially compared to typical electricity transmission line ROW clearings.

Roads. In many cases, construction access roads would not be needed during operations and would be reclaimed after construction. In some cases, certain roads would remain, such as the permanent maintenance roads used for transmission line/pipeline inspection and maintenance and the permanent facility access roads. Maintenance roads (where needed) would generally be dirt or gravel roads, while some facility access roads might be paved. In addition to vegetative clearing, roads may introduce strong visual contrasts to the landscape, depending on the routes relative to surface contours and the widths, lengths, and surface treatments of the roads. Ground disturbances (e.g., grading, erosion control measures, and blasting) might introduce lasting visual impacts, while improper management could lead to the growth of invasive species or erosion, both of which could introduce undesirable contrasts in line, color, and texture, primarily for foreground and near-middleground views.

Mainline Facilities: Electricity Transmission Lines. Electricity transmission towers, where visible, would create potentially large visual impacts. The tower structures, conductors, insulators, aeronautical safety markings, and lights would all create visual impacts. A transmission line's visual presence would last from construction throughout the life of the project.

Tower structures for the 500-kV lines analyzed would typically be galvanized steel lattice towers, but they could be steel monopole towers in some cases. The structures could be as tall as 150 feet with crossarms as much as 100 feet wide, although crossarms typically would be far less wide. Towers could be considerably taller in special situations (e.g., valley crossings). Various types of steel lattice transmission towers and steel monopoles would be used depending on function, but the towers within each class are very similar in appearance. Lattice towers have an open framework of thin members (compared to monopoles) but overall are much wider than monopoles. Monopoles present a single but more massive upright member, but the overall width is much smaller than that of a lattice tower (see Figure 3.9-3). Special steel lattice turning towers may be employed to bear the extra weight and tension of conductors where a turn occurs in the line. Turning towers utilize stronger, thicker, steel members than are used for typical steel lattice towers, and appear more massive than typical towers when viewed from the same view point.

Under certain conditions, lattice towers tend to blend better into the background when viewed from a distance against mountains or vegetation. With their slender members and open structure, they allow the forms, lines, colors, and textures of the background landscape to show through. The simpler, narrower monopoles may create less contrast with the natural environment in foreground views when viewed against the sky (i.e., skylined) compared to the "industrial" structural look of lattice towers, which can be visually overbearing at short distances (DOE 2003).

FIGURE 3.9-3 Towers: Lattice (left) and Monopole (right)

Both types of towers would create vertical lines in the landscape, an effect that is much more pronounced for monopoles than for lattice towers, and the conductors would create horizontal lines that would be visible depending on viewing distance and lighting conditions. Structures located so that viewers would see land or vegetation (such as a mountain) behind the structures (i.e., not skylined) would generally create smaller visual impacts. In the open landscapes present in much of the West and under favorable viewing conditions, the towers and conductors might be visible for many miles, especially if skylined. A variety of mitigation measures can be used to reduce impacts from these structures (see Section 3.9.4.3), but because of their size, it is difficult to avoid at least some level of visual impact in many circumstances, except at very long distances.

Tower structures, conductors, and insulators are subject to specular reflection, that is, the direct reflection of light off smooth reflective surfaces. These reflections could cause very bright spots (or brief flashes of light to moving observers) to appear under certain lighting conditions where the sun directly illuminates the reflective surface, which could extend the visibility of the surfaces for several miles (BPA 2002). Nonreflective coatings or processes to eliminate or diminish specular reflection are commercially available and are often used to mitigate these impacts.

Other visual impacts associated with electricity transmission lines include aeronautical safety markings and warning lights, airway marker balls, and bird deflectors. Aeronautical safety markings and warning lights are required by the FAA (FAA 2006) and are designed to enhance the visibility of the structures to aircraft. As such, they increase visual impacts associated with the towers and/or conductors on which they are placed.

Safety markings consist of red and white markings painted on the upper parts of towers, and the regular geometry and colors of the markings would contrast with the natural surroundings when visible (during daylight hours). The warning markings would be less visible in distant views. Warning lights would be visible on towers and in some cases on conductors both day and night, but they would be much more noticeable to ground-based observers at night. The red steady or flashing lights might be visible for a number of miles, depending on atmospheric and other viewing conditions. Aviation marker balls are round colored balls (usually aviation orange) that are attached to the conductors or overhead ground wires for daytime marking. They are available in various sizes, ranging from 9 inches in diameter and larger, with 24-inch balls in common use. Their spherical shape and the colors of the markings contrast with natural surroundings when visible (during daylight hours).

Substations. Each transmission line will start from an existing substation and end at a new substation. Intermediate substations may also be required if there is a voltage change along the route. Substations vary in size and configuration but may be several acres in size; they are cleared of vegetation and typically surfaced with gravel. They are normally fenced, may include security lighting, and are reached by a permanent access road. In general, substations include a variety of visually complex structures, conductors, fencing, lighting, and other features that result in an “industrial” appearance. The industrial look of a typical substation, together with the substantial height of its structures (up to 40 feet or more) and its large areal extent, may result in large, negatively perceived visual impacts for nearby viewers if the facility cannot be screened from view (see Figure 3.9-4).

Mainline Facilities: Liquid Petroleum and Gaseous Product Pipelines. In the United States, liquid petroleum and gaseous product pipelines are generally buried several feet below the surface, except at valves, compressor stations, pigging stations, city gate stations, metering facilities, some river

FIGURE 3.9-4 Transmission Lines Leaving Substation

crossings, and/or where very steep topography, bedrock, or other subsurface conditions preclude burial. Visual impacts are therefore typically less for buried portions of a pipeline than for above-ground portions and are limited primarily to those impacts associated with ROW clearing. In situations where pipelines cannot be buried, smaller-diameter pipelines might be laid directly on the ground, while larger-diameter pipelines would rest on regularly spaced support structures that are typically constructed of metal or concrete.[9] An above-ground pipeline generally would introduce a strong, generally horizontal line into natural landscapes and might introduce significant color contrast as well, depending on surface treatment.

Valves. Valves are short, above-ground sections of one or more pipelines, which control flow through a pipeline and may typically be found at spacings of every 5 to 20 miles along the pipeline route. Valves typically occupy an area of a few hundred square feet or less and generally do not require a pad or surfacing. They may be enclosed by a railing and are typically about waist high. The visible pipeline consists of two short vertical segments and a horizontal segment long enough to contain the valve. Their regular geometry introduces form and line contrasts into most natural landscapes and may introduce color contrasts as well, depending on surface treatment; however, their relatively small size typically results in large visual impacts only for nearby viewers (see Figure 3.9-5).

Compressor and Pump Stations. Natural gas pipelines may require compressor stations, and liquid petroleum product pipelines may require pump stations in order to keep the pipeline product at sufficient pressure to ensure flow. Natural gas compressor station facilities are generally sited on 15 to 22 acres of land and usually placed at 40- to 100-mile intervals along the pipeline. Pump stations for petroleum product pipelines are located approximately every 50 to 200 miles along a pipeline. Pump station acreage varies widely but can exceed 25 acres. Both types of facility typically contain above-ground pipeline, valves, control systems, structures (typically made of sheet metal), and lighting systems; they may be on pavement or gravel and are normally fenced facilities. Pump stations may also contain large liquid storage tanks. Structure heights may exceed 30 feet. Both types of facilities typically have a very industrial appearance, with visually complex and generally rectilinear geometry, and the facilities

FIGURE 3.9-5 Natural Gas Control Valve

9 Interstate pipelines eligible for inclusion in West-wide energy corridors would be subject to U.S. Department of Transportation Office of Pipeline Safety installation requirements.

typically introduce strong visual contrasts in line, form, texture, and color with nonindustrial surroundings, particularly for nearby viewers (see Figures 3.9-6 and 3.9-7).

Pipeline Inspection Gauge (Pig) Launch/ Recovery Facilities. For liquid petroleum product pipelines, pig launch/recovery facilities (pigging facilities) would be colocated with pump stations. For natural gas facilities, pigging facilities would be on the ROW but would not be colocated with compressor stations. Pigging facilities are usually smaller than pump or compressor stations and typically consist of one or more short sections of above-ground pipeline, valves, and other control equipment, and they may include buildings (typically made of sheet metal), generators, storage areas, and a helipad. Pigging facilities are normally fenced and surfaced with gravel. While they have a similar industrial look, pigging facilities would generally be expected to have smaller visual impacts than either pump or compressor stations because of their smaller size.

City Gate Stations and Metering Stations. City gate stations are small facilities that would be located at points where gas from a transport pipeline would be distributed to small-diameter gas mains for eventual end use. City gate stations would normally be gravel-surfaced, fenced facilities with short segments of above-ground pipes and valves and one or more control buildings (see Figure 3.9-8). Meter/regulator stations are small facilities that generally would be constructed adjacent to the cleared pipeline ROW at each of the receipt and interconnect points. Typically, a meter/regulator station would include meter and regulator equipment, a filter separator, and a control building housed within a fenced perimeter.

FIGURE 3.9-6 Typical Natural Gas Compressor Station

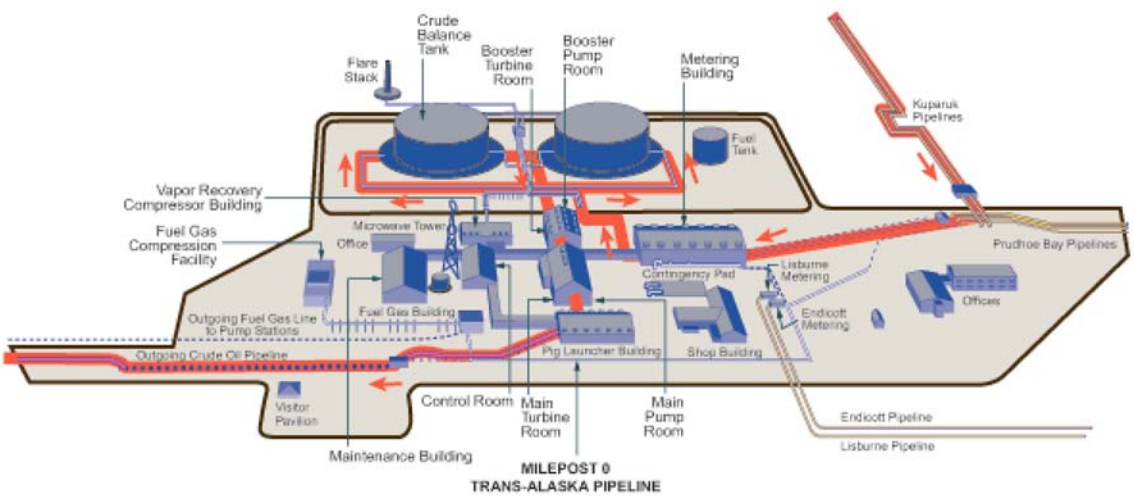


FIGURE 3.9-7 Schematic of Pumping Station

FIGURE 3.9-8 Typical Natural Gas City Gate

River Crossings (Pipeline Bridges). In those instances where pipelines could not rest on stream or river bottoms and could not be buried underneath a stream or river, a pipeline bridge would be used. Pipeline bridges vary in size and construction depending on pipeline size, and they can range from relatively simple structures that cross small streams to large suspension bridges that cross major rivers. In some cases, pipelines can be "piggybacked" on existing bridges; in such cases, the visual impacts are generally minimal. However, the strong horizontal line of a pipeline bridge could be conspicuous in river crossings, particularly over larger rivers, and if a suspension bridge is used, the strong vertical and curved lines that are introduced may add substantially to the visual impact. It should be noted that some people might regard an aesthetically well-designed bridge as a positive visual addition to a landscape, or at least it could be regarded far less negatively than other visual impacts (see Figure 3.9-9).

Workers, Vehicles, and Equipment. Visual impacts from workers, vehicles, and equipment should generally be smaller at most locations during operation of an electricity transmission/distribution line or pipeline than impacts that occur during construction.

FIGURE 3.9-9 Trans-Alaska Pipeline Bridge over Gulkana River

Maintenance activities would consist primarily of regular ROW inspections, maintenance activities (e.g., vegetation management on the ROW), and occasional repairs. Some inspections and other activities might be conducted by helicopter or small aircraft. Ground-based activities require work crews (generally small crews except for major repairs), vehicles, and equipment that would create small, temporary visual impacts while under way. Some small-vehicle traffic for workers and large-equipment traffic for ROW management and repairs would be expected. Both would produce visible activity and dust in dry soils. Suspension and visibility of dust would be influenced by vehicle speeds, road surface materials, and weather conditions.

Visual Impacts during Site Decommissioning. For both electricity transmission/distribution facilities and pipelines, decommissioning would involve removal of all above-ground facilities and gravel workpads and roads; subsurface facilities would be removed to a depth of 3 feet from the surface. Either the original construction laydown areas or new laydown areas, each several acres in size, would be established to support decommissioning; however, such laydown areas would be used only for interim storage, and salvaged equipment and materials would be promptly removed from laydown areas to staging areas that are not located on federal land. Other decommissioning activities would include road redevelopment, recontouring, grading, scarifying, seeding and planting, and perhaps stabilizing disturbed surfaces within the ROW.

Visual impacts during decommissioning would be similar in nature to those encountered in the construction phase but typically of shorter duration and smaller magnitude. Along with the decommissioning activities themselves, impacts would include the presence of workers, vehicles, and equipment with intermittent or phased activity persisting over extended periods of time, as well as the presence of idle or dismantled equipment for as long as it remained on-site. Decommissioning activities could generate dust, emissions, litter, and other effects associated with the presence of workers, vehicles, and equipment.

Newly disturbed soils would create a visual contrast that generally would persist for at least several seasons before revegetation would begin to disguise past activity. Invasive species may colonize newly and recently reclaimed areas. These species may be introduced naturally; in seeds, plants, or soils introduced for intermediate restoration; or by vehicles. Non-native plants that are not locally adapted could produce persisting contrasts of color, form, and texture. In forested areas and in areas with dry soils or other challenging environments, regrowth to preproject conditions could take a number of years and might not be realized without active management.

3.9.4.3 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Visual Resources?

The previous evaluations identified potential visual impacts that could be incurred during the construction, operation, and decommissioning of pipelines and electricity transmission lines within a designated energy corridor. The nature, extent, and magnitude of these potential impacts would vary on a site-specific basis and depend on the specific phase of the project (e.g., construction or operation). Similarly, visual impact mitigation measures would vary on a site-specific basis and depend on the specific phase of the project.

The BLM, DOI, and FS have established mitigation measures pertaining to visual impacts of energy production and roads on federal lands of the western United States. Several of their publications (BLM 1984, 1985, 1986a,b, 1992, 2006g; DOI and USDA 2006; FS 1975, 1977, 2001) were the sources for mitigation measures listed in this section. These publications describe additional mitigation measures and provide related information.

Mitigation Measures Related to Project Siting within a Designated Corridor. The greatest potential for visual impacts associated with a designated corridor would occur as a result of decisions made during the siting and design of the projects within a corridor. In many cases, visual impacts associated with pipelines and electricity transmission lines could be avoided by careful project siting. Project planning for siting should include a detailed visual resource analysis by a professional landscape architect that identifies and maps landscape characteristics, key observation points (KOPs) and key viewsheds, prominent scenic and cultural landmarks, and other visually sensitive areas along the corridor to be developed. The land management agency and locally based public should be consulted to provide input on identifying important visual resources in the project area and on the siting and design process. GIS tools and visual impact simulations provide valuable tools for conducting visual analyses (including mapping), analyzing the visual characteristics of landscapes, visualizing the potential impacts of project siting and design, and fostering the type of communication among stakeholders that informs decision making. The visual analyses provide data that will be critical for identifying constraints and opportunities for siting projects to minimize visual impacts.

Where feasible, the following specific project-siting measures can help reduce visual impacts of corridor development:

- Where possible within a corridor, projects should be sited outside the viewsheds of KOPs.
- When ROWs and associated facilities must be sited within view of KOPs, they should be sited as far away as possible, since visual impacts generally diminish as viewing distance increases.
- Siting within a corridor should take advantage of both topography and vegetation as screening devices to restrict views of projects from visually sensitive areas.
- The eye is naturally drawn to prominent landscape features (e.g., knobs and waterfalls); thus, projects and their elements should not be sited next to such features where possible within corridors.
- The eye naturally follows strong natural lines in the landscape, and these lines and associated landforms can “focus” views on particular landscape features. For this reason, linear facilities generally should not be sited within a corridor so that they bisect ridge tops or run down the center of valley bottoms.
- “Skylining” of transmission towers, communication towers, and other structures should be avoided within the corridor; that is, they should not be placed on ridgelines, summits, or other locations where they will be silhouetted against the sky from important viewing locations. Skylining draws visual attention to the project elements and can greatly increase visual contrast.
- Siting within a corridor should take advantage of opportunities to use topography as a backdrop for views of facilities and structures to avoid skylining.
- Siting of linear features (ROWs and roads) within a corridor should follow natural land contours rather than straight lines, particularly up slopes. Fall-line cuts should be avoided. Following natural contours echoes the lines found in the natural landscape and often reduces cut-and-fill requirements; straight lines can introduce conspicuous linear contrasts that appear unnatural.
- Siting of facilities within a corridor, especially linear facilities, should take advantage of natural topographic breaks (i.e., pronounced changes in slope), and siting of facilities on steep side slopes should be avoided. Facilities sited on steep slopes are often more visible (particularly if either the project or viewer is elevated); they may also be more susceptible to soil erosion, which could also contribute to negative visual impacts.
- Where possible, ROWs and roads within a corridor should follow the edges of clearings (where they would be less conspicuous) rather than passing through the center of clearings.
- Because visual impacts are usually lessened when vegetation and ground disturbances are minimized, siting within a corridor should take advantage of existing clearings to reduce vegetation clearing and ground disturbance.
- Locations for ROW crossings of roads, streams, and other linear features within

a corridor should be chosen to avoid KOP viewsheds and other visually sensitive areas and to minimize disturbance to vegetation and landforms.

- The ROW should cross linear features (e.g., trails, roads, and rivers) within a corridor at right angles whenever possible to minimize the viewing area and duration.

- To the extent possible, projects should be colocated within a corridor to utilize existing/shared ROWs, existing/shared access and maintenance roads, and other infrastructure in order to reduce visual impacts associated with new construction.

Mitigation Measures Related to Project Design. Most visual impact mitigation measures that apply to siting pipeline and electricity transmission projects as a whole would also apply to siting and designing individual facilities, structures, roads, and other components of the projects. A number of additional mitigation measures are directed at minimizing vegetation and ground disturbance to lessen associated visual impacts:

- Where possible both within and outside of designated corridors, structures, roads, and other elements should be sited outside the viewsheds of KOPs and not in visually sensitive areas; they should be sited in swales, around bends, and behind ridges and vegetative screens.

- Where screening topography and vegetation are absent, natural-looking earthwork berms and vegetative or architectural screening should be used to minimize visual impacts. Vegetative screening can be particularly effective along roadways.

- Low-profile structures should be chosen whenever possible to reduce their visibility.

- The siting and design within and outside of designated corridors of facilities, structures, roads, and other project elements should match the form, line, color, and texture of the existing landscape to the extent possible.

- Openings in vegetation for facilities, structures, roads, etc., should mimic the size, shape, and characteristics of naturally occurring openings to the extent possible.

- Site design should attempt to minimize the number of structures required. Where feasible, activities should be combined and carried out in one structure, or structures should be colocated to share pads, fences, access roads, lighting, etc.

- Structures and roads should be sited and designed to minimize and balance cuts and fills. Retaining walls, binwalls, half bridges, and tunnels can be used to reduce cut and fill. Reducing cut and fill has numerous visual benefits, including fewer fill piles, landform and vegetation that appears more natural, fewer or reduced color contrasts with disturbed soils, and reduced visual disturbance from erosion and the establishment of invasive species.

- Facilities, structures, and roads should be sited in stable, fertile soils to reduce visual contrasts from erosion and to better support rapid and complete regrowth of affected vegetation. Site hydrology should also be carefully considered in siting operations to avoid visual contrasts from erosion.

- The vegetation-clearing design for the ROW and other features in forested areas should incorporate partial ROW clearing where feasible, including topping rather than removing trees that exceed the allowable height and leaving "islands" of vegetation within the ROW. Trees that would not present a safety or engineering hazard or otherwise interfere with operations should be left on the ROW. These actions would result in reduced vegetative disturbance (and therefore less slash), narrower ROWs, better screening, and a more natural-looking appearance.

- The vegetation-clearing design in forested areas should include the feathering of ROW edges (i.e., the progressive and selective thinning of trees from the edge of the ROW inward) combined with the mixing of tree heights from the edge of the ROW to create an irregular vegetation outline. These actions would result in a more natural-appearing edge, thereby avoiding the very high linear contrasts associated with straight-edged, clear-cut ROWs.

- Structures, roads, and other project elements should be set as far back from road, trail, and river crossings as possible, and vegetation should be used to screen views from crossings, where feasible.

Mitigation Measures Related to Building and Structural Materials. Visual impacts associated with electricity transmission and pipeline projects could be partially mitigated by choosing appropriate building and structural materials and surface treatments (i.e., paints or coatings designed to reduce contrast and reflectivity). A careful study of the site should be performed to identify appropriate colors and textures for materials; both summer and winter appearance should be considered, as well as seasons of peak visitor use. The choice of colors should be based on the appearance at typical viewing distances and consider the entire landscape around the proposed development. Appropriate colors for smooth surfaces often need to be two to three shades darker than the background color to compensate for shadows that darken most textured natural surfaces.

Specific mitigation measures include the following:

- Materials and surface treatments should repeat and/or blend with the existing form, line, color, and texture of the landscape.

- If the project will be viewed against an earthen or other non-sky background, appropriately colored materials should be selected for structures, or appropriate stains/coatings should be applied to blend with the project's backdrop.

- Materials, coatings, or paints having little or no reflectivity should be used whenever possible.

- Grouped structures should all be painted the same color to reduce visual complexity and color contrast.

- Camouflage treatment may be appropriate in highly sensitive areas to reduce project visibility and contrast.

- Above-ground pipelines should be painted/coated to match their surroundings.

- Electricity transmission/distribution projects should utilize nonspecular conductors and nonreflective coatings on insulators.

- Monopoles may reduce visual impacts more effectively than lattice towers in foreground and midground views, while lattice towers may be more appropriate for more distant views, where the latticework would "disappear," allowing background textures to show through.

- Lighting for facilities should not exceed the minimum required for safety and security, and designs that minimize upward light scattering (light pollution) should be selected.

Mitigation Measures Related to Construction. Visual impacts associated with construction activities can be partially mitigated by implementing the following measures, where feasible:

- Where possible, staging areas and laydown areas should be sited outside the viewsheds of KOPs and not in visually sensitive areas; they should be sited in swales, around bends, and behind ridges and vegetative screens.

- A site reclamation plan should be in place prior to construction. Reclamation of the construction ROW should begin immediately after construction to reduce the likelihood of visual contrasts associated with erosion and invasive weed infestation and to reduce the visibility of impacted areas as quickly as possible.

- Visual impact mitigation objectives and activities should be discussed with equipment operators before construction activities begin.

- Penalty clauses should be used to protect trees and other sensitive visual resources.

- Existing rocks, vegetation, and drainage patterns should be preserved to the maximum extent possible.

- Valuable trees and other scenic elements can be protected by clearing only to the edge of the designed grade manipulation and not beyond through the use of retaining walls, and by protecting tree roots and stems from construction activities. Berms can also be used to protect trees from blasting. Brush-beating or mowing rather than vegetation removal should be done where feasible.

- Slash from vegetation removal should be mulched and spread to cover fresh soil disturbances (preferred) or should be buried. Slash piles should not be left in sensitive viewing areas.

- Installation of gravel and pavement should be avoided where possible to reduce color and texture contrasts with the existing landscape.

- Horizontal and vertical pipeline bending should be used in place of cut and fill activities where feasible.

- For road construction, excess fill should be used to fill uphill-side swales to reduce slope interruption that would appear unnatural and to reduce fill piles.

- The geometry of road ditch design should consider visual objectives; rounded slopes are preferred to V-shaped and U-shaped ditches.

- Road-cut slopes should be rounded, and the cut/fill pitch should be varied to reduce contrasts in form and line; the slope should be varied to preserve specimen trees and nonhazardous rock outcroppings.

- Planting pockets should be left on slopes where feasible.

- Benches should be provided in rock cuts to accent natural strata.

- Topsoil from cut/fill activities should be segregated and spread on freshly disturbed areas to reduce color contrast and aid rapid revegetation. Topsoil piles should not be left in sensitive viewing areas.

- Disposal of excess fill material downslope should be avoided in order to avoid creating color contrast with existing vegetation/soils.

- Excess cut/fill materials should be hauled in or out to minimize ground disturbance and impacts from fill piles.

- Soil disturbance should be minimized in areas with highly contrasting subsoil color.

- Split-face rock blasting should be employed to minimize unnatural form and texture resulting from blasting. Rock stains or asphalt coatings could be applied to minimize the color contrasts of newly exposed rock.

- Construction on wet or frozen soils should be avoided to reduce erosion.

- Communication and other local utility cables should be buried where feasible.

- Culvert ends should be painted or coated to reduce color contrasts with existing landscape.

- Signage should be minimized; reverse sides of signs and mounts should be painted or coated to reduce color contrasts with the existing landscape.

- The burning of trash should be prohibited during construction; trash should be stored in containers and/or hauled off-site.

- Litter must be controlled and removed regularly during construction.

- Dust abatement measures should be implemented in arid environments to minimize the impacts of vehicular and pedestrian traffic, construction, and wind on exposed surface soils.

Mitigation Measures Related to Operations and Maintenance. Visual impacts associated with operation and maintenance activities could be partially mitigated by implementing the following measures, where feasible:

- Interim restoration should be undertaken during the operating life of the project as soon as possible after disturbances.

- Maintenance activities should include dust abatement (in arid environments), litter cleanup, and noxious weed control.

- Use of lighting at facilities should be minimized to reduce light pollution.

- Road maintenance activities should avoid blading existing forbs and grasses in ditches and adjacent to roads.

Mitigation Measures Related to Reclamation. As noted above, a reclamation plan that includes visual impact mitigation measures should be in place prior to construction, and reclamation activities should be undertaken as soon as possible after disturbances occur and be maintained throughout the life of the project. The following reclamation activities/practices can partially mitigate visual impacts associated with electricity transmission/distribution lines and pipelines, where feasible:

- All above-ground and near-ground structures should be removed.

- Soil borrow areas, cut and fill slopes, berms, waterbars, and other disturbed areas should be contoured to approximate naturally occurring slopes, thereby avoiding form and line contrasts with the existing landscapes. Contouring to rough texture would trap seed and discourage off-road travel, thereby reducing associated visual impacts.

- Cut slopes should be randomly scarified to reduce texture contrasts with existing landscapes and aid in revegetation.
- Disturbed areas should be covered with stockpiled topsoil or mulch and revegetated by using a mix of native species selected for visual compatibility with existing vegetation.
- Gravel and other surface treatments should be removed or buried.
- Rocks, brush, and forest debris should be restored whenever possible to approximate preexisting visual conditions.
- Edges of revegetated areas should be feathered to reduce form and line contrasts with the existing landscapes.

3.10 CULTURAL RESOURCES

3.10.1 What Are Cultural Resources?

Cultural resources include archaeological, historic, architectural sites or structures, or places from the past having important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social or cultural groups, such as American Indian Tribes ("traditional cultural properties"). Cultural resources can be either man-made or natural physical features associated with human activity and, in most cases, are unique, fragile, and nonrenewable. Cultural resources that meet the eligibility criteria (Text Box 3.10-2) for listing on the NRHP are termed "historic properties" under the National Historic Preservation Act (NHPA).

Text Box 3.10-1
Why Is It Important to Take Cultural Resources into Account?

Cultural resources are important to maintaining our heritage and are physical connections to our past. Cultural resources are also nonrenewable. Once removed, they are irreplaceable.

3.10.1.1 What Laws and Regulations Address Cultural Resources, and How Are the Agencies Meeting Their Responsibilities?

The NHPA is a comprehensive law that creates a framework for managing cultural resources in the United States. The law expands the NRHP; establishes SHPOs, Tribal Historic Preservation Officers, and the Advisory Council on Historic Preservation; and provides a number of mandates for federal agencies. Section 106 of the NHPA directs all federal agencies to take into account the effects of their undertakings (actions and authorizations) on cultural resources included in or eligible for the NRHP ("historic properties"). Section 106 of the Act is implemented by regulations of the Advisory Council on Historic Preservation (36 CFR 800).

Section 106 regulations permit agencies to integrate compliance with the NEPA process. The agencies are complying with their Section 106 responsibilities for this PEIS through this provision. As a land use planning action, this PEIS represents the first phase of the Section 106 process, and compliance is focused on consultation and the programmatic definitions of resources that might be affected, the types of effects that might be anticipated, and recommendations for agencies to avoid, minimize, or mitigate adverse effects if development does occur within the energy corridors. Full compliance with Section 106 would occur when specific proposals for corridor development are acted upon.

In addition, numerous other laws, regulations, policies, and Executive Orders pertaining to cultural resources apply to federal agencies and to either projects undertaken on federal land or which require federal permitting or funding. The major requirements are listed in Table 3.10-1 and would apply to future development within the corridors.

Text Box 3.10-2
NRHP Criteria for Significance

"The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and..." meet one or more of the following four criteria for evaluation: A, B, C, or D.

Criterion A: Associative Value – Event. "Properties can be eligible for the *National Register* if they are associated with events that have made a significant contribution to the broad patterns of our history."

Criterion B: Associative Value – Person. "Properties can be eligible for the *National Register* if they are associated with the lives of persons significant in our past."

Criterion C: Design or Construction Value. "Properties can be eligible for the *National Register* if they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction."

Criterion D: Information Value. "Properties can be eligible for the *National Register* if they have yielded, or may be likely to yield, information important in prehistory or history."

Also applicable is a special criteria consideration:

Criteria Consideration G: Properties That Have Achieved Significance within the Last Fifty Years. "A property achieving significance within the last fifty years is eligible if it is of exceptional importance."

3.10.1.2 How Are Cultural Resources Managed on Federal Lands?

Cultural resources on federal lands are managed primarily through application of the laws identified in Table 3.10-1. Most federal agencies have published guidance on how to appropriately apply the laws governing the management of cultural resources on their lands. The BLM maintains the 8100 Series manual and handbooks, which outline cultural resources management on land it manages. DOD Instruction 4715.3, "Environmental Conservation," outlines cultural resources management procedures for the military. The individual branches of the military have also produced additional guidance. The FS issued the manual *Title 2300 – Recreation, Wilderness, and Related Resource Management* for lands under its management, and the DOE issued the policy statement DOE P 141.1, "Department of Energy Management of Cultural Resources," and guidance for development of Cultural Resource Management Plans (DOE G 450.1-3).

Many federal agencies have been actively engaged in inventorying the properties they manage for cultural resources, as required by Section 110 of the NHPA (16 USC 470h-2). The agencies also conduct project-specific surveys as required by Section 106 of the NHPA in areas that will be affected by a project, and most recorded cultural resources have been identified through these surveys. Once identified, Section 106 requires that the resources be evaluated for significance according to NRHP criteria (see Text Box 3.10-2). Agency managers must consider the effects of projects, such as proposed ROWs, on those resources that meet the criteria for eligibility to the NRHP.

The total amount of land surveyed by the BLM for cultural resources on all of its holdings (261,000,000 acres) is 17,214,460 acres with roughly 279,000 cultural resources being identified (BLM 2005e). The FS manages

TABLE 3.10-1 Cultural Resource Laws and Regulations

Law or Order Name	Intent of Law or Order
Antiquities Act of 1906	This was the first law to protect and preserve cultural resources on federal lands. It makes it illegal to remove cultural resources from federal land without a permit, establishes penalties for illegal excavation and looting, and allows the President to establish historical monuments and landmarks.
National Historic Preservation Act (1966) (NHPA)	This law created the legal framework for considering the effects of federal undertakings on cultural resources in the United States. The law expands the NRHP, establishes the Advisory Council on Historic Preservation, State Historic Preservation Offices, and Tribal Historic Preservation Offices. Section 106 and its accompanying regulations direct all agencies to take into account the effects of their actions on properties included in or eligible for the NRHP, and establishes the process for doing so.
E.O. 11593, "Protection and Enhancement of the Cultural Environment" (1971)	E.O. 11593 directs federal agencies to inventory their cultural resources and to record to professional standards any cultural resource that may be altered or destroyed.
Archaeological and Historic Preservation Act (1974) (AHPA)	The AHPA addresses impacts to cultural resources resulting from federal activities and provides a funding mechanism to recover, preserve, and protect archaeological and historical data.
Archaeological Resources Protection Act of 1979 (ARPA)	ARPA establishes civil and criminal penalties for the unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources, prohibits trafficking in resources from public lands, and directs federal agencies to establish educational programs on the importance of archaeology.
American Indian Religious Freedom Act of 1978 (AIRFA)	AIRFA protects First Amendment guarantees to religious freedom for American Indians. It requires federal agencies to consult when a proposed land use might conflict with traditional Indian religious beliefs or practices, and to avoid interference to the extent possible.
Native American Graves Protection and Repatriation Act of 1990 (NAGPRA)	NAGPRA establishes the rights of Indian Tribes to claim ownership of certain "cultural items," including human remains, funerary objects, sacred objects, and objects of cultural patrimony. It requires federal agencies and museums to identify holdings of such remains and work towards their repatriation. Excavation or removal of such cultural items requires consultation, as does discovery of these items during land use activities.
E.O. 13007, "Indian Sacred Sites" (1996)	E.O. 13007 defines sacred sites and directs agencies to accommodate Indian religious practitioners' access to and use of sacred sites, avoid adverse effects, and maintain confidentiality. It does not create new rights, but strongly affirms those that exist.
E.O. 13287, "Preserve America" (2003)	E.O. 13287 encourages the federal government to take a leadership role in the protection, enhancement, and contemporary use of historic properties and establishes new accountability for agencies with regard to inventories and stewardship.
National Environmental Policy Act (NEPA)	This law requires federal agencies to analyze the impacts of an action on the human environment, to ensure that federal decision makers are aware of the environmental consequences of a project before implementation.
Federal Land Policy and Management Act of 1976 (FLPMA)	This act requires the BLM and FS to manage their lands on the basis of multiple use in a manner that will "protect the quality of…historical…resources and archeological values." It is a comprehensive law that provides for long-range land use planning, permits to regulate use of the public lands, and enforcement of public land laws and regulations.

193,229,415 acres across the nation. On these lands, 318,259 cultural resources have been identified (FS 2005). DOD manages 29.7 million acres in the United States. DOD has surveyed approximately 28% of its lands, and currently manages more than 155,000 identified archaeological sites.

3.10.2 What Are the Cultural Resources Associated with Energy Corridors in the 11 Western States?

3.10.2.1 Regional Prehistoric Cultural Contexts

Cultural resources are the physical evidence of past human activity. Through archaeology and ethnographic research, scientists have developed an historic framework for understanding how North America was settled and how Native peoples lived on this continent prior to the arrival of Europeans. The history of Native Americans in the 11 western states is commonly approached by dividing the American West into six cultural areas: Great Basin, Southwest, Plains, Plateau, California, and the Northwest Coast (see Figure 3.10-1). These cultural areas generally correspond to the major physiographic regions of the American West. The Native groups in a given cultural area had to adapt to the regional climate and environment in order to survive. As a result, there are certain shared ways of life that characterize each region. Table 3.10-2 provides a summary of the major prehistoric periods and the types of cultural resources associated with each culture area. The cultural resource types presented in Table 3.10-2 represent the most common remains associated with each time period, not the total range of cultural resources associated with each time period. More detailed historical chronologies and discussions of known cultural resource types are found in Appendix Q.

3.10.2.2 What Is the Historical Setting of the Western United States?

Historic period cultural resources occur across all 11 western states. As with the prehistoric periods, Euro-American settlement and use of the West can also be understood through adaptation to the six cultural regions that loosely correspond to the major physiographic regions of the West. While there is considerable overlap in the general types of cultural resources that are found in the West, there is considerable regional variability. Table 3.10-3 lists the cultural areas and historic era cultural resource types by state. Again, this list of cultural resource types is not comprehensive, but is intended to provide the most common site types. Additional information on the historic context for the 11 western states and the types of resources expected for each area is presented in Appendix Q.

3.10.3 How Were the Potential Effects of Corridor Designation to Cultural Resources Evaluated?

The analysis used in the PEIS regarding cultural resources attempts to characterize the types of cultural resources that could be found in the energy corridors being designated. This section contains summary tables of the historic and prehistoric time periods and their associated cultural resource types. This information is intended to provide an understanding of the cultural resources that could potentially be encountered in the proposed energy corridors. The summary tables are based on Appendix I, which contains a more thorough discussion of the various time periods.

While the scope of the PEIS does not allow examination of any particular locations or individual cultural resources, it was possible to collect cultural resources data on the Proposed

TABLE 3.10-2 Time Periods and Examples of Characteristic Cultural Resources for Culture Areas in the 11 Western States

Culture Area	Paleoindian	Middle Period or Archaic	Late or Sedentary Period
Northwest Coast	*10,500+ to 4000 BC* Cave or rockshelter occupation sites	*4000 BC to AD 200* Open campsites	*AD 200 to 1750* Semisubterranean house villages Open campsites Tent camps
California	*9000(?) to 6000 BC* Open campsites Animal kill or processing sites	*6000 to 3000 BC* Open campsites Coastal villages Plant and seafood processing sites	*3000 to AD 1750* Large coastal villages Burial mounds Extensive seafood and sea mammal processing sites Intensive plant processing sites Prehistoric trails
Great Basin	*9500+ to 6000 BC* Open campsites Cave occupation sites Lithic processing sites Animal kill or processing sites	*6000 to 2000 BC* Cave or rockshelter occupation sites Pithouse villages Plant processing sites Fishing sites Lithic processing sites Animal kill or processing sites	*2000 to AD 1750* Cave or rockshelter occupation sites Tipi ring sites Cave burials Cairns and cairn lines Small pithouse villages Plant processing sites Storage pits Lithic processing sites Pictograph and petroglyph sites Animal kill or processing sites Prehistoric roads
Southwest	*12,000 to 6000 BC* Open campsites Animal kill or processing sites Cave occupation sites Lithic processing sites	*6000 to 1 BC* Open campsites Cave or rockshelter occupation sites Pithouses and storage pits Wattle-and-daub structures Lithic processing sites Pictograph and petroglyph sites	*AD 1 to 1750* Pithouse villages Storage pits Above-ground structures (pueblos) Below-ground structures (kivas) Irrigation ditches Roads Navajo hogans and pueblitos Pictograph and petroglyph sites Intaglios Prehistoric roads or trails
Plains	*10,000 to 6000 BC* Open campsites Cave or rockshelter occupation sites Animal kill or processing sites Lithic processing sites	*6000 to 1 BC* Open campsites Cave or rockshelter occupation sites Pithouses and storage pits Tipi ring sites Cairns and cairn lines	*AD 1 to 1750* Open campsites Tipi ring sites Wattle-and-daub structures Earthlodge villages Burial mounds Storage pits

TABLE 3.10-2 (Cont.)

Culture Area	Paleoindian	Middle Period or Archaic	Late or Sedentary Period
Plains (Cont.)		Animal kill or processing sites Lithic processing sites Plant processing sites	Cave or rockshelter occupation sites Small pithouse villages Cairns and cairn lines Animal kill and processing sites Lithic processing sites Plant processing sites Pictograph and petroglyph sites Prehistoric trails
Plateau	*10,000 to 6000 BC* Open campsites Cave or rockshelter occupation sites Fishing sites Lithic processing sites Animal kill or processing sites	*6000 to 2000 BC* Open campsites Small pithouse villages Cave occupation sites Animal or fish processing sites Plant processing sites Animal kill or processing sites	*2000 to AD 1750* Pithouse and longhouse villages, often with burials Tipi ring sites Cave burials Cairns and cairn lines Open campsites Cave occupation sites Storage pits Animal or fish processing sites Lithic processing sites Plant processing sites Pictograph and petroglyph sites Animal kill or processing sites Prehistoric trails

Source: Modified from BLM (2005h).

Action and analyze it using a GIS. Information on known cultural resources within a 2-mile-wide corridor was requested from cultural resources managers within each of the affected states. The data received varied in completeness and detail. A discussion of the information collected for the project is provided in Appendix Q.

Generally, some information on known cultural resources within a corridor was provided, as well as the number of cultural resources eligible for the NRHP. Traditional cultural properties were not identified specifically. (See Section 3.11 for a discussion of Native American resources, including traditional cultural properties, and Appendix C, which includes a discussion of Tribal consultation undertaken for the PEIS.) In a few instances, no information about cultural resources within a specific corridor was available. By combining the historic and prehistoric contexts with the information collected from cultural resources managers, it is possible to get an understanding of the current level of knowledge of cultural resources for most states. Only project-specific investigations would identify the actual cultural resources within a proposed corridor.

TABLE 3.10-3 Major Culture Areas and Historic Period Site Types (AD 1550 to present) Listed by State

State	Proposed Corridor Area (acres)	Culture Areas	Range of Historic Resources
Arizona	288,703	Southwest, Great Basin	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, CCC camps, and railroads.
California	309,499	California, Great Basin	Missions, towns, forts, mining-related sites, logging-related sites, agricultural sites, railroads, CCC camps, and historic trails.
Colorado	268,223	Great Basin, Plains, Southwest	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, CCC camps, and railroads.
Idaho	186,346	Great Basin, Plateau	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, and railroads.
Montana	52,748	Plains, Plateau, Great Basin	Fur trade sites, trading posts, military outposts, historic trails, farming sites, ranching sites, mining sites, and railroads.
Nevada	1,034,446	Great Basin	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, and railroads.
New Mexico	126,697	Southwest, Plains	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, and railroads.
Oregon	240,245	Great Basin, Plateau, Northwest Coast	Fur trade sites, trading posts, military outposts, historic trails, farming sites, ranching sites, mining sites, and railroads.
Utah	335,148	Great Basin	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, and railroads.
Washington	7,871	Northwest Coast, Plateau	Fur trade sites, trading posts, logging sites, sawmills, agricultural sites, fishing-related sites, and historic trails.
Wyoming	196,902	Great Basin, Plains	Historic trails, fur trade sites, agricultural sites, ranching sites, mining-related sites, logging sites, military outposts, and railroads.

3.10.4 What Are the Potential Effects to Cultural Resources of the Alternatives, and How Do They Compare?

3.10.4.1 No Action Alternative

Under No Action, no Section 368 energy corridors would be designated. Proposed energy development projects would follow existing siting and development requirements and procedures. Siting would be driven by the needs of the developer, with cultural resources in proposed ROWs being considered by federal agencies during the NEPA or other permitting process. Preexisting designated energy corridors would be available for use in siting.

Under No Action, energy transport ROWs are not as likely to be colocated, but would rather be implemented within individual project-specific ROWs, each with its own access roads and support facilities (such as electrical substations or pump stations). Cultural resources within each project ROW could be impacted as a result of development. Some cultural resources could be placed under direct threat just as a result of access. The authorization and development of multiple ROWs could result in increased access to previously inaccessible cultural resources, which could, in turn, lead to illegal looting, erosion, disturbance, and other alteration of those resources.

3.10.4.2 The Proposed Action

The designation of energy corridors and land use plan amendments under the Proposed Action are not expected to affect cultural resources in the 11 western states.

In the second step of the siting process (Section 2.2.1.2), information pertaining to cultural resources located in the preliminary corridors was collected from the affected states. Table 3.10-4 presents the information collected in this effort. (See Appendix R for a more detailed discussion of the data request.) Based on this information, some corridor locations were altered to avoid key cultural resource areas. Unfortunately, much of the information collected was not of sufficient detail or breadth for use in siting the corridors; however, the information does illustrate the current level of knowledge of cultural resources in the vicinity of the corridors (see Section 1.9.3 for a discussion on how this information was considered), and is presented here to demonstrate the potential occurrence of cultural resources within any West-wide network of energy corridors. Table 3.10-4 indicates the reported number of cultural resources found within 1 mile of the preliminary corridor centerlines for each state and the reported percentage of this land for each state that has been previously surveyed for cultural resources. In most cases, data was available for only a portion of a state or corridor.

Table 3.10-4 shows that an average of only 7% of the land within 1-mile of the corridor centerlines has been surveyed for cultural resources. It is almost certain that additional cultural resources exist in the unexamined sections of the proposed corridors. In addition, the historical significance of most cultural resources that have been identified in these areas is unknown. The surveys indicate only if a cultural resource is present.

Respondents to the data request also indicated that several historic districts and areas having a high potential sensitivity for cultural resources would likely be crossed by the corridors proposed at the July 2006 data call. Sensitivity refers to the likelihood of the presence of cultural resources based on environmental factors such as water or landforms used by prehistoric people rather than specific knowledge of resources being present. A primary conclusion drawn from the data request was that most of the cultural resources within the proposed corridors have yet to be identified. It is also clear that mitigation

TABLE 3.10-4 Cultural Resource Site and Survey Information Reported for the Proposed West-wide Energy Corridors[a]

State	Data Source	Corridor Acres	Surveyed Acres	Corridor Surveyed	Cultural Resources	NRHP Eligible
Arizona	SHPO/FS	1,087,674	61,785	6%	2,641	1,332[b]
California	SHPO/BLM/FS	1,270,259	53,305	4%	2,182	NDR[c]
Colorado	SHPO/FS	686,052	275,885	40%	2,101	NDR
Idaho	SHPO/FS	653,389	NDR		975	NDR
Montana	FS (Custer NF)	402,301	946	<1%	14	NDR
Nevada	SHPO/BLM/FS	2,257,029	15,115	<1%	2,495	20
New Mexico	BLM	669,590	39,130	6%	1,147	NDR
Oregon	SHPO	1,116,005	NDR		719	NDR
Utah	SHPO	965,530	228,083	23%	1,230	449
Washington	NDR	135,649	NDR	NDR	NDR	NDR
Wyoming	SHPO	807,119	NDR	NDR	5,341	1,041

[a] Data collected based on July 2006 preliminary corridor locations. See Appendix R for more information on the data collected for this table.

[b] Includes both cultural resources that are eligible for the NRHP and those that are unevaluated.`

[c] NDR = no data received during the cultural resources data request.

measures for cultural resources will be a necessary consideration of any future development.

Traditional cultural properties of interest to Native Americans may occur within the corridors, and will need to be identified during consultation with affected Tribes at the project development stage. Though some Tribes did identify such resources for avoidance during corridor siting, others preferred to wait until actual impacts are known. (See Appendix C for a discussion of the Native American consultations undertaken for the PEIS.)

All six of the cultural areas identified in Section 3.10.3 — Great Basin, Southwest, California, Plains, Plateau, and Northwest Coast — contain proposed corridors (see Figure 3.10-2). There is the potential for any of the cultural resource types identified in Tables 3.10-2 and 3.10-3 and Appendix Q to be present. The Great Basin region has the highest concentration of proposed corridors, thus making cultural resources in this region more likely to be present. Examples of the prehistoric era cultural resources in the Great Basin include open campsites, pithouse villages, plant processing sites, and lithic processing sites.

Some of the types of historic era cultural resources associated with the Great Basin include historic trails, fur trade sites, ranching sites, agricultural sites, mining-related sites, and logging sites. Large portions of the California and Plains cultural areas are privately held and are not subject to corridor designation.

National historic trails would be crossed by energy corridors under the Proposed Action. Table 3.10-5 identifies the trails that would be crossed. Historic trails, while covering long distances, do not retain their integrity in all locations. Attempts were made during siting to avoid crossing pristine sections of national historic trails. Many trails are crossed by the proposed corridors in locations where current infrastructure is present, in an attempt to minimize future issues. Designation of the proposed energy corridors is not expected to affect national historic trails.

TABLE 3.10-5 National Historic Trails Likely to Be Crossed by the Proposed Corridors

State	Trail(s)
Arizona	Juan Batista de Anza Old Spanish Trail
California	California Juan Batista de Anza Old Spanish
Colorado	Old Spanish
Idaho	California Nez Perce Oregon
Montana	Lewis and Clark Nez Perce
Nevada	California Old Spanish Pony Express
New Mexico	El Camino Real de Tierra Adentro Old Spanish
Oregon	California Lewis and Clark Oregon
Utah	California Old Spanish Pony Express
Wyoming	California Cherokee Mormon Oregon Overland Pony Express
Washington	Lewis and Clark

3.10.5 Following Corridor Designation, What Types of Impacts Could Result to Cultural Resources with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

3.10.5.1 What Are the Usual Impacts to Cultural Resources of Building and Operating Energy Transport Projects?

Direct and indirect impacts to cultural resources can be determined only on a project-specific basis for which the anticipated parameters of an undertaking are known. However, certain activities associated with development of an energy transport project have a high potential to impact cultural resources. Earthmoving activities (e.g., grading and digging) have the highest potential for disturbing or destroying significant cultural resources, while pedestrian and vehicular traffic and indirect impacts of earthmoving activities, such as soil erosion, may also have an effect. Visual impacts on significant cultural resources, such as sacred landscapes, historic trails, and other viewsheds, may also occur. Table 3.10-6 lists common types of cultural resources, the types of activities that impact the resources, and common mitigation for these impacts.

TABLE 3.10-6 Cultural Resource Types, Impacts, and Mitigation from Energy Development

Cultural Resource Types	Examples	Impacts	Mitigation
Archaeological sites	Prehistoric activity center, prehistoric village site, historic cabin, railroad camps	*Surface:* Material collected or removed. Mixing with other materials from same areas. Crushing of artifacts from heavy machinery. *Subsurface:* Material excavated and removed, material being redeposited.	Avoidance, consultation with appropriate stakeholders, scientific excavation of portions of an archaeological site, complete excavation of a archaeological site, monitoring of development to minimize effects.
Structures	Prehistoric Pueblo dwellings, bridges, historic farmsteads or ranches, prehistoric cliff dwellings	Portions of key structures being removed or demolished; alteration of the setting could reduce character of dwelling, vibrations from heavy machinery could compromise structural stability.	Avoidance, documentation of structure, stabilization and rehabilitation of a structure, reconstruct structure in a new location.
Landscape	National historic trails, prehistoric trails and roads, mining districts, battlefields	Intrusion of modern development into an area with integrity, earthmoving that could remove evidence of past activities.	Avoidance, placement of development to minimize effect on landscape, limit type of development to low visibility types.
District	Historic districts, archaeological districts	Removal or alteration of key components to a district, earthmoving activities that could destroy surface or subsurface evidence of past activities, intrusion of modern development in a area that retains historic character.	Avoidance, placement of development to minimize effect on district, documentation of district prior to modification, stabilization of components of district.
Traditional cultural property[a]	Resource collection areas, mountain or river area, burials	Removal of specific plant resources, alteration of animal migration routes, unauthorized removal of funerary object, intrusions of modern development into a sacred landscape.	Mitigation may not be possible; consultation with affected community or Tribe, avoidance, replanting in new locations of specific resources, restrict the type of development to minimize visibility, monitoring by Native Americans to protect key resources.

[a] See Table 3.11-3 for a more detailed description of Tribal traditional cultural properties.

Project area preparations have the greatest potential for direct impacts to cultural resources; these activities tend to disturb larger areas than construction activities. Vehicular traffic and ground clearing (such as the removal of vegetative cover) can directly affect cultural resources, if they are present in the project area, by compacting soils, potentially crushing artifacts, disturbing historic features (e.g., trails); vibrations may compromise various site types such as deteriorated structures, displacing cultural material from its original context. Preparations are more likely to impact surface features of a cultural resource than subsurface features. These activities could also impact areas of interest to Native Americans, such as sacred areas or areas used for harvesting traditional resources, such as medicinal plants. Indirect effects on cultural resources could occur through an increased potential for soil erosion as a result of these activities. Other possible impacts could involve the collection of artifacts by workers, or amateur collectors gaining access to areas that may have been previously inaccessible to the public. Although the activities that occur during initial site development are characterized as temporary actions, cultural resources are nonrenewable and, once impacted (i.e., removed or damaged), cannot be recovered and returned to their proper context.

The construction of a new transmission line or a pipeline has the potential to adversely affect cultural resources, because of the ground disturbance during this phase. The amount of area disturbed could be considerable (generally double the normal ROW) and could destroy cultural resources. Construction activities have a greater potential for disturbing subsurface features of a cultural resource. As previously stated, an indirect effect of ground disturbance could be soil erosion, which could also impact cultural resources outside the construction footprint. There is a potential for greater impacts to subsurface cultural resources with a pipeline construction project due to the larger area excavated compared to that needed for a transmission line. The need for pump stations associated with pipelines requires that more area be modified than is needed for transmission line substations. Access roads along a transmission or pipeline route could provide access to areas that might have been previously inaccessible.

Any increase in the presence of humans in an uncontrolled and unmonitored environment containing significant cultural resources increases the potential for adverse impacts caused by looting (unauthorized collection of artifacts), vandalism, and inadvertent destruction to unrecognized resources. In addition, visual impacts on cultural resources could occur during the construction phase. Large areas of exposed ground surface, increases in dust, and the presence of large-scale machinery, equipment, and vehicles could contribute to adverse impacts on cultural resources (e.g., those with a landscape component that contributes to their significance, such as a historic trail or sacred landscape).

The potential for impacts resulting from operation are primarily limited to those caused through the access to remote areas provided by access roads. Nevertheless, human presence increases the likelihood of unauthorized collection of artifacts and vandalism, as well as inadvertent destruction of unrecognized resources. In addition, there may be visual impacts on the resources, since the visible transmission line towers may be perceived as intrusions on sacred or historical landscapes. If the development site would need to be expanded during operation, the impacts would be similar to those associated with construction.

3.10.5.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Cultural Resources?

Project-specific development is subject to full compliance under Section 106 of the NHPA. Compliance includes consultation with the appropriate SHPO(s), affected Tribes, and other stakeholders to identify, evaluate, and avoid, minimize, or mitigate adverse impacts to historic properties. Tribal consultation is also necessary to establish whether the project is likely to disturb traditional cultural properties, graves, and funerary objects; affect access rights to particular locations; disrupt traditional cultural practices; and/or visually impact areas important to the Tribe(s).

