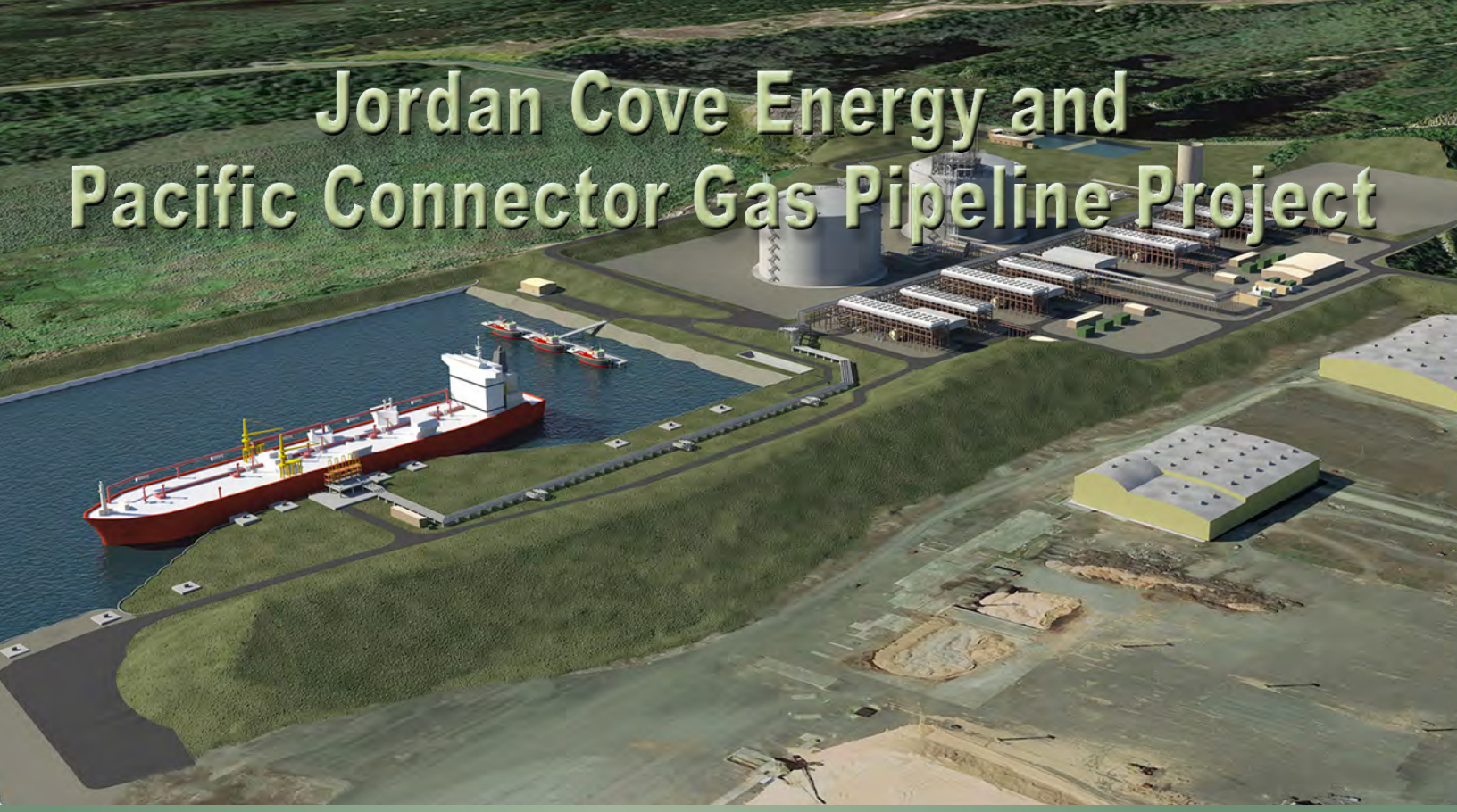
Jordan Cove Energy and Pacific Connector Gas Pipeline Project



Final Environmental Impact Statement

Jordan Cove Energy Project, L.P.
Docket No. CP13-483-000

Pacific Connector Gas Pipeline, L.P.
Docket No. CP13-492-000

DOE Docket No. FE 12-32-LNG ■ DOE/EIS-0489

FERC/EIS 0256F
September 2015

Cooperating Agencies
USDA Forest Service, Pacific Northwest Region
Department of the Army, Corps of Engineers, Portland District
US Department of Energy
US Environmental Protection Agency, Region 10
US Department of Homeland Security Coast Guard, Portland
US Department of Transportation, Pipeline and Hazardous Materials Safety Administration
US Department of the Interior Bureau of Land Management, Oregon State Office
US Department of the Interior Bureau of Reclamation, Klamath Basin Area Office
US Department of the Interior Fish and Wildlife Service, Oregon State Office

Federal Energy Regulatory Commission
Office of Energy Projects
Washington, DC 20426

Final Environmental Impact Statement

JORDAN COVE ENERGY AND PACIFIC CONNECTOR GAS PIPELINE PROJECT

Jordan Cove Energy Project, L.P.	Docket Nos.	CP13-483-000
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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas 3
Jordan Cove Energy Project, L.P.
Docket No. CP13-483-000
Pacific Connector Gas Pipeline, L.P.
Docket No. CP13-492-000
FERC/EIS-0256D

TO THE PARTY ADDRESSED:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared this final environmental impact statement (EIS) for the Jordan Cove Liquefaction Project proposed by Jordan Cove Energy Project LP (Jordan Cove) and the Pacific Connector Pipeline Project proposed by Pacific Connector Gas Pipeline LP (Pacific Connector) (collectively referred to as the JCE & PCGP Project, or the Project) in the above-referenced dockets. Under Section 3 of the Natural Gas Act (NGA), Jordan Cove requests authorization to produce a maximum of 6.8 million metric tons per annum of liquefied natural gas (LNG) at a terminal in Coos Bay, Oregon for export to overseas markets. Pacific Connector seeks a Certificate of Public Convenience and Necessity under Section 7 of the NGA to transport about 1.07 billion cubic feet per day of natural gas in a pipeline from the Malin hub to the Jordan Cove terminal, crossing portions of Klamath, Jackson, Douglas, and Coos Counties, Oregon.

The final EIS assesses the potential environmental effects of the construction and operation of the Project in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the Project would result in some limited adverse environmental impacts. However, if the Project is constructed and operated in accordance with applicable laws and regulations, with implementation of Jordan Cove's and Pacific Connector's proposed mitigation measures, and the additional mitigation measures recommended by the FERC staff and federal land managing agencies in this EIS, environmental impacts would be reduced to less-than-significant levels.

The United States (U.S.) Department of Agriculture Forest Service (Forest Service); U.S. Army Corps of Engineers; U.S. Department of Energy; U.S. Environmental Protection Agency; U.S. Department of Homeland Security Coast Guard; U.S. Department of the Interior Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), and Fish and Wildlife Service; and the Pipeline and Hazardous Materials Safety Administration within the U.S. Department of Transportation participated as cooperating agencies in preparation of this EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposal and participate in the NEPA analysis.

The BLM, with the concurrence of the Forest Service and Reclamation, would adopt and use the EIS to consider issuing a Right-of-Way Grant for the portion of the Project on federal lands. Both the BLM and the Forest Service would also use this EIS to evaluate proposed amendments to their District or National Forest land management plans to make provision for the Pacific Connector pipeline. Other cooperating agencies would use this EIS in their regulatory

process, and to satisfy compliance with the NEPA and other related federal environmental laws (including the National Historic Preservation Act). Although the cooperating agencies provided input to the conclusions and recommendations presented in the EIS, the agencies would present their own conclusions and recommendations in their respective Records of Decision for the Project.

Jordan Cove's proposed facilities would include an access channel from the existing Coos Bay navigation channel; a terminal marine slip including a single LNG vessel berth and tug boat berth; a loading platform and transfer pipeline; two LNG storage tanks; four liquefaction trains and associated refrigerant storage bullets; fire water ponds; ground flares; 420-megawatt South Dune Power Plant; support buildings; utility and access corridor between the terminal and the power plant; Southwest Oregon Resource Security Center; and a natural gas treatment plant.

Pacific Connector's proposed facilities would include a 232-mile-long, 36-inch-diameter underground welded steel pipeline between Malin and Coos Bay; the 41,000 horsepower Klamath Compressor Station; the Klamath-Eagle Receipt Meter Station and Klamath-Beaver Receipt Meter Station within the compressor station tract; the Clarks Branch Delivery Meter Station at the interconnection with Northwest Pipeline's Grants Pass Lateral; the Jordan Cover Delivery Meter Station at the interconnection with the Jordan Cove LNG terminal; 5 pig[1] launchers and receivers; 17 mainline block valves; and 11 communication towers co-located with other facilities.

The FERC mailed copies of the final EIS to federal, state, and local government representatives and agencies; elected officials; regional environmental and non-governmental organizations; Indian tribes; affected landowners; newspapers and libraries in the project area; other interested individuals and groups; and parties to the proceedings. Paper copies of this EIS were mailed to those specifically requesting them; all others on our environmental mail list received a compact disk version. In addition, the final EIS is available for public viewing on the FERC's website (www.ferc.gov) using the eLibrary link. A limited number of hard copies are available for distribution and public inspection at:

Federal Energy Regulatory Commission
Public Reference Room
888 First Street NE, Room 2A
Washington, DC 20426
(202) 502-8371

Additional information about the Project is available from the Commission's Office of External Affairs, at **(866) 208-FERC,** or on the FERC (www.ferc.gov) using the eLibrary link. Click on the eLibrary link, click on "General Search," and enter the docket number excluding the last three digits in the Docket Number field (i.e., CP13-483). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnline

[1] A "pig" is a tool for cleaning and inspecting the inside of a pipeline.

Support@ferc.gov or toll free at (866) 208-3676; for TTY, contact (202) 502-8659. The eLibrary link also provides access to the texts of formal documents issued by the Commission, such as orders, notices, and rulemakings.

In addition, the Commission offers a free service called eSubscription that allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to www.ferc.gov/docs-filing/esubscription.asp.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
AADT	average annual daily traffic
AAQS	ambient air quality standards
AASHTO	American Association of State Highway Transportation Officials
ACDP	air contaminant discharge permit
ACEC	Area of Critical Environmental Concern
ACFM	actual cubic feet per minute
ACHP	Advisory Council on Historic Preservation
ACS	Aquatic Conservation Strategy
AEGL	Acute Exposure Guideline Level
AGPA	Alaska Gasline Port Authority
AIA	annual instrument approach
AIRFA	American Indian Religious Freedom Act
AIS	Automatic Information System
AMSL	above mean sea level
ANFO	Ammonium Nitrate and Fuel Oil
ANS	aquatic nuisance species
ANSI	American National Standards Institute
AOC	area of concern
APDBA	applicant prepared draft biological assessment
APE	area of potential effect
API	American Petroleum Institute
Applicants	Jordan Cove Energy and Pacific Connector
AQCR	Air Quality Control Region
AQRV	Air Quality-Related Values
AR2	Second Assessment Report (IPCC)
AR4	Fourth Assessment Report (IPCC)
AR5	Fifth Assessment Report (IPCC)
ASCE	American Society of Civil Engineers
ASL	above sea level
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATON	aids to navigation
ATV	all-terrain vehicle
Avista	Avista Corporation
BA	biological assessment
BACT	Best Available Control Technology
BBS	Breeding Bird Survey
BC	British Columbia
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BE	Biological Evaluation
BFM	bonded fiber mix
bgs	below ground surface
BIA	U.S. Bureau of Indian Affairs

BLEVE	boiling-liquid-expanding-vapor explosion
BLM	U.S. Department of the Interior Bureau of Land Management
BMP	best management practice
BO	biological opinion
BOEM	Bureau of Ocean Energy Management
BOG	boil-off gas
BPA	Bonneville Power Administration
BRAR13	2013 Blue Ridge Alternative Route
Bscf	billion standard cubic feet
Bscf/d	billion standard cubic feet per day
BST	Baker-Strehlow-Tang
Btu	British thermal units
Btu/ft-hr-°F	British thermal units per foot per hour per degrees Fahrenheit
Btu/ft^2-hr	British thermal units per square foot per hour
Btu/lb-°F	British thermal units per pound per degrees Fahrenheit
Btu/kWh	British thermal units per kilowatt hour
BVA	block valve
BWT	ballast water treatment
BWE	ballast water exchange
Byram	Byram Archaeological Consulting LLC
C-2	C-2 Cattle Company
CAA	Clean Air Act
CadnaA	computer aided noise abatement
CAL	Citizens Against LNG
CBC	Christmas Bird Count
CBEMP	Coos Bay Estuary Management Plan
CBNBWB	Coos Bay-North Bend Water Board
CBRL	Coos Bay Rail Link
CCS	carbon capture and storage
CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
CFD	computational fluid dynamics
CFR	Code of Federal Regulations
CH_4	methane
CHE	Coast and Harbor Engineering
CHU	critical habitat unit
CMP	Compensatory Mitigation Plan
CMZ	Channel Migration Zone
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
Coast Guard	U.S. Department of Homeland Security Coast Guard
COC	Corridor of Concern
COE	U.S. Army Corps of Engineers
COI	Certificate of Inspection
Commission	Federal Energy Regulatory Commission
Coos Tribes	Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians
COTP	Captain of the Port
Cow Creek Tribe	Cow Creek Band of Umpqua Tribe of Indians
CP	cathodic protection

CPR	cardio-pulmonary resuscitation
CRITFC	Columbia River Inter-Tribal Fish Commission
CSZ	Cascadia Subduction Zone
CTG	combustion turbine generators
CWA	Clean Water Act
CWD	coarse wood
cy	cubic yard
CZMA	Coastal Zone Management Act
DA	Development Aquatic
dB	decibel
dBA	A-weighted decibels
dBC	C-weight decibels
dbh	diameter at breast height
dB RMS	decibels root mean squared
DBV/PERC	double ball valve and powered emergency release coupling
DC	direct current
DCS	distributed control system
DE	Design Earthquake
DEA	David Evans & Associates, Inc.
DEGADIS	dense gas dispersion model
DEIS	draft environmental impact statement
Discovery Plan	*Plan and Procedures Addressing Unanticipated Discoveries of Cultural Resources and Human Remains*
DMEF	Dredged Material Evaluation Framework
DMMU	Dredged Material Management Unit
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOGAMI	Oregon Department of Geology and Mineral Industries
DOT	U.S. Department of Transportation
DP	Direct Pipe
DPS	Distinct Population Segments
DTR	daily timing restriction
DWSA	drinking water source area
ECA	Emissions Control Area
ECRP	Pacific Connector's Erosion Control and Revegetation Plan
ECSI	Environmental Cleanup Site Information
EEZ	economic exclusion zone
EFH	essential fish habitat
EFSC	Oregon Energy Facility Siting Council
EFU	Exclusive Farm Use
EI	environmental inspector
EIA	Energy Information Administration
EIS	environmental impact statement
EMD	electric motor driven
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPCM	Engineering, Procurement, and Construction Management
ERP	emergency response plan
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act

ESCP	Erosion and Sedimentation Control Plan
ESD	emergency shutdown
ESU	Evolutionarily Significant Units
EWMP	Estuarine Wetland/Open Water Mitigation Plan
F	Forest
FAA	Federal Aviation Administration
FDS	Fire Dynamics Simulator
FEED	front-end engineering design
FEIS	final environmental impact statement
FEMAT	Forest Ecosystem Management Assessment Team
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FLPMA	Federal Land and Policy Management Act of 1976
FMSC	Federal Maritime Security Council
FOI	Forest Operations Inventory
Forest Service	U.S. Department of Agriculture Forest Service
fps	foot per second
FR	Federal Register
FSH	Forest Service Handbook
FSM	Forest Service Manual
ft^3	cubic feet
FTA	free trade agreement
FTE	full-time equivalent
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Department of the Interior Fish and Wildlife Service
FY	Fiscal Year
GAO	Government Accountability Office
g/hp-hr	grams per horsepower per hour
GDP	Gross Domestic Product
GHG	greenhouse gas
GIS	geographic information system
GNN	Gradient Nearest Neighbor
gpm	gallons per minute
GPS	global positioning system
Grand Ronde Tribes	Confederated Tribes of the Grand Ronde Reservation
GRI	GRI Geotechnical and Environmental Consultants
GTN	Gas Transmission Northwest Corporation
GTP	Global Temperature change Potential
GWP	global warming potential
H	horizontal
H_2S	hydrogen sulfide
HAP	Hazardous Air Pollutant
HAZOP	hazard and operability review
HBC	Hudson Bay Company
HCA	High Consequence Area
HDD	horizontal directional drill
HEC-RAS	Hydrologic Engineering Center-River Analysis System
HMU	Herd Management Unit
HOA	Head of Agreement
hp	horsepower
HPMP	Historic Properties Management Plan

HPS	high pressure sodium
HRA	Historical Research Associates, Inc.
HRSG	heat recovery steam generator
HU	hydrologic unit
HUC	Hydrologic Unit Code
Hz	hertz
I-5	Interstate 5
IBC	International Building Code
IHA	Incidental Harassment Authorization
IMO	International Maritime Organization
IOP	Interagency Operating Procedure
IPCC	Intergovernmental Panel on Climate Change
IRA	Inventories Roadless Area
ISA	International Society for Automation
ISO	International Organization for Standardization
ISPS Code	International Ship and Port Facility Security Code
JCE & PCGP	Jordan Cove Energy and Pacific Connector Gas Pipeline Project
Jordan Cove	Jordan Cove Energy Project L.P.
Jordan Cove's Plan	Jordan Cove's Upland Erosion Control, Revegetation, and Maintenance Plan
Jordan Cove's Procedures	Jordan Cove's Wetland and Waterbody Construction and Mitigation Procedures
JPA	Joint Permit Application
KBV	Kiewitt and Black & Veatch
kJ	kilojoules
KO	Knockout
KOAC	Known Owl Activity Center
km	kilometer
KOP	key observation point
kPa	kilopascals
kV	kilovolt
kVa	kilovolt amperes
kW	kilowatt
kWh	kilowatt-hour
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
Latgawa Tribe	Latgawa Native American Indian Tribe
lb/MWh	pound per megawatt-hour
LDC	local distribution company
LEDPA	Least Environmentally Damaging Practicable Alternative
Levy	Lloyd Levy Consulting, LLC
LFL	lower flammable limit
LiDAR	light detection and ranging
LMP	land management plan
LNG	liquefied natural gas
LOI	Letter of Intent
LOR	Letter of Recommendation
LRMP	Land and Resource Management Plan
LSOG	late-successional and old-growth
LSR	Late Successional Reserve
LSRA	Late Successional Reserve Assessment

LSRMA	Late-Successional Reserve Management Area
LUCS	Land Use Compatibility Statement
LWD	large woody debris
m^2	square meter
m^3	cubic meters
m^3/hr	cubic meters per hour
m/hr	meter per hour
m/s	meters per second
MA	Management Area
MAMU	marbled murrelet
MAOP	maximum allowable operating pressure
MARSEC	Maritime Security
MBF	thousand board feet
MBTA	Migratory Bird Treaty Act
MCE	Maximum Considered Earthquake
mcy	million cubic yards
mg/l	milligram per liter
mg/d	million gallons per day
mg/kg	milligram per kilogram
MHHW	mean higher high water
MIS	Management Indicator Species
MLLW	mean lower low water
MLRA	Major Land Resource Area
MLV	mainline block valve
mm	millimeter
MMBF	million board feet
MMBtu	million British thermal unit
MMBtu/hr	million British thermal units per hour
MMcf/d	million cubic feet per day
mmhos/cm	millimhos per centimeter
MMPA	Marine Mammal Protection Act
MMTPA	million metric tons per annum
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MP	milepost
mph	miles per hour
MPRSA	Marine Protection, Research, and Sanctuary Act
MR	Mixed Refrigerant
MRL	Mixed Refrigerant liquid
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	mean sea level
MTBM	micro-tunnel boring machine
MTSA	Maritime Transportation Security Act
MVA	megavolt ampere
Mw	maximum moment magnitude
MW	megawatt
MWh	megawatt-hour
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAISA	National Aquatic Invasive Species Act of 2003

NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990
NAS	Non-indigenous aquatic species
NAVD88	North American Vertical Datum of 1988
NCA	National Climate Assessment
NCDC	National Climactic Data Center
NCM	navigation channel mile
NEB	National Energy Board
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NF	National Forest
NFMA	National Forest Management Act
NFPA	National Fire Protection Association
NFS	National Forest System
NGA	Natural Gas Act
NGL	natural gas liquids
NHPA	National Historic Preservation Act
NISA	National Invasive Species Act of 1996
NMFS	National Oceanic and Atmospheric Administration National Marine Fisheries Service
nmi	nautical mile
NNL	National Natural Landmark
NNSR	Nonattainment New Source Review
NO	nitrogen oxide
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
Northwest	Northwest Pipeline GP
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPH	Notice of Presumed Hazards
NPS	National Park Service
NPWHC	North Point Workforce Housing Complex
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NRF	nesting, roosting, and foraging
NRHP	National Register of Historic Places
NSA	noise-sensitive area
NSO	northern spotted owl
NSPS	New Source Performance Standards
NSR	New Source Review
NTU	nephelometric turbidity unit
NVIC	Navigation and Vessel Inspection Circular
NWFP	Northwest Forest Plan
NWI	National Wetlands Inventory
NWS	National Weather Service
O_2	oxygen
O&C Act	Oregon and California Lands Act
O&C Lands	Oregon and California Lands
OAR	Oregon Administrative Record

OBE	Operating Basis Earthquake
OCIMF	Oil Companies International Marine Forum
OCMP	Oregon Coastal Management Program
OCRM	National Oceanic and Atmospheric Administration Office of Coast and Ocean Resource Management
ODA	Oregon Department of Agriculture
ODE	Oregon Department of Energy
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ODHS	Oregon Department of Human Services
ODLCD	Oregon Department of Land Conservation and Development
ODNRA	Oregon Dunes National Recreation Area
ODOT	Oregon Department of Transportation
ODSL	Oregon Department of State Lands
OEP	FERC's Office of Energy Projects
OHWM	ordinary high water mark
OHV	Off-Highway Vehicle
OHWM	ordinary high water mark
OIMB	Oregon Institute of Marine Biology
OPRD	Oregon Parks and Recreation Department
OPS	Office of Pipeline Safety
OPT	Ocean Power Technologies
ORBIC	Oregon Biodiversity Information Center
Oregon GAP	Oregon Gap Analysis Project
Oregon LNG	LNG Development Company LLC and the Oregon Pipeline Company
ORS	Oregon Revised Statute
OSHA	Occupational Safety and Health Administration
OSMB	Oregon State Marine Board
OSMRE	Office of Surface Mining Reclamation Enforcement
OSWB	Oregon State Weed Board
OWRD	Oregon Water Resources Department
Pacific Connector	Pacific Connector Gas Pipeline L.P.
PAG	plant association group
PAH	polynuclear aromatic hydrocarbon
PAR	permanent access road
PCB	polychlorinated biphenyl
PCE	primary constituent element
PCS	Project Consulting Services, Inc.
PCT	Pacific Crest Trail
PCTA	Pacific Crest Trail Association
PES	PES Environmental, Inc.
PFMC	Pacific Fishery Management Council
PFYC	Potential Fossil Yield Classification
PG&E	Pacific Gas and Electric Company
PGA	peak horizontal ground acceleration
PHMSA	Pipeline and Hazardous Materials Safety Administration
PI	point of intersection
PILT	Payment In Lieu of Taxes
P.L.	Public Law

Plan	FERC's Upland Erosion Control, Revegetation, and Maintenance Plan
PM_{10}	particulate matter with a diameter of less than 10 microns
$PM_{2.5}$	particulate matter with a diameter of less than 2.5 microns
POD	Plan of Development
Port	Oregon International Port of Coos Bay
PORTS	Physical Oceanographic Real-Time System
PP&L	Pacific Power and Light Company
ppm	parts per million
ppmvd	parts per million by volume, dry basis
PPV	peak particle velocity
Procedures	FERC's Wetland and Waterbody Construction and Mitigation Procedures
Project	Jordan Cove Energy and Pacific Connector Gas Pipeline Project
PSD	Prevention of Significant Deterioration
PSE	Puget Sound Energy
PSEL	plant site emission limit
PSHA	Probabilistic Seismic Hazard Analysis
psi	pounds per square inch
psig	pounds per square inch gauge
PST	Pacific Standard Time
psu	practical salinity unit
PWA	potential wilderness area
R.	Range
R&A	Rogers and Associates
RBC	Risk-Based Concentration
Reclamation	U.S. Department of the Interior Bureau of Reclamation
REO	Regional Ecosystem Office
RFPD	Rural Fire Protection District
RHA	Rivers and Harbors Act
RM	river mile
RML	rapidly moving landslide
RMP	Resource Management Plan
RNA	Research Natural Area
RPT	rapid phase transition
ROD	Record of Decision
RPT	rapid phase transition
RV	recreational vehicle
S&M	Survey and Manage
Sandia	Sandia National Laboratories
SAP	sampling and analysis plan
SAV	submerged aquatic vegetation
SBS	Siskiyou BioSurvey, LLC
SD	scaled distance factor
SDWA	Safe Drinking Water Act
SEL_{cum}	cumulative sound exposure level
SEP	surface emissive power
SEV	severity of ill effect
SHN	SHN Consulting Engineers & Geologists, Inc.
SHPO	State Historic Preservation Officer
SHU	SuiTable Habitat Unit

SIGTTO	Society of International Gas Tanker and Terminal Operators
Siletz Tribes	Confederated Tribes of the Siletz Reservation
SMPE	South Mist Pipeline Extension
SMS	Scenery Management System
SMU	Species Management Unit
SO_2	sulfur dioxide
SOLAS	Safety of Life at Sea
SONCC	Southern Oregon/Northern California Coast
SORSC	Southwest Oregon Regional Safety Center
SPCCP	Spill Prevention, Containment, and Countermeasures Plan
SRMA	Special Recreation Management Area
SSA	sole or principal source aquifer
SSE	Safe Shutdown Earthquake
SSI	Sensitive Security Information
SSTEMP	Stream Segment Temperature Model
SSURGO	Soil Survey Geographic (Database)
STATSGO	State Soil Geographic (Database)
STEP	Shipboard Technology Evaluation Program
STG	steam turbine generator
SVID	Shasta View Irrigation District
SWPCP	Storm Water Pollution Control Plan
SWPPP	Stormwater Pollution Prevention Plan
t	metric ton
T.	Township
TAR	temporary access road
TCP	Traditional Cultural Property
Tetra Tech	Tetra Tech, Inc.
TEWA	temporary extra work area
t/hr	metric ton per hour
THPO	Tribal Historic Preservation Office
TIA	Traffic Impact Analysis
TMDL	Total Maximum Daily Load
TMP	Transportation Management Plan
TPY	tons per year
TR	Timberland Resource
TSS	total suspended solids
Tuscarora	Tuscarora Gas Transmission Company
TVS	total volatile solids
U.S.	United States
UCSA	uncleared storage area
UFL	upper flammable limit
UPS	uninterruptible power supply
U.S.C.	United States Code
USDOI	U.S. Department of the Interior
USGCRP	United States Global Change Research Program
USGS	U.S. Geological Survey
V	vertical
V_s	shear velocity
v/c	volume-to-capacity ratio
VFR	Visual Flight Rules
VMS	Visual Management System

VOC	volatile organic compound
VQO	Visual Quality Objective
VRM	visual resource management
WD	Water-Dependent Development Shorelands
WEP	Washington Expansion Project
WHPA	wellhead protection area
Williams Northwest	Williams Northwest Pipeline Company
Williams Pacific Operator	Williams Pacific Connector Gas Operator, LLC
Williams	Williams Companies Inc.
WNV	West Nile virus
WQC	401 Water Quality Certification
WRCC	Western Regional Climatic Center
WRP	Wetland Reserve Program
WSA	Waterway Suitability Assessment
WSR	Waterway Suitability Report

EXECUTIVE SUMMARY

INTRODUCTION

On May 21, 2013, Jordan Cove Energy Project, L.P. (Jordan Cove) filed an application with the Federal Energy Regulatory Commission (FERC or Commission) in Docket No. CP13-483-000, under Section 3 of the Natural Gas Act (NGA), seeking authority to construct and operate a new liquefied natural gas (LNG) export terminal at Coos Bay, Oregon. Jordan Cove indicated that the terminal was designed to receive a maximum of 1.03 billion cubic feet per day of natural gas and produce a maximum of 6.8 million metric tons per annum of LNG. Pacific Connector Gas Pipeline, LP (Pacific Connector) filed its companion application with the FERC on June 6, 2013, in Docket No. CP13-492-00, under Section 7 of the NGA, seeking a Certificate of Public Convenience and Necessity for a transmission pipeline capable of transporting up to 1,060,000 dekatherms per day of natural gas from the Malin, Oregon hub to the Jordan Cove terminal. Pacific Connector would obtain natural gas from western Canadian and Rocky Mountain sources, through interconnections with the existing systems of Ruby Pipeline LLC (Ruby) and Gas Transmission Northwest LLC (GTN); and would also serve markets in southern Oregon through an interconnection with the existing Northwest Pipeline GP's (Northwest) Grants Pass Lateral. Hereafter, we[1] refer to these inter-related proposals collectively as the Jordan Cove Energy and Pacific Connector Gas Pipeline (JCE & PCGP) Project, or the Project.

This environmental impact statement (EIS) was produced by the FERC staff and other federal cooperating agencies to comply with the National Environmental Policy Act (NEPA), according to the implementing regulations outlined by the Council of Environmental Quality at Title 40 Code of Federal Regulations (CFR) Parts 1500-1508, and the Commission's regulations at 18 CFR 380. The purpose of this document is to inform the Commission, other permitting agencies, and the public about the potential adverse and beneficial environmental impacts of the Project and its alternatives, and to recommend measures that would avoid, reduce, or mitigate any significant adverse impacts to the extent practicable. We prepared this analysis based on information provided by Jordan Cove and Pacific Connector, independent research, and comments from federal, state, and local agencies, and the public.

The FERC is the federal agency responsible for authorizing onshore LNG terminals and interstate natural gas transmission facilities, as specified in section 311(e)(1) of the Energy Policy Act of 2005 (EPAct) and the NGA. In accordance with section 313(b)(1) of the EPAct, the FERC is the lead federal agency for the coordination of all applicable federal authorizations, and is also the lead federal agency for preparation of this EIS.

The United States (U.S.) Department of Agriculture, Forest Service (Forest Service); U.S. Army Corps of Engineers (COE); U.S. Department of Energy (DOE); U.S. Environmental Protection Agency (EPA); U.S. Department of Homeland Security, Coast Guard (Coast Guard); U.S. Department of the Interior, Bureau of Land Management (BLM), Bureau of Reclamation (Reclamation), and Fish and Wildlife Service (FWS); and the Pipeline and Hazardous Materials Safety Administration (PHMSA) within the U.S. Department of Transportation (DOT) are cooperating agencies, as defined in 40 CFR 1501.6, for the development of this EIS. A

[1] The pronouns "we," "us," or "our" are used to reference the environmental staff of the FERC's Office of Energy Projects (OEP).

cooperating agency has jurisdiction by law or special expertise with respect to environmental impacts involved with the proposal, and can participate in the NEPA analysis.

For the BLM and Forest Service, the primary purpose of this EIS is to consider and disclose the environmental consequences of construction and operation of the Pacific Connector pipeline on BLM and National Forest System (NFS) lands and to evaluate proposed land management plan (LMP) amendments. The BLM would need specific amendments to its LMPs for the Coos Bay, Roseburg, and Medford Districts, while the Forest Service would need to amend LMPs for the Umpqua, Rogue River, and Winema National Forests to allow for the pipeline. The BLM would also utilize this EIS when it considers Pacific Connector's Right-of-Way Grant application to allow for an easement across federal lands in accordance with the Mineral Leasing Act, with concurrence from the Forest Service and Reclamation.

PROPOSED ACTION

According to the applicants, the purpose of the Project is to create a new LNG export point on the West Coast of the continental United States to serve oversea markets around the Pacific Rim, using competitively priced natural gas from western Canadian and the Rocky Mountains sources obtained at the Malin hub. Jordan Cove's terminal would include an access channel from the existing Coos Bay navigation channel; marine slip with one LNG berth and a tug boat berth; loading platform and transfer pipeline; two LNG storage tanks; four liquefaction trains; a 420-megawatt South Dunes Power Plant; utility and access corridor between the terminal and the power plant; support buildings; the Southwest Oregon Resource Security Center; and the natural gas treatment plant.

Pacific Connector proposes to construct and operate a 232-mile-long, 36-inch-diameter underground welded steel pipeline between Malin and Coos Bay, crossing portions of Klamath, Jackson, Douglas, and Coos Counties, Oregon. Associated aboveground facilities would include the 41,000 horsepower Klamath Compressor Station; the Klamath-Eagle Meter Station and Klamath-Beaver Meter Station within the compressor station tract; Clarks Branch Delivery Meter Station at the interconnection with Northwest; the Jordan Cove Delivery Meter Station at the interconnection with the Jordan Cove LNG terminal; 5 pig[2] launchers and receivers; 17 mainline block valves; and 11 communication towers co-located with other facilities.

PUBLIC INVOLVEMENT

We began our environmental review of the Project in May and June of 2012, after approving separate requests from Jordan Cove and Pacific Connector to initiate our Pre-filing review process in Docket Nos. PF12-7-000 and PF12-17-000, respectively. On August 2, 2012, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Jordan Cove Liquefaction and Pacific Connector Pipeline Projects, Requests for Comments on Environmental Issues, and Notice of Public Scoping Meetings* (NOI). We sent the NOI to elected federal, state, and local government officials; agency representatives; regional environmental and non-governmental organizations; Indian tribes; affected landowners; and local libraries and newspapers. The NOI encouraged stakeholders to provide comments during a scoping period that lasted until October 29, 2012. Seven public meetings were held jointly with the BLM and Forest Service during the scoping period in Coos Bay (August 27, 2012), Roseburg

[2] A "pig" is a tool for cleaning and inspecting the inside of a pipeline.

(August 28, 2012), Klamath Falls (August 29, 2012), Medford (August 30, 2012), North Bend (October 9, 2012), Canyonville (October 10, 2012), and Malin (October 11, 2012). Transcripts of comments from the public scoping meeting were placed into the public record of these proceedings.