Mitigation plans regarding effects to historic properties shall be developed in consultation with SHPOs and other relevant parties as designated in the Section 106 regulations, and should be included as part of the CRMP. Mitigation measures may include the following actions as appropriate:

- Mitigating potential visual impacts from development on or near national historic trails that are eligible for listing on the NRHP may include avoiding linear projects parallel to a trail, restricting the width of a working ROW within a visual buffer on either side of a trail, and minimizing impacts by crossing at 90° to the trail. When possible, the proposed disturbance should be relocated to where it would be less visible from the trail (i.e., behind a rise). Special rehabilitation measures such as revegetation may help reduce the visual impacts on the trail. Also, special interpretive measures (such as signing) may be appropriate.

- Avoidance of impacts to historic properties is the preferred mitigation option.

- When looting, vandalism, erosion, or other indirect effects might occur as the result of project development, the mitigation plan should establish a monitoring program and identify other measures, as appropriate.

- Where looting and vandalism are issues, mitigation measures involving educating workers and the public regarding the consequences of unauthorized collection of artifacts and destruction of property on public land may be appropriate. Periodic surveillance of significant cultural resources in the vicinity of development projects may also help curtail potential looting/vandalism and erosion impacts. If impacts are recognized early, additional actions should be taken before the resource is destroyed.

- Where development places historic properties at risk from vandalism and looting, as determined by the authorizing officers during the NEPA analysis, project proponents may contribute to a mitigation fund to be used to mitigate these activities, including, but not limited to, support for a local site steward or other monitoring programs; signage, fencing, vegetation screens, or other protective measures; and interpretation of project findings to encourage local awareness and protection of historic properties. Measures taken should be established during the Section 106 process, subject to approval of the POC, and they should be appropriate to the resources to be protected and local circumstances.

- When cumulative and indirect effects are identified as issues in the CRMP, project proponents may contribute to a cumulative and indirect effects fund to mitigate these effects. Such funds may be used to monitor and identify long-term and cumulative effects of development on certain types of resources (e.g., the effects of vibrations from traffic on historic properties such as rock art panels) and for other actions or studies that improve understanding of indirect and cumulative effects and/or provide relief from them. When appropriate, such funds may be expended to develop historic context statements as a basis for identifying significant indirect and cumulative effects and appropriate mitigation and management efforts for them. Contributions should be proportionate to the expected effects and possible mitigation measures, and may be collected from successive project proponents as the corridors are developed. These measures should be established during the Section 106 process and should be subject to the approval of the POC.

- Off-site mitigation should be an option when it benefits historic properties and is approved by the agency POC in consultation with SHPOs and other appropriate parties.

3.11 TRIBAL TRADITIONAL CULTURAL RESOURCES

3.11.1 What Are the Tribal Traditional Cultural Resources Associated with Corridors in the 11 Western States?

3.11.1.1 What Are Tribal Traditional Cultural Resources?

For the purposes of this PEIS, Tribal traditional cultural resources are defined as cultural resources (see Section 3.10) of particular interest to Native American Tribal entities. Tribes maintain a unique relationship to the federal government, and federal lands contain many types of cultural resources that may be of specific interest to Tribes whose ancestors once lived on those lands. Examples of Tribal resources include cemeteries, campsites, and dwelling places associated with Tribal ancestors; traditional hunting, fishing, and gathering places; traditionally important plant and animal species and their habitats; and sacred places, landscapes, and resources important to the free practice of traditional Native American religions and the preservation of traditional Native American cultures. Throughout this section, they are referred to as Tribal resources.

Text Box 3.11-1
What Constitutes a Tribe?

As used in most U.S. laws, the term "Indian Tribe" means any Indian or Alaska Native Tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian Tribe (25 USC 479a).

3.11.1.2 What Is the Legal Framework for Considering Tribal Resources?

The U.S. government has a unique legal and government-to-government relationship with American Indian Tribes as set forth in the U.S. Constitution, treaties, statutes, Executive Orders, and federal court decisions. Since the formation of the Union, the United States has recognized Indian Tribes as domestic dependent nations under its protection. As domestic dependent nations, Indian Tribes exercise inherent sovereign powers over their members and territories (E.O. 13175) and may retain reserved rights beyond current reservation boundaries. Before the arrival of European immigrants, Native American Tribal Nations were sovereign entities governing themselves. The U.S. Constitution recognizes them as such. Treaties concluded between the U.S. government and Tribal Nations, while usually ceding land to the United States, sometimes include rights that the Tribes reserved to themselves, such as access to traditional resources. The terms of these treaties are binding unless specifically abrogated by Congress and take precedent over state law. Many of the lands ceded by Tribes who have retained reserved rights to traditional resources remain in federal hands and may be crossed by the energy corridors proposed in this document. Apart from reserved treaty rights, Native Americans form part of the cultural fabric of the United States. Under the Constitution, as reaffirmed by the American Indian Religious Freedom Act (AIRFA), they are guaranteed the right to freely exercise their traditional religions. This necessarily requires access to sacred sites now on federal land. Places, features, and objects of historical or cultural importance to them are eligible for listing on the NRHP. Because of their sovereign status, consultation with Native American Tribes is a form of government-to-government consultation. Tribal consultation regarding proposed energy corridors is detailed in Appendix C.

Text Box 3.11-2
Why Do Native American Tribes Have a Special Status?

Unlike other units of government within the United States, Tribes are "dependent domestic nations" with sovereignty recognized in the Constitution and treaties negotiated over the years. In these treaties, the United States did not grant rights to the Tribes; rather Tribes reserved rights they had in their preexisting status as sovereign nations.

The special relationship between the federal government and Tribal Nations is expressed in numerous laws that require consultation before actions are taken that could affect Tribal resources. Table 3.11-1 provides a list of these laws and orders. In general, these laws apply to federally recognized Tribes as determined by the Secretary of the Interior (25 USC 479a-1). AIRFA, however, uses a broader definition of "Native American" that includes groups that are not federally recognized. The most significant statutes and Executive Orders relevant to Tribal resources on federal lands are the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990; the American Indian Religious Freedom Act of 1978; E.O. 13007, "Indian Sacred Sites;" the NHPA; and the Archaeological Resources Protection Act of 1979 (ARPA) (Table 3.11-1). NAGPRA establishes that Native American burials, funerary objects, and sacred objects, or objects of cultural patrimony on federal lands belong to Native American Tribes. They belong first to the lineal descendants and secondarily to the affiliated Tribe. Objects of cultural patrimony belong to the Tribe as a whole and cannot be sold, appropriated, or conveyed away from the group even by a member of the group. AIRFA and E.O. 13007 reaffirm Native American rights to practice their traditional culture, and require federal agencies to allow Native Americans access to their sacred places on federal land whenever possible and to consult with the affected Tribes whenever a planned action has the potential to affect a Native American sacred site on federal land. NHPA confirms that Tribal sacred and cultural sites may be found significant and eligible for the NRHP and that Native American cultural authorities must be consulted when evaluating these sites for significance (Parker and King 1988). In addition, NHPA authorizes all federally recognized Indian Tribes to assume any or all of the functions of a SHPO with respect to Tribal land and to designate a Tribal historic preservation officer (THPO). THPOs may have information on Tribal resources beyond reservation boundaries on federal lands. NAGPRA and ARPA require notification of affected Tribes before excavation that could disturb sacred or culturally significant sites on federal land.

3.11.1.3 How Are Tribal Resources on Federal Lands Managed?

Tribal resources on federal lands are managed through the application of the principles of government-to-government consultation expressed in the above laws. Federal agencies have published guidance on how to appropriately include the stewardship of Tribal resources on the lands they manage. These manuals and guides include procedures for consultation, access to sacred sites, Tribal burials, and the repatriation of cultural patrimony. The BLM has produced relevant manuals and handbooks in its 8100 series. Forest Service Manual 1500, *External Relations*, and Handbook 1509.13, *American Indian and Alaska Native Relations Handbook*, deal with Native American issues. The DOD Instruction 4715.3, "Environmental Conservation Program," commits the DOD to follow applicable federal laws and regulations regarding Native American

TABLE 3.11-1 Tribal Resources Laws and Regulations

Law or Order Name	Intent of Law or Order
National Historic Preservation Act (NHPA), as amended (16 USC 470)	This law creates the legal framework for considering the effects of federal undertakings on cultural resources. It declares that traditional Native American properties may be included in the NRHP and requires consultation with relevant Native American Tribes' traditional cultural authorities regarding the status of potentially affected properties.
National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq.)	Implementing regulations (40 CFR 1500–1509) for studies assessing environmental effects of a project or program require agencies to invite Tribes to participate in the scoping process and to consult early with Tribes when their involvement is reasonably foreseeable.
Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1701)	FLPMA requires the Secretaries of Interior and Agriculture to consider the policies of land resource management programs on Tribal lands that have been developed and approved by Tribes when developing or revising agency land use plans.
National Forest Management Act (NFMA) of 1976 (16 USC 472 et seq.)	NFMA directs the U.S. Department of Agriculture's Forest Service to consult with and coordinate forest planning with Tribes.
American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996)	AIRFA protects the right of Native Americans to believe, express, and practice their traditional religions and to have necessary access to their sacred places on federal land. It requires consultation with Native American organizations if an agency action will affect a sacred site on federal lands.
Archaeological Resources Protection (ARPA) Act of 1979 (16 USC 470aa-mm)	ARPA establishes a permit process for the excavation or removal of any archaeological resources from federal lands. It requires notification of the relevant Tribes if the permit may result in harm to, disturbance to, or destruction of any Tribal religious or cultural site.
Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3002)	NAGPRA requires federal agencies to consult with the appropriate Native American Tribes prior to the intentional excavation of human remains and funerary objects and to report unintentionally excavated human remains on federal land to the affected Tribe. It establishes lineal descendants as the owners of cultural items and requires the repatriation of human remains found on agency lands.
Federally Recognized Tribe List Act of 1994 (25 USC 479a-1)	Requires the Secretary of the Interior to publish annually a list of all Indian Tribes which the Secretary recognizes to be eligible for the special programs and services provided by the United States to "Indians because of their status as Indians."

TABLE 3.11-1 (Cont.)

Law or Order Name	Intent of Law or Order
Executive Order 13007, “Indian Sacred Sites” (1996)	E.O. 13007 requires that a federal agency allow Native Americans to worship at sacred sites located on federal property, to give notice to and consult with Tribes when planning actions that might affect these sites.
Executive Order 13175, “Consultation and Coordination with Indian Tribal Governments” (2000)	E.O. 13175 requires federal agencies to develop an “accountable process” for insuring meaningful and timely input by Tribal officials in the development of legislation and regulatory policies that have Tribal implications.

Tribal resources. Individual services have issued internal guidance as well. The DOE issued the DOE P 141.1, “Department of Energy Management of Cultural Resources,” policy statement and “American Indian and Alaska Native Tribal Government Policy” (DOE 2006c).

Federal land managing agencies throughout the western states have active Tribal liaison programs. Through these programs, land managers establish relationships to local Tribal groups. These established relationships allow local national forest and BLM personnel to understand local Native American values, concerns, and priorities. Questions of access and protection and mitigation are usually negotiated locally. Local NHPA Section 106 and 110 inventories include Tribal resources, often classified as traditional cultural properties, or TCPs. However, because Tribes often consider the resources to be sacred, they are usually not willing to specify their exact location, particularly if they are not immediately threatened.

3.11.1.4 Tribal Resources in the West

There are more than 249 federally recognized Tribes with ancestral ties to the 11 western states (see Appendix C). Each Tribe recognizes natural features, natural resources, and artifacts important to its cultural traditions and identity. The specifics of the culturally important resources vary from Tribe to Tribe, depending on its environment, worldview, and other cultural factors. Nonetheless, it is possible to identify general similarities in Native American perspectives and to discuss in broad terms the types of sites and resources that have importance to western Tribes.

Native Americans often take a holistic view of the world, in which each part is seen in relation to the whole. They are less likely to divide the world around them into separate distinct units. Distinctions between the sacred and the secular may be meaningless to them. They are likely to take a view of their environment in which natural features considered inanimate by Western cultures are seen as imbued with a life force, having a will, and being connected to the whole. The taking of game or the gathering of plants or other natural resources may be seen as both a sacred and a secular act (Stoffle et al. 1990). A sacred place need not have any signs of human occupation or modification. It is as likely to be a landscape or natural feature such as a mountain or river, as a confined, easily mapped location. Locations of traditional activities are likely to be important both culturally and spiritually. Tribes often express ties to the land, expressed as sacred trusts, particularly to lands where their ancestors are buried.

Of the 252 Tribal entities contacted by the WWEC project, 44 entered into some level of consultation (Appendix C). Of these, only a few provided information concerning traditional cultural properties. Most took the view that the designation of corridors alone would not directly affect Tribal resources, but wished to be consulted if actual development projects were being planned within the corridors. Those Tribal resources that were reported included sacred mountains, concentrations of rock art, areas where burials were likely, traditional plant resource gathering areas, and traditional game species. These are typical of Tribal resources found throughout the West. Typical categories of Tribal resources are described below. It is likely that Tribal resources occur within the proposed corridors, only small sections of which have been inventoried for cultural resources (Section 3.10). When Tribally sensitive resources were reported, proposed corridor routes were modified to eliminate or minimize adverse impacts, wherever possible.

Sacred places and landscapes include areas associated with important ceremonies and rituals and culturally important practices. These include natural features such as mountains, rivers, lakes, springs, canyons, and old growth forest. They may be the backdrop for traditional lore. They may act as retreats for prayer or figure in important rites of passage such as marriages or vision quests. They may or may not include shrines discernable to outsiders. An environment unsullied by modern development may be critical to their sacred nature, such as views of a sacred mountain or valley, or the quiet and solitude in an important grove of old growth forest (Gulliford, 2000; Little et al. 2001).

Traditional plant gathering areas include locations of culturally important plant resources. They may be plant resources gathered for food, such as pine nuts, acorns, seed bearing grasses, or camas roots. Often these resources are traditionally managed by weeding, watering, burning, pruning, and transplanting — activities that require unimpeded access. Harvests are often communal efforts giving the location social and cultural importance as well. Other plants have medicinal or ritual importance and continue to be harvested. Plants that are ritual necessities are considered sacred resources. Plants were also gathered for fiber, construction, woodworking, and fuel. Each of these activities could have a sacred as well as a profane or mundane component (Stoffle 1990).

Habitats of culturally significant animals include both food animals and animals that are ritually important, playing a role in the mythology of the group. Seen from a holistic perspective, these subsistence resources also have cultural and religious importance and are approached reverentially, even if they are being killed. One consulting Tribal Nation noted that energy corridors often follow game migration routes.

Traditional fisheries are particularly important to groups living along major river systems like the Columbia and California’s Central Valley. Prized, culturally important fishing locations are among the reserved rights included in most Northwest treaties. Tidal zone resources were often managed incorporating prescribed ritual harvesting practices and the elimination of competitor species (Field 2002).

Rock art panels, including both petroglyphs and pictographs, often have a sacred character, as they link contemporary groups with the past. The figures may express important symbolism not readily revealed to outsiders. As with other traditional resources, they need to be seen holistically as part of an encompassing landscape.

Burials and funerary objects are important Tribal resources tying modern groups to their progenitors and to the land. They are one aspect of things that make the land sacred. Native American groups practiced a variety of methods for the disposal of their dead. Whatever the method, Tribes are usually sensitive to disturbance of burials by outsiders, including through scientific excavation.

Archaeological sites, particularly those that can be associated with ancestral populations, have cultural importance to Native American Tribes. They tie the group ritually, culturally, and historically to the landscape. Native Americans may be hesitant to allow excavation of ritually important locations, particularly by outsiders.

3.11.2 How Were the Potential Effects of Corridor Designation to Tribal Resources Evaluated?

The potential effects of corridor designation on Tribal resources were evaluated through a survey of ethnographic literature on Tribal groups in the West and consultation with cultural authorities within those Tribes. The ethnographic survey identified general patterns in each of six widely recognized cultural areas (see Section 3.10 and Appendix Q). As noted above, Tribal groups are reticent to identify traditional use areas and sacred landscapes unless they perceive that they are directly threatened. Most of the groups entering into consultation preferred to wait until specific development plans are proposed before identifying culturally sensitive areas. During the siting process, local knowledge of culturally sensitive areas was solicited from agency field offices. Wherever possible, corridors were sited to avoid known Tribal resources (Section 1.9.3).

Nevertheless, it is likely that Tribal resources are present within the proposed corridors. Only a small fraction of the corridors have been surveyed for cultural resources (see Section 3.10). Any or all of the abovementioned resource types could occur in any of the proposed corridors. Therefore, the impact of designation can only be treated generically.

Section 368 of EPAct is concerned only with the designation of energy corridors on federally managed lands. Energy ROWs crossing Tribal lands are considered under Section 1813 of EPAct and are not dealt with in this PEIS. However, some of the Section 368 corridors proposed for federally managed lands abut or approach Tribal lands. These are listed in Table 3.11-2. In all, 23 Tribal reservations are approached by the corridors proposed here. In every case but one, these corridors approach an existing Tribally designated corridor (12) or existing ROW (20) on Tribal lands.

Project proponents desiring to make use of the Section 368 corridors may also wish to extend energy transmission facilities onto or across Native American lands. Project applicants would secure access to Tribal lands in the same manner that they currently obtain access to those lands, independent of the federal corridor designations. Rights-of-way would be negotiated between energy developers and individual Tribal governments. All federally licensed, permitted, or approved rights-of-way would be subject to Section 106 of the National Historic Preservation Act whether on federal, state, private, or Tribal lands as well as local Tribal regulations and procedures.

3.11.3 What Are the Potential Effects to Tribal Resources of the Alternatives, and How Do They Compare?

The potential effects to Tribal resources are similar to those identified for cultural resources in Section 3.10.3. Since the Proposed Action does not involve any construction or project development, no direct impacts to Tribal resources are anticipated.

3.11.3.1 No Action Alternative

Under No Action, no West-wide system of energy corridors would be designated. Energy projects would be developed following procedures, policies, and requirements now in place for each of the federal land managing agencies and identified in existing federal land use management plans. Colocation of transmission lines and pipelines would not be

TABLE 3.11-2 Tribal Lands Approached by the Proposed Section 368 Energy Corridors

Reservation	Approaching Segment	Corridor Directly Abuts	Existing ROW	Existing Local Corridor
Arizona				
Cocopah Reservation	115-238	No	Elec., railroad	Yes
Hualapai Reservation	47-231	Yes	Elec.	Yes
Kaibab Reservation	113-116	Yes	Elec.	Yes
Navajo Reservation	47-68 & 68-116	Yes	Elec.	No
San Xavier Reservation	234-235	No	Elec., railroad	No
Tohono O'odham Reservation	115-208	No	Elec.	No
California				
Agua Caliente Reservation	30-52	No	Elec., nat. gas, road	No
Kumeyaay Campo Reservation	115-238	No	Elec., road	No
Kumeyaay La Posta Reservation	115-238	No	Elec., road	No
Morongo Reservation	30-52	No	Elec., nat. gas, road, railroad	No
Fort Mojave Reservation	41-47	Yes	None	No
Fort Yuma Quechan Reservation	115-238	Yes	Elec., road	No
Colorado				
Southern Ute Reservation	80-273	No	Nat. gas	No
Montana				
Crow Reservation	79-216	No	Nat. gas	No
Nevada				
Moapa River Reservation	37-232	Yes	None	Yes
Pyramid Lake Reservation	15-17	Yes	None	Yes
Te-Moak Western Shoshone (Elko Band)	17-35	No	Road	Yes
Te-Moak Western Shoshone (Wells Colony)	17-35	Yes	Elec., road	Yes
Walker River Reservation	17-18	Yes	Elec.	Yes
Walker River Reservation	18-224	Yes	None	Yes
New Mexico				
San Felipe Pueblo	80-273	Yes	Nat. gas	Yes
Santa Ana Pueblo	80-273	Yes	Nat. gas	Yes
Zia Pueblo	80-273	Yes	Nat. gas, elec., road	Yes
Utah				
Uintah and Ouray Reservation (Ute)	126-258	No	Elec., road	No

consistently encouraged. Impacts on Tribal cultural resources would remain unchanged.

3.11.3.2 The Proposed Action

Under the Proposed Action, selected corridors on federal lands would be designated as Section 368 energy corridors. The location of known Tribal resources was taken into account during the corridor siting process. There would be no direct impact from designation.

3.11.3.3 Mitigation Measures

Consultation with the affected Tribe(s) is generally required to devise appropriate mitigation measures for Tribal resources. Avoidance is often the preferred mitigation, although other options may be available.

3.11.4 Following Corridor Designation, What Types of Impacts Could Result to Tribal Resources with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

3.11.4.1 What Are the Usual Impacts to Tribal Resources of Building and Operating Energy Transport Projects?

The impacts discussed here are generic impacts of energy development on Tribal resources. These would be expected from development of energy transport facilities anywhere in the 11 western states. Project-specific analyses would be required before development could occur within the corridors. These resources tend to be fragile. For example, noise from construction of a pipeline or transmission line could reduce the quality of a sacred place, as could the visual impact of a completed transmission line. The very presence of a pipeline or transmission line may degrade a sacred landscape. Culturally important plant species may be susceptible to disturbances in their local environments. Major earthmoving activities, particularly during the construction of pipelines, could have major impacts on habitation sites, use places, and structures. The access roads used to maintain the lines in remote areas increase access to those areas. Increased human presence may degrade the solitude of a sacred or ceremonial location, and also make vandalism (the intentional destruction or removal of culturally important sites and artifacts) and unintentional degradation of Tribal resources more likely. Some potential impacts are summarized in Table 3.11-3.

3.11.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Tribal Resources?

As with other cultural resources, recognition and avoidance coupled with timely and meaningful consultation with Native American Tribes are the fundamental means of maximizing mitigation of adverse effects on Tribal resources. It should be noted, however, that even with survey and consultation, not all impacts to Tribal resources can be fully mitigated.

Some specific mitigation measures are listed below:

- The lead agency should consult with Native American governments early in the planning process to identify issues and areas of concern regarding any proposed energy transport project. Such consultation is required by the NHPA and other authorities and is necessary to determine whether construction and operation of the project are likely to disturb Tribal resources, impede access to culturally important locations, disrupt traditional cultural practices, impede the movements of culturally important animals, or visually impact culturally

TABLE 3.11-3 Impacts to Tribal Resources

Resource Type	Examples	Typical Impacting Factors
Sacred sites	Sacred mountains, rock formations, rivers, old growth forests, springs, burials, ceremonial resource collection area, rock art, cairns	Visual intrusions, noise, ground disturbance, increased access, vandalism, erosion, access may be impeded by pipelines
Plant harvesting areas	Food plants (nuts, fruits, roots, seed-bearing grasses), medicinal plants (teas, poultices, washes), fuel, construction, manufacture, ritually important plants	Herbicide application, grading, vegetation clearing, erosion, trampling
Animal habitat	Food animals, ritually important animals (totems)	Increased human presence, increased access for hunting, pipelines may hinder migration routes
Fishing areas	Fishing platforms, riverside, lakeside	Erosion from land clearing and earthmoving, increased access
Rock art	Petroglyphs, pictographs	Blasting, vandalism, loss of context
Cultural patrimony	Sacred/culturally important artifacts	Displacement, vandalism
Burial sites	Stone-lined burials, cave burials, simple burials	Earthmoving activities, land clearing/erosion, increased access/vandalism
Archaeological sites	Dwelling sites, campsites, ritual structures (sweat lodges, kivas)	Earthmoving activities, land clearing/erosion, increased access/vandalism

important landscapes. It may be possible to negotiate a mutually acceptable means of minimizing adverse effects to traditional cultural resources.

- Archaeological surveys and record searches required by Section 106 of the NHPA (see Section 3.10.1) may identify Native American archaeological or other culturally important sites (Parker and King 1998). Consultation with appropriate Native American governments and cultural authorities should be undertaken to validate and determine the importance of identified resources. Appropriate mitigation steps such as avoidance, removal, repatriation, or curation should be determined through this consultation.

- It may not be possible to fully mitigate impacts to sacred areas. Impacts may involve visual impacts to important viewsheds and landscapes. Avoidance is the best policy in these cases. If avoidance is not possible, timely and meaningful consultation with the affected Tribe(s) may result in a mutually acceptable plan to maximize mitigation. Such a plan can include monitoring of construction or operation activities by Native American cultural authorities.

- Springs are commonly sacred and culturally important places, particularly in arid regions. They should be avoided whenever possible. If it is necessary for construction, maintenance, or operation activities to take place in proximity to springs, appropriate measures, such as the use of geotextiles or silt fencing, should be taken to prevent the silt from degrading of water sources (see Section 3.5.4.2). The effectiveness of these mitigating barriers should be monitored. Particulars should be determined in consultation with the appropriate Native American Tribe(s).

- When it is impossible to avoid culturally important plant resources, it may be acceptable to compensate by protecting an equally large tract of the resource elsewhere, or to transplant and establish an equal amount of the resource that will be destroyed to a new appropriate location (Stoffle et al. 1990). Consultations should be undertaken with the affected Tribe(s) to determine whether this is acceptable. Most commonly, monitoring of a transplanted population would be required.

- Avoidance is the preferred mitigation of impacts on Tribal burial sites, but this is not always possible. Consultation with the lineal descendants or Tribal affiliates of the deceased should be undertaken before removing a known burial. Remains and objects should be protected and repatriated according to NAGPRA statutory procedures and regulations. Unanticipated burials are always possible. A contingency plan for dealing with unanticipated burials and funerary goods encountered during construction, maintenance, or operation of an energy transport facility should be developed in consultation with the appropriate Tribal governments and cultural authorities well in advance of construction.

- It may not be possible to completely avoid the habitat of culturally important animals. However, energy transport facilities should be designed to minimize impacts to game trails, migration routes, and nesting and breeding areas of culturally important species. Mitigation and monitoring procedures should be developed in consultation with the affected Tribe(s).

- Traditional Tribal fishing locations should be avoided. When projects cross waters traditionally used for Tribal fishing, care should be taken to preserve the quality of the waters. Riprap, geotextiles, silt fencing, or other suitable means should be employed to prevent silting and erosion at stream crossings (see Section 3.5.4.2). Mitigating procedures and monitoring should be determined in consultation with the affected Native American Tribe(s).

- Archaeological sites created by ancestral Native American populations should be avoided whenever possible. Mitigation by scientific excavation may not always be acceptable to the affected descendant Native American population. Consultation with the affiliated Tribe(s) should be undertaken when planning excavation. Monitoring or participation by Tribal representatives may be acceptable, as may repatriation or approved curation of artifacts considered to be cultural patrimony.

- Panels of petroglyphs and/or pictographs tend to be relatively immobile. Avoidance is the best mitigation. Such panels may be just one component of a larger sacred landscape, and simple avoidance may not be sufficient. Mitigation plans for rock art should be formulated in consultation with the appropriate Tribal cultural authorities.

- Prior to construction, training should be provided to contractor personnel whose activities or responsibilities could impact Tribal resources during construction. Monitoring or participation by Tribal representatives in coordination with the project's environmental compliance officer and other inspectors, the contractor's construction field supervisor(s), and all construction personnel would be expected to play an important role in keeping impacts to Tribal resources as minor as possible.

3.12 SOCIOECONOMIC CONDITIONS

3.12.1 What Are the Current Socioeconomic Conditions of the 11 Western States?

The socioeconomic environment potentially affected by corridor designation and the future development of energy transport projects on federal land includes 11 western states.[10] In the following sections, nine key measures of economic development are described. These are employment, unemployment, personal income, state sales tax and income tax revenues, population, available housing, and local government expenditures and employment. The projected data are presented for each state for 2007 and for a recently preceding period. Forecasts for each measure are based on population forecasts produced by the U.S. Bureau of the Census (2006c) for the period 2004 to 2030. In addition to their use in this PEIS, these data should also be used as the basis for the description of the affected environment at the implementation stage for individual energy transport projects.

[10] The socioeconomic environment also includes a number of Tribal groups and lands (see Appendixes C and K).

3.12.1.1 Employment

In 2003, almost 53% (14.4 million) of all employment in the 11 western states (27.2 million) was concentrated in California (Table 3.12-1). Employment in Arizona, Colorado, and Washington stood at 2.3 million, 2.2 million, and 2.7 million, respectively; the remaining seven states supported less than 2 million jobs each. Employment in the 11 western states as a whole is projected to increase to 28.7 million in 2007.

Over the period 1990 to 2003, annual employment growth rates were higher in Nevada (at 4.4%), Arizona (3.4%), and Utah (3.1%) than elsewhere in the 11 western states. At 1.1%, growth rates in California were somewhat less than the average rate of 1.8%.

3.12.1.2 Unemployment

In the majority of the states, unemployment rates declined over the period 1996 to 2006 (Table 3.12-2). Current unemployment rates in Colorado (4.3%) and Oregon (5.5%) are slightly higher than the corresponding average for the preceding 10-year period. With the exception of California, relatively small labor forces exist in each of the states. However, there are fairly large numbers of local workers who are presently unemployed in each state and therefore potentially available to work on the proposed energy corridor developments within the states.

3.12.1.3 Personal Income

California generated more than 57% of total personal income in the 11-state region, producing more than $1.3 trillion in 2004 (Table 3.12-3). The state is expected to generate $1.4 trillion in 2007. For the 11 western states as a whole, personal income is expected to rise from $2.3 trillion in 2004 to $2.4 trillion in 2007.

TABLE 3.12-1 State Employment (millions, except where noted)

	1990	2003	Annual Growth Rate 1990–2003 (%)	2007 (projected)
Arizona	1.5	2.3	3.4	2.5
California	12.5	14.4	1.1	15.1
Colorado	1.5	2.2	2.7	2.2
Idaho	0.4	0.6	3.1	0.6
Montana	0.3	0.4	2.3	0.4
Nevada	0.6	1.1	4.4	1.2
New Mexico	0.6	0.8	2.3	0.8
Oregon	1.2	1.6	1.7	1.6
Utah	0.7	1.1	3.1	1.1
Washington	2.1	2.7	1.7	2.8
Wyoming	0.2	0.3	1.8	0.3
Total	21.7	27.2	1.8	28.7

Source: U.S. Department of Labor (2006a).

TABLE 3.12-2 Unemployment Data

	Average Unemployment Rate 1996–2006 (%)	Current Unemployment Rate (%)[a]	Number of Unemployed Persons by State[a]
Arizona	4.5	4.1	119,600
California	6.3	4.8	847,500
Colorado	4.1	4.3	111,600
Idaho	4.2	3.2	24,500
Montana	4.3	3.4	17,300
Nevada	4.3	3.8	48,000
New Mexico	5.8	4.8	45,700
Oregon	5.3	5.5	102,500
Utah	5.3	3.4	44,900
Washington	5.4	4.6	152,100
Wyoming	5.8	2.9	8,400
Total			1,522,100

[a] Data for current unemployment rates and the numbers of unemployed persons are as of March 2006.

Source: U.S. Department of Labor (2006b).

TABLE 3.12-3 State Personal Income (in $ billions 2005, except where noted)

	1990	2004	Annual Growth Rate 1990–2004 (%)	2007 (projected)
Arizona	93.6	170.1	4.4	183.3
California	968.7	1,305.1	2.2	1,350.1
Colorado	96.8	171.8	4.2	176.7
Idaho	23.8	38.8	3.6	40.6
Montana	18.5	26.5	2.6	27.1
Nevada	37.1	81.5	5.8	88.5
New Mexico	33.9	51.5	3.0	52.9
Oregon	77.0	113.5	2.8	117.0
Utah	38.6	66.6	4.0	69.5
Washington	145.5	224.9	3.2	231.7
Wyoming	12.2	17.9	2.8	18.2
Total	1,545.7	2,268.1	2.8	2,355.5

Source: U.S. Department of Commerce (2006).

Annual growth in personal income for the period 1990 to 2004 was highest in Nevada at 5.8%. Elsewhere in the 11-state region, personal income growth rates in Arizona (4.4%), Colorado (4.2%), and Utah (4.0%) were all more than one percentage point higher than the 11-state average rate of 2.8%.

3.12.1.4 Sales Tax Revenues

Total sales tax revenues for the 9 states that levy a sales tax are projected to grow from $90.9 billion in 2002 to $97.5 billion in 2007 (Table 3.12-4). Growth is also expected for each individual state over the period of 2002 through 2007, with revenues in the largest sales tax-generating state, California, projected to reach $52.1 billion in 2007.

Higher than average annual growth in sales tax revenues during the period of 1992 to 2002 occurred in Nevada (7.8%), Wyoming (6.8%), Arizona (6.4%), Utah (5.6%), Idaho (5.4%), and Colorado (5.1%). The average annual growth rate for the nine states with a sales tax as a whole during the period of 1992 to 2000 was 3.8%.

3.12.1.5 Income Tax Revenues

In 2002, California generated 74% of total state income tax revenues in the 11-state region, producing $39.5 billion (Table 3.12-5). Oregon is the second-largest state income tax producer with $4.7 billion in 2002. Revenues for the entire region are projected to decrease from $55.1 billion in 2002 to $54.0 billion in 2007. Revenues of $38.6 billion are expected in California in 2007 (a $900 million decrease from 2002).

The majority of the 11 states experienced moderately large annual increases in state income tax revenues during the 1990s. Growth rates in California (5.2%), Colorado (5.1%), New Mexico (5.8%), and Utah (5.4%) were all higher than the average for the 11-state region of 5.0%. Relatively slow growth in revenues was experienced in Montana (3.9%).

TABLE 3.12-4 State Sales Tax Revenues (in $ billions 2005, except where noted)

	1992	2002	Annual Growth Rate 1992–2002 (%)	2007 (projected)
Arizona	4.7	8.7	6.4	9.9
California	36.8	49.1	2.9	52.1
Colorado	3.6	5.9	5.1	6.2
Idaho	0.9	1.5	5.4	1.7
Montana[a]	0.0	0.0	NA[b]	0.0
Nevada	2.3	5.0	7.8	5.8
New Mexico	2.2	2.9	2.7	3.0
Oregon[a]	0.0	0.0	NA	0.0
Utah	1.7	3.0	5.6	3.2
Washington	10.2	14.1	3.3	14.8
Wyoming	0.4	0.8	6.8	0.8
Total	62.8	90.9	3.8	97.5

[a] Montana and Oregon do not currently levy a sales tax.

[b] NA = not applicable.

Source: U.S. Bureau of the Census (2006a).

TABLE 3.12-5 State Income Tax Revenues (in $ billions 2005, except where noted)

	1992	2002	Annual Growth Rate 1992–2002 (%)	2007
Arizona	1.7	2.5	3.8	2.6
California	23.7	39.5	5.2	38.6
Colorado	2.2	3.7	5.1	3.6
Idaho	0.7	1.0	2.8	1.0
Montana	0.4	0.7	3.9	0.6
Nevada[a]	0.0	0.0	NA[b]	0.0
New Mexico	0.6	1.1	5.8	1.1
Oregon	3.1	4.7	4.4	4.6
Utah	1.1	1.8	5.4	1.8
Washington[a]	0.0	0.0	NA	0.0
Wyoming[a]	0.0	0.0	NA	0.0
Total	33.5	55.0	5.0	53.9

[a] There are currently no state income taxes in Nevada, Washington, or Wyoming.

[b] NA = not applicable.

Source: U.S. Bureau of the Census (2006a).

3.12.1.6 Population

Total population in the 11 western states stood at 61.3 million in 2000 and is expected to reach 67.6 million by 2007 (Table 3.12-6). Population in the region is concentrated in California, which, at 33.9 million, had more than 55% of the region's total population in 2000. Population in California is expected to increase to 36.9 million by 2007. With the exception of Washington (5.9 million) and Arizona (5.1 million), each of the remaining states had less than 5 million persons in 2000.

Population in the 11 western states grew at an annual average rate of 2.3% over the period from 1990 to 2000. Growth within the region was fairly uneven over the period, with relatively high annual growth rates in Nevada (5.2%) and Arizona (3.4%). Growth rates in Colorado, Idaho, and Utah were all close to the average for the region, with lower than average rates in the remaining states.

3.12.1.7 Vacant Rental Housing

With the largest population in the 11-state region, California also has the largest housing market and the largest number of vacant rental housing units (Table 3.12-7). Vacant rental units in the state stood at 190,000 in 2000 (55.1% of the 11-state total) and are expected to reach 206,000 in 2007. Elsewhere in the region, Arizona (61,900 units) and Washington (50,800) had larger numbers of vacant rental units. The number of units in the region as a whole stood at 470,300 in 2000, and is expected to reach 518,300 by 2007.

There was a slight decline in the number of vacant rental units over the period of 1990 to 2000, with an overall annual growth rate of −1.4%. A number of states, notably Colorado (–5.3%), California (–3.5%), Wyoming (–2.3%), and Arizona (–1.9%), have seen higher than average declines in vacant units, while other states, notably Oregon (5.7%), Nevada (5.1%), and Idaho (3.1%), have experienced relatively large increases in vacant rental units.

3.12.1.8 State and Local Government Expenditures

The distribution of funding for state and local government services is concentrated in California, with $356.1 billion in government expenditures in 2002, which represented almost 60% of all government expenditures in the 11-state region (Table 3.12-8). Expenditures in California are expected to reach almost $378 billion in 2007. Other states with fairly large state and local governments are Washington ($59.0 billion), Arizona ($39.2 billion), Colorado ($37.3 billion), and Oregon ($30.6 billion). Expenditures in the 11-state region were $594.5 billion in 2002 and are expected to reach $634.8 billion by 2007.

Annual growth rates in state and local government expenditures have increased fairly rapidly throughout the region, with an overall annual average rate of 4.9% over the period of 1992 to 2002. A number of states, notably Nevada (7.0%) and Utah (6.0%), were more than one percentage point higher than the regional average, while growth rates in Montana (3.5%) and Wyoming (3.4%) were relatively low during the period.

3.12.1.9 State and Local Government Employment

In addition to a higher share of total state sales and income tax revenues collected by the 11 western states, California's share of state and local government employment in 2005 (52.9%) was similar to the state's share of total population in the region (55.2%) (Table 3.12-9). Government employment in the state stood at 1.7 million in 2005, and was projected to reach 1.8 million in 2007. Other states with fairly large totals of government employees in 2005 were Washington (329,900), Arizona (281,800), and

TABLE 3.12-6 State Population (in millions, except where noted)

	1990	2000	Annual Growth Rate 1990–2000 (%)	2007 (projected)
Arizona	3.7	5.1	3.4	6.2
California	29.8	33.9	1.3	36.9
Colorado	3.3	4.3	2.7	4.7
Idaho	1.0	1.3	2.5	1.5
Montana	0.8	0.9	1.2	0.9
Nevada	1.2	2.0	5.2	2.5
New Mexico	1.5	1.8	1.8	1.9
Oregon	2.8	3.4	1.9	3.7
Utah	1.7	2.2	2.6	2.5
Washington	4.9	5.9	1.9	6.3
Wyoming	0.5	0.5	0.8	0.5
Total	51.2	61.3	2.3	67.6

Sources: U.S. Bureau of the Census (2006b, 2006c).

TABLE 3.12-7 Vacant Rental Housing Units (in thousands, except where noted)

	1990	2000	Annual Growth Rate 1990–2000 (%)	2007 (projected)
Arizona	75.0	61.9	–1.9	73.7
California	271.9	190.0	–3.5	205.8
Colorado	55.3	31.9	–5.3	34.1
Idaho	7.9	10.6	3.1	11.8
Montana	9.6	9.2	–0.5	9.7
Nevada	19.2	31.7	5.1	38.4
New Mexico	20.2	26.7	2.8	28.4
Oregon	21.6	37.5	5.7	40.2
Utah	14.7	14.0	–0.7	15.3
Washington	40.6	50.8	2.3	54.5
Wyoming	7.8	6.2	–2.3	6.5
Total	543.8	470.5	–1.4	518.4

Source: U.S. Bureau of the Census (2006b).

TABLE 3.12-8 Total Local Government Expenditures (in $ billions 2005, except where noted)

	1992	2002	Annual Growth Rate 1992–2002 (%)	2007
Arizona	22.6	39.2	5.6	44.6
California	225.8	356.1	4.7	377.8
Colorado	21.4	37.3	5.7	39.6
Idaho	5.2	9.1	5.9	9.9
Montana	4.8	6.7	3.5	7.0
Nevada	8.9	17.6	7.0	20.4
New Mexico	9.4	15.3	5.0	16.0
Oregon	19.2	30.6	4.8	32.2
Utah	10.1	18.1	6.0	19.6
Washington	38.7	59.0	4.3	62.0
Wyoming	3.9	5.5	3.4	5.7
Total	370.0	594.5	4.9	634.8

Source: U.S. Bureau of the Census (2006a).

TABLE 3.12-9 Total Local Government Employment (in thousands, except where noted)

	1995	2005	Annual Growth Rate 1995–2005 (%)	2007
Arizona	218.8	281.8	2.6	296.2
California	1,479.6	1,771.3	1.8	1,811.6
Colorado	204.9	250.1	2.0	254.7
Idaho	67.1	77.2	1.4	79.6
Montana	56.3	55.5	–0.1	56.4
Nevada	73.5	100.4	3.2	106.0
New Mexico	110.7	128.1	1.5	130.4
Oregon	166.1	182.4	0.9	186.2
Utah	104.8	127.7	2.0	131.4
Washington	283.2	329.9	1.5	336.6
Wyoming	37.9	43.8	1.4	44.2
Total	2,802.9	3,348.2	1.8	3,433.3

Source: U.S. Bureau of the Census (2006a).

Colorado (250,100). Total employment in the 11-state region was more than 3.3 million in 2005 and is expected to exceed 3.4 million in 2007 (Table 3.12-9).

Growth in government employment in the 11 states has been varied over the period of 1995 to 2005. While the average for the region stood at 1.8% over the period, governments in Nevada, for example, increased their employment by 3.2%, with a smaller increase in Arizona (2.6%). The majority of the states were within half a percentage point of the regional average, while Oregon (0.9%) saw slower growth and Montana (–0.1%) experienced declining government employment.

3.12.1.10 Public Land Use

Public land in the 11 western states has a variety of economic uses, including agriculture, mineral and energy resource extraction and distribution, recreation, and military uses (see Section 3.2 for discussions of these land uses). Considerable portions of public land in some states have multiple economic uses, with numerous economic activities sharing or coexisting on land in specific locations (Table 3.12-10).

3.12.2 How Were Potential Impacts of Corridor Designation to Socioeconomic Conditions Evaluated?

As changes in land use plans on federal land to allow energy transport facility construction under No Action and the designation of energy corridors under the Proposed Action would not result in any physical change in the natural environment, the socioeconomic impacts of land use plan changes and corridor designation are limited. Evaluation of the main impacts on property values on private land and on restrictions on other economic uses of designated energy corridor land was undertaken qualitatively based on experience analyzing other energy development projects.

3.12.3 What Are the Potential Effects to Socioeconomic Conditions of the Alternatives, and How Do They Compare?

3.12.3.1 No Action Alternative

Under No Action, utilities would continue to pursue the siting, construction, and operation of energy transport projects independently of an expedited process for the development of transport facilities on federal land. Although individual projects may involve construction on federal land with no corridor designation or coordinated permitting process for the approval of energy transport projects, the timing and scale of socioeconomic impacts and the extent to which federal land might be used for energy development are not known. The local impacts of land use plan changes to allow the development of energy transport projects, including changes in property values on private land and restrictions on other uses of federal lands, and the subsequent socioeconomic impacts of construction and operation of energy facilities would be evaluated at the project-specific level, and would incorporate by reference the data, methods, and discussion of impacts of the construction and operation of four types of energy transport systems over given lengths of federal land shown in Appendix E.

3.12.3.2 The Proposed Action

Under the Proposed Action, utilities would benefit from an expedited permitting process and the colocation of auxiliary facilities and other related infrastructure in designated corridors. However, as corridor designation would not entail the construction and operation of energy transport facilities, the impact of designation of federal land as part of energy

TABLE 3.12-10 Economic Use of Public Lands (millions of acres)[a]

	Grazing	Timber Production[b]	Energy Production[c]	ROWs	Recreation[d]	Military
State						
Arizona	11.5	2.4	0.0	0.3	21.0	4.4
California	8.2	10.1	0.2	0.2	40.2	3.9
Colorado	7.7	8.0	1.4	0.2	26.5	0.5
Idaho	11.8	12.6	0.0	0.3	34.3	0.1
Montana	8.1	12.4	0.8	0.2	34.2	0.0
Nevada	45.8	0.3	0.3	0.6	14.9	3.4
New Mexico	12.6	2.8	3.9	0.4	13.9	3.5
Oregon	13.6	14.4	0.1	2.5	31.7	0.1
Utah	22.1	3.6	1.1	0.4	18.5	1.8
Washington	0.0	0.0	0.0	0.0	11.6	1.0
Wyoming	17.5	4.1	4.0	0.3	14.3	0.0
Total	158.9	70.7	11.9	5.5	261.0	18.6

[a] Categories of economic use are not necessarily exclusive, with public land often managed to support multiple economic uses.

[b] Land leased for timber production by BLM and FS.

[c] Land leased for oil, gas, geothermal, and coal production, and other uses.

[d] Includes land managed by the BLM, BOR, NPS, and USFWS.

transport corridors would likely be limited to changes in property values on private land and restrictions on existing or additional uses of federal lands.

Changes in property values may occur on private land adjacent to designated corridors, on private land that might be used to connect designated corridors where contiguous parcels of federal land are not available, in communities where the visual impacts of energy transport projects may affect the resale value of land, or where construction access and operations activities produce local road congestion, affecting property values. The precise nature of the impact of designation on property values would depend on the range of alternate uses of specific land parcels available to landowners' current property values and the perceived value of costs (visual impacts, traffic congestion, noise and dust pollution, electromagnetic field effects) and benefits (infrastructure upgrades, utility hookups, cheap and reliable energy supplies, local tax revenues) from proximity to a designated corridor that may be used for energy development to potential purchases of property owned by individuals residing in local communities. As there are a range of socioeconomic environments and land use types along designated corridors in each of the 11 western states, the impacts of designation on property values would likely vary by location.

Designation of federal lands for energy transport corridors may restrict existing or other additional uses of federal lands, particularly agriculture, logging, ranching, mining and minerals extraction, tourism, and recreation, if land parcels are partially or exclusively reserved for energy corridor development. The impacts would also vary by location along proposed corridors, depending on land use types impacted, which would affect minerals extraction and rangeland agriculture, for example, and geomorphological characteristics, which would affect tourism and recreation.

Even with corridor designation on federal land, utilities may choose not to use a designated corridor for specific energy projects, preferring the siting of facilities independently of an expedited process, meaning that it is difficult to predict the impacts on property values in the vicinity of designated corridors and on other economic uses of federal land.

3.12.3.3 How Do the Potential Effects Compare between the Alternatives?

As the impacts of each alternative on property values on private land and other economic uses of federal lands would likely be related to the amount of federal land anticipated to be needed for energy transport development, the impacts of each alternative can be compared on this basis.

Under the No Action Alternative, the absence of an expedited permitting process may mean less federal land would be utilized compared to the other alternatives if energy transport projects would be more easily permitted on private land, or may mean that more federal land is used if facilities cannot take advantage of colocation, as would be the case with an expedited process. As the location and timing of land use changes under No Action cannot be anticipated in the absence of corridor designation, the impacts of this alternative would be unpredictable. Under the Proposed Action, corridor designation would make clear the location of potential energy developments and would likely mean more federal land would be designated for energy transport development than under No Action. Based simply on the amount of federal land involved in designation, impacts to other economic uses of public lands would probably be larger under the Proposed Action than for the No Action Alternative. Impacts of corridor designation under the Proposed Action on property values cannot be determined.

3.12.4 Following Corridor Designation, What Types of Impacts Could Result to Socioeconomic Conditions with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

3.12.4.1 What Are the Usual Impacts to Socioeconomic Conditions of Building and Operating Energy Transport Projects?

Economic and fiscal impacts of energy transport project construction and operation in each state include direct impacts, which include the construction expenditures and employment associated with building the transmission lines, pipeline systems, and ancillary facilities, and indirect effects, which include the subsequent impacts in each state resulting from the spending of project wages and salaries, as well as from expenditures related to the procurement of material and equipment and the collection of sales and income tax revenues. The construction and operation of energy transport projects under each alternative would produce employment and generate income and state tax revenues and would likely require the in-migration of workers for certain occupational categories, which in turn would affect rental housing markets and create the need for additional state and local government expenditures and employment. Development may also affect property values on private land in the vicinity of energy transport developments and other economic uses of public land, if transport projects preclude activities such as agriculture, logging, ranching, mining and minerals extraction, tourism, and recreation.

The precise magnitude and timing of the socioeconomic impacts of corridor designation and the location and size of the resulting construction and operation of energy facilities are not known at this time. These would be evaluated at the project-specific level and would incorporate by reference the data, methods, and discussion of impacts of the construction and operation of four types of energy transport systems over given lengths of federal land shown in Appendix E.

3.12.4.2 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Socioeconomic Conditions?

Under each of the alternatives, mitigation of socioeconomic impacts is unlikely to be required. Although future construction of energy transport projects within the proposed corridors or in No Action ROWs is likely to require some in-migration of workers and family members from outside each state, the number of in-migrants arriving in each state is likely to be small, and not likely to create impacts to rental housing markets, and likely to require only small increases in local government expenditures and employment.

3.13 ENVIRONMENTAL JUSTICE

Executive Order 12898 (February 16, 1994) requires federal agencies to include environmental justice as a part of their missions. Specifically, it directs them to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations. Assessment of the potential environmental justice impacts associated with the proposed energy transport corridor designation followed guidelines described in the CEQ's *Environmental Justice Guidance under the National Environmental Policy Act* (CEQ 1997a). In addition to their use in this PEIS, the data and methods used in this section should also be used at the implementation stage for individual energy transport projects.

3.13.1 What Environmental Justice Populations Would Be Associated with Energy Corridor Development in the 11 Western States?

Demographic data from the 2000 census (U.S. Bureau of the Census 2006b) was used to describe the geographic distribution of minority and low-income populations in the affected area. The following definitions were used to define minority and low-income individuals.

Minorities. Individuals identifying themselves as belonging to any of the following racial groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

Beginning with the 2000 census, the census form allows individuals to designate, where appropriate, multiple population group categories to reflect their ethnic or racial origin(s). In addition, persons who classify themselves as being of multiple racial origin may choose up to six racial groups as the basis of their racial origins. The term "minority" includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or Other Race (U.S. Bureau of the Census 2006b).

The CEQ guidance proposed that minority populations should be identified where either (1) the minority population of the affected area exceeds 50%, or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The PEIS applied both criteria in using the Census Bureau data for census block groups, wherein consideration was given to the minority population that is both more than 50% of the population of the affected area and

20 percentage points higher than the minority population percentage in the state (the reference geographic unit).

Low-income population. Individuals were included who fell below the poverty line. The poverty line takes into account family size and the ages of individuals in the family. In 1999, for example, the poverty line for a family of five with three children below the age of 18 was $19,882 (U.S. Bureau of the Census 2006b). For any given family below the poverty line, all family members are considered as being below the poverty line, for the purposes of analysis.

The CEQ guidance proposed that low-income populations should be identified where either (1) the low-income population of the affected area exceeds 50%, or (2) the low-income population percentage of the affected area is meaningfully greater than the low-income population percentage in the general population or other appropriate unit of geographic analysis.

The PEIS applied both criteria in using the Census Bureau data for census block groups, wherein consideration was given to the low-income population that is both more than 50% of the population of the affected area and 20 percentage points higher than the low-income population percentage in the state (the reference geographic unit).

Data in Table 3.13-1 shows the minority and low-income composition of the total population located in the proposed energy corridors and an associated 2-mile buffer zone in the 11 western states, based on 2000 census data and CEQ guidelines. Individuals identifying themselves as Hispanic or Latino are included in the table as a separate entry. However, because Hispanics can be of any race, this number also includes individuals identifying themselves as being part of one or more of the population groups listed in the table.

There are a large number of minority individuals located within the 2-mile buffer zone in some of the 11 western states that would potentially host energy transport system developments on federal lands. In New Mexico, 56% of the population residing within the 2-mile buffer are classified as minority, with 34% in the California buffer, 29% in Arizona, and 25% in Nevada. While the state percentage of minority individuals in the buffer does not exceed the state average by 20 percentage points or more in any of the 11 states, the number of minority persons within the buffer in New Mexico exceeds 50% of the total population, meaning that the buffer in this state has a minority population defined by CEQ guidelines. The number of low-income individuals does not exceed the state average by 20 percentage points or more in any of the states, and does not exceed 50% of the total population in any of the states, which means that there are no low-income populations in any of the 11 western states, according to CEQ guidelines.

3.13.2 How Were the Potential Effects of Corridor Designation on Environmental Justice Evaluated?

Evaluation of the potential impacts of energy transport corridor designation involved (1) an assessment as to whether the impacts of construction and operation would produce impacts that are high and adverse, and (2) a determination as to whether any high and adverse impacts would disproportionately affect minority and low-income populations. In the event that impacts were found to be high and adverse, disproportionality would be determined by comparing the proximity of impacts to the locations of low-income and minority populations. If impacts are not high and adverse, there can be no disproportionate impacts on minority and low-income populations.

As changes in land use on federal land to allow energy transport facility construction under No Action and the designation of energy corridors under the Proposed Action would not result in any physical change in the natural

TABLE 3.13-1 Corridor and Corridor Buffer Minority and Low-Income Populations

	Arizona	California	Colorado	Idaho	Montana	Nevada
Total Population	189,770	324,327	91,596	90,992	37,315	337,475
White, Non-Hispanic	134,142	216,237	80,844	76,979	34,899	252,284
Hispanic or Latino	42,996	69,113	8,106	11,363	605	49,455
Non-Hispanic or Latino Minorities	12,632	38,977	2,646	2,650	1,811	35,736
One Race	10,263	31,394	1,457	1,542	1,226	28,330
Black or African American	1,066	16,201	313	193	37	9,184
American Indian or Alaskan Native	7,945	5,127	729	630	1,021	6,902
Asian	937	8,662	390	594	129	10,584
Native Hawaiian or Other Pacific Islander	177	572	54	49	14	1,156
Some Other Race	138	832	71	76	25	504
Two or More Races	2,369	7,583	1,189	1,108	585	7,406
Total Minority	55,628	108,090	10,752	14,013	2,416	85,191
Low-Income	29,239	35,123	8,649	11,728	3,983	30,815
Percent Minority	29.3	33.3	11.7	15.4	6.5	25.2
Percent Low-Income	15.4	10.8	9.4	12.9	10.7	9.1
State Percent Minority	36.2	53.3	25.5	12.0	10.5	34.8
State Percent Low-Income	13.9	14.2	9.3	11.8	14.6	10.5

TABLE 3.13-1 (Cont.)