The FERC issued a Notice of Availability (NOA) of the DEIS on November 7, 2014. The NOA established a 90-day period for comments on the DEIS, ending on February 13, 2015. The 90-day comment period was established to meet public review requirements of the BLM for the proposed amendments to BLM and Forest Service LMPs. Dates and locations of public meetings to take comments on the DEIS announced in the NOA included: Coos Bay on December 8, 2014; Roseburg on December 9, 2014; Canyonville on December 10, 2014; Medford on December 11, 2014; Klamath Falls on December 12, 2014; and Malin on December 13, 2014. Transcripts of the DEIS comment meetings were placed in the public record for these proceedings.

Comments from the public meetings, as well as written comments on the DEIS submitted by the public and agencies, are provided along with our responses in appendix W. The FERC received 443 individual written letters commenting on the DEIS, including 7 letters from federal agencies, senators, and congressmen; 2 letters from Indian tribes; 1 collaborative letter from the various Oregon state agencies; 1 letter from a local government agency; 39 letters from companies and organizations; and 393 letters from individuals. These numbers do not include comments from the public meetings, filings by the applicants, letters that do not contain comments on the DEIS, duplicate or redundant comment letters, letters submitted after the comment period ended, and attachments.

We have made changes in this Final EIS (FEIS) both in response to comments received on the DEIS and as a result of updated information that became available after issuance of the DEIS. This FEIS is being mailed to the agencies, individuals, and organizations on the mailing list that is provided in appendix A, and was submitted to the EPA for formal issuance of a NOA for the FEIS.

ALTERNATIVES CONSIDERED

Alternatives considered in this EIS include the no action alternative, system alternatives, LNG terminal alternatives, pipeline route alternatives, and aboveground facilities alternatives. In the case of the no action alternative, while denying Project approval would avoid the environmental impacts identified in this FEIS, the objectives of the Project would not be met.

We considered the possibility of using existing jurisdictional interstate pipeline systems, including those operated by Northwest, Ruby, and GTN, as potential system alternatives to the Pacific Connector pipeline. We also considered one non-jurisdictional intrastate route, the existing Coos County Pipeline. These system alternatives were rejected as impracticable or infeasible because either the existing pipeline routes do not connect Malin with Coos Bay, or the existing systems would be not be able to handle the additional volumes of natural gas required to be transported by Pacific Connector.

We do not consider any of the proposed LNG export terminals on the Gulf Coast or East Coast of the United States to be reasonable or practicable alternatives to the Jordan Cove proposal, because they would not meet one of the main objectives of the Project (to establish an LNG

export point on the West Coast). LNG vessels taking cargo from Gulf Coast or East Coast terminals would have substantially longer and less direct routes to Asian markets than from the West Coast. Furthermore, Jordan Cove proposes to acquire its natural gas from western Canadian and Rocky Mountain sources, while proposed East Coast export terminals would likely receive natural gas from the Appalachian Basin, and Gulf Coast terminals would likely receive natural gas from sources in Louisiana and Texas.

We acknowledge that there are existing LNG terminals in Mexico and Alaska. If one of the existing LNG terminals on the West Coast of Mexico was converted to export, it would not meet Jordan Cove's objective of using western Canadian and Rocky Mountain natural gas. The existing LNG export terminal at Kenai, Alaska, does not have supplies or volume capacity to meet the goals of the Jordan Cove terminal. We also considered if it was possible to convert any of the existing LNG storage facilities (peak shaving plants) in the Pacific Northwest to LNG export terminals, but found they did not have adequate ports for LNG vessel access.

There are other proposals to construct and operate new LNG export terminals in British Columbia, Canada, Alaska, and in Warrenton, Oregon. In the case of the proposed British Columbia terminals, their permitting status appears uncertain and they may not be ready for construction within the same time frame as the Jordan Cove terminal. The two new proposals for LNG export terminals in Alaska would not be able to access natural gas supplies in western Canada and the Rocky Mountains, thus not meeting one of the main objectives of the Project. The Oregon LNG and Northwest Washington Expansion Project (WEP) could meet most of the Project objectives. The FERC issued a DEIS for Oregon LNG and the WEP on August 5, 2015, which appears to show that it would have similar environmental impacts as the JCE & PCGP Project.

We considered alternative designs for Jordan Cove's facilities at Coos Bay, including underground, lower, or wider LNG storage tanks. Underground, wider, or lower LNG storage tanks would be infeasible, given Jordan Cove's need for a certain amount of LNG storage for commercial viability, low groundwater, and configuration within the Ingram Yard to include the LNG vapor exclusion area.

We examined multiple pipeline route alternatives in detail. In the case of the Modified Blue Ridge 2013 Alternative Route, we requested that Pacific Connector provide additional environmental data, including the results of on-the-ground surveys where access could be obtained on BLM lands. Although fewer private parcels would be crossed, our analysis using the additional data confirmed the findings in the DEIS, that the Modified Blue Ridge 2013 Alternative Route does not have significant environmental advantages over the corresponding segment of the proposed route between mileposts (MP) 11.1 and 21.8, because the alternative would affect more old growth forest habitat for marbled murrelet and northern spotted owl. The Shasta View Irrigation District (SVID) Alternative Route would meet Reclamation's goals of avoiding impacts on the SVID facilities; however, we recommended that Pacific Connector could use its proposed route if it can reach an agreement with Reclamation, including mitigation for the SVID. We also assessed alternative locations for Pacific Connector's aboveground facilities, but found the proposed sites to be environmentally preferable.

PROJECT IMPACTS AND MITIGATION

We evaluated the impacts of the Project on a range of environmental resources, including land use, geology, soils, waterbodies and wetlands, vegetation, wildlife, fisheries, special status species, recreation and visual resources, socioeconomics, cultural resources, air quality, noise, and safety. We also considered cumulative impacts of other proposed activities that may occur in a similar time frame within the same watersheds as the Project.

Land Use

The upland facilities for the Jordan Cove terminal would be on privately owned lands; zoned for industrial and water dependent use. In total, construction of the terminal facilities would affect 32 acres of open water, 63 acres of open land, 67 acres of forest, and 33 acres of industrial land. Construction of the temporary North Point Workforce Housing Complex (NPWHC) would affect an additional 49 acres of industrial land. No residences are located within 1 mile of the terminal.

The Pacific Connector pipeline route would cross about 157 miles of private lands and about 75 miles of public lands. About 62 percent of the route would cross forest, 16 percent would be agricultural land, 12 percent would be rangelands, and 8 percent would be urban or built-up lands. The pipeline construction right-of-way would be within 50 feet of 10 residences, and Pacific Connector filed site-specific residential construction plans to reduce impacts that were included in the DEIS for public review and comment.

Jordan Cove and Pacific Connector obtained necessary conditional use permits and land use compatibility statements from the affected counties. We recommend that construction not begin until after Jordan Cove and Pacific Connector receive a determination of consistency with the Coastal Zone Management Act (CZMA) from the Oregon Department of Land Conservation and Development (ODLCD) in response to their August 2014 application.

Of the public lands crossed by the Pacific Connector pipeline, about 40 miles would be administered by the BLM, and 31 miles would be NFS lands. The pipeline would also cross about 0.7 mile of Reclamation land and numerous irrigation features that are part of Reclamation's Klamath Project. The Pacific Connector pipeline route would cross certain land allocations defined by the Northwest Forest Plan on federal lands, including 24.1 miles of Late Successional Reserves (LSR), 4.3 miles of unmapped LSRs, 42.7 miles of Matrix, and 5.2 miles of Riparian Reserves. The EIS discusses two site-specific LMP amendments for the BLM's Coos Bay District; three site-specific plan amendments for the BLM's Roseburg District; four site-specific plan amendments for the Umpqua National Forest; six site-specific plan amendments for the Rogue National Forest; five site-specific plan amendments for the Winema National Forest; and one general amendment that applies to all BLM and NFS lands crossed by the proposed pipeline route.

Storm Surge, Geology, and Soils

The LNG terminal and the far western portion of the Pacific Connector pipeline route are within the Cascadia Subduction Zone (CSZ). This area may be subject to seismic activity, including a potential tsunami generated by a future megathrust earthquake on the CSZ. Tsunami inundation models for the Jordan Cove terminal found that a 2,475-year return period event could result in a tsunami peak run-up elevation of about +33 feet. Therefore, to protect its facilities from a potential future tsunami, Jordan Cove would raise the elevation of its LNG terminal processing

area to +46 feet, and would surround the LNG storage tanks with a storm surge barrier about 60 feet high.

Earthquakes can result in ground subsidence, lateral spreading, and soil liquefaction. Modeling for the Jordan Cove LNG terminal location indicated that the maximum subsidence for the most likely earthquake scenario considered is approximately 8 feet. The majority of the sandy soils encountered below the fill at the LNG terminal site are dense enough to resist liquefaction during design-level earthquakes. Liquefaction/lateral spread mitigation at the terminal would consist of ground improvement by vibro-compaction using on-site sand. Based on the distance of the LNG storage tanks to the edge of the flat slopes, and the limited extent of liquefiable soils, the risk of lateral spreading is low. We recommend that Jordan Cove provide final seismic design data before the Commission allows any construction of the terminal.

We identified five Quaternary and Holocene age fault zones that would be crossed by the pipeline route between MPs 172 and 213 within the Klamath Basin. Pacific Connector indicated it would check the trench for evidence of stratigraphic offsets potentially related to ground rupture. If such features are observed, Pacific Connector would implement additional mitigation measures at these locations, including burying the pipe in a wider trench backfilled with loose gravel or sand. High liquefaction and/or lateral spreading potential were identified at seven sites (Haynes Inlet, Kentuck Inlet, Willanch Slough, Coos River, Willis Creek, Rogue River, and Klamath Valley/Klamath River) along the pipeline route. Pacific Connector would conduct numerical modeling for these sites prior to construction to estimate the magnitude of liquefaction-induced settlement and lateral spreading that would be expected during the design earthquake event. If the numerical modeling indicates that liquefaction settlement and/or lateral spreading would result in excessive pipe stress conditions, further mitigation design would be needed. Mitigation options may include deeper burial below the liquefiable soils, thicker pipe, and/or weighting the pipe with a concrete coating, if necessary.

Pacific Connector selected its pipeline route to avoid areas with high risk of geological hazards such as landslides. The route would cross two known moderate-risk rapidly moving landslide sites (at MP 18.1 and MP 36.9). However, the risks to the pipeline at these sites are not considered hazardous enough to require additional mitigation or rerouting.

The pipeline alignment would be within 500 feet of potential mine hazards at 23 locations, 16 of which are aggregate mines or quarries. The route between MPs 108.6 and 110.9 avoids the Peavine Quarry within the Umpqua National Forest. The alignment at MP 150.5 is within approximately 100 feet northeast of the Heppsie Mountain quarry on BLM land. Between MPs 108.6 and 109.4, the pipeline would be within 200 feet of three historic mercury mines, but would not cross any adits or workings.

The portion of Coos Bay that would be dredged to create the access channel to the Jordan Cove terminal marine slip does not contain any contaminated sediments. Testing at the former Weyerhaeuser mill site, where the South Dune Power Plant is proposed to be located, indicated that concentrations of contaminates are below screening levels that would represent a risk to public health. The Oregon Department of Environmental Quality (ODEQ) recommended "No Further Action" at this location, and approved a closure plan. Jordan Cove would cover the former mill site with clean sediments from the marine slip and access channel to raise the elevation for the planned South Dunes Power Plant and associated facilities. Testing in 2014 at the Ingram Yard, the proposed LNG terminal location, found ash-mended soils, so Jordan Cove

has developed site-specific health and safety plans, and prepared an *Unanticipated Hazardous Waste Discovery Plan*.

From the ODEQ data base, Pacific Connector identified three hazardous waste sites near its facilities; however, the company has filed plans detailing how contaminates at the three sites would be avoided or removed. A C*ontaminated Substances Discovery Plan* was developed by Pacific Connector that specifies the measures that would be implemented if unanticipated contaminated soils are encountered during construction.

Within the Jordan Cove terminal area, 56 acres of Heceta Fine Sand and 45 acres of Dune Land soils both have a slight potential for water erosion and high to severe potential for wind erosion. Jordan Cove would reduce the potential for soil erosion by following the measures of the FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* (*Plan*) and its own *Erosion and Sediment Control Plan* (ESCP).

The Pacific Connector pipeline route would cross about 93 miles of soils with a high or severe water erosion potential, and 15 miles of very fine to coarse sand to silt loam soils that are highly susceptible to wind erosion. The pipeline alignment would cross approximately 72 miles of soils classified as prime farmland or farmland of statewide importance. Crops are not grown on all of these soils. None of Pacific Connector's aboveground facilities would be located on prime farmland; so no prime farmland would be taken out of production. Potential impacts on soils, including farmland, would be minimized through measures specified in Pacific Connector's *Erosion Control and Revegetation Plan* (ECRP).

Water and Wetlands

There are no EPA-designated sole source aquifers near the Project. There are four existing groundwater wells within the Roseburg Forest Products tract near temporary extra workspace areas to be used by Jordan Cove. We recommend that the surface features of those wells be protected from construction activities. To prevent or reduce impacts on groundwater from the accidental release of hazardous materials, Jordan Cove prepared a *Spill Prevention, Containment, and Countermeasures Plan* (SPCCP).

Jordan Cove estimates that it would need a total of approximately 1.7 billion gallons of water for construction and 1.3 million gallons of water per day during operation of the terminal facilities. Water requirements for the LNG terminal would be supplied by the Coos Bay North Bend Water Board (CBNBWB). The CBNBWB has 18 groundwater wells located within the Oregon Dunes National Recreation Area (ODNRA) to the north of the LNG terminal; however, the closest CBNBWB well is about 3,500 feet away and should not be affected by the Project. The CBNBWB's well field is capable of producing up to 4 million gallons per day of water during normal precipitation years.

There are no public groundwater supply wells within 400 feet of the Pacific Connector pipeline; however, the route would cross six wellhead protection areas. Pacific Connector identified five private wells within 150 feet of the pipeline, but none of these are used for drinking water. Pacific Connector developed a *Groundwater Supply Monitoring and Mitigation Plan* to ensure that wells are not adversely affected, and an SPCCP that outlines measures that would be implemented during construction to avoid or minimize the potential effects of hazardous material spills on groundwater resources.

The access channel from the existing navigation channel to the Jordan Cove marine slip would affect about 30 acres in Coos Bay. The access channel would be created by dredging about 1.3 million cubic yards of material from the bay bottom. Jordan Cove's *Report on Turbidity Due to Dredging* included a model that predicted total suspended solids (TSS) could be expected to be at a maximum of 500 milligrams per liter (mg/l) at the immediate vicinity of a hydraulic cutterhead dredge, but would rapidly reduce to a maximum of 14 mg/l by a distance of 60 meters. Therefore, turbidity from dredging of the access channel would be temporary (lasting about 4 to 6 months during construction) and localized, minimizing impacts on the aquatic environment of the bay.

The pipeline route would cross 19 fifth-field watersheds, with proposed access roads crossing an additional 5 watersheds. The construction of the pipeline would affect waterbodies at 265 locations. The pipeline would be installed under three major rivers (Coos, Rogue, and Klamath) using horizontal directional drills (HDD), while three waterbodies (Kentuck Slough, Catching Slough, and the Medford Aqueduct) would be bored. The South Umpqua River would be crossed using Direct Pipe (DP) technology at one location and with diverted crossing methods at a second location. The bores, DP, and HDDs should avoid direct impacts on those rivers and their aquatic environments. Pacific Connector has prepared an *HDD Contingency Plan and Failure Procedure* that describes measures to contain an inadvertent release of drilling mud during the HDD process.

Only Coos Bay, between about MPs 1.7 and 4.1, would be crossed with a wet open-cut method. According to models run by Pacific Connector, turbidity caused by the crossing of Haynes Inlet would not be more than 10 percent above ambient levels for a maximum distance of 350 feet, with concentrations of TSS over 50 mg/l limited to less than 100 feet from actual trenching. Thus, impacts on the aquatic environment of the bay would be localized, and temporary (for the approximate 16 day construction period). Pacific Connector would minimize impacts from construction in the bay by following the measures outlined in its *Report on Preliminary Pipeline Study of the Haynes Inlet Water Route*, including keeping the backhoe bucket below the water level, following a turbidity monitoring plan, installing turbidity curtains, and fueling and maintaining equipment more than 150 feet from standing water.

The remainder of the waterbodies along the Pacific Connector pipeline route would be dry crossed (using dam-and-pump or fluming methods). All waterbodies would be crossed during the in-water work windows recommended by the Oregon Department of Fish and Wildlife (ODFW), with the pipeline installed below scour depth. Pacific Connector produced a Stream Crossing Risk Analysis, and impacts on waterbodies would be minimized by following the FERC's *Wetland and Waterbody Construction and Mitigation Procedures* (*Procedures*). Impacts on dry-crossed streams would be temporary (with most construction occurring at a single crossing within a 48-hour period), and localized, with models predicting TSS levels less than 100 mg/l within 10 meters downstream of the crossing site. Removal of shade by clearing streamside riparian vegetation would not greatly increase water temperatures. The maximum predicted increase was 0.3°F at one 2-foot-wide crossing, and modeling indicated that instream water temperatures would return to ambient conditions within a short distance downstream from all crossings.

Pacific Connector would use about 75,000 gallons of water per day for dust suppression during construction, and approximately 62 million gallons of water would be required for the hydrostatic testing of the pipeline. At the source, hydrostatic test water would be screened, and released under low velocity conditions through energy dissipating devices and sediment filters in vegetated uplands. Pacific Connector developed a *Hydrostatic Testing Plan* that includes measures to prevent the transfer of aquatic invasive species and pathogens from one watershed to another.

Approximately 38 acres of wetlands would be impacted by construction of the Jordan Cove terminal, with approximately 36 acres of wetlands being permanently affected during operation. Jordan Cove developed a *Compensatory Wetland Mitigation Plan* to address unavoidable impacts on wetlands. Impacts on freshwater wetland resources would be mitigated by creation of new upland wetlands at the West Bridge and West Jordan Cove sites. Impacts to estuarine wetland resources would be mitigated by creation of new eelgrass beds in the bay and creation of new tidal wetlands at Kentuck Slough. In this EIS, we recommend that prior to construction Jordan Cove should document approval of its final *Wetland Mitigation Plan* by appropriate regulatory agencies, including the COE, ODEQ, ODFW, and ODSL.

The Pacific Connector pipeline route would cross approximately 9 miles of wetlands. Construction of the pipeline would impact about 196 acres of wetlands. Long-term impacts would occur for about 6 acres of wetlands (with about 1.6 acres of this resulting from wetlands within the 10-foot-wide mowed permanent operational right-of-way). Pacific Connector would minimize impacts on wetlands by following our *Procedures*, and would mitigate impacts in accordance with its *Compensatory Wetland Mitigation Plan* and *Estuarine Wetland/Open Water Mitigation Plan*. Further, the COE would issue permits under the River and Harbors Act (RHA) and section 404 of the Clean Water Act (CWA) for the crossing of waters of the United States, including wetlands, and the ODEQ would issue a Water Quality Certification under section 401 of the CWA. We have included a recommendation in this EIS that construction not begin until all applicable federal permits have been issued.

Vegetation

Construction of the Jordan Cove facilities would result in a total of approximately 397 acres of clearing (about 195 acres of this would result from construction of FERC jurisdictional facilities). Clearing of the terminal and related facilities during construction would affect about 98 acres of forest and about 165 acres of upland herbaceous associations. Jordan Cove would compensate for the loss of vegetative habitats by following the measures of its *Wildlife Habitat Mitigation Plan*.

Construction of the pipeline would impact approximately 4,523 acres of vegetation. This would consist of 2,882 acres of forested lands, 643 acres of grasslands/shrublands, 103 acres of wetland/riparian areas, and 896 acres of agricultural areas. Of the forested land crossed, about 821 acres of late-successional old-growth, 821 acres of mid-seral, and 1,240 acres of clear-cut or regenerating forests would be impacted. Pacific Connector would compensate for the loss of vegetative habitats in accordance with its *Wildlife Habitat Mitigation Plan*. In this EIS, we recommend that prior to construction both Jordan Cove and Pacific Connector should file documentation that their final *Wildlife Habitat Mitigation Plans* were found acceptable by the ODFW.

In accordance with its ECRP, Pacific Connector would replant native conifer species outside of the 30-foot-wide maintenance corridor during restoration of forested area. In addition, Pacific Connector developed an *Integrated Pest Management Plan* to minimize the potential spread of vegetative pests and noxious weeds. Pacific Connector would also fund various projects on federal lands that would improve forest structure and health, and reduce the effects of wildfires.

The applicants conducted botanical surveys to identify plants listed under the Endangered Species Act (ESA) and federal special status species. The Jordan Cove terminal would not affect any federally listed plant species. Along the route of Pacific Connector pipeline, botanical surveys identified 3 vascular plants, 1 bryophyte, and 2 fungi listed as BLM sensitive species, and 66 fungi, 13 lichens, 1 bryophyte, and 3 vascular plants listed as Forest Service Survey and Manage species. Appendices to this EIS include a Survey and Manage Species Persistence Evaluation and a Biological Evaluation for Forest Service Sensitive Species. Four federally listed threatened or endangered plant species are likely to be adversely affected by the pipeline: Applegate's milk-vetch, Gentner's fritillary, large-flowered meadowfoam, and Kincaid's lupine. Pacific Connector developed a *Federally-listed Plant Conservation Plan* to address how avoidance, minimization, propagation, restoration, and other conservation measures would be applied to protected plant species.

Wildlife and Aquatic Resources

Approximately 178 species of amphibians, reptiles, birds, and mammals were observed during surveys in upland habitats on the North Spit in the vicinity of the Jordan Cove terminal. Overall, 47 amphibians and reptiles, 278 birds, and 106 mammal species are known or suspected to occur in upland habitats crossed by the Pacific Connector pipeline route. In general, construction related impacts on wildlife would be short-term, and most mobile species would temporarily relocate to adjacent similar habitats. To reduce impacts on wildlife from operation of the LNG terminal, we recommend that Jordan Cove develop a lighting plan in consultations with the appropriate resource agencies. Both applicants have filed drafts of their *Migratory Bird Conservation Plans;* however, we recommend they document that final plans were approved by the FWS.

The Coos Bay estuary, where the LNG terminal would be located, and which a 2.4-mile-long portion of the pipeline would cross, contains habitats for marine fish, anadromous fish, and shellfish. We identified essential fish habitat (EFH) for groundfish, coastal pelagic species, Pacific Coast salmon, and highly migratory fish. Dredging of the terminal access channel would raise turbidity levels for a short time period over a limited area in the bay. For a mechanical dredge, the maximum TSS concentrations would be 6,000 mg/1 at the dredge site, decreasing to 50 mg/l within 660 feet. Because we are concerned that terminal construction, including noise from pile driving in the slip, may affect marine mammals in Coos Bay, we recommend that Jordan Cove develop, in consultation with the U.S. Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS), a *Monitoring and Adaptive Management Plan* for the protection of pinnipeds, We found the potential for shoreline erosion and fish strandings to be low, with LNG vessel wakes lower than natural waves and similar to current deep-draft commercial ship traffic in the bay. Also during terminal operation, there is the potential for LNG vessels at dock to entrain small marine organisms during water intake for engine cooling. However, this minimal loss would be less than expected natural mortality levels for larval stage species in the bay.

The Pacific Connector pipeline route would cross 88 waterbodies that are known or assumed to be inhabited by fish. Excepting the Coos Bay estuary, the waterbodies crossed by the pipeline contain warmwater (such as crappie), coolwater (including bass, perch, suckers, and chub), and coldwater (such as trout) fish species. Pacific Connector would cross most waterbodies using dry techniques such as fluming or dam-and-pump, and impacts would be of limited extent, duration, and effects. Stream crossings would usually be done within 48 hours. At a maximum, we estimated that dry-crossings would generate turbidity levels of less than 100 mg/l TSS within 10 meters.

The applicants conducted biological surveys to identify federally listed threatened and endangered and special status species. The Pacific Connector pipeline may potentially affect 3 mammals, 19 birds, 1 amphibian, 1 reptile, 10 terrestrial invertebrates, 7 aquatic invertebrates, and 6 fish listed as special status species by the BLM and Forest Service. In addition, the pipeline may affect 2 terrestrial mollusks and 2 vertebrates listed as Forest Service Survey and Manage species. Of the ESA species, the Project is likely to adversely affect the fisher, marbled murrelet, northern spotted owl, vernal pool fairy shrimp, and six fish species (green sturgeon, eulachon, two units of coho salmon, Lost River sucker, and shortnose sucker). In February 2015, the FERC submitted an EFH assessment to the NMFS, and a biological assessment (BA) to both the NMFS and FWS. The Services have responded with requests for additional information, that the FERC will address in revisions to the BA. In this EIS, we recommend that construction not begin until after we have concluded formal consultations with the NMFS and FWS.

Recreational and Visual Resources

Recreational activities in the vicinity of Jordan Cove terminal on the North Spit and Coos Bay include hiking, horseback riding, biking, off-road vehicle use, wildlife viewing, hunting, shellfish harvesting, fishing, and boating. The beach from Ten Mile Creek to the mouth of Coos Bay is visited by an average of 38 people on a weekday, and 60 people total on a weekend day. An average of 14,710 recreational crabbing trips per year are taken to Coos Bay. Recreational clamming and crabbing is done on the mudflats outside of the Coos Bay navigation channel, and therefore there would be no direct impacts from LNG vessel traffic to from the terminal on individuals conducting those activities. On average there are about 31,560 trips per year in Coos Bay by recreational boaters, the majority of which are for fishing. We conclude that LNG vessels in the waterway would not significantly impact recreational users of Coos Bay, because the number of LNG vessels would be less than historic numbers of deep-draft cargo ships that used to call at the Port, recreational boaters could simply move out of the way of LNG vessels in the navigation channel, and delays would probably not exceed 30 minutes while an LNG vessel passes in transit. In addition, LNG vessel operators would need to meet any vessel traffic and/or facility control measures determined necessary by the Coast Guard to address navigational safety and maritime security considerations.

There are recreational areas nearby the Jordan Cove terminal on BLM land on the North Spit and NFS lands within the ODNRA. However, we conclude that construction and operation of the Jordan Cove facilities, including noise and traffic, would not have adverse impacts on users of the nearby recreational lands.

The most visible elements of the terminal complex would be the two LNG storage tanks, each to be about 180 feet high and about 276 feet wide, and the three heat recovery steam generators stacks at the power plant that would each be about 100 feet tall. Visual impacts from the Jordan

Cove terminal would be minimized because the terminal would be situated next to an existing industrial facility (Roseburg Forest Products), there is a forested dune behind the terminal, the storage tanks would be surrounded by a 60-foot-high earthen storm barrier, and a reduced lighting plan would be implemented.

The Pacific Connector pipeline route would cross the Haynes Inlet Water Trail, a small segment of the BLM's Upper Rock Creek Area of Critical Environmental Concern (ACEC), three National Scenic Byways (U.S. Highway 101, State Highway 62, and U.S. Highway 97), and one National Scenic Trail (Pacific Crest Trail). The pipeline would be installed under U.S. Highway 101 within the waters of Coos Bay, and Pacific Connector would use HDDs to avoid impacts on State Highway 62 and U.S. Highway 97. Pacific Connector would implement the measures outlined in its *Recreation Management Plan* to minimize impacts on the Haynes Inlet Water Trail, and the Pacific Crest Trail, and their recreational users. In this EIS, we recommend that before construction, Pacific Connector should document consultations with applicable resource agencies regarding the crossing of the Haynes Inlet Water Trail, and their review and approval of the *Recreation Management Plan*. Pacific Connector developed an *Upper Rock Creek ACEC Crossing Plan* to reduce impacts on that land parcel that the BLM found acceptable.

The clearing of forest for the pipeline right-of-way and introduction of new aboveground facilities would have long-term and permanent visual impacts. Pacific Connector has developed an *Aesthetics Management Plan* to lessen visual impacts at key observation points, such as heavily traveled highway crossings. We conducted a new analysis of key observation points for the crossing of the Pacific Crest Trail, and outlined new design features to mitigate impacts on the trail. In this EIS, we recommend that before construction, Pacific Connector should revise its *Recreation Management Plan*, *Aesthetics Management Plan*, and *Leave Tree Protection Plan* to incorporate our new measures, and file approval of the revised plans by the Forest Service. A number of the Forest Service plan amendments address impacts on visual resources on NFS lands.

Socioeconomics and Transportation

Jordan Cove's LNG terminal would be constructed over a 42 month period, with an average workforce of 922 employees. At the peak of construction, there would be about 1,800 non-local workers needing housing in Coos County. These non-local workers, and their families, could compete for housing with visitors to Coos County, especially during the summer tourist season. Therefore, Jordan Cove would offer housing for its employees at the NPWHC.

Jordan Cove estimated that construction of its LNG terminal and related facilities would cost about $3 billion. About $2.6 billion would be for materials, equipment, and other expenditures, with $653 million of that amount spent in the states of Oregon and Washington combined. Total wages during terminal construction would be $412 million. To operate its LNG terminal and related facilities, Jordan Cove would employ about 145 full-time workers, at an average annual salary of $80,000, generating a total of almost $12 million in direct annual wages. During operation of the terminal, Jordan Cove would pay $20 million a year in funding for education and $10 million for urban renewal.

Construction of the Pacific Connector pipeline would extend over two years, with an average monthly workforce of 1,400 people, and a peak workforce of 1,844 people spread over five construction spreads. The average workforce for each construction spread would be about 280

workers per month, with a peak of 369 workers mid-season. Pacific Connector estimates that approximately 50 percent of the construction jobs for the pipeline would be filled by non-local workers. The number of non-local hires would average 700 workers and peak at approximately 922 workers. The average non-local workforce for each construction spread would be about 140 workers per month, with a peak of 184 workers. Pacific Connector would not provide temporary construction camps along the pipeline route to house non-local employees. Instead, non-local workers would have to seek housing from the available stock, which is estimated to include 21,169 rental houses, 7,889 hotel-motel rooms, and 4,460 recreational vehicle hook-ups in the four affected counties combined.

Pacific Connector intends to spend about $1.7 billion to build its facilities. Total construction payroll is estimated to be $240 million. Costs for materials and equipment bought in or brought to Oregon are estimated at about $464 million. About $33 million would be spent during construction for local contracted services, such as logging and hauling, road improvements, and professional services. Federal taxes on construction payroll would be about $46 million, with $19.2 million generated in state income taxes. Temporary workers would spend approximately $99,000 in state lodging taxes. During its first year of operation the pipeline would generate an estimated total of $11.1 million in property tax revenues.

During construction of the Jordan Cove LNG terminal, equipment would be brought in by train, boats and barges, and trucks. The only material planned to come to the terminal by rail would be sheet pile, which would be delivered by approximately 25 railcars. Over a two-year period during construction of the terminal, Jordan Cove expects deliveries by about 82 cargo ships and 18 barges, in total. Jordan Cove estimated that deliveries by trucks to the terminal during construction would number 1,996 in year one; 17,840 in year two; reach a peak of 48,990 in year three; and reduce to 35,232 in year four. Jordan Cove intends to bus construction workers to the terminal from the NPWHC and two other off-site parking lots. Bus trips would number about 5,850 in year one, 42,250 in years two and three, and 13,000 in year four. In this EIS, we recommend that Jordan Cove revise its *Traffic Impact Analysis* to account for truck and bus traffic during construction, document approval of the revised plan by the Oregon Department of Transportation, Coos County, and the City of North Bend, and include road improvements and other mitigation measures required by the agencies.

The Southwest Oregon Regional Airport is located in the City of North Bend, directly across Coos Bay and less than 1 mile from the LNG terminal. The end of the runway at the airport is about 1.1 miles from the terminal LNG storage tanks. In 2014, the Federal Aviation Administration (FAA) issued four Notices of Presumed Hazard for the two LNG storage tanks at the terminal and two towers at the South Dune Power Plant. In this EIS, we recommend that construction should not begin until after Jordan Cove files determinations from the FAA, including the resolution of the hazard findings, and the results of any additional airport studies.

About 709 existing roads would be used to access the Pacific Connector pipeline right-of-way and move construction equipment, materials, and personnel. Pacific Connector estimated that 80 percent of the workforce would be transported from contractor yards to and from the right-of-way on crew buses. Impacts on local traffic would be minimized by following the measures outlined in Pacific Connector's *Transportation Management Plans*.

Cultural Resources

Cultural resource inventories have been conducted covering the Jordan Cove LNG terminal facilities; except the NPWHC. These investigations identified three archaeological sites, which require additional testing and monitoring.

For the Pacific Connector Project, surveys have covered about 201 miles of the pipeline route, the compressor station and meter station locations, 26 pipe or contractor yards, 16 rock source or disposal areas, 497 access road segments, and 98 temporary extra workspace areas (92 fully surveyed, 6 partly surveyed). These investigations resulted in the identification of 104 archaeological sites within the area of potential effect; with 79 of these sites on non-federal land, and 25 sites on federal land. We made determinations of eligibility for the National Register of Historic Places (NRHP) and Project effects after consultations with the Oregon State Historic Preservation Office (SHPO), applicable federal land management agencies, and interested Indian tribes. We determined that 21 sites on non-federal land are not eligible for the NRHP and require no further work, and 19 sites can be avoided or the Project would have no adverse effects on them. There are 27 sites on non-federal land that are unevaluated and require additional investigations. Twelve sites on non-federal land are eligible for the NRHP and cannot be avoided, and require data recovery excavations as treatment. Of the sites identified on federal lands, 14 are not eligible for the NRHP and require no further work. Three sites should be avoided, and we found that the Project would have no adverse effects on two sites. Additional information is needed for one site. Five sites on federal land are eligible for the NRHP and cannot be avoided, and require data recovery excavations as treatment.

The resolution of adverse effects at historic properties that would be adversely affected by the Project would be conducted as outlined in a Memorandum of Agreement (MOA) filed with the Advisory Council on Historic Preservation in August 2011 under the previous LNG import and sendout pipeline projects in Docket Nos. CP07-441-000 and CP07-444-000. The MOA also detailed procedures for phased additional investigations in areas where access was previously denied. If the Project is authorized by the Commission, we would amend the MOA. In this EIS we recommend that construction not begin until after Jordan Cove and Pacific Connector file additional inventory and testing reports; the review of those reports by the SHPO, federal land managing agencies, and interested Indian tribes; and the FERC staff amends the MOA.