	New Mexico	Oregon	Utah	Washington	Wyoming
Total Population	125,846	122,760	113,486	11,901	55,308
White, Non-Hispanic	55,980	109,938	102,701	10,163	49,245
Hispanic or Latino	51,547	6,594	7,062	1,341	4,390
Non-Hispanic or Latino Minorities	18,319	6,228	3,723	397	1,673
One Race	16,800	3,887	2,657	213	1,012
Black or African American	849	527	372	22	191
American Indian or Alaskan Native	15,149	2,059	1,641	109	566
Asian	573	1,018	450	64	159
Native Hawaiian or Other Pacific Islander	43	138	120	9	27
Some Other Race	186	145	74	9	69
Two or More Races	1,519	2,341	1,066	184	661
Total Minority	69,866	12,822	10,785	1,738	6,063
Low-Income	27,958	11,874	10,715	1,261	5,810
Percent Minority	55.5	10.4	9.5	14.6	11.0
Percent Low-Income	22.2	9.7	9.4	10.6	10.5
State Percent Minority	55.3	16.5	14.7	21.1	11.1
State Percent Low-Income	18.4	11.6	9.4	10.6	11.4

Source: U.S. Bureau of the Census (2006b).

environment, the impacts of land use changes and corridor designation that might affect environmental justice are limited. Evaluation of access to ecological resources that may be of cultural or religious significance, changes in property values on private land, and restrictions on other economic uses of rezoned or designated energy corridor land was undertaken qualitatively based on experience analyzing other energy projects.

3.13.3 What Are the Potential Effects to Environmental Justice of the Alternatives, and How Do They Compare?

3.13.3.1 No Action Alternative

Under No Action, utilities would continue to pursue the siting, construction, and operation of energy transport projects independently of an expedited process for the development of transport facilities on federal land. Although individual projects may involve construction on federal land with no corridor designation and a coordinated permitting process for the approval of energy transport projects, the timing and scale of environmental justice impacts, the extent to which federal land might be used for energy development, and the location of this land are not known at this time. The local impacts of land use plan changes to allow the development of energy transport projects, including changes in access to ecological resources that may be of cultural or religious significance, changes in property values on private land and restrictions on other uses of federal lands, and the subsequent socioeconomic impacts of construction and operation of energy facilities on federal and private land would be evaluated at the project-specific level.

3.13.3.2 The Proposed Action

Under the Proposed Action, utilities would benefit from an expedited permitting process and the colocation of auxiliary facilities and other related infrastructure in designated corridors. Although corridor designation would not entail the construction and operation of energy transport facilities, corridor designation for energy transport facilities might impact access to certain animals or vegetation types that may be of cultural or religious significance to certain population groups or form the basis for subsistence agriculture. The curtailment of various economic uses of federal lands with energy corridor designation, such as leasing for mineral, energy, and forestry resource development, may also affect minority and low-income populations if minority and low-income individuals involved in specific resource developments are concentrated in impacted local communities.

Property value impacts on private land in the vicinity of corridor developments may also affect minority and low-income populations, depending on the extent to which these population groups are concentrated in impacted local communities. Changes in property values may occur on private land adjacent to designated corridors, on private land that might be used to connect designated corridors where contiguous parcels of federal land are not available, in communities where the visual impacts of energy transport projects may affect the resale value of land, or where construction access and operations activities produce local road congestion, affecting property values. The precise nature of the impact of designation on property values would depend on the range of alternate uses of specific land parcels available to landowners' current property values and the perceived value of costs (visual impacts, traffic congestion, noise and dust pollution, electromagnetic field effects) and benefits (infrastructure upgrades, utility hookups, cheap and reliable energy supplies, local tax revenues) from proximity to a designated corridor that may be used for energy development to potential purchasers of property owned by minority and low-income individuals in local communities. As there are a range of socioeconomic environments and land use types along designated corridors in each of the 11 western states, the potential impacts on property values would likely vary by location.

With the exception of the minority population in New Mexico, the minority and low-income populations in each of the 11 western states are neither more than 50% of the population of the buffer area, nor 20 percentage points higher than the minority population percentage in each state, meaning that if impacts of corridor designation under the Proposed Action were found to be high and adverse, with the exception of the minority population in New Mexico, impacts to environmental justice populations would not be disproportionate.

3.13.3.3 How Do the Potential Effects Compare between the Alternatives?

As the impacts of each alternative on property values on private land and other economic uses of public lands would be related to the amount of land it is anticipated would be needed for energy transport development, the environmental justice impacts of each alternative can be compared on this basis.

Under the No Action Alternative, the absence of an expedited permitting process may mean less federal land would be utilized compared to the other alternative if energy transport projects would be more easily permitted on private land, or it may mean that more federal land is used if facilities cannot take advantage of colocation, as would be the case with a coordinated process. As the location and timing of zoning changes under No Action cannot be anticipated in the absence of corridor designation, it is likely that the impacts of this alternative would be unpredictable. Under the Proposed Action, corridor designation would make clear the location of potential energy developments and would likely mean more federal land would be designated for energy transport development than under No Action. Based simply on the amount of federal land involved in designation, impacts to ecological resources that may be of cultural or religious significance and impacts to other economic uses of public lands would be larger under the Proposed Action than for No Action. Impacts of corridor designation under the Proposed Action on property values cannot be determined.

Even with corridor designation on federal land, utilities may choose not to use a designated corridor for specific energy projects, preferring the siting of facilities independent of an expedited process, meaning that predicting the impacts on resources that may be of cultural or religious significance, impacts on property values, and impacts on other economic uses in the designated corridors under the Proposed Action is difficult. With the exception of the minority population in New Mexico, the minority and low-income population in each of the 11 western states is neither more than 50% of the population of the corridor and buffer area nor 20 percentage points higher than the minority population percentage in each state, meaning that if impacts of corridor designation under the Proposed Action were found to be high and adverse, with the exception of impacts to the minority population in designated corridors and buffers in New Mexico, there would be no disproportionate impacts to minority and low-income populations.

3.13.4 Following Corridor Designation, What Types of Impacts Could Result to Environmental Justice with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

In addition to impacts on accessibility to ecological or cultural resources, property values, and other economic issues on federal land, the analysis of the environmental justice impacts of construction and operation of energy transport projects would consider the following impacts: noise and dust generated during the construction of the electrical and pipeline facilities, noise and

EMF effects associated with energy project operations, and the visual impacts of electricity transmission towers and other energy facilities.

Noise and dust impacts generated during the construction of energy transport systems and other facilities would likely be minimal, given the typically small amount of land that is disturbed and the relative remoteness of the locations of the energy corridors. A more significant issue may be impacts from the access roads that would be required during construction for the delivery of equipment and materials to energy project sites. There may be environmental justice issues associated with the construction of any type of energy transport projects within designated corridors or project ROWs, depending on such factors as the various terrains across which these roads would be constructed, access road lengths, the lengths of time the roads would be used for construction traffic, and the proximity of access roads to minority and low-income populations.

A major potential environmental justice impact of energy transport project development and operation might be the visual impact of the electricity transmission towers and other infrastructure associated with each energy transport project. Although a preliminary screening process excluded development on federal lands that are designated as being of scenic quality or interest, energy transport projects may potentially alter scenic quality in areas of traditional or cultural significance to minority and low-income populations. Impacts from project operation could also create an environmental justice issue if noise impacts from an energy transport project are significant. The extent to which noise is an issue would depend on the number of towers and other facilities in any specific energy project (see Section 3.7), the exact location of infrastructure relative to areas of traditional or cultural significance, and the block groups with communities where low-income or minority populations are disproportionately represented.

3.13.5 What Measures Would Mitigate the Potential Environmental Justice Impacts under the Alternatives?

The mitigation of environmental justice impacts associated with the visual impacts of electricity transmission lines may include siting the towers and other facilities to minimize contrast with scenic views, using appropriate construction materials that minimize scenic contrast, and avoiding construction near traditional and cultural sites that are important to low-income and minority populations. A more complete listing of possible mitigation measures is presented in Section 3.9.

Noise and dust impacts during the construction of energy transport projects and noise and EMF effects during project operation or impacts to property values and to other economic uses of federal land during construction or operation would not likely produce impacts that are high and adverse to the general population. Similar impacts to minority and low-income populations would also be expected, with no additional mitigation required. Noise and dust impacts during construction, particularly those associated with the construction of access roads, could be reduced using standard mitigation methods (see Sections 3.7 and 3.6, respectively), while noise and EMF effects during project operation would be minimal because of the remote locations of the majority of the energy corridor projects.

3.14 HEALTH AND SAFETY

3.14.1 What Are the Potential Health and Safety Impacts Associated with Corridors in the 11 Western States?

The designation of Section 368 energy corridors would not in itself result in any health and safety impacts or concerns. Public and worker health and safety issues and concerns materialize only with the construction of energy transport projects within designated corridors and adjacent private parcels or within ROWs developed under the No Action Alternative.

3.14.2 How Were Potential Health and Safety Impacts Evaluated?

The energy transport systems considered eligible for introduction into designated energy corridors include high-voltage (i.e., greater than 69 kV) electricity transmission and natural gas, liquid petroleum, and hydrogen transport via pipeline. With the exception of hydrogen transport, the transport over long distances of electricity, natural gas, and liquid petroleum products (crude oils as well as petroleum distillate fuels and petrochemical feedstocks) all involve well-developed and well-understood technologies.

There is a very large body of practical experience in the design, installation, and operation of each of these technologies. The health and safety aspects of each technology are also addressed in regulations promulgated by various federal and state agencies as well as in accepted industry standards and practices. While the primary purpose of these regulations and protocols is to ensure the safe construction and safe and reliable operation of these energy transport systems, there are also controls in place to mitigate health or safety aspects to the public (e.g., control access to hazardous areas) and to educate the public on potential hazards (e.g., required warning signage). Consequently, a careful review of the industry responses to those regulations and industry protocols constitutes a reliable methodology for identifying potential or expected health and safety impacts of each individual technology.

The evaluation methodology for identifying health and safety concerns for long-distance hydrogen pipelines is somewhat different since very little empirical data are available for this technology. While it is intuitive that the initial design basis for long-distance hydrogen pipelines will be derived largely from experiences in the design, installation, and operation of natural gas and liquid petroleum pipelines, unique properties of hydrogen will dictate modifications to component design as well as the development of unique construction and operating techniques for long-distance hydrogen pipelines.

Because this is an emerging technology, certain critical design factors that can greatly influence health and safety, such as expected system operating pressures (which may be substantially higher than those for natural gas transport) have not yet reached consensus. Additionally, material research that is currently under way to identify unique requirements for mainline pipe and other system components for successful transport of hydrogen may also dictate unique construction and operating strategies. Consequently, the evaluation of health and safety concerns for hydrogen pipelines begins by considering those concerns associated with natural gas pipeline design, construction, and operation that are most likely to also be associated with hydrogen pipelines and then goes on to review the state of research and development into design and construction of long-distance hydrogen transport systems to identify additional unique health and safety concerns that may materialize.

A different approach is also required to identify those health and safety impacts that are unique to the juxtaposition of different energy transport technologies within energy corridors. Here, the body of practical experience is somewhat limited, although many of the interferences that exist between transport technologies and that can reduce the reliability of adjacent systems or lead to or exacerbate health or safety impacts have already been identified, and adjustments to design and operational procedures have been incorporated into industry standards and practices to account for and mitigate these interferences and impacts. And while there are myriad examples of the safe and reliable coexistence of energy transport technologies in close proximity, not all permutations of technology juxtapositions have generated sufficient amounts of data to support in-depth study or summary determinations on related health and safety impacts.

Likewise, there is limited experience in increased health and safety impacts resulting from off-normal events when two or more energy transport systems are colocated, although intuitively, increases in the scope and severity of impacts from off-normal events and the complexity of the response action would result from the involvement or near presence of another energy technology. Therefore, identification of the health and safety impacts that derive solely from the proximate existence of other energy transport technologies requires not only reviewing the current literature for explicit examples but also deliberately considering (1) how events that occur in one transport technology may affect adjacent technologies and (2) how to infer additional health and safety impacts from these interferences.

3.14.3 What Are the Potential Effects to Health and Safety of the Alternatives, and How Do They Compare?

3.14.3.1 No Action Alternative

Under the No Action Alternative, energy transport projects would be sited and implemented in project-specific ROWs on both private and public lands. Each type of project (transmission line or pipeline) would have unique health and safety concerns associated with construction, operation, and decommissioning (see Section 3.14.4 below). The majority of these concerns extend primarily or exclusively to the workforces needed for construction, operation, and decommissioning. Some of these health and safety concerns may also impact the public in all phases of the project's life cycle, although the severity of a majority of those impacts to the public decreases rapidly as the distance from the energy transport system increases.

Transmission lines and pipelines are all subject to federal (FERC, DOT/OPS, OSHA, EPA) and state regulations that focus on the protection of workers and the protection of public health and the environment. The regulations promulgated by these agencies incorporate design and/or operating requirements intended specifically to avoid or mitigate impacts to health and safety. Likewise, nonenforceable industry standards are based largely on ensuring safe construction and reliable (i.e., safe) operation. Energy transport projects installed under No Action would be subject to these applicable and relevant regulations and industry standards. Under the No Action Alternative, it is reasonable to conclude that all relevant regulations and industry standards and practices would be applied uniformly and equitably to all projects, regardless of location. Consequently, there would be no significant differences to health and safety impacts under No Action for routine construction, operation, and decommissioning of any of the energy transport systems under consideration in this PEIS.

Development of energy transport projects within the designated energy corridors is assumed to occur from the corridor centerlines outward, although some projects may be placed at or near the edges of the corridors. Development from the centerline outward would preserve, to the greatest extent and for the longest period of time possible, buffer zones at the outer edges of the designated corridors. It is assumed that these vacant buffer zones would remain and that land use within the zones would continue to be under the control of the federal lands agencies in these locations, which would prevent incompatible land uses or uses that would increase impacts on the public. Such buffer zones have the effect not only of reducing the severity of construction- and routine operations-related health and safety impacts on the nearest public receptor, but also reducing the severity of impacts from off-normal events such as ground faults, fires, or explosions.

Under No Action, minimum distances to public receptors or compatible land uses in areas proximate to energy systems cannot be guaranteed. Developers would seek to secure construction ROWs that are only as wide as needed to establish the area needed for construction. Similarly, requested operating ROWs can be expected to be only as wide as needed to ensure adequate access and reliable operation free of interferences. Consequently, for projects occurring on federal land under the No Action Alternative, it is likely that ROWs would be only as wide as necessary; however, federal land managers would nevertheless be in a position to control adjacent land usage to ensure adequate separation to the nearest public receptor. However, for ROWs established on private lands under the No Action Alternative, there is no mechanism in place to guarantee minimum safe distances to public receptors or compatible land uses in areas proximate to energy systems.

Thus, under No Action, regulatory controls and industry standards would still be fully in effect regardless of where energy transport projects are located; therefore, no changes to the health and safety impacts on workers are anticipated. However, there is a slightly increased potential for increased impacts on nearby public receptors in those situations (or locations) where ideal buffer zones and compatible land uses would not be maintained.

The development of an energy transport system project in areas with high potential for geologic hazard may increase the likelihood of a hazardous occurrence. While implementation of the projects would result in more individual ROWs, the potential for increased geologic hazard risks along these ROWs would depend on the specific locations of each project and its surrounding geologic environment.

3.14.3.2 The Proposed Action

The simple designation of energy corridors and subsequent land use plan amendments under the Proposed Action are not expected to affect health and safety. Health and safety considerations and impacts would arise only with the construction and subsequent operation and eventual decommissioning of energy transport projects within the designated corridors or on adjacent private lands through which those energy transport systems pass. Potential impacts would be associated primarily with the nature of the activity, rather than the location in which that activity is conducted. Consequently, health and safety aspects and impacts associated with these activities are largely aspatial and would not be substantially affected by specific locations. Nevertheless, as discussed below, there are some health and safety considerations that are either aggravated by, or uniquely affected by, natural circumstantial factors that may be present in some designated corridors.

Potential health and safety impacts from project construction and operation would occur regardless of considerations of land ownership or the designation status of the corridor segment in which the activity is taking place. However, formal corridor designations offer the best guarantee of comprehensive and equitable treatment of health and safety matters anywhere within the designated corridor through the application of appropriate federal lease stipulations or IOPs that may, in some instances, establish controls beyond those already in place in regulation or industry standards and practices. However, similar controls may not necessarily be in place for those segments of energy transport systems that extend into adjacent private lands.

Although activities related to construction, installation, and operation of energy transport projects display the potential for many common impacts regardless of the locations at which such activities take place, additional concerns or aggravated impacts may arise due to the presence of circumstantial factors. For example, construction activities in rugged terrain or in areas of heightened potential for natural hazards such as landslides and earthquakes impose additional unique hazards and increase the potential for impacts to occur. Often, such circumstances will dictate the use of unconventional construction techniques (e.g., airlift helicopters for transporting materials to remote locations), introducing additional health and safety impacts unique to such unconventional techniques.

In such areas, it is reasonable to expect that industry design, installation, and operating standards and procedures would be modified to account for the additional hazards to protect worker safety and to preserve long-term system integrity and reliability. The natural hazards that might be encountered in pursuit of the Proposed Action and thus would result in project-specific health and safety issues are discussed below. Each of these hazards has the potential to cause major structural damage to an energy transport project. However, the likelihood and magnitude of health and safety impacts from such natural events can only be evaluated at the project-specific level.

The risks that would be associated with geologic hazards under the Proposed Action hazards are site-specific and depend completely on the locations of individual projects, the type of energy transport project, and the local geologic setting. The following subsections describe the geologic hazards along the designated corridors under the Proposed Action on a regional basis. The common impacts caused by the geologic hazards are related to the threat of potential spills and fires if the integrity of the infrastructures is damaged. The magnitude of the impacts depends on the magnitudes of the spills and/or fires, implementation of the contingency plan, and the mitigation measures implemented after the hazards occur.

Higher levels of impacts would result from higher totals of miles affected within different categories of hazard zones. It should be noted that additional project sites that are not located in the designated corridors under the Proposed Action may exist on nonfederal lands. Similar geologic hazards could occur. They are not evaluated in this PEIS because the locations of these sites have not been decided. The evaluation should be addressed at the project level.

Volcanic Hazards. Figure 3.14-1 shows the locations of volcanoes younger than late Pleistocene within 20 miles of the designated corridors under the Proposed Action. California, Oregon, and Utah have the highest number of volcanoes located near the designated corridors (Figure 3.14-1) and the highest number of designated corridor acres likely to be affected by the volcanoes (Table 3.14-1). The numbers of volcanoes and/or volcanic fields and acres of nearby designated corridor likely affected are 11 volcanoes/volcanic fields and 68,660 acres in California, 8 volcanoes/volcanic fields and 57,540 acres in Oregon, 4 volcanoes/volcanic fields and 40,830 acres in Utah, 2 volcanoes/volcanic fields and 13,770 acres in Idaho, and 1 volcanic field and 920 acres in Arizona.

Seismic Hazards. Low levels of ground-shaking hazards (with peak horizontal ground acceleration between >0.1 and 0.2 g) occur in 9 of the 11 western states (except Colorado and New Mexico). The five states with the highest total acres of designated corridors in low-level ground-shaking hazard areas are Nevada (75,670 acres), California (51,110 acres), Utah (22,130 acres), Montana (15,820 acres), and Oregon (11,930 acres) (Table 3.14-2). Other states affected by low-level ground-shaking hazards have no more than 5,230 acres of designated corridor intercepted (Idaho). Figure 3.14-2 shows the ground-shaking hazards in the 11 western states.

TABLE 3.14-1 Designated Corridor Segments and Acres of Segments within the Influence of Nearby Active Volcanoes under the Proposed Action

State	Segment	Volcano Name	Proposed Action Corridor Acres	Volcano Type
Arizona	113-116	Santa Clara	925	Volcanic field
California	27-41	Amboy	13,016	Cinder cone
California	3-8	Brushy Butte	5,579	Shield volcano
California	18-23	Coso Volcanic Field	3,896	Lava domes
California	23-106	Coso Volcanic Field	3,410	Lava domes
California	23-25	Coso Volcanic Field	1,883	Lava domes
California	18-23	Golden Trout Creek	3,278	Volcanic field
California	27-225	Lavic Lake	3,111	Volcanic field
California	27-266	Lavic Lake	2,459	Volcanic field
California	27-41	Lavic Lake	7,753	Volcanic field
California	18-23	Long Valley	1,858	Caldera
California	3-8	Medicine Lake	11,078	Shield volcano
California	8-104	Medicine Lake	5,290	Shield volcano
California	18-23	Mono Craters	1,595	Lava domes
California	18-23	Mono Lake Volcanic Field	2,053	Cinder cones
California	261-262	Shasta	1,772	Stratovolcano
California	6-15	Steamboat Springs	628	Lava domes
Idaho	50-203	Hell’s Half Acre	2,931	Shield volcano
Idaho	252-253	Wapi Lava Field	884	Shield volcano
Idaho	49-112	Wapi Lava Field	9,644	Shield volcano
Idaho	49-202	Wapi Lava Field	312	Shield volcano
Nevada	18-23	Mono Lake Volcanic Field	2,792	Cinder cones
Nevada	15-17	Steamboat Springs	8,497	Lava domes
Nevada	6-15	Steamboat Springs	655	Lava domes
Oregon	7-11	Devils Garden	7,742	Volcanic field
Oregon	7-11	Four Craters Lava Field	6,171	Volcanic field
Oregon	10-246	Hood	3,050	Stratovolcano
Oregon	230-248	Hood	8,026	Stratovolcano
Oregon	16-24	Jackies Butte	1,369	Volcanic field
Oregon	24-228	Jackies Butte	8,603	Volcanic field
Oregon	7-24	Jackies Butte	561	Volcanic field
Oregon	24-228	Jordan Craters	4,813	Volcanic field
Oregon	7-11	Newberry Volcano	4,937	Shield volcano
Oregon	24-228	Saddle Butte	5,796	Volcanic field
Oregon	7-11	Squaw Ridge Lava Field	6,466	Volcanic field
Utah	116-206	Bald Knoll	130	Cinder cones
Utah	114-241	Black Rock Desert	9,935	Volcanic field
Utah	116-206	Markagunt Plateau	4,313	Volcanic field
Utah	113-114	Santa Clara	20,097	Volcanic field
Utah	113-116	Santa Clara	6,355	Volcanic field

In addition to low-level ground-shaking hazards, California also has 140,480 acres of designated corridors in intermediate (with peak horizontal ground acceleration between >0.2 and 0.4 g) and 16,540 acres in high (with peak horizontal ground acceleration between >0.4 and 1 g) ground-shaking hazards zones. Nevada has 280,330 acres of designated corridors in the intermediate ground-shaking hazards zone (Table 3.14-2).

Liquefaction. In eastern California, about 4,650 acres of the designated corridors are in an intermediate liquefaction hazard zone (fluvial sediment intercepting the intermediate ground-shaking risk zone) (Table 3.14-3 and Figure 3.14-3). Low-level liquefaction hazard areas intercepted by the designated corridors occur in Arizona (4,930 acres), California (660 acres), Montana (1,200 acres), Nevada (14,650 acres), New Mexico (1,450 acres), Oregon (330 acres), Utah (10,030 acres), and Wyoming (590 acres) (Table 3.14-3). Their locations are shown in Figure 3.14-3.

Surface Rupture. Figure 3.14-4 shows the designated corridors that cross surface ruptures (or faults) younger than Later Pleistocene (<130,000 years before present). Table 3.14-4 lists the affected designated corridor segments. Most of the ruptures, a total of 45 out of 48, are Holocene and Late Pleistocene in age. There are only three historical faults less than 150 years in age. These occur in the Owens Valley fault zone and as unnamed faults in volcanic tablelands located in California and the Olinghouse fault zone in Nevada. Many of the faults may be crossed by the designated corridors several times (Table 3.14-4). Younger faults are more likely to be reactivated when earthquakes occur.

TABLE 3.14-2 Designated Corridor Lengths Intercepted by Various Ground-Shaking Zones with a 10% Probability of Exceedance in 50 Years under the Proposed Action

	Lengths of Corridor Intercepted by Various Ground-Shaking Zones (acres)		
	Peak Horizontal Ground Acceleration (g)		
States	>0.1–0.2	>0.2–0.4	>0.4–1.0
Arizona	110		
California	51,110	140,480	16,540
Idaho	5,230		
Montana	15,820		
Nevada	75,670	280,330	
Oregon	11,930		
Utah	22,130		
Washington	4,690		
Wyoming	1,980		
Total	188,670	420,820	16,540

TABLE 3.14-3 Liquefaction Potential within the Designated Corridors under the Proposed Action

	Designated Corridor Acres per Potential Liquefaction Levels		
State	High	Intermediate	Low
Arizona			4,930
California		4,650	660
Colorado			0
Idaho			0
Montana			1,200
Nevada			14,650
New Mexico			1,450
Oregon			330
Utah			10,030
Washington			0
Wyoming			590

Most of the designated corridor-fault crossings occur in California (13) and Nevada (26). A few designated corridor-fault crossings occur in Arizona (3), Colorado (1), New Mexico (2), Oregon (1), and Utah (2) (Table 3.14-4).

Landslide Hazards. The locations where the designated corridors cross potential landslide areas are shown in Figure 3.14-5 and listed in Table 3.14-5. Those states with high total acres of corridors crossing high-incidence and/or high-susceptibility landslide zones include California (10,840 acres), Colorado (117,800 acres), Idaho (6,690 acres), Nevada (4,610 acres), Utah (25,530 acres), and Wyoming (21,630 acres). Oregon, Arizona, and Montana also have designated corridors that cross high-incidence and/or high-susceptibility landslide zones but to a lesser extent (Table 3.14-5). Several states have a relatively high amount of designated corridors that intercept moderate-incidence and/or moderate-susceptibility landslide zones, including Arizona (7,390 acres), California (17,760 acres) Colorado (134,830 acres), Montana (7,690 acres), Nevada (25,720 acres), Oregon (19,190 acres), Utah (13,850 acres), and Wyoming (24,230 acres).

3.14.4 Following Corridor Designation, What Types of Health and Safety Impacts Could Result with Project Development, and How Could Impacts Be Minimized, Avoided, or Compensated?

3.14.4.1 What Are the Usual Impacts to Health and Safety of Building and Operating Energy Transport Projects?

Although each of the energy transport systems is unique in its function, some common aspects are shared among the transport systems with respect to construction, operation, and decommissioning. For example, construction of any buried pipeline will involve similar activities of site clearing and preparation, excavation, and mainline pipe installation and burial, regardless of whether the pipeline carries gases or liquids. Construction of electrical towers also shares some of those activities (e.g., excavations for tower foundations). Consequently, it follows that there would be similar health and safety impacts common to the

TABLE 3.14-4 Designated Corridor Segments Crossed by Surface Ruptures Younger Than Late Pleistocene (<130,000 years before present) under the Proposed Action

Segment	State	Fault Name	Age (years)
113-116	Arizona	Hurricane fault zone, Anderson Junction section	<130,000
113-116	Arizona	Dutchman Draw fault	<130,000
113-116	Arizona	Washington fault zone, northern section	<130,000
113-116	Arizona	Washington fault zone, northern section	<130,000
108-267	California	San Andreas fault zone, San Bernardino Mountains section	<15,000
27-41	California	Pisgah-Bullion fault zone, Pisgah section	<15,000
27-266	California	Lenwood-Lockhart fault zone, Lenwood section	<15,000
23-25	California	Lenwood-Lockhart fault zone, Lockhart section	<130,000
23-106	California	Garlock fault zone, Western Garlock section	<15,000
23-106	California	Garlock fault zone, Western Garlock section	<15,000
23-106	California	Garlock fault zone, Western Garlock section	<15,000
23-25	California	Garlock fault zone, Central Garlock section	<15,000
23-106	California	Southern Sierra Navada fault zone, Haiwee Reservoir section	<130,000
23-106	California	Southern Sierra Navada fault zone, Haiwee Reservoir section	<130,000
23-106	California	Southern Sierra Navada fault zone, Haiwee Reservoir section	<130,000
23-25	California	Southern Sierra Navada fault zone, Haiwee Reservoir section	<130,000
23-106	California	Southern Sierra Navada fault zone, Haiwee Reservoir section	<130,000
18-23	California	Little Lake fault zone	<15,000
18-23	California	Little Lake fault zone	<15,000
18-23	California	Southern Sierra Navada fault zone, Haiwee Reservoir section	<130,000
18-23	California	Owens Valley fault zone, 1822 rupture section	Historic
18-23	California	Owens Valley fault zone, Keough Hot Springs section	<15,000
18-23	California	Unnamed faults in Volcanic Tablelands	<15,000
18-23	California	Unnamed faults in Volcanic Tablelands	<15,000
18-23	California	Unnamed faults in Volcanic Tablelands	<15,000
18-23	California	Unnamed faults in Volcanic Tablelands	<15,000
18-23	California	Unnamed faults in Volcanic Tablelands	<15,000
18-23	California	Unnamed faults in Volcanic Tablelands	Historic
18-23	California	Unnamed faults in Volcanic Tablelands	<15,000
8-104	California	Likely fault zone	<130,000
3-8	California	Mayfield fault zone	<15,000
3-8	California	Mayfield fault zone	<15,000
3-8	California	Mayfield fault zone	<15,000
3-8	California	Mayfield fault zone	<15,000
134-136	Colorado	Roubideau Creek fault	<15,000
224-225	Nevada	West Spring Mountains fault	<15,000
224-225	Nevada	West Spring Mountains fault	<15,000
224-225	Nevada	West Spring Mountains fault	<15,000
224-225	Nevada	West Spring Mountains fault	<15,000
39-113	Nevada	California Wash fault	<15,000
18-224	Nevada	Ash Meadows fault zone	<130,000
232-233 (W)	Nevada	Maynard Lake fault	<130,000

TABLE 3.14-4 (Cont.)

Segment	State	Fault Name	Age (years)
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
18-224	Nevada	Clayton Ridge fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Dry Lake fault	<130,000
110-233	Nevada	Silver King Pass fault	<130,000
110-233	Nevada	Silver King Pass fault	<130,000
18-23	Nevada	Unnamed faults near Alkali Valley	<130,000
18-224	Nevada	Indian Head fault	<15,000
110-233	Nevada	The Cove fault	<130,000
110-114	Nevada	Snake Valley fault	<15,000
110-114	Nevada	Snake Valley fault	<15,000
110-114	Nevada	Southern Spring Valley fault zone	<15,000
110-114	Nevada	Central Steptoe fault zone	<130,000
110-114	Nevada	Central Steptoe fault zone	<130,000
110-114	Nevada	Steptoe Valley fault system	<130,000
17-18	Nevada	Unnamed fault zone in Dead Camel Mountains	<15,000
17-18	Nevada	Unnamed fault zone in Dead Camel Mountains	<15,000
44-110	Nevada	Steptoe Valley fault system	<130,000
44-110	Nevada	Steptoe Valley fault system	<130,000
44-110	Nevada	Steptoe Valley fault system	<130,000
15-17	Nevada	Olinghouse fault zone	Historic
15-17	Nevada	Olinghouse fault zone	Historic
15-17	Nevada	Olinghouse fault zone	Historic
15-104	Nevada	Warm Springs Valley fault zone	<15,000
17-35	Nevada	Unnamed fault zone on northwest side of Trinity Range	<15,000
17-35	Nevada	Unnamed fault zone on northwest side of Trinity Range	<15,000
15-104	Nevada	Warm Springs Valley fault zone	<15,000
17-35	Nevada	Edna Mountain fault	<130,000
17-35	Nevada	Buffalo Mountain fault	<130,000
17-35	Nevada	Buffalo Mountain fault	<130,000
17-35	Nevada	Buffalo Mountain fault	<130,000
16-24	Nevada	Black Rock fault zone	<15,000
16-104	Nevada	Unnamed faults near Squaw Valley	<130,000
17-35	Nevada	Sheep Creek Range western faults	<130,000
17-35	Nevada	Ruby Mountains fault zone	<15,000
81-272	New Mexico	Black Hill fault	<130,000
81-272	New Mexico	Cliff fault	<130,000
16-24	Oregon	Santa Rosa Range fault system, Quinn River section	<15,000

TABLE 3.14-4 (Cont.)

Segment	State	Fault Name	Age (years)
110-114	Utah	Southern Snake Range fault zone	<15,000
110-114	Utah	Southern Snake Range fault zone	<15,000
110-114	Utah	Southern Snake Range fault zone	<130,000
256-257	Utah	Wasatch fault zone, Weber section	<15,000

construction, installation, and decommissioning phases of the life cycles of each of the energy transport systems. Although the specific construction and operation activity dictates the majority of the health and safety considerations, circumstantial factors such as the size and complexity of the construction activities (including the potential for simultaneous construction of adjacent energy transport systems), weather extremes, rugged terrain, or remoteness of locations can aggravate them.

Detailed health and safety plans would typically address such factors and special arrangements (e.g., facilitated access to emergency medical attention) can ameliorate their impacts to a satisfactory extent. The construction workforce would absorb the majority of impacts related to construction and decommissioning. However, transportation of heavy or oversize loads and the movement of construction vehicles along public roadways impose potential safety impacts on the public during the construction and decommissioning phases (and also during major repair, replacement, or technology upgrade activities that may occur during the operating phase).

In addition to health and safety impacts associated with actual activities related to site preparation, construction, installation, and operation of any given energy transport system, overarching health and safety considerations result from the fact that such activities will be conducted largely in outdoor environments, some of them being rugged and remote. Exposure to the extremes and exigencies of weather, involving both temperatures and storms, will impact construction and operating workforces. Likewise, exposure to harmful plants and interactions with dangerous animals and insects will be ever-present hazards for both workforces. Such inherent hazards exist irrespective of the alternative under which an energy transport system is being constructed or operated. Tables 3.14-6 and 3.14-7 provide an enumeration of the major health and safety issues associated with the construction of pipelines and high-voltage electricity transmission systems, respectively.

The majority of health and safety impacts that would occur from routine operations are largely unique to each energy transport system; for example, electricity transmission line workers experience exposures to energized systems and working at heights, while gas and liquid petroleum pipeline workers experience exposures to hazardous or flammable materials or high operating pressures. However, exposure to weather extremes will be common to workers on any of the hypothetical projects, and common health and safety impacts would be imposed on all pipeline workers during repair or replacement of mainline pipes and on all construction workers during decommissioning of any of the energy transport systems, where the potential impacts would be virtually identical to those experienced during initial construction. Tables 3.14-8 and 3.14-9 display the major health and safety issues associated with the routine operation of pipelines and high-voltage electricity transmission systems, respectively.

TABLE 3.14-5 Potential Landslide Areas Crossed by the Designated Corridors under the Proposed Action

State	Types	Total Acres
Arizona	High Incidence	2,080
	Moderate Susceptibility	7,390
California	High Incidence and Susceptibility	2,840
	High Incidence	8,000
	Moderate Incidence	14,680
	Moderate Susceptibility	3,070
Colorado	High Incidence and Susceptibility	53,790
	High Incidence	12,040
	Moderate Incidence	108,500
	High Susceptibility	51,970
	Moderate Susceptibility	26,330
Idaho	High Incidence	1,050
	High Susceptibility	5,640
Montana	High Incidence	1,770
	Moderate Incidence	1,420
	High Susceptibility	1,190
	Moderate Susceptibility	6,270
Nevada	High Incidence	4,610
	Moderate Incidence	6,660
	Moderate Susceptibility	19,070
Oregon	High Incidence and Susceptibility	40
	High Incidence	2,330
	Moderate Incidence	19,190
Utah	High Incidence	18,240
	Moderate Incidence	2,110
	High Susceptibility	7,290
	Moderate Susceptibility	11,740
Washington	Moderate Incidence	2,070
Wyoming	High Incidence and Susceptibility	1,260
	Moderate Incidence	9,210
	High Susceptibility	20,360
	Moderate Susceptibility	15,020

Another important consideration is the effect on health and safety during the simultaneous construction of multiple energy transport systems within a corridor. While the construction-related impacts for each individual transport system would be unchanged, the increased level of construction activity within a relatively limited area has the potential to result in additional or aggravated impacts. For example, the potential for traffic accidents would increase dramatically as the number of construction and hauling vehicles increases on roads accessing the corridor segment where simultaneous construction activities are occurring. In fact, it is reasonable to expect that safety considerations, when combined with the reality of having limited capacities to support logistical activities (such as transporting materials to the general area), would necessarily limit or constrain simultaneous and proximate construction activities, and thus ameliorate increased health and safety impacts. The anticipated increases in health and safety impacts would be imposed largely on the

TABLE 3.14-6 Major Health and Safety Hazards Associated with Pipeline Construction

Activity	Generic Hazard	Control
Clearing ROW and constructing access roads	Physical hazards from use of heavy equipment, power saws; falling trees and branches; exposure to herbicides; bee stings and animal bites; noise exposure; trips and falls, eye pokes; heat and cold stress; smoke inhalation	Employee training; health and safety plan; daily safety briefing; use of personal protective equipment (PPE); safeguards on equipment; safe practices for downing trees; safe operation of equipment; approved herbicide application procedures; first aid; burn permit/waste management plan
Construction and use of temporary power and/or energy systems used during construction activities	Employee injury and property damage from contact with hazardous energy sources (electrical, thermal, mechanical, etc.)	Electrical safety program; appropriate design and installation of temporary systems
Working on electrical equipment and systems	Employee contact with live electricity and energized equipment	Electrical safety program; PPE program; appropriately designed electrical devices
Exposure to hazardous materials/chemicals	Employee contact with hazardous materials/chemicals as a result of accidental releases	PPE program; spill/emergency response plans, equipment; worker training
Exposure to hazardous waste	Personnel who are working with or have the potential to be exposed to contaminated soil, groundwater, or debris during construction	Hazardous waste management program
Confined space entry	Employee injury from physical and chemical hazards; dangerous atmospheres	Permit-required, confined-space entry program; air monitoring programs; PPE program; respiratory protection program
General construction activity: power tools	Employee injury from hand and portable power tools	Hand and portable power tool safety program; PPE program
General construction activity: walking/working on surfaces	Employee injury/property damage from inadequate walking and work surfaces	Housekeeping and material handling and storage program
General construction activity: noise	Employee exposure to occupational noise	Hearing conservation program; PPE program
General construction activity: material handling	Employee injury from improper lifting and carrying of materials and equipment	Back injury prevention program; use of appropriate lifting/rigging devices and equipment
General construction activity: impacts	Employee injury to head, eye/face, hand, body, foot, and skin	PPE program

TABLE 3.14-6 (Cont.)

Activity	Generic Hazard	Control
General construction activity: dusts, vapors, fumes	Employee exposure to hazardous gases, vapors, dusts, and fumes	Hazard communication program; respiratory protection program; PPE program; air monitoring program; fugitive dust management plans
General construction activity: hoisting and lifting	Employee injury or property damage from falling loads; injury or damage from contact with derrick or crane	Hoisting and rigging program; employee awareness training; PPE
General construction activity: various hazards	Employee exposure to various hazards; reporting of hazardous conditions during construction	Injury and illness prevention program
General construction activity: heat/cold stress	Heat and cold stress; weather extremes	Heat and cold stress monitoring and control program; shelter from weather extremes; appropriate clothing
General construction activity: fall potential	Fall potential resulting from working in rugged areas	General safety program; safety harnesses
General construction activity: trenching and excavation	Employee injury resulting from trench wall collapse; injury from trenching excavating equipment	Proper bracing of trench walls; trench stabilization techniques; employee training programs; rescue response plans, equipment, and training
General construction activity: welding	Employee exposure to compressed gases (welding gases)	Hazard communication program; compressed gas storage, handling, and use training
General construction activity: working near/in water	Employee exposure to water (water crossings)	Special construction techniques and training; special personal protective devices
Construction and testing of high-pressure natural gas systems	Employee injury and property damage due to failure of pressurized system components or unexpected release of pressure	Pressure vessel and pipeline safety program; electrical safety program
Dangerous animals/insects	Bites and injuries sustained from contact with dangerous animals, insects, and plants	Hazard awareness training; protective clothing; pest and vegetation control programs; dangerous animal management programs; on-site first-aid capabilities

TABLE 3.14-7 Major Health and Safety Hazards Associated with Construction of High-Voltage Electricity Transmission Systems

Activity	Generic Hazard	Control
Clearing ROW and constructing access roads	Physical hazards from use of heavy equipment, power saws; falling trees and branches; exposure to herbicides; bee stings and animal bites; noise exposure; trips and falls; eye pokes; heat and cold stress; smoke inhalation	Training; health and safety plan; daily safety briefing; use of PPE; safeguards on equipment; safe practices for downing trees; safe operation of equipment; approved herbicide application procedures; first aid; burn permit/waste management plan
Installing transmission line support towers	Heavy equipment operation, crane operation; overhead work/falling items; falls from height	Licensed equipment operators; work area controls; PPE/hard hats; safety equipment
Stringing conductors	Rotating equipment; lines under tension; suspended loads; overhead work/falling items	Work area controls; PPE; safety equipment
River crossings	Work near or in streams: drowning hazard	Safety equipment; monitors
Installing AC mitigation	Heavy equipment operation; buried utilities; falls in trenches	Trenching/confined space entry plan; ground surveys
Building substations	General construction hazards; working around live electricity and energized equipment; exposure to hazardous materials	Electrical safety plan; hazardous materials safety plan
Confined space entry (equipment vaults)	Employee injury from physical and chemical hazards; dangerous atmospheres	Permit required; confined space entry program; air monitoring program; PPE program; respiratory protection program
General construction activity: power tools	Employee injury from hand and portable power tools	Hand and portable power tool safety program; PPE program
General construction activity: walking/working on surfaces	Employee injury/property damage from inadequate walking and work surfaces	Housekeeping and material handling and storage program
General construction activity: noise	Employee exposure to occupational noise	Hearing conservation program; PPE program
General construction activity: material handling	Employee injury from improper lifting and carrying of materials and equipment	Back injury prevention program
General construction activity: impacts	Employee injury to head, eye/face, hand, body, foot, and skin	PPE program

TABLE 3.14-7 (Cont.)

Activity	Generic Hazard	Control
General construction activity: dusts, vapors, fumes	Employee exposure to hazardous gases, vapors, dusts, and fumes	Hazard communication program; respiratory protection program; PPE program; air monitoring program; fugitive dust management plans
General construction activity: various hazards	Employee exposure to various hazards; reporting of hazardous conditions during construction	Injury and illness prevention program
General construction activity: heat/cold stress	Heat and cold stress; weather extremes	Heat and cold stress monitoring and control program; shelter from weather extremes; appropriate clothing
General construction activity: fall potential	Fall potential resulting from working in rugged areas	General safety program; safety harnesses; employee training programs; rescue response plans, equipment, and training
General construction activity: welding	Employee exposure to compressed gases (welding gases) (compressed air-driven tools and equipment)	Hazard communication program; compressed gas storage, handling, and use training
General construction activity: working near/in water	Employee exposure to water (water crossings)	Special construction techniques and training; special personal protective devices
Installation and testing of gas-filled equipment	Employee injury and property damage due to failure of pressurized system components or unexpected release of pressure	Gas-filled equipment safety program; electrical safety program
Dangerous animals/insects	Bites and injuries sustained from contact with dangerous animals, insects, and plants	Hazard awareness training; protective clothing; pest and vegetation control programs; dangerous animal management programs; on-site first-aid capabilities

TABLE 3.14-8 Health and Safety Hazards Associated with Pipeline Operations

Activity	Generic Hazard	Control
Motor vehicle and heavy equipment use	Employee injury and property damage from collisions between people and equipment	Motor vehicle and heavy equipment safety program
Forklift operations	Same as heavy equipment use	Forklift operation program
Trenching and excavation during pipeline repair/replacement activities	Employee injury and property damage from the collapse of trenches and excavations	Excavation/trenching program
Working at elevated locations	Falls from the same level and elevated areas	Fall protection program; scaffolding/ladder safety program
Use of cranes, derricks, or other lifting devices	Property damage from falling loads; employee injuries from falling loads; injuries and property damage from contact with crane or derrick	Crane and material handling program
Working with flammable and combustible gases (natural gas) and flammable liquid fuels	Fire/spills; accidental exposures	Fire protection and prevention program; Emergency response plans, equipment, and first responder training; hazard communication program; PPE
Working with hazardous materials	Employee injury due to ingestion, inhalation, dermal contact	Hazard communication program; PPE; engineered barriers
Hot work (including cutting and welding)	Employee injury and property damage from fire; exposure to fumes during cutting and welding; ocular exposure to ultraviolet and infrared radiation during cutting and welding	Hot work safety program; respiratory protection program; employee exposure monitoring program; PPE program; fire protection and prevention program
Troubleshooting and maintenance of pipeline systems and general operational activities	Employee injury and property damage from contact with hazardous energy sources (electrical, thermal, mechanical, etc.); employee exposure to gases maintained at high pressures (natural gas and hydrogen pipeline systems only)	Electrical safety program; high pressure gas training
Working on electrical equipment and systems	Employee contact with live electricity	Electrical safety program; PPE program
Confined space entry	Employee injury from physical and chemical hazards and life-threatening atmospheres	Permit required; confined-space entry program; PPE; respirator program

TABLE 3.14-8 (Cont.)

Activity	Generic Hazard	Control
General pipeline operation activities: power tools	Employee injuries from hand and portable power tools	Hand and portable power tool safety program; PPE program
General pipeline operation activities: walking/working on surfaces	Employee injury and property damage from inadequate walking and work surfaces	Housekeeping and material handling and storage program
General pipeline operation activities: noise	Employee overexposure to occupational noise	Hearing conservation program; PPE program
General pipeline operation activities: material handling	Employee injury from improper lifting and carrying of materials and equipment	Back injury prevention program
General pipeline operation activities: hazardous chemicals	Employee overexposure to hazardous gases, vapors, dusts, and fumes	Hazard communication program; respiratory protection program; PPE program; employee exposure monitoring program
General pipeline operation activities: various hazardous conditions	Reporting and repair of hazardous conditions	Injury and illness prevention program
General pipeline operation activities: heat/cold stress	Heat and cold stress	Heat and cold stress monitoring and control program
General pipeline operation activities: ergonomics	Ergonomic injuries	Ergonomic awareness program
Maintenance and repair of natural gas system: compressed gases	Employee injury and property damage due to failure of pressurized system components or unexpected release of pressure	Pressure vessel and pipeline safety program; electrical safety program
Maintenance and repair of natural gas system: compressed gases, flammable materials	Employee injury and property damage due to natural gas ignition and fire	Emergency action program/plan; risk management plan

TABLE 3.14-9 Health and Safety Hazards Associated with Operation of High-Voltage Electricity Transmission Systems

Activity	Generic Hazard	Control
AC flow	EMF exposure	Line routing; ROW spacing; clearances; de-energizing when possible
Induced currents	Corrosion of adjacent pipelines and other metallic buried infrastructure	Monitoring; cathodic protection systems; pipe coatings
Induced voltages	Shock hazards	AC mitigation installation; use of ground fault mats; grounding of metallic equipment and objects
ROW maintenance/hot work repairs	Heavy equipment operation; power saw operation; falling trees, branches; exposure to herbicides; working around energized transmission lines and shock hazards	Health and safety plan; daily briefings; licensed operators; safeguards on equipment; PPE and safety equipment; electrical safety plan and procedures
Transmission line maintenance	Falls from heights; shock hazards; risks of helicopter/airplane operation	Training; safety equipment; work in good weather
Inspections conducted on the ground	Weather extremes; rugged terrain; dangerous animals, insects, and plants	Heat and cold stress monitoring and control program; hazard awareness training; protective clothing; pest and vegetation control programs; dangerous animal management programs; on-site first-aid capabilities

construction crews involved; however, safety impacts to the public could also be expected from increased construction-related traffic where the transport of work crews and materials to and from the corridor relies on public roadways.

As noted above, simultaneous construction activities on adjacent ROWs have the potential of increasing the risk of accidents because they would add to the overall scale and complexity of construction activities within a relatively small geographic area. Other impacts are also anticipated. Simultaneous construction, especially in relatively remote areas, would result in a short-term but severe workforce drain. If such workforce shortages are overcome by hiring less experienced or poorly trained workers, an increase in the potential for accidents could result. Such potential increases in accident potential would be ameliorated by comprehensive worker training and controlled procedures. Increased activity levels because of simultaneous construction in an area have been known to result in an increase in intrusions by unauthorized and untrained individuals into active construction and laydown areas, also increasing the potential for accidents. Finally, the increase in transportation density on existing roadways would increase the potential for vehicle accidents.

Although the majority of health and safety impacts from the routine operation of electricity transmission systems affect only the operator’s workforce, some potential impacts to the public would result from the electromagnetic fields that are generated coincident to the transmission of high-voltage AC electricity.

The potential health effects from exposure to EMFs generated by high-voltage AC current have been studied for several decades (BPA 1996). However, while the ability of an EMF to interact with matter within living cells is known, these interactions are quite weak, and there is no known mechanism by which these interactions might affect biology or health. Large numbers of epidemiological and laboratory studies have not been able to identify a causative mechanism nor any verified health effects. However, because of the possible existence of an as yet unidentified mechanism and because an association has been observed between some health effects (e.g., leukemia) and EMF exposure in some but not in a majority of studies, this area of research is ongoing. To further add perspective to this issue, EMF around high-voltage AC transmission lines weakens with distance from the conductors and approaches background levels within several hundred feet. Exposure levels to members of the public are typically comparable to those from many common household appliances, such as televisions, refrigerators, and fluorescent lights (BPA 1996).

Finally, the potential for fires may also be affected by corridor development. Both positive and adverse impacts are possible. Clearing and maintaining a ROW through a wooded area (e.g., especially one containing high-fire-risk species such as pinion juniper) can result in the creation of a man-made firebreak. Clearing mainline ROWs and certain functional areas, such as electrical substations and pump and compressor stations, for operational safety can also reduce the amount of fuel available within the ROW for fires. However, potential impacts would also include an increased risk of fires because of the use of flammable fuels and hazardous materials during construction or decommissioning, spills or releases of flammable commodities from operational pipelines, and the operation of internal combustion sources (e.g., vehicle engines) and external combustion sources (e.g., boilers) during construction and decommissioning phases and, to a lesser extent, during operating phases of any of the energy transport systems that might be located within the corridor.

Vegetation management would also increase the risk of fire or facilitate the spread of fire. A ROW cleared of native vegetation that subsequently becomes populated by certain invasive species would result in increased risks of both initiation and spread of fire. For example, if invasive annual grasses (e.g., cheatgrass) were allowed to invade and populate a ROW, the risk of fires in that ROW might be more than the risks in the undisturbed ROW.[11] Fire risks might increase because of the presence of certain structures associated with energy transport systems. Tall electricity transmission towers and communication towers, as well as structures that are substantially taller than surrounding vegetation, represent an increased potential for lightning strikes (however, standard practice would require that all such structures be grounded). Ground faults or arcing from energized electricity conductors and substation equipment also represent an increased potential for fire.

The presence of high-voltage electricity transmission lines would, in some instances, increase the risk to personnel fighting fires in areas proximate to the transmission lines. The powerlines and their support towers would represent obstacles to safe staging of fire-fighting equipment (including air tankers), and damage to towers or power conductors due to exposure to intense heat from an adjacent fire could cause wholesale failure of the transmission system involving electrical arcing to ground that would jeopardize fire-fighting personnel and equipment in the immediate vicinity.

[11] See Section 3.8 for additional discussions on impacts to ROWs from invasive species.

3.14.4.2 Impacts from Environmental and Circumstantial Factors

The health and safety issues discussed in the above paragraphs derive largely from anthropogenic activities related to corridor development (including the siting), construction, installation, and operation of energy transport systems. However, additional health and safety hazards also exist, deriving from environmental factors that may exist in some portions of the designated energy corridors. These environmental factors include geologic conditions, especially those suggestive of inherent instability such as volcanic and seismic activity and earthquake and/or landslide potential.

Not only does the existence of such conditions suggest the potential for impacts on individuals and/or structures, the manner in which energy transport projects are constructed and installed can exacerbate the potential for such impacts to occur. Such destabilizing events can impact construction and/or operating workforces directly if they were present in the affected area at the time of the event, or indirectly, by causing catastrophic damage to the energy transport facilities and related structures. Environmental impacts would also likely result in either scenario. Detailed descriptions of where within the 11-state study area the potential for such events exists have been provided above. Discussions of the nature of the anticipated impacts from natural events are provided in the following paragraphs.

Volcanic Hazards. The potential for volcanic hazards originates from potential future volcanic activities in areas within or near the designated corridors as well as the energy transport project sites on nonfederal lands that have not been designated, which would affect the integrity of the facilities in the corridors. Volcanic hazards take different forms. Direct blasts are among the most destructive of volcanic phenomena. Flows of hot melted rock (lava) can destroy structures along its path. Debris avalanches moving down slopes of a volcano can also be catastrophic. Pyroclastic flows of massive, hot, dry rock fragments on a volcano's flanks and debris flows of water-saturated debris down valleys can travel great distances and at great speeds, creating great destructive forces along their paths. The physical impacts of falling fragments of lava or rock and ash (tephra fall) that are blasted into the air by volcanic explosions can cause serious property damage. Other volcanic-associated hazards include fires, floods produced by the exceedingly rapid melting of snow and ice during eruptions, and earthquakes.

The potential for volcanic hazard depends on several factors: the likelihood of eruption, the distance from a volcanic vent, the type of volcano, the topography near a volcano, and the scale of an eruption (Wolfe and Pierson 1995; Hyde and Crandell 1978; Miller 1989). A volcano is more likely to erupt if it has been active historically or during the Holocene time (within the last 10,000 years) as opposed to a volcano with much older eruption records. Potential hazards tend to be greatest the closer one is to a volcano vent, the steep slopes near a volcano, and along valleys leading from a volcano. Volcanoes with silicic magma are more explosive than volcanoes with basaltic magma; thus, the former create a larger hazard potential. In addition, the size of an eruption, while not predictable, is proportional to the hazard potential.

Earthquake Hazards. Earthquakes produce a variety of hazards, including strong ground shaking, liquefaction, landslides (described in the next section), soil compaction, and surface fault rupture (FEMA 2004). These hazards affect the integrity of facilities and can potentially cause fires in the designated corridors as well as the energy transport project sites on nonfederal lands that have not been designated. Ground shaking produces inertia forces on structures. Depending on the inertial properties of the structures, the mechanical strengths of the structural materials, the connections of different components of the structures, and their geometric shapes, the damage from earthquakes can include: separation of the structures from their foundations, structure collapses, and/or buckling (Bertero 1997). Liquefaction normally occurs when saturated sandy and/or silty material is under intense ground shaking. Liquefied sands and silts lose their bearing capacity, thus damaging the structures above. Loose natural sediment and poorly compacted fill can cause soil compaction during ground shaking. Due to the spatial variations of soil properties, differential settlements may occur, causing damage to structures.

Earthquakes may reactivate surface ruptures and cause displacements. The displacements can shear, compress, or pull structures, if they are built directly astride the faults. Significant structural damage can result if the displacement is large. Surface rupturing (or faulting) commonly recurs along existing fault traces. Younger faults are likely to be more active than older faults.

Seismic hazards generally depend on the distance from the epicenter of an earthquake and the magnitude of the earthquake. In evaluating seismic hazards, the frequency of earthquakes along a fault must be considered. Areas underlain by unconsolidated sediment, such as areas along streams and rivers and near the coast, are more susceptible to earthquake hazards.

Landslide Hazards. A landslide is defined here as the downhill movement of geologic material by the force of gravity. They range from rock falls, catastrophic rock avalanches, and debris flows, to deep-seated landslides of weathered and unconsolidated material. Landslides commonly occur in weak geologic material, such as weathered and fractured rocks and unconsolidated sediment, and on steep slopes (although saturated debris flows can occur on gentler slopes). Fine-grained clastic rocks (especially those that are poorly consolidated) and highly fractured rocks are especially susceptible to sliding, particularly at times of intense or sustained rainfall (Radbruch-Hall et al. 1982).

Landslides are commonly triggered by heavy rains and/or rapid snowmelts, volcanic eruptions, earthquakes, and toe-cutting on unstable slopes by natural erosion or human activities. Numerous examples can be found in the 11-state area. In the Rocky Mountains and Pacific Coast regions, the dynamic tectonic environment has recreated rugged terrains. Numerous faults spread across the regions. Landslides were widely reported in Utah and southern California from 1982 to 1984 and from 1997 to 1998 during the abnormally high precipitation related to El Nino effects (Baum and Fleming 1988; Chleborad 2000; Spiker and Gori 2003; Witkind 1986; Giraud 2005). Numerous landslides were triggered by the 1964 Alaska earthquake. Rapidly moving landslides (debris avalanches) are common on slopes of volcanoes during their eruptions (Hoblitt et al. 1998). Wildfires in southern California denuded vegetation, making hillsides susceptible to debris flow by winter rainstorms. In addition, human activities can induce landslides, as when roads and structures are built without adequate lateral supports or proper drainage.

The impact of the energy transport project sites on the potential for landslides is through construction activities. Such activities include vegetation clearing, changing drainage patterns, grading slopes inadequately, removing existing toe supports of steep slopes, or blasting during land development and road and facility construction. The modification of land surfaces can facilitate water infiltration in rainstorms and snowmelts, thus allowing pore pressure buildup in the subsurface, making it easier for the slopes to fail. In landslide-prone areas, removing the toe supports of slopes can also trigger or reactivate landslide.

The impacts of landslides on the environment include changes in (1) local topography, (2) land surface drainage,

(3) streams and valleys downgradient of the landslides, (4) forest destruction, and (5) stream habitat deterioration (Schuster and Highland 2001). When a landslide is significant, natural drainages can be blocked or dammed by landslide material, forming a temporary lake behind the dam that floods the area upstream of the dam (Witkind 1986). A failure of the dam eventually would send a surge of floodwater and sediments downstream. The magnitude of the impact depends on the location and magnitude of the landslides.

While construction activities can induce landslides, naturally occurring landslides can adversely affect the integrity of structures on energy transport project sites. Losses of properties and infrastructures may result from direct debris impact, sediment burial, and erosion along the paths of the landslides. The damage to structures may, in turn, cause environmental impacts, such as spills of petroleum products.

3.14.4.3 What Mitigation Is Available to Minimize, Avoid, or Compensate for Potential Project Impacts to Health and Safety?

Mitigation of Construction-Related Hazards. Mitigation of impacts from construction would be accomplished in large part through the required implementation of plans and administrative and engineering controls designed to comply with state and federal regulations, conform to accepted industry standards and practices, or satisfy lease stipulations. That is, mitigation would be an integral part of normal construction practices under controls required by prevailing regulations and guidelines. The magnitude of specific impacts to be mitigated might vary somewhat under the various alternatives, but the nature of the corresponding applicable mitigative measures used would be quite similar under both alternatives and would depend on the specific activities involved, site conditions, and specific circumstances encountered at the time of construction. The latter factors would include the specific physical conditions encountered along a particular route, including soil, geologic, hydrologic, and biologic conditions and specific circumstances at the time of construction, including the time of year, weather conditions, and other construction projects that might be occurring in the vicinity.

The majority of hazards present depend on specific construction activities, rather than on the types of energy transport systems; thus, most anticipated impacts would be common for the various systems. Common activities include land clearing (grubbing), excavation, land reclamation, operation of heavy equipment, use of hand tools, and use of energized equipment. Electricity transmission line construction might also involve the use of helicopters to install towers, work at heights, and work with specialized conductor-stringing equipment. Pipeline construction in remote areas may also need to resort to airlifting components and construction equipment to the ROW. Pipeline construction would involve a great deal more excavation, soil management, and welding, and would involve a generally greater overall effort than electricity transmission line construction. Although the majority of construction activities will occur within the construction ROW within the designated corridor, some activities involving material laydown and storage areas would occur off-ROW and would have the potential to impact the public. Hazards to the public would also be associated with construction traffic, loss of utility services if accidentally severed, and risks from unauthorized access to construction worksites and material storage and laydown areas.

Construction hazards would be mitigated primarily through the implementation of plans and controls designed to guarantee compliance with applicable state and federal regulations, guidelines, and practices as stipulated under an overarching health and safety plan for approved projects. This plan would identify all construction project risks to workers and the public and would list required or appropriate good practices, protections, and countermeasures necessary to minimize risks to the degree practicable. In some instances, additional plans would also be warranted. For example, hazardous material and hazardous waste management, storm water management, transportation of materials, equipment and workforce, fire safety, vegetation management, and emergency response would all typically be addressed in respective plans.

Those plans would establish procedures for both routine and off-normal operations based on applicable regulations, permit conditions, or applicable federal or state agency guidance; assign responsibilities; establish appropriate mitigation strategies; and introduce mechanisms for auditing plan conformance and evaluating the effectiveness and sufficiency of both engineering and administrative controls. As noted in the above discussion of alternatives, the adoption of uniform corridor designations would tend to assure consistent application of a high level of hazard mitigation, as requirements would be developed at a programmatic level for application to individual projects in the corridor. Such programmatic requirements might include additional requirements imposed by the managing federal agencies beyond those that would ordinarily be required for similar projects.

Mitigation of Operation-Related Impacts. Mitigation of operation-related impacts from energy transport systems would be accomplished primarily through design considerations of the routes, ROWs, and facilities making up the systems and through the development and implementation of various operating plans. Similar to those plans developed to support construction, plans developed for operation would address critical aspects of operation including, but not limited to, hazardous material and waste management, storm water management, and monitoring for external impacting factors (e.g., seismic activity, landslides, etc.). Operating plans would establish detailed procedures, assign responsibilities, and establish self-auditing processes for evaluating overall effectiveness and sufficiency of operations.

Mitigation strategies would be developed for both routine and off-normal operating conditions. Under normal operating conditions, health and safety impacts to the public from any of the approved systems would be minimal. No active mitigation would be required. Mitigation of impacts under failure modes for the various systems, however, would involve both design considerations and active emergency response measures. The nature, design, and effectiveness of such measures would, in any case, vary substantially from place to place, and would be further affected by the nature of the alternative under which systems are built.

Impacts from accidents and other fault modes in electrical, natural gas, oil, or hydrogen transport systems would depend on the nature of the failure, its time and location, and regional factors. The ability of system operators and public emergency response agencies to correct and mitigate failures would depend on the severity of the failure, available corrective actions, and the location of the affected facilities in relation to populated areas and to emergency services. The speed and effectiveness of mitigation would also depend on the ability of failures to be detected. The primary means of detection would be through SCADA systems. Secondary detection and confirmation would be through public reporting of accidents, fires, or loss of service.

The loss of function of transport systems would have impacts outside the immediate location of accidents due to the potential loss of critical services and energy supplies to whole regions of the country. The mitigation of these impacts would also depend on design considerations, in this case, system design and response effectiveness. System reliability designs would consider alternate supplies, routes, redundancies, and workarounds to address local failures. SCADA systems and technologies, again, would play an important role in the ability of the system to maintain functionality in the event of a failure in part of the system.

Mitigation of impacts due to transport system failures would vary somewhat under the proposed alternatives, as the nature of the alternatives suggests different levels of coordination of operation, and thus response to failures of the component systems making up the alternatives. Under the alternative that includes corridor designation, the Proposed Action, a more coordinated detection and response function might be possible for transport systems than in the absence of such designation under No Action. Such coordination might involve shared, and thus more frequent, inspections; shared, and thus improved, access roads; mutual notification of operators in an affected area; and coordinated response plans.

Design considerations would also mitigate impacts from failures under the Proposed Action. Transport systems built in designated corridors would be strategically placed to minimize impacts from failures from individual systems and to minimize the possibility of a failure in one system from causing a failure in one or more other systems. This benefit would be achieved though a system of restrictions and preferences for the coplacement of multiple systems in a designated corridor. It would be expected that a more nearly optimal placing of transport systems to assure system reliability and to minimize cascading impacts would be possible under corridor designation than under the absence of such a designation.

Mitigation of Impacts during Decommissioning. Decommissioning involves activities similar to construction, and thus presents many of the same health and safety hazards. These hazards mainly affect workers, but some, including increased construction traffic and the presence of potentially hazardous work areas for intruders, also affect members of the public, albeit at low risk levels. However, decommissioning phases are expected to last for shorter periods of time than the construction phase and may involve fewer specific steps, since some portions of energy transport systems that are below grade (e.g., tower foundations, mainline pipe) may be simply cleaned and abandoned in place rather than removed. Such a strategy would not only reduce the duration of the decommissioning activity as well as the extent of health and safety impacts, but would also be less disruptive of ecosystems that had reestablished after disruptions occurring during original construction.

As with construction, worker health and safety risks associated with decommissioning would be mitigated through the implementation of an overarching health and safety plan. The health and safety plan would include a comprehensive list of hazards and identification of procedures, protections, and countermeasures designed to reduce them to the lowest level practicable. As with the construction phase, additional companion plans addressing certain aspects of decommissioning may also be warranted. In most instances, virtually an identical array of plans and controls would be established as were in place for the construction phase. For example, a traffic management plan to minimize risks to workers and the public may be warranted. Specific plans for addressing unique hazards associated with the use of explosives, other hazardous materials, or fuels, or from working around electricity, also would be prepared. Provisions to protect unauthorized access by intruders during off-hours would also be included as a measure to protect the public.

Finally, as with the construction phase, the majority of the activities would occur within the ROW, and their related health and safety impacts would be imposed primarily on the deconstruction workforce. However, impacts to the public would also occur from activities occurring off the ROW such as at off-ROW material storage and component dismantlement and salvage recycling operations and as a result of deconstruction-related traffic on public roadways. Impacts to the public would also occur from unauthorized access to deconstruction worksites and off-ROW storage and recycling facilities.

As is the case for construction, the adoption of uniform corridor designations under the Proposed Action would encourage a comprehensive approach to hazard mitigation during decommissioning, and thus would be a benefit of programmatic level management of projects in the corridor. A set of uniform requirements would tend to cover gaps in health and safety impact mitigation programs that might appear if projects were developed in the absence of corridor designations.

Mitigation Measures for Geologic Hazards. Identifying areas with potential geologic hazards is critical in a project. Experienced engineering geologists can achieve the objective by conducting appropriate site-specific geologic studies.

Projects being planned in areas with geologic hazards would need special engineering consideration and designs. Depending on the type of potential geologic hazards (e.g., ground shaking, liquefaction, landslides, etc.), the designs may vary and should address specific needs for structural supports.

In addition, unstable slopes and local factors that could induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and dip angles of geologic strata) should be identified during the planning phase of individual projects. Creating excessive slopes during excavation and blasting operations should be avoided. In cases where geologic hazard areas are unavoidable, contingency plans should be prepared for each area where potential pipeline spills might occur because of geologic hazards. Such plans, for example, might include the addition of extra mainline valves positioned to isolate susceptible pipeline segments, thus limiting the amount of commodity in jeopardy of release, should system integrity be compromised.

4 HOW ARE CUMULATIVE IMPACTS EVALUATED?

A cumulative impact, as defined by the CEQ, "results from the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). The analysis presented in this chapter places the impacts associated with West-wide energy corridor designation and land use plan amendments (the Proposed Action) into a broader context that takes into account the full range of impacts of actions taking place within the 11 western states in the foreseeable future. When viewed collectively over space and time, individual minor impacts could produce significant impacts. The goal of the cumulative impacts analysis, therefore, is to identify potentially significant impacts early in the planning process to improve decisions and move toward more sustainable development (CEQ 1997b; EPA 1999).

Text Box 4-1
What Are Cumulative Impacts?

Cumulative impacts are the incremental environmental effects of an action or actions, such as those analyzed in this PEIS, in combination with other past, present, and reasonably foreseeable future actions.

Sections 4.1 through 4.4 describe the methodology, regions of interest, time frame, and reasonably foreseeable future actions for the cumulative impacts assessment. Section 4.5 presents a description of the types of actions and trends occurring on federal and nonfederal lands in the 11 western states. The cumulative impacts analyses for each resource area are presented in Section 4.6. These analyses take into account the issues raised in public scoping and focus on the effects associated with the Proposed Action described in Chapter 2.

4.1 WHAT IS THE PROCESS OF ASSESSING CUMULATIVE IMPACTS?

The analysis of cumulative impacts presented in the following sections focuses on the natural resources, ecosystems, and human communities that could be affected by the incremental impacts of the alternatives described in Chapter 2. The cumulative impacts analysis builds upon the analyses of the direct and indirect impacts of the alternatives developed during preparation of this PEIS and encompasses incremental impacts to human and environmental receptors in the 11 western states.

4.1.1 What Is the General Approach?

The general approach for the cumulative impacts assessment follows the principles outlined by the CEQ (1997b) and the guidance developed by the EPA (1999) for independent reviewers of environmental impact statements. The cumulative assessment presented in Section 4.6 incorporates the following basic guidelines:

- Individual receptors (or receptor groups) described in the affected environment (i.e., resource description) sections in Chapter 3 become the end points or units of analysis for the cumulative impacts analysis;

- Direct and indirect impacts described in the environmental consequences sections in Chapter 3 form the basis for the impacting factors used in the cumulative analysis;

- Impacting factors (e.g., soil disturbance) are derived from a set of past, present, and reasonably foreseeable future actions or activities; and

- The temporal and spatial boundaries of the cumulative impacts analysis are defined around the individual receptors (within each of the 11 western states) and the set of past, present, and reasonably foreseeable future actions or activities that could impact them.

In this PEIS, all of the environmental consequences for the various resource areas are discussed in Chapter 3.

4.1.2 What Is the Methodology?

The cumulative impacts analysis focuses on the human resources and environmental receptors that can be affected by the incremental impacts associated with the designation of West-wide energy corridors and land use plan amendments in combination with other past, present, and reasonably foreseeable future actions. The CEQ discusses the assessment of cumulative effects in detail in its report entitled *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997b). On the basis of the guidance provided in this report, the following methodology was developed for assessing cumulative impacts:

1. The significant cumulative impacts issues associated with the Proposed Action are identified, and the assessment goals are defined. These issues were initially identified during scoping and are discussed in Chapters 1 and 2. Other actions and issues were added later as they were identified.

2. The geographic scope (i.e., regions of influence) is defined for the analysis. The regions of influence encompass the areas of affected resources and the distances at which impacts associated with the alternatives may occur. The regions of influence are discussed in Section 4.2.

3. The time frame for the analysis is defined. The temporal aspect of the cumulative impacts analysis generally extends from the past history of impacts on each receptor through the anticipated life of the project (and beyond, for resource areas having more long-term impacts). The time frame of the actions to be evaluated in the cumulative analysis is presented in Section 4.3.

4. Past, present, and reasonably foreseeable future actions are identified. These include projects, activities, or trends that could impact human and environmental receptors within the defined regions of influence and within the defined time frame. Past and present actions are generally accounted for in the analysis of direct and indirect impacts under each resource area and carried forward to the cumulative impacts analysis. Foreseeable future actions (by type) are identified in Table 4.1-1 and described in Section 4.4.

5. The baseline conditions of resources and receptors (i.e., ecosystems and human communities) identified during scoping are characterized. Baseline characteristics are described in the affected environment sections for each resource area in Chapter 3.

6. Direct and indirect impacts to resources and receptors are characterized. Direct impacts are caused by implementing an alternative, and they occur at the same time and place as the Proposed Action. Indirect impacts are caused by the Proposed Action, but occur later in time or farther in distance from the corridors and are still reasonably foreseeable. These impacts are detailed in the environmental consequences sections of Chapter 3 for each resource area.

TABLE 4.1-1 Reasonably Foreseeable Future Actions in the 11 Western States

Types of Actions	Associated Activities and Facilities
Oil and gas exploration, development, and production	*Exploration and development:* • Exploratory drilling • Construction of well pads • Well installation • Spills/releases • Pipeline and utility corridors • Access roads and helipads • Compressor stations • Site reclamation and rehabilitation *Production:* • Production and processing plants • Refineries • Carrier pipelines • Spills/releases • Power plants • Access roads *Oil shale mining and processing:* • Surface mines • Underground mines • In situ retorting • Processing plants (rock crushing and retorting) • Refineries • Solid waste (overburden, waste rock, spent shale, and tailings) • Site reclamation and rehabilitation *Tar sands mining and processing:* • Surface mines • Underground mines • In situ recovery (e.g., steam injection) • Extraction plants • Solid waste (overburden, waste sand, spend sand, tailings) • Refineries • Site reclamation and rehabilitation
Coal and other mineral exploration, development, and production (extraction)	*Exploration and development:* • Exploratory drilling and trenching • Access roads and helipads *Production:* • Surface mines • Underground mines • Access roads • Processing (beneficiation) plants • Transportation (e.g., railroads) • Solid waste (overburden, waste rock, and tailings) • Site reclamation and rehabilitation

TABLE 4.1-1 (Cont.)

Types of Actions	Associated Activities and Facilities
Transmission and distribution systems	*Utility corridors:* • Carrier pipelines • Oil and gas pipelines • Fuel transfer stations • Spills/releases • Transmission lines • Substations • Access roads
Renewable energy development	*Wind energy:* • Vegetation clearing and excavation • Construction of meteorological towers • Construction of turbine towers • Access roads • Electrical substations and transformer pads • Ancillary facilities (e.g., control building and sanitary facilities) *Geothermal energy:* • Power plants • Well installation • Solid waste • Hydrogen sulfide recovery and recycling *Hydropower:* • Generating stations *Other technologies:* • Solar • Biomass
Commercial timber production	• Timber and vegetation harvesting • Access roads
Transportation	• Highways, roads, and parkways • Railroads (coal transport) • Hazardous material releases
Legislative actions related to land management	• See Table 4.5-8
Major land uses (federal and nonfederal)	• Forest land • Grassland pasture and rangeland • Cropland • Special uses (parks and wildlife areas) • Other uses (including commercial) • Urban land
Grazing and rangeland management	• Livestock grazing • Resource conservation (during nonuse periods) • Rangeland improvements (e.g., water pipelines, reservoirs, and fences)

TABLE 4.1-1 (Cont.)

Types of Actions	Associated Activities and Facilities
Recreation and leisure	• Visiting scenic and historic places • Cross-country and downhill skiing • Hunting and fishing • ATV use • Camping, hiking, and picnicking • Viewing wildlife • Driving for pleasure
Remediation	• Abandoned mine lands • Hazardous material sites
Population trends	• Agricultural, residential, and commercial property development adjacent to federal lands • Urbanization • Resource use (e.g., water)

7. The potential impacting factors of each past, present, or reasonably foreseeable future action or activity are determined. Impacting factors are the mechanisms by which an action affects a given resource or receptor. Both No Action and the Proposed Action would generate factors that could cause impacts to resource areas and receptors. These individual contributions are summarized in Table 4.6-1 and aggregated to form the basis of the cumulative impacts analysis to follow.

8. Cumulative impacts on receptors are evaluated by considering the impacting factors for each of the various resource areas and the incremental contribution of the Proposed Action to the cumulative impact. The cumulative impacts for each resource area are presented in Section 4.6 and are summarized in Table 4.6-2.

Cumulative impacts can be additive, less than additive, or more than additive (synergistic). In cases where the contributions of individual actions to an impacting factor were uncertain or not well known, a qualitative evaluation of cumulative impacts was necessary. A qualitative evaluation covers the locations of actions, the times they would occur, the degrees to which the impacted resource is at risk, and the potential for long-term and/or synergistic effects.

4.2 WHAT ARE THE REGIONS OF INFLUENCE?

The regions of influence encompass the geographic areas of affected resources and the distances at which impacts associated with the Proposed Action may occur. To determine which other actions should be included in a cumulative impacts analysis, the regions of influence must first be defined. These regions should not be limited to just the locations of the Proposed Action but should also take into account the distances that cumulative impacts may travel and the regional characteristics of the affected resources.

Because this PEIS addresses corridor designation and land use plan amendments at a programmatic level, the regions of influence for each resource evaluated by the cumulative impacts analysis are the 11 western states in which the corridors or corridor segments would be constructed. The geographic boundaries of areas of concern within these regions may vary based on the nature of the resource area being evaluated and the distance at which an impact may occur (thus, for example, the evaluation of air quality may have a greater regional extent of impact than cultural resources).

4.3 WHAT IS THE TIME FRAME OF THE ACTION ALTERNATIVES?

The time frame of the cumulative impact analysis incorporates the sum of the effects of the alternatives in combination with past, present, and future actions, since impacts may accumulate or develop over time. The future actions described in this analysis are those that are “reasonably foreseeable”; that is, they are ongoing (and will continue into the future), are funded for future implementation, or are included in firm near-term plans. The reasonably foreseeable time frame for future actions evaluated in this cumulative analysis is 20 years from the designation of West-wide energy corridors and land use plan amendments. While it is difficult to project reasonably foreseeable future actions (or trends) beyond this time frame, it is acknowledged that the effects identified in the cumulative impacts analysis will likely continue beyond the 20-year horizon.

4.4 WHAT ARE THE REASONABLY FORESEEABLE FUTURE ACTIONS?

Reasonably foreseeable future actions include projects, activities, or trends that could impact human and environmental receptors within the defined regions of influence and within the defined time frame. Table 4.1-1 presents the types of future actions on federal lands that have been identified as reasonably foreseeable in the 11 western states as part of the cumulative impact analysis. Both actions that are related to West-wide energy corridor designation and actions that are unrelated to the program are described.

4.5 WHAT ARE THE TYPES OF ACTIONS?

4.5.1 Oil and Gas Exploration, Development, and Production

Oil and gas provide 62% of the energy supply in the United States and almost all of its transportation fuels (National Energy Policy Development Group 2001). In 2005, about 22% of domestic oil and 24% of domestic natural gas were produced in nine of the 11 western states (EIA 2006a).

Table 4.5-1 compares oil and gas production between 2000 and 2005 in the nine producing western states. During this period, overall production of oil in the western states decreased by almost 8% (although it increased significantly in Montana and Colorado); gas production increased by 19%. The EIA (2007a) projects continued growth and reliance on fossil fuels in the coming decades and that fossil fuels (oil, gas, and coal) will provide the same 86% share of the total U.S. primary energy supply in 2030 as they did in 2005. Future actions will focus on the development of new recovery techniques to enhance oil and gas recovery in the field (National Energy Policy Development Group 2001).

Onshore oil and gas production on federal lands make up about 5% and 11%, respectively, of domestic production (National Energy Policy Development Group 2001). In FY2004, sales of oil and gas from BLM-administered lands in the western states accounted for more than 90% of the total oil and gas sales volume from federal lands. In that year, 59,520 oil and gas wells operated on more than 18,000 leases (Table 4.5-2). The number of competitive and noncompetitive oil and gas leases declined slightly from FY2000 to FY2004, after peaking in FY2002 and FY2003 (BLM 2005i).

A recent interagency study of the oil and gas resources on federal lands focused on

TABLE 4.5-1 Oil and Gas Production in the Western Region in 2000 and 2005

State	Oil Production (bbl)[a] 2000	Oil Production (bbl)[a] 2005	Oil Production (bbl)[a] Percent Change	Gas Production (mcf)[a] 2000	Gas Production (mcf)[a] 2005	Gas Production (mcf)[a] Percent Change
Arizona	59,000	50,000	–15.3	368	233	–36.7
California	271,132,000	230,294,000	–15.1	418,865	352,044	–16.0
Colorado	18,481,000	22,823,000	23.5	760,213	1,143,985	50.5
Montana	15,428,000	32,855,000	113.0	70,424	108,555	54.1
Nevada	621,000	447,000	–28.0	7	5	–28.6
New Mexico	67,198,000	60,660,000	–9.7	1,820,516	1,656,850	–9.0
Oregon	0	0	0	1,412	454	–67.8
Utah	15,636,000	16,651,000	6.5	281,117	311,994	11.0
Wyoming	60,726,000	51,626,000	–15.0	1,326,042	2,003,826	51.1
Total	449,281,000	415,406,000	–7.5	4,678,964	5,577,946	19.2

[a] bbl = barrels and mcf = million cubic feet.

Sources: EIA (2001, 2006c, 2007b).

TABLE 4.5-2 Oil and Gas Activities on BLM-Administered Public Lands in FY2004

State	Producible and Service Holes	Producible Leases	Acres in Producing Status	Oil Sales Volume (bbl)[a]	Gas Sales Volume (mcf)[a]
Arizona	1	0	0	–[b]	–
California	5,887	304	70,339	15,827,500	6,733,922
Colorado	3,573	2,039	1,340,546	3,998,996	111,355,670
Idaho	–	–	–	–	–
Montana	2,156	1,360	736,958	3,434,518	21,371,718
Nevada	102	29	15,498	598,796	–
New Mexico	25,112	6,598	3,769,487	30,336,794	930,158,803
Oregon	–	–	–	–	
Utah	3,745	1,235	916,106	4,121,756	126,362,710
Washington	1	0	0	–	–
Wyoming	18,943	7,263	3,719,919	33,345,702	911,199,107
Total	59,520	18,828	10,568,853	91,664,062	2,107,181,930

[a] bbl = barrels and mcf = million cubic feet.

[b] – = no activity.

Source: BLM (2005i).

five geologic basins in the western states: Paradox/San Juan Basin, Uinta/Piceance Basin, Greater Green River Basin, Powder River Basin, and the Montana Thrust Belt. The study found that as much as 68% of undiscovered U.S. oil resources and 74% of undiscovered natural gas resources (including coalbed methane) are present within federal lands (DOI 2003, 2005c). The potential for the future expansion in oil and gas exploration, development, and production on federal lands is high.

Oil shale is a sedimentary rock that releases petroleum-like liquid when heated. The mining and processing of oil shale is more complex and expensive than conventional oil recovery; however, increasing oil prices and advances in technology are making it a more feasible energy option. It is estimated that about 72% of the U.S. acreage containing oil shale deposits occurs under federal land in the Green River Formation, a geologic unit that underlies portions of Colorado, Utah, and Wyoming (Figure 2.2-4f). The oil shale in the Green River Formation has the potential to yield as much as 1.5 trillion barrels of oil (BLM 2005i). While there are currently no federal oil shale leases, the likelihood of future leases is high. The BLM is currently preparing a PEIS for oil shale leasing in these three states (BLM 2006j).

Tar sand deposits comprise another oil-yielding resource under western federal land, primarily in eastern Utah (Figure 2.2-4f). These deposits are a combination of clay, sand, water, and bitumen that can be mined and processed to produce oil. It is estimated that these deposits could yield as much as 76 billion barrels of oil (BLM 2005i). While there are currently no federal tar sand leases, the likelihood of future leases is high. The BLM is currently preparing a PEIS for tar sands leasing (together with oil shale leasing) in Colorado, Utah, and Wyoming (BLM 2006j).

4.5.2 Coal and Other Mineral Exploration, Development, and Production

Coal accounts for more than half of the electricity generation in the United States. The electric power sector is the largest coal consumer, accounting for the largest increase (2.1%) in coal consumption relative to other sectors (industrial, commercial, and residential) in 2005 (EIA 2006b).

Coal production in the West reached a record level in 2005, with a total of 553.6 million short tons being produced in seven of the 11 western states, about half of the total U.S. coal production (1,131.5 million short tons) in 2005 (EIA 2006b). Wyoming is the biggest producer of coal in the United States, with a total of 404.3 million short tons of coal produced in 2005 (Figure 2.2-4f).

Table 4.5-3 compares coal production between 2000 and 2005 in the seven producing western states. During this period, overall production increased by almost 14%, continuing a trend of steady increases since the 1970s. The EIA (2007) projects continued growth through 2030 with an average of 1.1% per year from 2005 to 2015 and 1.8% per year from 2015 to 2030. Most of the projected growth is attributed to increased output of surface mines in the Powder River Basin in Wyoming. Demand for low-sulfur western coal is expected to increase because of its environmental benefits relative to other coal sources (National Energy Development Policy Group 2001).

About 38% of the coal produced in the United States comes from federal and Tribal lands in the western states (BLM 2006i).

Economic production of mineral resources on BLM-administered land includes locatable, leasable, and salable solid minerals. Locatable minerals, defined under the General Mining Law of 1972, can be obtained by locating a mining claim; they include both metallic and

TABLE 4.5-3 Coal Production in the Western Region in 2000 and 2005

State	2000 (million short tons)	2005 (million short tons)	Percent Change from 2000 to 2005
Arizona	13.1	12.1	–8.3
Colorado	29.1	38.5	24.4
Montana	38.4	40.4	5.0
New Mexico	27.3	28.5	4.2
Utah	26.7	24.5	–9.0
Washington	4.2	5.3	20.8
Wyoming	338.9	404.3	16.2
Total	477.7	553.6	13.7

Sources: EIA (2006b, 2007c).

nonmetallic materials. Locatable minerals mined on BLM land include gold, silver, lead, and uranium. By the end of FY2005, there were 200,838 active mining claims on file with the BLM, with the highest number (73,418) in Nevada (BLM 2006h). This represents a 12% decline from FY2000 in which 227,431 mining claims (105,555 in Nevada) were on file (BLM 2001a). In FY2002, about 1,000 development holes were drilled for uranium on BLM land (BLM 2005i).

Leasable minerals are subject to the Mining Leasing Act of 1920 and include energy and nonenergy resources; leases to these resources are obtained through a competitive bidding process. Leasable minerals mined on BLM land include coal, sodium, potassium, phosphate, gilsonite, and uranium. The number of leases and associated acres for coal, sodium, potassium, phosphate, and gilsonite on BLM-administered land in FY2000 and FY2005 are shown in Table 4.5-4. The number of coal leases and associated acres have decreased slightly in Colorado, New Mexico, and Utah since 2000, but have increased in Wyoming. The number of leases and associated acres for sodium mining have also decreased since 2000; potassium and phosphate leases have remained steady, although the acres associated with their mining have increased. The number of leases and associated acres for gilsonite mining have remained steady (gilsonite is a natural, resinous hydrocarbon that is similar to a hard petroleum asphalt).

Salable minerals include basic natural resources such as sand and gravel that the BLM sells to the public at fair market value. Other salable materials include soil, stone, clay, and pumice. In FY2005, about 19.5 million cubic yards of mineral materials were disposed of through exclusive and nonexclusive sales and free use permits, representing an increase of 7.5 million cubic yards over FY2000 (BLM 2006h).

The FS reports an estimated 50 billion tons of coal under its NFS lands, with the largest reserves in Colorado and Utah. In 2002, the agency's mineral activities included 150,000 mining claims; 3,000 bonded operations; and 9,000 sales contracts and leases. Other minerals with high development potential on NFS lands include uranium, phosphate, lead, gold, silver, platinum-paladium, and sand and gravel (Schuster and Krebs 2003).

4.5.3 Transmission and Distribution Systems

About 90% of the oil and gas pipeline and electricity transmission ROWs in the western

TABLE 4.5-4 Solid Mineral Leases on BLM Public Lands in FY2000 and FY2005

Leasable Mineral Resource	Number of Leases		Acres	
	2000	2005	2000	2005
Coal				
Colorado	62	53	81,873	79,050
Montana	28	28	43,901	34,635
New Mexico	12	11	27,232	25,272
Utah	93	84	112,355	106,514
Washington	2	2	521	521
Wyoming	81	84	153,755	174,746
Total	278	262	419,637	420,738
Sodium				
Arizona	1	0	4	0
California	34	13	25,826	21,334
Colorado	8	8	16,675	16,674
Nevada	15	0	36,953	0
New Mexico	4	4	2,000	2,000
Utah	8	0	15,366	0
Wyoming	66	63	84,366	77,739
Total	136	88	181,190	117,747
Potassium				
California	8	6	10,286	10,286
Nevada	0	1	0	2,320
New Mexico	108	112	129,115	135,035
Utah	22	18	35,412	34,612
Total	138	137	174,813	182,253
Phosphate				
Idaho	1	1	1,409	1,409
Montana	84	86	39,715	43,755
Utah	7	7	13,029	13,029
Total	92	94	54,153	58,193
Gilsonite				
Utah	13	13	3,641	3,640

Sources: BLM (2001a, 2006h).

states cross public lands (National Energy Policy Development Group 2001). In FY2005, the BLM had a total of 88,729 existing ROWs for oil and gas pipelines and electricity transmission lines in the 11 western states (BLM 2006h). This represents a 6% increase over the number of ROWs (83,249) in existence in FY2000. The largest increase in ROWs granted between FY2000 and FY2005 occurred in Wyoming (up 23.2%), New Mexico (up 12.7%), Nevada (up 9.7%), and Utah (up 9.7%) (Table 4.5-5). BLM processed 2,727 ROW applications and granted or amended 3,775 ROWs in FY2005 (BLM 2006h).

TABLE 4.5-5 Number of Existing ROWs on BLM Public Lands in FY2000 and FY2005

State	Total ROWs in 2000	Total ROWs in 2005			% Change from 2000 to 2005
		MLA[a]	FLPMA[a]	Total	
Arizona	4,760	283	4,242	4,525	–4.9
California	6,180	243	5,548	5,791	–6.3
Colorado	6,297	1,211	4,966	6,177	–1.9
Idaho	5,128	112	4,571	4,683	–8.7
Montanaa	4,387	322	3,263	3,585	–18.3
Nevada	6,845	116	7,395	7,511	9.7
New Mexico	23,259	17,960	8,260	26,220	12.7
Oregon[b]	8,919	22	9,320	9,342	4.7
Utah	4,668	847	4,273	5,120	9.7
Wyoming	12,806	6,098	9,677	15,775	23.2
Total	83,249	26,021	61,515	88,729	6.6

[a] MLA = Mineral Leasing Act of 1920; FLPMA = Federal Land Policy and Management Act of 1976.

[b] Authorized use is tallied by the administrative state. The Montana number includes ROWs on BLM-administered land in North Dakota and South Dakota, and Washington is included in the tally for Oregon.

Sources: BLM (2001a, 2005i).

The National Energy Policy Development Group (2001) projects that the demand for additional energy and electricity will increase the number of ROWs across public lands in the years to come. Other federal agencies authorized to grant ROWs for electric, oil, and gas transmission include the FS, the NPS (electric only), the USFWS, the BOR, and the BIA.

4.5.4 Renewable Energy Development

4.5.4.1 Wind Energy

Wind energy is derived from the naturally occurring energy of the wind. It accounts for about 6% of the renewable electricity generation and 0.1% of the total U.S. electrical supply (National Energy Policy Development Group 2001). Most of the wind energy potential in the United States is in the western states (Figure 2.2-2a). Currently about 20% of the installed wind energy capacity is generated on federal lands, and the potential for future development on federal lands in the western states is high (BLM 2005i). For example, the BLM (2005i) estimates that as many as 10 million acres (46%) of federal land in Nevada have the potential for wind energy development.

4.5.4.2 Geothermal Energy

Geothermal energy resources are the steam and hot water generated by heat from within the Earth. They account for about 17% of the renewable electricity generation and 0.3% of the total U.S. electricity supply (National Energy Policy Development Group 2001). Most of the U.S. production of geothermal energy occurs in the western states (and also Alaska and Hawaii), with as much as 50% on federal land (BLM 2006i). California and Nevada are currently the highest-producing states (Table 4.5-6; Figure 2.2-4b). The number of leases granted by BLM increased by about 22% between FY2000 and FY2005. The number of acres in use for geothermal development also increased during this period.

4.5.4.3 Hydropower

Hydropower generation accounts for about 7% of the total U.S. electricity supply (National Energy Policy Development Group 2001). Five of the western states depend heavily on this resource: California, Idaho, Montana, Oregon, and Washington. Since the areas best suited for this technology have already been developed, it is likely that future development of this technology will be relatively low. Generating capacity in the future will be affected most by activities at existing facilities (e.g., adding turbines or increasing efficiency) or by droughts (which can reduce generating capacity) (BLM 2006i).

4.5.4.4 Other Technologies

Other renewable energy sources with potential for increased development in the West include solar energy and biomass (organic matter). Solar energy accounts for about 1% of renewable electricity generation and about 0.02% of the total U.S. electricity supply (National Energy Policy Development Group 2001). The potential for solar energy development in the 11 western states is shown in Figure 2.2-4c. Currently, there are applications pending for commercial solar power generating facilities on BLM public lands in Imperial and San Bernardino counties in southern California.

Biomass resources account for about 76% of renewable electricity generation and about 1.6% of the total U.S. electricity supply (National Energy Policy Development Group 2001). It is

TABLE 4.5-6 Competitive and Noncompetitive Geothermal Leases on BLM Public Lands in FY2005

State	Acres in Use	Leases	Producing Wells[a]	Total Electrical Generation (GW-hour)[a]
Arizona	2,084	1[b]	NA[c]	NA
California	90,397	67	273	4,109
Idaho	2,465	3[b]	NA	NA
Nevada	322,239	213	45	1,120
New Mexico	4,581	4	1	0
Oregon	54,151	57	4	217
Utah	8,047	9	0	0

[a] The number of producing wells and total electrical generation are from BLM (2005j) for fiscal year 2004.

[b] Number represents noncompetitive lease(s).

[c] NA = not available.

Sources: BLM (2005i, 2006h).

estimated that restoration activities on as many as 12 million acres of public land administered by the BLM would remove biomass that could be used as an energy source. The FS is currently soliciting proposals to increase the use of woody biomass from the NFS by creating markets for small-diameter vegetation and low-valued trees removed during forest restoration activities (*Federal Register* 2006).

4.5.5 Commercial Timber Production

About 33% of the land in the United States is forest land (749 million acres); of this, about one-third (246 million acres) is owned by the federal government. The remainder is classified as nonfederal forest land (406 million acres) and forest land in parks and other special use areas (98 million acres) (Lubowski et al. 2006). The FS defines forest land as "land at least 10-percent stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially reforested." Timberland is a class of forest land that is capable of commercial timber production and not removed from timber use by statute or administrative regulation (Alig et al. 2003).

As of 2002, about 30% of U.S. forest land (231 million acres) was located in the 11 western states (Table 4.5-7). States with the greatest forest land acreage include California (40.2 million acres), Oregon (29.7 million acres), and Montana (23.3 million acres). About 54% (125 million acres) of forest land in the West is classified as timberland, of which about 76.8 million acres are federally owned. Timberland makes up the highest percentage of forest land in Montana (82%), Oregon (80%), Washington (80%), and Idaho (78%).

The USDA reports that in recent decades, U.S. timberland acreage has had an upward trend, gaining 19 million acres between 1987 and 1997 and stabilizing at 504 million acres between 1997 and 2002. These increases were due in part to reclassification in response to rising prices for forest products (Lubowski et al. 2006). Forecasts of forest land acreage in the

TABLE 4.5-7 Forest Land in the 11 Western States by Major Class, FY2002 (in 1,000 acres)

	Total Forest Land			Timberland			Reserved
State	Federal	Nonfederal	Total[a]	Federal	Nonfederal	Total[a]	Timberland and Other Forest Land[b]
Arizona	10,192	9,235	19,427	2,438	1,089	3,527	15,901
California	22,371	17,862	40,233	10,130	7,651	17,781	22,451
Colorado	15,075	6,562	21,637	8,020	3,587	11,607	10,030
Idaho	17,129	4,517	21,646	12,596	4,227	16,824	4,823
Montana	16,512	6,781	23,293	12,506	6,679	19,184	4,108
Nevada	9,608	596	10,204	265	99	363	9,841
New Mexico	9,522	7,159	16,682	2,829	1,530	4,359	12,323
Oregon	17,741	11,910	29,651	14,194	9,637	23,831	5,819
Utah	11,913	3,764	15,676	3,586	1,097	4,683	10,994
Washington	9,422	12,369	21,790	6,104	11,244	17,347	4,443
Wyoming	8,832	2,163	10,995	4,093	1,647	5,739	5,256
Total	148,317	82,918	231,234	76,761	48,487	125,245	105,989

[a] Distributions may not add to totals due to rounding.

[b] Includes forest land in parks, wildlife areas, and other special use areas.

Source: ERS (2007).

West over the next 40 years show a slight decline (about 3% relative to 2002), although total public forest land acreage is not expected to change. The total area of timberland in the West (including public, forest industry, and nonindustrial private land) is also projected to decline by about 3% by 2050 (Alig et al. 2003).

Major timber products include roundwood, lumber (softwood and hardwood), plywood, turpentine, rosin, pulpwood, and paperboard. Production levels for these products rose steadily between 1965 and 1988, then experienced declines until the mid-1990s. Since the mid-1990s, roundwood production has fallen slightly. Lumber production has been increasing but, as of fiscal year 2002, remains below the record levels of the late 1980s. The USDA reported a record in per capita consumption of lumber in the United States in 2002, which was below the high set in 1999 but greater than per capita consumption levels in the 1960s, 1970s, and early 1980s. About 40% of the lumber consumed was used for housing. Other uses include manufacturing at 13%; nonresidential construction (e.g., railroads) at 8%; and shipping (pallets, containers, and dunnage) at 11% (Howard 2003).

The potential for continued growth in the wood products markets will follow the trends in new housing construction and residential improvements. Demand by the furniture and fixtures industry, another major market for hardwood lumber, plywood, veneer, and particleboard, is on the decline, falling 11% in 2002 because of continued growth in furniture imports from China (Howard 2003).

4.5.6 Transportation

4.5.6.1 Federal Lands Highway Program

The Federal Lands Highway Program is administered by the Federal Lands Highway Division of the Federal Highway Administration (FHWA) within the U.S. Department of Transportation. The program provides funding and engineering services for the planning, design, construction, and rehabilitation of forest highway system roads, bridges and tunnels, park roads and parkways, Indian reservation roads, defense access roads, other federal lands roads, and public authority-owned roads serving federal lands (FHWA 2007). A recent Transportation Research Board task force report cites the important relationship between transportation and visitation levels on federal lands. As tourism-related visits (and traffic) rise, access and user demands are exceeding the system's carrying capacity. Current interagency initiatives are focusing on meeting these demands (Eck and Wilson 2000).

4.5.6.2 Transportation of Coal by Rail

Coal is an important commodity transported by rail. Over the past decade, coal's share of rail traffic has increased mainly because of the increased production in the western states of low-sulfur coal, which is transported long distances over rail. In 2000, an average of 14.4 million tons of coal were transported along domestic railroads each week. The demand for clean coal (i.e., low sulfur coal) is expected to increase in the coming decades. This increase in demand could result in capacity shortfalls and delays in transportation, since the current rail system has little excess capacity (National Energy Policy Development Group 2001). Currently, two rail expansion projects have been proposed for the Powder River Basin of Wyoming to meet this increased demand. These include the Dakota, Minnesota, & Eastern Railroad Powder River Basin Expansion Project and the Burlington Northern and Santa Fe Railway Company's expansion projects (to four tracks).

4.5.7 Legislative Acts Related to Land Management

Major statutes governing the management of federal lands are listed in Table 4.5-8.

TABLE 4.5-8 Major Statutes Governing Land Management Activities on Federal Lands in the 11 Western States

Federal Agency	Major Statute	Citation
Bureau of Land Management	Federal Coal Leasing Amendments Act of 1976	P.L. 94–377, 90 Stat. 1083–1092
	Federal Land Exchange Facilitation Act of 1988	P.L. 100–409, 102 Stat. 1086 43 USC 1716
	Federal Land Policy and Management Act of 1976	P.L. 94–579, 90 Stat. 2744 43 USC 2301
	Federal Land Transaction Facilitation Act of 2000	P.L. 106–248, 114 Stat. 613 43 USC 2301 et seq.
	General Mining Law of 1872	Ch. 152, 17 Stat. 91 30 USC 22 et seq.
	Materials Act of 1947	Ch. 406, 61 Stat. 681 30 USC 601 et seq.
	Mineral Leasing Act for Acquired Lands (1947)	Ch. 513, 61 Stat. 913 30 USC 351–359
	Mineral Leasing Act of 1920	Ch. 85, 41 Stat. 437 30 USC 181 et seq.
	Public Rangelands Improvement Act of 1978	P.L. 95–514, 92 Stat. 1803 43 USC 1901 et seq.
	South Nevada Public Land Management Act of 1988	P.L. 105–263, 112 Stat. 2343 31 USC 6901 note
	Taylor Grazing Act of 1934	Ch. 865, 48 Stat. 1269 43 USC 315 et seq.
	Wild Free-Roaming Horses and Burros Act of 1971	P.L. 92–195, 85 Stat. 649 16 USC 1331 et seq.
Forest Service	Cooperative Forestry Assistance Act of 1978	P.L. 95–313, as amended, 92 Stat. 365 16 USC 2101 et seq.
	Forest and Rangeland Renewable Resources Planning Act of 1974	P.L. 93–378, 88 Stat. 476 16 USC 1600 et seq.
	Forest and Rangeland Renewable Resources Research Act of 1978	P.L. 95–307, 92 Stat. 353 16 USC 1641 et seq.
	Multiple-Use Sustained-Yield Act of 1960	P.L. 86–517, 75 Stat. 215 16 USC 528 et seq.
	National Forest Management Act of 1976	P.L. 94–588, 90 Stat. 2949 16 USC 1601 et al.

TABLE 4.5-8 (Cont.)

Federal Agency	Major Statute	Citation
Forest Service (Cont.)	Organic Administration Act of 1897	Ch. 2, 30 Stat. 11 16 USC 473 et seq.
	Pickett Act (1910)	CH. 421, 36 Stat. 847
	Weeks Law of 1911	Ch. 186, 36 Stat. 961 16 USC 515 et al.
National Park Service	Mining in National Parks (1976)	P.L. 94–429, 90 Stat. 1342 16 USC 1901–1912
	National Park Service General Authorities Act of 1970	P.L. 91–383, 84 Stat. 825 16 USC 1a–1, 1c
	National Park Service Organic Act of 1916	Ch. 408, 39 Stat. 535 16 USC 1–4
	National Parks Omnibus Management Act of 1998	P.L. 105–391, 112 Stat. 3497 16 USC 5901 et seq.
	Omnibus Parks and Public Lands Management Act of 1996	P.L. 104–333, 110 Stat. 4093 16 USC 1 et seq.
	Preservation of American Antiquities (1906)	Ch. 3060, 34 Stat. 225 16 USC 431–433
	Recreational Fee Demonstration Program: § 315 of the Interior and Related Agencies Appropriations Act, 1996; § 101(c) of the Omnibus Consolidated Rescissions and Appropriations Act, 1996	P.L. 104–134, 110 Stat. 1321–2000 16 USC 460l
	Yellowstone National Park Act (1872)	Ch. 24, 17 Stat. 32 16 USC 21 et seq.
Fish and Wildlife Service	Endangered Species Act of 1973	P.L. 93–205, 87 Stat. 884 16 USC 1531–1544
	Fish and Wildlife Act of 1956	Ch. 1036, 70 Stat. 1120 16 USC 742a et seq.
	Migratory Bird Treaty Act of 1918	Ch. 128, 40 Stat. 755 16 USC 703–712
	Fish and Wildlife Coordination Act of 1934	Ch. 55, 48 Stat. 401 16 USC 661–667e

TABLE 4.5-8 (Cont.)

Federal Agency	Major Statute	Citation
Fish and Wildlife Service (Cont.)	National Wildlife Refuge System Administration Act of 1966	P.L. 90–404, 80 Stat. 927 16 USC 668dd–668ee
	National Wildlife Refuge System Improvement Act of 1997	P.L. 105–57 16 USC 668dd
	San Francisco Bay National Wildlife Refuge (1972)	P.L. 92–330, 86 Stat. 399 16 USC 668dd note
National Wilderness Preservation System, National Wild and Scenic Rivers System, and National Trails System (multiagency)	California Desert Protection Act of 1994	P.O. 103–433, 108 Stat. 4471
	National Parks and Recreation Act of 1978	P.L. 95–625, 92 Stat. 3467
	National Trails System Act (1965)	P.L. 90–543, 82 Stat. 919 16 USC 1241 et seq.
	Outdoor Recreation Act of 1963	P.L. 88–29 16 USC 4601
	Wild and Scenic Rivers Act (1968)	P.L. 90–542, 82 Stat. 906 16 USC 1271 et seq.
	Wilderness Act (1964)	P.L. 88–577, 78 Stat. 890 16 USC 1131 et seq.
Other	Energy Policy Act of 2005	P.L. 109–58, 42 USC 15801
	Federal Power Act (1920)	Ch. 285, 41 Stat. 1063 16 USC 791–828c
	National Energy Policy and Conservation Act (2000)	P.L. 106–469 42 USC 6201
	National Environmental Policy Act of 1969	42 USC 4321–4347

Source: Vincent et al. (2001).

4.5.8 Major Uses of Federal and Nonfederal Land

In 2002, the major uses of federal and nonfederal land in the United States were forest-use land, grassland pasture and rangeland, cropland, special uses (parks and wildlife areas), miscellaneous other uses, and urban land.[1] Table 4.5-9 compares the major land uses for the 11 western states in 1997 and 2002. Most of the land (47%) in the 11 western states is used as grassland pasture and rangeland. Although total grazing land acreage in the United States has been on the decline since the 1940s, it remained fairly stable in the 11 western states between 1997 and 2002. Forest-use land increased by 5.9 million acres (about 3%) in the 11 western states during the same 5 years. Population has increased between 1990 and 2000 (Section 4.5.12); however, the total acreage devoted to urban land use decreased between 1997 and 2002. Land under the special-use category increased by 5.3 million acres (about 6%) between 1997 and 2002; this was most likely the result of improved data, which led to the reclassification of land in the miscellaneous other-use category (Lubowski et al. 2006).

4.5.9 Grazing and Rangeland Management

In FY2002, grazing land comprised about 60% of the land area in the 11 western states. Grazing takes place on lands the Economic Research Service (ERS) categorizes as cropland pasture, grassland pasture and range, and forest land-grazed (Table 4.5-10). Cropland pasture is the smallest, but generally the most productive component of grazing acreage, accounting for only 1% of the land area in the 11 western states. Grassland pasture and range occupies almost half of the land area in the 11 western states. Grazing is also high on forest land in the West, accounting for about 12% of land area in the 11 western states. New Mexico, Wyoming, and Nevada have the greatest percentage of grazing land. Almost all of BLM lands, as well as the majority of the acreage of the NFS, are available for grazing by private livestock ranchers.

The total grazing land in the United States has declined by about 25% since 1945, due mainly to changes in land use to recreational, wildlife, and environmental uses (with some acres converted to urban uses). Other reasons cited by Lubowski et al. (2006) include fewer farms and less land in farms, increases in forest stand density (making grazing more difficult), and changes in livestock feeding practices.

In FY2005, there were 17,374 permits and leases for livestock grazing, with a total of about 12.6 million active animal unit months (AUMs) on BLM-administered land in the 11 western states. Of those, about 6.8 million AUMs (54%) were authorized and in use (BLM 2006h). About 90% of the authorizations were for the grazing of cattle, 9.5% for sheep and goats, and less than 1% for horses and burros. The nonuse AUMs are generally attributed to drought and financial conditions (BLM 2004f). Table 4.5-11 shows the number of permits and leases and AUMs by state for BLM-administered rangeland. The FS authorizes about 8 million AUMs annually (Schuster and Krebs 2003).

Since 1996, there has been a general downward trend in the number of permits and leases and active use of federal lands for grazing. This trend continues a decades-long trend for public land livestock operators and for the livestock industry as a whole as it consolidates into fewer but larger operations. Studies have shown, however, that federal rangelands administered by the BLM and the FS will continue to be an important part of the livestock-raising subsector of the agriculture industry (BLM 2004f).

A study conducted by Van Tassell et al. (2001) for the FS projected a downward trend in the future livestock grazing demands on federal lands, with the greatest decline in AUMs occurring on land administered by the FS. The

---

[1] The major use categories discussed in this section are defined in the footnotes of Table 4.5-9, based on Lubowski et al. (2006).

TABLE 4.5-9 Major Uses of Land by State in 1997 and 2002 (in 1,000 acres)[a]

State	Cropland[b]		Grassland and Pasture and Range[c]		Forest Use Land[d]		Special Uses[e]		Urban Land		Other Use Land[f]	
	1997	2002	1997	2002	1997	2002	1997	2002	1997	2002	1997	2002
Arizona	1,254	1,235	40,509	40,533	16,306	17,608	10,092	11,373	1,746	1,080	4,571	897
California	10,628	10,655	22,343	21,729	32,579	33,780	20,996	21,558	5,922	5,095	13,277	6,997
Colorado	11,415	12,044	27,867	28,158	18,781	18,925	5,699	6,022	1,070	814	2,623	417
Idaho	5,766	6,408	21,165	20,984	17,123	16,824	5,266	6,175	233	263	3,641	2,305
Montana	18,573	18,118	46,039	46,361	19,165	19,184	6,414	6,863	196	168	2,965	2,458
Nevada	867	884	46,273	46,448	8,199	8,636	5,726	6,882	801	350	9,204	7,088
New Mexico	2,427	2,671	52,188	51,676	14,084	14,978	6,360	6,449	636	484	2,615	1,410
Oregon	5,338	5,311	22,395	23,239	26,664	27,169	3,593	3,946	610	662	3,450	1,112
Utah	2,045	2,044	23,737	24,339	13,832	14,905	5,058	4,958	549	444	7,916	5,882
Washington	8,400	7,983	7,406	7,369	17,418	17,347	6,639	6,839	1,371	1,367	2,749	1,682
Wyoming	3,080	2,860	44,873	44,323	5,085	5,739	6,332	6,416	206	109	2,777	2,697
Total	69,793	70,213	354,800	355,159	189,236	195,095	82,175	87,481	13,340	10,836	55,788	32,945

[a] Includes both federal and nonfederal lands.