We have conducted government-to-government consultations with Indian tribes that may attach religious or cultural significance to sites in the region, or may be interested in potential Project impacts on cultural resources. While the applicants have also communicated with interested Indian tribes, we are recommending that before construction can begin, Jordan Cove should finalize its Memorandum of Understanding with interested Indian tribes, and Pacific Connector should document meetings and agreements with the Cow Creek Band of Umpqua Tribe of Indians and the Klamath Tribes.

Air Quality and Noise

Jordan Cove's Prevention of Significant Deterioration (PSD) preconstruction permit application demonstrates compliance with all requirements. The airshed basin that contains the project area is in attainment with General Conformity requirements. During construction, a temporary reduction in ambient air quality may result from emissions and fugitive dust generated by equipment. Construction of the LNG terminal would not result in a significant impact on

regional air quality or result in any violation of applicable ambient air quality standard. The PSD permit application showed that during terminal operations all carbon monoxide impacts and annual impacts from sulfur dioxide, nitrous oxide (NO_2), and particulate matter with a diameter of less than 10 microns (PM_{10}) were below significant levels. For all pollutants generated during terminal operations, the combined impacts at the points of highest concentration are well below the applicable National Ambient Air Quality Standards (NAAQS) and the PSD increments.

The airsheds through which the Pacific Connector pipeline route would pass all attain the ambient air quality standards, with one exception. About 4.3 miles of pipeline route and the Klamath Compressor Station would be located within the Klamath Falls $PM_{2.5}$ nonattainment area, and about 325 feet of pipeline route within the PM_{10} maintenance area. Pipeline construction would not result in significant impacts on regional air quality or result in any violation of applicable ambient air quality standard. Operation of the Klamath Compressor Station could have 1-hour NO_2 impacts that approach the NAAQS. Potential emissions of Hazardous Air Pollutants from the turbines, boiler, and generator at the station are estimated to be just 1.3 tons per year. Both Jordan Cove and Pacific Connector would obtain required permits issued by the ODEQ under the Clean Air Act (CAA) prior to construction.

Operation of the Project would be a significant source of greenhouse gas (GHG) emissions (2.1 million metric tonnes of carbon dioxide equivalent per year). However, the Project could be an important reducer of global GHG to the extent that it displaces current (and projected increasing) coal use in Asia. The type of displacement that would actually occur depends on a multitude of complex geopolitical and economic factors that cannot reasonably be foreseen.

Noise from construction of the LNG terminal is expected to be similar to typical commercial structure construction programs, which average from 47 to 57 A-weighted decibels (dBA) at 2,000 feet. These levels would be reduced by more than 15 dBA at the 1.4-mile distance to the nearest noise sensitive area (NSA). Noise from operation of the LNG terminal is predicted to have a day-night sound level (L_{dn}) of about 51.4 dBA at one NSA. This would be below the FERC standard of an L_{dn} of 55 dBA.

Noise from construction of the Pacific Connector pipeline would be temporary, and would dissipate with distance. Pipeline construction noise is predicted to be 95 dBA at 50 feet, and would attenuate to 87 dBA and 74 dBA at 100 feet and 300 feet, respectively. HDDs for the pipeline would generate estimated L_{dn} sound levels between 59.6 to 72.7 dBA at the four nearest residences to the Coos River crossing, 62.6 to 70.8 dBA at the three nearest residences to the Rogue River crossing, and 57 to 58.4 dBA at the three nearest residences to the Klamath River crossing. We are recommending that Pacific Connector implement noise mitigation for all HDDs to reduce the noise levels below 55 dBA.

During operation of the Klamath Compressor Station noise levels are estimated to vary between 47.5 and 56.1 L_{dn} dBA at the closest residences. Pacific Connector has agreed to acquire the two closest houses to the station where operational noise levels may be above our standard of an L_{dn} of 55 dBA. We are also recommending that both Jordan Cove and Pacific Connector file the results of noise surveys after putting their facilities into service, to document compliance with our standard.

Reliability and Safety

As part of the NEPA review, Commission staff must assess whether the proposed facilities would be able to operate safely and securely. As a result of our technical review of the preliminary engineering design and our recommended mitigation, we conclude that the facility design proposed by Jordan Cove includes acceptable layers of protection or safeguards which would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the off-site public.

As a cooperating agency, DOT assisted FERC staff in evaluating whether Jordan Cove's proposed design would meet the DOT siting requirements. On June 18, 2014, DOT provided a letter to the FERC staff stating that DOT had no objection to Jordan Cove's methodology for determining the single accidental leakage sources for candidate design spills to be used in establishing the 49 CFR Part 193 siting requirements for the proposed LNG liquefaction facilities. Based on the hazardous area calculations we reviewed, we conclude that potential hazards from the siting of the facility at this location would not have a significant impact on public safety. The areas impacted by these design spills also appear to meet the DOT's exclusion zone requirements by either being within the facility property boundary, within land controlled by Jordan Cove, or over a navigable body of water. If the facility is constructed and becomes operational, the facility would be subject to DOT's inspection and enforcement program. Final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by DOT staff.

As a cooperating agency, the Coast Guard analyzed the suitability of the waterway for LNG marine traffic. Based on its review and its own independent risk assessment, the Coast Guard has determined that the waterway could be made suitable for the type and frequency of LNG marine traffic associated with the proposed Jordan Cove LNG facility. This opinion was contingent upon the availability of additional measures necessary to responsibly manage the maritime safety and security risks. If appropriate resources are not in place prior to LNG vessel movement along the waterway, then the Coast Guard would consider at that time what, if any, vessel traffic and/or facility control measures would be appropriate to adequately address navigational safety and maritime security considerations.

Cumulative Impacts

Construction of the Project, in addition to other projects within the same watersheds, would have cumulative impacts on a range of environmental resources. This EIS addresses those cumulative impacts by resource. For the federal projects, there are laws and regulations in place that protect waterbodies and wetlands, threatened and endangered species, and historic properties, and limit impacts from air and noise pollution. The BLM and Forest Service have requirements in their LMPs to protect resources on the lands they manage. For some resources, there are also state laws and regulations that apply to private projects. The design features, best management practices, permitting requirements, and proposed mitigation measures for this Project should reduce impacts on environmental resources. The analysis area is vast; the 19 fifth-order watersheds crossed by the pipeline route include more than two million acres. We conclude that the Project would not have significant adverse cumulative impacts when added to other projects in a watershed, because the total percentage of land impacted by the combined projects within a watershed would be minimal at the landscape scale.

MAJOR CONCLUSIONS

We conclude that construction and operation of the Project would result in some limited adverse environmental impacts. However, most of these impacts would be reduced to less-than-significant levels with the implementation of the applicants' proposed mitigation measures and the additional measures we recommend in this EIS. The primary reasons for our decision are:

- LNG marine traffic in the waterway would be required to adhere to any vessel traffic and/or facility control measures determined necessary by the Coast Guard to address navigational safety and maritime security considerations;
- the final engineering design for the LNG terminal would incorporate detailed seismic specifications and other measures to protect the terminal from future earthquakes and potential tsunamis, and mitigation measures would be implemented by Pacific Connector to address landslides and other geological hazards along the pipeline route;
- Jordan Cove would implement the measures outlined in the FERC's *Plan* and *Procedures* and its own ESCP, and Pacific Connector would implement the measures its project-specific ECRP, which would minimize impacts on soils, waterbodies, and wetlands;
- Jordan Cove would implement the measures of its *Project Compensatory Wetland Mitigation Plan* to mitigate for the loss of wetlands, and its *Wildlife Habitat Mitigation Plan* to mitigate for the loss of vegetation at the terminal location;
- Pacific Connector would implement the measures in its *Stream Crossing Risk Analysis*, *Report on Preliminary Pipeline Study of the Haynes Inlet Water Route, HDD Contingency Plan and Failure Procedures,* and *Hydrostatic Testing Plan* to minimize impacts on waterbodies, and its *Integrated Pest Management Plan* to minimize the potential spread of vegetative pests and noxious weeds;
- the COE and ODEQ may issue permits to Jordan Cove and Pacific Connector under the RHA, CWA, and CAA that would contain measures to minimize impacts on water quality and air quality;
- Jordan Cove and Pacific Connector would obtain a determination from ODLCD that the Project is consistent with the CZMA;
- If the Project is approved, then the BLM and Forest Service could amend their respective LMPs in the appropriate Districts and National Forests to allow for the pipeline, and the BLM could issue a Right-of-Way Grant to Pacific Connector for an easement over federal lands, to be concurred with by the Forest Service and Reclamation, based on the implementation of an approved Plan of Development that includes additional measures to minimize impacts on environmental resources;
- Pacific Connector would implement the measures in its *Compensatory Mitigation Plan* to mitigate for impacts on federally listed threatened and endangered species;
- The FERC would revise its BA, enter into formal consultations with the NMFS and FWS, and the Services would issue biological opinions that include additional conservation measures to assure that the Project would not jeopardize the continued existence of any species under their jurisdiction and would not adversely modify or destroy designated critical habitat;
- adverse effects on historic properties would be resolved through an amended Project MOA;
- the LNG terminal would meet the federal safety regulations regarding the thermal radiation and flammable vapor dispersion exclusion zones and appropriate design

standards, and Pacific Connector's natural gas facilities would also be designed, constructed, and operated in accordance with DOT safety standards; and

- an environmental inspection and mitigation monitoring program would be implemented to ensure compliance with all mitigation measures that become conditions of any FERC authorization.

In addition, we recommend that the Commission Project Order include as an environmental appendix the 102 conditions listed in section 5.2 of this FEIS. Jordan Cove and Pacific Connector should be required to implement those environmental conditions and mitigation measures to further reduce the impacts that may result from construction and operation of their facilities. We determined that these additional measures are necessary to reduce adverse impacts associated with the Project, and, in part, we are basing our conclusions in the FEIS on the implementation of the measures.

1.0 INTRODUCTION

The vertical line in the margin identifies text that is new or modified in the FEIS and differs materially from corresponding text in the DEIS. Changes were made to address comments from cooperating agencies and other stakeholders on the DEIS; incorporate modifications to the Project after publication of the DEIS; update information included in the DEIS; and incorporate information filed by Jordan Cove Energy Project, L.P. and Pacific Connector Gas Pipeline, LP in response to our recommendations in the DEIS. As a result of the changes, some of the recommendations identified in the DEIS are no longer applicable to the Project and do not appear in the FEIS, while some recommendations identified in the DEIS have been substantively modified in the FEIS, and some new recommendations have been added in the FEIS.

1.1 PROJECT SUMMARY

On May 21, 2013, Jordan Cove Energy Project, L.P. (Jordan Cove)[1] filed an application for its liquefaction project with the Federal Energy Regulatory Commission (FERC or Commission) under Section 3 of the Natural Gas Act (NGA). Pacific Connector Gas Pipeline, LP (Pacific Connector)[2] filed its companion application with the FERC for the supply pipeline to Jordan Cove's liquefied natural gas (LNG) terminal under Section 7 of the NGA on June 6, 2013. The FERC issued a Notice of Application for the Jordan Cove Liquefaction Project on May 30, 2013, and a Notice of Application for the Pacific Connector Pipeline Project was issued on June 19, 2013. Hereafter in this environmental impact statement (EIS), Jordan Cove and Pacific Connector are also referred to as the applicants, and their inter-related proposals are collectively referred to as the Jordan Cove Energy and Pacific Connector Gas Pipeline (JCE & PCGP) Project, or the Project.[3]

In Docket No. CP13-483-000, Jordan Cove seeks authorization to construct and operate a new LNG export terminal in Coos County, Oregon. The terminal would be capable of receiving natural gas, processing that gas, liquefying the gas into LNG, storing the LNG, and loading the LNG onto vessels at its marine dock. Jordan Cove indicated that it could receive a maximum of 1.03 billion cubic feet per day (Bcf/d) of natural gas from Pacific Connector and produce a maximum of 6.8 million metric tons per annum (MMTPA) of LNG.[4]

In Docket No. CP13-492-000, Pacific Connector seeks a Certificate of Public Convenience and Necessity (Certificate) to construct and operate a new 232-mile-long, 36-inch-diameter natural gas transmission pipeline, crossing through Klamath, Jackson, Douglas, and Coos Counties, Oregon.

[1] Seventy-five percent of Jordan Cove is controlled by Jordan Cove LNG LP, a Delaware limited partnership that is a subsidiary of Veresen Inc. (Veresen), and 25 percent is controlled by Energy Projects Development LLC, a Colorado limited liability company owned by private investors. See Jordan Cove's April 23, 2014, filing with the FERC in Docket No. CP13-483-000.

[2] Pacific Connector is a joint venture between Veresen and the Williams Companies Inc. (Williams), with Williams Pacific Connector Gas Operator LCC as the manager and operator of the pipeline.

[3] Individually, the Jordan Cove proposal is referred to as the Jordan Cove Liquefaction Project, Jordan Cove LNG terminal, Jordan Cove Project, or Jordan Cove facilities; the Pacific Connector proposal may be referenced similarly, as the Pacific Connector Pipeline Project, Pacific Connector pipeline, or pipeline project.

[4] See Jordan Cove's January 15, 2015, filing with the FERC.

The pipeline would be designed to transport natural gas from interconnections with the existing Ruby Pipeline LLC (Ruby)[5] and Gas Transmission Northwest LLC (GTN) systems near Malin, Oregon.

Pacific Connector also requested a blanket certificate to allow for future construction, operation, and abandonment activities under Subpart F of Title 18 Code of Federal Regulations (CFR) Part 157 of the Commission's regulations, and requested a blanket certificate to provide open-access transportation services under its tariff in accordance with Subpart G of Part 284. Requests for future minor actions performed under the blanket program are restricted to minor actions and would be filed as prior notices or in annual reports that would be subject to individual environmental reviews by FERC staff in accordance with Part 157.206.

The FERC is the federal agency responsible for authorizing onshore LNG terminals and interstate natural gas transmission facilities, as specified in Section 311(e)(1) of the Energy Policy Act of 2005 (EPAct) and the NGA. For the JCE & PCGP Project, in accordance with Section 313(b)(1) of the EPAct, the FERC is the lead federal agency for the coordination of all applicable federal authorizations, and is also the lead federal agency for preparation of this EIS in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA), as outlined in the Council on Environmental Quality (CEQ) regulations for implementing the NEPA (40 CFR Parts 1500-1508).

The United States (U.S.) Department of Agriculture Forest Service (Forest Service) Pacific Northwest Region; U.S. Army Corps of Engineers (COE) Portland District; U.S. Department of Energy (DOE); U.S. Environmental Protection Agency (EPA) Region 10; U.S. Department of Homeland Security Coast Guard (Coast Guard) Portland, Sector Columbia River; U.S. Department of the Interior Bureau of Land Management (BLM) Oregon State Office, Bureau of Reclamation (Reclamation) Klamath Basin Area Office, and Fish and Wildlife Service (FWS) Oregon State Office; and the Pipeline and Hazardous Materials Safety Administration (PHMSA) within the U.S. Department of Transportation (DOT) are cooperating agencies, as defined in 40 CFR Part 1501.6, for the development of this EIS. A cooperating agency has jurisdiction by law or special expertise with respect to environmental impacts involved with the proposal, and can participate in the NEPA analysis.

The Forest Service, COE, DOE, EPA, BLM, Reclamation, FWS, and DOT are cooperating in a manner consistent with an interagency agreement signed in May 2002 with the FERC regarding early coordination of required environmental and historic preservation reviews of interstate natural gas pipeline facilities.[6] The Coast Guard and DOT are also cooperating with the FERC under the

[5] Veresen, the partner who owns portions of Jordan Cove and Pacific Connector, recently acquired a 50 percent stake in the Ruby Pipeline; see Natural Gas Intelligence, 29 September 2014, "Veresen Sees New Ruby Pipeline Stake as Upside for Jordan Cove LNG."

[6] May 2002 Interagency Agreement on Early Coordination of Required Environmental and Historic Preservation Reviews Conducted in Conjunction With the Issuance of Authorizations to Construct and Operate Interstate Natural Gas Pipelines Certificated by the Federal Energy Regulatory Commission, signed by the FERC, Advisory Council on Historic Preservation, CEQ, EPA, Department of the Army, Department of Agriculture, Department of Commerce, DOE, Department of the Interior, and DOT.

terms of a February 2004 interagency agreement for review of LNG facilities.[7] In June 2005, the FERC and COE entered into a Memorandum of Understanding (MOU) that specified that the FERC, as lead federal agency, would be responsible for determining the purpose and need of a project for the NEPA document and the Commission's authorization. Although the COE should exercise its independent judgment while carrying out its regulatory responsibilities, it should give deference, to the maximum extent allowed by law, to the FERC's determinations of project purpose, need, and alternatives.[8] The purpose and scope of the actions of the federal cooperating agencies with regards to the review of this Project are further summarized in section 1.3 below. Together with the cooperating agencies, it is the intent of the FERC to produce an EIS that satisfies the requirements of the NEPA. Prior to issuance of this EIS, the cooperating agencies had opportunities to review preliminary and administrative drafts and comment to the FERC.

While the FERC authorizes the siting, construction, and operation of onshore LNG terminals, authorization to export LNG to foreign countries is granted by the DOE's Office of Fossil Energy. The DOE authorized Jordan Cove to export LNG to free trade agreement (FTA) nations in 2011, and authorized the export of LNG to non-FTA nations in March 2014.[9] The purpose and need for the DOE actions are further summarized below in section 1.3.2.

The BLM and Forest Service would use this EIS in their assessments of amendments they are considering to their land management plans (LMP) for the Coos Bay, Roseburg, Medford, and Lakeview Districts, and for the Umpqua, Rogue River, and Winema National Forests. In addition, the BLM would use this EIS when considering the issuance of a Right-of-Way Grant to Pacific Connector for a pipeline easement over federal lands, with concurrence from the Forest Service and Reclamation (as further discussed below in sections 1.4.2 and 4.1.3.4).

1.1.1 Background

Natural gas, which is primarily methane (CH_4), is a naturally occurring fossil fuel that is used for a variety of purposes, including industrial, electric generation, home heating and cooking, and in some cases as a fuel for motor vehicles. Natural gas is obtained from underground sources and transported in pipelines from its place of production to customers. In the United States, the interstate transportation of natural gas via pipelines and its storage as LNG[10] are regulated by the FERC. Domestic exploration, production, gathering, and intrastate transportation of natural gas,

[7] February 2004 Interagency Agreement Among the Federal Energy Regulatory Commission, United States Coast Guard, and Research and Special Programs Administration for the Safety and Security Review of Waterfront Import/Export Liquefied Natural Gas Facilities.

[8] *Memorandum of Understanding Between the United States Army Corps of Engineers and the Federal Energy Regulatory Commission Supplementing the Interagency Agreement on Early Coordination of Required Environmental and Historic Preservation Reviews Conducted in Conjunction with the Issuance of Authorizations to Construct and Operate Interstate Natural Gas Pipelines Certificated by the Federal Energy Regulatory Commission*, executed 30 June 2005.

[9] The DOE issued its *Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Jordan Cove LNG Terminal to Free Trade Agreement Nations* on December 7, 2011 in FE Docket No. 11-127-LNG. On March 24, 2014, DOE issued its *Order Conditionally Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel From the Jordan Cove LNG Terminal in Coos Bay, Oregon to Non-Free Trade Agreement Nations* in Docket No. 12-32-LNG (DOE/FE Order No. 3413).

[10] LNG storage in cryogenic tanks for domestic pipeline transportation, not an import or export terminal, is referred to as a "peak shaving plant."

including local distribution pipeline networks to individual consumers, are activities regulated by the states.

LNG is natural gas that has been cooled to about -260 degrees Fahrenheit (°F), which turns the gas into a liquid. As a liquid, LNG is about 600 times more compact than its equivalent amount of gas vapors. Once liquefied, it can then be stored in cryogenic containers, and transported great distances overseas between natural gas producing countries and consumers using specially designed ships. After receipt at an import terminal, the LNG can be warmed and vaporized back into a gaseous state.

On September 4, 2007, Jordan Cove, in Docket No. CP07-444-000, filed an application with the FERC to construct and operate an LNG import terminal at Coos Bay, Oregon. That same day, Pacific Connector, in Docket No. CP07-441-000, filed an application with the FERC to construct and operate a 234-mile-long, 36-inch-diameter natural gas sendout pipeline connecting the Jordan Cove LNG import terminal with existing natural gas transportation systems, including the facilities of Northwest Pipeline GP (Northwest), Avista Corporation (Avista), GTN, Tuscarora Gas Transmission Company (Tuscarora), and Pacific Gas and Electric Company (PG&E). The purpose of the Jordan Cove LNG import terminal was to provide new sources of natural gas to the West Coast of the United States. It was Pacific Connector's original intent to transport those additional supplies of natural gas from the Jordan Cove terminal to markets in Oregon, California, and Nevada. In May 2009, the FERC produced a final EIS (FEIS) for Docket Nos. CP07-441-000 and CP07-444-000. The Commission authorized both the Jordan Cove LNG import terminal and the Pacific Connector sendout natural gas pipeline in an *Order Granting Authorizations Under Section 3 of the Natural Gas Act and Issuing Certificates* on December 17, 2009.

On April 16, 2012, the Commission issued an *Order Granting Rehearing in Part, Dismissing Request for Stay, and Vacating Certificate and Section 3 Authorizations* that vacated the authorizations for both the Jordan Cove LNG import terminal in Docket No. CP07-444-000 and the associated Pacific Connector sendout pipeline in Docket No. CP07-441-000. The Commission vacated the authorizations because the LNG import purpose for the project was no longer feasible.[11]

Despite the vacation of Jordan Cove's LNG import proposal and the associated Pacific Connector sendout pipeline, including the public records supporting its original December 17, 2009 authorizations, the Commission held that portions of our[12] FEIS produced in May 2009 could still be valid for re-use. As stated in the April 16, 2012 Commission Order: "Depending on the details of the proposed project, it is possible that portions of the environmental information and analysis developed in conjunction with the import terminal may remain viable for resubmission and use for the contemplated export terminal and associated pipeline facilities."[13] Therefore, where applicable, this current EIS references information from the May 2009 FEIS.

On February 29, 2012, Jordan Cove requested that the FERC consider initiating the environmental pre-filing process for its liquefaction project. The FERC accepted that request on March 6, 2012,

[11] 139 FERC § 61,040, Section IV., page 7, paragraph 20.
[12] The pronouns "we," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects (OEP). In addition, we consider the staffs of our third-party environmental contractor, and the federal cooperating agencies and their contractors who are participating in the production of this EIS to be an extension of the FERC staff.
[13] 139 FERC § 61,040

and assigned Docket No. PF12-7-000 to the Jordan Cove LNG export proposal. On June 7, 2012, Pacific Connector filed its revised request to initiate the FERC's environmental pre-filing process for its newly proposed pipeline project. The FERC accepted that request on June 8, 2012, assigning Docket No. PF12-17-000 to the new Pacific Connector pipeline proposal. The public scoping activities that were part of the FERC's pre-filing process, including consultations with stakeholders, are described in section 1.6 below.

1.1.2 Current Proposals

The proposed action analyzed in this EIS includes the activities outlined in Jordan Cove's and Pacific Connector's applications to the FERC. The Commission and cooperating agencies would consider the potential environmental impacts of the applicants' proposals as disclosed in this EIS prior to making their decisions. Below is a brief summary of the facilities included in the proposal; however, see chapter 2 for a full description of these facilities and the proposed action.

The main jurisdictional facilities associated with Jordan Cove's LNG export terminal include:

- access channel from the existing Coos Bay navigation channel, and a terminal marine slip with a berth for one LNG vessel and a dock for tug and escort boats;
- LNG loading platform and transfer line;
- LNG storage system, consisting of two full-containment storage tanks;
- four natural gas liquefaction trains;
- emergency and hazard systems, plant systems, and electrical systems;
- a utility corridor between the LNG terminal and the South Dunes Power Plant;
- a pipeline gas conditioning facility;
- the North Point Workforce Housing Complex (NPWHC); and
- other security and control facilities, administrative buildings, and support structures associated with the terminal.

The non-jurisdictional facilities associated with the Jordan Cove's LNG export terminal would include:

- South Dunes Power Plant, consisting of a nominal 420-megawatt (MW) natural gas–fired combined cycle electric generating system and heat recovery steam generator units;
- Southwest Oregon Regional Security Center (SORSC); and
- other security and control facilities, administrative buildings, and support structures associated with the power plant.

The main jurisdictional natural gas pipeline facilities proposed by Pacific Connector include:

- a 232-mile-long,[14] 36-inch-diameter welded steel underground pipeline, extending between interconnections near Malin and the Jordan Cove terminal;
- the Klamath Compressor Station, at the eastern beginning of the pipeline;

[14] The total length of the pipeline does not match the mileposts (MP), which have been retained from the original route proposed in Docket No. CP07-441-000. Where realignments have been adopted into the proposed route, the MPs are designated with an "R." In addition, the MPs are reversed, numbered from west to east, again as a reflection of the engineering design for the original pipeline for the vacated LNG import project. Now, in Docket No. CP13-492-000, the Pacific Connector pipeline would begin at the Klamath Compressor Station at MP 228.1 and terminate at the Jordan Cove Meter Station at MP 1.5R.

- four meter stations, including the Klamath-Beaver Meter Station and Klamath-Eagle Meter Station co-located within the Klamath Compressor Station tract, the Clarks Branch Meter Station, and the Jordan Cove Meter Station;
- five pig[15] launcher or receiver units, co-located with other aboveground facilities;
- 17 mainline block valves (MLV); and
- a gas control communication system, including 11 radio towers, co-located at other facilities.

The non-jurisdictional facilities associated with the Pacific Connector Pipeline Project include electric lines to the meter stations and compressor station.

The general location of facilities proposed by Jordan Cove and Pacific Connector, as well as the extent of various land-ownerships, are shown on figure 1.1-1. The facilities are more fully described in section 2.1 of this EIS.

1.1.3 Major Differences Between the Import and Export Proposals

In its original Docket No. CP07-444-000, Jordan Cove proposed to import LNG, while in its new proposal in Docket No. CP13-483-000 it would export LNG. The switch to LNG export rather than import resulted in some design changes at the terminal. For example, the vaporizers which were critical elements for an LNG import terminal would be unnecessary at an export terminal, and instead would be replaced by liquefaction trains, and the addition of refrigerant resupply and storage, and aerial cooling system. The natural gas liquids extraction facility for the LNG import proposal in Docket No. CP07-444-000 would not be necessary for the export proposal, and would be replaced by a pipeline natural gas processing plant.

While the waterway for LNG marine traffic is the same, the number of LNG vessels visiting the terminal is expected to increase from 80 vessels per year in the import proposal to 90 vessels per year for the export project. The slip for the export terminal was redesigned to incorporate a new open cell technology sheet pile berth on the east side for LNG vessels. The new berth design would eliminate many of the previously proposed pilings to be installed in the slip.

Two excavated and dredged material disposal areas associated with the original LNG import terminal proposal would be eliminated from the current LNG export terminal proposal. This includes elimination of the Jordan Cove Excavated Material Stockpile Site on the north side of the LNG terminal, because those materials would now be placed at the former Weyerhaeuser linerboard mill site, where the newly planned South Dunes Power Plant would be located, about 1 mile east of the liquefaction facility. The firewater ponds for the LNG export terminal would now be relocated to the former site of the Jordan Cove Excavated Material Placement Site within the terminal tract. The Port Commercial Sand Stockpile Site and the slurry pipeline between the terminal and the stockpile site, proposed in Docket No. CP07-444-000, would also be eliminated for the export project, as the materials dredged during construction of the access channel would now be deposited at the former Weyerhaeuser linerboard mill site.

[15] A pig is an internal pipeline cleaning and inspection tool.

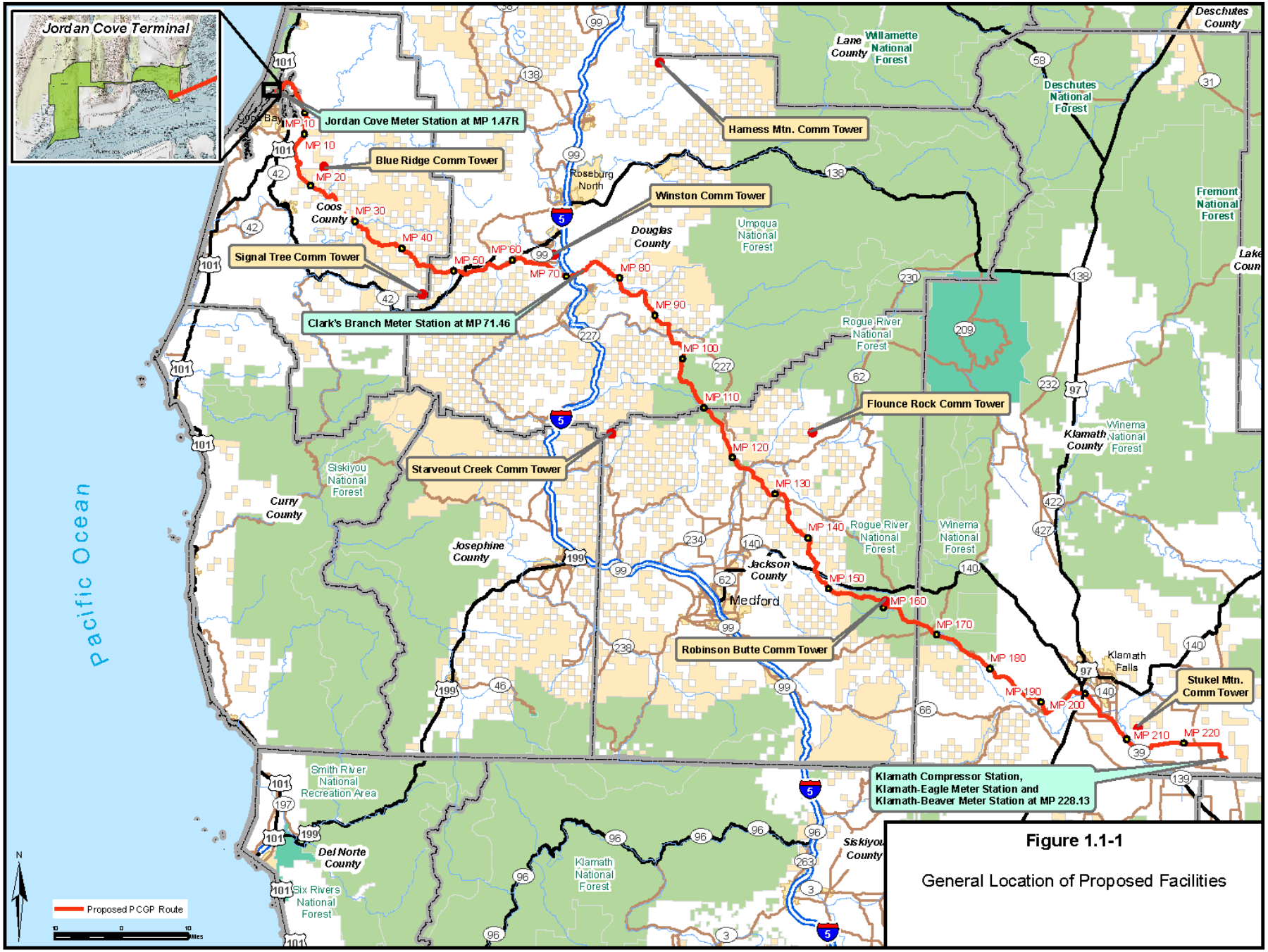

Figure 1.1-1

General Location of Proposed Facilities

The 420-MW South Dunes Power Plant would take the place of the smaller 37-MW electric power plant within the import terminal tract, as planned under Docket No. CP07-444-000. A new 1-mile-long, 150-foot-wide utility corridor would be installed between the South Dunes Power Plant and the LNG export terminal.

In addition, some of the support buildings at the terminal have changed or been relocated since the original proposal. A new SORSC would be erected on the east side of Jordan Cove Road, south of the Trans-Pacific Parkway. The firewater pump building would be moved to the new location for the firewater ponds in the northwest corner of the terminal tract.

A number of new temporary work areas were identified that would be necessary during construction of the LNG export terminal. A temporary workers construction camp and parking lot would be located on the north side of the city of North Bend, south of the McCullough Bridge. Two other temporary parking lots would be used during construction: one at the Mill Casino in the city of Coos Bay, and the other at the abandoned Myrtlewood recreational vehicle (RV) park near the community of Hauser. New temporary laydown areas to be used during construction would be located north of the liquefaction trains within the LNG terminal, west of the gas processing plant, and south of the South Dunes Power Plant (see figure 2.1-2, in the next chapter of this EIS).

In addition, Jordan Cove identified three new wetland mitigation areas. They include the West Bridge site on the east side of the existing Roseburg Forest Products property, the West Jordan Cove site located southeast of the West Bridge site, and the Kentuck Slough site on the north side of Coos Bay about 3 miles east of the LNG terminal (see figure 2.1-1, in the next chapter).

Table 1.1.3-1 lists both the elements deleted from the former LNG import terminal in Docket No. CP07-444-000, and the elements added or modified for the newly proposed LNG export terminal in Docket No. CP13-483-000.

TABLE 1.1.3-1

Major Differences Between the Previous LNG Import Proposal in Docket No. CP07-444-000 and the Current Jordan Cove Export Terminal in Docket No. CP13-483-000

Element	Size/Location a/	Reasons for the Changes
Elements Deleted or Modified from the Formerly Proposed LNG Import Terminal in Docket No. CP07-444-000		
LNG unloading platform overwater at the vessel berth	16 acres for the LNG vessel berth and transfer pipeline on the east side of the terminal marine slip.	The LNG unloading platform over water on the east side of the marine slip would be removed for the new export terminal proposal, and replaced by new open cell technology sheet pile LNG vessel berth design and onshore loading platform for the export proposal.
Gas vaporizers	Six submerged combustion vaporizers located within the 20-acre LNG terminal process area.	Gas vaporizers are not necessary for a liquefaction project.
Natural gas liquid extraction facilities	Less than 1 acre, to the east of the LNG terminal, within the Roseburg Forest Products property.	Natural gas liquid extraction facilities are not necessary for the liquefaction project. Replaced by pipeline natural gas conditioning facility, to be located on the west side of the South Dunes Power Plant.
37-MW power plant	Located within the 20-acre LNG terminal process area.	This small plant was replaced by the larger 420-MW South Dunes Power Plant, as more electricity would be needed for the liquefaction project.