[b] Total acreage in the crop rotation.

[c] Grassland and other nonforested pasture and range in farms, excluding cropland used only for pasture, plus estimates of open or nonforested grazing land not in farms.

[d] Forest-use land includes both grazed and ungrazed forest but excludes an estimated 98 million acres in parks, wildlife areas, and other special uses of land.

[e] Special uses include transportation, parks, wildlife areas, defense and industrial areas, farmsteads (and farm roads and lanes).

[f] Other uses category refers to areas in miscellaneous uses not inventoried and marshes, open swamps, bare rock areas, desert, tundra, and other land generally of low value for agricultural purposes.

Sources: Lubowski et al. (2006); ERS (2007).

TABLE 4.5-10 Grazing Land in the 11 Western States, 2002 (in 1,000 acres)[a]

State	Cropland Pasture	Grassland Pasture and Range	Forest Land Grazed	Total Grazing Land	Percent of Land Area
Arizona	214	40,533	11,709	52,456	72.2
California	1,345	21,729	12,070	35,144	35.1
Colorado	1,835	28,158	10,516	40,509	60.9
Idaho	770	20,984	4,432	26,186	49.5
Montana	1,726	46,361	6,620	54,707	58.7
Nevada	314	46,448	6,887	53,649	76.4
New Mexico	837	51,676	9,482	61,995	79.7
Oregon	1,003	23,239	11,558	35,800	58.1
Utah	602	24,339	9,596	34,537	65.5
Washington	499	7,369	3,879	11,747	27.5
Wyoming	913	44,323	3,543	48,779	78.2
Total	10,058	355,159	90,292	455,509	60.5

[a] Includes both federal and nonfederal land.

Source: ERS (2007).

study attributed the declines mainly to urban sprawl and the increase in suburbanization (e.g., ranchette development). Other causes cited were increased demand for recreation, building of second homes in rural areas, and reforestation projects. Wildlife utilization of grazing lands (especially nonconsumptive utilization) is expected to increase into the future.

4.5.10 Recreation

Table 4.5-12 lists the number of recreation visits for the BLM, FS, and NPS in FY2000 and FY2005. By far, the NFS experienced the greatest number of visits (over 135 million). Visits to BLM lands increased in the 11 western states by 5.5 million (about 11%), with the greatest increases occurring in Montana, Nevada, and Colorado. Declines in visits were also recorded, most notably in Wyoming, Oregon, and Idaho. Visits to FS sites decreased by about 7.5 million (about 5%) in five of the six states for which data were available (California, Colorado, Idaho, Montana, and Washington). Visits to NPS sites decreased in the 11 western states by 4.1 million (about 5%) between FY2000 and FY2005. The greatest declines occurred in Nevada, Utah, and Colorado.

The fastest-growing outdoor recreation activities through 2050 (as measured by the number of participants) are projected to be cross-country skiing (95% growth); downhill skiing (93% growth); visiting historic places (76% growth); sightseeing (71% growth); and biking (70% growth). By activity days, increases through 2050 are projected to be visiting historic places (116% growth); downhill skiing (110% growth); snowmobiling (99% growth); sightseeing (98% growth); and nonconsumptive wildlife activity (97% growth) (Bowker et al. 1999). Public lands offer opportunities for these activities; for example, most downhill skiing capacity is located in the western states, especially on national forest lands (Cordell et al. 1990). Therefore, the potential for increased tourism and recreational use of public lands over the next 20 years is considered high.

TABLE 4.5-11 Grazing Permits and Leases on BLM Public Lands as of FY2005

State	Permits or Leases	Active AUMs[a]	Authorized AUMs[b]
Arizona	758	660,528	376,752
California	555	361,430	120,987
Colorado	1,594	664,003	279,480
Idaho	1,889	1,351,806	811,145
Montana	3,743	1,283,126	891,671
Nevada	662	2,187,729	937,965
New Mexico	2,286	1,861,231	1,093,869
Oregon	1,284	1,026,548	604,873
Utah	1,519	1,238,877	620,030
Washington	294	32,144	–[b]
Wyoming	2,790	1,949,749	1,061,827
Total:	17,374	12,617,171	6,798,599

[a] An AUM (animal unit month) is the amount of forage needed by an “animal unit” (i.e., a mature 1,000-lb cow and her calf) for one month. The active AUMs reported are the total number that could be authorized on BLM public lands.

[b] Authorized use is tallied by administrative state. The Montana number includes AUMs authorized on BLM-administered land in North Dakota and South Dakota; and Washington is included in the tally for Oregon.

Source: BLM (2006h).

4.5.11 Remediation

The EPA uses the National Priorities List (NPL) as an informational tool to identify sites that may present a significant risk to public health and/or the environment. Sites included on the NPL undergo an initial assessment to determine whether further investigation to characterize the nature and extent of the public health and environmental risks associated with the site is necessary, and to determine what response action, if any, may be warranted. Inclusion of a site on the NPL does not necessarily mean that the EPA will require a response action. The numbers of sites on the NPL that occur in each of the 11 western states are as follows (numbers in parentheses indicate additional sites that have been deleted from the NPL): Arizona, 8 (3); California, 93 with an additional 3 proposed (11); Colorado, 17 with an additional 2 proposed (3); Idaho, 6 with an additional 3 proposed (3); Montana, 14 with an additional 1 proposed (0); Nevada, 1 (0); New Mexico, 12 with an additional 2 proposed (4); Oregon, 11 with an additional 1 proposed (4); Utah, 14 with an additional 5 proposed (4); Washington, 48 (17); and Wyoming, 2 (1). Additional information on these sites, including site name, description, threats/contaminants, and cleanup status, can be found at EPA (2007).

As of the end of FY2005, the BLM reports a total of 3,586 sites on its public lands in the 11 western states that have had releases of

TABLE 4.5-12 Recreation Visits for the BLM, FS, and NPS in FY2000 and FY2005

	Visits to BLM Lands			Visits to FS Lands			Visits to NPS Lands[a]		
State	2000	2005	% Change	2000	2005	% Change	2000	2005	% Change
Arizona	4,997,000	5,557,000	11.2	13,859,000	14,309,000	3.2	11,525,818	10,799,429	–6.3
California	8,400,000	9,604,000	14.3	32,403,000	29,786,000	–8.1	34,410,505	33,400,604	–2.9
Colorado	4,756,000	5,746,000	20.8	27,948,000	25,728,000	–7.9	5,807,033	5,352,839	–7.8
Idaho	6,326,000	5,870,000	–7.2	7,907,000	7,043,000	–10.9	437,473	446,507	2.1
Montana	3,136,000	4,093,000	30.5	9,151,000	8,657,000	–5.4	3,696,401	3,877,478	4.9
Nevada	5,045,000	6,183,000	22.6	–[b]	7,188,000	–[b]	6,647,299	5,847,070	–12.0
New Mexico	2,380,000	2,384,000	<1.0	–[b]	2,912,000	–[b]	1,766,079	1,650,441	–6.6
Oregon	8,137,000	7,190,000	–11.6	–[b]	17,196,000	–[b]	831,394	901,254	8.4
Utah	6,169,000	6,208,000	<1.0	–[b]	10,620,000	–[b]	8,843,646	8,046,646	–9.0
Washington	–[c]	–[c]	–	9,786,000	7,935,000	–18.9	7,275,528	7,091,427	–2.5
Wyoming	3,655,000	2,050,000	–43.9	–[b]	5,094,000	–[b]	5,754,332	5,453,845	–5.2
Totals:	49,346,000	54,885,000	11.2	–[b]	138,689,000	–5.2[d]	86,995,508	82,867,540	–4.8

[a] NPS data are reported for calendar year (January through December).

[b] Data for 2000 not available.

[c] Washington's total is included with Oregon.

[d] Value based on data from Arizona, California, Colorado, Idaho, Montana, and Washington only.

Sources: BLM (2001a, 2006h); Parker (2007); NPS (2001, 2006b).

hazardous substances and other pollutants, with the greatest number (1,234 sites, or 34%) having occurred in California. Four other states had release sites numbering more than 10% of the total: Arizona (589), Idaho (456), Nevada (464), and Oregon (357). Of the total sites, 3,029 have been closed and administratively archived with no further action planned. During FY2005, 330 removal actions and one remedial action were conducted on BLM lands in the 11 western states (BLM 2006h).

4.5.12 Population Trends

The West is the fastest growing region in the United States. Between 1990 and 2000, it grew at a faster rate (19.7%) than the nation as a whole (13.2%). Five western states had population increases greater than 25% in the 10-year period, with Nevada growing by more than 66% (Table 4.5-13). The West is also the most urbanized of the four U.S. regions, with more than 88% of the population living in urban areas in 2000 (Table 4.5-14). In 2000, the percentages of populations living in urban areas in seven of the 11 western states were at or above the national average of 79%, with the highest being California (at 94.4%) (BLM 2004f).

The BLM (2004f) also reports an important trend in the relationship between the amount of public land and the population growth in western state counties. In 1994, the ERS classified counties in the 11 western states into three groups: metropolitan (22% of counties); nonmetropolitan nonpublic lands (31% of counties); and nonmetropolitan public lands (47% of counties). *Nonmetropolitan public*

TABLE 4.5-13 Population Change in the 11 Western States and the United States from 1990 to 2000

	Population in 1990	Population in 2000	Percent Increase 1990 to 2000
States:			
Arizona	3,665,228	5,130,632	40.0
California	29,760,021	33,871,648	13.8
Colorado	3,294,394	4,301,261	30.6
Idaho	1,006,749	1,293,953	28.5
Montana	799,065	902,195	12.9
Nevada	1,201,833	1,998,257	66.3
New Mexico	1,515,069	1,819,046	20.1
Oregon	2,842,321	3,421,399	20.4
Utah	1,722,850	2,233,169	29.6
Washington	4,866,692	5,894,121	21.1
Wyoming	453,588	493,782	8.9
Regions:			
West	52,786,082	63,197,932	19.7
Northeast	85,445,930	100,236,820	17.3
Midwest	59,668,632	64,392,776	7.9
South	50,809,229	53,594,378	5.5
Totals for United States	248,709,873	281,421,906	13.2

Source: BLM (2004f).

TABLE 4.5-14 Rural and Urban Populations in the 11 Western States and the United States from 1990 to 2000

	Urban 1990 (%)	Rural 1990 (%)	Urban 2000 (%)	Rural 2000 (%)	Urban Increase 1990 to 2000
States:					
Arizona	87.5	12.5	88.2	11.8	0.7
California	92.6	7.4	94.4	5.6	1.8
Colorado	82.4	17.6	84.5	15.5	2.0
Idaho	57.4	42.6	66.4	33.6	9.0
Montana	52.5	47.5	54.1	45.9	1.5
Nevada	88.3	11.7	91.5	8.5	3.2
New Mexico	73.0	27.0	75.0	25.0	2.0
Oregon	70.5	29.5	78.7	21.3	8.3
Utah	87.0	13.0	88.2	11.8	1.2
Washington	76.4	23.6	82.0	18.0	5.6
Wyoming	65.0	35.0	65.1	34.9	0.1
Regions:					
West	86.3	13.7	88.6	11.4	2.4
Northeast	78.9	21.1	84.4	15.6	5.5
Midwest	71.7	28.3	74.7	25.3	3.0
South	68.6	31.4	72.8	27.2	4.2
Total for United States	75.2	24.8	79.0	21.0	3.8

Source: BLM (2004f).

lands were defined as counties with federal lands occupying more than 30% of the total area. Between 1990 and 2000, counties designated by the ERS as *nonmetropolitan public land* experienced an increase in population of 25%, about 10% higher than the increase for counties designated *nonmetropolitan nonpublic land* and 5% higher than the increase for counties designated *metropolitan* over the same period. This disproportionate rate of population increase is changing the social context of public lands throughout the West.

4.6 WHAT ARE THE CUMULATIVE IMPACTS?

Corridor designation and land use plan amendments under the Proposed Action will not contribute to cumulative impacts to resources in the 11 western states. However, the construction and operation of energy transport projects within designated corridors could contribute to cumulative impacts affecting both federal and nonfederal land. The level of contributions of these projects to cumulative impacts may vary depending on the number of projects colocated within a given corridor segment and whether projects occur simultaneously or over a longer span of time. For example, multiple projects involving pipelines could increase the risk of groundwater degradation relative to single projects if they were to occur simultaneously or within a short time span. Colocated projects also increase this risk across the area over which they extend. The cumulative impacts analyses presented in the following sections encompass the direct and indirect impacts associated with both the period of energy transport project construction and the postconstruction period of operation (covered in Chapter 3) for corridor designation and development, and the potential impacting factors for activities associated with reasonably foreseeable future actions (Table 4.6-1).

Project development within designated corridors combined with other past, present, and reasonably foreseeable future actions could affect all resource areas; however, the most significant impacts would be to ecological and visual resources. Impacts to geologic resources (including soil), air quality, socioeconomics, and those resulting from noise due to corridor construction would be short in duration (for the construction period) and would therefore not likely contribute significantly to cumulative impacts. For this analysis, it is assumed that the requirements of the IOPs and mitigation measures identified in this PEIS would be met. These IOPs and mitigation measures would require comprehensive, ongoing environmental monitoring programs to evaluate environmental conditions and adjust impact mitigation objectives, as necessary, and would reduce the contribution of corridor designation and development to cumulative impacts for most resource areas. Table 4.6-2 provides a summary of cumulative impacts in the 11 western states (based on the analysis of the general development trends described in Section 4.5) for each resource area and the contributions to these impacts from the Proposed Action.

4.6.1 Land Use

The cumulative impacts of past, present, and future land use trends in the 11 western states relate to the increase in urbanization of private land and the increase of commercial, industrial, and recreational use of public lands. Under the Proposed Action, corridor designation could indirectly affect current land use on about 1.68 million acres along 3,696 miles of federal land not previously designated at the local level for energy transport. Land use and property values on nonfederal land could also be affected by the corridor designations under the Proposed Action. Corridor development is generally compatible with many land uses, including livestock grazing and recreation. However, significant impacts could result in areas where permanent loss of productive use or future use (e.g., mining or military operations) occurred. Consultation with the appropriate managing agency would ensure compatibility between corridor development and the current and planned land uses in the project area.

4.6.2 Geologic Resources

The cumulative impacts of past, present, and future actions on geologic resources in the 11 western states relate to the increased use of geologic materials for construction activities associated with oil and gas development and production, mining, renewable energy development, timber harvesting (e.g., road building), and transportation; and the increased potential for soil erosion due to ground disturbance occurring during these activities. The development of energy transport projects within designated corridors would contribute to these impacts; however, since sand, gravel, and crushed stone are abundant in the 11 western states, the volume needed for future energy transport projects is not expected to adversely affect the availability of these resources over the long term. The potential for soil erosion would be low to moderate during the initial construction phase and any other construction periods that could occur over the next 20 years, but was short in duration. Soil erosion and contamination could occur during the operational phase, but would be of limited extent and magnitude.

4.6.3 Paleontological Resources

The cumulative impacts of past, present, and future actions on paleontological resources in the 11 western states relate to the increased accessibility that may accelerate erosional processes over time and expose fossils, leaving them vulnerable to theft and vandalism. Ground-

TABLE 4.6-1 Potential Impacting Factors of Activities Associated with Reasonably Foreseeable Future Actions in the 11 Western States by Resource Area

Resource Area and Associated Activities	Impacting Factor	Type of Action[a]
Geologic Resources:		
Earthmoving/blasting	Soil disturbance/erosion	A, B, C, D, F, K
Construction	Resource use	A, B, C, D, F, K
Spills/releases	Resource contamination	A, B, C, D, F, G
Site remediation	Soil disturbance Elimination/reduction of contamination	A, B, C, D, F, G
Paleontology:		
Earthmoving/blasting	Soil disturbance/erosion Resource damage/destruction	A, B, C, D, F, K
Vegetation clearing/roads	Increased accessibility Vandalism/theft	A, B, C, D, E, F
Water Resources –		
Groundwater:		
Construction/operations	Resource use	A, B, C, D, F, I, J, K
Spills/releases	Resource contamination	A, B, C, D, F, G
Site remediation	Elimination/reduction of contamination	A, B, C, D, F, G
Surface Water:		
Earthmoving/blasting	Soil disturbance/erosion	A, B, C, D, F, K
Construction/operations	Resource use	A, B, C, D, F, I, J, K
Spills/releases	Resource contamination	A, B, C, D, F, G
Site remediation	Elimination/reduction of contamination	A, B, C, D, F, G
Air Quality:		
Earthmoving/blasting	Dust emissions	A, B, C, D, F, K
Vegetation clearing/roads	Dust emissions	A, B, C, D, F, K
Equipment/vehicles	Exhaust emissions	A, B, C, D, E, F, J, K
Facility operations	Fuel combustion emissions	A, B, C, D, F, K
Spills/releases	Evaporative emissions (from crude oil, petroleum products, and hazardous chemicals)	A, B, C, D, F, G
Noise:		
Earthmoving/blasting	Increased ambient noise levels	A, B, C, D, F, K
Construction/operations	Increased ambient noise levels	A, B, C, D, E, F
Traffic	Increased ambient noise levels	A, B, C, D, E, F, J, K
Corona effects	Increased ambient noise levels	C
Aircraft surveillance	Increased ambient noise levels	C

TABLE 4.6-1 (Cont.)

Resource Area and Associated Activities	Impacting Factor	Type of Action[a]
Ecological Resources – Vegetation and Wetlands:		
Vegetation clearing/roads	Injury/destruction Habitat disturbance/loss Reduced growth/density Increased invasive vegetation Dust emissions Hydrological changes (flow, temperature)	A, B, C, D, E, F, I, K
Construction/operations	Injury/destruction Habitat disturbance/loss Dust emissions Hydrological changes (flow, temperature)	A, B, C, D, E, F, K
Spills/releases	Increased exposure risk Injury/mortality	A, B, C, D, F, G
Ecological Resources – Aquatic Biota and Wildlife:		
Vegetation clearing/roads	Injury/mortality Interference with behavioral activities Habitat disturbance/loss Increased noise Dust emissions	A, B, C, D, E, F, G, I, J, K
Construction/operations	Injury/mortality Interference with behavioral activities Habitat disturbance/loss Increased noise Dust emissions	A, B, C, D, E, F, G
Spills/releases	Increased exposure risk Injury/mortality	A, B, C, D, F, G
Visual Resources:		
Urbanization	Decreased visibility (light pollution)	K
Vegetation clearing/roads	Increased contrast with surrounding landscape	A, B, C, D, E, F, K
All-terrain vehicle use	Degradation of visual quality	J
Tower/facility construction	Increased contrast with surrounding landscape	A, B, C, D
Operations	Decreased visibility	A, B, C, D, F
Cultural Resources:		
Earthmoving/blasting	Soil disturbance/erosion Resource damage/destruction	A, B, C, D, E, F, G, H, I, J, K
Vegetation clearing/roads	Increased accessibility Vandalism/theft	A, B, C, D, E, F, G, H, I, J, K

TABLE 4.6-1 (Cont.)

Resource Area and Associated Activities	Impacting Factor	Type of Action[a]
Socioeconomics:		
Construction/operations	Increased housing needs Increased expenditures Increased employment Increased taxes/revenues Change in private property values	A, B, C, D, E, F, J, K
Environmental Justice:		
Construction/operations	Noise Dust emissions EMF effects Degradation of visual quality Change in private property values	A, B, C, D, E, F
Health and Safety:		
Exploration	Occupational hazards	A, B
Construction/operations	Occupational hazards	A, B, C, D, E, F, J, K
Air emissions	Respiratory impairment	A, B, D, F, G
Spills/releases	Increased exposure risks	A, B, C, D, F, G
Land Use:		
Construction/operations	Conflicts in land use Increased human activity	A, B, C, D, E, F, G, H, I, J, K

[a] Key to actions: A = oil and gas exploration, development, and production; B = mineral exploration, development, and production; C = transmission and distribution systems; D = renewable energy development; E = commercial timber harvest; F = transportation; G = legislative actions related to land use; H = land management; I = grazing and rangeland management; J = tourism and recreation; K = property development.

disturbing activities associated with ROW clearing, construction of the transmission systems and required infrastructure, and increased accessibility on public lands could damage or destroy fossil remains and disrupt the contexts in which they are found. The contribution of future project development to adverse cumulative impacts to paleontological resources in the 11 western states may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.

4.6.4 Water Resources

4.6.4.1 Groundwater Resources

The cumulative impacts of past, present, and future actions on the availability and quality of groundwater resources throughout the 11 western states are variable and area-specific. In general, the potential for groundwater degradation increases with the number of energy-related projects because of the increased

TABLE 4.6-2 Anticipated Cumulative Impacts in the 11 Western States and Contributions from the Proposed Action by Resource Area

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Land Use	4.6.1	The cumulative impacts of the past, present, and future land use trends relate to the increase in urbanization of private lands and the increase of commercial, industrial, and recreational uses of public lands.	Corridor designation could indirectly affect current land use on about 1.68 million acres of federal land, and land use and property values on adjacent nonfederal land. Corridor development under the Proposed Action is generally compatible with many land uses; however, significant impacts could result in areas where permanent loss of productive use or future use (e.g., mining or military operations) occurred. Consultation with the appropriate managing agencies would ensure compatibility between corridor development and the current and planned land uses in the project area.
Geologic Resources	4.6.2	Cumulative impacts relate to the increased use of geologic materials for construction activities associated with oil and gas development and production, mining, renewable energy development, timber harvesting, and transportation; and the increased potential for soil erosion due to ground disturbance.	Corridor designation is not expected to contribute to cumulative impacts. Construction activities would not impact the availability of geologic resources or increase the soil erosion potential over the long term. Soil erosion and contamination could occur during operational phase, but would be of limited extent and magnitude.
Paleontological Resources	4.6.3	Cumulative impacts relate to the increased accessibility that may accelerate erosional processes over time and expose fossils, leaving them vulnerable to theft and vandalism.	Corridor designation is not expected to contribute to cumulative impacts. However, the contribution of energy transport project construction and operation to adverse cumulative impacts may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Water Resources	4.6.4	*Groundwater:*	*Groundwater:*
		The cumulative impacts of past, present, and future actions to the availability and quality of groundwater are variable and area-specific; however, the potential for groundwater degradation increases with the number of energy-related projects in the 11 western states. Groundwater availability could be affected by activities that change recharge patterns, groundwater depth, or groundwater flow direction or volume.	Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to cumulative impacts related to groundwater degradation, especially along corridor segments where pipelines would be installed if spills were to occur in the future. Projects are not expected to impact groundwater availability over the long term.
		Surface Water:	*Surface Water:*
		The cumulative impacts of past, present, and future actions relate to changes in the patterns and rates of surface runoff (and erosion) and water quality as a result of earthmoving activity associated with energy-related projects and urban development, which are on the rise in the 11 western states. The potential for surface water degradation also increases with the number of energy-related projects in the 11 western states.	Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to cumulative impacts related to surface water degradation, especially along corridor segments where pipelines would be installed if spills were to occur in the future. Projects are not expected to impact surface water runoff over the long term.
Air Quality	4.6.5	The cumulative impacts of past, present, and future actions relate to increased pollutant loads associated with oil and gas development and production, mining, and increased traffic (due to increases in population and tourism).	Corridor designation is not expected to contribute to cumulative impacts. The contribution of an energy transport project to cumulative impacts would depend on the mix of technologies and the location of emission sources within a multiple transmission system. Emissions associated with construction activities would be localized and short in duration.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Noise	4.6.6	The cumulative impact of past, present, and future actions due to noise are associated with oil and gas development and production, mining, renewable energy development, timber harvesting, and traffic.	Corridor designation is not expected to contribute to cumulative impacts. The contribution of energy transport project construction and operation to cumulative impacts during ROW construction would be high, but localized and short in duration. Noise sources during the operations phase would include compressor/pump stations, aircrafts for pipeline surveillance and monitoring, corona noise from transmission lines, and substations. These, along with periodic repair and maintenance activities, would contribute to adverse noise impacts over the long term.
Ecological Resources	4.6.7	*Vegetation and Wetlands:* The cumulative impacts of past, present, and future actions to vegetation and wetlands result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and destruction of vegetation, reduced growth and density, habitat disturbance (fragmentation) or loss, and increased growth of invasive species.	*Vegetation and Wetlands:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects would contribute to cumulative impacts. Vegetation along streams and rivers may be affected where they intersect the corridor segments. Wetland concentration areas, as well as other sensitive ecological resources, were considered during corridor routing.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Ecological Resources (Cont.)	4.6.7	*Aquatic Biota:* The cumulative impacts of past, present, and future actions to aquatic biota result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., obstructions to fish movement), and increased risk of toxic release exposures.	*Aquatic Biota:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute significantly to cumulative impacts as a result of thermal effects and water quality degradation.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Ecological Resources (Cont.)	4.6.7	*Wildlife:* The cumulative impacts of past, present, and future actions to wildlife result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., migration), and increased risk of toxic release exposures.	*Wildlife:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute significantly to cumulative impacts as a result of various project-related stressors (e.g., habitat disturbance or exposure to contaminants).

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Ecological Resources (Cont.)	4.6.7	*Threatened, Endangered, and Special Status Species:* The cumulative impacts of past, present, and future actions to threatened, endangered, and other special status species result from increased construction and operation activities associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, changes in water temperature, and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., migration), and increased risk of toxic release exposures.	*Threatened, Endangered, and Special Status Species:* Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to adverse cumulative impacts to threatened, endangered, and other special status species. Since these impacts would be variable and species-specific, they need to be assessed on a project-specific basis through NEPA evaluations and ESA consultations prior to development.
Visual Resources	4.6.8	The cumulative impacts of past, present, and future actions to visual resources relate to activities associated with urbanization, oil and gas development and production, mining, renewable energy development, timber harvesting, increased recreation activities (e.g., ATV use), and increased traffic (due to increases in population and tourism).	Corridor designation is not expected to contribute to cumulative impacts. The contribution of energy transport project construction and operation to cumulative impacts is expected to be large, particularly in areas without existing transport facilities and cleared ROWs. Adverse impacts would be greatest on steeply sloped areas with low vegetation diversity and a lack of screening vegetation, and in forested areas because of the high degree of contrast created by vegetation removal.

TABLE 4.6-2 (Cont.)

Discipline Area	Section in PEIS	Anticipated Trends and Cumulative Impacts	Contributions from Proposed Action
Cultural Resources	4.6.9	The cumulative impacts of past, present, and future actions to cultural resources relate to the potential for damage or destruction of artifacts and their context and increased pedestrian and vehicular traffic, which can increase accessibility to artifacts and areas of significance to Native Americans and accelerate erosional processes over time.	Corridor designation is not expected to contribute to cumulative impacts. However, the contribution of energy transport project construction and operation to adverse cumulative impacts may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.
Socioeconomics	4.6.10	The cumulative impacts of past, present, and future actions relate to increased employment, income, and tax revenues associated with oil and gas development and production, mining, timber harvesting, and increases in population and tourism.	Corridor designation is not expected to contribute to cumulative impacts. The construction and operation of energy transport projects could contribute to cumulative impacts. Development may also affect property values on adjacent private land.
Environmental Justice	4.6.11	The cumulative impacts of past, present, and future actions related to disproportionately high and adverse impacts on minority and low-income populations and include accessibility to ecological or cultural resources, property values, and impacts related to activities that generate noise, dust, EMF, and degradation of visual quality.	Corridor designation is not expected to contribute to cumulative impacts. The cumulative impacts of energy transport project construction and operation are not expected to be disproportionately high and adverse since these populations are neither more than 50% of the population of the corridor buffer area or 20 percentage points higher than the minority population percentage in each state (except for New Mexico).
Health and Safety	4.6.12	The cumulative impacts of past, present, and future actions on human health and safety pertain mainly to workforces, but may be of concern to the public. Health impacts on a more regional scale are influenced by the agricultural and industrial trends in a given air shed.	Corridor designation is not expected to contribute to cumulative impacts. The safety impacts of energy transport project construction and operation on human health are of concern mainly for the workforces involved in project construction, operation, and decommissioning. Factors determining the potential for safety impacts to the public include the proximity to the corridor and the number of construction vehicles on public roadways.

risk of hazardous substance releases to the environment. The development of energy transport projects within designated corridors could contribute to adverse impacts over time, particularly along corridor segments where pipelines would be installed if spills were to occur in the future. Project construction and operation are not expected to impact groundwater availability, since only small amounts of water would be used. Other factors not related to past, present, and future actions (e.g., precipitation and recharge rates) can have an important effect on the availability of groundwater resources.

4.6.4.2 Surface Water Resources

The cumulative impacts of past, present, and future actions to surface water resources throughout the 11 western states relate mainly to changes in the patterns and rates of surface runoff (and erosion) and water quality. These impacts are the result of earthmoving activities associated with energy-related projects, transportation, and urbanization, all of which are on the rise in the West. Increased sediment loading associated with erosion is also caused by ground disturbance (e.g., during earthmoving phases of construction) and can degrade the quality of surface water. The contribution of the development of energy transport projects within designated corridors to these impacts is expected to be low to moderate during the project construction phase and short in duration. Over the long term, project construction and operation are not expected to adversely affect surface runoff.

The potential for surface water contamination increases with the number of energy-related projects because of the increased risk of hazardous substance releases to the environment. Project construction and operation could contribute to adverse impacts over time, particularly along corridor segments where pipelines would be installed if spills were to occur in the future.

4.6.5 Air Quality

The cumulative impacts of past, present, and future actions to air quality in the 11 western states relate to increases in pollutant loads associated with oil and gas development and production, mining, and increased traffic (due to increases in population and tourism). The contribution of an energy transport project to these impacts would depend on the mix of technologies deployed and the location of emission sources within a multiple transport system.

Project construction activities could contribute to regional pollutant loads (including particulates, CO, NO_x, SO_2, and VOCs) from construction equipment and vehicle exhaust emissions if multiple construction projects were to occur simultaneously. Otherwise, these emissions would be fairly localized and short in duration. Increased particulates would also result from fugitive dust emissions along unpaved roads, in areas where the vegetative cover has been removed, and during earthmoving activities (including blasting). Batch plant operations during construction would also add to these emissions.

4.6.6 Noise

The cumulative impacts of past, present, and future actions because of noise result from the increased construction and operation activities associated with oil and gas development and production, mining, renewable energy development (e.g., construction of turbine towers for the development of wind energy), and timber harvesting. Increased traffic along transportation routes also contributes to the adverse cumulative effects of noise. The contribution of the construction of energy transport projects to these impacts is expected to be high during the ROW construction phase as the result of using heavy earthmoving equipment and blasting bedrock (in some areas), but would be localized and short in duration. Over the long term, contributions to adverse cumulative impacts resulting from noise sources would be associated with the project operations phase. Noise sources would include compressor/pump stations; aircraft used for pipeline surveillance and monitoring; corona noise from transmission lines; and substations. Repair and maintenance activities requiring the short-term use of vehicles and heavy equipment would also contribute to adverse noise impacts over the long term.

4.6.7 Ecological Resources

4.6.7.1 Vegetation and Wetlands

The cumulative impacts of past, present, and future actions on vegetation and sensitive habitats like wetlands and riparian zones along rivers and streams result from increased construction and operations activities (e.g., ground disturbance, vegetation removal, and the installation of facilities and infrastructure), which are associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, and timber harvesting. Other factors such as urbanization, increased recreational use and tourism, and changes in water temperature and degradation of water quality from increased turbidity, sedimentation, or contamination also contribute to adverse impacts over the long term. Adverse impacts include injury to and destruction of vegetation, reduced growth and density, habitat disturbance (fragmentation) or loss, and increased growth of invasive species (reducing species diversity and increasing the frequency and intensity of wildfires). The construction and operation of energy transport projects would contribute to these impacts. Impacts to riparian habitats along rivers and streams would be expected in areas where they intersect designated corridors. The locations of wetland concentration areas, as well as other sensitive ecological resources, were considered during corridor routing.

4.6.7.2 Aquatic Biota

The cumulative impacts of past, present, and future actions on aquatic biota result from increased construction and operations activities (e.g., ground disturbance, vegetation removal, and installation of facilities and infrastructure) associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, timber harvesting, urbanization, and increased recreational use and tourism. Changes in water temperature and degradation of water quality from increased turbidity, sedimentation, or contamination would also contribute to adverse impacts over the long term. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., obstructions to fish movement), and increased risk of toxic release exposures. All life stages of aquatic biota, including eggs, larvae, and adults, could be affected. The construction and operation of energy transport projects under the Proposed Action could contribute significantly to these impacts.

4.6.7.3 Wildlife

The cumulative impacts of past, present, and future actions on wildlife result from increased construction and operations activities (e.g., ground disturbance, vegetation removal, and installation of facilities and infrastructure) associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, timber harvesting, urbanization, and increased recreational use and tourism. Adverse impacts include injury and mortality, habitat disturbance (fragmentation) or loss, interference with behavioral activities (e.g., migration), and increased risk of toxic release exposures. The construction and operation of energy transport projects under the Proposed Action could contribute significantly to these impacts.

4.6.7.4 Threatened, Endangered, and Other Special Status Species

The cumulative impacts of past, present, and future actions on threatened, endangered, and other special status species result from the increased construction and operations activities (e.g., ground disturbance, vegetation removal, and installation of facilities and infrastructure) associated with oil and gas development and production, mining, transmission and distribution systems, renewable energy development, timber harvesting, urbanization, and increased recreational use and tourism. Corridor designation is not expected to contribute to cumulative impacts to threatened and endangered species. However, the construction and operation of energy transport projects under the Proposed Action could contribute to the adverse cumulative impacts incurred by these species from other anthropogenic activities. Impacts to threatened and endangered species and designated critical habitat would be variable and species-specific. These impacts would need to be assessed on a project-specific basis through NEPA evaluations and ESA consultations prior to development.

4.6.8 Visual Resources

The cumulative impacts of past, present, and future actions to visual resources in the 11 western states relate mainly to activities associated with urbanization, oil and gas development and production, mining, renewable energy development (e.g., construction of turbine towers for the development of wind energy), timber harvesting, increased recreation activities (e.g., ATV use), and increased traffic (due to increases in population and tourism). Long-term impacts include decreased visibility (e.g., light pollution, increased contrast with surrounding landscape, and degradation of visual quality of the landscape). The contribution of the construction and operation of energy transport projects under the Proposed Action to these impacts is expected to be large, particularly in areas without existing energy transport facilities and cleared ROWs. Adverse impacts due to ROW clearing would be greatest in landscapes with low visual absorption capability (the degree to which the landscape can absorb visual impacts without serious degradation in perceived scenic quality) such as steeply sloped areas with low vegetative diversity and a lack of screening vegetation, and in forested areas because of the high degree of contrast created by vegetation removal. Contributions to the cumulative impacts would be highest in areas where long-distance visibility is greatest.

4.6.9 Cultural Resources

The cumulative impacts of past, present, and future actions on cultural resources in the 11 western states relate to the potential for damage or destruction of artifacts and their context and increased pedestrian and vehicular traffic, which may increase accessibility to artifacts and areas of significance to Native Americans and accelerate erosional processes over time. The contribution of future project development to adverse cumulative impacts to cultural resources in the 11 western states may still occur even though all managing agencies have procedures and policies for reducing or mitigating impacts on a project-specific basis.

4.6.10 Socioeconomics

The cumulative impacts of past, present, and future actions relate to increased employment, personal income, and tax revenues associated with oil and gas development and production, mining, timber harvesting, and increases in population and tourism. The construction and operation of energy transport projects under the Proposed Action would contribute to these impacts. Development may also affect property values on adjacent private land.

4.6.11 Environmental Justice

Potential impacts to low-income and minority populations could be incurred as a result of the construction and operation of project-specific infrastructure under the Proposed Action; however, because impacts are likely to be small, and because there are no low-income or minority populations defined by CEQ guidelines (see Section 3.13.1) in the 11 states (with the exception of New Mexico where there is a minority population), impacts of corridor designation would not disproportionately affect low-income or minority populations.

4.6.12 Health and Safety

The cumulative impacts of past, present, and future actions on human health and safety are of concern mainly for the workforces involved in project construction, operation, and decommissioning. These include but are not limited to exposure to physical hazards from use of heavy equipment, injury from contact with energy sources (e.g., electrical), exposure to noise and hazardous materials (gases, gusts, or fumes), heat and cold stress, and bites and injuries from contact with dangerous animals, insects, or plants. Some health and safety concerns may impact the public, although these impacts generally decrease with increasing distance from the project of interest. Safety impacts to the public would occur mainly during construction and decommissioning due to transportation of heavy or oversize loads and movement of construction vehicles along public roadways, and would be relatively short in duration. Multiple projects occurring simultaneously or within a short time span could increase the potential for traffic accidents; however, this would be of short duration (during construction and decommissioning phases only). The contributions of energy transport projects under the Proposed Action to these impacts are variable and area-specific. Factors determining the potential for health impacts to the public include the agricultural and industrial trends in a given air shed, which can affect air quality and the incidence of air quality-related health problems.

5 WHAT UNAVOIDABLE ADVERSE IMPACTS MIGHT BE CAUSED BY CORRIDOR DESIGNATION AND LAND USE PLAN AMENDMENT?

The designation of the Section 368 energy corridors and amendment of land use plans under the Proposed Action would not result in unavoidable adverse impacts. Unavoidable adverse impacts to resources could occur as a result of the development and operation of energy transport projects within the corridors designated under the Proposed Action or within project-specific ROWs under No Action. The magnitude of the unavoidable adverse impacts, as well as the degree to which they could be mitigated, would vary by project type and location.

Many of these project development and operational impacts could be reduced through implementation of the mitigation practices identified in this PEIS, which could be stipulated as part of the permitting processes currently used by the agencies and be expected to continue under both alternatives. The magnitude and extent of unavoidable adverse impacts associated with project development in corridors designated under the Proposed Action could be further mitigated through the consideration and implementation of one or more of the IOPs identified in this PEIS.

5.1 POSSIBLE IMPACTS TO LAND USE

Designation of energy corridors and land use plan amendment under the Proposed Action could result in unavoidable changes in land use within the designated corridors. Land use within most designated corridors would be changed for multimodal energy transport, except in areas locally designated as energy corridors (within locally designated corridors incorporated into the Proposed Action). Land uses potentially affected by the construction and operation of energy transport projects include timber harvest, oil and gas leasing, and minerals extraction. The construction and operation of energy transport projects under each of the alternatives could result in temporary, unavoidable impacts to recreation, livestock grazing, timber harvest, oil and gas leasing, and minerals extraction. Long-term unavoidable impacts to current and future uses may also occur under each alternative, depending on the type of energy transport project developed and its operational requirements (such as the need for a treeless ROW).

5.2 POSSIBLE IMPACTS TO GEOLOGIC AND PALEONTOLOGICAL RESOURCES

No adverse impacts to geologic and paleontological resources are anticipated with corridor designation or land use plan amendments. Unavoidable adverse impacts could be incurred under both alternatives during the construction of an energy transport project on federal and nonfederal land. Project construction could result in unavoidable impacts to natural topography, soil erosion, drainage patterns, and slopes as well as damage or destroy paleontological resources along the project-specific ROW on federal and nonfederal land. Project construction could also result in the compaction, excavation, and removal of soil from the project area (depending on the specific type of energy transport system being developed). Long-term removal of sand, gravel, and crushed stone to support project needs would also be unavoidable in some locations. The likelihood, magnitude, and extent of unavoidable impacts could be reduced under both alternatives through the implementation of the mitigation measures identified in this PEIS. The consideration and implementation of the IOPs identified in this PEIS could further minimize unavoidable adverse impacts of project construction and operation.

5.3 POSSIBLE IMPACTS TO WATER RESOURCES

Corridor designation and land use plan amendment are not expected to adversely impact water resources (either surface water or groundwater). Unavoidable adverse impacts could be incurred under both alternatives only as a result of construction of an energy transport project on federal and nonfederal land. While there is a potential for unavoidable adverse impacts to water resources from construction under both alternatives, the likelihood, magnitude, and extent of impacts could be reduced under each alternative through the implementation of the mitigation measures identified in this PEIS.

Similarly, consideration and implementation of the IOPs identified in this PEIS could further minimize unavoidable adverse impacts of project development and operation in corridors designated under the Proposed Action. There could be minor loss of floodplain area because of placement of project infrastructure within a floodplain. It is assumed that projects would be designed to minimize placement of infrastructure within floodplains, and any infrastructure located within floodplains would be relatively small in number and size. Thus, neither floodwater movement nor floodwater storage capacity are expected to be impacted by project development or operation.

An accidental petroleum pipeline spill contacting a surface water body or infiltrating into an aquifer could impact surface water and groundwater quality and use in the vicinity of the accidental release. Implementation of spill prevention, control, and cleanup procedures would minimize the likelihood, magnitude, and extent of unavoidable adverse impacts of an accidental spill to water quality.

5.4 POSSIBLE IMPACTS TO AIR QUALITY AND AMBIENT NOISE LEVELS

No adverse impacts to air quality or ambient noise are anticipated with corridor designation and land use plan amendment under the Proposed Action. Unavoidable adverse impacts could be incurred during the construction of energy transport projects on federal and nonfederal lands under both alternatives. Unavoidable impacts could also occur under each alternative during operation of energy transport projects requiring the use of compressor or pump stations or from corona effect noise during electricity transmission. Construction, clearing and grading, trenching, excavation, and construction vehicle traffic would result in fugitive dust and vehicle emissions. During operation of energy transport systems, unavoidable air impacts would occur primarily during operation of natural gas compressor stations powered by gas turbines or reciprocating engines.

Construction and operation of energy transport projects could result in unavoidable noise impacts under both alternatives. Elevated noise levels would be generated during various construction activities, such as vegetation clearing and ROW grading, excavation and blasting, and vehicle traffic (including helicopter delivery of electricity transmission towers in remote areas). Noise levels may also be elevated during operations of turbines and reciprocating engines at pipeline compressor and pump stations.

The likelihood, magnitude, and extent of unavoidable adverse impacts could be reduced under each alternative through the implementation of the mitigation measures identified in this PEIS. Similarly, the consideration and implementation of the IOPs identified in this PEIS could further minimize unavoidable adverse impacts from project development and operation in corridors designated under the Proposed Action.

5.5 POSSIBLE IMPACTS TO ECOLOGICAL RESOURCES

No adverse impacts to ecological resources are anticipated with corridor designation and land use plan amendment under the Proposed Action. Unavoidable adverse impacts would be incurred on federal and nonfederal lands under both alternatives during the construction and operation of energy transport projects. The construction and maintenance of project-specific ROWs under each alternative would result in unavoidable temporary and permanent changes in vegetation and wildlife habitats.

Vegetation and habitats immediately within a project ROW would be destroyed during clearing and grading. Unavoidable impacts to wildlife could include habitat loss, disturbance and/or displacement, mortality, and obstruction to movement. Increased noise during construction and operation of compressor stations could disrupt local wildlife foraging and breeding of some wildlife. Aquatic biota and habitats could be affected by siltation resulting from runoff from areas of disturbed soils, and from accidental releases of hazardous materials from construction equipment (such as fuels) and from an accidental petroleum pipeline release. Under No Action, there is a greater potential for habitat fragmentation because individual energy transport projects would be less likely to be colocated than they would be under the Proposed Action. In addition, in areas where the combined project ROWs within the corridors designated under the Proposed Action would be greater than the widths of the No Action ROWs, wildlife species may have greater difficulty crossing the wider corridors.

The likelihood, magnitude, and extent of unavoidable adverse impacts to ecological resources could be reduced under both alternatives through the implementation of the mitigation measures identified in this PEIS, while consideration and implementation of the IOPs identified in this PEIS could further minimize unavoidable adverse impacts from the development and operation of projects within corridors designated under the Proposed Action.

5.6 POSSIBLE IMPACTS TO VISUAL RESOURCES

Corridor designation and land use plan amendment are not expected to adversely impact visual resources. Unavoidable adverse impacts would be incurred on federal and nonfederal lands under both alternatives during the construction and operation of an energy transport project. Under each of the alternatives, short-term impacts could be incurred during the construction of an energy transport project. Fugitive dust and the presence of construction equipment and crews would be visible in the vicinity of the construction site, potentially affecting local viewsheds and recreational experiences. Because project-specific ROWs and infrastructure (e.g., electricity transmission towers, compressor stations) would be visible throughout the lifespan of the project, there could be long-term unavoidable impacts on some viewsheds and the recreational experiences of visitors in those viewsheds. More viewsheds could be affected by projects developed under the No Action Alternative than under the Proposed Action because individual energy transport projects would be less likely to be colocated under the No Action Alternative than they would under the Proposed Action, and thus would occur in more viewsheds.

The likelihood, magnitude, and extent of unavoidable adverse impacts to visual resources could be reduced under both alternatives through the implementation of the mitigation measures identified in this PEIS, while consideration and implementation of the IOPs identified in this PEIS could further minimize unavoidable adverse impacts of project development and operation in corridors designated under the Proposed Action.

5.7 POSSIBLE IMPACTS TO CULTURAL RESOURCES

No adverse impacts to cultural resources would be anticipated with corridor designation and land use plan amendment under the Proposed Action. Unavoidable adverse impacts could be incurred during the construction and operation of an energy transport project within a corridor designated under the Proposed Action or within a No Action ROW. Under both alternatives, cultural resources could be destroyed on federal and nonfederal lands by construction activities such as clearing and grading, pipeline trenching, and transmission tower placement. Development of new ROWs under each of the alternatives could also increase access to previously inaccessible areas on federal and nonfederal lands, which could lead to vandalism of both known and undiscovered cultural sites.

The likelihood, magnitude, and extent of unavoidable adverse impacts to cultural resources could be reduced under both alternatives through the implementation of the mitigation measures identified in this PEIS, while consideration and implementation of the IOPs identified in this PEIS could further minimize unavoidable adverse impacts of projects developed and operated on corridors designated under the Proposed Action.

5.8 POSSIBLE IMPACTS TO TRIBAL TRADITIONAL CULTURAL RESOURCES

The designation of Section 368 energy corridors and land use plan amendment would not result in adverse impacts to Tribal traditional cultural resources. Unavoidable adverse impacts to some Tribal resources could be incurred on federal and nonfederal lands under both alternatives during the construction and operation of energy transport projects. Clearing and grading, pipeline trenching, and transmission tower placement could result in unavoidable adverse impacts to some Tribal interests and treaty rights. These project-specific activities could impact resources of interest to Tribes, as well as affect burial and ceremonial rituals. Project-specific ROWs may also increase access to previously inaccessible areas, which could lead to vandalism of both known and undiscovered sacred sites. The likelihood, magnitude, and extent of unavoidable adverse impacts to Tribal interests and treaty rights could be reduced under both alternatives through implementation of the mitigation measures identified in this PEIS. Under the Proposed Action, the potential for unavoidable impacts of project construction and operation may be further minimized by the consideration and implementation of the IOPs identified in this PEIS.

5.9 POSSIBLE SOCIOECONOMIC IMPACTS

Designation of energy corridors and land use plan amendment under the Proposed Action are not expected to result in unavoidable adverse socioeconomic impacts. Construction of energy transport projects under each of the alternatives would produce employment and income and state tax revenues and would likely require the temporary in-migration of workers for certain occupational categories, affecting rental housing markets and creating the need for additional state and local government expenditures and employment. These socioeconomic effects would be incurred on federal and nonfederal lands under both alternatives.

6 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

This chapter discusses the relationship within each alternative between the short-term use of the environment and the maintenance and enhancement of long-term productivity. The designation of Section 368 energy corridors and land use plan amendment are not expected to affect the short-term uses or long-term productivity of the environment. The impacts (short- and long-term) from utilization of resources associated with project development under each alternative are presented in Chapter 3. For this PEIS, *short-term* refers primarily to the period of construction of an energy transport project; it is this time when the most extensive environmental impacts are likely to occur.

The comparison of the alternatives shows that there would be little difference in the types of impacts that could result with project development under both alternatives. Under each alternative, there would be continued use on federal and nonfederal lands of the environment for the development and operation of energy transport projects in the 11 western states. Development of energy transport projects under each of the alternatives would result in largely temporary impacts, and the long-term productivity of the physical environment would not be affected by the alternatives.

The construction of energy transport projects within the Section 368 corridors that would be designated under the Proposed Action could occur along 6,055 miles of proposed corridors throughout the 11 western states, as well as on additional miles of other federal and nonfederal lands. While there would be no Section 368 energy corridors designated under the No Action Alternative, future energy transport projects may be expected to be built as energy demand continues to grow throughout the West. These future energy transport projects would be less likely to be colocated within energy corridors as they might be under the Proposed Action, but rather may be expected to be relatively widely dispersed across the 11 western states.

When viewed from a West-wide perspective, the development of energy transport projects under either alternative would not require the short-term disturbance or long-term alteration of a major amount of federal and nonfederal land. However, development of energy transport projects under each of the alternatives would result in the local, short- and long-term disturbance of vegetation, wildlife, and habitats. Under both alternatives, land clearing and grading and construction activities would disturb wildlife and their habitats within individual project ROWs as well as on other federal and nonfederal lands that would be crossed by the projects. Short- and long-term construction-related disturbances of biota and habitats could result in long-term reductions in biological productivity within the project-specific ROWs.

Environmental impacts during construction could be mitigated under No Action by current permitting and mitigation requirements, and under the Proposed Action by implementing the mitigation measures, as well as by the consideration and implementation of the IOPs identified in this PEIS. The impacts to the environment during operations would constitute a long-term use of the environment, and could be similarly mitigated.

Federal and nonfederal lands in the West currently support a variety of land uses (depending on their specific locations), including livestock grazing, recreation, commercial and residential development, timber harvest, oil and gas leasing, and minerals extraction. The long-term presence of energy transport projects and associated ROWs could affect long-term land use within and along designated corridors or No Action ROWs on both federal and nonfederal lands, especially if previous land use activities were determined to be incompatible with energy transport projects. Energy transport projects within the proposed corridors or No Action ROWs could also affect long-term quality and use of visual resources and affect recreational use on federal and nonfederal lands. While some recreational activities (such off-road vehicle use) could experience long-term increases in activity, changes in the types and patterns of recreational usage can be positive or negative, depending on the subjective values of the interested and affected public.

Under the Proposed Action, improvements in the reliability and capability of the national electricity grid to deliver electricity, as well as the relief of congestion in the grid, would be expected to contribute to long-term socioeconomic benefits throughout the West.

7 WHAT IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES WOULD BE INVOLVED WITH IMPLEMENTATION OF THE ALTERNATIVES?

This chapter describes the irreversible and irretrievable commitments of resources associated with the implementation of the alternatives evaluated in this PEIS. A resource commitment is considered *irreversible* when direct and indirect impacts from its use limit future use options. Irreversible commitments apply primarily to nonrenewable resources, such as cultural resources, and also to those resources that are renewable only over long periods of time, such as soil productivity or forest health. A resource commitment is considered *irretrievable* when the use or consumption of the resource is neither renewable nor recoverable for future use. Irretrievable commitments apply to loss of production, harvest, or use of natural resources.

Irreversible and irretrievable commitments of resources could be incurred as a result of the designation of the energy corridors, which affects land use, and also with implementation of specific energy transport projects within the designated corridors.

7.1 POSSIBLE IMPACTS OF SECTION 368 CORRIDOR DESIGNATION AND LAND USE PLAN AMENDMENT

Designation of Section 368 energy corridors and land use plan amendment on federal lands in the 11 western states would not result in an irreversible or irretrievable commitment of resources within the designated corridors. Such changes could occur at the time that a specific project and its ROW were authorized and the project was constructed and operated.

7.2 POSSIBLE IMPACTS OF DEVELOPMENT OF ENERGY TRANSPORT PROJECTS

The development of energy transport projects on other federal and nonfederal lands under both alternatives could result in the consumption of sands, gravels, and other geologic resources, as well as fuel, structural steel, and other materials. Water resources could also be consumed during construction, although water use would be temporary and largely limited to on-site concrete mixing and dust abatement activities.

In general, the impact to biological resources from project construction and operation would not constitute an irreversible and irretrievable commitment of resources. During project construction and operation, individual animals would be impacted. Site-specific and species-specific analyses and mitigation conducted at the project level during permitting and authorization would make adverse impacts to entire populations unlikely.

Clearing of ROWs within designated corridors and on other federal and nonfederal lands would result in the direct loss of vegetation within the ROWs, which would be irretrievable. While habitat would be impacted during construction within project ROWs under both alternatives, implementation of the mitigation measures (such as habitat restoration) identified in this PEIS would reduce these impacts over time. Under the Proposed Action, the consideration and implementation of the IOPs identified in this PEIS could further reduce ecological impacts. However, some habitats within designated corridors would be irretrievably committed with the development of energy transport projects.

Cultural and paleontological resources, as well as Tribal traditional cultural properties, are nonrenewable, and any disturbance of these resources would constitute an irreversible and irretrievable commitment of resources. However, consideration and implementation of the IOPs and mitigation measures identified in this PEIS could minimize the potential for impacts to these resources. Access to previously inaccessible areas could lead to vandalism of both known and unknown cultural, Tribal, and paleontological resources, thereby rendering them irretrievable. Impacts to visual resources could constitute an irreversible and irretrievable commitment of resources, but could also be mitigated somewhat through the consideration and implementation of the mitigation measures and, under the Proposed Action, the IOPs identified in this PEIS.

9 REFERENCES

ABC Wind Company, LLC, undated, *Draft, Draft, Draft, Draft Plan of Development for the ABC Wind Generating Facility*.

AGFD (Arizona Game and Fish Department), 2006, *Species Lists*, Arizona Game and Fish Department, Phoenix, Arizona. Available at http://www.azgfd.gov/w_c/edits/hdms_species_ lists.shtml. Accessed June 6, 2006.

AirNav.com., 2006, *Database for Public Use Airports in the United States*. Available at http:// airnav.com/airports/us. Accessed November 30, 2006.

Alig, R.J., A.J. Plantinga, S. Ahn, and J.D. Kline, 2003, *Land Use Changes Involving Forestry in the United States: 1952 to 1997, with Projections to 2050*, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

American Society of Mammalogists, 1999, *Mammals of New Mexico*, the American Society of Mammalogists, Lawrence, Kan. Available at http://www.mammalsociety.org/statelists/newme xico.html. Accessed June 7, 2006.

Anderson, G.S., and U.J. Kurze, 1992, "Outdoor Sound Propagation," Chapter 5 in *Noise and Vibration Control Engineering — Principles and Applications*, L.L. Beranek and I.L. Vér (eds.), John Wiley & Sons, Inc., New York, N.Y.

Anderson, M.T., and L.H. Woosley Jr., 2005, *Water Availability for the Western United States — Key Scientific Challenges*, Circular 1261, U.S. Geological Survey, Reston, Va. Available at http://pubs.usgs.gov/circ/2005/ circ1261/. Accessed June 2006.

Anderson, S.H., et al., 1977, "The Effect of Transmission-line Corridors on Bird Populations," *The American Midland Naturalist* 97(1):216–221.

ANL (Argonne National Laboratory), 2007a, *The Design, Construction, and Operation of Long-Distance High-Voltage Electricity Transmission Technologies*, Argonne National Laboratory, Argonne, Ill.

ANL, 2007b, *Natural Gas Pipeline Technology Overview*, Argonne National Laboratory, Argonne, Ill.

Anthony, R.G., and M.L. Morrison, 1985, "Influence of Glyphosate Herbicide on Small-Mammal Populations in Western Oregon," *Northwest Science* 59(3):159–168.

APLIC (Avian Power Line Interaction Committee) and USFWS (U.S. Fish and Wildlife Service), 2005, *Avian Protection Plan (APP) Guidelines*, April. Available at http://www.eei.org/industry_issues/environment/ land/wildlife_and_endangered_species/AvianPr otectionPlanGuidelines.pdf. Accessed March 7, 2007.

Apt, J., L.B. Lave, S. Talukdar, M.G. Morgan, and M. Ilic, 2004, *Electrical Blackouts: A Systemic Problem, Issues in Science and Technology*, National Academy of Sciences and The University of Texas at Dallas, July 9.

Arizona Department of Environmental Quality, 2007, *National Ambient Air Quality Standards*, Air Quality Division. Available at http://www. azdeq.gov/environ/air/download/naaqs.pdf. Accessed July 23, 2007.

Arizona Game and Fish, 2007, Arizona Interagency Desert Tortoise Team. Available at http://www.azgfd.gov/w_c/desert_tortoise_aidtt. shtml. Accessed July 23, 2007.

Baum, R.L., and R.W. Fleming, 1988, *Landslides and Debris Flows in Ephraim Canyon, Central Utah*, Bulletin 1842-C, U.S. Geological Survey.

Beaulaurier, D.L., et al., 1984, "Mitigating the Incidence of Bird Collisions with Transmission Lines," pp. 539–550 in *Proceedings of the Third International Symposium on Environmental Concerns in Rights-of-Way Management*, A.F. Crabtree (ed.), Mississippi State University, Mississippi State, Miss.

Beck, A.M., and R.J. Vogel, 1972, "The Effects of Spring Burning on Rodent Populations in a Brush Prairie Savanna," *Journal of Mammalogy* 53:336–346.

Behnke, R.J., 1992, *Native Trout of Western North America,* Monograph Number 6, American Fisheries Society, Bethesda, Md.

Berger, J., 2004, "The Last Mile: How to Sustain Long-Distance Migration in Mammals," *Conservation Biology* 18(2):320–331.

Bertero, V.V., 1997, *Earthquake Engineering*, National Information Service for Earthquake Engineering, University of California, Berkeley. Available at http://nisee.berkeley.edu/bertero/index.html. Accessed June 9, 2006.

Bevanger, K., 1995, "Tetraonid Mortality Caused by Collisions with Power Lines in Boreal Forest Habitats in Central Norway," *Fauna norv. Ser. C, Cinclus* 18:41–51.

Bevanger, K., 1998, "Biological and Conservation Aspects of Bird Mortality Caused by Electricity Power Lines: A Review," *Biological Conservation* 86:67–76.

BIA (Bureau of Indian Affairs), 2006, *Performance and Accountability Report — FY 2005*, Washington, D.C.

Bird, B., and M. Schenk, 2005, *Sage-Grouse (Centrocercus spp.)*, Fish and Wildlife Habitat Management Leaflet 26, May. Available at http://www.whmi.nrcs.usda.gov/technical/leaflet.htm. Accessed June 30, 2006.

BirdLife International, 2003, *Protecting Birds from Powerlines: A Practical Guide on the Risks to Birds from Electricity Transmission Facilities and How to Minimise Any Such Adverse Effects*, T-PVS/Inf (2003) 15, Convention on the Conservation of European Wildlife and Natural Habitats, Standing Committee, 23rd Meeting, Strasbourg, December 1-4, 2003. Available at http://www.coe.int/T/E/Cultural_Co-operation/Environment/Nature_and_biological_diversity/Nature_protection/. Accessed October 23, 2006.

Birdnature.com, 2006, North American Migration Pathways (map). Available at http://www.birdnature.com/flyways.html. Accessed June 7, 2004.

Bishop, D.E., and P.D. Schomer, 1991, "Community Noise Measurements," in *Handbook of Acoustical Measurements and Noise Control*, 3rd ed., C.M. Harris (ed.), McGraw-Hill, Inc., New York, N.Y.

BLM (Bureau of Land Management), 1984, *Visual Resource Management*, BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior.

BLM, 1985, *BLM Manual 9113*, *Roads*, Release 9-247, U.S. Department of the Interior, June.

BLM, 1986a, *Visual Resource Inventory*, BLM Manual Handbook 8410-1, Release 8-28, U.S. Department of the Interior, Jan.

BLM, 1986b, *Visual Resource Contrast Rating*, BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Jan.

BLM, 1992, *Final Environmental Impact Statement Transcolorado Gas Transmission Project: Colorado/New Mexico*, U.S. Department of the Interior, Bureau of Land Management, Montrose District Office, Montrose, Colo., July.

BLM, 1997, *Record of Decision and Green River Resource Management Plan*, U.S. Department of the Interior, Bureau of Land Management, Rock Springs District Office, Wyo., Oct.

BLM, 1998a, *8270 — Paleontological Resource Management*, Release 8-68, U.S. Department of the Interior, July.

BLM, 1998b, *H-8270-1 — General Procedural Guidance for Paleontological Resource Management*, Release 8-69, U.S. Department of the Interior, July.

BLM, 2000, *Resource Management Plan Amendment/Environmental Impact Statement for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties*, Draft, Las Cruces Field Office, Las Cruces, N.M., Nov. Available at http://www.nm.blm.gov/lcfo/ lcfo_home.html. Accessed March 7, 2007.

BLM, 2001a, *Public Land Statistics 2000*, Vol. 185, BLM/BC/ST-01/001+1165, March.

BLM, 2001b, *Special Status Species Management*, BLM Manual 6840, Jan.

BLM, 2002, *Final Environmental Impact Statement Renewal of the Federal Grant for the Trans-Alaska Pipeline System Right-of-Way*, BLM/AK/PT-03/005+2880+990, U.S. Department of the Interior, Bureau of Land Management, Anchorage, Alaska, Nov.

BLM, 2003a, *2003 Public Rewards from Public Lands, Arizona*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/az.htm. Accessed November 10, 2006.

BLM, 2003b, *2003 Public Rewards from Public Lands, California*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/ca.htm. Accessed November 10, 2006.

BLM, 2003c, *2003 Public Rewards from Public Lands, Colorado*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/co.htm. Accessed November 10, 2006.

BLM, 2003d, *2003 Public Rewards from Public Lands, Idaho*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/id.htm. Accessed November 10, 2006.

BLM, 2003e, *2003 Public Rewards from Public Lands, Montana*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/mt.htm. Accessed November 10, 2006.

BLM, 2003f, *2003 Public Rewards from Public Lands, Nevada*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/nv.htm. Accessed November 10, 2006.

BLM, 2003g, *2003 Public Rewards from Public Lands, New Mexico*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/nm.htm. Accessed November 10, 2006.

BLM, 2003h, *2003 Public Rewards from Public Lands, Oregon/Washington*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/or.htm. Accessed November 10, 2006.

BLM, 2003i, *2003 Public Rewards from Public Lands, Utah*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/ut.htm. Accessed November 10, 2006.

BLM, 2003j, *2003 Public Rewards from Public Lands, Wyoming*. Available at http://www.blm.gov/nhp/pubs/rewards/2003/wy.htm. Accessed November 10, 2006.

BLM, 2004a, *Final Environmental Impact Statement for the Jack Morrow Hills Coordinated Activity Plan/Proposed Green River Resource Management Plan Amendment*, U.S. Department of the Interior, Bureau of Land Management, Rock Springs, Wyoming, July.

BLM, 2004b, *Draft Resource Management Plan and Draft Environmental Impact Statement for the Price Field Office, Price, Utah*, DES 04-35, Price Field Office, Price, Utah, July.

BLM, 2004c, *Draft Roan Plateau Resource Management Plan Amendment and Environmental Impact Statement*, Colorado State Office, Glenwood Springs Field Office, Nov.

BLM, 2004d, *Rawlins Resource Management Plan Draft Environmental Impact Statement*, U.S. Department of the Interior, Bureau of Land Management, Rawlins, Wyo., Dec.

BLM, 2004e, *National Sage-Grouse Habitat Conservation Strategy*, U.S. Department of the Interior, Bureau of Land Management, Washington, D.C., Nov. Available at http://www.blm.gov/nhp/spotlight/sage_grouse/docs/Sage-Grouse_Strategy.pdf. Accessed April 17, 2006.

BLM, 2004f, *Proposed Revisions to Grazing Regulations for the Public Lands: Final Environmental Impact Statement*, FES 04-39, Oct.

BLM, 2004g, "Hydraulic Considerations for Pipeline Crossings of Stream Channels," Appendix 18 in *Draft Resource Management Plan and Draft Environmental Impact Statement for the Price Field Office Price, Utah.* Available at http://www.blm.gov/rmp/ut/price/documents/Appendicies/Appendix_18-Hydraulic_Consideration_for_Pipeline_Crossings_of_Stream_Channels.pdf. Accessed May 3, 2007.

BLM, 2005a, *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States, Draft Programmatic Environmental Impact Statement*, DES 05-56, U.S. Department of the Interior, Reno, Nev. Available at http://www.blm.gov/nhp/spotlight/VegEIS/. Accessed March 7, 2007.

BLM, 2005b, *Draft Vernal Resource Management Plan, Appendix B Hydraulic Considerations for Pipeline Crossings of Stream Channels*. Available at http://www.ut.blm.gov/vernalrmpguide/. Accessed July 2006.

BLM, 2005c, *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States*, FES 05-11, U.S. Department of the Interior, Bureau of Land Management, Washington, D.C., June.

BLM, 2005d, *Vernal Resource Management Plan Draft Environmental Impact Statement*, Utah State Office, Vernal Field Office, Vernal, Utah.

BLM, 2005e, *Public Land Statistics 2005*. Available at http://www.blm.gov/natacq/pls05/PLScover06web.pdf. Accessed December 6, 2006.

BLM, 2005f, *Working Together for Healthy Lands and Thriving Communities — 2004 Annual Report*, Public Affairs, Washington, D.C.

BLM, 2005g, *Annual Report on Performance and Accountability — Fiscal Year 2005*, U.S. Department of the Interior, Washington D.C.

BLM, 2005h, *Draft Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Report*, DES 05-56, U.S. Department of the Interior, Nov.

BLM, 2005i, *Energy Facts: Onshore Federal Lands*, U.S. Department of the Interior.

BLM, 2006a, BLM Handbook H-5000-1 (*Public Domain Forest Management*) and Manual 1112 (*Safety*) and 9015 (*Integrated Weed Management*).

BLM, 2006b, BLM Handbook H-9211-1 (*Fire Management Activity Planning Procedures*) and H-9214-1 (*Prescribed Fire Management*), and Manual 1112 (*Safety*), 9210 (*Fire Management*), 9211 (*Fire Planning*), 9214 (*Prescribed Fire*), and 9215 (*Fire Training and Qualifications*).

BLM, 2006c, BLM Manual 1112 (*Safety*), 4100 (*Grazing Administration*), 9014 (*Use of Biological Control Agents on Public Lands*), and 9015 (*Integrated Weed Management*).

BLM, 2006d, BLM Handbook H-9011-1 (*Chemical Pest Control*) and Manual 1112 (*Safety*), 9011 (*Chemical Pest Control*), 9015 (*Integrated Weed Management*), and 9220 (*Integrated Pest Management*).

BLM, 2006f, *Bureau of Land Management National Wild Horse and Burro Program*, Bureau of Land Management, Washington, D.C. Available at http://www.wildhorseandburro.blm.gov/index.php. Accessed November 2, 2006.

BLM, 2006g, *Visual Resource Management for Fluid Minerals — Best Management Practices: Better Ways for Achieving Better Results*, Fluid Minerals Group, Washington, D.C.

BLM, 2006h, *Public Land Statistics, 2005*, Vol. 190, BLM/BC/ST-06/001+1165, U.S. Department of the Interior, Washington D.C., June.

BLM, 2006i, *National Energy Initiatives*. Available at http://www.blm.gov/energy/. Accessed October 20, 2006.

BLM, 2006j, *Oil Shale and Tar Sands Leasing Programmatic EIS Information Center*. Available at http://ostseis.anl.gov/index.cfm. Accessed October 21, 2006.

BLM, 2007, *The California Desert Plan Conservation Area Plan 1980, as amended*, U.S. Department of the Interior.

Bowker, J.M., D.B.K. English, and H.K. Cordell, 1999, "Projections of Outdoor Recreation Participation to 2050," Chapter VI in *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends*, H.K. Cordell, C. Betz, J.M. Bowker, D.B.K. English, S.H. Mou, J.C. Bergstrom, R.J. Teasley, M.A. Tarrant, and J. Loomis (eds.), Sagamore Publishing, Champaign, Ill.

BPA (Bonneville Power Administration), 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, J.M. Lee, Jr., principal author, Portland, Ore., Dec.

BPA, 2002, *Grand Coulee – Bell 500-kV Transmission Line Project Final Environmental Impact Statement*, Bonneville Power Administration, Dec.

BPA, 2006, *Challenge for the Northwest: Protecting and Managing an Increasingly Congested Transmission System*, DOE/BP-3705, Bonneville Power Administration, Portland, Ore., April.

Brattstrom, B.H., and M.C. Bondello, 1983, "Effects of Off-Road Vehicle Noise on Desert Vertebrates," pp. 167–206 in *Environmental Effects of Off-Road Vehicles, Impacts and Management in Arid Region*, R.H. Webb and H.G. Wilshire (eds.), Springer-Verlag, New York, N.Y. (as cited in Larkin 1996).

Braun, C.E., 1998, "Sage-Grouse Declines in Western North America: What Are the Problems?," in *Proceedings of the Western Association of State Fish and Wildlife Agencies* 67:134–144.

Brown, B.T., et al., 1999, "The Influence of Weapons-Testing Noise on Bald Eagle Behavior," *Journal of Raptor Research* 33:227–232.

Brown, W.M., and R.C. Drewien, 1995, "Evaluation of Two Power Line Markers to Reduce Crane and Waterfowl Collision Mortality," *Wildlife Society Bulletin* 23(2):217–227.

Burchfiel, B.C., P.W. Lipman, and M.L. Zoback, 1992, "Introduction," in *The Cordilleran Orogen: Conterminous U.S.: The Geology of North America*, Volume G-3, B.C. Burchfiel, P.W. Lipman, and M.L. Zoback (eds.), Geological Society of America, Boulder, Colo.

Burke Museum of Natural History and Culture, 2006, *Research & Collections*, Burke Museum of Natural History and Culture, University of Washington, Seattle, Washington. Available at http://www.washington.edu/burkemuseum/collections/index.php. Accessed June 7, 2006.

California Air Resources Board, 2007, *Ambient Air Quality Standards*, updated Feb. 22, 2007. Available at http://www.arb.ca.gov/research/aaqs/aaqs.htm. Accessed July 23, 2007.

CAISO (California Independent System Operator), 2006, *2006 Summer Loads and Resources Operations Assessment*, California Independent System Load Operator Corporation, Grid Assets, Version 3.0, April 10, 2006.

CASQA (California Stormwater Quality Association), 2003, *Construction Handbook*. Available at http://www.cabmphandbooks.com/Construction.asp. Accessed July 2006.

Cassell, M., 1999, "The Rio Grande," in *The Green Line Online*, Volume 9, Number 4, Colorado Riparian Association. Available at: http://www.coloradoriparian.org/GreenLine/V09-4/RioGrande.html. Accessed September 18, 2006.

CDFG (California Department of Fish and Game), 2006, *Complete List of Amphibian, Reptile, Bird, and Mammal Species in California*, California Department of Fish and Game, Sacramento, California. Available at http://www.dfg.ca.gov/whdab/pdfs/species_list.pdf. Accessed October 24, 2006.

CDW (Colorado Division of Wildlife), 2006, *Natural Diversity Information Source*, Colorado Department of Natural Resources, Division of Wildlife, Denver, Colo. Available at http://ndis.nrel.colostate.edu/wildlifespx.asp. Accessed July 5, 2006.

CEQ (Council on Environmental Quality), 1997a, *Environmental Justice Guidance under the National Environmental Policy Act*, Council on Environmental Quality, Executive Office of the President, Washington, D.C. Available at http://www.whitehouse.gov//CEQ/. Accessed December 2006.

CEQ, 1997b, *Considering Cumulative Effects under the National Environmental Policy Act*, Jan.

Chleborad, A.F., 2000, *Preliminary Method for Anticipating the Occurrence of Precipitation-Induced Landslides in Seattle, Washington*, Open-File Report 00-469, U.S. Geological Survey.

Christenson, G.E., L.D. Batatian, and C.V. Nelson, 2003, *Guidelines for Evaluating Surface-Fault-Rupture Hazards in Utah*, Miscellaneous Publication 03-6, Utah Geological Survey.

Coffin, P.D., and W.F. Cowan, 1995, *Lahontan Cutthroat Trout* (Oncorhynchus clarkii henshawi) *Recovery Plan*, U.S. Fish and Wildlife Service, Portland, Ore. Available at http://ecos.fws.gov/docs/recovery_plans/1995/950130.pdf. Accessed March 26, 2007.

Colescott, J.H., and M.P. Gillingham, 1998, "Reactions of Moose (*Alces alces*) to Snowmobile Traffic in the Greys River Valley, Wyoming," *Alces* 34(2):329–338.

Colorado Department of Public Health and Environment, 2007, *Ambient Air Quality Standards*, Colorado Air Quality Control Commission. Available at http://www.cdphe.state.co.us/regulations/airregs/100114aqccambientairquality.pdf. Accessed July 23, 2007.

Colorado Herpetological Society, 2006, *County Record Tables for Colorado Amphibians and Reptiles*, Colorado Herpetological Society, Lakewood, Colo. Available at http://coloherp.org/geo/index.php. Accessed June 30, 2006.

Connelly, J.W., et al., 2000, "Guidelines to Manage Sage Grouse Populations and Their Habitats," *Wildlife Society Bulletin* 28(4):967–985.

Connelly, J.W., et al., 2004, *Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats*, unpublished report, Western Association of Fish and Wildlife Agencies, Cheyenne, Wyo.

Cordell, H.K., J.C. Bergstrom, L.A. Hartmann, and D.B.K. English, 1990, *An Analysis of the Outdoor Recreation and Wilderness Situation in the United States 1989-2040: A Technical Document Supporting the 1989 USDA Forest Service RPA Assessment*, General Technical Report RM-189, U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo., April.

Cote, S.D., 1996, "Mountain Goat Responses to Helicopter Disturbance," *Wildlife Society Bulletin* 24(4):681–685.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979, *Classification of Wetlands and Deepwater Habitats of the United States*, FWS/OBS-79/31, U.S. Department of the Interior, U.S. Fish and Wildlife Service, Government Printing Office, Washington, D.C.

Crawford, J.A., et al., 2004, "Ecology and Management of Sage-Grouse and Sage-Grouse Habitat," *Journal of Range Management* 57:2–19.

Dahl, T.E., 1990, Wetlands Losses in the United States 1780s to 1980s, U.S. Department of the Interior, U.S. Fish and Wildlife Service, Washington D.C., Jamestown N.D.: Northern Prairie Wildlife Research Center Online. (Version 16JUL97). Available at http://www.npwrc.usgs.gov/resource/wetlands/wetloss/index.htm. Accessed March 7, 2007.

Delaney, D.K., et al., 1999, "Effects of Helicopter Noise on Mexican Spotted Owls," *Journal of Wildlife Management* 63(1):60–76.

DOD (U.S. Department of Defense), 2006, *Department of Defense Base Structure Report: A Summary of DOD's Real Property Inventory — Fiscal Year 2005 Baseline*, Office of the Deputy Undersecretary of Defense (Installations and Environment).

DOD, 2007, Sustainable Ranges Initiative. Available at https://www.denix.osd.mil/denix/Public/Library/Sustain/Ranges/sustainableranges.html. Accessed July 23, 2007.

DOE (U.S. Department of Energy), 2000, *Bonneville Power Administration Transmission System Vegetation Management Program Final Environmental Impact Statement*, DOE/EIS-0285, U.S. Department of Energy, Bonneville Power Administration, Portland, Ore., May.

DOE, 2003, *Tucson Electric Power Company Sahuarita-Nogales Transmission Line Environmental Impact Statement*, DOE/EIS-0336, U.S. Department of Energy, July.

DOE, 2006a, *National Electric Transmission Congestion Study*, Washington, D.C., August. Available at http://www.oe.energy.gov/DocumentsandMedia/Congestion_Study_2006-9MB.pdf. Accessed May 2, 2007.

DOE, 2006b, *Facilities Information Management System*. Available at http://fims.hr.doe.gov. Accessed November 30, 2006.

DOE, 2006c, *American Indian and Alaska Native Tribal Government Policy*.

DOE and DOI (U.S. Department of the Interior, Bureau of Land Management), 2004, *Final Environmental Impact Statement for the Imperial-Mexicali 230-kV Transmission Lines,* DOE/EIS-0365, DOE, Washington, D.C., and DOI, El Centro, Calif., Dec.

DOI (U.S. Department of the Interior), 1999, *Collection, Storage, Preservation, and Scientific Study of Fossils from Federal and Indian Lands*, May.

DOI, 2003, *Interagency Study of Oil and Gas Resources in Five U.S. Basins Issued: Study Fulfills Obligation of Act Signed by the Clinton Administration*. Available at http://www.doi.gov/news/030116a.htm. Accessed October 24, 2006.

DOI, 2005a, *Quality of Water Colorado River Basin*, *Progress Report No. 22, Final Draft*, the Bureau of Reclamation.

DOI, 2005b, *Strategic Plan Bureau of Reclamation — FY2000 to FY2005*, U.S. Department of the Interior. Available at http://www.usbr.gov/gpra/strategicplan2000-2005.pdf. Accessed December 5, 2006.

DOI, 2005c, *Federal Agencies Agree to Improve Interagency Coordination of Oil and Gas Development on Public Lands: The MOU Responds to Provisions of the Energy Policy Act of 2005,* Oct. 25. Available at http://www.doi.gov/news/05_News_Releases/051025a.htm. Accessed October 24, 2006.

DOI and USDA (U.S. Department of Agriculture), 2006, *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development Gold Book*, 4th ed., BLM/WO/ST-06/021+3071, Bureau of Land Management, Denver, Colo. Available at http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/gold_book.html. Accessed March 7, 2007.

Doucet et al., 1981, "The Effect of a Utility Right-of-Way on White-Tailed Deer in a Northern Deer Yard," pp. 59-1 to 59-9 in *Proceedings of Second Symposium on Environmental Concerns in Rights-of-Way Management*, R.E. Tilman (ed.), Oct. 16–18, 1979.

Doucet et al., 1987, "Deer Behavior in a Powerline Right-of-Way Located in a Northern Wintering Yard," pp. 7–12 in *Proceedings of Fourth Symposium on Environmental Concerns in Rights-of-Way Management*, W.R. Byrnes and H.A. Holt (eds.), Oct. 25–28, 1987.

Douglas, M.E., P.C. Marsh, and W.L. Minckley, 1994, "Indigenous Fishes of Western North America and the Hypothesis of Competitive Displacement: *Meda fulgida* (Cryprinidae)," *Copeia* 1994:9–19.

Duffy, W.G., C.R. Berry, and K.D. Keenlyne, 1996, *Biology of the Pallid Sturgeon with an Annotated Bibliography through 1994*, South Dakota Cooperative Research Unit Technical Bulletin Number 5, South Dakota State University, Brookings, S.D.

Eck, R.W., and E.M. Wilson, 2000, *Transportation Needs of National Parks and Public Lands*, Transportation Research Board Task Force (A5T55), Washington, D.C.

EIA (Energy Information Administration), 2001, *Historical Natural Gas Annual 1930 through 2000*, DOE/EIA-E-0110(00), U.S. Department of Energy, Dec.

EIA, 2006a, *Annual Energy Review 2005*, DOE/EIA-0384, U.S. Department of Energy, July.

EIA, 2006b, *Annual Coal Report 2005*, DOE/EIA-0584(2005), U.S. Department of Energy, Oct.

EIA, 2006c, *Natural Gas Annual 2005*, DOE/EIA-0131(05), U.S. Department of Energy, Nov.

EIA, 2006d, *Annual Energy Outlook 2006 with Projections to 2030,* DOE/EIA-0383 (2006), U.S. Department of Energy, Feb.

EIA, 2007a, *Annual Energy Outlook 2007 with Projections to 2030*, DOE/EIA-0383(2007), U.S. Department of Energy, Feb. Available at http://www.eia.doe.gov/oiaf/aeo/index.html. Accessed May 2, 2007.

EIA, 2007b, *Official Energy Statistics: Crude Oil Production 2000 through 2005*. Available at http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdu_udc_mbbl_a.htm. Accessed March 21, 2007.

EIA, 2007c, *Coal Industry Annual 2000*, DOE/EIA-0584(2000), U.S. Department of Energy.

Electricity Advisory Board, 2002, *Competitive Wholesale Electricity Generation: A Report of the Benefits, Regulatory Uncertainty, and Remedies to Encourage Full Realization across All Markets*, prepared for the U.S. Department of Energy, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1974, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, EPA 550/9-74-004, Office of Noise Abatement and Control, Arlington, Va., March.

EPA, 1988, *Gap Filling PM-10 Emission Factors for Selected Open Area Dust Sources*, EPA-450/B-88-003, Research Triangle Park, N.C.

EPA, 1996, *Fundamentals of the Rosgen Stream Classification System*. Available at http://www.epa.gov/watertrain/stream_class/index.htm. Accessed May 2006.

EPA, 1999, *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, EPA 315-R-99-002, Office of Federal Activities, Washington, D.C., May.

EPA, 2000, *Sole Source Aquifer Designations in EPA, Region 9*. Available at http://www.epa.gov/region09/water/groundwater/ssa-pfs/ssafact.pdf. Accessed March 2007.

EPA, 2004a, *User's Guide for the AMS/EPA Regulatory Model — AERMOD*, Office of Air Quality Planning and Standards, Research Triangle Park, N.C., Sept. Available at http://www.epa.gov/scram001/dispersion_prefrec.htm. Accessed May 2007.

EPA, 2004b, *Compilation of Air Pollutant Emission Factors, vol. 1 Stationary Point and Area Sources*, Report Number AP-42, fifth edition through Supp. F and updates through 2004, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. Available at http://www.epa.gov/ttn/chief/ap42/index.html. Accessed March 12, 2007.

EPA, 2006a, *National Ambient Air Quality Standards (NAAQS)***,** Office of Air and Radiation, updated April 14, 2006. Available at http://www.epa.gov/air/criteria.html. Accessed December 13, 2006.

EPA, 2006b, *Level III Ecoregions*, Western Ecology Division, Corvalis, Ore. Available at http://www.epa.gov/wed/pages/ecoregions/level_iii.htm. Accessed July 5, 2006.

EPA, 2006c, Sole Source Aquifer Designation of the Troutdale Aquifer System; Clark County, WA. Available at Available at http://www.epa.gov/fedrgstr/EPA-WATER/2006/September/Day-06/w14710.htm. Accessed July 6, 2007.

EPA, 2007a, *An Overview of the Sole Source Aquifer Protection Program in EPA, Region 10*. Available at http://yosemite.epa.gov/R10/water.nsf/bledf256c3d7d444882567e600623096/f70f80471fc2e154882564de005621c0!OpenDocument. Accessed March 2007.

EPA, 2007b, Designated Sole Source Aquifers in EPA Region X. Available at http://www.epa.gov/safewater/sourcewater/pubs/qrg_ssamap_reg10.pdf. Accessed July 6, 2007.

EPA, 2007c, Designated Sole Source Aquifers in Region VIII. Available at http://www.epa.gov/safewater/sourcewater/pubs/qrg_ssamap_reg8.pdf. Accessed on July 6, 2007.

EPA, 2007d, Ground Water: Sole Source Aquifer. Available at http://www.epa.gov/region09/water/groundwater/ssa.html. Accessed on July 6, 2007.

ERS (Economic Research Service), 2007, *Major Land Uses Data Series – 1045 through 2002*, U.S. Department of Agriculture. Available at http://www.ers.usda.gov/data/majorlanduses/. Accessed March 30, 2007.

Erwin, W.J., and R.H. Stasiak, 1979, "Vertebrate Mortality during Burning of a Reestablished Prairie in Nebraska," *American Midland Naturalist* 101:247–249.

Eschholtz, W.E., et al., 1996, "Winter Use of Glyphosate-Treated Clearcuts by Moose in Maine," *Journal of Wildlife Management* 60(4):764–769.

ESRI (Environmental Systems Research Institute, Inc.), 2004, surf_wat.course_centerline (a GIS database), Redlands, Calif.

FAA (Federal Aviation Administration), 2000, *Proposed Construction or Alteration of Objects That May Affect the Navigable Airspace*, Advisory Circular 70/7460-2K, U.S. Department of Transportation.

FAA, 2006, *Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures*, U.S. Department of Transportation, Feb. Available at http://www.faa.gov/airports_airtraffic/air_traffic/publications/. Accessed March 7, 2007.

Faanes, C.A., 1987, *Bird Behavior and Mortality in Relation to Power Lines in Prairie Habitats*, Fish and Wildlife Technical Report 7, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

Federal Register, 1982, *Wild and Scenic River Guidelines*, Vol. 47, No. 173, Washington, D.C. Available at http://www.nps.gov/rivers/guidelines.html. Accessed June 2006.

Federal Register, 2006, *Request for Proposals for Woody Biomass Utilization Grant — Forest Restoration Activities on National Forest System Lands*, U.S. Department of Agriculture, Forest Service, Vol. 71, No. 172, p. 52523, Sept. 6.

Feeney, D., et al., 2004, *Big Game Migration Corridors in Wyoming*, Wyoming Open Spaces, April, University of Wyoming, Laramie, Wyo. Available at http://www.uwyo.edu/openspaces/docs/MigrationCorridors.pdf. Accessed September 26, 2006.

Feldmeth, C.R., 1981, "The Evolution of Thermal Tolerance in Desert Pupfish (Genus *Cyprinodon*)" pp. 357–384 in *Fishes in North American Deserts*, R.J. Naiman and D.L. Soltz (eds.), Wiley-Interscience Publication, New York, N.Y.

FEMA (Federal Emergency Management Agency), 2004, *Primer for Design Professionals, Communicating with Owners and Managers of New Buildings on Earthquake Risk*, Ch. 3. Available at http://www.fema.gov/txt/plan/prevent/rms/389/fema389_ch3.txt.

FEMA, 2006, *Floodplain Management Bulletin 1-98: Use of Flood Insurance Study (FIS) Data as Available Data*. Available at http://www.fema.gov/fima/fis_data.shtm. Accessed July 2006.

Fenneman, N.M., and D.W. Johnson, 1946, *Physiographic Divisions of the Conterminous U.S.*, U.S. Geological Survey, Washington, D.C.

FERC (Federal Energy Regulatory Commission), 2005, *Final Environmental Impact Statement Volume 1 Capacity Replacement Project*, Northwest Pipeline Corporation, Docket Nos. CP05-32-000, -001, FERC/EIS-0178, U.S. Army Corps of Engineers, Washington State Department of Ecology, Washington Department of Fish and Wildlife, Washington, D.C., July.

FERC, 2006, *2006 State of the Markets Report*, Washington, D.C. Available at http://www.ferc.gov/market-oversight/st-mkt-ovr/st-mrt-ovr.asp. Accessed May 2, 2007.

Fernie, K.J., and S.J. Reynolds, 2005, "The Effects of Electromagnetic Fields from Power Lines on Avian Reproductive Biology and Physiology: A Review," *Journal of Toxicology and Environmental Health, Part B* 8:127–140.

FHWA (Federal Highway Administration), 2006, *Overview of the Federal Lands Highway Program*. Available at http://www.fhwa.dot.gov/flh/. Accessed October 26, 2006.

Field, L., 2002, "Abalone Tales: California Indian Natural Resource Management," *News from Native California* 16(2):33–34.

Foppen, R., and R. Reijnen, 1994, "The Effects of Car Traffic on Breeding Bird Populations in Woodland. II. Breeding Dispersal of Male Willow Warblers (*Phylloscopus trochilus*) in Relation to the Proximity of a Highway," *Journal of Applied Ecology* 32:95–101.

Ford, W.M., et al., 1999, "Effects of a Community Restoration Fire on Small Mammals and Herpetofauna in the Southern Appalachians," *Forest Ecology and Management* 114:233–243.

Forest Ecosystem Management Assessment Team, 1993, *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment*, U.S. Department of the Interior, U.S. Department of Agriculture, U.S. Department of Commerce, and U.S. Environmental Protection Agency, Washington, D.C.

FS (Forest Service, U.S. Department of Agriculture), 1975, Chapter 2: "Utilities," in *National Forest Landscape Management, Volume 2*, Agriculture Handbook 478, U.S. Department of Agriculture.

FS, 1977, Chapter 4: "Roads," in *National Forest Landscape Management, Volume 2*, Agriculture Handbook 483, U.S. Department of Agriculture.

FS, 1995a, *Landscape Aesthetics, a Handbook for Scenery Management*, Agriculture Handbook 701, U.S. Department of Agriculture.

FS, 1995b, *Wildlife, Fish, and Sensitive Plant Habitat Management,* FS Manual 2600, U.S. Forest Service, Washington, D.C., June.

FS, 1996, *Probable Fossil Yield Classification*, Paleontology Center of Excellence and Forest Service Region 2 Paleo Initiative, unpublished, Denver Colo. On file at the Nebraska National Forest, Chadron, Neb.

FS 2000, *Watershed Conservation Practices Handbook*, Forest Service Handbook 2509.25-99-1. Available at http://www.fs.fed.us/r2/psicc/publications/environmental_impact_statements/eis_uspwp/WCPAppendixA.htm. Accessed March 13, 2007.

FS, 2001, *The Built Environment Image Guide for the National Forests and Grasslands*, U.S. Department of Agriculture, FS-170, Sept. Available at http://www.fs.fed.us/recreation/programs/beig/BEIG_readers_guide.htm. Accessed July 12, 2006.

FS, 2003, *Report of the Forest Service, FY2002: Healthy Forests and Grasslands — Financial and Performance Accountability*, U.S. Department of Agriculture, May.

FS, 2004, *Lands and Realty Management*, FS-803, U.S. Department of Agriculture, August.

FS, 2005a, *Forest Service Sensitive Species That Are Not Listed or Proposed under the ESA*, Forest Service, U.S. Department of Agriculture, Washington, D.C., Oct. 31. Available at http://www.fs.fed.us/biology/resources/pubs/tes/fs_ss_310ct05.pdf. Accessed March 15, 2007.

FS, 2005b, *Performance and Accountability Report*. Available at http://www.fs.fed.us/plan/par/2005/docs/par-2005.pdf. Accessed December 6, 2006.

FS, 2006a, *Lands and Realty Management: Land Areas of the National Forest System as of September 30, 2005*. Available at http://www.fs.fed.us/land/staff/lar/LAR05/table4.htm. Accessed October 23, 2006.

FS, 2006b, About Us — Meet the Forest Service. Available at http://www.fs.fed.us/aboutus/meetfs.shtml. Accessed November 9, 2006.

FS, 2006c, *Inventoried Roadless Area Acreage: Categories of National Forest System Lands Summarized by State*. Available at http://roadless.fs.fed.us/documents/feis/data/sheets/acres/ appendix_state_acres.html. Accessed November 28, 2006.

FS, 2006d, *National Forest Visitor Use Monitoring Program National Project Results: January 2000 through September 2003*. Available at http://www.fs.fed.us/recreation/programs/nvum/index.shtml. Accessed November 10, 2006.

Gaines, W.L., et al., 2003, *Assessing the Cumulative Effects of Linear Recreation Routes on Wildlife Habitats on the Okanogan and Wenatchee National Forests*, General Technical Report PNW-GTR-586, U.S. Department of Agriculture, U.S. Forest Service, Pacific Northwest Research Station, Portland, Ore.

GAO (U.S. Government Accountability Office), 1996, *Land Ownership: Information on the Acreage, Management, and Use of Federal and Other Lands*, GAO/RCED-96-40, March.

Giraud, R.E., 2005, *Guidelines for the Geologic Evaluation of Debris-flow Hazards on Alluvial Fans in Utah*, Miscellaneous Publication 05-6, Utah Geological Survey.

Golden, J., et al., 1979, *Environmental Impact Data Book*, Ann Arbor Science Publishers Inc., Ann Arbor, Mich., p. 509.

Griffith, J.S., and T.R. Tiersch, 1989, "Ecology of Fishes in Refield Canyon, Arizona, with Emphasis on *Gila robusta intermedia*," *Southwestern Naturalist* 34:131–164.

Groves, C.R., and K. Steenhof, 1988, "Responses of Small Mammals and Vegetation to Wildfires in Shadscale Communities of Southwestern Idaho," *Northwest Science* 62:205–210.

GSA (U.S. General Services Administration), 2005, *Overview of the United States Government's Owned and Leased Real Property: Federal Real Property Profile as of September 30, 2004*, GSA Office of Governmentwide Policy.

Gulliford, A., 2000, Sacred *Objects and Sacred Places: Preserving Tribal Traditions*, University of Colorado Press, Boulder, Colo.

Gunnison Sage-grouse Rangewide Steering Committee, 2005, *Gunnison Sage-grouse Rangewide Conservation Plan*, Colorado Division of Wildlife, Denver, Colorado, April. Available at http://wildlife.state.co.us/Wildlife Species/SpeciesOfConcern/Birds/GunnisonConsPlan.htm. Accessed March 16, 2007.

Hagan, J.M., et al., 1996, "The Early Development of Forest Fragmentation Effects on Birds," *Conservation Biology* 10(1):188–202.

Hanson, C.E., D.A. Towers, and L.D. Meister, 2006, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, prepared by Harris Miller Miller & Hanson, Inc., Burlington, Mass., for Office of Planning and Environment, Federal Transit Administration, U.S. Department of Transportation, Washington, D.C., May. Available at http://www.hmmh.com/rail_manuals01fta.html. Accessed July 5, 2007.

Hanson, D., 2006, Personal e-mail communication to T. Patton (Argonne National Laboratory), June 20, 2006.

Harper, K.A., et al., 2005, "Edge Influence on Forest Structure and Composition in Fragmented Landscapes," *Conservation Biology* 19(3):768–782.

Hayes, M., R. Hoff, J. Michel, D. Scholz, and G. Shigenaka, 1992, *An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response*, Report No. HMRAD 92-4, National Oceanic and Atmospheric Administration, Hazardous Materials Response and Assessment Division.

Hedlund, J.D., and W.H. Rickard, 1981, "Wildfire and the Short-Term Response of Small Mammals Inhabiting a Sagebrush-Bunchgrass Community," *Murrelet* 62:10–14.

Hirsch, C.L., S.E. Albeke, and T.P. Nesler, 2006, *Range-wide Status of Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*): 2005*, Colorado River Cutthroat Trout Conservation Team Report, Colorado Division of Wildlife, Fort Collins, Colo., March.

Hoblitt, R.P., J.S. Walder, C.L. Driedger, K.M. Scott, P.T. Pringle, and J.W. Vallance, 1998, *Volcano Hazards from Mount Rainier, Washington, Revised 1998*, Open-File Report 98-428, U.S. Geological Survey.

Hoff, R., 1995, *Responding to Oil Spills in Coastal Marshes: The Fine Line between Help and Hindrance*, HAZMAT Report 96-1, National Oceanic and Atmospheric Administration, Hazardous Materials Response and Assessment Division.

Hole, R.B., Jr., 2005, *The Amphibians and Reptiles of New Mexico*. Available at http://www.interaktv.com/NM/NMHerps.html. Accessed June 7, 2006.

Howard, J.L., 2003, *U.S. Timber Production, Trade, Consumption, and Price Statistics 1965–2002*, Research Paper FPL-RP-615, U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Dec.

Hyde, J.H., and D.R. Crandell, 1978, *Postglacial Volcanic Deposits at Mount Baker, Washington, and Potential Hazards from Future Eruptions*, Professional Paper 1022-C, U.S. Geological Survey.

Idaho Department of Environmental Quality, 2007, *National Ambient Air Quality Standards*, Air Quality Division, Available at http://www.deq.idaho.gov/air/data_reports/monitoring/overview.cfm. Accessed July 23, 2007.

Irons, D.B., et al., 2000, "Nine Years after the Exxon Valdez Oil Spill: Effects on Marine Bird Populations in Prince Sound, Alaska," *The Condor* 102:723–737.

Jantzen, T.L., 2005, A Geospatial Data Infrastructure for Texas. Available at http://www.crwr.utexas.edu/gis/gishydro06/Introduction/TermProjects/Final_Report_Jantzen.htm. Accessed May 2007.

Joseph, T.W., J.A. Sinning, R.J. Behnke, and P.B. Holden, 1977, *An Evaluation of the Status, Life History, and Habitat Requirements of Endangered and Threatened Fishes of the Upper Colorado River System*, FWS/OBS-77/62, U.S. Fish and Wildlife Service, Fort Collins, Colo.

Kinsey, J.S., and C. Cowherd, Jr., 1992, "Fugitive Emissions," in *Air Pollution Engineering Manual*, A.J. Bunicore and W.T. Davis (eds.), Van Nostrand Reinhold, New York, N.Y.

Knick, S.T., and D.L. Dyer, 1996, "Distribution of Black-Tailed Jackrabbit Habitat Determined by Geographical Information System in Southwestern Idaho," Chapter 3R in Vol. 2 of *BLM/IDARNG Research Project Final Report*, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Snake River Field Station, Boise, Idaho.

Knick, S.T., and D.L. Dyer, 1997, "Distribution of Black-Tailed Jackrabbit Habitat Determined by GIS in Southwestern Idaho," *Journal of Wildlife Management* 61:75–85.

La Plata County, 2002, *Final La Plata County Impact Report*, Oct. Available at http://co.laplata.co.us/pdf/plan_doc/final_impactrpt/final_ir1.pdf. Accessed March 7, 2007.

LaCommare, K.H., and J.H. Eto, 2004, *Understanding the Cost of Power Interruptions to U.S. Electricity Consumers*, LBNL-55718, Lawrence Berkeley National Laboratory.

LaGory, K., et al., 2001, *A Study of the Effects of Gas Well Compressor Noise on Breeding Bird Populations of the Rattlesnake Canyon Habitat Management Area, San Juan County, New Mexico*, U.S. Department of Energy, National Petroleum Technology Office, National Energy Technology Laboratory, Tulsa, Okla.

Larkin, R.P., 1996, *Effects of Military Noise on Wildlife: A Literature Review*, Technical Report 96/21, U.S. Army Construction Engineering Research Laboratory, Champaign, Ill.

Lee, J.M., et al., 1996, *Electrical and Biological Effects of Transmission Lines: A Review*, Bonneville Power Administration, Portland, Ore., Dec.

Lehman, R.N., and J.W. Allendorf, 1989, "The Effects of Fire, Fire Exclusion, and Fire Management on Raptor Habitats in the Western United States," in *Proceedings of the Western Raptor Management Symposium and Workshop, 1987, October 26–28, Boise, Idaho*, Scientific and Technical Series No. 12, National Wildlife Federation, Washington, D.C.

Lepage, D., 2006, "Avibase — Bird Checklists of the World." Available at http://www.bsc-eoc.org/avibase/. Accessed June 6, 2006.

Levings, G.W., D.F. Healy, S.F. Richey, and L.F. Carter, 1998, *Water Quality in the Rio Grande Valley, Colorado, New Mexico, and Texas, 1992–95*, U.S. Geological Survey Circular 1162. Available at http://water.usgs.gov/circ/circ1162. Accessed September 18, 2006.

Library of Congress, 2006, *Paleontological Resources Preservation Act: S.263 (referred to U.S. House of Representatives Committee after being received from the U.S. Senate)*, first session of the 109th Congress. Available at http://thomas.loc.gov/. Accessed July 17, 2006.

Lincoln, F.C., et al., 1998, *Migration of Birds*, U.S. Fish and Wildlife Service Circular 16, U.S. Department of the Interior, Washington, D.C. Available at http://www.npwrc.usgs.gov/resource/birds/migratio/index.htm. Accessed October 20, 2006.

Little, C.E., J. Page, and R. Rudner, 2001, *Sacred Lands of Indian America*¸ Henry N. Abrams, New York, N.Y.

Lubowski, R.N., M. Versterby, S. Bucholtz, A. Baez, and M.J. Roberts, 2006, *Major Uses of Land in the United States, 2002*, Economic Information Bulletin No. 14, U.S. Department of Agriculture, Economic Research Service, May.

Lunseth, B.G., 1988, "Browse Production and Utilization on a Pipeline Right-of-Way," pp. 1–6 in *Fourth Symposium on Environmental Concerns in Rights-of-Way Management*, W.R. Byrnes and H.A. Holt (eds.), Purdue University, West Lafayette, Ind.

Lyon, L.J., et al., 2000a, "Direct Effects of Fire and Animal Responses," in *Wildland Fire in Ecosystems: Effects of Fire on Fauna*, J.K. Smith (ed.), General Technical Report RMRS-GTR-42-Vol. 1, U.S. Forest Service, Rocky Mountain Research Station, Ogden, Utah.

Lyon, L.J., et al., 2000b, "Fire Effects on Animal Populations," in *Wildland Fire in Ecosystems: Effects of Fire on Fauna*, J.K. Smith (ed.), General Technical Report RMRS-GTR-42-Vol. 1, U.S. Forest Service, Rocky Mountain Research Station, Ogden, Utah.

Manci, K.M., et al., 1988, *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*, NERC-88/29, U.S. Fish and Wildlife Service, National Ecology Research Center, Fort Collins, Colo.

McLaren, S., 2001, "Mammals of Oregon." Available at http://www.mammalsociety.org/statelists/ormammals.html. Accessed June 7, 2006.

Meehan, W.R. (ed.), 1991, *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats*, American Fisheries Society Special Publication 19, Bethesda, Md.

Mendelssohn, I., and Q. Lin (eds.), 2003, *Coastal Marine Institute*, *Development of Bioremediation for Oil Spill Cleanup in Coastal Wetlands*, prepared by Louisiana State University, Wetland Biogeochemistry Institute, Center for Coastal, Energy, and Environmental Resources, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region.

Meyer, J.R., and J.M. Lee, Jr., 1981, "Effects of Transmission Lines on Flight Behavior of Waterfowl and Other Birds," pp. 62.1–62.15 in *Proceedings of the Second Symposium on Environmental Concerns in Rights-of-Way Management*, R.E. Tillman (ed.), Mississippi State University, Mississippi State, Miss.

Miller, C.D., 1989, *Potential Hazards from Future Volcanic Eruptions in California*, Bulletin 1847, U.S. Geological Survey.

Miller, N.P., 2002, "Transportation Noise and Recreational Lands," in *InterNoise 2002*, the 2002 International Congress and Exposition on Noise Control Engineering, Aug. 19–21, Dearborn, Mich.

Mills, M.J., 1994, *Harvest, Catch, and Participation in Alaska Sport Fisheries during 1993*, Alaska Department of Fish and Game Fishery Data Series 94-28, Anchorage, Alaska.

Montana Department of Environmental Quality, 2007, *Federal & State Air Quality Standards*. Available at http://www.deq.mt.gov/AirQuality/Planning/Air_standards/AIR_STANDARDS.pdf. Accessed July 23, 2007.

Montana Fish, Wildlife, and Parks, undated, *Animal Field Guide*, Montana Fish, Wildlife, and Parks, Helena, Montana. Available at http://fwp.mt.gov/fieldguide/default.aspx. Accessed June 7, 2006.

Montana Sage Grouse Work Group, 2005, *Management Plan and Conservation Strategies for Sage Grouse in Montana — Final*. Available at http://fwp.mt.gov/fwppaperapps/wildthings/SGFinalPlan.pdf. Accessed November 1, 2006.

Moyle, P.B., 1976, *Inland Fishes of California*, University of California Press, Berkeley, Calif.

MPCA (Minnesota Pollution Control Agency), 1999, *A Guide to Noise Control in Minnesota, Acoustical Properties, Measurement, Analysis, Regulation*, Saint Paul, Minnesota. Available at http://www.pca.state.mn.us/programs/pubs/noise.pdf. Accessed June 15, 2006.

Naiman, R.J., 1981, "An Ecosystem Overview: Desert Fishes and Their Habitats," pp. 493–531 in *Fishes in North American Deserts*, R.J. Naiman and D.L. Soltz (eds.), Wiley-Interscience Publication, New York, N.Y.

National Atlas, 2006, National Atlas Home Page. Available at http://nationalatlas.gov/. Accessed July 12, 2006.

National Audubon Society, 2005, *Important Bird Areas Program*, National Audubon Society, New York, N.Y. Available at http://www.audubon.org/bird/iba/index.html. Accessed November 1, 2006.

National Commission on Energy Policy, 2006, *Siting Critical Energy Infrastructure: An Overview of Needs and Challenges*, Washington, D.C.

National Energy Policy Development Group, 2001, *National Energy Policy: Reliable, Affordable, and Environmentally Sound Energy for America's Future*, May. Available at http://www.energy.gov/about/nationalenergypolicy.htm. Accessed March 27, 2007.

National Geographic Society, 1999, *Field Guide to the Birds of North America*, 3rd ed., Washington, D.C.

NatureServe, 2006, *NatureServe Explorer: An Online Encyclopedia of Life*, Version 6.0, Arlington, Va. Available at http://www.natureserve.org/explorer. Accessed October 20, 2006.

Naugle, D.E., et al., 2004, "West Nile Virus: Pending Crisis for Greater Sage-Grouse," *Ecology Letters* 7:704–713.

NCDC (National Climatic Data Center), 1997, *Hourly United States Weather Observations 1990-1995 (HUSWO)*. CD available from National Climatic Data Center, 151 Patton Avenue, Asheville, N.C., Oct.

NDOT (Nevada Department of Transportation), 2004, *2006 Construction Site Best Management Practices*. Available at http://www.nevadadot.com/reports_pubs/Water_Quality/. Accessed July 2006.

Nevada Division of Environmental Protection, 2007, *Ambient Air Quality Standards*, Bureau of Air Quality Planning. Available at http://ndep.nv.gov/baqp/445b391.pdf. Accessed July 23, 2007.

New Mexico Environmental Department, 2007, *Ambient Air Quality Standards*, Air Quality Bureau, September 6, 2006. Available at http://www.nmenv.state.nm.us/aqb/regs/20_2_03NMAC_090606.pdf. Accessed July 23, 2007.

New Mexico State University, 2007, Hydrologic Unit–Region 12: Texas-Gulf. Available at http://wrri.nmsu.edu/wrdis/watersheds/huc12.html. Accessed May 2007.

NNHP (Nevada Natural Heritage Program), 2002, *Index to Available Species Lists*, State of Nevada, Department of Conservation & Natural Resources, Natural Heritage Program, Carson City, Nev. Available at http://heritage.nv.gov/lists/reptiles.html. Accessed June 7, 2006.

NOAA (National Oceanic and Atmospheric Administration), 1994, *Shoreline Countermeasures Manual, Alaska*, NOAA Hazardous Materials Response and Assessment Division.

NOAA, 1998, *Oil Spill Impacts and the Biological Basis for Response Guidance: An Applied Synthesis of Research on Three Subarctic Intertidal Communities*, NOAA Technical Memorandum NOS ORCA 125.

NOAA, 2000, *Characteristic Coastal Habitats, Choosing Spill Response Alternatives*, National Ocean Service, Office of Response and Restoration, Hazardous Materials Response and Assessment Division.

NPS (National Park Service), 2001, *2001 Statistical Abstract*, National Park Service Social Science Program, Public Use Statistics Office, Denver, Colo.

NPS, 2006a, *Natural Resource Management Reference Manual #77* (formerly NPS-77). Available at http://www.nature.nps.gov/RM77/. Accessed June 29, 2006.

NPS, 2006b, *2005 Statistical Abstract*, National Park Service Social Science Program, Public Use Statistics Office, Denver, Colo.

NPS, 2006c, *About Us – National Park Service*. Available at http://www.nps.gov/aboutus/index.htm. Accessed November 10, 2006.

NRC (National Research Council), 1995, *Wetlands: Characteristics and Boundaries*, Committee on Characterization of Wetlands, National Academy Press, Washington, D.C.

NRCS (National Resources Conservation Service), 1999, *Soil Taxonomy, a Basic System of Soil Classification for Making and Interpreting Soil Surveys*, 2nd edition, Agriculture Handbook, Number 436, U.S. Department of Agriculture.

NRCS, 2000, *Summary Report, 1997 National Resources Inventory (Revised December 2000)*. Available at http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/table9.html. Accessed March 2, 2007.

NRCS, 2003, *National Resources Inventory — 2001 Annual NRI: Land Use*, July.

NRCS, 2006a, *Official Soil Series Descriptions (OSD) with Series Extent Mapping Capabilities*, U.S. Department of Agriculture. Available at http://soils.usda.gov/technical/classification/osd/index.html. Accessed June 29, 2006.

NRCS, 2006b, *National Resources Inventory 2003 Annual Report — Land Use*, Washington, D.C., May.