TABLE 1.1.3-1

Major Differences Between the Previous LNG Import Proposal in Docket No. CP07-444-000 and the Current Jordan Cove Export Terminal in Docket No. CP13-483-000

Element	Size/Location a/	Reasons for the Changes
Administration building	55-foot by 81-foot sized building, within 18 acres located along the former access road to the LNG terminal.	Replaced by new control building along new utility corridor, and new administration building on the north side of the new gas processing plant between the South Dunes Power Plant and Jordan Cove Road.
Jordan Cove excavated material placement site	149 acres on the north side of the LNG terminal.	Materials excavated during construction of the marine slip would now be placed at the South Dunes Power Plant site.
Port commercial sand stockpile site	68 acres, on the North Spit about 1.5 miles southwest of the LNG terminal.	Materials dredged during construction of the access channel would now be placed at the South Dunes Power Plant site.
Dredged material slurry pipeline to Port commercial sand stockpile site	3 acres, on the North Spit extending 1.6 miles from LNG terminal to the formerly proposed Port commercial sand stockpile site.	Elimination of the Port commercial sand stockpile site eliminates the need for the slurry pipeline to that site.
Elements Added to or Modified at the Newly Proposed LNG Export Terminal in Docket No. CP13-483-000		
90 LNG vessel visits per year	Waterway for LNG marine traffic would use existing navigation channel in Coos Bay, which is 300 feet wide and 7.5 miles long to the Jordan Cove terminal.	Increase in number of LNG vessel visits for export from 80 per year for the import proposal.
LNG vessel berth and loading platform	9 acres, including the transfer pipeline, on the east side of the marine slip.	New open cell technology sheet pile for LNG vessel berth on east side of the Marine Slip. Loading facilities would be constructed on upland shore side, rather than on a platform over water as in the former berth design.
Barge dock	3 acres on the southeast side of the marine slip.	Barge dock needed to bring equipment and materials to the terminal.
LNG storage tanks	27 acres, north of the marine slip within the LNG terminal processing area.	Two LNG storage tanks shifted slightly to the west from original import proposal, with redesigned elevation and berm, and relocated impoundment basin.
Liquefaction trains	20 acres, on the east side of the terminal processing area.	Four liquefaction trains needed for LNG export proposal. They replace six vaporizers formerly proposed for the import project.
Refrigerant storage and resupply system	2 acres, north of the LNG storage tanks within the terminal processing area.	Needed for liquefaction.
Flare	1 acre, north of the refrigerant storage area within the terminal.	Flare redesigned and location changed.
Temporary construction laydown area	21 acres, northeast of the flare within the terminal.	Reconfigured for liquefaction project.
Terminal firewater pond and new pump building	4 acres, at northwest corner of the terminal tract.	Location moved to former location of Jordan Cove excavated material placement site for import proposal.
Terminal control building and warehouse	8 acres, along the new utility corridor between the South Dunes Power Plant area and the LNG terminal.	New design for the liquefaction project.
Industrial wastewater line relocation	13 acres, north of the terminal, parallel to the Trans-Pacific Parkway.	Existing industrial wastewater line used by Weyerhaeuser to be relocated to allow for construction of the LNG terminal.
Raw water line relocation	3 acres, north of the South Dunes Power Plant area, parallel to the Trans-Pacific Parkway.	Existing water line to be relocated for liquefaction project.
Utility corridor from South Dunes Power Plant to LNG terminal	11 acres, 1 mile long and 150 feet wide, between South Dunes Power Plant and LNG terminal.	New utility corridor, for electric power lines and access road, from power plant to LNG terminal, as more electricity is needed for liquefaction project.
Southwest Oregon Regional Safety Center	8 acres, on east side of Jordan Cove Road, west of the South Dunes Power Plant.	New facility for fire protection, Sheriff, Coast Guard, and Port offices.

TABLE 1.1.3-1

Major Differences Between the Previous LNG Import Proposal in Docket No. CP07-444-000 and the Current Jordan Cove Export Terminal in Docket No. CP13-483-000

Element	Size/Location a/	Reasons for the Changes
Temporary gas processing plant construction laydown areas	4 acres, east of the SORSC and west of the gas processing plant.,	Newly identified areas for construction of the South Dunes Power Plant and related nearby facilities.
South Dune administration building, operations building, control building, hazardous material storage building, guard house, electrical powerhouse, and firewater pumphouse	4 acres, north of the gas processing plant.	New support buildings needed for the power plant complex.
Gas processing plant	9 acres, on the west side of the South Dunes Power Plant.	New pipeline gas conditioning facility needed for liquefaction project.
420-MW South Dunes Power Plant	58 acres, at former Weyerhaeuser linerboard mill site, 1 mile east of the LNG terminal, on the northeast side of geographic Jordan Cove.	Replaces smaller electric power plant formerly proposed for the LNG import terminal. More electricity would be needed for liquefaction project.
South Dunes temporary construction laydown areas and stormwater pond	11 acres, south of the South Dunes Power Plant.	Newly identified as needed for construction and operation of the South Dunes Power Plant.
Temporary North Point Workforce Housing Complex and parking lot	49 acres, on the North Bend side of the McCullough Bridge, about 2 miles southeast of LNG terminal.	New construction worker housing proposed for liquefaction project.
Temporary parking lot at the Mill Casino	Mill Casino parking lot, approx. 15 acres	New parking lot for commuting workers
Temporary parking lot at the Myrtlewood RV Camp	Myrtlewood RV Camp parking lot, approx. 6 acres	New parking lot for community workers near Hauser
West Jordan Cove wetland mitigation site	3 acres, east of the LNG terminal and west of the power plant.	Newly identified area to be dredged to create new estuarine wetland habitat to mitigate for wetlands lost during construction and operation of the liquefaction project.
West Bridge wetland mitigation site	2 acres, on the east side of the Roseburg Forest Products property.	Newly identified area to be maintained as a wetland to mitigate for wetlands lost during construction and operation of the liquefaction project.
Kentuck Slough Wetland Mitigation Site	44 acres, on the north side of Coos Bay, about 3 miles east of the LNG terminal.	Newly identified area to be maintained as a wetland to mitigate for wetlands lost during construction and operation of the liquefaction project.

a/ Acres rounded to the nearest whole acre.

The Pacific Connector pipeline would be basically the same as in Docket No. CP07-441-000, except the direction of the transportation of the natural gas is reversed, now going east to west. Instead of taking natural gas from the Jordan Cove terminal at Coos Bay and delivering it to the Oregon-California border, as proposed in CP07-441-000, the new pipeline proposal in Docket No. CP13-492-000 would take gas from the Malin hub to the Jordan Cove terminal. The Tulelake, Russell Canyon, and Buck Butte Meter Stations formerly proposed under Docket No. CP07-441-000 have been eliminated from the new proposal under Docket No. CP13-492-000, because Pacific Connector would no longer be providing natural gas to GTN, PG&E, and Tuscarora to serve markets in Oregon, California, and Nevada. In their place, Pacific Connector would construct and operate the new Klamath-Eagle and Klamath-Beaver Meter Stations, at new interconnections to receive natural gas from GTN and Ruby, within the newly proposed Klamath Compressor Station tract. The Butte Falls Compressor Station, formerly located at milepost (MP) 132.1 under Docket No. CP07-441-000, would be eliminated from the new project in Docket No. CP13-492-000, as Pacific Connector would now compress gas at the eastern beginning of its pipeline, at the Klamath Compressor Station, at MP 228.1.

The Shady Cove Meter Station proposed in Docket No. CP07-441-000 has been removed from the new pipeline project under Docket No. CP13-492-000 because Pacific Connector no longer intends to provide natural gas to the Avista system. The Clarks Branch Meter Station has been relocated to about MP 71.5 along the new realignment for the crossing of Interstate (I)-5 and the South Umpqua River. The location of the Jordan Cove Meter Station was relocated to MP 1.5R, adjacent to the newly planned South Dunes Power Plant, which is part of the Jordan Cove Liquefaction Project in Docket No. CP13-483-000. In addition, Pacific Connector has identified 17 new locations of its MLVs along the pipeline route.

The pipeline route remains relatively unchanged from that proposed under Docket No. CP07-441-000, and as analyzed in our May 2009 FEIS (see section 3.4 in chapter 3 for a description of the minor route variations that have been incorporated into the proposed route since the May 2009 FEIS). Table 1.1.3-2 lists both the elements deleted from the former pipeline project in Docket No. CP07-441-000, and the elements added or modified for the newly proposed pipeline project in Docket No. CP13-492-000.

TABLE 1.1.3-2

Major Differences Between the Original Pipeline Project Proposed in Docket No. CP07-441-000 and the Current Pacific Connector Project Proposed in Docket No. CP13-492-000

Element	Acres/Location a/	Reasons for the Changes
Elements Deleted or Modified from the Formerly Proposed Pacific Connector Pipeline Project in Docket No. CP07-441-000		
Jordan Cove Meter Station	2 acres, at original pipeline MP 0.0	Relocated to MP 1.5R, adjacent to the newly planned South Dunes Power Plant for the liquefaction project.
Clarks Branch Meter Station	1 acre, at original pipeline MP 69.7	Relocated to MP 71.5 along realignment for new crossings of I-5 and South Umpqua River.
Shady Cove Meter Station	3 acres, at original pipeline MP 122.1	Eliminated, as Pacific Connector would no longer be connecting to the Avista system.
Butte Falls Compressor Station	7 acres, at original pipeline MP 132.1	Eliminated; instead the compressor station would be moved to the eastern starting point of the Pacific Connector pipeline at MP 228.1.
Tulelake, Russell Canyon, and Buck Butte Meter Stations	7 acres, at original pipeline MP 230.9	Eliminated, as natural gas would no longer be delivered to GTN, PG&E, and Tuscarora at the Oregon-California border. Instead, Pacific Connector would now connect to the existing GTN and Ruby supply pipelines within the newly proposed Klamath Compressor Station at MP 228.1.
Elements Added to or Modified for the Newly Proposed Pacific Connector Pipeline Project in Docket No. CP13-492-000		
Klamath Compressor Station	31 acres, at pipeline MP 228.1	41,000 hp of compression at the eastern beginning of the Pacific Connector pipeline.
Klamath-Eagle and Klamath-Beaver Meter Stations	Within Klamath Compressor Station tract	To interconnect with existing GTN and Ruby pipeline systems at MP 228.1.
Clarks Branch Meter Station	1 acre, at newly proposed pipeline MP 71.5	Relocated because of route realignment for new crossing of I-5 and South Umpqua River between MPs 67.5 to 74.8.
Jordan Cove Meter Station	1 acre, at pipeline MP 1.5R	Relocated for new liquefaction project, adjacent to the South Dunes Power Plant.
17 MLVs	Total of about 2 acres outside of other proposed aboveground facilities, at MPs 1.5R, 15.7, 29.5, 48.4, 59.9, 71.5, 80.0, 94.7, 112.1, 122.2, 132,0, 150.7, 169.5, 187.4, 197.8, 214.3, and 228.1	MLVs relocated to account for realignments along pipeline route.

TABLE 1.1.3-2

Major Differences Between the Original Pipeline Project Proposed in Docket No. CP07-441-000 and the Current Pacific Connector Project Proposed in Docket No. CP13-492-000

Element	Acres/Location a/	Reasons for the Changes
Major route realignments related to the (1) Brunschmid Wetland Reserve; (2) Weaver Ridge; (3) I-5 and Western South Umpqua River Crossings; and (4) McLoughlin Lane	MPs 9.4R to 12.4R; MPs 42.7 to 49.8; MPs 67.5 to 74.8; and MPs 187.4 to 191.1	See section 3.4

a/ Acres rounded to the nearest whole acre.

1.1.4 Changes Since the November 2014 DEIS

Substantial changes in the text made since the DEIS are marked with a vertical line in the margin. In general, this document has been updated to include new information from the applicants that was filed with the FERC after November 2014, and new information and comments made on the DEIS by cooperating agencies and the public. This FEIS has also been revised in some areas to include additional analysis requested by commenters on the DEIS, and to correct errors or omissions found in the DEIS.

1.2 ENVIRONMENTAL SETTING

The Project is located in southwest Oregon. Jordan Cove's LNG terminal would be situated on the bay side of the North Spit of Coos Bay, near the coast of the Pacific Ocean, in Coos County, Oregon. LNG vessels would access the terminal through a waterway for LNG marine traffic, which is defined by the Coast Guard for the Project as extending from the outer limits of the U.S. territorial waters 12 nautical miles off the coast of Oregon, and up the existing Coos Bay navigation channel about 7.5 miles to the terminal.

The Pacific Connector pipeline would begin at the Klamath Falls Compressor Station and interconnections with Ruby and GTN near Malin in Klamath County, Oregon. The pipeline would generally trend northwest for about 232 miles to the Jordan Cove LNG terminal, crossing portions of Klamath, Jackson, Douglas, and Coos Counties, Oregon. The pipeline would traverse through the basin and range sage and juniper woodlands ecozone of the Klamath Basin, over the Southern Cascades conifer forest and oak woodlands and conifer forest ecozones of the Klamath Mountains, through Camas Valley and Douglas-fir forests of the Coastal Range, and terminate in the Coastal lowlands. Detailed descriptions of each ecozone crossed and environmental resources potentially affected by the Project are included in the respective sections of chapter 4 in this EIS.

1.3 PURPOSE AND NEED

Under Section 3 of the NGA, the Commission considers as part of its decision to authorize natural gas facilities, all factors bearing on the public interest. Specifically, regarding whether to authorize natural gas facilities used for exportation, the Commission would authorize the proposal unless it finds the proposed facilities would not be consistent with the public interest. Under Section 7 of the NGA, the Commission determines whether interstate natural gas transportation facilities are in the public convenience and necessity and, if so, grants a Certificate to construct and operate them. The Commission bases its decision on technical competence, financing, rates, market demand, gas supply, environmental impact, long-term feasibility, and other issues concerning a proposed project. The

Commission will consider the public benefit and need for this Project when making its decision on whether or not to authorize it, as documented in the Project Order.[16]

The applicants' objectives in proposing this Project were defined by Jordan Cove and Pacific Connector in their applications to the FERC (as summarized in section 1.3.1). The information presented below on the applicants' objectives does not frame the federal decision space; it is only provided for information. The federal cooperating agencies' purpose and scope regarding this Project are defined in detail within section 1.3.2.

1.3.1 Applicants' Objectives for the Proposed Project

According to Jordan Cove's application, the Project is a market-driven response to the increasing availability of competitively priced natural gas from western Canadian and Rocky Mountain sources, and robust international demand for natural gas. The newly proposed liquefaction terminal is designed to produce about 6 MMTPA (equivalent to about 0.9 Bcf/d of natural gas), and Jordan Cove intends to export that LNG by loading it onto vessels for overseas transport. Jordan Cove would like to be the first LNG export terminal to be approved, constructed, and operated on the West Coast of the continental United States, and thus positioned to mainly serve markets around the Pacific Rim. In addition to meeting Asian demand, Jordan Cove could serve American customers by providing LNG to Alaska and Hawaii.

Jordan Cove could obtain natural gas for export as LNG from Canadian and Rocky Mountain sources via existing interstate transmission pipeline systems that are currently underutilized. In February 2014, Canada's National Energy Board granted a 25-year license to Jordan Cove allowing for the export of up to 1.55 Bcf/d of natural gas to the United States.[17] On March 18, 2014, the DOE granted Jordan Cove with the authority to import from Canada up to 565.75 Bcf/year of natural gas.[18]

The applicants' objectives for the Pacific Connector Pipeline Project are two-fold: (1) to provide natural gas to the Jordan Cove LNG terminal; and (2) to supply additional volumes of natural gas to markets in southern Oregon. Pacific Connector can obtain supplies from Canadian and Rocky Mountain sources at the Malin hub, where North American natural gas would be competitively traded on a daily basis, through interconnections with GTN and Ruby at the proposed Klamath-Eagle and Klamath-Beaver Meter Stations. Jordan Cove expects Pacific Connector to supply a maximum of 1.04 Bcf/d of natural gas to the LNG terminal.

Jordan Cove and Pacific Connector have entered into non-binding Heads of Agreements (HOA) with several prospective customers in the Asia-Pacific region for terminal and pipeline capacity,

[16] The Commission's Order represents its record of decision.
[17] See *Natural Gas Intelligence*, 3 March 2014, "Canada OKs Gas Exports to Supply Jordan Cove LNG Terminal." While the amount of Canadian export gas authorized by the National Energy Board exceeds the amount of gas that Jordan Cove requested for its liquefaction needs in its application to the FERC in Docket No. CP13-483-000, this is because Jordan Cove would like the option of being able to expand its terminal facilities in the future. However, Jordan Cove can only receive the amount of gas authorized by the Commission under this current proposal, and any future expansion would be subject to a new application, resulting in a new and separate environmental review of that expansion proposal by the FERC staff.
[18] See *Order Granting Long-Term Multi-Contract Authorization to Import Natural Gas From Canada to the Proposed Jordan Cove LNG Terminal in the Port of Coos Bay, Oregon* in FE Docket No. 13-141-NG (DOE/FE Order No. 3412). A copy of this Order was filed with the FERC on March 25, 2014, in Docket No. CP13-483-000.

respectively. Jordan Cove stated that it expects to enter into binding long-term liquefaction tolling service agreements for the terminal's capacity by the end of 2015.[19]

The Jordan Cove Liquefaction Project and the Pacific Connector Pipeline Project are interconnected and dependent upon one another. Jordan Cove needs the Pacific Connector pipeline to provide it with natural gas that it can liquefy into LNG for export. Pacific Connector is dependent on Jordan Cove as the main destination for the natural gas to be transported through its pipeline for prospective overseas customers. This EIS recognizes this interdependency and analyzes the environmental impacts of both projects together as a single comprehensive enterprise.

1.3.2 FERC and the Federal Cooperating Agencies Purpose and Scope

This EIS discloses and assesses the potential environmental impacts that are likely to result from the construction and operation of the JCE & PCGP Project. If significant environmental impacts are identified, the EIS describes measures that would be implemented to avoid, reduce, or mitigate those adverse effects. In addition to complying with the NEPA, our purposes for preparing this EIS include:

- a description and evaluation of reasonable alternatives to the proposed actions that would avoid or minimize adverse effects on the environment;
- the identification and assessment of the potential direct, indirect, and cumulative impacts on the natural and human environment that would result from implementation of the proposed actions;
- the identification and recommendations for specific mitigation measures, as necessary, to avoid or minimize significant environmental effects; and
- the involvement of the public, other agencies, and interested stakeholders in the environmental review process.

The topics addressed in this EIS include a description of the Project (chapter 2); alternatives (chapter 3); existing environment and impacts (chapter 4); and the FERC staff's conclusions and recommended mitigation measures (chapter 5). Chapter 4 is divided into sections by resource topic and includes land use (in section 4.1); geology, including hazards (section 4.2); soils and sediments (section 4.3); water resources and wetlands (section 4.4); upland vegetation and timber (section 4.5); wildlife and aquatic resources, including essential fish habitat (EFH) (section 4.6); threatened, endangered, and special status species (section 4.7); recreation and visual resources (section 4.8); socioeconomics (section 4.9); transportation (section 4.10); cultural resources (section 4.11); air quality, climate change, and noise (section 4.12); reliability and safety (section 4.13); and cumulative impacts (section 4.14). This EIS describes the affected environment as it currently exists under each resource topic, discusses the environmental consequences of the Project, and outlines measures to avoid, minimize, or mitigate impacts. As stated above, chapter 3 presents a range of reasonable alternatives and analyzes whether any of those alternatives offer significant environmental advantages over the proposed action. The information and analyses presented in this EIS are intended to support subsequent conclusions and decisions made by the Commission and the cooperating agencies.

[19] See Jordan Cove's April 20, 2015, filing with the FERC.

1.3.2.1 Purpose and Scope of the FERC's Action

The Commission has authority over the siting, construction, and operation of onshore LNG terminals, and pipelines engaged in the interstate transportation of natural gas. The FERC is the lead federal agency for the Project, and for the development of this EIS.

Our analysis in this EIS focuses on facilities and actions that are under the FERC's jurisdiction. However, this EIS also analyzes the potential environmental impacts resulting from non-jurisdictional connected actions, such as the construction and operation of the South Dunes Power Plant and the SORSC at the Jordan Cove terminal, and local utility lines to the Pacific Connector compressor station and meter station, because those facilities support the FERC jurisdictional facilities.

The Commission would consider the findings in this EIS during its review of Jordan Cove's and Pacific Connector's applications. The identification of environmental impacts related to the construction and operation of the Project, and the mitigation of those impacts, as disclosed in this EIS, would be components of the Commission's decision making process. The Commission would issue its decision in an Order. If the Project is approved, the Order would specify that the LNG terminal can be constructed and operated under the authority of Section 3 of the NGA, and a Certificate would be issued for the pipeline. The Commission may accept the applications in whole or in part, and can attach engineering and environmental conditions to the Order that would be enforceable actions to assure that the proper mitigation measures are implemented prior to the Project going into service.

1.3.2.2 Purpose and Scope of the Actions of the Forest Service, BLM, and Reclamation

The BLM, Forest Service, and Reclamation are cooperating with the FERC in the preparation of this EIS, which addresses impacts of the Pacific Connector Pipeline Project on lands administered by these agencies. The Pacific Connector pipeline route would cross portions of four BLM Districts (Coos Bay, Roseburg, and Medford Districts as well as the Klamath Falls Resource Area of the Lakeview District) and three National Forests (Umpqua, Rogue River, and Winema National Forests), as well as a portion of Reclamation's Klamath Basin Project area (see figure 1.1-1). As cooperating agencies, the BLM, Forest Service, and Reclamation anticipate adopting this EIS pursuant to 40 CFR 1506.3(c).

BLM land use planning requirements were established in Sections 201 and 202 of the Federal Land Policy and Management Act of 1976 (FLPMA, 43 United States Code [U.S.C.] 1711-1712) and the regulations in 43 CFR 1600. Forest Service land use planning requirements were established by the National Forest Management Act (NFMA) and the regulations in 36 CFR 219. These laws and regulations require a unit-specific LMP for each BLM administrative management unit (Resource Management Plans or RMPs) and National Forest (Land and Resource Management Plans or LRMPs).[20] All projects or activities on BLM land or within a National Forest must be consistent with the governing LMP.

Representatives of the Forest Service, BLM, and Reclamation have worked cooperatively with the FERC staff and Pacific Connector during pipeline route selection over federal lands and

[20] When referring to both the BLM RMPs and Forest Service and LRMPs collectively, this EIS will hereafter use the term "land management plans" or LMPs.

incorporation of best management practices (BMPs) to minimize environmental consequences. The BLM and Forest Service have determined that the linear nature of the Pacific Connector Pipeline Project would not be consistent with certain requirements of the LMPs of the BLM Districts and National Forests crossed. To address these inconsistencies, the BLM and Forest Service propose to amend the LMPs of the respective BLM Districts and National Forests to make provision for the Project. Although Reclamation's Klamath Basin Area is not subject to an LMP, the agency has also worked closely with the FERC staff and Pacific Connector to address issues related to the siting, construction, and operation of the pipeline where it would cross Reclamation lands and facilities that are part of Reclamation's Klamath Irrigation Project.

For the BLM and Forest Service, the primary purpose of this EIS is to consider and disclose the environmental consequences of construction and operation of the Pacific Connector pipeline on BLM and National Forest System (NFS) lands and to evaluate proposed LMP amendments. The need for this EIS arises from the BLM and other federal land management agencies' obligation to respond to the application for a Right-of-Way Grant submitted by Pacific Connector. The Forest Service must also assess the significance of the proposed plan amendments with respect to the delivery of goods and services from the affected National Forests pursuant to 36 CFR 219.10(f) (1982 version). The BLM would utilize this EIS to consider Pacific Connector's right-of-way application and decide, with concurrence from the Forest Service and Reclamation, to grant, grant with conditions, or deny the Temporary Use Permit and the Right-of-Way Grant. The BLM and Forest Service are also using this EIS process to identify specific stipulations (including design features and mitigation measures) related to resources within their respective jurisdictions for inclusion in the Right-of-Way Grant.

Both the BLM and Forest Service have identified suites of "Design Features" or "Project Requirements"[21] that are deemed necessary by these agencies to accomplish goals and objectives of their respective LMPs. The design features or requirements specific to the pipeline crossing of BLM and NFS lands are included as attachments to Pacific Connector's Plan of Development (POD).[22] There are 29 attachments to the POD; each of these include draft monitoring elements to ensure that the wide array of actions are implemented and assess the effectiveness of the actions relative to the goals and objectives of the respective LMPs. Collectively, the POD is incorporated into the project's description, which is fully described in chapter 2 of the EIS (section 2.6). Attachment CC to the POD is a compensatory mitigation plan (CMP) developed in conjunction with BLM and the Forest Service (see section 2.1.6 of this EIS). This CMP focuses on off-site actions such as reallocation of land from the Matrix land allocation to the Late Successional Reserve (LSR) land allocation, placement of large woody debris (LWD), snag creation, stand density/fuels reduction, road resurfacing and decommissioning, culvert replacement, stream crossing repairs, invasive weed control, pre-commercial thinning, fire suppression facilities development, and meadow restoration. In addition, Pacific Connector would be required to acquire timber-producing lands to replace those BLM Matrix lands proposed for reallocation to

[21] The BLM, Forest Service, and Reclamation use the term "Design Features" or "Project Requirements" rather than "mitigation" to describe elements of a plan that occur within a project area and are standard requirements of a project. The BLM and Forest Service reserve the term "mitigation" to describe measures taken to reduce or compensate for otherwise unavoidable impacts. The term "mitigation" as used elsewhere in this EIS refers to the full range of activities designed to reduce adverse effects of the Project.

[22] Pacific Connector filed its POD as a stand-alone document with the Environmental Report attached to its June 2013 application to the FERC.

LSR by the BLM. These plans would be included in the Right-of-Way Grant, if the grant is approved, as attachments to Pacific Connector's POD. In the Draft EIS (DEIS), Reclamation did not identify mitigation measures specific to its lands or facilities beyond the procedures outlined in the POD, including Pacific Connector's *Klamath Project Facilities Crossing Plan* (Attachment O of the POD); and its *Winter Construction Plan for the Klamath Basin* (Appendix 1E attached to Resource Report 1 of Pacific Connector's application to the FERC).

Although these compensatory mitigation actions required by the BLM and Forest Service (which are summarized in section 2.1.6 of this EIS and fully described in appendix F of this EIS) are specific in terms of activity and location, this EIS addresses them in a programmatic fashion. While many of these mitigation actions may require additional analyses and surveys to comply with NEPA and ensure consistency with LMPs, subsequent environmental compliance for mitigation actions would not preclude the BLM from issuing authorizations necessary for construction and operation. The BLM and Forest Service anticipate that this EIS would provide the basis for tiering subsequent site-specific NEPA analyses, in accordance with the CEQ regulations at 40 CFR 1508.28(b). The BLM and Forest Service will conduct supplemental environmental analysis and consultation efforts with various federal, state, and local entities, as well as tribal governments, prior to authorizing future site-specific mitigation actions described in the CMP. Environmental compliance for these mitigation actions could be concurrent with authorized project actions.

Reclamation is currently working together with Pacific Connector to identify measures specific to lands and facilities they manage to address impacts to the Klamath Project, which may include mitigation actions by Pacific Connector. Reclamation and Pacific Connector have not identified specific projects at this time; therefore, Reclamation may conduct additional environmental compliance activities to meet their responsibilities under NEPA and other federal laws and regulations prior to implementation of any mitigation requirements specific to Reclamation jurisdiction.

The BLM Oregon State Director is the authorized officer for decisions related to amendments of the respective BLM LMPs, issuance of the Temporary Use Permit, and issuance of a Right-of-Way Grant, if authorized. The Forest Supervisor for the Umpqua National Forest is the authorized officer for decisions related to amendments of Forest Service LMPs and issuance of a concurrence letter to BLM, if warranted. The Responsible Official for Reclamation regarding issuance of a concurrence letter to BLM, if warranted, is the Area Manager of Reclamation's Mid-Pacific Region Klamath Basin Area Office.

1.3.2.3 Purpose and Scope of the Actions of Other Federal Cooperating Agencies

Coast Guard

The Coast Guard is a cooperating agency for the production of this EIS, serving as a subject matter expert for, and providing recommendations on, the maritime safety and security aspects of, the Project. The Coast Guard does not issue a permit, license, order, or record of decision in this context, and is responsible for assessing the suitability of the waterway, and issuing a Waterway Suitability Report (WSR) and a Letter of Recommendation (LOR). The laws and regulations underpinning the Coast Guard review of this Project are further discussed below in section 1.4.3.1.

The Coast Guard is responsible for the safety and security of the waterway that LNG vessels would use to reach the Jordan Cove terminal. The recommendations of the Coast Guard that would make the waterway suitable for LNG marine traffic were contained in the WSR and LOR issued by the Captain of the Port (COTP).

Jordan Cove submitted a Waterway Suitability Assessment (WSA) to the Coast Guard for its original LNG import project in 2006. The Coast Guard issued a WSR on July 1, 2008, and provided an LOR on April 24, 2009, which are still considered valid. The Coast Guard stated in a February 21, 2012 response to a February 10, 2012 inquiry from Jordan Cove's consultant[23] that waterway impacts associated with export operations from Jordan Cove's terminal should be similar to those previously identified for the import proposal as outlined in Jordan Cove's original WSA, and as analyzed in the FERC's May 2009 FEIS for Docket No. CP07-444-000. However, the Coast Guard advised Jordan Cove to amend and update its Letter of Intent and Emergency Response Plan, and the WSA, for the export proposal, for Coast Guard review. Export operations should also be included in an amended and updated Operations Manual and Facility Security Plan to be prepared by Jordan Cove. On December 28, 2012, Jordan Cove submitted its amended and updated Letter of Intent to the Coast Guard for the export project. Jordan Cove acknowledged in its annual review of the WSA (dated October 2012) that the terminal was to be used to export LNG and made appropriate corrections to the various sections of the WSA. On January 13, 2014, Jordan Cove forwarded its most recent annual review of the WSA to the Coast Guard, who responded on February 14, 2014, with the following statement: "we have no objection to your conclusion that the minor changes do not change the risk associated with the waterway or the facility as originally evaluated in your 2007 WSA." On February 27, 2014, the Coast Guard accepted the annual review of the WSA for the Jordan Cove Project. The WSA is considered Sensitive Security Information and is therefore not publicly releasable. Public documents related to the Coast Guard's determination can be found in appendix B of this EIS.

U.S. Army Corps of Engineers

The COE exerts regulatory authorities over waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA), Sections 404 and 408 of the Clean Water Act (CWA), and Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). The laws and regulations underpinning the COE's actions are further discussed below in section 1.4.3.3.

The COE is a cooperating agency in the production of this EIS. The agency's purpose for participating in the development of the EIS is to streamline the Section 10 and Section 404 permitting process by working with the FERC to eliminate duplication of efforts. The EIS can reduce duplications of efforts in permit reviews for the Project by allowing the FERC to be the lead federal agency and fulfill obligations for compliance with a variety of federal environmental laws, including NEPA, the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Magnuson-Stevens Fishery Conservation and Management Act (MSA), Marine Mammal Protection Act (MMPA), and National Historic Preservation Act (NHPA), on behalf of the cooperating agencies, as further discussed in section 1.4. The COE may adopt the EIS for the purposes of exercising its regulatory authorities. On October 15, 2013, Jordan Cove and Pacific Connector submitted a single comprehensive Joint Permit Application (JPA) for the Project to the

[23] This correspondence was attached to Appendix A.1 in Resource Report 1 of Jordan Cove's May 2013 application to the FERC in Docket No. CP13-483-000.

COE, to satisfy the requirements of Section 10 of the RHA and Section 404 of the CWA.[24] The COE indicated that it would use its standard individual permit review process, and would issue its own public notice of the JPA submitted by Jordan Cove and Pacific Connector; separate from the FERC's Notice of Intent (NOI) and our Notice of Availability (NOA) for the DEIS.[25]

U.S. Department of Energy

The DOE, a cooperating agency in the preparation of this EIS, may adopt this EIS to consider the environmental impacts associated with its decision whether to authorize the export of LNG, as proposed by Jordan Cove. The DOE must meet its obligations under Section 3 of the NGA, to authorize the import and export of natural gas, including LNG, unless it finds that the proposed import or export would not be consistent with the public interest. The purpose and need for the DOE action is to respond to the applications filed by Jordan Cove with the DOE.

On September 22, 2011, Jordan Cove filed an application with the DOE seeking authorization to export up to 1.2 Bcf/d of natural gas converted to LNG from its proposed terminal at Coos Bay, Oregon to FTA nations.[26] The DOE issued its *Order Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Jordan Cove LNG Terminal to Free Trade Agreement Nations* on December 7, 2011, in DOE/FE Docket No. 11-127-LNG (DOE/FE Order No. 3041).

On March 23, 2012, Jordan Cove filed an application with the DOE, in FE Docket No. 12-32-LNG, seeking authorization to export LNG to non-FTA nations. DOE issued its *Order Conditionally Granting Long-Term Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel From the Jordan Cove LNG Terminal in Coos Bay, Oregon to Non-Free Trade Agreement Nations* (DOE/FE Order No. 3413) on March 24, 2014. This Order would allow Jordan Cove to export up to 6 MMTPA of LNG (equivalent to 292 Bcf/year of natural gas) for 20 years after either the first shipment or seven years after the date of the Order. The LNG may be exported to any country with which the United States does not have a FTA, which currently has or in the future could develop the capacity to import LNG, and with whom trade is not prohibited. The authorization is conditioned on the completion of the environmental review process to comply with the NEPA, and Jordan Cove must also comply with the mitigation measures required by federal and state agencies for the Project. In addition, Jordan Cove must file with the DOE copies of long-term contracts for both natural gas supply and the export of LNG.

Because the Project may involve actions in floodplains, in accordance with 10 CFR Part 1022, *Compliance with Floodplain and Wetland Environmental Review Requirements,* this EIS includes a floodplain assessment. A floodplain statement of findings would be included in any DOE determinations. Section 4.4 of this EIS discusses elements of the Project that may be within

[24] A copy of the JPA was filed with the FERC on November 6, 2013, replacing Appendix G.2 of Resource Report 2 in Jordan Cove's May 21, 2013, application to the FERC.
[25] This was articulated in a September 11, 2013, letter to the FERC from the COE Eugene Field Office. The COE issued its public notice on November14, 2014, to take comments on the Jordan Cove-Pacific Connector CWA Section 404 application.
[26] DOE/FE Docket No. 11-127-LNG, a copy of which was filed with the FERC by Jordan Cove in Docket No. CP13-483-000 on September 23, 2011.

floodplains, so that the FERC, as lead federal agency, can document compliance with Executive Order (EO) 11988.[27]

U.S. Environmental Protection Agency

The EPA is a cooperating agency in the production of this EIS. The EPA has responsibilities under NEPA, the Clean Air Act (CAA), CWA, and MPRSA (see section 1.4.3.4 of this EIS). The EPA shares responsibility for administering and enforcing Section 404 of the CWA with the COE, and has authority to veto COE permit decisions.

The EPA also co-administers the MPRSA with the COE. Section 103 of the MPRSA authorizes the COE to issue permits for the ocean disposal of dredged material. That permit decision would be made using the EPA's environmental criteria, and subject to the EPA's concurrence. If disposal is proposed at an EPA-designated site under Section 102 of the MPRSA, that disposal must be consistent with that site's Site Management and Monitoring Plan.

In addition, Section 309 of the CAA directs the EPA to review and comment in writing on the environmental impact associated with all major federal actions. This obligation is independent of its role as a cooperating agency under the NEPA regulations. Consistent with this direction, the EPA evaluates all federally issued EISs for adequacy in meeting the procedural and public disclosure requirements of the NEPA.

Before a permit could be issued, the COE Regulatory Project Manager would need to submit to the EPA a public notice pursuant to 33 CFR 337. I(a)(l 7), 33 CFR 325.3(a)(I 7), 40 CFR 225.2(a)), and a Section 103 criteria evaluation for the disposal of dredged material at an EPA designated Ocean Dredged Material Disposal Site based on 40 CFR 227, "Criteria for the Evaluation of Permit Applications of Ocean Dumping of Materials." As a part of this review, the EPA is required to consider impacts to potential economic effects, which would include any impacts to the COE's ability to maintain safe navigation for the public.

U.S. Department of Transportation

The DOT is a cooperating agency in the production of this EIS. The DOT has authority to enforce safety regulations and design standards for the LNG terminal (see section 4.13.10 of this EIS), as well as safety regulations and standards related to the design, construction and operation of natural gas pipelines, under the Natural Gas Pipeline Safety Act (49 U.S.C. 1671 et seq.). In a June 18, 2014, letter to the FERC, PHMSA stated that it had reviewed the criteria used by Jordan Cove in identifying credible leakage scenarios and establishing the siting for the LNG terminal to confirm compliance with 49 CFR 193, and had no objections to Jordan Cove's methodologies.[28] The DOT would also monitor the construction and operation of the natural gas facilities to determine compliance with its design and safety standards.

[27] EO 11988, *Floodplain Management*, requires federal agencies to avoid adverse impacts associated with the occupancy and modification of floodplains, and to avoid floodplain development wherever there is a practicable alternative. The objectives of the EO include the minimization of impacts from floods resulting from agency actions, and the preservation of floodplains where possible.

[28] This letter was filed in the FERC public record under Docket No. CP13-483-000 on June 19, 2014.

1.3.3 Issues Considered Outside the Scope of this EIS

During the pre-filing process as well as the public comment period on the DEIS (see section 1.8 below as well as appendix W), some citizens and organizations raised issues that are considered outside the scope of this EIS. Those issues will not be addressed in this EIS because we do not consider them to be environmental in nature. Examples of out-of-scope issues include the need to export LNG; horizontal hydraulic drilling through shale formations during exploration for natural gas (often referred to as "fracking"); induced production of natural gas; "life-cycle" cumulative environmental impacts associated with the entire LNG export process; the concept of a "programmatic" EIS to cover LNG export terminals throughout the United States; and administrative information technology system operations at the FERC.

With regard to the public benefit or need to export LNG from the United States to foreign nations, that decision rests with the DOE, and is therefore outside of the jurisdiction of the FERC. The Commission explained the background behind the different authorities that the United States Congress has assigned to the FERC in comparison to the DOE in its *Order Granting Section 3 Authorization* to Sabine Pass Liquefaction LLC issued on April 16, 2012, in Docket No. CP11-72-000.[29] While the Commission has the authority to site and approve or disapprove the construction and operation of onshore LNG terminals, the DOE retains the ability to approve or disprove the import or export of the commodity itself. In the case of the Jordan Cove Project, the DOE granted authority to export LNG to FTA nations in December 2011 and to non-FTA nations in March 2014.

The FERC does not have any authority over activities related to the exploration, production, and gathering of natural gas in the United States or Canada. Those activities, in the United States, would be regulated by individual states. Pacific Connector can obtain natural gas from Canadian and Rocky Mountain supplies at the Malin hub, through interconnections with GTN and Ruby. However, there is no reasonable way to determine the exact sources of the natural gas transported in the GTN and Ruby pipelines; nor is there a reasonable way to identify the well-specific exploration and production methods used to obtain those gas supplies.[30]

Some commenters claim that the export of LNG from the Jordan Cove terminal would result in the indirect impact of inducing additional drilling activities or stimulating natural gas production in the United States.[31] The Commission has previously taken the position that it is virtually impossible to estimate export volumes that may come from future shale natural gas production, and that the number and location of future natural gas wells is unknowable at this time. The Project does not depend on additional United States production, because much of the gas may come from Canadian sources, and existing transmission pipelines in the western states are underutilized. It is speculative to assume that the Jordan Cove export proposal would cause increased natural gas production because other factors, unrelated to the Project, over which the Commission has no control (e.g., regional domestic market demands, permitting for new gas wells, or technologies and efficiencies in exploration) may also influence production. Therefore, induced or additional

[29] 139 FERC ¶ 61,039 (2012), III, pages 9-12.
[30] The Commission addressed this issue in its *Order Granting Section 3 Authorization* to Sabine in Docket No. CP11-72-000 (139 FERC ¶ 61,039 [2012], IV, pages 31-33), and also in *Central New York Oil and Gas Company* (137 FERC ¶ 61,121 [2011], page 98).
[31] Letters to the FERC from the EPA dated October 29, 2012, and the Sierra Club on June 21, 2013.

natural gas production is not a "reasonably foreseeable" indirect effect of the Project, and is not addressed in this NEPA document.[32]

The "life-cycle" cumulative environmental impacts, from exploration, production, and gathering of natural gas; transportation to Pacific Connector; and shipment of LNG overseas from the Jordan Cove terminal are far beyond the jurisdictional authority of the FERC or the activities directly related to the Project.[33] Nor can those impacts be easily or reasonably calculated, given the number of unknown elements in the chain, and actions by entities other than Pacific Connector and Jordan Cove. As mentioned above, the number and location of wells producing natural gas in Western Canada and the Rocky Mountain regions are unknown, as are the gathering systems that would ultimately transport that gas to GTN and Ruby. Jordan Cove has not identified the specific vessels that would ship the LNG abroad or the exact customers for the LNG. Without knowing the final destination of the LNG, it would not be possible to calculate the environmental impacts associated with its overseas shipping.[34]

The Commission has not produced any "programmatic" environmental studies for natural gas projects in the recent past. The Commission does not intend to conduct a nation-wide analysis of proposed LNG export terminals. As stated above, it is the DOE that determines the public benefits of exporting LNG from terminals in the United States. The FERC's review and approval of individual projects under the NGA does not constitute a coordinated federal program. In a previous case, the Commission stated that it "does not direct the development of the gas industry's infrastructure, either on a broad regional basis, or in the design of specific projects."[35] As articulated in the September 18, 2008, Commission Order for the Bradwood LNG import project in Docket No. CP06-365-000, the FERC does not engage in regional planning exercises that would result in the selection of one terminal location over another.[36] Instead, it is the Commission's historic policy to allow market forces to influence where LNG terminals should be situated; assuming that the locations are environmentally acceptable based on the analysis contained in a project-specific EIS. Companies select the location of their proposed facilities based on market and other factors, and the Commission staff analyzes the environmental impacts of construction

[32] This issue was also discussed in Jordan Cove's Answer to Motions to Intervene, pages 6-7, filed on July 3, 2013 in Docket No. CP13-483-000, and Combined Answers of LNG Development Company and Oregon Pipeline Company, pages 4-10, filed on August 26, 2013 in Docket Nos. CP09-6-001 and CP09-7-001. They cite *Cheniere Creole Trail Pipeline*, 142 FERC ¶ 61,137 (2013), page 19, and *Sabine Pass Liquefaction*, 140 FERC ¶ 61,076 (2012), pages 9-10.

[33] According to former FERC Chairman Jon Wellinghoff, there is no legal basis for the FERC to consider the cumulative environmental impacts of shale gas drilling activities when reviewing a proposed LNG export terminal. On January 10, 2014, Mr. Wellinghoff was quoted in the industry press as saying: "The FERC does not have the statutory authority to look at impacts all the way back to the wellhead."

[34] The Commission's September 18, 2008 *Order Granting Authority Under Section 3 of the Natural Gas Act and Issuing Certificates* for the proposed Bradwood Landing LNG import project in Docket No. CP06-365-000 (124 FERC ¶ 61,257 [2008], Section D, pages 25-26) indicated that different studies of life-cycle greenhouse gas emissions for imported LNG, including long distance ship transport, came up with conflicting figures and conclusions. A recent study for the DOE by the National Energy Technology Laboratory (NETL 2014) estimated the 20-year global warming potential of life cycle GHG emissions of exporting LNG from New Orleans, Louisiana to Shanghai, China to use as fuel to burn in an electric power plant would be 824 kgCO2e/MWh, which is lower than using coal from China or natural gas transported by pipeline from Yamal, Russia; however, NETL did not model exporting LNG from the West Coast of the United States to Asian markets.

[35] See *Texas Eastern Transmission, LP & Algonquin Gas Transmission, LLC* (2012) 141 FERC § 61,043, page 25.

[36] 124 FERC § 61,257, Section D, pages 29-30.

and operation of those facilities at the selected locations. Companies would be at risk for the costs of constructing and operating an LNG terminal, as influenced by their own research into economic conditions and market needs.

There were also some comments on administrative issues that are not environmental topics and will not be addressed in this EIS. Those comments were mainly about the FERC's information management system, including eComment. Those issues are outside the scope of this EIS.

1.4 PERMITS, APPROVALS, AND CONSULTATIONS

1.4.1 Other Federal Environmental Laws

Besides the NGA, EPAct, and NEPA, the FERC and cooperating agencies are required to comply with other federal laws that involve consideration of the Project's potential impact on a range of environmental resources. This includes compliance with the CAA, CWA, Coastal Zone Management Act (CZMA), ESA, MSA, MMPA, MBTA, and the NHPA. As the lead federal agency for the JCE & PCGP Project, the FERC has undertaken the lead role for consultations under these statutes for itself and on behalf of the cooperating agencies. The status of compliance with those acts is described in this EIS. FLPMA and the Mineral Leasing Act are directly related to the BLM's decision making process as it relates to the Project's Right-of-Way Grant application.

There are other federal agencies that must be consulted, or would issue permits or approvals based on these federal environmental laws, before this Project could be constructed. For example, the FWS must be consulted regarding compliance with the ESA and MBTA, and the U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) must be consulted regarding compliance with the ESA, MSA, and MMPA. In order to comply with Section 106 of the NHPA, the FERC must afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking.

Some federal permits or approvals, such as Section 401 of the CWA, the CAA, and the CZMA, have been delegated to state agencies, as discussed below. For example, the ODEQ has been delegated CWA Section 401 and 402 responsibilities and air quality permits under the CAA, and the Oregon Department of Land Conservation and Development (ODLCD) has delegated responsibilities under the CZMA.

In accordance with Section 313(d) of the EPAct, the FERC is required to keep a complete consolidated record of all actions or decisions made by agencies undertaking federal authorizations. On October 19, 2006, in Order No. 687, the FERC issued implementing regulations regarding the maintenance of a consolidated record. Section 313(c) of the EPAct requires that the FERC establish a schedule for federal authorizations. Pursuant to Order No. 687, the FERC issued an initial Notice of Schedule for *Environmental Review of the Jordan Cove Liquefaction and Pacific Connector Pipeline Projects* on July 16, 2014, and revised the Notice of Schedule on February 6 and June 11, 2015.

While the EPAct amended the NGA to give exclusive authority to the FERC to approve or deny an application for the siting, construction, expansion, or operation of an LNG terminal, it specified that nothing in the Act was intended to overrule other federal authorities. This includes the protection of the rights of states with federally delegated responsibilities under the CZMA, CAA, and CWA.

Table 1.4.1-1 lists the major federal, state, and local permits, approvals, and consultations identified for the Project.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
FEDERAL			
Federal Energy Regulatory Commission (FERC)	Sections 3 and 7 of the Natural Gas Act (NGA) [Title 15 United States Code [U.S.C.] 717] Section 311 of the Energy Policy Act of 2005 (EPAct) Title 18 Code of Federal Regulations (CFR) 153, 157, 375, and 385	Order Granting Section 3 Authorization and Issuing Certificate of Public Convenience and Necessity.	On May 21, 2013, Jordan Cove filed an application with the FERC under Section 3 of the NGA. On June 6, 2013, Pacific Connector filed an application with the FERC under Section 7 of the NGA. The FERC's decision is pending.
	Order No. 687 National Environmental Policy Act (NEPA) 42 U.S.C. 4321 et seq. 40 CFR 1500-1508 18 CFR 380.12	Produce Environmental Impact Statement (EIS).	On August 2, 2012, the FERC issued Notice of Intent (NOI) to Prepare an EIS. On November 7, 2014, the FERC issued a DEIS.
Advisory Council on Historic Preservation (ACHP)	Section 106 of the National Historic Preservation Act (NHPA) 54 U.S.C. 306108 36 CFR 800	Opportunity to comment on the undertaking.	On October 26, 2010, the FERC notified the ACHP that the Project would result in adverse effects on historic properties. In November 19, 2010 letter to the FERC the ACHP declined to participate in the resolution of adverse effects. On August 30, 2011, the FERC submitted its Memorandum of Agreement (MOA) to the ACHP for the original LNG import and send out pipeline project (Docket Nos. CP07-441-000 and CP07-444-000). If the newly proposed LNG export and supply pipeline project (Docket Nos. CP13-483-000 and CP13-492-000) is authorized by the FERC, the MOA would be amended.
Federal Communication Commission	License for fixed microwave stations and service 47 U.S.C. 303 47 CFR 101	Review proposals for new or additions to existing communication towers.	Pending.
U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)	Farmland Protection Policy Act 7 U.S.C. 4201-4209 7 CFR Part 658	Determine if the Project would result in the permanent conversion of prime farmland.	On August 30, 2012, the NRCS commented on the FERC's NOI.
USDA Forest Service (Forest Service)	Mineral Leasing Act (MLA) 30 U.S.C. 181 et seq. 43 CFR 2882	Concur with Right-of-Way (ROW) Grant.	On April 17, 2006, Pacific Connector submitted its initial SF 299 ROW Grant application. On February 25, 2013, Pacific Connector amended that application. The Forest Service decision on concurrence with the ROW Grant is pending until after issuance of FEIS and preparation of a ROD.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
Forest Service (cont.)	36 CFR 219.17	Amend Land and Resource Management Plans (LRMP).	On September 21, 2012, Forest Service and BLM issued a Supplemental NOI. FERC's November 2014 DEIS analyzed proposed Plan amendments. The Forest Service's Proposed Decision(s) on amendment of LRMPs are subject to Objection. A final Decision will follow consideration and resolution of any objections. The Forest Service has chosen to utilize the Protest Process of the BLM as its Objection Process for this Project.
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS)	Section 7 of the Endangered Species Act (ESA) 16 U.S.C. 1531 et seq. 50 CFR 222 50 CFR 224 50 CFR 402	Provide a biological opinion (BO) if the Project is likely to adversely affect federally listed threatened or endangered aquatic species or their habitat.	On February 24, 2015, the FERC submitted its biological assessment (BA) and essential fish habitat (EFH) assessment to the NMFS. On March 23 and July 10, 2015, NMFS requested additional information before accepting the FERC's BA and EFH Assessment. The NMFS will issue its BO pending review of the FERC's BA and EFH Assessment.
	Marine Mammal Protection Act (MMPA) 16 U.S.C. 1361 et. seq. 50 CFR 82 50 CFR 216	Consult on protected marine mammals.	On October 8, 2014, Jordan Cove and Pacific Connector submitted their draft application for incidental harassment authorization to the NMFS. Review pending.
	Magnuson-Stevens Fishery Conservation and Management Act (MSA) 16 U.S.C. 1801-1884 50 CFR 600	Provide conservation recommendations if the Project would adversely impact EFH.	Pending review of the FERC's EFH Assessment.
U.S. Department of Defense (DOD)	Section 311(f) of the EPAct and Section 3 of the NGA 15 U.S.C. 717b 18 CFR 153, 157, 375, and 385 Memorandum of Understanding (MOU) between FERC and DOD	Consult with the Secretary of Defense to determine whether an LNG facility would affect the training or activities of an active military installation.	On September 27, 2012, the FERC sent a letter about the Project to the DOD Siting Clearinghouse. On November 2, 2012, the DOD replied that the Project would have minimal impact on military operations in the area.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
U.S. Department of the Army, Corps of Engineers (COE)	Section 10 of the Rivers and Harbors Act (RHA) 33 U.S.C. 403 33 CFR 320 to 330	Process permit application for structures or work in or affecting navigable waters of the United States.	On June 13, 2013, and July 8, 2013 Jordan Cove and Pacific Connector respectively submitted separate Joint Permit Applications (JPA) with the COE. On August 15, 2013, COE requested that a single comprehensive JPA be resubmitted for the complete Project. On October 15, 2013, Jordan Cove and Pacific Connector submitted a single comprehensive JPA. On November 14, 2014, COE issued a Notice to take public comments on Jordan Cove-Pacific Connector permit application. On March 20, 2015, COE provided comments to applicants, which the applicants responded to on June 9, 2015. Permit pending review of JPA.
	Section 408 of RHA	Approval of requests to alter COE civil works projects.	Determination pending submittal and review of additional information.
	Section 404 of the Clean Water Act (CWA) 33 U.S.C. 1344 33 CFR 320 to 330	Process permit application for the placement of dredged or fill material into waters of the United States.	On June 13, 2013, and July 8, 2013 Jordan Cove and Pacific Connector respectively submitted separate JPAs with the COE. On August 15, 2013, COE requested that a single comprehensive JPA be resubmitted for the complete Project. On October 15, 2013, Jordan Cove and Pacific Connector submitted a single comprehensive JPA. Permit pending review of JPA. Between March 2013 and March 2014, Jordan Cove submitted various wetland delineation reports to the COE. On March 13, 2014, the COE concurred with the boundaries and extent of Waters of the U.S. depicted in the Jordan Cove wetland delineation report. On June 26, 2013, Pacific Connector submitted its wetland delineation report to the COE. On August 5, 2014, the COE concurred with the boundaries and extent of Waters of the U.S. depicted in the Pacific Connector wetland delineation report.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
COE (continued)	Section 404 of the Clean Water Act (CWA) 33 U.S.C. 1344 33 CFR 320 to 330	Process permit application for the placement of dredged or fill material into waters of the United States.	On November 14, 2014, COE issued a Notice to take public comments on Jordan Cove-Pacific Connector's CWA Section 404 permit application. On March 20, 2015, the COE provided comments to applicants. Permit pending review of JPA.
	Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) 33 U.S.C. 1401 et. seq. 33 CFR Part 324	Issue a permit for the ocean disposal of dredged material under MPRSA consistent with EPA criteria and subject to EPA concurrence.	Jordan Cove included a dredged material management plan with its JPA to the COE. Permit pending review of JPA.
U.S. Department of Energy (DOE) Office of Fossil Energy	Section 3 of the NGA 15 U.S.C. 717b 18 CFR 153, 157, 375, and 385	Authority to export LNG to Free Trade Agreement (FTA) Nations.	On September 22, 2011, Jordan Cove filed an application with the DOE in FE Docket No. 11-127-LNG. On December 7, 2011, DOE issued DOE/FE Order No. 3041 granting authority for Jordan Cove.to export LNG to FTA Nations.
	Section 3 of the NGA 15 U.S.C. 717b 18 CFR 153, 157, 375, and 385	Authority to export LNG to Non-FTA Nations.	On March 23, 2012, Jordan Cove filed an application with the DOE in FE Docket No. 12-32-LNG. On March 24, 2014, DOE issued DOE/FE Order No. 3413 granting authority for Jordan Cove.to export LNG to non-FTA Nations.
DOE, Bonneville Power Administration (BPA)	Land Use Agreement for electric transmission line crossings	Permit review.	Decision pending.
U.S. Environmental Protection Agency (EPA)	Section 404 of the CWA 33 U.S.C. 1412 40 CFR 227, 228	Co-administers CWA 404 program with the COE. EPA retains veto authority for wetland permits issued by the COE.	On October 29, 2012, EPA commented on the FERC's NOI. Review pending issuance of COE permit.
	Section 103 of the MPRSA 33 U.S.C. 1344, and 40 CFR Part 230	COE issues a permit for the ocean disposal of dredged material under MPRSA consistent with EPA criteria. The permit is subject to EPA concurrence if disposal is proposed at an EPA ocean dredged material disposal site designated under Section 102 of the MPRSA.	Jordan Cove included a dredged material management plan with its JPA to the COE. EPA concurrence pending issuance of permit by COE.
	Section 309 of the Clean Air Act (CAA) 42 U.S.C. 7401 et seq. 40 CFR 1503.1(a)	Reviews and evaluates EIS for adequacy in meeting the procedural and public disclosure requirements of the NEPA.	On February 11, 2015, the EPA commented on the DEIS.
U.S. Department of Homeland Security, Coast Guard	Ports and Waterway Safety Act 33 U.S.C. 1221 33 U.S.C. 1231 33 CFR 160 33 CFR 127	Captain of the Port (COTP) issues a Letter of Recommendation (LOR) and Waterway Suitability Report (WSR) recommending the suitability of the waterway for LNG marine traffic.	On July 1, 2008, COTP issued a WSR. On April 24, 2009, the Coast Guard issued an LOR.
		Review Emergency Manual.	On June 25, 2010, Coast Guard reviewed document and marked it "Examined."
		Review Operations Manual.	Pending. Must be completed prior to receiving first LNG vessel.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
Coast Guard (continued)	33 CFR 165	Establish safety and security zones for LNG vessels in transit and while docked.	On May 17, 2011, Security Zone noticed in 76 FR 28317.
	Maritime Transportation Security Act 46 U.S.C. 701 33 CFR 105	Review and Approve Facility Security Plan.	Pending. Must be completed 60 days prior to receiving first LNG vessel at the facility
	Navigation and Vessel Inspection Circular – Guidance related to Waterfront Liquefied Natural Gas (LNG) Facilities NVIC 05-05 NVIC 05-08 NVIC 01-11	Develop LNG Vessel Transit Management Plan.	Pending. Must be completed prior to receiving first LNG vessel.
		Validate WSA and produce WSR.	On July 1, 2008, the Coast Guard issued a WSR for original LNG import project. On February 21, 2012, the Coast Guard acknowledged validity of the current WSR when the facility changed from import to export. The WSA was updated as part of Jordan Cove's annual review in October 2012 and was updated to change the proposed terminal from import to export. On January 13, 2014, Jordan Cove submitted its most recent annual review of the WSA to the COTP. On February 24, 2014, COTP stated that the risk associated with the waterway and facility has not changed since the Project was originally evaluated.
U.S. Department of the Interior (USDOI), Bureau of Land Management (BLM)	Section 28 of MLA 30 U.S.C. 181 43 CFR 2880	Issue ROW Grant for crossing federal lands.	On April 17, 2006, Pacific Connector submitted its initial SF 299 ROW Grant application. On February 25, 2013, Pacific Connector amended that application. The BLM Decision on the ROW Grant will follow BLM and Forest Service Decisions on LRMP amendments and receipt of Letters of Concurrence from the Forest Service and Reclamation.
	Federal Land Policy and Management Act of 1976, as amended 43 CFR 1610	Resource Management Plan Amendments.	On September 21, 2012, BLM and Forest Service issued a Supplemental NOI. FERC's November 2014 DEIS analyzed proposed Plan amendments. BLM's Proposed Decision(s) on amendments of RMPs are subject to Objection. A final Decision will follow consideration and resolution of any objections.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
USDOI Bureau of Reclamation	MLA 30 U.S.C. 181 et seq. 43 CFR 288.23(i)	Concur with issuance of the ROW Grant	On April 17, 2006, Pacific Connector submitted its initial SF 299 ROW Grant application. On February 25, 2013, Pacific Connector amended that application. Reclamation decision on ROW Grant is pending until after FERC issues FEIS.
USDOI Fish and Wildlife Service (FWS)	Section 7 of the ESA 16 U.S.C. 153 et seq. 50 CFR 402.02	Provide a BO if the project is likely to adversely affect terrestrial federally-listed threatened and endangered species or their habitat.	On September 4, 2012, FWS commented on FERC's NOI. On February 24, 2015, the FERC submitted its BA to FWS. On April 7 and May 12, 2015, FWS commented on the FERC's BA. FWS would issue its BO pending review of the FERC's BA.
	Fish and Wildlife Coordination Act (FWCA) 16 U.S.C. 661-667(d) 23 CFR Part 773	Provide comments to prevent loss of and damage to wildlife resources.	FWS generally addresses FWCA issues via comments on FERC NEPA and COE 404 permit processes.
	Migratory Bird Treaty Act (MBTA) 16 U.S.C. 703 Executive Order 13186	Consultation regarding compliance with the MBTA.	On February 13, 2015, Jordan Cove and Pacific Connector submitted its draft Migratory Bird Conservation Plan to the FWS. Review pending.
U.S. Department of Transportation (DOT), Pipeline and Hazardous Materials Safety Administration (PHMSA)	Natural Gas Pipeline Safety Act (NGPS) 49 U.S.C. 601 49 CFR Parts 190-199	Administer national regulatory program to ensure the safe transportation of natural gas.	On September 19, 2013, Jordan Cove submitted to PHMSA data related to the analysis of potential hazardous fluid leakage sources. On June 18, 2014, PHMSA stated it had no objections to Jordan Cove's methodologies for identifying credible leakage scenarios in siting its LNG terminal.
DOT, Federal Aviation Administration (FAA)	18 CFR Subchapter E Federal Aviation Regulations (FAR) Part 77 IAW FAA Order 7400.2G, 6-1-6	Aeronautical Study of Objects Affecting Navigable Airspace. Feasibility Study for Hazard Determination.	On May 8, 2007, the FAA issued an aeronautical study for the communication tower at Pacific Connector's Jordan Cove Meter Station proposed under Docket No. CP07-441-000. On November 1, 2008, the FAA issued a limited aeronautical review of the LNG tanks at the Jordan Cove terminal proposed in Docket No. CP07-444-000. In 2013, Jordan Cove submitted 36 7460-1 forms to FAA. On July 24, 2014, FAA issued 31 Determinations of No Hazard and 5 Notices of Presumed Hazards. Continuing consultations with FAA are pending.
U.S. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms	Explosives User Permit 27 CFR 555	Issue permit to purchase, store, and use explosives during project construction.	Permits to be obtained by Jordan Cove and Pacific Connector, as necessary, before construction.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
STATE – OREGON			
Oregon Department of Agriculture (ODA)	Oregon Endangered Species Act Oregon Senate Bill 533 and Oregon Revised Statute (ORS) 564	Consult on Oregon listed plant species, and ODA would review botanical survey reports covering non-federal public lands prior to ground-disturbing activities where state listed botanical species are likely to occur.	On September 15, 2008, ODA informed Jordan Cove that it was in compliance with state laws, and no species should be adversely affected. On July 24, 2006, ODA provided Pacific Connector with a list of state listed species. In September 2007 and November 2008 Pacific Connector submitted botanical survey reports to ODA. ODA's review of these botanical reports is pending.
Oregon Department of Consumer and Business Services – Building Code Division	ORS 455.446	Site-specific exemption approval under the state building code,	On April 14, 2014, Department agreed on the location for the Jordan Cove fire station (at the SORSC).
Oregon Department of Energy (ODE)	State Authorities under Section 311 of the EPAct	Furnish an advisory report on state safety and security issues to the FERC regarding the Jordan Cove LNG terminal proposal, and conduct operational safety inspections if the facility is approved and built.	On October 29, 2012, ODE filed environmental comments as part of the State of Oregon's response to the FERC's NOI issued August 2, 2012. On June 20, 2013, ODE filed a motion to intervene in response to the FERC's Notice of Application issued May 30, 2013. ODE did not submit a State Safety Report to the FERC within 30 days of the Notice of Application. On June 14, 2014, ODE entered into an MOU with Jordan Cove regarding LNG emergency preparedness at the export terminal. On February 12, 2015, ODE filed environmental comments as part of the State of Oregon's response to the FERC's November 214 DEIS. Safety inspections pending operation of facilities.
ODE – Energy Facility Siting Council (EFSC)	Oregon State Siting Standards ORS 469.300 Oregon Administrative Rule (OAR) 345	Authority to review proposals for power plants generating more than 25 MW and issue a Site Certificate.	On November 30, 2012, Jordan Cove filed amended Notice of Intent for the South Dunes Power Plant. On February 14, 2013, EFSC issued a Project Order, with an amended Project Order issued on October 14, 2013. On January 9, 2014, Jordan Cove submitted its preliminary Application for Site Certificate, which ODE determined to be complete on December 23, 2014. On December 29, 2014, Jordan Cove filed its final Application for Site Certificate. The ODE issued a Draft Proposed Order on the application on May 27, 2015.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
	OAR 345-21 & 22	Enforce Oregon's CO_2 Standards. Enforce Oregon's Retirement Bond Requirements.	On June 10, 2014, ODE entered into an MOU with Jordan Cove regarding CO_2 and Facilities Retirement.
Oregon Department of Environmental Quality (ODEQ)	Water Quality Certification Section 401 of the CWA ORS 468B OAR 340-48	Issue a license or permit to achieve compliance with state water quality standards.	Pacific Connector submitted water quality information to ODEQ concurrent with its JPA to the COE. Review pending.
	Section 402 of CWA ORS 468B OAR 340-45	Issue National Pollutant Discharge Elimination System (NPDES) permits for discharge of stormwater.	On July 22, 2014, Jordan Cove submitted its modified NPDES permit application to ODEQ. On February 25, 2015, Jordan Cove submitted ocean discharge findings related to NPDES Wastewater permit application, Review pending. One year prior to construction, Pacific Connector intends to submit its NPDES permit applications to ODEQ.
	Ballast Water Management ORS 620-992 OAR 340-143	Review liabilities and offences connected to shipping and navigation.	Pending review of this EIS.
	CAA – Title V 40 CFR 98 ORS 468A OAR 340-215, 216, 218, 222, & 228	Issue Title V Air Quality Operating permit. Issue Title V Acid Rain permit. Enforce Greenhouse Gas (GHG) Reporting Requirements.	In March 2013, Jordan Cove submitted an air quality permit application to the ODEQ. In April 2015, ODEQ issued a draft Air Contaminate Discharge and Prevention of Significant Deterioration permit to Jordan Cove. In June 2015, Pacific Connector submitted its air quality permit application to ODEQ. Review pending.
	Prevention of Significant Deterioration CAA ORS 468B OAR 340-224 & 225	Review Best Available Control Technologies to minimize discharges from new major sources, and review air quality analyses to ensure compliance with National Ambient Air Quality Standards.	In March 2013, Jordan Cove submitted an air quality permit application to the ODEQ. ODEQ issued a draft Air Contaminate Discharge and Prevention of Significant Deterioration permit to Jordan Cove. In June 2015, Pacific Connector submitted its air quality permit application to ODEQ Review pending.
	Hazardous Waste Activity ORS 466 OAR 340-102	Review plans for storage and management of hazardous waste	Review pending.
Oregon Department of Fish and Wildlife (ODFW)	Fish and Wildlife Coordination Act and the Oregon Endangered Species Act under ORS 496, 506, and 509 OAR 635	Consult on sensitive species and habitats that may be affected by the Project and, in general, regarding conservation of fish and wildlife resources.	In December 2014, Jordan Cove and Pacific Connector produced the latest revision of their Wildlife Habitat Mitigation Plan. ODFW review pending.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
ODFW (continued)	Fish and Wildlife OAR 345-22 & 60	Consult on and approve fish and wildlife mitigation plan.	On January 29, 2014, Jordan Cove submitted its Draft Wildlife Salvage Plan to ODFW. The ODFW guidance for salvage plans was also included in the December 2014 application submittal for the EFSC site certification. Review pending.
	Oregon Fish Passage Law ORS 509.-585 OAR 635-412-5 to 40	Review stream crossing plans for consistency with Oregon Fish Passage Law and screening criteria.	Pacific Connector submitted its Fish Passage Waiver Application and Fish Passage Plan for Road and Stream Crossings. ODFW requested that the application be restructured; therefore, Pacific Connector will re-submit the application per the ODFW criteria in late 2015. ODFW review pending.
	In-Water Blasting ORS 509-140, et al. OAR 635-425 to 50	Consider issuance of in-water blasting permits.	Pacific Connector submitted In-Water Blasting Permit Application. The ODFW requested that the application be restructured; therefore, Pacific Connector will re-submit the application per the ODFW criteria in late 2015. ODFW review pending.
Oregon Department of Forestry (ODF)	Easement on State lands Oregon Forest Practices Act OAR 629 ORS 477 ORS 527	Management of State Forest lands for Greatest Permanent Value, develops Forest Management Plans, stewardship under State's Land Management Classification System, monitors harvests of timber on private lands, and protects non-federal public and private lands from wildfires.	Pacific Connector anticipates submittal of final plans to ODF in 2015.
Oregon Department of Geology and Mineral Industries (DOGAMI)	Building Code Section 1802.1 ORS 455.446	Review of structural designs in tsunami zones. Review of geotechnical investigations for geological hazards.	Review by DOGAMI is pending.
State Historic Preservation Office (SHPO)	Section 106 of the NHPA 36 CFR 800 ORS 338-920	Review cultural resources reports and comments on recommendations for National Register of Historic Places eligibility and project effects. Issue permits for excavation of archaeological sites on non-federal lands.	On June 3, 2011, the Oregon SHPO signed the FERC's MOA for the original LNG import proposal and sendout pipeline project in Docket Nos. CP07-441-000 and CP07-444-000. If the FERC authorizes the newly proposed LNG export proposal and supply pipeline project (in Docket Nos. V+CP13-483-000 and CP13-492-000) the MOA would be amended. SHPO review of future cultural resources investigations reports pending.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
Oregon Department of Land Conservation and Development (ODLCD)	Coast Zone Management Act (CZMA) 15 CFR Part 930 ORS 196.435	Determine consistency with CZMA program policies.	On August 1, 2014, Jordan Cove and Pacific Connector submitted their applications for Certification of Consistency to the ODLCD. On July 8, 2015, the ODLCD signed a stay agreement that delays their review to January 9, 2016.
Oregon Department of State Lands (ODSL)	Submerged and Submersible Land Easement OAR 141-122	Grant submerged land easements.	In 2010, Port applied for easement for eelgrass mitigation site, which is still pending. In July 2012, ODSL issued easement to Port for terminal access channel. On May 15, 2014, Pacific Connector submitted its easement application. ODSL review pending. In April 2015, ODSL determined the application to be incomplete until revised Land Use Compatibility Statements (LUCS) are submitted from Jackson and Klamath counties.
	Lease and Registrations OAR 141-082	Issue wharf registrations	On October 1, 2010, ODSL issued Wharf Registration for mooring dolphins. Jordan Cove anticipates applying for a Wharf Registration for the barge berth in May 2015.
	Sand and Gravel Lease/License OAR 141-014	Issue licenses or leases for removal of state-owned materials.	In 2010, Port submitted application that is still pending.
	Joint Removal-Fill Law ORS 196-795-990 OAR 141-85	Approve removal or fill of material in waters of the state.	On February 19, 2013, ODSL issued Amended Proposed Order allowing dredging of Jordan Cove access channel and slip. On December 2, 2013, ODSL found Pacific Connector's application to be complete; however, in January 2015, ODSL determined the application to be incomplete until revised LUCS are submitted from Jackson and Klamath counties.
	Special Use Permits OSAR 141-125	Allow work within state-owned lands	Jordan Cove is preparing an application to work within tidally-influenced state-owned waters at the Kentuck Slough Mitigation Site.
	Compensatory Wetland Mitigation Rules OAR 141-85-121	Review and approve wetland mitigation plans.	On July 15, 2013, Pacific Connector filed an application with ODSL. Decision Pending.
Oregon Department of Transportation (ODOT)	Section 303(c) DOT Act 49 CFR 303 OAR 734-030(4) OAR 734-051-4020	Review and approve traffic management plans	On August 2, 2012, ODOT commented on Jordan Cove's Traffic Impact Analysis. On November 1, 2013, ODOT commented on Jordan Cove's August 19, 2013 Addendum. ODOT's review of Pacific Connector's Transportation Management Plans is pending.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
ODOT (continued)	State Highway ROW ORS 374-305 OAR 734- 55	Permits to be issued from each DOT District Office to allow construction within State Highway ROW and use of State Highways for Project access, and where utilities would cross over, under, or run parallel to ODOT ROWs.	Applications for ODOT Approach and Utility Permits to be submitted with enough advance notice (which could be up to 12 months or more depending on individual District requirements) prior to construction activities to ensure adequate time to review the specific proposals.
Oregon Department of Water Resources (ODWR)	New Water Rights ORS 537 OAR 690-310	Issue permits to appropriate surface water and groundwater.	Pacific Connector submitted an application for a license to temporarily use surface waters for pipeline construction and testing. ODWR review pending.
	Temporary Water Use ORS 537 OAR 690-340	Issue limited licenses for temporary use of surface waters.	Pacific Connector anticipates submitting an application in late 2015.
Oregon Public Utilities Commission (OPUC)	OAR 860-031	Authorize intrastate electric transmission lines. Inspect the natural gas facilities for safety.	Pending Pacific Connector's submittal of appropriate applications to OPUC. Pending operation of facilities.
LOCAL – COUNTIES			
Coos County	Coos County Zoning and Land Development Ordinance, Coos County Comprehensive Plan, and Coos Bay Estuary Management Plan (CBEMP) ORS 197.015(10)(b)(H)	Issue Conditional Use Permits. Zoning Changes and Verifications. Issue LUCS under Statewide Planning Goals.	In December 2007, Coos County issued a Conditional Use Permit for the Jordan Cove LNG terminal. In January 2008, Coos County issued a Conditional Use Permit for Jordan Cove's access channel and marine slip. On August 21, 2009, Coos County adopted new Wetland Map for Jordan Cove's terminal in CBEMP Zoning District 6-WD, after remand from Oregon's Land Use Board of Appeals (LUBA). On September 23, 2009, Coos County approved Comprehensive Plan amendment and Zoning Map amendment for Jordan Cove's future use of the former Kentuck Golf Course for wetland mitigation. On December 16, 2009, Coos County approved a correction of maps of wetlands within CBEMP Zoning District 6-WD for Jordan Cove's terminal. March 22, 2012, Coos County partly approved a correction of the Coastal Shoreline Boundary in the 7-D zone at the former Weyerhaeuser linerboard property.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
Coos County (continued)			On July 25, 2012, Coos County reissued an Administrative Conditional Use Permit for fill at the Jordan Cove terminal in CBEMP Zoning District 6-WD.and made an Administrative Interpretation for Zoning Districts 5-WD and 6-WD. On October 4, 2012, Coos County approved fill at the former mill site in CBEMP IND Zone and 7-D Zone, and vegetative shoreline stabilization in CBEMP 7-D. On April 18, 2015, Coos County approved Jordan Cove's request for a barge berth in CBEMP Zoning Districts 6-DA and 6-WD; fire station, road, and utility corridor within Zoning District 7-D; and a realignment of Jordan Cove Road in Zoning District 8-WD. On September 8, 2010, Coos County issued a Conditional Use Permit to Pacific Connector. On June 14, 2013, Coos County issued a LUCS to Pacific Connector. On November 14, 2013 Jordan Cove withdrew its application for design and site plan review for the South Dunes Power Plan due to the pending EFSC application.
	Section 311 of EPAct	Review and provide consultation regarding Jordan Cove's Emergency Response Plan.	On July 16, 2009, Jordan Cove signed concept agreements with the Coos County Sheriff's Office, Emergency Management, and Health Department.
Douglas County	Douglas County Comprehensive Plan and Douglas County Land Use and Development Ordinance ORS 197.015(10)(b)(H)	Issue Conditional Use Permits Issue LUCS	On December 11, 2009, Douglas County issued a Conditional Use Permit to Pacific Connector. On March 20, 2014, Douglas County Planning Commission approved a Major Amendment to its 2009 decision to allow the Pacific Connector pipeline to cross 7.3 miles within the Coastal Zone in Douglas County. That decision was affirmed by the Board of Commissioners for Douglas County on April 30, 2014. Douglas County then issued a revised LUCS on June 2, 2014 for the 7.3-mile portion of the pipeline within the Coastal Zone Management Area within Douglas County.