NRCS, 2007a, *National Resources Inventory — 2003 Annual NRI: Land Use*, Feb.

NRCS, 2007b, *National Resources Inventory — 2002 and 2003 Annual NRI: Glossary of Key Terms*. Available at http://www.nrcs.usda.gov/technical/land/nri02/glossary.html. Accessed March 2, 2007.

NRDC (National Resources Defense Council), 2006, *The National Forest "Roadless Area" Rule*. Available at http://www.nrdc.org/land/forests/qroadless.asp#1. Accessed November 29, 2006.

NREL (National Renewable Energy Laboratory), 2005, Renewable Resources Maps and Data. Available at http://www.NREL.gov/renewable_resources/. Accessed September 15, 2006.

NWCC (National Wind Coordinating Committee), 1998, *Permitting of Wind Energy Facilities: A Handbook*, Siting Subcommittee, c/o RESOLVE, Washington, D.C., March.

Olendorff, R.R., and R.N. Lehman, 1986, *Raptor Collisions with Utility Lines: An Analysis Using Subjective Field Observations*, prepared for Pacific Gas and Electric Company, San Ramon, Calif., by U.S. Department of the Interior, Bureau of Land Management, Sacramento, Calif., Feb.

Oregon Department of Environmental Quality, 2007, *2006 Oregon Air Quality Data Summaries*, Air Quality Division. Available at http://www.deq.state.or.us/aq/forms/2006ar/ 2006ar.pdf. Accessed July 23, 2007.

Owl Research Institute, 2004, *Owl Identification Guide, Identification of North American Owls*, Ninepipes Center for Wildlife Research and Education, Charo, Mont. Available at http://www.owlinstitute.org/idguide.html. Accessed April 13, 2004.

Pacific Fishery Management Council, 2000, *Amendment 14 to the Pacific Coast Salmon Plan (1997) Incorporating the Regulatory Impact Review/Initial Regulatory Flexibility Analysis and Final Supplemental Environmental Impact Statement*, Portland, Oregon, May.

Pacific Fishery Management Council, 2003, Pacific Coast Salmon Plan: Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California as Revised through Amendment 14 (Adopted March 1999), Portland, Oregon, Sept.

Paige, C., and S.A. Ritter, 1999, *Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities*, Partners in Flight, Western Working Group, Boise, Idaho.

Palmer, A.R., and J. Geissman, 1999, *Geologic Time Scale*, compiled for the Geological Society of America.

Parker, G., 2007, Email communication from G. Parker, U.S. Forest Service, to T. Patton, Argonne National Laboratory, April 21, 2007.

Parker, P.L., and T.F. King, 1998, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, National Register Bulletin 38, National Park Service, Washington, D.C.

Parker, T.H., et al., 2005, "Edge and Area Effects on the Occurrence of Migrant Forest Songbirds," *Conservation Biology* 19(4):1157–1167.

PBS&J, 2002, *Final Environmental Impact Statement, Table Mountain Wind Generating Facility*, BLM Case Nos. N-73726 and N-57100, prepared by PBS&J, San Diego, Calif., for U.S. Bureau of Land Management, Las Vegas Field Office, Nev., July.

Pearsons, K.S., R.L. Bennett, and S.A. Fidell, 1979, *Initial Study on the Effects of Transformer and Transmission Line Noise on People Volume 1: Annoyance*, EPRI EA-1240, prepared by Bolt, Beranek, & Newman, Inc., Canoga Park, Calif., for Electric Power Research Institute, Inc., Palo Alto, Calif., Dec.

Pegg, M.A., and C.L. Pierce, 2002, "Fish Community Structure in the Missouri and Yellowstone Rivers in Relation to Flow Characteristics," *Hydrobiologia* 479:155–167.

PHMSA (Pipeline and Hazardous Materials Safety Administration), 2006, *Pipeline Construction*. Available at http://primis.phmsa.dot.gov/comm/PipelineConstruction.htm. Accessed July 2006.

Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegarrd, B.D. Richter, R.E. Sparks, and J.C. Stromberg, 1997, "The Natural Flow Regime: A Paradigm for River Conservation and Restoration," *BioScience* 47:769–784.

Proffitt, C.E. (ed.), 1998, *Effects and Management of Oil Spills in Marsh Ecosystems: A Review Produced from a Workshop Convened July 1996 at McNeese State University*, OCS Study MMS 98-0018, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La.

Radbruch-Hall, D.H., R.B. Colton, W.E. Davies, I. Lucchita, B.A. Skipp, and D.J. Varnes, 1982, *Landslide Overview Map of the Conterminous United States*, U.S. Geological Survey Professional Paper 1183. Available at http://pubs.usgs.gov/pp/p1183/pp1183.html. Accessed June 12, 2006.

Raney, J.P., and J.M. Cawthorn, 1991, "Aircraft Noise," in *Handbook of Acoustical Measurements and Noise Control*, C.M. Harris (ed.), 3rd ed., McGraw-Hill, Inc., New York, N.Y.

Recreation.gov, 2006, *Database for Recreation Areas and Their Managing Partners for Selected States*. Available at http://www.recreation.gov/index/jsp. Accessed December 4, 2006.

Reed, R.A., et al., 1996, "Contribution of Roads to Forest Fragmentation in the Rocky Mountains," *Conservation Biology* 10(4):1098–1106.

Regional Ecosystem Office, 2007, *Northwest Forest Plan (NWFP) Overview*, Portland, Ore. Available at http://www.reo.gov/general/aboutNWFP.htm. Accessed July 23, 2007.

Reijnen, R., and R. Foppen, 1994, "The Effects of Car Traffic on Breeding Bird Populations in Woodland. I. Evidence of Reduced Habitat Quality for Willow Warblers (*Phylloscopus trochilus*) Breeding Close to a Highway," *Journal of Applied Ecology* 32:85–94.

Reijnen, R., and R. Foppen, 1995, "The Effects of Car Traffic on Breeding Bird Populations in Woodland. IV. Influence of Population Size on the Reduction of Density Close to a Highway," *Journal of Applied Ecology* 32:481–491.

Reijnen, R., et al., 1995, "The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads," *Journal of Applied Ecology* 32:187–202.

Reijnen, R., et al., 1996, "The Effects of Traffic on the Density of Breeding Birds in Dutch Agricultural Grasslands," *Biological Conservation* 75:255–260.

Reijnen, R., et al., 1997, "Disturbance by Traffic of Breeding Birds: Evaluation of the Effects and Considerations in Planning and Managing Road Corridors," *Biodiversity and Conservation* 6:567–581.

Rich, A.C., et al., 1994, "Defining Forest Fragmentation by Corridor Width: The Influence of Narrow Forest-Dividing Corridors on Forest-Nesting Birds in Southern New Jersey," *Conservation Biology* 8(4):1109–1121.

Rich, T.D., et al., 2004, *Partners in Flight North American Landbird Conservation Plan*, Cornell Lab of Ornithology, Ithaca, New York. Available at http://www.partnersinflight.org/cont_plan/ default.htm. Accessed November 1, 2006.

Riffell, S.K., et al., 1996, "Does Repeated Human Intrusion Cause Cumulative Declines in Avian Richness and Abundance?," *Ecological Applications* 6(2):492–505.

Rinne, J.N., and J.A. Stefferud, 1997, "Factors Contributing to Collapse Yet Maintenance of a Native Fish Community in the Desert Southwest (USA)" in *Developing and Sustaining World Fisheries Resources: The State of Science and Management*, D.A. Hancock, D.C. Smith, A. Grant, and J.P. Beaumer (eds.), Second World Fish Congress, Brisbane, Australia.

Rinne, J.N., and W.L. Minckley, 1991, *Native Fishes of Arid Lands: A Dwindling Resource of the Desert Southwest*, General Technical Report RM-206, U.S. Department of Agriculture, U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Santillo, D.J., 1994, "Observations on Moose, *Alces alces*, Habitat and Use on Herbicide Treated Clearcuts in Maine," *Canadian Field Naturalist* 108(1):22–25.

Santillo, D.J., et al., 1989a, "Response of Songbirds to Glyphosate-Induced Habitat Changes on Clearcuts," *Journal of Wildlife Management* 53(1):64–71.

Santillo, D.J., et al., 1989b, "Responses of Small Mammals and Habitat to Glyphosate Application on Clearcuts," *Journal of Wildlife Management* 53(1):164–172.

Sawyer, H., and F. Lindzey, 2001, *Sublette Mule Deer Study*, final report, Wyoming Cooperative Fish & Wildlife Research Unit, Laramie, Wyo., March. Available at http://www.uppergreen.org/library/docs/Muledeerstudy1.pdf. Accessed June 8, 2006.

SCEC (Southern California Earthquake Center), 1999, *Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Liquefaction in California*. Available at http://www.scec.org/education/products/liqreport.pdf. Accessed June 13, 2006.

SCGC (Southern California Gas Company), 2002, *Water Quality Construction Best Management Practices Manual*. Available at http://www.socalgas.com/construction/doc/bmp_manual2004.pdf. Accessed July 2006.

Schooley, R.L., et al., 1996, "Can Shrub Cover Increase Predation Risk for a Desert Rodent?," *Canadian Journal of Zoology* 74:157–163.

Schreiber, R.K., and J.H. Graves, 1977, "Powerline Corridors as Possible Barriers to the Movements of Small Mammals," *The American Midland Naturalist* 97(2):504–508.

Schuster, E.G., and M.A. Krebs, 2003, *Forest Service Programs, Authorities, and Relationships: A Technical Document Supporting the 2000 USDA Forest Service RPA Assessment*, General Technical Report RMRS-GTR-112, U.S. Department of Agriculture, U.S. Forest Service, Rocky Mountain Research Station, Fort Collins, Colo.

Schuster, R.L., and L.M. Highland, 2001, *Socioeconomic and Environmental Impacts of Landslides*, Open-File Report 01-0276, U.S. Geological Survey. Available at http://infotrek.er.usgs.gov/pubs/. Accessed on June 12, 2006.

Scurlock, D., 1998, *From the Rio to the Sierra: An Environmental History of the Middle Rio Grande Basin*, General Technical Report RMRS-GTR-5, U.S. Department of Agriculture, U.S. Forest Service, Rocky Mountain Research Station, Fort Collins, Colo.

Sharpe, P.B., and B. Van Horne, 1998, "Influence of Habitat on Behavior of Townsend's Ground Squirrel (*Spermophilus townsendii*)," *Journal of Mammalogy* 79:906–918.

Spiker, E.C., and P.L. Gori, 2003, *National Landslide Hazards Mitigation Strategy — A Framework for Loss Reduction*, Circular 1244, U.S. Geological Survey.

Stamm, R., 2004, personal communication from R. Stamm (Bureau of Land Management, Washington, D.C.) to K.P. Smith (Argonne National Laboratory, Lakewood, Colo.), July 14.

Starnes, W.C., 1995, "Colorado River Basin Fishes," pp. 149–152 in *Our Living Resources: A Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals, and Ecosystems*, E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac (eds.), U.S. Department of the Interior, National Biological Service, Washington, D.C.

State of Nevada, 2006, *Surface Area Disturbance Permit Dust Control Plan (Plan) Preparation Guidelines October 2002*, Division of Environmental Protection, Bureau of Air Pollution Control, Carson City, Nev. Available at http://ndep.nv.gov/bapc/permitd.html. Accessed May 25, 2006.

Steenhof, K., et al., 1993, "Nesting by Raptors and Common Ravens on Electrical Transmission Line Towers," *Journal of Wildlife Management* 57(2):271–281.

Stiver, S.J., et al., 2006, *Greater Sage-Grouse Comprehensive Conservation Strategy*, unpublished report, Western Association of Fish and Wildlife Agencies, Cheyenne, Wyo.

Stoffle, R.W., D.B. Halmo, J.E. Olmsted, and M.J. Evans, 1990, *Native American Cultural Resource Studies at Yucca Mountain, Nevada*, University of Michigan, Ann Arbor, Mich.

Stout, I.J., and G.W. Cornwell, 1976, "Nonhunting Mortality of Fledged North American Waterfowl," *Journal of Wildlife Management* 40:681–193.

Strittholt, J.R., et al., 2000, *Importance of Bureau of Land Management Roadless Areas in the Western U.S.A.*, prepared for the National BLM Wilderness Campaign by the Conservation Biology Institute, Corvallis, Ore. Available at http://www.consbio.org/cbi/projects/blm/blm.htm. Accessed January 28, 2005.

Thompson, L.S., 1978, "Transmission Line Wire Strikes: Mitigation through Engineering Design and Habitat Modification," pp. 51–92 in *Impacts of Transmission Lines on Birds in Flight: Proceedings of a Conference,* January 31–February 2, 1978, ORAU-142, Oak Ridge Associated Universities, Oak Ridge, Tenn.

Thomson, J.L., et al., 2005, *Wildlife at a Crossroads: Energy Development in Western Wyoming — Effects of Roads on Habitat in the Upper Green River Valley*, The Wilderness Society, Washington, D.C. Available at http://www.uppergreen.org/library/docs/WildlifeAtCrossroads_report.pdf. Accessed June 8, 2006.

Titus, T., undated, *Amphibians and Reptiles of Oregon*. Available at http://darkwing.uoregon.edu/~titus/herp/herp.html. Accessed June 7, 2006.

Trombulak, S.C., and C.A. Frissell, 2000, "Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities," *Conservation Biology* 14(1):18–30.

TVA (Tennessee Valley Authority), 2002, *Draft Environmental Assessment Kingston Fossil Plant Units 1 through 9 Reduction Systems for Nitrogen Oxide Control, Appendix D Stream Crossings and Construction Procedures for Pipeline*. Available at http://www.tva.gov/environment/reports/kingston/appendix_d.pdf. Accessed July 2006.

U.S. Bureau of the Census, 2006a, "Census of Governments," U.S. Bureau of the Census, Washington, D.C. Available at http://www.census.gov/gov/www/index. Accessed July 2006.

U.S. Bureau of the Census, 2006b, "American Fact Finder," U.S. Bureau of the Census, Washington, D.C. Available at http://factfinder.census.gov/. Accessed July 2006.

U.S. Bureau of the Census, 2006c, "State Interim Population Projections by Age and Sex: 2004–2030." U.S. Bureau of the Census, Washington, D.C. Available at http://www.census.gov/population/www/projections/projectionsagesex.html. Accessed July 2006.

U.S. Bureau of the Census, 2006d, "American Indian Reservations and Trust Lands." Available at http://www.census.gov/geo/www/ezstate/airpov.pdf. Accessed December 1, 2006.

U.S. Department of Commerce, 2006, "Local Area Personal Income," Bureau of Economic Analysis. Available at http://www.bea.doc.gov/bea/regional/reis/. Accessed July 2006.

U.S. Department of Labor, 2006a, "Quarterly Census of Employment and Wages," Bureau of Labor Statistics. Available at http://data.bls.gov/cgi-bin/drsv. Accessed July 2006.

U.S. Department of Labor, 2006b, "Local Area Unemployment Statistics," Bureau of Labor Statistics. Available at ftp://ftp.bls.gov/pub/time.series/la/. Accessed July 2006.

UDWR (Utah Division of Wildlife Resources), 2003, *Utah Division of Wildlife Resources Statewide Management Plan for Mule Deer*, State of Utah Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah. Available at http://www.wildlife.utah.gov/hunting/biggame/pdf/mule_deer_plan.pdf. Accessed June 12, 2006.

UDWR, 2005, *Utah Division of Wildlife Resources Statewide Management Plan for Elk*, State of Utah Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah. Available at http://www.wildlife.utah.gov/hunting/biggame/pdf/elk_plan.pdf. Accessed June 12, 2006.

UDWR, 2006, *Utah Conservation Data Center*, State of Utah Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah. Available at http://dwrcdc.nr.utah.gov/ucdc/default.asp. Accessed June 30, 2006.

University of California Museum of Paleontology, 2006, The Paleontology Portal. Available at http://www.paleoportal.org. Accessed September 22, 2006.

USDA (U.S. Department of Agriculture), 1996, *Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation* (*RUSLE*), USDA Agriculture Handbook Number 703, Washington, D.C.

USDA, 2002a, *Fire Effects Information System*, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at http://www.fs.fed.us/database/feis. Accessed March 7, 2007.

USDA, 2002b, "Wildlife Species: *Spermophilus townsendii*," *Fire Effects Information System*, U.S. Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at http://www.fs.fed.us/database/feis/animals/mammal/spto/all.html. Accessed March 7, 2007.

USDA, 2002c, "Wildlife Species: *Lepus californicus*," in *Fire Effects Information System*, U.S. Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at http://www.fs.fed.us/database/feis/animals/mammal/leca/all.html. Accessed March 7, 2007.

USDA, 2002d, "Wildlife Species: Bird List," in *Fire Effects Information System*, U.S. Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at http://www.fs.fed.us/database/feis/animals/bird/. Accessed March 7, 2007.

USDA, 2006, *State Agricultural Overview — 2005*, National Agricultural Statistics Service, Agricultural Statistics Board. Available at http://www.nass.usda.gov/Statistics_by_State/. Accessed December 1, 2006.

USFWS (U.S. Fish and Wildlife Service), 1994, *Lahontan cutthroat trout*, *Oncorhynchus clarki henshawi*, *Recovery Plan*, Portland, Ore.

USFWS, 2002, *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, U.S. Department of the Interior, U.S. Fish and Wildlife Service, Oct.

USFWS, 2003, *Harvest Information Program Preliminary Estimates of Waterfowl Hunter Activity and Harvest during the 2001 and 2002 Hunting Seasons*, administrative report, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, Md., July. Available at http://www.fws.gov/migratorybirds/reports/HuntingStatistics/HIPHunterActivity.pdf. Accessed October 24, 2006.

USFWS, 2004, *Sage Grouse Fact Sheet*, U.S. Fish and Wildlife Service, Mountain Prairies Region, Region 6, Lakewood, Colo. Available at http://mountain-prairie.fws.gov/species/birds/sagegrouse. Accessed April 24, 2006.

USFWS, 2006a, *Annual Report of Lands under Control of the U.S. Fish and Wildlife Service as of September 30, 2005*, compiled by the Division of Realty.

USFWS, 2006b, *Short History of the Refuge System*. Available at http://www.fws.gov/refuges/history/over/over_hist-b_fs.html. Accessed November 10, 2006.

USFWS, 2006c, "Upper Colorado River Endangered Fish Recovery Program." Available at http://www.fws.gov/coloradoriverrecovery/. Accessed May 3, 2007.

USFWS, 2007, *USFWS Threatened and Endangered Species System (TESS)*, U.S. Fish and Wildlife Service, Washington, D.C. Available at http://ecos.fws.gov/tess_public/StartTESS.do. Accessed March 26, 2007.

USGS (U.S. Geological Survey), 2003, *Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands* (a database). Available at http://nationalatlas.gov/. Accessed on July 14, 2006.

USGS, 2005, *2005 Assessment Updates*, Energy Resources Program, Oil and Gas-National Oil and Gas Assessment, U.S. Department of the Interior. Available at http://energy.cr.usgs.gov/oilgas/noga/ass_updates.html. Accessed July 20, 2006.

USGS, 2006, *Hydrologic Landscape Regions of the United States*. Available at http://water.usgs.gov/GIS/metadata/usgswrd/XML/hlrus.xml. Accessed May 2006.

Utah Department of Environmental Quality, 2007, *Ambient Air Quality in Utah — Criteria Pollutants*, Division of Air Quality. Available at http://www.airquality.utah.gov/Public-Interest/annual-report/Ambient_air_quality/Criteria_Pollutant_2005.htm. Accessed July 23, 2007.

Van Tassell, L.W., E.T. Bartlett, and J.E. Mitchell, 2001, *Projected Use of Grazed Forages in the United States: 2000–2050 — A Technical Document Supporting the 2000 USDA Forest Service RPA Assessment*, General Technical Report RMRS-GTR-82, U.S. Department of Agriculture, U.S. Forest Service, Rocky Mountain Research Station, Fort Collins, Colo.

Vincent, C.H., B.A. Cody, M.L. Corn, R.W. Gorte, S.L. Johnson, and D. Whiteman, 2001, *Federal Land Management Agencies: Background on Land and Resource Management*, Congressional Research Service, Report for Congress RL30867, February 27.

Washington Department of Ecology, 2007, *Ambient Air Quality Standards*, Air Quality Program. Available at http://fortress.wa.gov/ecy/aqp/Public/AmbientAirQualityStandards.shtml. Accessed July 23, 2007.

Waters, T.F., 1995, *Sediment in Streams: Sources, Biological Effects, and Control*, American Fisheries Society Monograph 7, American Fisheries Society, Bethesda, Md.

Watts, S.T., and S.T. Knick, 1996, "The Influence of Vegetation, Soils, and Disturbance on Townsend's Ground Squirrel Abundance," in *BLM/IDARNG Research Project Final Report*, Vol. 2, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Snake River Field Station, Boise, Idaho.

WebMET.com, 2006, Utah, AERMET Upper Air Met Data, TD6201 Format (AERMOD), The Meteorological Resource Center. Available at http://www.webmet.com/State_pages/met_ut.htm. Accessed July 2006.

WGFD (Wyoming Game and Fish Department), 2004, *Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats*, Wyoming Game and Fish Department, Cheyenne, Wyo., Dec. Available at http://gf.state.wy.us/downloads/pdf/og.pdf. Accessed July 27, 2006.

WGFD, 2006, *Wyoming Game & Fish Species List*, Wyoming Game and Fish Department, Cheyenne, Wyo. Available at http://gf.state.wy.us/wildlife/nongame/SpeciesList/index.asp. Accessed June 6, 2006.

White R.G., and R.G. Bramblett, 1993, "The Yellowstone River: Its Fish and Fisheries," pp. 396–414 in *Proceedings of the Symposium on Restoration Planning for the Rivers of the Mississippi River Ecosystem*, L.W. Hesse, C.B. Stalnaker, N.G. Benson, and J.R. Zuboy (eds.), Biological Report 19, U.S. Department of the Interior, National Biological Service, Washington, D.C.

Whittier, T.R., R.M. Hughes, and D.P. Larsen, 1988, "Correspondence between Ecoregions and Spatial Patterns in Stream Ecosystems in Oregon," *Canadian Journal of Fisheries and Aquatic Sciences* 45:1264–1278.

Williams, C.E., 1995, "Chapter Six. Effects of Powerline Corridors on Forest Ecosystem Integrity," pp. 76–86 in *Environmental Contaminants, Ecosystems and Human Health*, S.K. Majumdar et al. (eds.), The Pennsylvania Academy of Science, Easton, Penn.

Witkind, I.J., 1986, *Potential Geologic Hazards near the Thistle Landslide, Utah County, Utah*, Open-File Report 861–119, U.S. Geological Survey.

Wolfe, E.W., and T.C. Pierson, 1995, *Volcanic-Hazard Zonation for Mount St. Helens, Washington, 1995*, Open-File Report 95-497, U.S. Geological Survey.

Wolfe, E.W., and T.C. Pierson, 1995, *Volcanic-Hazard Zonation for Mount St. Helens, Washington, 1995*, Open-File Report 95–497, U.S. Geological Survey.

Wolock, D.M., T.C. Winter, and G. McMahon, 2004, "Delineation and Evaluation of Hydrologic-Landscape Regions in the United States Using Geographic Information System Tools and Multivariate Statistical Analyses," *Environmental Management*, V. 34, Supplement 1, pp. S71–S88.

Wood, E.W., 1992, "Prediction of Machinery Noise," in *Noise and Vibration Control Engineering: Principles and Applications*, L.L. Beranek, and I.L. Vér (eds.), John Wiley & Sons, Inc., New York, N.Y.

WRAP (Western Regional Air Partnership), 2006, *Emissions Data Management System (EDMS)*. Available at http://www.wrapedms.org/default_login.asp. Accessed July 2006.

WRCC (Western Regional Climate Center), 2006a, *Climatological Data Summaries (Temperature and Precipitation)*. Available at http://www.wrcc.dri.edu/Climsum.html. Accessed June 2006.

WRCC, 2006b, *Historical Climate Information, Climate of Arizona*. Available at http://www.wrcc.dri.edu/narratives/ARIZONA.htm. Accessed July 6, 2006.

WRCC, 2006c, *Historical Climate Information, Climate of California*. Available at http://www.wrcc.dri.edu/narratives/CALIFORNIA.htm. Accessed July 6, 2006.

WRCC, 2006d, *Historical Climate Information, Climate of Colorado*. Available at http://www.wrcc.dri.edu/narratives/COLORADO.htm. Accessed July 6, 2006.

WRCC, 2006e, *Historical Climate Information, Climate of Idaho*. Available at http://www.wrcc.dri.edu/narratives/IDAHO.htm. Accessed July 6, 2006.

WRCC, 2006f, *Historical Climate Information, Climate of Montana*. Available at http://www.wrcc.dri.edu/narratives/MONTANA.htm. Accessed July 6, 2006.

WRCC, 2006g, *Historical Climate Information, Climate of Nevada*. Available at http://www.wrcc.dri.edu/narratives/NEVADA.htm. Accessed July 6, 2006.

WRCC, 2006h, *Historical Climate Information, Climate of New Mexico*. Available at http://www.wrcc.dri.edu/narratives/NEWMEXICO.htm. Accessed July 6, 2006.

WRCC, 2006i, *Historical Climate Information, Climate of Oregon*. Available at http://www.wrcc.dri.edu/narratives/OREGON.htm. Accessed July 6, 2006.

WRCC, 2006j, *Historical Climate Information, Climate of Utah*. Available at http://www.wrcc.dri.edu/narratives/UTAH.htm. Accessed July 6, 2006.

WRCC, 2006k, *Historical Climate Information, Climate of Washington*. Available at http://www.wrcc.dri.edu/narratives/WASHINGTON.htm. Accessed July 6, 2006.

WRCC, 2006l, *Historical Climate Information, Climate of Wyoming*. Available at http://www.wrcc.dri.edu/narratives/WYOMING.htm. Accessed July 6, 2006.

Wyoming Department of Environmental Quality, 2007, *Ambient Standards,* last updated January 30, 2006. Air Quality Division. Available at http://deq.state.wy.us/aqd/stnd/Chapter2_2-3-05FINAL_CLEAN.pdf. Accessed July 23, 2007.

Young, J.R., 2003, *The Gunnison Sage-Grouse (Centrocercus minimus),* Western State College of Colorado, Gunnison, Colo. Available at http://www.western.edu/bio/young/gunnsg/gunnsg.htm. Accessed April 9, 2004.

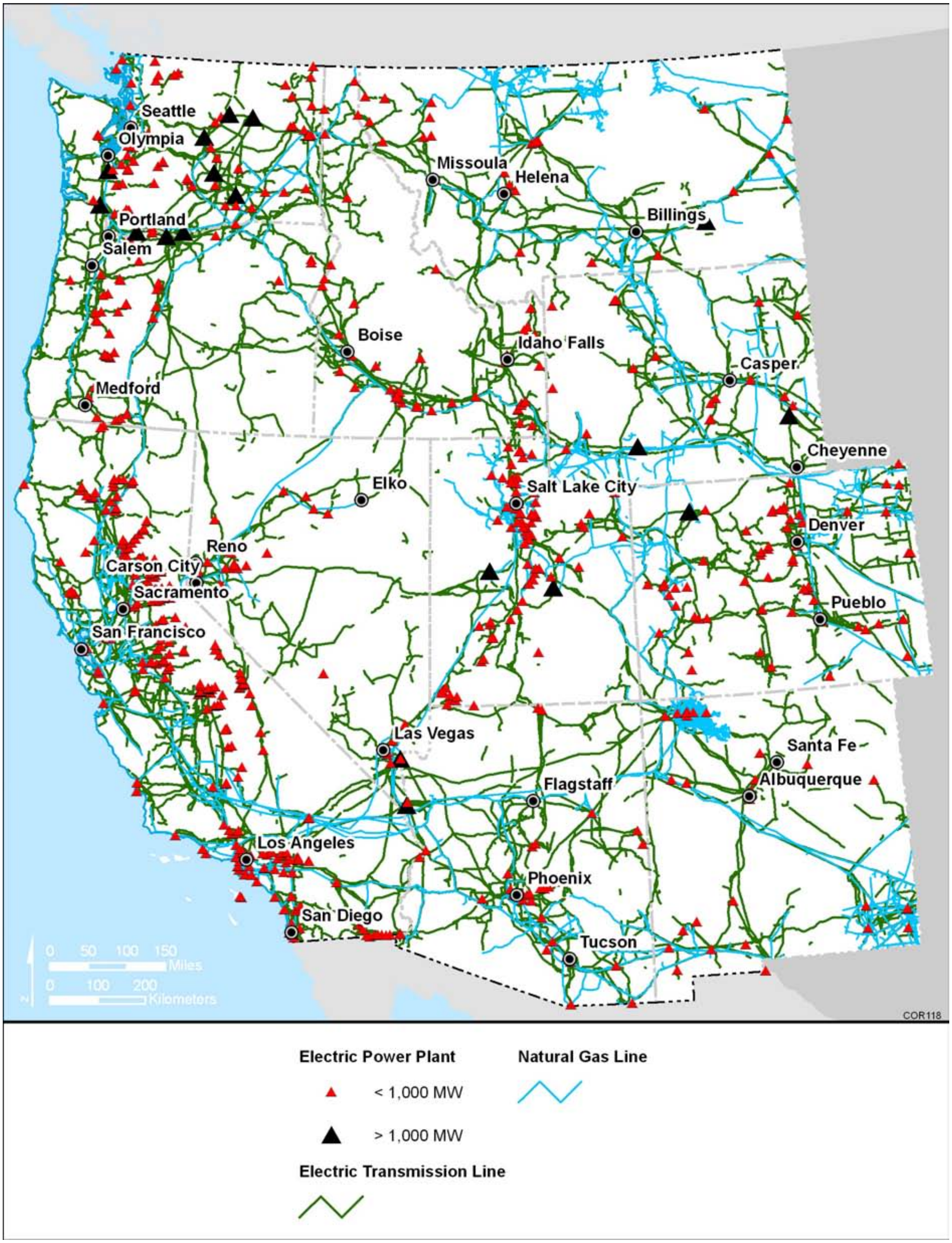


FIGURE 1.1-1 Distribution of Electricity Transmission Lines, Power Plants, and Natural Gas Pipelines on Private and Public Lands in the West. (Power plants with capacities lower than 200 MW were not included.)

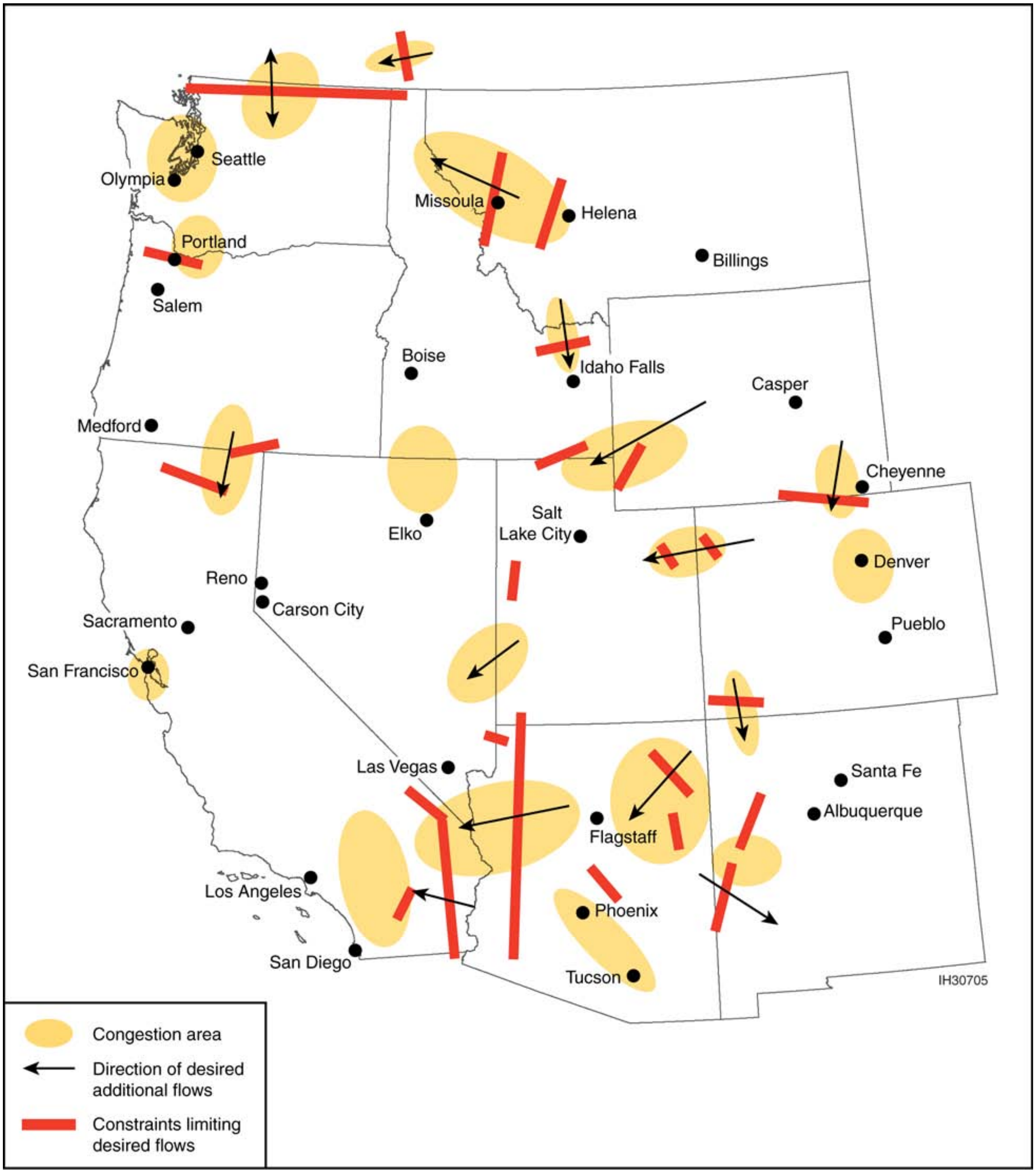


FIGURE 1.1-2 Transmission Constraints Limiting Desired Flows of Electricity, with Arrows Depicting the Direction of Additional Desired Flows That May Be Needed to Reduce Constraints in the West. (The red bars indicate near-term and potential longer-term [10 years] constraints [including congestion] on transmission infrastructure that crosses the bars.) (Source: DOE 2006a)

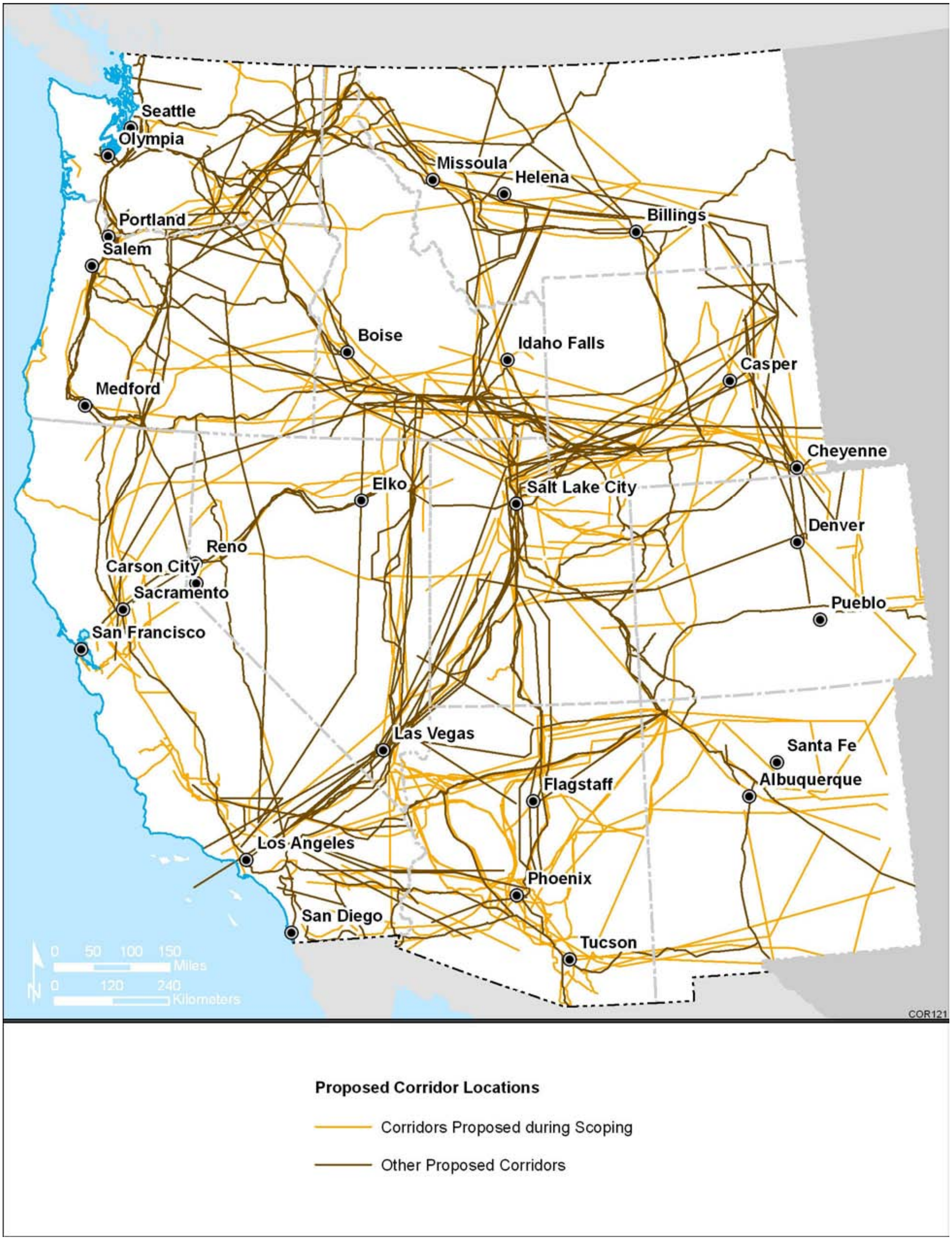


FIGURE 2.1-1 Proposed Energy Corridors Received during and after Public Scoping

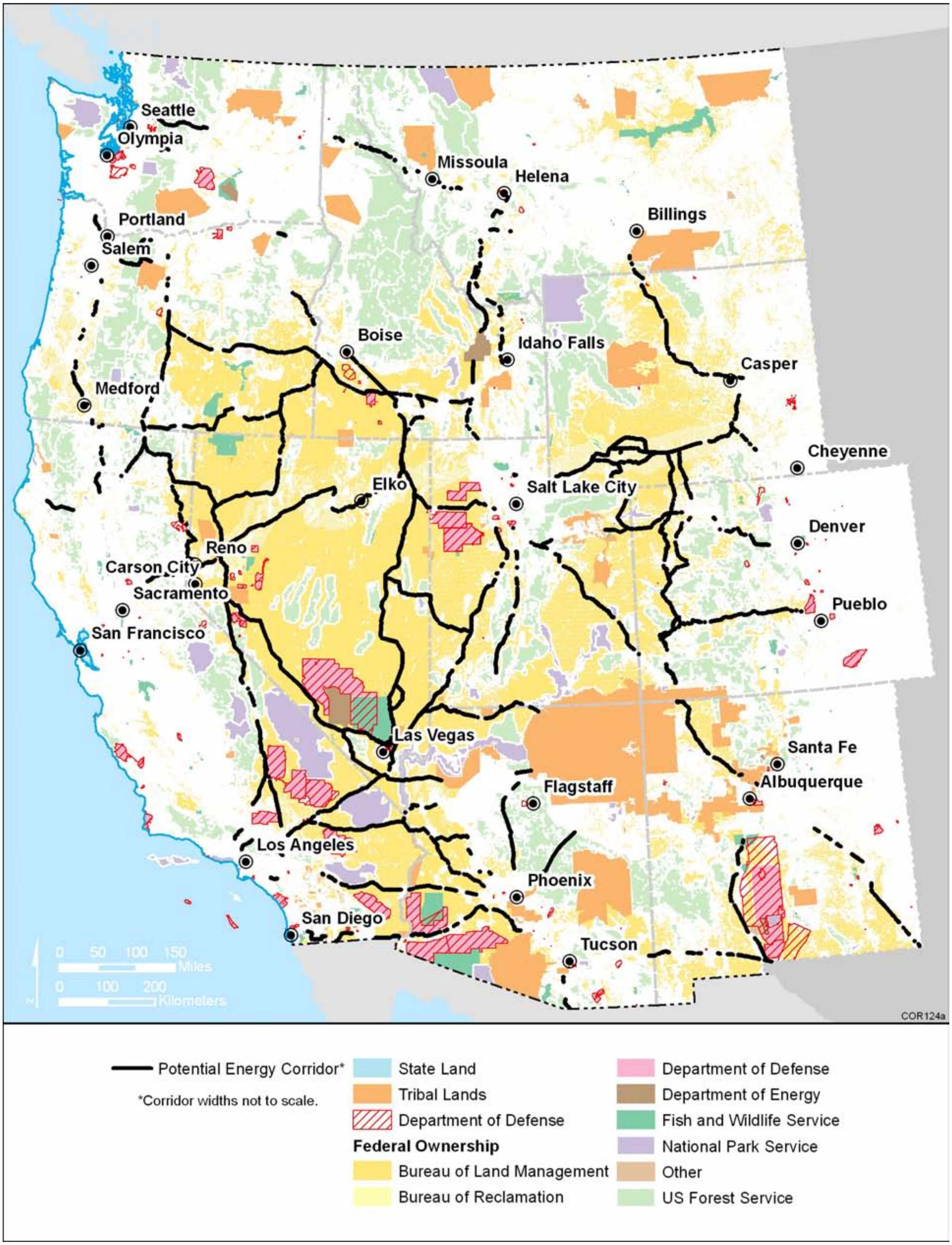


FIGURE 2.2-1 Proposed Section 368 Energy Corridors on Federal Lands in the 11 Western States

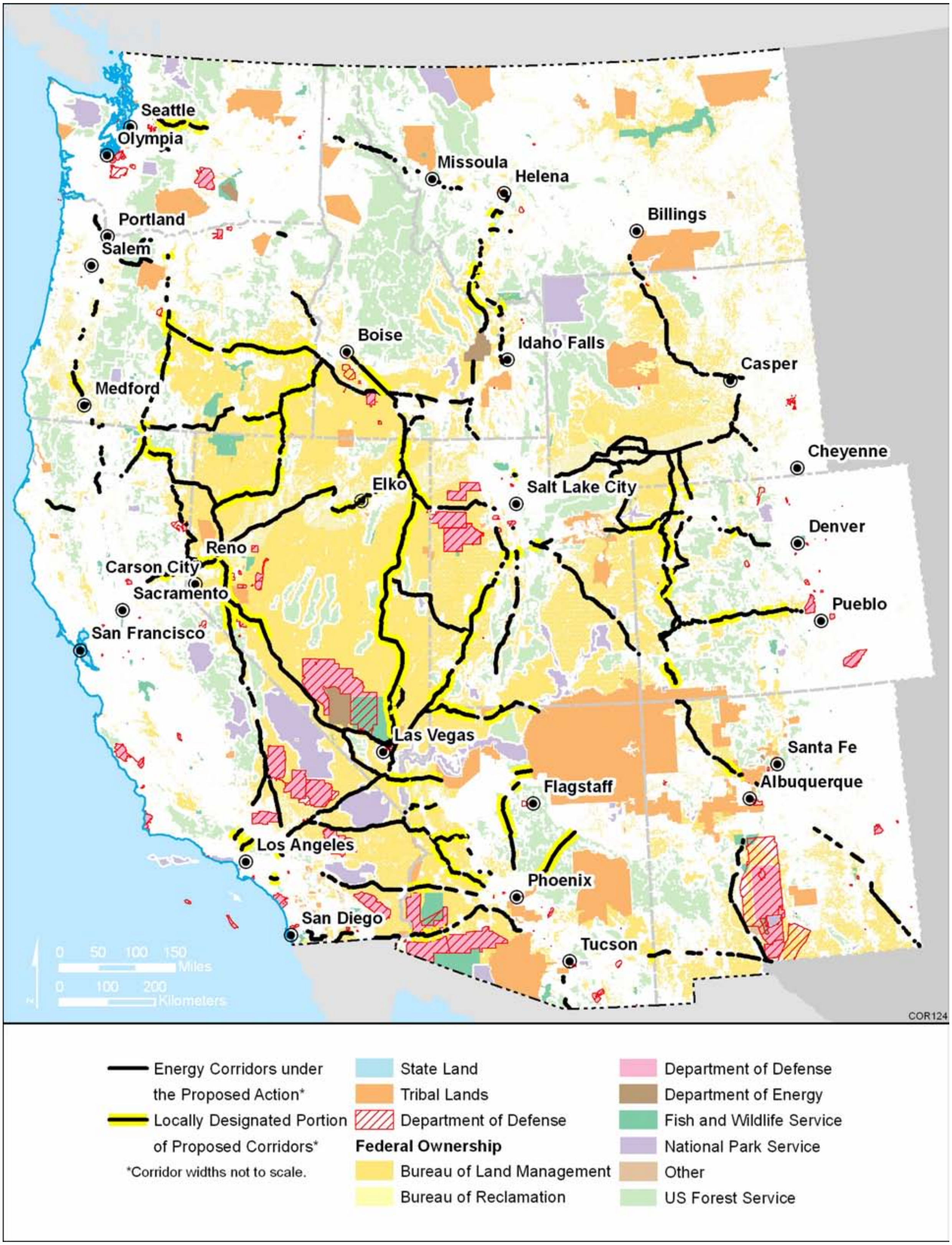


FIGURE 2.2-2 Locally Designated Energy Corridors Incorporated into the Proposed Section 368 Energy Corridors

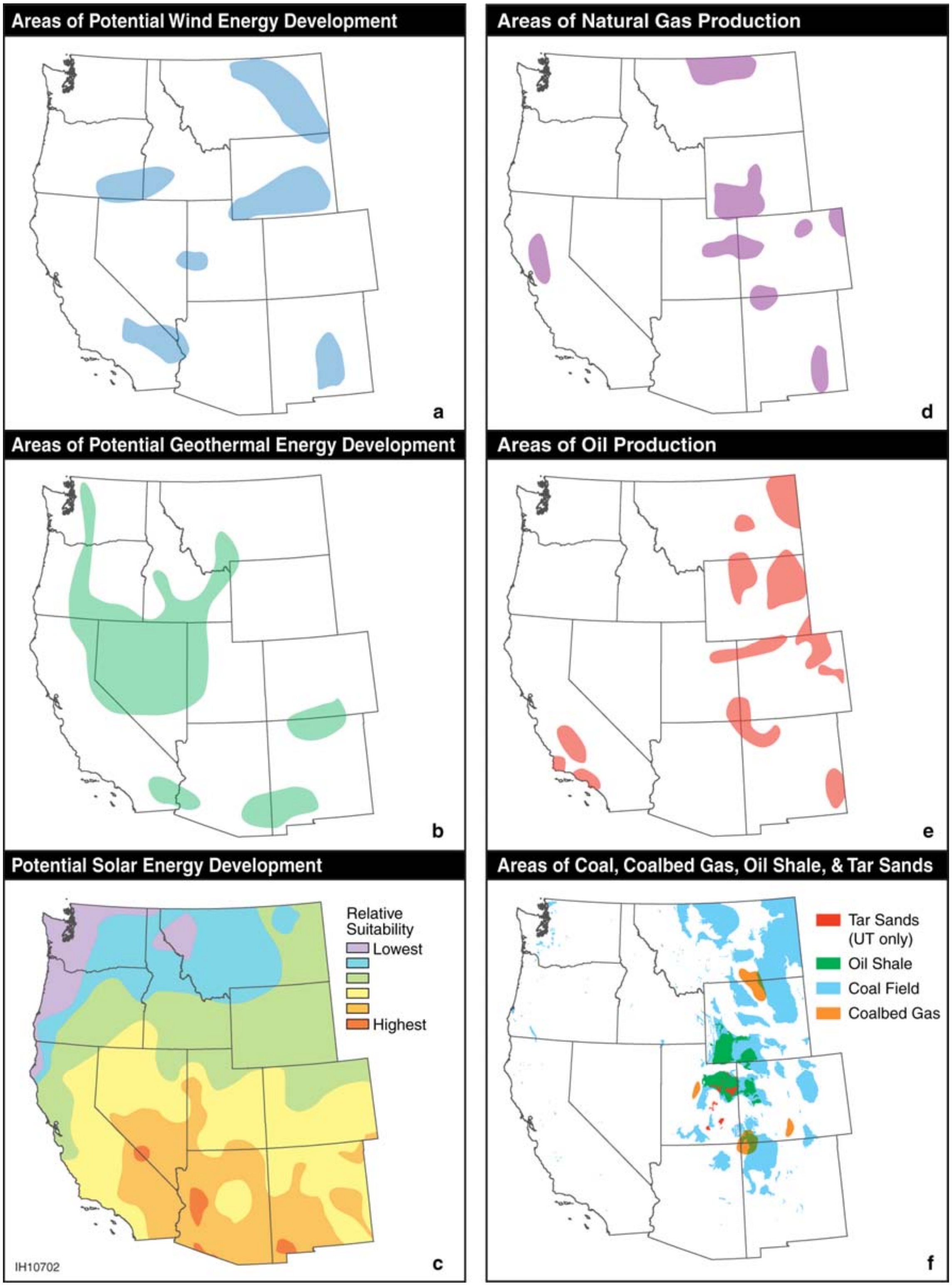


FIGURE 2.2-4 Areas of Potential (a) Wind Energy, (b) Geothermal Energy, and (c) Solar Energy Development; and Areas of (d) Natural Gas Production, (e) Oil Production, and (f) Coal, Coalbed Gas, Oil Shale, and Tar Sands Resources in the 11 Western States (Sources: NREL 2005; USGS 2005)

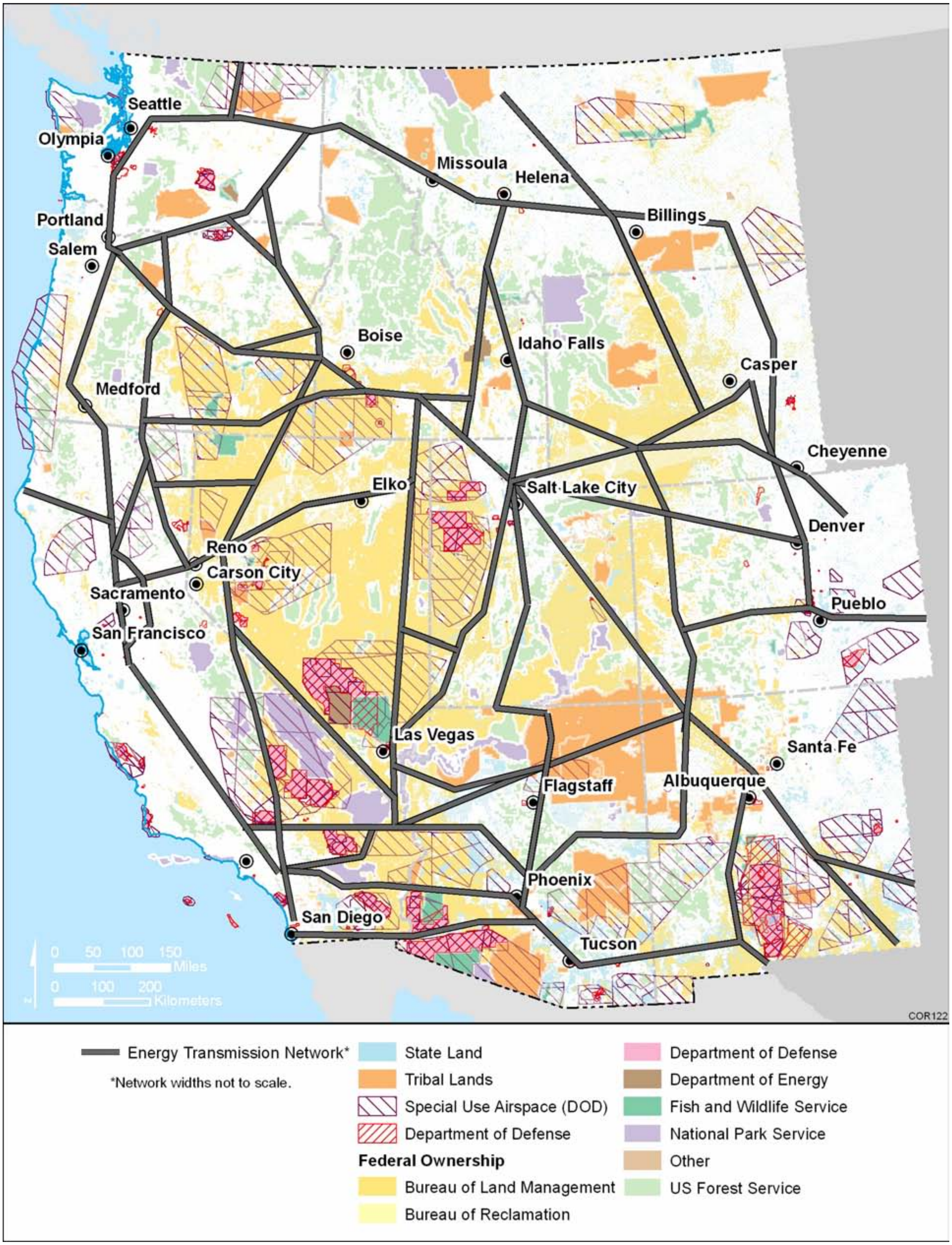


FIGURE 2.2-5 Unrestricted Conceptual West-wide Energy Transport Network Following Step 1 of the Corridor Siting Process