TABLE 1.4.1-1

Major Permits, Approvals, and Consultations for the JCE & PCGP Project

Agency	Authority/Regulation/ Permit	Agency Action	Initiation of Consultations and Permit Status
Jackson County	Jackson County Comprehensive Plan and Jackson County Land Development Ordinance ORS 197.015(10)(b)(H)	Issue Conditional Use Permits Issue LUCS	On June 18, 2013 Jackson County provided a LUCS for the Project. The LUCS indicated that the Project was not subject to the land development standards of the Jackson County Land Development Ordinance because it would be authorized by the FERC. Therefore, no conditional use permits would be necessary.
Klamath County	Klamath County Land Development Code ORS 197.015(10)(b)(H)	Issue Conditional Use Permits Issue LUCS	On August 21, 2012, Klamath County responded to the FERC NOI with a list of local permits that Pacific Connector should apply for. On June 10, 2013, Klamath County provided a LUCS for the Project. The LUCS indicated that the Project would require county applications and review if it is not authorized by the FERC. Therefore, no conditional use permits would be necessary.
All Counties	Road Crossing Permits	Review permits to cross county roads.	To be submitted prior to construction.
	Grading Permits	Review permits for excavation and grading activities.	To be submitted prior to construction.
	Solid Waste Disposal	Review permits for disposal of solid waste generated by construction.	To be submitted prior to construction.
LOCAL – CITIES			
City of Coos Bay	CBEMP	Issue Conditional Use Permit Zoning Verification	On June 15, 2007, the City approved the establishment of a 2-acre eelgrass mitigation site in aquatic unit 52-NA.
City of North Bend	North Bend Comprehensive Plan	Conditional Use Permit Amend Chapters 18.04 and 18.44	On October 8, 2013, the City approved Jordan Cove's request to amend the M-H Heavy Industrial Zone to allow conditional use for temporary work force housing.
City of North Bend	North Bend City Code	Conditional Use Permit Amend Chapter 18.80	On April 23, 2014, the City approved a conditional use permit to site housing at the NPWHC and variances to allow vehicle parking and drainage. This decision is being appealed to the LUBA.
City of North Bend	North Bend City Code	Conditional Use Permit Amend Chapters 18.84 and 18.88	On March 25, 2014, the City approved a legislative text amendment to North Bend Shorelands Management Unit 48 to allow for a bridge at Jordan Cove's NPWHC.

1.4.1.1 Endangered Species Act

Section 7 of the ESA (16 U.S.C. 1531-1544), as amended, states that "Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act," and any project authorized, funded, or

conducted by a federal agency should not "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined...to be critical" (16 U.S.C. Section 1536(a)(2)(1988)). The lead federal agency, or the applicant as a non-federal party, is required to consult with the FWS and the NMFS to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur in the vicinity of the Project. If, upon review of existing data, or data provided by the applicant, one (or both) of the Services find that any federally listed species or critical habitats may be affected by the Project, the FERC is required to prepare a biological assessment (BA) to identify the nature and extent of adverse impacts, and to recommend measures that would avoid, reduce, or mitigate impacts on habitats and/or species.

The FWS provided a Conservation Framework for the northern spotted owl (NSO; *Strix occidentalis caurina*) and marbled murrelet (MAMU; *Brachyramphus marmoratu*) to the applicants, to assist with their development of an applicant-prepared draft biological assessment (APDBA). The Conservation Framework identified impact analyses and categorization methods, as well as compensatory mitigation guidance for impacts on these species and their critical habitats.

Jordan Cove and Pacific Connector filed their APDBA with the FERC on September 19, 2013, and revised it on April 7, 2014. The FERC reviewed the APDBA, and after updating information,[37] we submitted our own BA for the Project to the NMFS and FWS on February 24, 2015. The NMFS requested additional information in letters to the FERC dated March 23 and July 10, 2015. The FWS commented to the FERC on the BA on April 7 and May 12, 2015.

Because our BA finds that the Project is likely to adversely affect some federally listed species, the FWS and NMFS should each develop a biological opinion (BO) as to whether authorizing the Project may jeopardize the continued existence of any species under their jurisdiction or adversely modify or destroy designated critical habitat. See section 4.7 of this EIS for a summary of our ESA analysis.

1.4.1.2 Magnuson-Stevens Fishery Conservation and Management Act

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. The MSA requires federal agencies to consult with the NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA Section 305(b)(2)). Although absolute criteria have not been established for conducting EFH consultations, the NMFS recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the NEPA, the Fish and Wildlife Coordination Act, or the ESA to reduce duplication and improve efficiency (50 CFR 600). As part of the consultation process for this Project, we will consolidate an EFH Assessment with the BA, on behalf of the federal cooperating agencies for this Project.

[37] After review of the APDBA, the FERC issued a data request to the applicants on December 13, 2013, to fill in information gaps. The applicants responded to that data request with filings on December 23, 2013, and February 7 and April 7, 2014.

The FERC submitted its BA and EFH Assessment for the JCE & PCGP Project to the NMFS on February 24, 2015. The NMFS requested additional information in letters to the FERC dated March 23 and July 10, 2015. See section 4.6 of this EIS for a summary of our EFH Assessment.

1.4.1.3 Marine Mammal Protection Act

All marine mammals are protected under the MMPA (16 U.S.C. 31). This act was amended by the U.S. Congress in 1994. The MMPA prohibits, with certain exceptions, the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the United States. The term "take," as defined in Section 3 of the MMPA, means "to harm, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal" (16 U.S.C. Section 1362(13)). "Harassment" is also defined in the MMPA and in regulations promulgated by the NMFS.

Sections 101(a)(5)(A) and (D) of the MMPA direct the U.S. Secretary of Commerce, through the NMFS, to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals of a species or population stock by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specific geographic region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of authorization is provided to the public for review. Authorization would be granted by the NMFS if it finds that the taking will have a negligible impact on the species or stock, will not have an unmitigatable adverse impact on the availability of the species or stock for subsistence uses (where relevant), and it prescribes permissible methods of taking, and requirements pertaining to the mitigation, monitoring, and reporting of such taking. NMFS has defined "negligible impact" as "an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock though effects on annual rates of recruitment or survival."

The NMFS may use relevant portions of this EIS during its review, and may adopt measures to protect marine mammals outlined in this EIS. It may also require additional mitigation and monitoring measures to ensure that the taking result in the least practicable adverse impact on affected marine mammal species or stocks. The public would have an opportunity to comment to the NMFS in response to its Notice of Receipt of an application for an Incidental Harassment Authorization, or a request for the implementation of regulations governing incidental taking, and following the publication of the proposed rule.

On October 8, 2014, Jordan Cove and Pacific Connector submitted their draft application for Incidental Harassment Authorization (IHA) under the MMPA to the NMFS.[38] Impacts from the JCE & PCGP Project on marine mammals are discussed in sections 4.6 and 4.7 of this EIS. In addition, marine mammals listed under the ESA are discussed in detail in our BA and EFH Assessment.

1.4.1.4 Marine Protection, Research and Sanctuaries Act

In 1972, Congress enacted the MPRSA (16 U.S.C. 1401 et seq., also known as the Ocean Dumping Act) to prohibit the dumping of material into the ocean that would unreasonably degrade or endanger human health or the marine environment. Virtually all authorized materials dumped

[38] The IHA was filed with FERC on October 10, 2014, under Docket No. CP13-492.

today are dredged materials (sediments) removed from the bottom of water bodies in order to maintain navigation channels and berthing areas.

Ocean dumping cannot occur unless a permit is issued under the MPRSA. In the case of dredged material, the decision to issue a permit is made by the COE, using the EPA's environmental criteria and subject to the EPA's concurrence. The EPA is also responsible for designating ocean dumping sites for dredged material, or sites for disposal of other materials.

Jordan Cove proposed to dispose of materials dredged during maintenance of its access channel and marine slip at Site F, an existing EPA-designated offshore placement site located about 1,000 feet north of the north jetty (see section 2.1.1.12). Jordan Cove included a *Dredge Material Management Plan* with its JPA for review by the COE.

1.4.1.5 National Historic Preservation Act

Section 106 of the NHPA (54 U.S.C. 306108) requires that federal agencies take into account the effects of their undertakings on historic properties, and afford the ACHP an opportunity to comment. Historic properties include prehistoric or historic sites, districts, buildings, structures, objects, landscapes, or properties of traditional religious or cultural importance listed on or eligible for listing on the National Register of Historic Places (NRHP). Jordan Cove and Pacific Connector, as non-federal parties, can provide cultural resources data, analyses, and recommendations to the FERC, as allowed by the ACHP's regulations for implementing Section 106, at 36 CFR 800.2(a)(3). However, the FERC remains responsible for all determinations.

As the lead federal agency, it is the FERC's responsibility, under Section 106 and its implementing regulations, to consult with the Oregon State Historic Preservation Office (SHPO), identify historic properties within the area of potential effect (APE), and make determinations of NRHP eligibility and project effects, on behalf of all the federal cooperating agencies. In order to comply with Section 101(d)(6)(B) of the NHPA, and the Native American Religious Freedom Act, the FERC is consulting with Indian tribes that may attach religious or cultural significance to historic properties in the APE,[39] also on behalf of the federal cooperating agencies. The BLM and Forest Service are proposing to amend their respective LMPs to make provision for the pipeline, and are responsible for consulting with affected tribes on those actions.

To resolve adverse effects at historic properties identified along the pipeline route that cannot be avoided, and outline additional phased cultural resources investigations, a Memorandum of Agreement (MOA)[40] was produced, and submitted to the ACHP on August 30, 2011. If the FERC authorizes the newly proposed Jordan Cove LNG export terminal and associated Pacific Connector pipeline, the MOA would be amended to account for the differences between the original projects

[39] See 36 CFR Part 800.2(c)(2)(ii). Indian tribes are defined in Part 800.16(m) as "…an Indian tribe, band, nation, or other organized group or community, including a native village, regional corporation, or village corporation, as those terms are defined in Section 3 of the Alaska Native Claims Settlement Act (43 U.S.C. 1602), which is recognized as eligible for special programs and services provided by the United States to Indians because of their status as Indians."

[40] July 2011 Memorandum of Agreement Between the Federal Energy Regulatory Commission, U.S. Bureau of Land Management, U.S. Bureau of Reclamation, U.S. Forest Service, and the Oregon State Historic Preservation Office Regarding the Jordan Cove Liquefied Natural Gas Terminal and Pacific Connector Gas Pipeline Project (FERC Docket Nos. CP07-441-000 and CP07-444-000), with Jordan Cove, Pacific Connector, Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw, and the Coquille Indian Tribe as concurring parties.

under Docket Nos. CP07-441-000 and CP07-444-000 and the newly proposed activities under Docket Nos. CP13-483-000 and CP13-492-000. See section 4.11 of this EIS for a discussion of the status of compliance with the NHPA.

1.4.1.6 Rivers and Harbors Act

Section 10 of the RHA (33 U.S.C. 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been authorized by the COE. Jordan Cove and Pacific Connector submitted a JPA to the COE to obtain a permit under the RHA. Potential Project-related impacts on waterbodies and wetlands are discussed in section 4.4 of this EIS.

Approval from the COE is required for alterations to, or to temporarily or permanently occupy or use, any COE federally authorized civil works project pursuant to Section 408 of the RHA. Proposed alterations must not be injurious to the public interest or affect the COE project's ability to meet its authorized purpose. The COE, Portland District, has determined that the Pacific Connector Pipeline as currently proposed would not affect any COE authorized civil works projects, and therefore does not require Section 408 authorization. However, Jordan Cove's proposed marine slip and access channel has the potential of affecting the Coos Bay Federal Navigation Channel, a COE civil works project. If it is determined that the marine slip and/or the access channel would result in an alteration to the federal navigation channel, Section 408 approval would be required.

1.4.1.7 Clean Water Act

The CWA (33 U.S.C. 1251 et seq.) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Section 404 of the CWA outlines procedures by which the COE can issue permits (after notice and opportunity for public hearings) for the discharge of dredged or fill material into waters of the United States at specified disposal sites. The EPA has the authority to review and veto COE decisions on Section 404 permits. The FWS and NMFS use their Fish and Wildlife Coordination Act authorities to review and comment during the 404 permitting process. Jordan Cove and Pacific Connector submitted a JPA to the COE to obtain a permit under Section 404 of the CWA.

The authority to issue Water Quality Certifications pursuant to Section 401 of the CWA and National Pollutant Discharge Elimination System (NPDES) permits pursuant to Section 402 of the CWA has been delegated to the ODEQ. Jordan Cove and Pacific Connector would submit their JPA to the ODEQ to obtain Water Quality Certifications under Section 401 of the CWA. The applicants intend to submit their applications to ODEQ for NPDES permits under Section 402 of the CWA to allow for the discharge of stormwater about one year prior to the start of Project construction. Section 4.4 of this EIS discusses impacts on water resources that may be applicable to compliance with the CWA.

1.4.1.8 Clean Air Act

The primary objective of the CAA (42 U.S.C. 85), as amended, is to establish federal standards for various pollutants from both stationary and mobile sources, and to provide for the regulation of polluting emissions via state implementation plans. In addition, the CAA was established to prevent

significant deterioration in certain areas where air pollutants exceed national standards and to provide for improved air quality in areas that do not meet federal standards (non-attainment areas).

The EPA has regulatory authority under the CAA. Section 309 of the CAA directs the EPA to review and comment in writing on environmental impacts associated with all major federal actions. The EPA has delegated permitting authority under the CAA to the ODEQ. Emissions from all phases of construction and operation of the proposed LNG terminal and pipeline would be subject to applicable federal and state air regulations.

Jordan Cove submitted an air quality permit application to the ODEQ in March 2013. Pacific Connector submitted its air quality permit application in June 2015. Section 4.12.1 of this EIS has a detailed discussion of air quality issues.

1.4.1.9 Coastal Zone Management Act

In 1972, Congress passed the CZMA to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the nation's coastal zone for this and succeeding generations" and to "encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone" (16 U.S.C. 1452, Section 303 (1) and (2)).

Section 307 (c)(3)(A) of the CZMA states that "any applicant for a required federal license or permit to conduct an activity, in or outside the coastal zone, affecting any land or water use or natural resource of the coastal zone of that state shall provide a certification that the proposed activity complies with the enforceable policies of the state's approved program and that such activity will be conducted in a manner consistent with the program." In order to participate in the coastal zone management program, a state is required to prepare a program management plan for approval by the NOAA Office of Coast and Ocean Resource Management (OCRM). Once the OCRM has approved a plan and its enforceable program policies, a state program gains "federal consistency" jurisdiction. This means that any federal action (e.g., a project requiring federally issued licenses or permits) that takes place within a state's coastal zone must be found to be consistent with state coastal policies before the federal action can occur.

All components of the Jordan Cove LNG terminal, and the Pacific Connector pipeline from MP 0.0 to approximately MP 46 are within the designated Oregon coastal zone and are subject to federal CZMA review. The ODLCD is the state's designated coastal management agency and has established the Oregon Coastal Management Program (OCMP). The program's mission is to work in partnership with coastal local governments, state and federal agencies, and other stakeholders to ensure that Oregon's coastal and ocean resources are managed, conserved, and developed consistent with statewide planning goals. To accomplish this mission, the program combines various state statutes for managing coastal lands and waters into a single, coordinated package. These include: (1) the 19 Statewide Planning Goals, which are Oregon's standards for comprehensive land use planning; (2) city and county comprehensive land use plans; and (3) state agencies and natural resource laws such as the Oregon Beach Bill and the Removal-Fill Law.

Under the provisions of the CZMA, Jordan Cove and Pacific Connector must provide a certification to the FERC, COE, and the ODLCD that their projects comply with and would be conducted in a manner consistent with the state's approved management program (15 CFR 930.50 Subpart D). On August 1, 2014, Jordan Cove and Pacific Connector submitted their applications

for Certification of Consistency to the ODLCD. On July 8, 2015, the ODLCD signed a stay agreement that delays their review to January 9, 2016. See section 4.1.1.2 of this EIS for further information regarding compliance with the CZMA.

1.4.1.10 Migratory Bird Treaty Act

Migratory birds are species that nest in the United States and Canada during the summer and migrate south to the tropical regions of Mexico, Central and South America, and the Caribbean for the nonbreeding season. Migratory birds are protected under the MBTA (16 U.S.C. 703–711). EO 13186 (66 *Federal Register* [FR] 3853) discusses federal agency responsibilities for conservation of migratory birds and their habitats. Destruction or disturbance of migratory bird nests, or any eggs or young contained within it, is a violation of the MBTA. The MBTA also prohibits other forms of taking of migratory birds. For certain limited circumstances, the FWS may authorize certain types of migratory bird take.

As directed by EO 13186, on March 30, 2011, the FERC and FWS entered into an MOU that focuses on migratory birds and strengthening conservation through enhanced collaboration between the agencies. This voluntary MOU does not waive legal requirements under the MBTA, Bald and Golden Eagle Protection Act, ESA, or any other statutes, and does not authorize the take of migratory birds.

On February 13, 2015, Jordan Cove and Pacific Connector submitted their joint draft *Migratory Bird Conservation Plan* to the FWS. Section 4.6 of this EIS discusses migratory bird species that inhabit the project area, and measures the applicants would implement to avoid, reduce, or mitigate impacts on migratory birds.

1.4.2 Review and Use of the FERC EIS by the BLM, Forest Service, and Reclamation

As cooperating agencies, BLM and Forest Service have prepared sections of this EIS that are relevant to their proposed actions (i.e., evaluation of plan amendments and issuance of a Right-of-Way Grant), and would be used to support their respective agency decision-making processes (e.g., RODs). Each agency independently decides whether to adopt the EIS as a basis for agency decisions pursuant to 40 CFR 1506.3.

The BLM Oregon/Washington State Director would be able to make the following decisions and determinations upon adoption of the analysis in this EIS:

- Whether to amend the RMPs for the BLM Coos Bay, Roseburg, and Medford Districts and the Klamath Falls Resource Area of the Lakeview District as proposed; and
- Whether to grant, grant with conditions, or deny the Temporary Use Permit and the Right-of-Way Grant to Pacific Connector (Mineral Leasing Act of 1920, Section 185(f) and in accordance with 43 CFR 2882.3(i)). BLM would not issue the Right-of-Way Grant without concurrence from the Forest Service and Reclamation.

The Forest Supervisor of the Umpqua National Forest would be able to make the following decisions and determinations based on the analysis in this EIS, if adopted:

- Whether to amend the LRMPs for the Umpqua, Rogue River, and Winema National Forests as proposed pursuant to 36 CFR 219.10(f) (1982 version);

- Determine the significance of the proposed amendments pursuant to 36 CFR 219.10(f) (1982 version), using criteria in Forest Service Manual - Land Management Planning (Section 1926.5);[41] and
- Determine whether the Forest Service would concur to the granting of a Temporary Use Permit and a Right-of-Way Grant by the BLM, and, if so, issue a letter of concurrence following amendments of the respective National Forest LRMPs to make provision for the Project.

For the Forest Service, the following types of actions are not considered to be significant changes to their LRMPs:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management;
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management;
3. Minor changes in standards and guidelines; and
4. Opportunities for additional projects or activities that will contribute to achievement of the management prescription.

The criteria by which the Forest Service determines if an amendment is significant are as follows:

- The change would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected; and
- The change may have an important effect on the entire LRMP or affect land and resources throughout a large portion of the planning area during the planning period.

In accordance with 36 CFR 219.17(b)(2), the Forest Service has elected to use the 1982 planning rule procedures to amend LRMPs, as provided in the transition procedures of the 2000 planning rule.

Reclamation's Mid-Pacific Region Klamath Basin Area Office Manager would be able to make the following decision and determination based upon the analysis in this EIS:

- Determine whether Reclamation would concur by issuance of a letter of concurrence to the granting of a Right-of-Way Grant by the BLM.

Before BLM can issue the Temporary Use Permit and Right-of-Way Grant that allows the Project to use and subsequently occupy federal lands, the applicant would be required to submit a complete POD to address all relevant construction and post-construction activities, including off-site mitigation plans. If upon adoption of the EIS and issuance of a ROD, the BLM issues a Temporary Use Permit and a Right-of-Way Grant with concurrence of the Forest Service and Reclamation, these authorizations will stipulate specific conditions, including those described in the approved POD, related to lands, facilities, and easements within each agency's respective jurisdiction.

[41] The BLM does not have a similar requirement.

1.4.2.1 Consistency with Federal Land Management Plans

Approximately 71 miles of the Pacific Connector pipeline route would cross federal lands administered by the BLM or the Forest Service. The pipeline route would cross portions of four BLM Districts and three National Forests. Land within each BLM District is managed in accordance with the District's RMP, while land within each National Forest is managed according to the National Forest's LRMP. Under these plans, BLM and NFS lands are divided into land allocations, each of which has specific goals and objectives as well as corresponding management direction (BLM RMPs) or standards and guidelines (Forest Service LRMPs). Before BLM can issue a Temporary Use Permit and a Right-of-Way Grant for the Project, the BLM and the Forest Service must determine that the Project is consistent with all applicable BLM and Forest Service LMPs.

In 1994, the ROD for the Northwest Forest Plan (NWFP) amended LMPs for federal lands within the range of the NSO including the LRMPs of the Umpqua, Rogue River, and Winema National Forests. Subsequently in 1995, the RMPs of the BLM's Coos Bay, Roseburg, Medford Districts, and Klamath Falls Resource Area of the Lakeview District, were revised to incorporate the requirements of the NWFP. Thus the elements of the NWFP have been incorporated into the LMPs of all seven administrative units of the BLM and Forest Service that may be included in the BLM Right-of-Way Grant. The NWFP represented a major shift in focus for federal land management agencies in the affected area from an emphasis on intensive timber management to an emphasis on the maintenance of biodiversity and habitat for species dependent on late-successional and old-growth (LSOG) forests. The NWFP provided a comprehensive conservation strategy for managing LSOG forests and promoting the long-term health of the rich diversity of plant and animal communities and species that are an integral part of that ecosystem.

The core components of the NWFP conservation strategy are: (1) a network of mapped and unmapped LSRs distributed across the landscape where management actions must protect or enhance late-successional forest conditions; (2) an Aquatic Conservation Strategy (ACS) providing for the delineation of Riparian Reserves and other measures to maintain and restore aquatic and riparian habitats; and (3) a series of broadly stated standards and guidelines to guide development of on-the-ground projects for implementation of the conservation strategy. The NWFP also addresses the need to protect rare and poorly known plant and animal LSOG species broadly referred to as Survey and Manage (S&M) species. The standards and guidelines set forth in the NWFP for S&M species were amended in 2001.

When projects comply with the standards and guidelines or management direction of a LMP, they are "consistent" with that plan. Conversely, projects that are not consistent with these standards and guidelines are generally not consistent with the plan. When a project is not consistent with the governing LMP(s) where the action occurs, the following three options are available to the land management agency:

- The agency does not approve the project and it is not implemented;
- The applicant modifies the project to make it compliant with the underlying LMP(s); or
- The agency amends the underlying LMP to make provision for the project to go forward.

This EIS documents actions that would be taken by Pacific Connector to avoid, reduce, or mitigate impacts by realigning the construction corridor to prevent impacts to critical resources, and by

incorporating a wide range of conservation measures and BMPs, including adopting the May 2013 versions of the FERC's *Erosion Control and Revegetation Plan* (FERC's *Plan*), the *Wetland and Waterbody Construction and Mitigation Procedures* (FERC's *Procedures*), and various attachments to the POD, including Appendix CC (CMP). Collectively, these proposed actions, including all elements of the POD, would become enforceable conditions of the Temporary Use Permit and/or the Right-of-Way Grant, if issued.

The linear nature of the pipeline corridor makes it impossible to avoid every circumstance that would be inconsistent with the management requirements and standards and guidelines of RMPs and LRMPs for federal lands within the range of the NSO. As proposed, the Project is not consistent with some aspect of each of the relevant LMPs at some locations, and amendments to these plans are required in order to make provision for the Project to proceed. The BLM process for amending an RMP is set forth in 43 CFR 1610.5, while the complementary Forest Service process for amending an LRMP is set forth in 36 CFR 219, Subpart B. Some of the environmental issues evaluated in this EIS that are directly related to these LMP amendments are:

- Effects on S&M species and their habitat and the degree to which the pipeline project may threaten the continued persistence of affected species within the range of the NSO (approximately 448 sites of 78 species could be affected by the pipeline project, including approximately 369 sites of 67 species within the clearing limits of the pipeline corridor, 94 of these sites are occupied by *Arborimus longicaudus* [red tree vole][42]);
- Effects on LSR functionality and the degree to which mitigating effects of "Matrix to LSR" land reallocations and other mitigations render the Project neutral or beneficial to the creation and maintenance of late-successional habitat (approximately 475 acres of mapped LSR[43] would be directly impacted and 1,896 acres of Matrix would be reallocated as LSR);
- Direct Effects on unmapped LSRs for occupied MAMU habitat and Known Owl Activity Centers (KOACs) would be 76 acres, including impacts to three KOACs.

The loss of BLM General Forest Lands through "Matrix to LSR" reallocation would be offset by the applicant acquiring timber-producing lands so the BLM can mitigate for management limitations on O&C and Coos Bay Wagon Road lands. The Forest Service has not identified acquisition of replacement lands as a compensatory mitigation measure. Other issues associated with Forest Service-specific plan amendments that must be evaluated in the context of their significance to the delivery of goods and services or attainment of LRMP goals and objectives include:

- Effects of removal of effective shade on perennial streams on the Umpqua National Forest;
- Effects of crossing approximately 2 acres of the Management Area (MA) 26, Restricted Riparian land allocation on the Rogue River National Forest and of running parallel to riparian areas on the Umpqua National Forest for approximately 0.1 mile;
- Effects on changes in visual quality objectives on the Rogue River and Winema National Forests; and
- Effects of detrimental soil conditions caused by soil displacement and compaction on the Winema, Rogue River, and Umpqua National Forests.

[42] This information is incomplete; surveys for S&M species are ongoing and final results are not available for inclusion in the EIS.
[43] This value was updated based on 2013 route adjustments.

With the exception of the boundary changes resulting from the reallocation of Matrix land to LSR, these proposed BLM and Forest Service amendments to BLM and Forest Service LMPs are Project-specific, and apply only to the Pacific Connector Pipeline Project, if authorized.

Appendix E of this EIS contains an assessment regarding the Project's consistency with federal LMPs. Table 1.4.2.1-1 categorizes the proposed amendments by existing LRMP direction or requirements and BLM/Forest Service administrative unit. The designations of the various proposed amendments refer to the NOI published by the Forest Service and BLM in the *Federal Register* on September 21, 2012.

As is evident in table 1.4.2.1-1, amendments associated with S&M species are relevant to all land allocations on each of the seven BLM and Forest Service administrative units, while those associated with LSR impacts (and related mitigation) are relevant to only the BLM Coos Bay and Roseburg Districts and the Umpqua and Rogue River National Forests. For the BLM Medford District and the Klamath Falls Resource Area, only S&M species amendments are relevant. S&M species and LSR-related amendments are the only amendments relevant to any of the BLM districts. On the National Forests, many other issues, including soil displacement/compaction and visual quality objectives (VQOs), require plan amendments for the Project to be a conforming use under the governing LRMPs. Based on comments submitted on the DEIS, the Forest Service has made minor revisions in the language for amendment RRNF-3 (Site-Specific Amendment of VQO on the PCT). This revised language is presented in section 2.1.3 of the FEIS.

TABLE 1.4.2.1-1

BLM and Forest Service Land Management Plan Consistency and Proposed Amendments

Standards and Guidelines or Management Direction a/	Proposed Plan Revision (Amendment)	BLM District					National Forest	
		Coos Bay	Roseburg	Medford	Lakeview (KFRA)	Umpqua	Rogue River	Winema
Requirement to protect Survey and Manage (S&M) species habitat	Site-specific waiver of management recommendations for protection of known sites of S&M species	BLM/FS-1	BLM/FS-1	BLM/FS-1	BLM/FS-1	BLM/FS-1	BLM/FS-1	BLM/FS-1
Requirement to protect habitat in contiguous existing or recruitment habitat for marbled murrelet (MAMU) within 0.5 mile of occupied sites	Site-specific exemption of requirement to protect MAMU habitat	BLM-1	BLM-1					
Requirement to protect habitat in Known Owl Activity Centers (KOACs)	Site-specific exemption of requirement to retain habitat in KOACs		BLM-2					
Requirement to mitigate for impacts to Late-Successional Reserves (LSRs)	Reallocation of Matrix Lands to LSR	BLM-4	BLM-3			UNF-4	RRNF-7	
Forest-wide Standards and Guidelines for fisheries prohibit removal of effective shade on perennial streams	Site-specific amendment to allow removal of effective shade on perennial streams					UNF-1		
Standards and Guidelines for riparian land allocation require that transmission corridors be located outside these areas	Site-specific amendment to allow utility corridors in riparian areas					UNF-2	RRNF-5	
Standards and Guidelines for Management Area (MA) 3 do not allow new utility corridors in the management area	Site-Specific Amendment to allow utility corridors in MA 3							WNF-1
Standards and Guidelines for soils allow only a certain amount (10-20 percent) of displacement and compaction, depending on the land allocation	Site-specific amendment to waive limitations on detrimental soil conditions					UNF-3	RRNF-6	WNF-4 WNF-5
Visual quality objectives (VQO) must be met within a specified timeframe	Site-specific amendment of VQOs						RRNF-2 RRNF-3 RRNF-4	WNF-2 WNF-3

a/ BLM RMPs use the term "Management Direction" for on-the-ground requirements that projects must meet on BLM lands. Forest Service LRMPs use the term "Standards and Guidelines" for on-the-ground requirements that projects must meet on NFS lands.

1.4.2.2 BLM Review and Approval Requirements

Adopt FERC EIS

As a cooperating agency, the BLM would consider adopting the EIS for the Project pursuant to 40 CFR 1506.3(c) if, after an independent review of the document, the BLM Oregon/Washington State Director concurs that the analysis provides sufficient evidence to support agency decisions and is satisfied that agency comments and suggestions have been addressed.

Issue ROD that Amends RMPs

If the EIS for the Project is adopted by the BLM, the agency may issue a ROD that would document the Oregon/Washington State Director's decision regarding approval of amendments to the RMPs to make provision for the Project to move forward.

Issue ROD for Award of a Right-of-Way Grant to Authorize Occupancy of Federal Lands

Concurrent with amendment of RMPs, the Oregon/Washington State Director may issue a ROD to authorize a Temporary Use Permit and a Right-of-Way Grant for the Project. The BLM would consult with the Forest Service and Reclamation before making a decision regarding these authorizations.

Issue Right-of-Way Grant

Prior to use and occupancy of federal lands by the Project, a Temporary Use Permit and a Right-of-Way Grant must be issued by the BLM. If issued by the BLM, these would include: (1) a POD, which would contain, among other requirements: conditions and mitigation measures identified in the EIS; (2) standards and site-specific stipulations (including mitigation measures) developed by the BLM, Forest Service, and Reclamation; and (3) terms and conditions from the BOs issued by the FWS and NMFS.

1.4.2.3 Forest Service Review and Approval Requirements

Adopt FERC EIS

As a cooperating agency, the Forest Service would consider adopting the EIS for the Project pursuant to 40 CFR 1506.3(c) if, after an independent review of the document, the Forest Supervisor of the Umpqua National Forest concurs that the analysis provides sufficient evidence to support agency decisions and is satisfied that agency comments and suggestions have been addressed.

Issue ROD that Amends LRMPs

If the EIS for the Project is adopted by the Forest Service, the agency could issue a ROD that would document the decision of the Forest Supervisor of the Umpqua National Forest regarding approval of amendments to LRMPs to make provision for the Project. The ROD would include statements of plan consistency and determinations of significance of effects of plan amendments on the delivery of goods and services under the plan.

Issue Letter of Concurrence to BLM

The Forest Service would use the analysis in this EIS to determine whether to issue a letter of concurrence to BLM regarding the issuance of a Temporary Use Permit and a Right-of-Way Grant for the portion of the route crossing NFS lands administered by the Forest Service.

1.4.2.4 Reclamation Review and Approval Requirements

Issue Letter of Concurrence to BLM

Reclamation would use the analysis in this EIS to determine whether to issue a letter of concurrence to the BLM regarding the issuance of a Right-of-Way Grant for the portion of the pipeline route crossing lands and facilities of the Klamath Project administered by Reclamation's Mid-Pacific Region Klamath Basin Area Office.

1.4.3 Reviews by Other Federal Agencies

1.4.3.1 Coast Guard Review

The Coast Guard exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under EO 10173; the Magnuson Act (50 U.S.C. 191); the Ports and Waterways Safety Act of 1972, as amended (33 U.S.C. 1221 et seq.); and the Maritime Transportation Security Act of 2002 (46 U.S.C. 701). The Coast Guard is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of the facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the LNG storage tanks. The Coast Guard also has authority for LNG facility security plan review, approval, and compliance verification as provided in 33 CFR 105, and siting as it pertains to the management of vessel traffic in and around the LNG facility. As required by its regulations, the Coast Guard is responsible for issuing an LOR as to the suitability of the waterway for LNG marine traffic.

In accordance with 33 CFR 127.007, each applicant must submit a Letter of Intent (LOI) to the local COTP to begin the LOR process. Jordan Cove submitted an LOI to the Coast Guard for its original LNG import Project in 2006. The Coast Guard has informed Jordan Cove that the previous LOI is suitable for the current Project provided it is amended to address any operating changes required for the change from an import to export terminal.

On June 14, 2005, the Coast Guard issued a Navigation and Vessel Inspection Circular – Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic (Navigation and Carrier Inspection Circular [NVIC] 05-05). The purpose of the NVIC 05-05 is to provide Coast Guard COTPs/Federal Maritime Security Coordinators, members of the LNG industry, and port stakeholders with guidance on assessing the suitability of a waterway for LNG marine traffic that takes into account conventional navigation safety/waterway management issues contemplated by the existing LOI/LOR process. In addition, maritime security implications were also considered. In accordance with this guidance, each LNG project applicant is to submit a WSA to the cognizant COTP. On December 22, 2008, the Coast Guard published a second NVIC, Guidance Related to Waterfront Liquefied Natural Gas (LNG) Facilities (NVIC 05-08; Coast Guard 2008). The purpose of NVIC 05-08 was to revise the format of the LOR to conform to its intended effect of being a recommendation of the waterway suitability to the FERC. The NVIC 05-08 is further discussed in section 4.13. On January 24, 2011, the Coast Guard published a third NVIC: Guidance Related To Waterfront Liquefied Natural Gas (LNG) Facilities (NVIC 01-2011). The purpose of NVIC 01-2011 was to revise the format of the LOR to conform to its intended effect of being a recommendation to FERC as to the suitability of the waterway. In this NVIC, the Coast Guard has added guidance on release of the LOR and message management, and provided an updated template for the LOR analysis.

The WSR for the Jordan Cove LNG Project was issued pursuant to NVIC 05-05. The final review and LOR were issued pursuant to NVIC 05-08, which replaced NVIC 05-05. NVIC 05-08 eliminated the term WSR and replaced it with "Letter of Recommendation (LOR) Analysis." For the purpose of clarity, the WSR is equivalent to the LOR Analysis. Section 813 of the Coast Guard Authorization Act of 2010 requires the Coast Guard to consider recommendations made by the States prior to making a recommendation to FERC on the suitability of the waterway for marine traffic associated with an LNG facility. Although this law was effective after the WSR and LOR were issued, the Oregon Department of Energy (ODE) (as lead State agency) was an active participant in the WSA validation committee and concurred with the verbiage of the WSR and LOR.

Jordan Cove submitted a WSA to the Coast Guard for its original LNG import project in 2006. The Coast Guard issued a WSR on July 1, 2008, and issued an LOR on April 24, 2009, which are both still valid. The Coast Guard acknowledged the validity of the WSR and LOR in their letter to Amergent Techs (Jordan Cove's contractor) on February 21, 2012. Jordan Cove submitted to the Coast Guard on January 13, 2014 its most recent annual review of the WSA. On February 14, 2014, the COTP indicated that the risks associated with the waterway and the terminal facility as originally evaluated did not substantially change for the newly proposed LNG export Project. The public portions of the Coast Guard's WSR and LOR are attached to this EIS as appendix B. See section 4.13 of this EIS for additional discussion of marine safety.

1.4.3.2 U.S. Department of Defense Consultation

As required by Section 311(f) of the EPAct and Section 3 of the NGA, we have consulted with the U.S. Department of Defense (DOD) to determine if there would be any impacts associated with the Project on military training or activities on any active military installations. On September 27, 2012, we sent a letter to the DOD Siting Clearinghouse informing them of the Project, and requesting comments. Colonel Suzanne Johnson, Military Assistant to the Executive Director of the DOD Siting Clearinghouse responded, in a letter to the FERC dated November 2, 2012, that the Project would have minimal impact on military operations in the area. Therefore, the DOD does not oppose construction of the Project.

1.4.3.3 U.S. Army Corps of Engineers Review

The COE is the primary federal agency responsible for reviewing and processing applications for permits pursuant to Section 404 of the CWA and Section 10 of the RHA. Jordan Cove and Pacific Connector submitted their single comprehensive JPA to the COE in October 2013. The COE would process the JPA in accordance with its regulations at 33 CFR Parts 320 through 330 and supporting guidance.

In an October 9, 2012, letter to the FERC responding to our NOI, the COE requested that this EIS address the following topics:

- purpose and need for the Project;
- characterization of waterbodies and wetlands (including high tide line, mean high water, ordinary high water, and wetland boundaries);
- classifications of fisheries in waterbodies;
- waterbody and wetland construction drawings;
- potential to encounter contaminated sediments;
- modifications to the FERC's Plan and Procedures; and
- proposed compensatory mitigation measures.

The COE can adopt the FERC's EIS for its NEPA purposes, and to document compliance with other federal laws, including the ESA, MSA, and NHPA. The purpose and need for the Project are briefly summarized in section 1.3 above. We discuss issues pertaining to impacts on water resources and wetlands, including contaminated sediments and proposed mitigation measures, in section 4.4 of this EIS. Fisheries are discussed in section 4.6. Modifications to the FERC's *Plan* and *Procedures* are addressed in sections 4.4 and 4.6.

Approval from the COE is required for alterations to, or to temporarily or permanently occupy or use, any COE federally authorized civil works project pursuant to Section 408 of the RHA. Proposed alterations must not be injurious to the public interest or affect the COE project's ability to meet its authorized purpose. The COE, Portland District, has determined that the Pacific Connector Pipeline as currently proposed would not affect any COE authorized civil works projects, and therefore does not require Section 408 authorization. However, Jordan Cove's proposed marine slip and access channel has the potential of affecting the Coos Bay Federal Navigation Channel, a COE civil works project. If it is determined that the marine slip and/or the access channel would result in an alteration to the federal navigation channel, Section 408 approval would be required.

1.4.3.4 U.S. Environmental Protection Agency Review

The EPA shares responsibility for administering and enforcing Section 404 of the CWA with the COE. The COE administers the day-to-day program, including individual permit decisions and jurisdictional determinations; develops policy and guidance; and enforces Section 404 provisions. The EPA develops and interprets environmental criteria used in evaluating permit applications, identifies activities that are exempt from permitting, reviews/comments on individual permit applications, enforces Section 404 provisions, and has authority to veto COE permit decisions.

The EPA also co-administers the MPRSA with the COE. Section 103 of the MPRSA authorizes the COE to issue permits for the ocean disposal of dredged material. That permit decision is made using the EPA's environmental criteria and is subject to EPA's concurrence if disposal is proposed at an EPA-designated site, under Section 102 of the MPRSA. Use of an EPA site must also meet the requirements of the site's Site Management and Monitoring Plan.

In addition, the EPA has an obligation under Section 309 of the CAA to review and comment in writing on the environmental impact associated with all major federal actions. This obligation is independent of its role as a cooperating agency under the NEPA regulations. Consistent with this direction, EPA evaluates all federally issued EISs for adequacy in meeting the procedural and public disclosure requirements of the NEPA. The EPA commented on our DEIS in a letter to the FERC dated February 11, 2015.

1.4.3.5 U.S. Fish and Wildlife Service and National Marine Fisheries Service Review

The FWS and NMFS have the authority under the ESA to work with federal agencies and applicants to conserve ESA-listed species and their critical and other habitats. The FWS and NMFS will consult with lead federal agencies for actions that may affect ESA-listed species and/or critical habitats. The FWS and NMFS have the authority under the Fish and Wildlife Coordination Act (FWCA) to review applications for CWA Section 404 and Section 401 permits. The FWS has authority under the MBTA and EO 13186 and its associated MOUs with federal agencies to conserve migratory birds and their habitats. Jordan Cove and Pacific Connector submitted draft Migratory Bird Conservation Plans to the FWS for review.

The NMFS has the authority under the MSA and MMPA to review a project's impacts to essential fish habitats and to protect marine mammals. The NMFS would review the draft application for IHA under the MMPA submitted by Jordan Cove and Pacific Connector in October 2014, and would issue a Letter of Authorization under Section 101(a)(5) of the MMPA and 50 CFR 216 subpart 1.

The FERC submitted its BA and EFH Assessment for this Project to the FWS and NMFS on February 24, 2015. The NMFS requested additional information in letters to the FERC dated March 23 and July 10, 2015, and the FWS commented on our BA in letters dated April 7 and May 12, 2015. After accepting our BA, these agencies would enter into formal consultation and produce their individual BOs for the Project. In addition, the NMFS would review the draft application for IHA under the MMPA submitted by Jordan Cove and Pacific Connector in October 2014, and would issue a Letter of Authorization under Section 101(a)(5) of the MMPA and 50 CRF 216 subpart 1.

1.4.3.6 U.S. Department of Energy Review

DOE's authority to regulate the export of the natural gas commodity arises from Section 3 of the NGA. By law, under Section 3(c) of the NGA, applications to export natural gas to countries with which the United States has FTAs that require national treatment for trade in natural gas are deemed to be consistent with the public interest and the Secretary must grant authorization without modification or delay.

In the case of LNG export applications to non-FTA nations, NGA Section 3(a) requires DOE to conduct a public interest review and to grant the applications unless DOE finds that the proposed exports will not be consistent with the public interest. Additionally, the NEPA requires DOE to consider the environmental impacts of its decisions on non-FTA nations export applications. In this regard, DOE acts as a cooperating agency with the FERC as the lead agency in this EIS pursuant to the requirements of the NEPA. The DOE authorized Jordan Cove to export LNG to FTA nations and non-FTA nations in Orders issued in December 2011 and March 2014, respectively.

1.4.3.7 U.S. Department of Transportation Review

The DOT is a cooperating agency in the production of this EIS. The DOT would review the design and construction of the Project under 49 CFR 193. In June 2014, PHMSA accepted Jordan Cove's methodologies for modeling credible leak scenarios at the terminal. This is discussed in more detail in section 4.13 of this EIS.

1.4.4 State Agency Permits and Approvals

In addition to the federal permitting authorities that have been delegated to the states, as discussed above, various laws and regulations promulgated by the state of Oregon pertain to the JCE & PCGP Project. The Coast Guard also worked with representatives of the state of Oregon in reviewing the WSA for the Project.

The FERC encourages cooperation between applicants and state and local authorities, but this does not mean that state and local agencies, through application of state and local laws, may prohibit or unreasonably delay the construction or operation of facilities approved by the FERC. Any state

or local permits issued with respect to FERC regulated facilities must be consistent with the conditions of any Certificate the FERC may issue.[44]

Oregon permits, authorizations, and consultations with state agencies relevant to the Project are listed in table 1.4.1-1. Reviews by Oregon state agencies are discussed below.

1.4.4.1 Oregon Department of Agriculture

The Oregon Department of Agriculture (ODA) maintains the state list of endangered and threatened species, in accordance with Oregon Administrative Rule (OAR) Chapter 603, Division 73, and reviews reports of botanical surveys under Oregon Senate Bill 533 and its corresponding Oregon Revised Statute (ORS) 564. These state laws and regulations require surveys for state listed species on non-federal public lands prior to ground-disturbing activities, unless habitat for the species does not exist in the project area. Furthermore, the ODA Noxious Weed Control Program and the Oregon State Weed Board maintain the State Noxious Weed List for the State of Oregon.

Botanical surveys for special status species, including state listed species under the jurisdiction of the ODA, were conducted by the applicants' contractors where access was granted. On September 15, 2008, the ODA indicated that no state listed plant species would be adversely affected at the LNG terminal, based on Jordan Cove's original botanical survey results.[45] Because areas where access was previously denied along the proposed pipeline route cannot be surveyed by Pacific Connector until after a Certificate is issued by the FERC, providing the company with the power of eminent domain, complete botanical survey reports would be submitted to ODA prior to construction that document all suitable habitat and state listed plant species that may be affect by the Project. Potential Project-related impacts on upland plant species are discussed in section 4.5 of this EIS, while wetland plant species are discussed in section 4.4.

1.4.4.2 Oregon Department of Energy

According to the EPAct, the Governor of a state in which an LNG terminal is proposed is to designate an appropriate state agency to consult with the Commission. That state agency should provide the FERC with an advisory report on state and local safety concerns, within 30 days of the FERC's notice of an application for an LNG terminal, for the Commission to consider prior to making a decision. The ODE has been designated by the Governor of Oregon as the state agency to coordinate the review of proposed LNG projects by other state agencies and consult with the FERC. However, the ODE did not submit a State Safety Advisory Report to the FERC in response to our Notice of Application issued on May 30, 2013, for Jordan Cove's LNG export terminal under Docket No. CP13-483-000.

Oregon state agencies filed environmental comments with the FERC about the proposed Jordan Cove LNG export terminal on October 29, 2012, in response to our NOI issued on August 2, 2012. On June 20, 2013, the ODE filed with the FERC a motion to intervene and statement of position, but we do not consider that statement to represent the State Safety Advisory Report. On June 10, 2014, the ODE entered into an MOU with Jordan Cove regarding emergency response at the

[44] See, e.g., *Schneidewind v. ANR Pipeline Co*., 485 U.S. 293 (1988); *National Fuel Gas Supply v. Public Service Commission*, 894 F.2d 571 (2n Cir. 1990); and Iroquois Gas Transmission System, L.P., *et al.*, 52 FERC 61,091 (1990) and 59 FERC 61,094 (1992).

[45] Jordan Cove updated the botanical survey report as Appendix B.3 of Resource Report 3 filed with its May 2013 application to the FERC. Jordan Cove has not yet documented ODA review of the 2013 report.

planned LNG terminal. Oregon state agencies, including the ODE, commented on our DEIS in a letter to the FERC dated February 12, 2015.

The ODE's Energy Facility Siting Council (EFSC) has the authority to approve or disapprove Jordan Cove's South Dunes Power Plant, and, if approved, the EFSC would issue a site certificate. A site certificate is a binding agreement between the State of Oregon and the applicant, authorizing the applicant to construct and operate the facility on an approved site. To issue a site certificate, the EFSC must find that the facility complies with the EFSC standards as well as all other applicable Oregon statutes and administrative rules identified in the Project Order. The ODE serves as staff to EFSC.

The types of facilities under EFSC's jurisdiction are defined in ORS 469.300. During the review process, the applicant would file a Notice of Intent, EFSC (through the ODE) would issue a Project Order and the applicant would file its Application for a Site Certificate. After review of the application, the ODE would issue a Draft Proposed Order, with recommended findings of fact, conclusions of law and site certificate conditions. Following close of the record on the Draft Proposed Order, the ODE would issue a Proposed Order and Notice of Contested Case proceeding. The contested case proceeding is conducted by an appointed hearing officer. Following the contested case proceeding and issuance of the hearing officer's proposed contested case order, the EFSC would issue the Final Order, which is the decision document (which could either approve or deny issuance of the site certificate).

Jordan Cove filed its original NOI for the South Dunes Power Plant with the EFSC on August 1, 2012, and amended that notice on November 30, 2012. The EFSC (through the ODE) issued a public notice, and took comments on the amendment up through January 4, 2013. On February 14, 2013, the EFSC (through the ODE) issued its original Project Order for the South Dunes Power Plant, with an amended Project Order issued on October 14, 2013. Jordan Cove submitted its preliminary Application for Site Certificate on January 9, 2014. The ODE determined the application to be complete on December 23, 2014, and Jordan Cove filed its final Application for Site Certificate on December 29, 2014. The ODE issued a Draft Proposed Order on the application on May 27, 2015. The Draft Proposed Order recommends the EFSC approve the application and grant a Site Certificate, subject to the conditions listed in the Draft Proposed Order. We discuss the South Dunes Power Plant under non-jurisdictional facilities in section 2.2.1 of this EIS.

The ODE is also the state agency that would enforce Oregon's carbon dioxide (CO_2) emission standards, and would enforce the state's requirements for retirement bonds. Our analysis of CO_2 emissions can be found in section 4.12.1 of this EIS. The ODE signed an MOU with Jordan Cove on June 10, 2014, regarding compliance with the state's CO_2 standards and its Retirement and Financial Assurance Standard for the LNG terminal.[46] We discuss future potential abandonment of facilities in section 2.9 of this EIS.

1.4.4.3 Oregon Department of Environmental Quality

The ODEQ is responsible for protecting and enhancing Oregon's water and air quality, managing the proper disposal of hazardous and solid waste, overseeing clean-ups of spills or releases of hazardous materials, and enforcing Oregon's environmental laws and regulations. The agency's

[46] The MOUs between the State of Oregon and Jordan Cove were filed with the FERC on July 1, 2014 in Docket No. CP13-483-000.

duties to regulate sewage treatment and disposal systems are found in ORS Chapter 454, for solid waste management in Chapter 459, hazardous materials in Chapters 465 and 466, air and water quality in Chapter 468, and ballast water in Chapter 783. The EPA has delegated authority to ODEQ under both the CWA and CAA. The state rules for administration of those authorities can be found in OAR 340, Division 40 for groundwater quality protection; Divisions 41, 42, and 48 for water quality; Division 45 for NPDES permits; Division 44 for waste disposal wells; Divisions 49-50, 53, and 55 for wastewater; Divisions 93-98 for solid waste; Divisions 100-104 for hazardous waste; Division 143 for ballast water; and Divisions 2002, 202, 204, 208, 210-216, 218, 220, 222-226, 228, 232, 236, 238, 240, 244, 246, and 250 for air quality.

Under its delegated responsibilities, the ODEQ issues CWA Section 401 Removal and Fill Water Quality Certificate permits, Water Pollution Control Facility permits, and NPDES permits under Section 402 of the CWA. Pacific Connector stated that it provided the ODEQ with water quality information when it submitted its JPA to the COE. The company also applied for coverage under ODEQ's general NPDES permit for discharge of construction stormwater. Water quality issues are addressed in detail in section 4.4 of this EIS.

Under its delegated responsibilities required by the CAA, ODEQ administers the Title V Air Permit program and the acid rain program, and issues air contaminant discharge permits (ACDP). The agency is also responsible for enforcing greenhouse gas (GHG) reporting requirements, and collecting data on GHG emissions for certain facilities that hold Title V or ACDP operating permits. In addition, ODEQ makes determinations about the Prevention of Significant Deterioration (PSD) of air quality from new major sources or major modifications at existing sources, and reviews air quality analyses completed to comply with National Ambient Air Quality Standards (NAAQS).

Jordan Cove submitted its air quality permit application to the ODEQ in March 2013, and its multisource air quality modeling protocol to the ODEQ in April 2013. Pacific Connector submitted its air quality permit application in June 2015. Air quality issues are addressed in section 4.12.1 of this EIS.

1.4.4.4 Oregon Department of Fish and Wildlife

The ODFW is responsible for keeping the state sensitive fish and wildlife list and developing the state's Wildlife Diversity Plan. The purpose of the Fish and Wildlife Habitat Mitigation Policy (OAR 345-22-60) developed by the ODFW is to apply consistent goals and standards to mitigate impacts on fish and wildlife habitat caused by land and water development actions. The policy provides goals and standards for general application to individual development actions, and for the development of more detailed policies for specific classes of development actions or habitat types. In implementing this policy, the ODFW will recommend or require mitigation for losses of fish and wildlife habitat resulting from development actions. Priority is given to native species. Both Jordan Cove and Pacific Connector have voluntarily agreed to categorize habitat on lands affected by the Project and seek mitigation of impacts on wildlife in a manner consistent with the ODFW's policies. Both applicants consulted with the ODFW regarding habitat categorization during 2008 and 2009. Jordan Cove filed with the FERC its latest revision of its *Wildlife Habitat Mitigation Plan* in December, 2014, which was supposed to address ODFW comments on an earlier version. Pacific Connector submitted its *Wildlife Habitat Mitigation Plan* to ODFW in December 2014 as well (as part of a joint plan with Jordan Cove).

ORS 509.585 (Oregon Fish Passage Law) applies to all project components that cross waters of the state where native migratory fish species are or were historically present. ODFW would also review fish screening at water intakes under ORS 498-306. Under ORS 509 and OAR 635, ODFW has responsibilities for review of stream crossing plans to provide for passage of native migratory fish. Pacific Connector has applied to the ODFW for approval of fish passage measures at waterbodies crossed by the pipeline route. On January 29, 2014, Jordan Cove submitted its *Draft Wildlife Salvage Plan* to ODFW. Further discussions of fish and wildlife issues can be found in section 4.6 of this EIS.

OAR 635-425 through 50 requires in-water blasting permits to be issued by ODFW for locations where explosives may be used to cross streams. While in general, in-water blasting is discouraged, unless it is the only practicable method for accomplishing project goals, the ODFW may issue a permit if it contains conditions for preventing injury to fish and wildlife and their habitats. Pacific Connector applied to the ODFW for a permit to conduct in-water blasting at waterbodies with exposed bedrock.

1.4.4.5 Oregon Department of Forestry

The ODF manages State Forests for the Greatest Permanent Value. The ODF has created a Forest Management Plan to provide strategic direction and guide management activities. Part of the plan is to identify multi-purpose objectives, and protect sensitive resources according to the state's Land Management Classification System. The ODF also monitors the commercial harvest of forest products from private timber lands, according to the Oregon Forest Practices Act. The ODF is responsible for protection of non-federal and private forest lands from wildfires.

Pacific Connector would be required to submit a Notification to the ODF. The Notification serves three purposes: notification of a forest operation (ORS 527.670), a request for a Permit to Use Fire or Power Driven Machinery (ORS Chapter 477), and notice to the Department of Revenue of timber harvest (ORS 321.550). A separate notification should be filed for each county and timber owner affected by the Project. All notifications require a 15-day waiting period before activity may begin unless a waiver is requested. Also, any action that would result in the conversion of forestland to other land uses (ORS 527.730) or practices not in statute or rule would require the submission of a Plan for Alternate Practice and written approval from the State Forester.

Pacific Connector's June 2013 application to the FERC contained a *Right-of-Way Clearing Plan*, a *Fire Prevention and Suppression Plan*, and a *Prescribed Burning Plan* as part of its POD. Pacific Connector would prepare and submit to the ODF State Forester for approval a written plan, describing how the pipeline would be in compliance with the Forest Practices Act (OAR 629-605-170), prior to harvesting activities. This EIS discusses potential Project-related impacts on timber in section 4.5.2.

1.4.4.6 Oregon Department of Geology and Mineral Industries

The mission of the Oregon Department of Geology and Mineral Industries (DOGAMI) is to provide earth science information for the citizens of Oregon. DOGAMI identifies and quantifies natural hazards, and works to minimize potential impacts of earthquakes, landslides, and tsunamis. Its administrative rule at OAR 632, includes the identification of Tsunami Inundation Zones under Division 5. The agency is also the steward of Oregon's mineral resources, and it regulates mining activities, and oil and gas exploration and production on non-federal lands. Jordan Cove and Pacific Connector obtained baseline information about geological hazards from DOGAMI.

Jordan Cove has prepared a Tsunami Hydrodynamic Modeling Methodology. DOGAMI has reviewed this modeling effort, and recommended using their rupture Scenario L1 to best represent the 2,475-year hazard level design criteria outlined in the revised FERC seismic design criteria. This EIS addresses geological hazards in section 4.2.

1.4.4.7 Oregon State Historic Preservation Office

The FERC, as the lead federal agency, on behalf of the federal cooperating agencies, would consult with the Oregon SHPO regarding the identification of historic properties and determination of Project-related effects, in accordance with 36 CFR 800, in order to comply with Section 106 of the NHPA. On June 3, 2011, the SHPO signed the MOA for the original Jordan Cove LNG import terminal and Pacific Connector sendout pipeline under Docket Nos. CP07-441-000 and CP07-444-000 regarding the resolution of adverse effects and providing for a phased approach to future investigations. If the new proposals under Docket Nos. CP13-483-000 and CP13-492-000 are approved by the Commission, we would amend the MOA, with SHPO concurrence.

The SHPO also has authorities under ORS 358-920 to issue permits for cultural resources surveys on non-federal public land, and for the excavation of archaeological sites on non-federal lands. Jordan Cove and Pacific Connector would obtain applicable permits from the SHPO prior to conducting other archaeological work related to the Project. Consultations with the SHPO and the status of compliance with the NHPA are discussed in section 4.11 of this EIS.

1.4.4.8 Oregon Department of Land, Conservation, and Development

The ODLCD assists communities and citizens in improving the built and natural environment. Under Oregon's statewide land use planning program, the ODLCD provides protection for farm and forest lands, conservation of natural resources, plans for orderly development, and coordinates among local governments. Comprehensive land use planning coordination is required under ORS 197. All cities and counties have adopted plans that meet state standards and adhere to 19 Statewide Planning Goals and Guidelines, as articulated in OAR 660-15.

In addition, NOAA has delegated to the state of Oregon the finding of consistency with the CZMA, under 15 CFR Part 930. In accordance with ORS 196.435, the ODLCD's Ocean and Coastal Services Division has been designated the state's coastal zone management agency, and administers the CZMA federal consistency review program under OAR 660-035. Applicants for certification of CZMA consistency are encouraged by the ODLCD to obtain state and local permits and other authorizations required by enforceable policies. The requirements of the CZMA are applicable to NPDES permits and must be included in the NPDES permit for the Jordan Cove industrial wastewater treatment facility.

On August 1, 2014, Jordan Cove and Pacific Connector submitted their applications for Certification of Consistency to the ODLCD. On July 8, 2015, the ODLCD signed a stay agreement that delays their review to January 9, 2016. The CZMA consistency process is discussed in section 4.1.1.2 of this EIS.

1.4.4.9 Oregon Department of State Lands

Under Oregon's Removal-Fill Law (ORS 196-800-990), permits are issued by the ODSL for:

- projects requiring the removal or fill of 50 cubic yards or more of material in waters of the state;

- the removal or fill of any material regardless of the number of cubic yards affected in a stream designated as essential salmon habitat; and
- the removal or fill of any material from the bed and banks of scenic waterways regardless of the number of cubic yards affected.

An application to the ODSL should demonstrate independent utility, best use of waters, and outline measures to minimize impacts on water resources. To meet the requirements of OAR Division 85, compensatory mitigation should be offered to replace all lost functions and values of wetlands and waterbodies impacted by a project. We discuss impacts on water resources and wetlands, and proposed measures to avoid, reduce, or mitigate those impacts in section 4.4 of this EIS.

ODSL requested the opportunity to concur with the applicants' delineations of waters of the state; this would occur as part of and jointly with the COE review. The applicants provided survey reports to ODSL in June of 2013.

The applicants would also need to obtain easements or rights-of-way to cross lands owned or managed by ODSL, including state waters. Jordan Cove indicated that it would be submitting two applications to the ODSL: (1) for the LNG terminal; and (2) another for the South Dunes Power Plant. Jordan Cove and Pacific Connector would submit its JPA to ODSL to obtain permits under the state's Joint Removal-Fill Law.

On February 19, 2013, the ODSL issued an Amended Proposed Order that would allow the dredging of Jordan Cove's proposed access channel and the portion of the marine slip in Coos Bay, under the state's Submerged and Submersible Land Easement regulations (OAR 141-122). ODSL accepted Pacific Connector's application for construction-associated dredging/disturbance in the bay under Permit Number 54484-RF on December 2, 2013. Pacific Connector submitted its application to ODSL for removal-fill permits for the remainder of the proposed pipeline route as part of its JPA with the COE.

1.4.4.10 Oregon Department of Water Resources

The mission of the ODWR is to address the state's water supply needs through the restoration and protection of stream flows and watersheds. ODWR is charged with administering state laws and regulations governing surface and groundwater resources, such as the Ground Water Act under ORS 537-505. Its core functions include collecting water resources data, and enforcing water rights, under OAR Chapter 690. All water is publicly owned in Oregon, and users must obtain a permit or water right from ODWR, including water withdrawals from underground wells, streams, or lakes.

ODWR maintains a database of water well locations, and a database for stream flows and lake levels. The applicants utilized the 2008 database for their application to FERC; however, FERC updated the analysis using the revised 2012 database.

Pacific Connector would apply to the ODWR for a license for temporary use of surface waters during pipeline construction and testing. Water resources are discussed in section 4.4 of this EIS.

1.4.4.11 Oregon Department of Transportation

The Oregon Department of Transportation (ODOT) has the responsibility to preserve the operational safety, integrity, and function of the state's highway facilities. The ODOT must also

ensure that improvements to the highway system can be accomplished without undue impacts or damage to utilities within the highway right-of-way. Construction that may impact the state right-of-way is subject to ORS 374.305, under which no person, firm, or corporation may place, build, or construct on any state highway right-of-way, approach road, structure, pipeline, ditch, cable or wire, or any other facility, thing, or appurtenance without first obtaining written permission from the ODOT. A permit from the ODOT is required for any work on a highway that is part of the state highway system, including but not limited to interstate highways, other highways on the National Highway System, and routes on the federal-aid highway system.

On August 2, 2012, the ODOT commented on Jordan Cove's Traffic Impact Analysis. However, the ODOT would need to review Jordan Cove's 2014 addendum to the Traffic Impact Analysis. Pacific Connector produced a *Traffic Management Plan*, but has not documented ODOT review of that plan. The applicants would have to obtain transportation permits (e.g., approach and utility permits, and over-dimensional trip permits) from the ODOT prior to construction. Transportation-related issued are discussed in section 4.10 of this EIS.