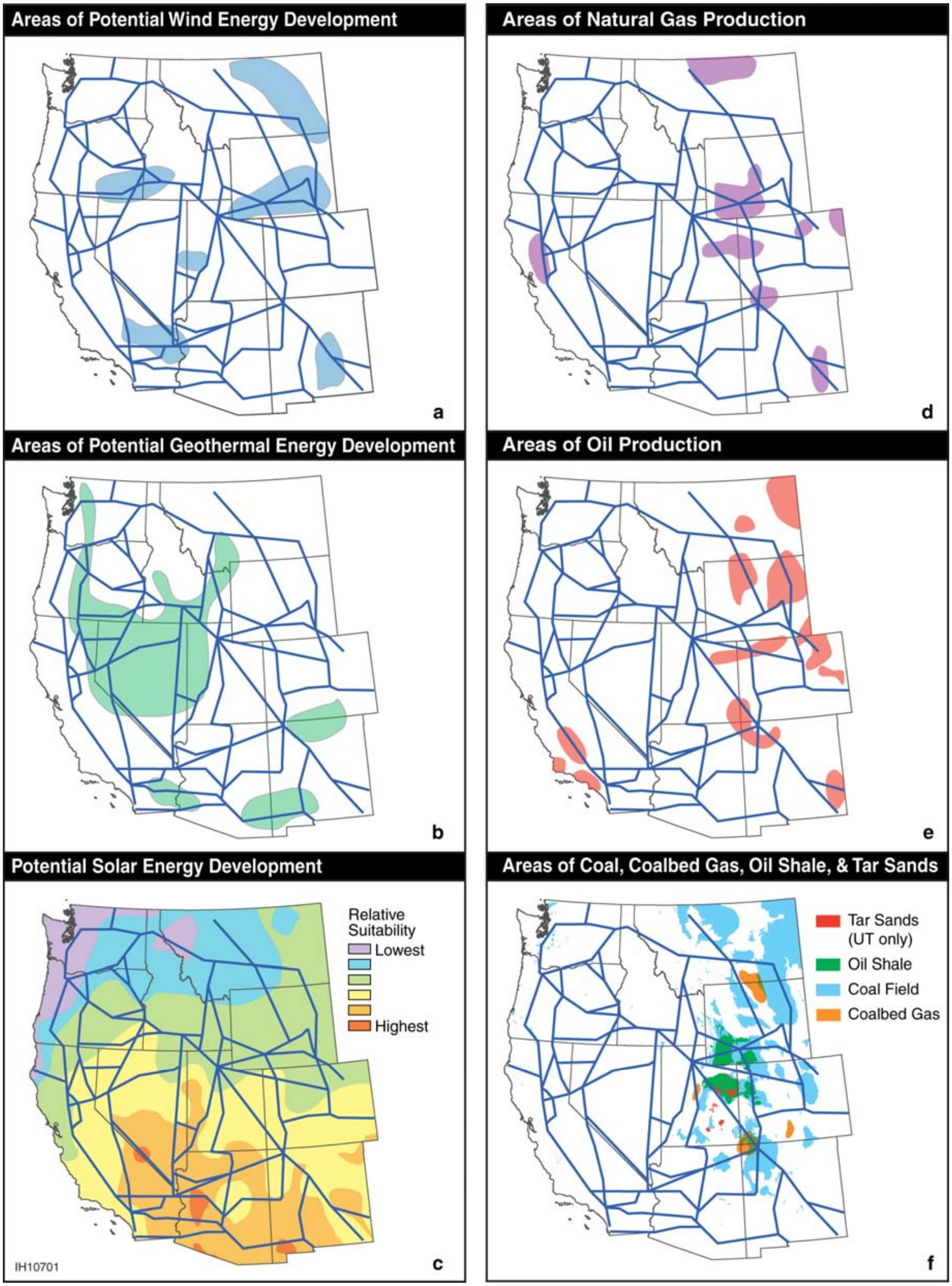


FIGURE 2.2-6 Relationship of the Unrestricted Conceptual West-wide Energy Transport Network and Areas of Current and Potential Future Energy Development

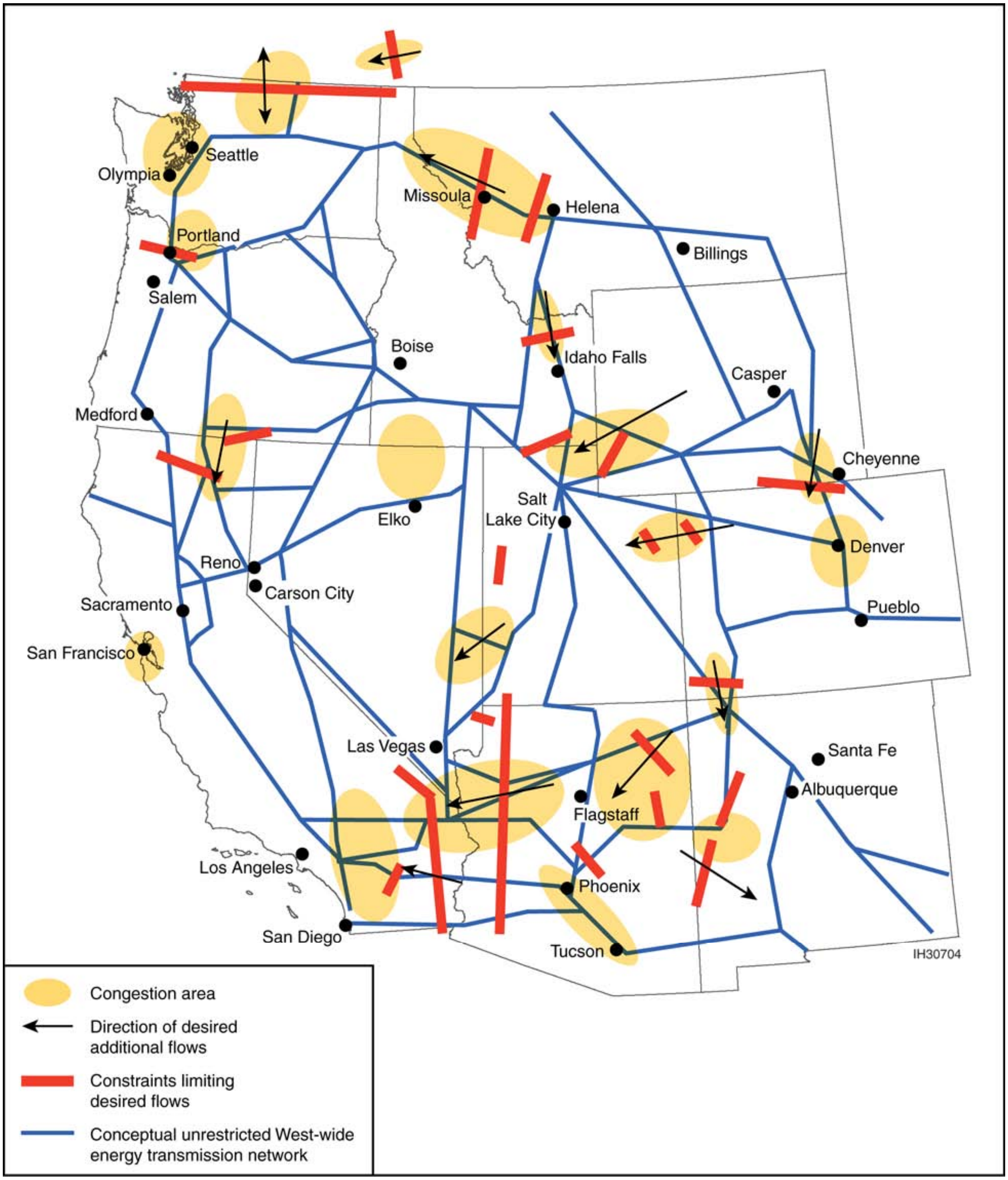


FIGURE 2.2-7 Relationship of the Unrestricted Conceptual Energy Corridor Network with Current and Potential Future Transmission Constraints and Congestion Paths and Areas of Congestion Overlain on the Network

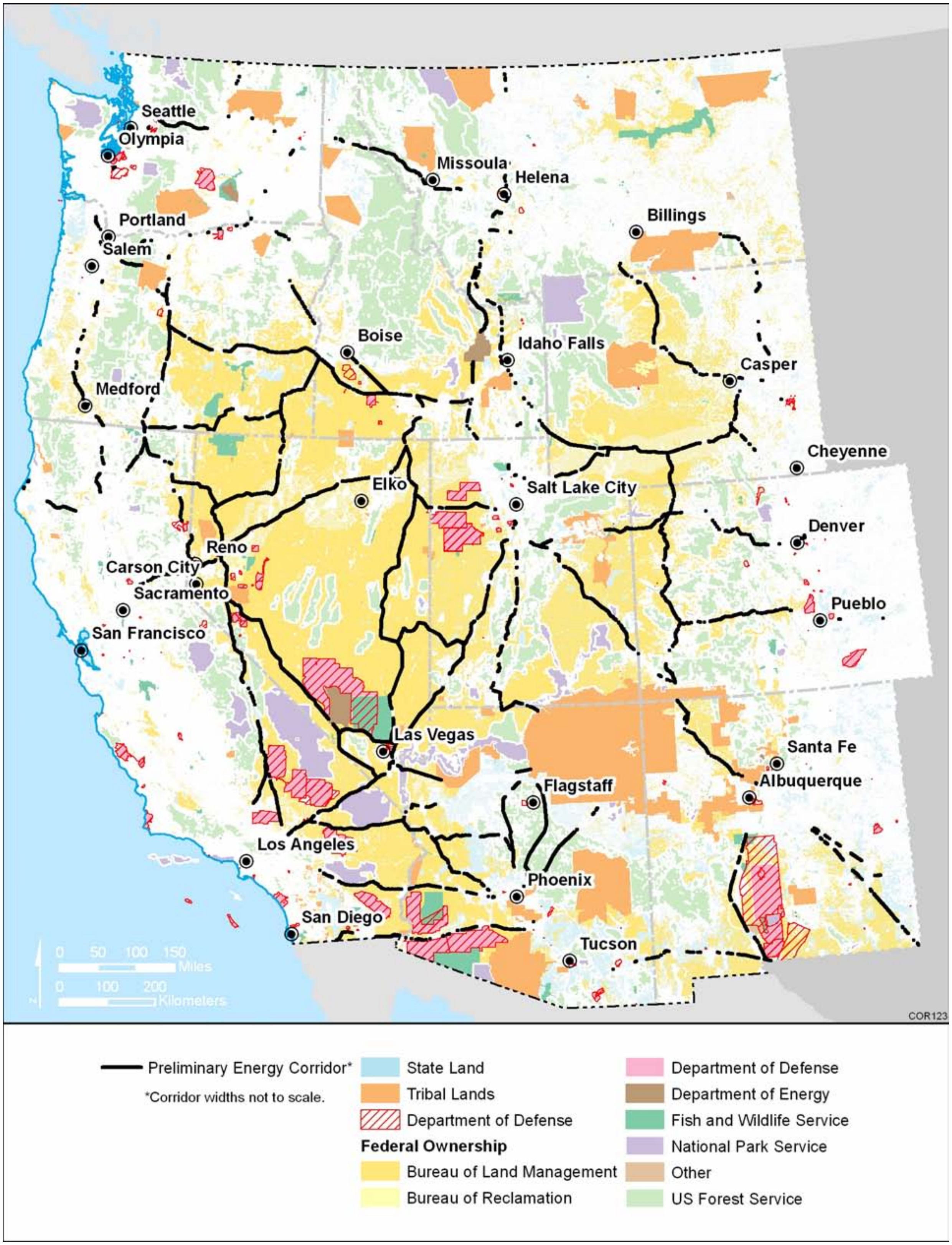


FIGURE 2.2-8 Preliminary Section 368 Energy Corridors on Federal Lands in the 11 Western States Following Step 2 of the Corridor Siting Process

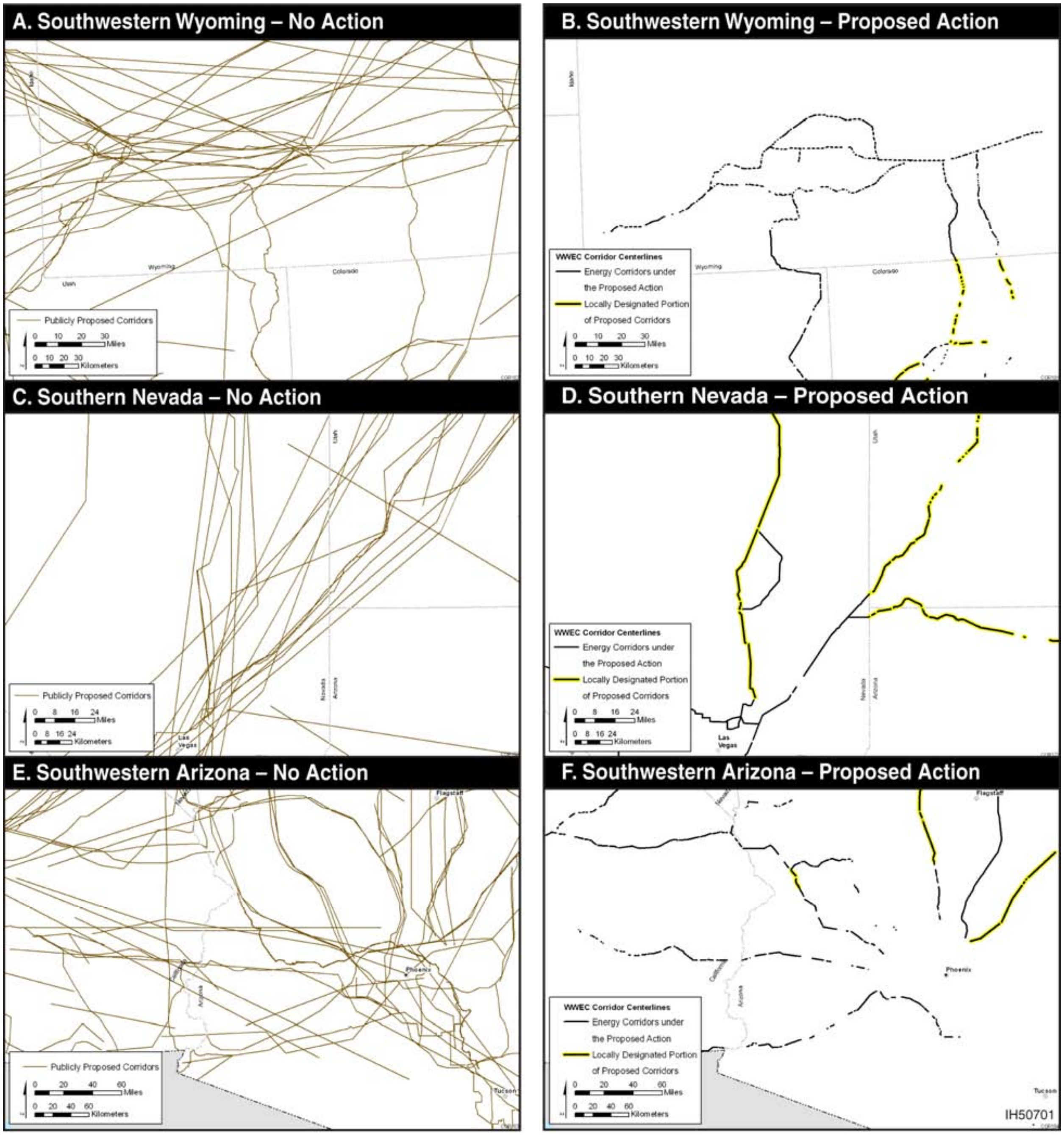


FIGURE 2.6-1 Potential Distribution of Energy Transport Projects in Southwestern Wyoming, Southern Nevada, and Southwestern Arizona under No Action and the Proposed Action

FIGURE 3.10-1 Major Cultural Areas and National Historic Trails in the 11 Western States

FIGURE 3.10-2 Map Showing Relationships between the Proposed Action and the Cultural Areas in the 11 Western States

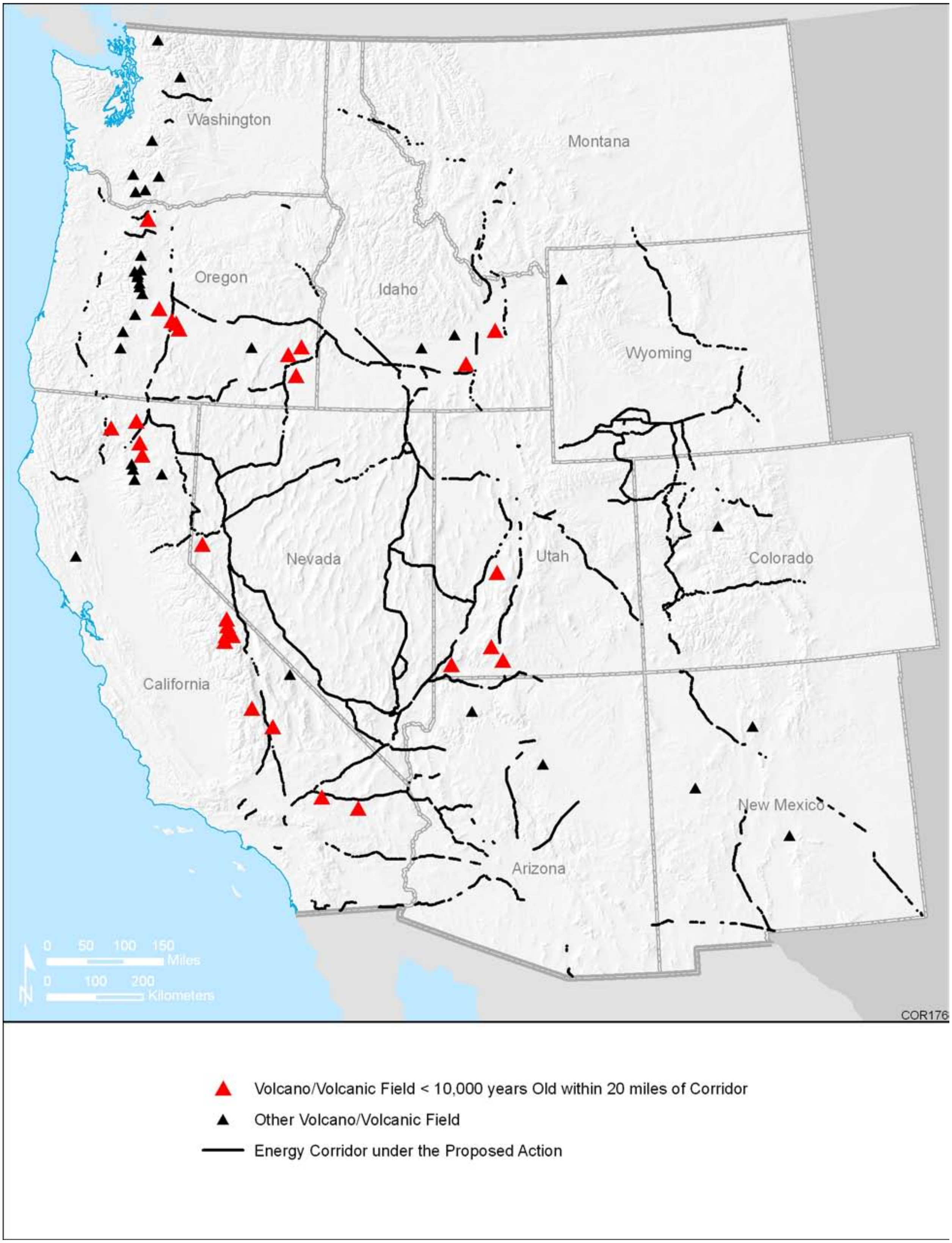


FIGURE 3.14-1 Locations of Active Volcanoes and the Designated Corridors

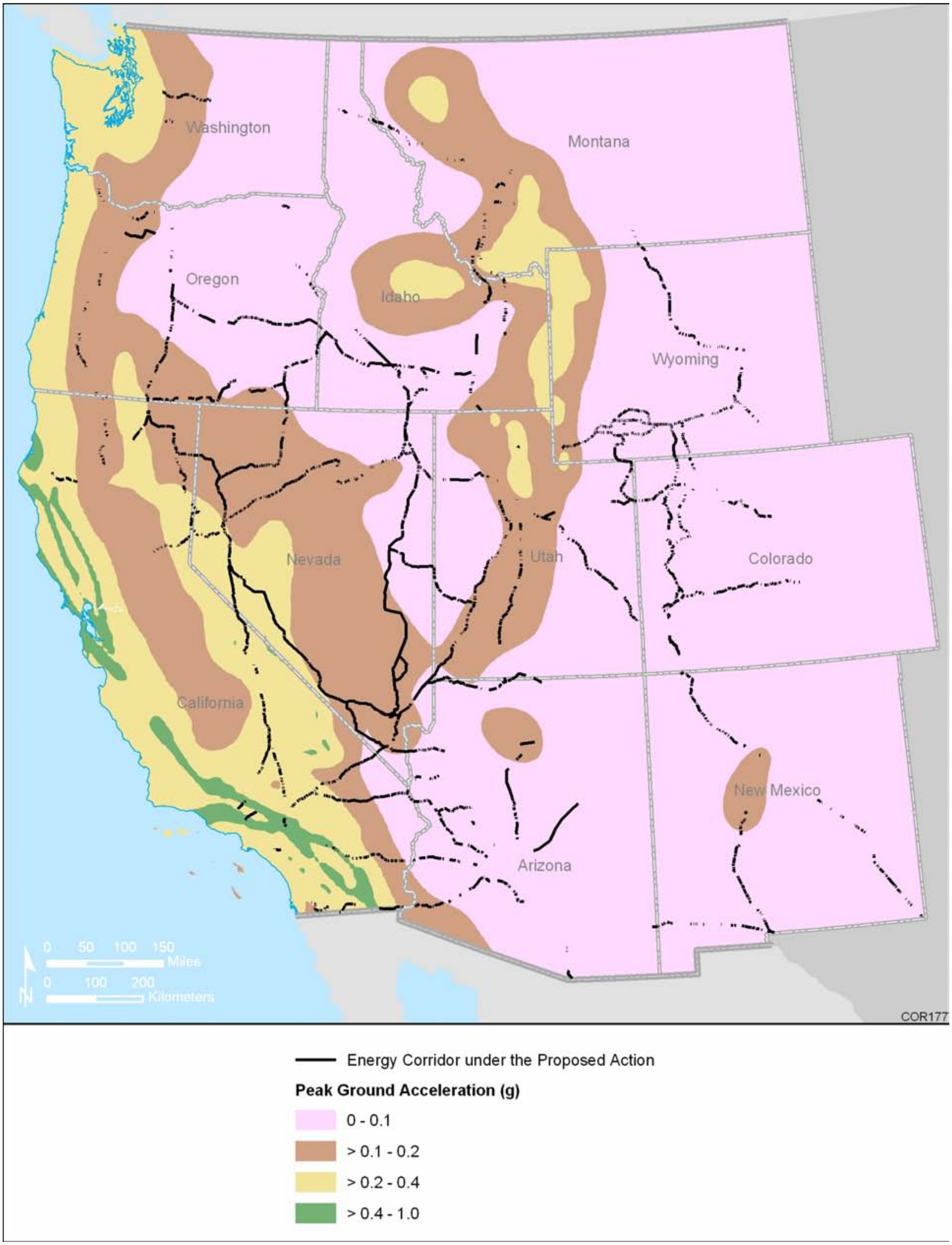


FIGURE 3.14-2 Locations of Various Ground-Shaking Zones with a 10% Probability of Exceedance in 50 Years under the Proposed Action

FIGURE 3.14-3 Liquefaction Hazards in the 11 Western States under the Proposed Action

FIGURE 3.14-4 Surface Ruptures (Faults) Crossed by the Designated Corridors under the Proposed Action

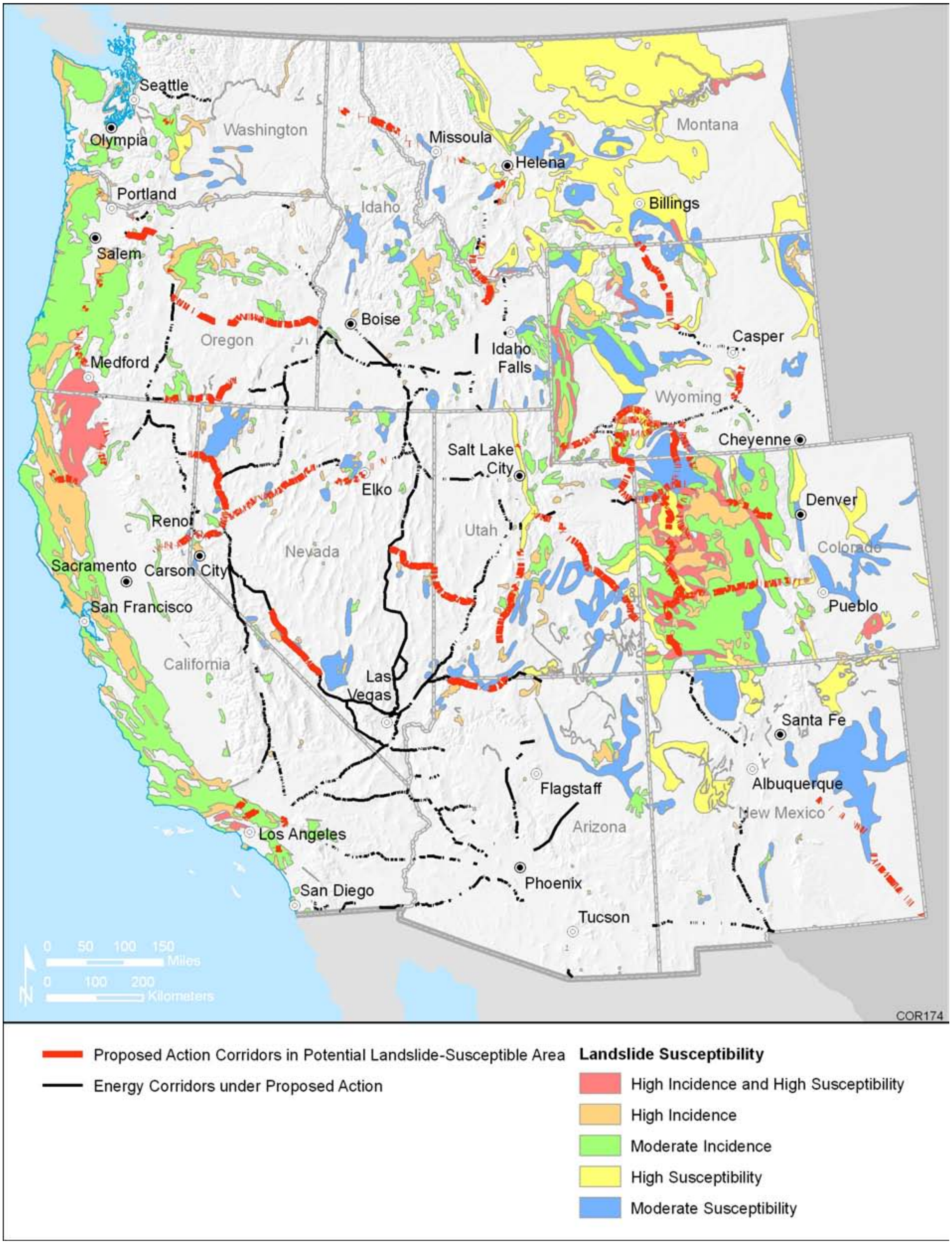


FIGURE 3.14-5 Potential Landslide Areas Crossed by the Designated Corridors under the Proposed Action

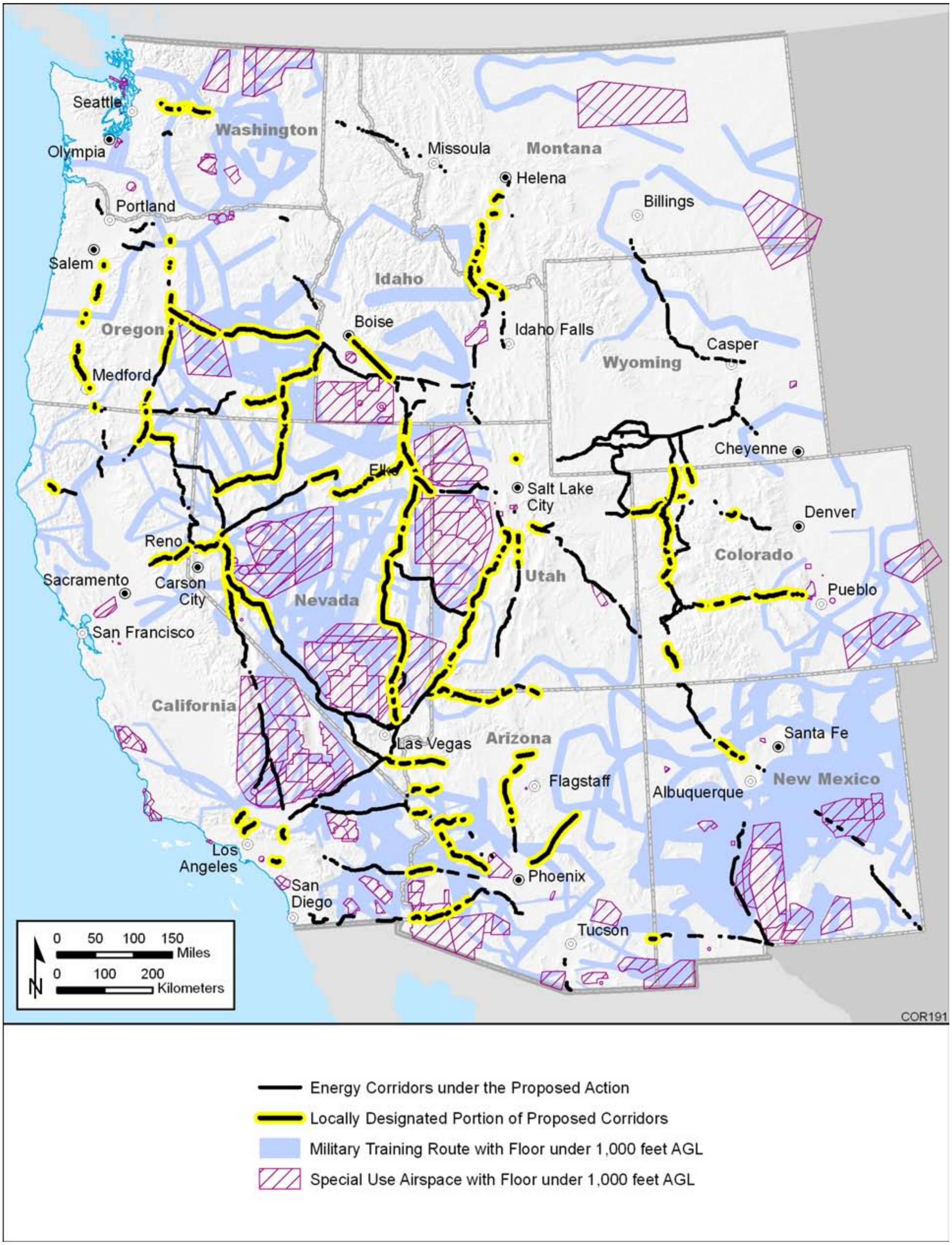


FIGURE 3.2-1 Map Showing Restricted Military Airspace (including MTRs and SUAs) over the 11 Western States

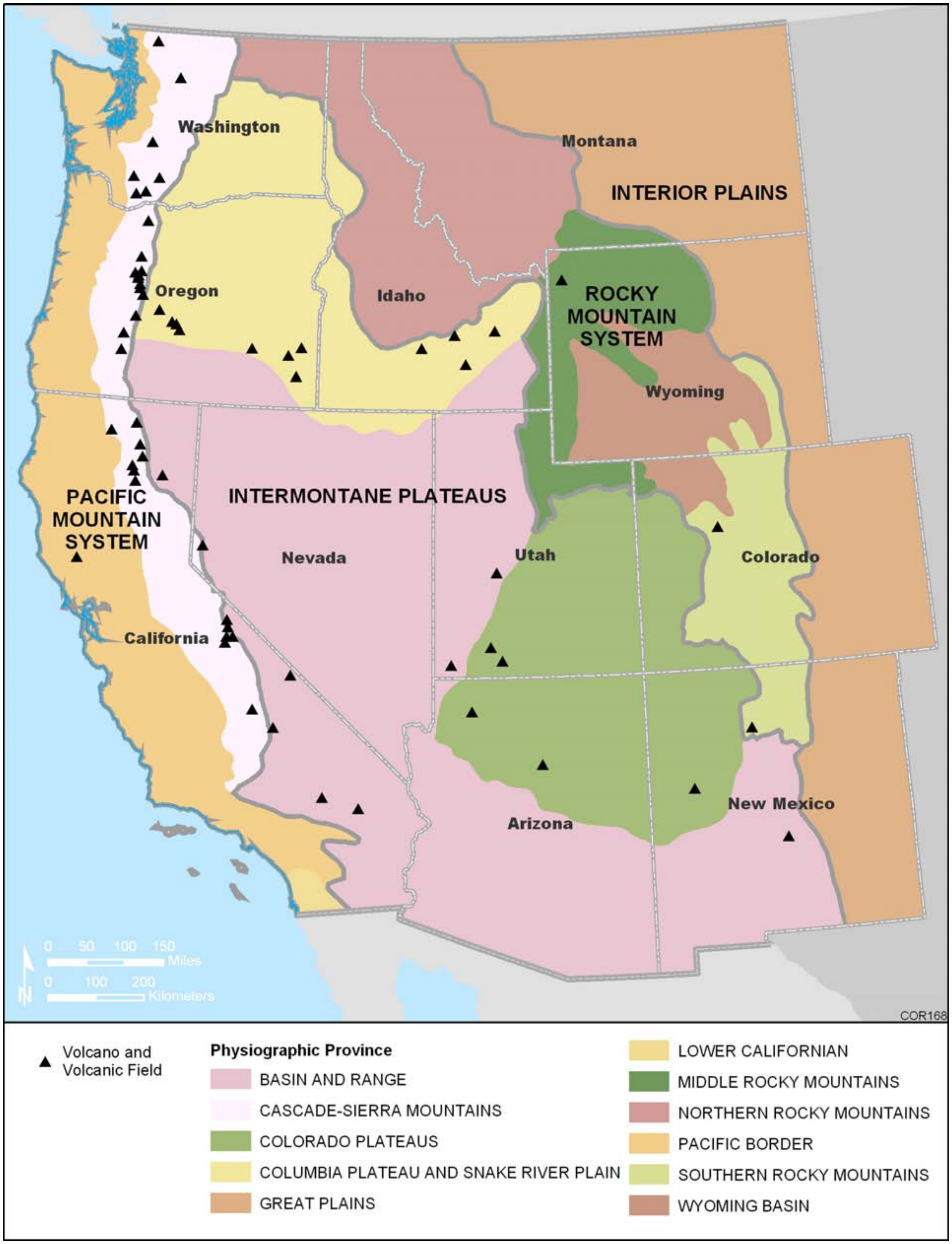


FIGURE 3.3-1 Physiographic Provinces of the 11 Western States (Sources: Modified from Fenneman and Johnson 1946 and National Atlas 2006)

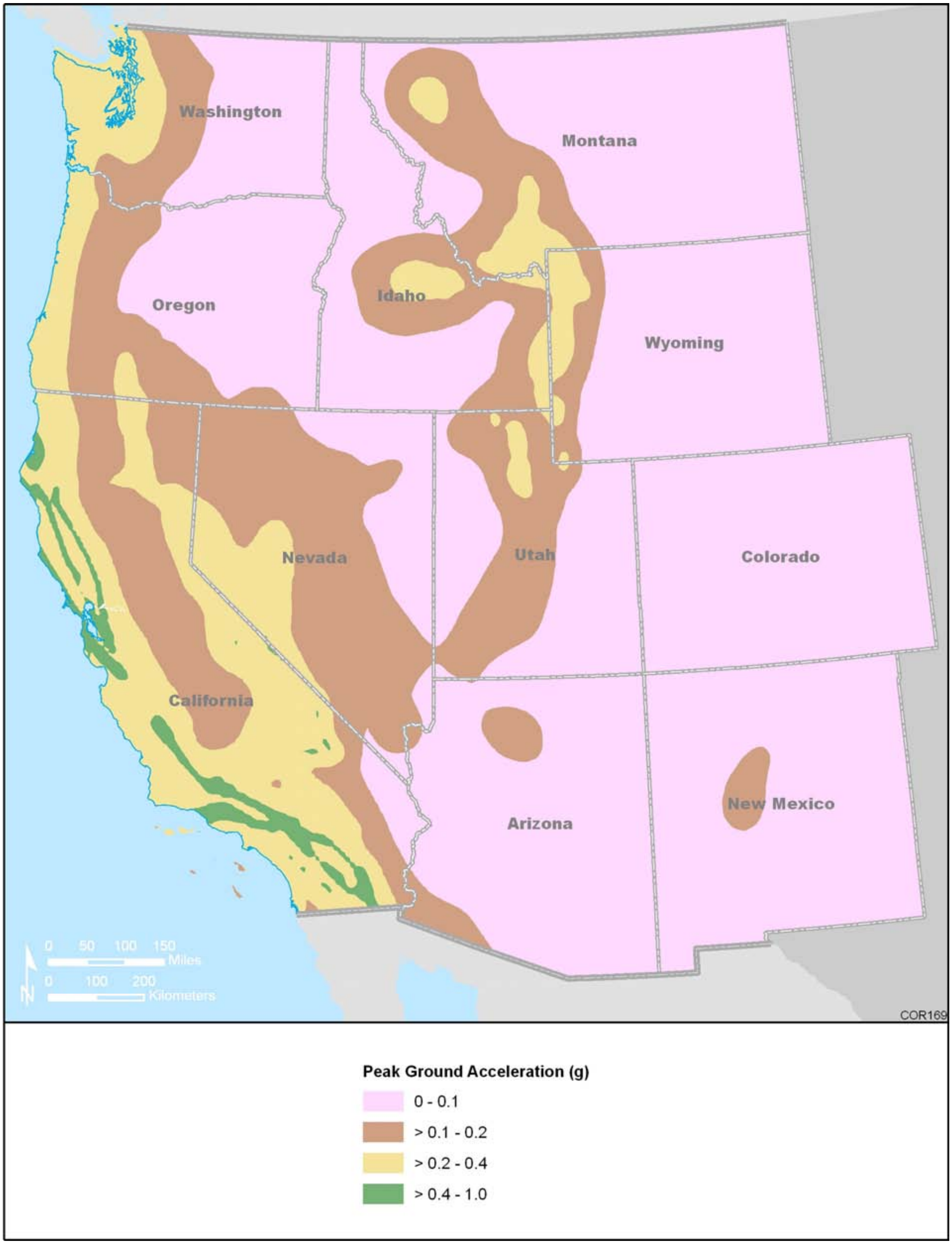


FIGURE 3.3-2 Peak Horizontal Ground Acceleration of the 11 Western States with a 10% Probability of Exceedance in 50 Years (in g) (Source: National Atlas 2006)

FIGURE 3.3-3 Major Areas with Liquefaction Potential in the 11 Western States (Sources: Modified from SCEC 1999 and National Atlas 2006)

FIGURE 3.3-4 Surface Fault Lines in the 11 Western States (Source: National Atlas 2006)

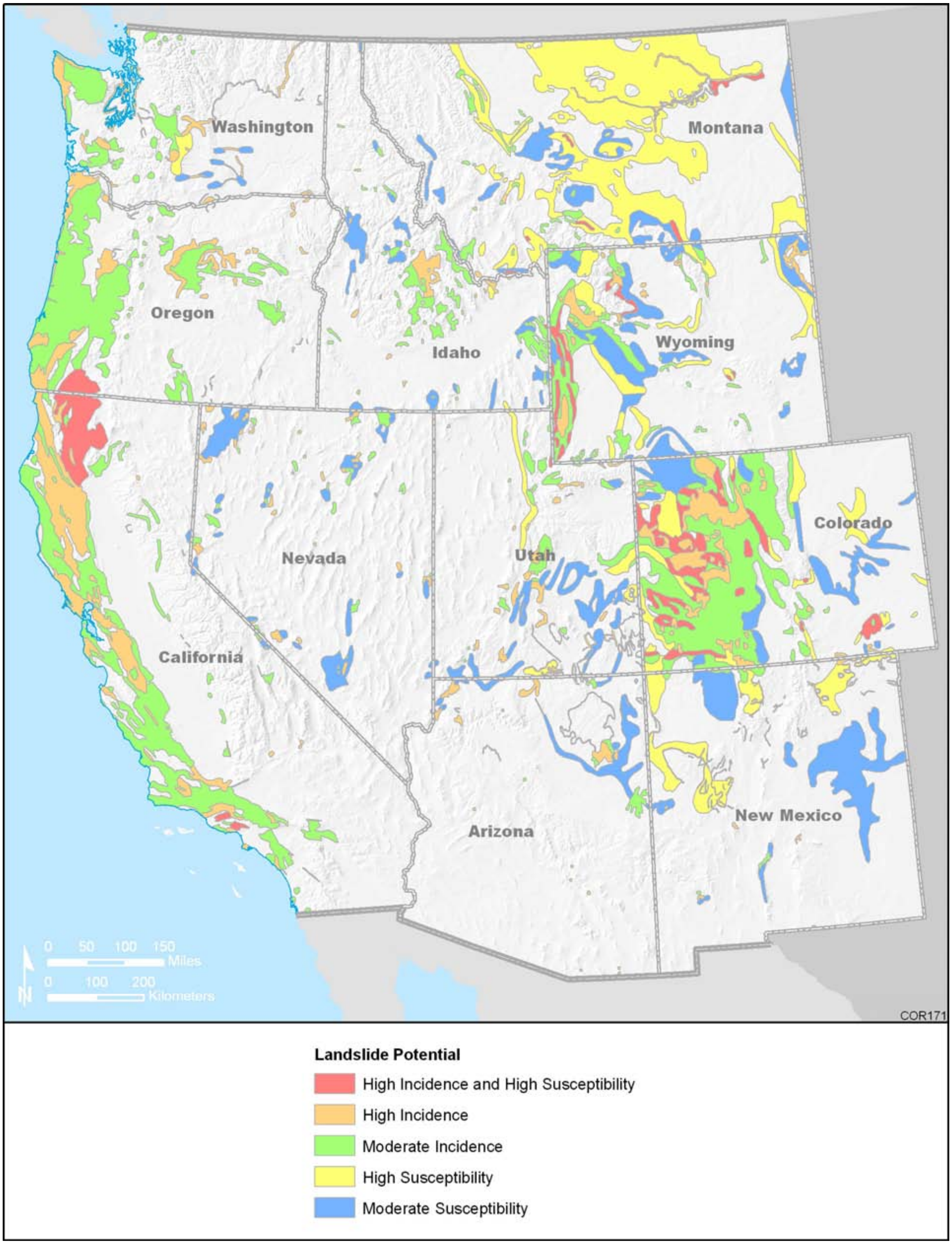


FIGURE 3.3-5 Landslide Hazard Potential Map of the 11 Western States (Source: National Atlas 2006)

FIGURE 3.5-1 Principal Aquifer Systems in the 11 Western States

FIGURE 3.5-2 Hydrologic Regions for the 11 Western States (Source: BLM 2005a)

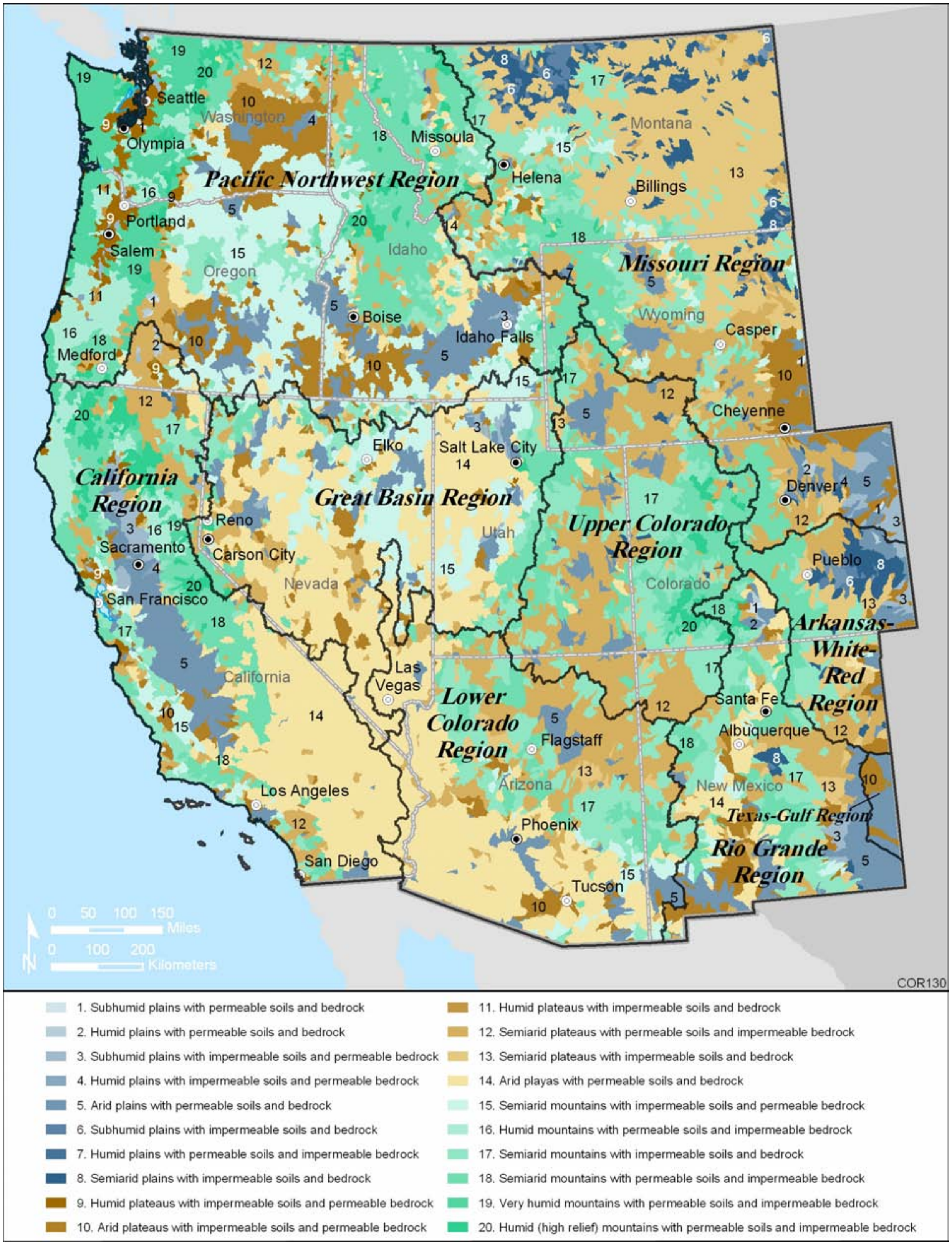


FIGURE 3.5-3 Hydrologic Landscape Regions for the 11 Western States (Sources: BLM 2005a; USGS 2006)

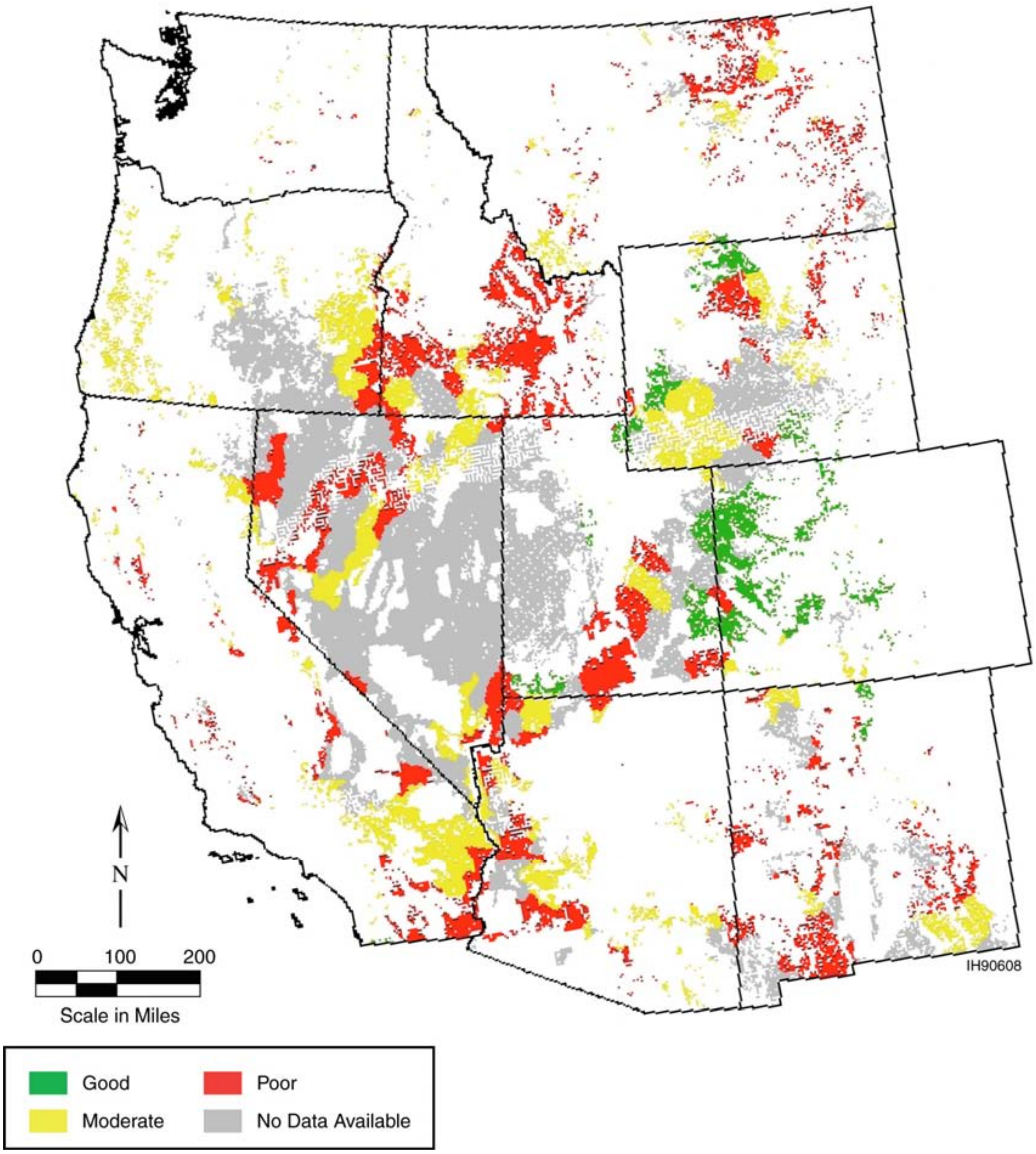


FIGURE 3.5-4 Water Quality on BLM Lands in the 11 Western States (Source: BLM 2005a)

NO.	NAME
1	Big Marsh Creek Wild and Scenic River
2	Big Sur Wild and Scenic River
3	Cache la Poudre Wild and Scenic River
4	Chetco Wild and Scenic River
5	Clackamas Wild and Scenic River
6	Clarks Fork of the Yellowstone Wild and Scenic River
7	Crescent Creek Wild and Scenic River
8	Crooked Wild and Scenic River
9	Deschutes Wild and Scenic River
10	Donner Und Blitzen Wild and Scenic River
11	Eagle Creek Wild and Scenic River
12	East Fork Jemez Wild and Scenic River
13	Eel Wild and Scenic River
14	Elk Wild and Scenic River
15	Elkhorn Creek Wild and Scenic River
16	Flathead Wild and Scenic River
17	Grande Ronde Wild and Scenic River
18	Illinois Wild and Scenic River
19	Imnaha Wild and Scenic River
20	John Day Wild and Scenic River
21	Joseph Creek Wild and Scenic River
22	Kern Wild and Scenic River
23	Kings Wild and Scenic River
24	Klamath Wild and Scenic River
25	Klickitat Wild and Scenic River
26	Little Deschutes Wild and Scenic River
27	Lostine Wild and Scenic River
28	Lower American Wild and Scenic River
29	Malheur Wild and Scenic River
30	McKenzie Wild and Scenic River
31	Merced Wild and Scenic River
32	Metolius Wild and Scenic River
33	Middle Fork Clearwater Wild and Scenic River
34	Middle Fork Feather Wild and Scenic River
35	Middle Fork Salmon Wild and Scenic River
36	Minam Wild and Scenic River
37	Missouri Wild and Scenic River
38	North Fork American Wild and Scenic River
39	North Fork Crooked Wild and Scenic River
40	North Fork John Day Wild and Scenic River
41	North Fork Malheur Wild and Scenic River
42	North Fork Owyhee Wild and Scenic River
43	North Fork Sprague Wild and Scenic River
44	North Fork of Middle Fork Willamette Wild and Scenic River
45	North Powder Wild and Scenic River
46	North Umpqua Wild and Scenic River
47	Owyhee Wild and Scenic River
48	Pecos Wild and Scenic River
49	Powder Wild and Scenic River
50	Quartzville Creek Wild and Scenic River
51	Rapid Wild and Scenic River
52	Rio Chama Wild and Scenic River
53	Rio Grande Wild and Scenic River
54	Roaring Wild and Scenic River
55	Rogue Wild and Scenic River
56	Saint Joe Wild and Scenic River
57	Salmon Wild and Scenic River
58	Sandy Wild and Scenic River
59	Sespe Creek Wild and Scenic River
60	Sisquoc Wild and Scenic River
61	Skagit Wild and Scenic River
62	Smith Wild and Scenic River
63	Snake Wild and Scenic River
64	South Fork John Day Wild and Scenic River
65	Squaw Creek Wild and Scenic River
66	Sycan Wild and Scenic River
67	Trinity Wild and Scenic River
68	Tuolumne Wild and Scenic River
69	Upper Rogue River Wild and Scenic River
70	Verde Wild and Scenic River
71	Wallowa Wild and Scenic River
72	Wenaha Wild and Scenic River
73	West Little Owyhee Wild and Scenic River
74	White Salmon Wild and Scenic River
75	White Wild and Scenic River

FIGURE 3.5-5 Wild and Scenic River Segments in the 11 Western States

FIGURE 3.5-7 Wild and Scenic River Segments Intercepted by the Proposed Energy Corridors

FIGURE 3.6-2 PM_{10} Nonattainment Areas in the 11 Western States

FIGURE 3.6-3 $PM_{2.5}$ Nonattainment Areas in the 11 Western States

FIGURE 3.6-4 8-hour Ozone Nonattainment Areas in the 11 Western States

FIGURE 3.6-5 Sulfur Dioxide (SO_2) Nonattainment Areas in the 11 Western States

FIGURE 3.6-6 Carbon Monoxide (CO) Nonattainment Areas in the 11 Western States

FIGURE 3.6-7 PSD Class I Areas in the 11 Western States

FIGURE 3.8-1 Level III Ecoregions in the 11 Western States (Source: EPA 2006b)

FIGURE 3.8-3 Energy Corridors and Level III Ecoregions