1.5 PUBLIC REVIEW AND COMMENTS

The Pacific Connector Pipeline Project was previously proposed to transport imported natural gas from the Jordan Cove terminal at Coos Bay to planned interconnections with PG&E and Tuscarora near Malin to service markets in California and Nevada (FERC Docket No. CP07-441-000). On June 15, 2009, the Forest Service published an NOI (74 [113] FR 27214–28217) for proposed LRMP amendments related to that proposal. Most of the proposed amendments associated with FERC Docket No. CP07-441-000 remain largely unchanged because the current Pacific Connector Pipeline Project follows nearly the same route on NFS lands. Comments received by the Forest Service in response to the Forest Service NOI published in 74 FR 27214–28217 were considered by the Forest Service in this scoping process if they were related to the current proposed forest plan amendments. A total of 77 comments were received by the Forest Service between June 15 and July 31, 2009, in response to the June 2009 Forest Service NOI and were considered by the Forest Service in the analysis in this EIS of environmental consequences of the Pacific Connector Pipeline Project on NFS lands. The FERC began its environmental review of the Jordan Cove liquefaction and LNG export proposal, and the associated Pacific Connector supply pipeline with the initiation of our pre-filing review process. On February 29, 2012, Jordan Cove requested that the FERC initiate the pre-filing review process for its newly proposed LNG export project, and we accepted that request on March 6, 2012, assigning it Docket No. PF12-7-000. On June 7, 2012, Pacific Connector requested that the FERC initiate the pre-filing review process for its newly proposed natural gas supply pipeline project, and we accepted that request on June 8, 2012, assigning it Docket No. PF12-17-000.

In their requests to initiate the pre-filing review process, Jordan Cove and Pacific Connector documented that they had previously contacted stakeholders, including federal, state, and local agencies, and some non-governmental organizations, about the newly proposed projects. In addition, both companies established project-specific webpages. Jordan Cove held an Open House meeting in Coos Bay on March 27, 2013. The Open House was advertised to the public through

notices published in local newspapers. FERC staff attended the Open House, and organized a site visit to the proposed LNG terminal and the planned South Dunes Power Plant.[47]

Pacific Connector held additional Open House meetings in Roseburg, Coos Bay, Klamath Falls, and Medford, Oregon during the week of June 25 through 28, 2012. Pacific Connector published notices about these Open Houses in local newspapers. FERC staff attended the Open Houses and were available to answer questions from the public.

On August 2, 2012, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Jordan Cove Liquefaction and Pacific Connector Pipeline Projects, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings*.[48] The NOI was sent to affected landowners; federal, state, and local government agencies; elected officials; environmental and public interest groups; interested Indian tribes; and local libraries and newspapers. The NOI described the Project, listed currently identified environmental issues, outlined the proposed actions of the DOE, BLM, and Forest Service, discussed the scoping and environmental review process, announced the date, location, and time of four public scoping meetings, and explained how the public could participate and comment.

During the week of August 27-30, 2012, the FERC, BLM, and Forest Service held joint public scoping meetings in Coos Bay, Roseburg, Klamath Falls, and Medford to take comments about the Project, which were recorded by a court reporter.[49] FERC staff also conducted site visits to spots along the proposed route of the Pacific Connector pipeline and alternatives, and to the Klamath Compressor Station location on August 28 and 29, 2012.[50]

The original FERC NOI indicated that the scoping period would end on September 4, 2012. On August 28, 2012, the FERC issued a *Notice of Extension of Comment Period and Additional Public Scoping Meetings for the Jordan Cove Liquefaction and Pacific Connector Pipeline Projects*. The scoping period was extended until October 29, 2012. On September 21, 2012, the FERC issued a *Notice of Additional Public Scoping Meetings for the Jordan Cove Liquefaction and Pacific Connector Pipeline Projects*. That notice announced additional public meetings, held October 9-11, 2012 in North Bend, Canyonville, and Malin. Also on September 21, 2012, the BLM and Forest Service published a supplemental NOI[51] that specifically addressed Pacific Connector's application for a Right-of-Way Grant over federal lands, and proposed amendments to BLM and Forest Service District and Forest LMPs to make provisions for the pipeline. Throughout the pre-filing review process, we received comments on a wide variety of environmental issues. Between March 6, 2012, when pre-filing was initiated for the Jordan Cove Project, and August 2, 2012, when we issued our NOI, the FERC received 7 letters. From August 3, 2012, to October 29, 2012 (the end of the announced scoping period), we received 170 discrete documents commenting on

[47] The FERC announced staff attendance at the site visit and Open House in a *Notice of Onsite Environmental Review* issued March 16, 2012. Staff notes from the site visit were placed in the FERC public record on April 17, 2012.
[48] The FERC's NOI was also published in the *Federal Register* on August 13, 2012 (vol. 77, no. 156, pp. 48138-48145).
[49] Transcripts of all of the public scoping meetings for this Project were placed into the FERC public record for the proceedings.
[50] The FERC issued a *Notice of Onsite Environmental Review* on August 10, 2012, informing the public about the site visits. Staff notes of the site visits were placed in the FERC public record on September 20, 2012.
[51] *Federal Register* (vol. 77, no. 184, pp. 58570-58575).

the Project, including 130 letters from individuals,[52] 26 letters from non-governmental organizations, 5 letters from federal agencies, 4 letters from state and local agencies, 3 letters from private companies, and 2 letters from members of the U.S. Congress. In addition, 429 form letters were filed. Between October 30, 2012, and September 30, 2014, when much of the text for the DEIS was written, the FERC received an additional 26 comment letters. The comments received during the pre-filing scoping period identified many of the environmental issues that were addressed in our DEIS.

During the pre-filing period, the FERC staff conducted consultations and participated in meetings with other key federal and state agencies to identify issues that should be addressed in this EIS. Five interagency meetings were held between March 2012 and April 2013: two at the BLM District Office in Roseburg on March 26, 2012, and March 12, 2013; and three meetings at the BLM District Office in Medford on June 27, August 30, and October 11 of 2012. A meeting was also held with Oregon state agencies on August 27, 2012, in Salem, organized by the ODE (see table 1.5-1). The cooperating agencies also participated in bi-weekly NEPA-status telephone conference calls.[53] The FERC, BLM, and Forest Service held seven public scoping meetings in Oregon during the pre-filing period, and six public meetings to take comments on the DEIS.

TABLE 1.5-1

Public and Interagency Meetings for the JCE & PCGP Project Attended In-Person by FERC Staff

Date	Location	Purpose	Attendees
3/26/12	Roseburg, OR	Interagency Meeting	FERC, BLM, Forest Service, EPA, COE, ODEQ
3/27/12	Coos Bay, OR	Open House/Site Visit	FERC, Jordan Cove, public
6/25/12	Roseburg, OR	Open House	FERC, Pacific Connector, public
6/26/12	Coos Bay, OR	Open House	FERC, Pacific Connector, public
6/27/12	Klamath Falls, OR	Open House	FERC, Pacific Connector, public
6/27/12	Medford, OR	Interagency Meeting	FERC, BLM, Forest Service, EPA, COE, FWS, ODEQ, Coast Guard, Jordan Cove, Pacific Connector
6/28/12	Medford, OR	Open House	FERC, Pacific Connector, public
8/27/12	Coos Bay, OR	Public Scoping Meeting	FERC, BLM, Forest Service, public
8/27/12	Salem, OR	State Agency Meeting	FERC, BLM, Forest Service, ODE, ODA, ODFW, ODSL, ODLCD, DOGAMI, SHPO, ODOT, Oregon Department of Justice, and Oregon Governor's Office
8/28/12	Roseburg, OR	Public Scoping Meeting	FERC, BLM, Forest Service, public
8/28/12	Douglas County, Oregon	Site Visit	FERC, BLM, Forest Service, Cow Creek Tribe, Pacific Connector, public
8/29/12	Klamath Falls, OR	Public Scoping Meeting	FERC, BLM, Forest Service, Reclamation, public
8/29/12	Malin, OR	Site Visit	FERC, Pacific Connector, public
8/30/12	Medford, OR	Public Scoping Meeting	FERC, BLM, Forest Service, public
8/30/12	Medford, OR	Interagency Meeting	FERC, BLM, Forest Service, Reclamation, NMFS, FWS, COE, Pacific Connector, public
10/9/12	North Bend, OR	Public Scoping Meeting	FERC, BLM, Forest Service, public
10/10/12	Canyonville, Or	Public Scoping Meeting	FERC, BLM, Forest Service, public
10/11/12	Malin, OR	Public Scoping Meeting	FERC, BLM, Forest Service, Reclamation, public
10/11/12	Medford, OR	Interagency Meeting	FERC, BLM, Forest Service, Reclamation, EPA, COE, Jordan Cove, Pacific Connector
3/12/13	Roseburg, OR	Interagency Meeting	FERC, BLM, Forest Service, Reclamation, EPA, COE, FWS, Coast Guard, Jordan Cove, Pacific Connector
12/8/14	Coos Bay, OR	DEIS Public Comment Meeting	FERC, BLM, Forest Service, public

[52] Not including form letters.
[53] Staff notes for all interagency meetings and the bi-weekly NEPA-status telephone conference calls have been placed into the FERC public record for these proceedings.

TABLE 1.5-1

Public and Interagency Meetings for the JCE & PCGP Project Attended In-Person by FERC Staff

Date	Location	Purpose	Attendees
12/9/14	Roseburg, OR	DEIS Public Comment Meeting	FERC, BLM, Forest Service, public.
12/10/14	Canyonville, OR	DEIS Public Comment Meeting	FERC, BLM, Forest Service, public
12/11/14	Medford, OR	DEIS Public Comment Meeting	FERC, BLM, Forest Service, public
12/12/14	Klamath Falls, OR	DEIS Public Comment Meeting	FERC, BLM, Forest Service, Reclamation, public
12/13/14	Malin, OR	DEIS Public Comment Meeting	FERC, BLM, Forest Service, Reclamation, public

The FERC issued an NOA of the DEIS on November 7, 2014. The NOA established a 90-day period for comments on the DEIS, ending on February 13, 2015. The 90-day comment period was established to meet public review requirements of the BLM for the proposed amendments to BLM and Forest Service LMPs.

A formal notice was also published by the EPA in the *Federal Register* on November 17, 2014, indicating that the DEIS was available. The FERC mailed 2,174 CDs and 218 hardcopies of the DEIS to interested parties, including federal, state, and local officials and agencies; affected landowners; Indian tribes; environmental groups and non-governmental organizations; parties to the proceedings; area libraries and newspapers; and individuals who requested a copy of the DEIS.

The NOA announced the time, date, and location of six public comment meetings in Oregon to take comments on the DEIS. Dates and locations of the public meetings included: Coos Bay on December 8, 2014; Roseburg on December 9, 2014; Canyonville on December 10, 2014; Medford on December 11, 2014; Klamath Falls on December 12, 2014; and in Malin on December 13, 2014. Transcripts of the meetings were placed in the public record for these proceedings.[54]

Comments from the public meetings, as well as written comments on the DEIS submitted by the public and agencies, are provided along with our responses in appendix W. Between the issuance of the NOA for the DEIS on November 7, 2014, and the close of the comment period on February 13, 2015 the FERC received 443 individual written letters commenting on the DEIS, including 7 letters from federal agencies, senators, and congressmen; 2 letters from Indian tribes; 1 collaborative letter from the various Oregon state agencies; 1 letter from a local government agency; 39 letters from companies and organizations; and 393 letters from individuals. These numbers do not include attachments, filings by the applicants; letters that do not contain comments on the DEIS; or duplicate redundant comment letters from individuals (i.e., where a single individual submitted a discrete identical comment letter multiple times). The general issues raised in comments on our DEIS are listed in table 1.5-2.

TABLE 1.5-2

Topics Raised in Comments on the DEIS

Topic of Comment	Percentage of Comments
Air Quality and Noise	9
Alternatives	3
BLM and Forest Service related comments (e.g., Plan Amendments)	8
Cultural Resources	1
Cumulative Impacts	1
FERC/NEPA Process	10

[54] Copies of the transcripts of the public meetings to take comments on the DEIS were placed into the dockets through the FERC's eLibrary system on January 13, 2015.

TABLE 1.5-2

Topics Raised in Comments on the DEIS

Topic of Comment	Percentage of Comments
General Comments on the EIS (e.g., comments on the Table of Contents)	6
Geology	1
Land Use	1
Out of Scope Comments	6
Project Description	8
Purpose and Need	7
State or Other Permitting Processes	2
Recreation / Visual	<1
Safety and Reliability	13
Socioeconomics	6
Soils	1
Transportation	1
Vegetation	1
Water and Wetlands	5
Wildlife and Fish	9

We have made changes in this FEIS both in response to comments received on the DEIS and as a result of updated information that became available after issuance of the DEIS. This FEIS is being mailed to the agencies, individuals, and organizations on the mailing list that is provided in appendix A, and was submitted to the EPA for formal issuance of a NOA.

In accordance with the CEQ's regulations implementing NEPA, no agency decision on a proposed action may be made until 30 days after the EPA publishes an NOA of the FEIS. However, the CEQ regulations provide an exception to this rule when an agency decision is subject to a formal internal process that allows other agencies or the public to make their views known. In such cases, the agency decision may be made at the same time the notice of the FEIS is published, allowing both periods to run concurrently. Should the Commission issue an Order authorizing the Project, it would be subject to a 30-day rehearing period. Therefore, the Commission could issue its decision concurrently with the EPA's NOA.

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2.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed action consists of the activities outlined by Jordan Cove and Pacific Connector in their applications to the FERC. The proposed facilities are more fully described in section 2.1 below.

This EIS addresses all facilities associated with the JCE & PCGP Project. That includes facilities that come under the jurisdiction of the FERC and some that do not. The non-jurisdictional facilities include the South Dunes Power Plant that would serve the Jordan Cove terminal, the SORSC, the vessels used for maritime transport of LNG, and various utility services to aboveground facilities along the Pacific Connector pipeline.

2.1 PROJECT COMPONENTS

The main Project components consist of Jordan Cove's LNG export terminal and Pacific Connector's pipeline and ancillary facilities. Chapter 4 of this EIS addresses specific environmental resources that may be potentially impacted by construction and operation of the proposed facilities.

2.1.1 Jordan Cove LNG Terminal

Jordan Cove proposes to construct and operate a new LNG export terminal on the bay side of the North Spit of Coos Bay, Oregon. The general location of the terminal is shown on figure 2.1-1. As listed in section 1.1.2 of this EIS, the main components of Jordan Cove's LNG export terminal include a connection to the Pacific Connector pipeline and gas processing plant, an electric power plant and utility corridor, four liquefaction trains, two full-containment LNG storage tanks, a transfer pipeline to the berth, loading facilities at the berth, a marine slip, and an access channel for LNG vessels. The main facilities at the LNG terminal are shown on figure 2.1-2. In addition, there is a discussion of the disposal of excavated and dredged materials, wetland mitigation areas, and temporary construction use areas and staging areas, including a temporary construction workers camp known as the NPWHC.

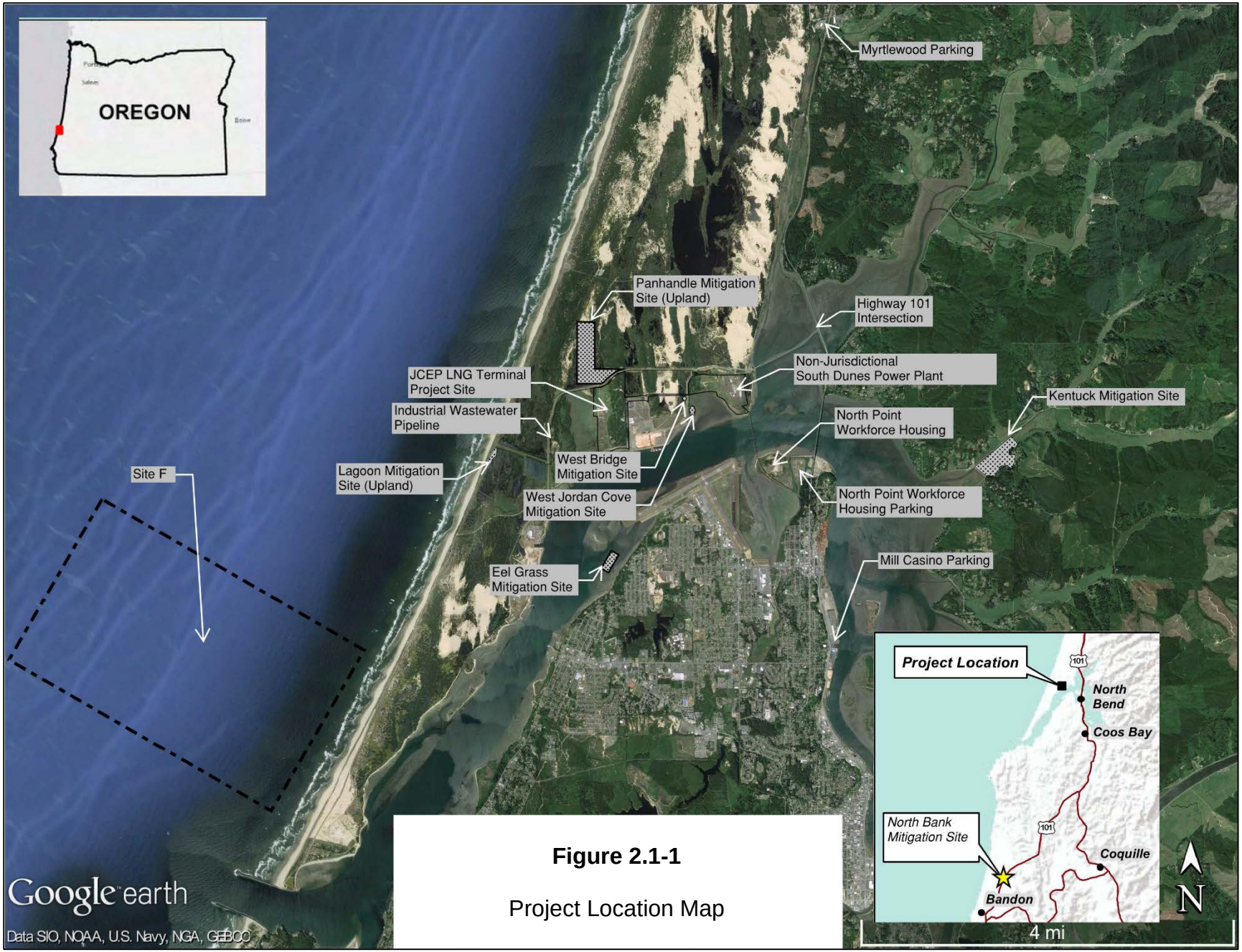
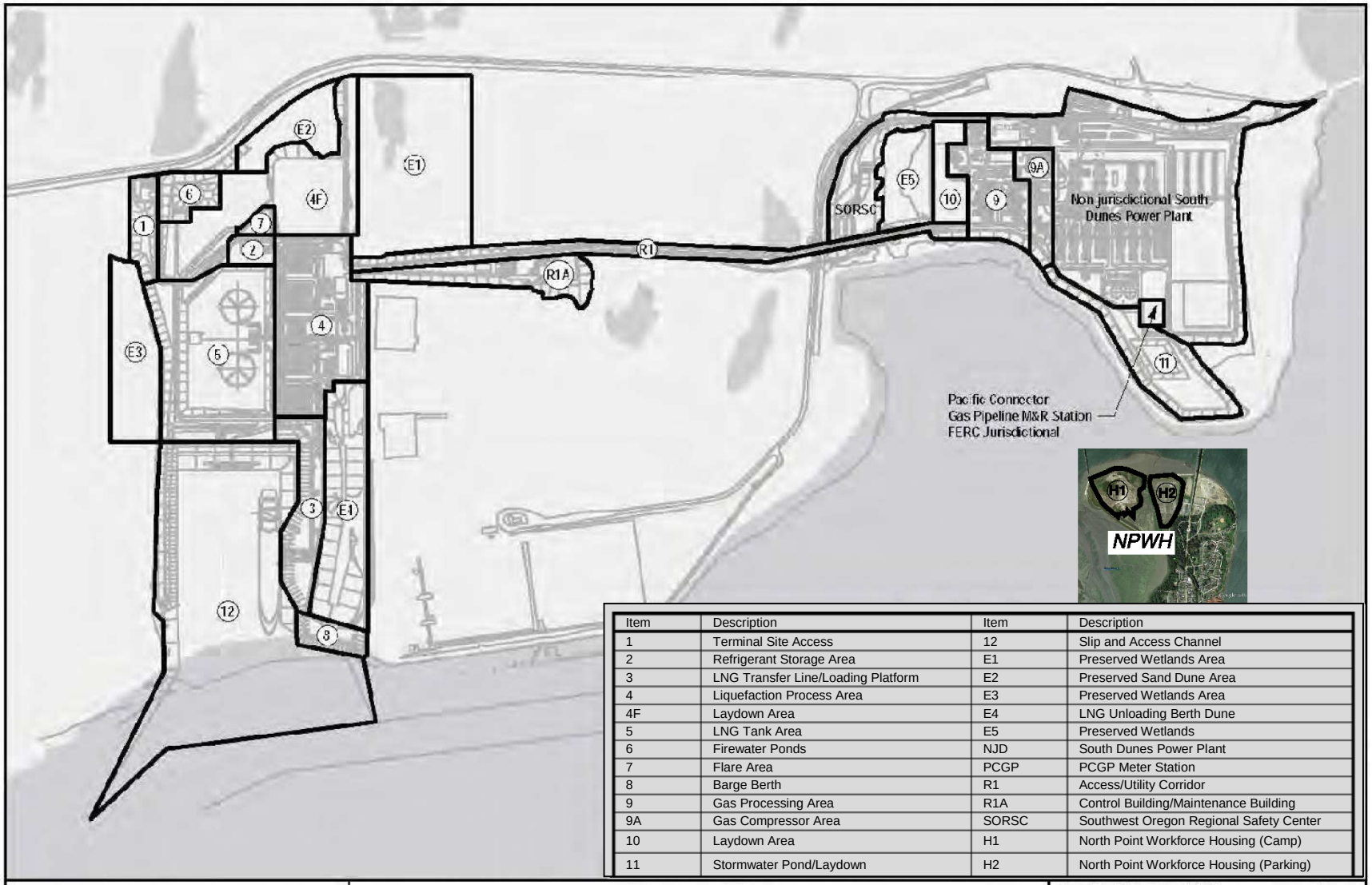


Figure 2.1-1

Project Location Map



Item	Description	Item	Description
1	Terminal Site Access	12	Slip and Access Channel
2	Refrigerant Storage Area	E1	Preserved Wetlands Area
3	LNG Transfer Line/Loading Platform	E2	Preserved Sand Dune Area
4	Liquefaction Process Area	E3	Preserved Wetlands Area
4F	Laydown Area	E4	LNG Unloading Berth Dune
5	LNG Tank Area	E5	Preserved Wetlands
6	Firewater Ponds	NJD	South Dunes Power Plant
7	Flare Area	PCGP	PCGP Meter Station
8	Barge Berth	R1	Access/Utility Corridor
9	Gas Processing Area	R1A	Control Building/Maintenance Building
9A	Gas Compressor Area	SORSC	Southwest Oregon Regional Safety Center
10	Laydown Area	H1	North Point Workforce Housing (Camp)
11	Stormwater Pond/Laydown	H2	North Point Workforce Housing (Parking)

Figure 2.1-2

LNG Terminal Facilities

0 250 500 1,000 Ft

1:12,000

Source:

Black and Veatch

Rev 1 4-22-15

2.1.1.1 LNG Marine Traffic

The Coast Guard defines the waterway for LNG marine traffic for the Jordan Cove Project as extending from the outer limits of the United States territorial waters, 12 nautical miles off the coast of Oregon, and 7.5 nautical miles up the Coos Bay navigation channel to the proposed location of the Jordan Cove LNG terminal (figure 2.1-3). The federally maintained Coos Bay navigation channel extends from the mouth of Coos Bay to the city of Coos Bay Docks at about navigation channel mile (NCM) 15.1 (figure 2.1-4). For the analysis in this EIS and the corresponding BA and EFH Assessment specific to species covered by the ESA and MSA, we also considered impacts from LNG vessel marine traffic extending out to the economic exclusion zone (EEZ).

Jordan Cove estimated that it would take an LNG vessel between 1.5 hours (at 6 knots) and 2 hours (at 4 knots) to travel through the waterway from Buoy "K" to the terminal. An additional 90 minutes would be necessary for the LNG vessel to be turned in the access channel and parked at the terminal berth, with the assistance of tug boats. The entire round-trip transit time for a single LNG vessel to travel from Buoy K through the waterway, turn and dock at the berth, take on a full cargo of LNG, and then exist the terminal slip and travel through the waterway back out to the open ocean past Buoy K would be about 22 hours.

2.1.1.2 Access Channel

An access channel would connect the existing Coos Bay navigation channel with the Jordan Cove LNG terminal marine slip (figure 2.1-5). The access channel would begin at the confluence between the Jarvis Turn and the Upper Jarvis Range at about NCM 7.5 along the Coos Bay navigation channel. The access channel would be about 2,300 feet wide at the navigation channel and about 800 feet wide at the mouth of the proposed slip. The distance from the north edge of the navigation channel to the mouth of the slip would be about 700 feet. The walls of the access channel would be sloped to meet the existing bottom contours at an angle of 3 feet horizontal to one foot vertical (3:1). The access channel would be approximately 45 feet deep.

The access channel would cover about 30 acres below the mean higher high water (MHHW) line. Dredging of the access channel would affect about 15.2 acres of currently existing deep subtidal below -15.3 feet in depth; about 5.8 acres of existing shallow subtidal to the MLLW line; and about 8.1 acres of existing intertidal strata between the MHHW and MLLW lines. Details about dredging and the disposal of dredged materials are discussed in section 2.1.1.11 below.

The access channel would be within state waters in Coos Bay managed by the ODSL. Jordan Cove would construct the access channel and the marine slip at its proposed LNG terminal. After construction, Jordan Cove would transfer responsibility for maintenance of the access channel and marine slip to the Oregon International Port of Coos Bay (Port). The Port has already obtained an easement from ODSL for operation and maintenance of the access channel and the in-water portion of the slip.[1] Jordan Cove would reimburse the Port for costs associated with its operation and maintenance of the access channel and slip.

[1] The ODSL issued an Amended Proposed Order for the access channel and in-bay portion of the slip on February 19, 2013.

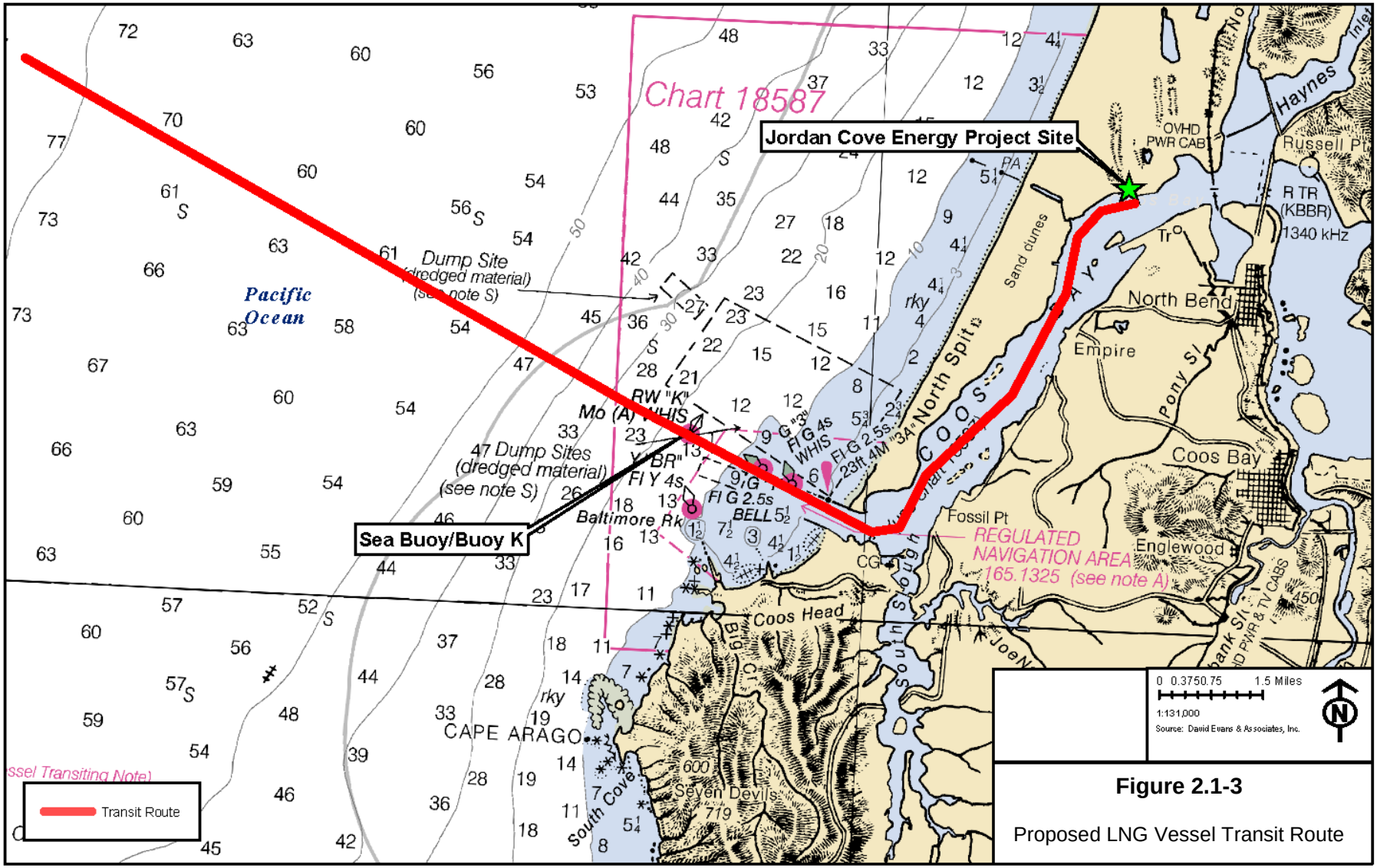


Figure 2.1-3

Proposed LNG Vessel Transit Route

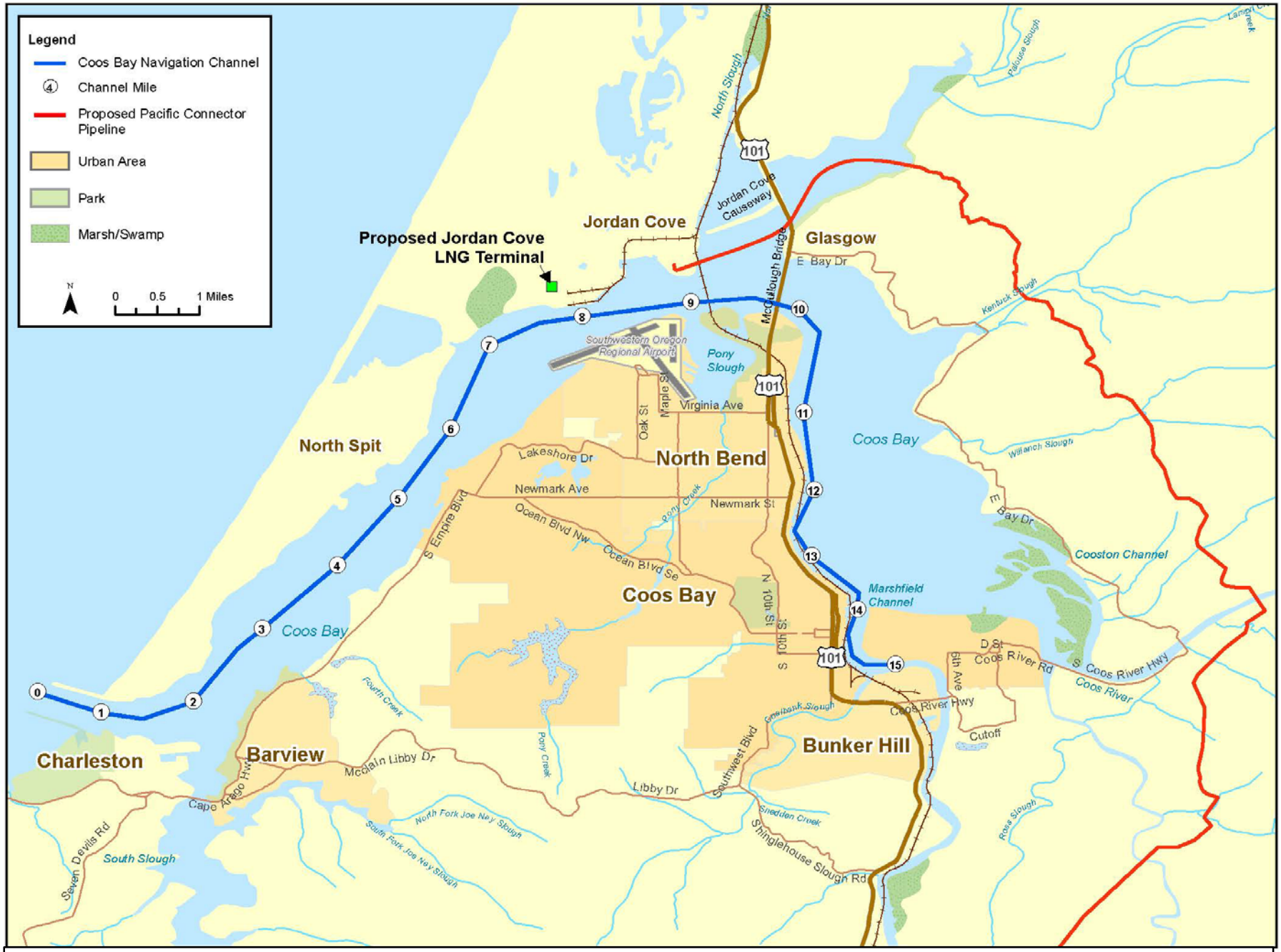


Figure 2.1-4. Coos Bay Navigation Channel and Other Features in the Vicinity of the Proposed LNG Terminal

Figure 2.1-5
Plot Plan of the Marine Facilities

2.1.1.3 Marine Slip and Berths

Jordan Cove would construct the marine slip at its proposed LNG terminal, at the north end of the access channel. Part of the marine slip would be constructed within state-waters of Coos Bay to the MLLW line, for which the Port has obtained an easement from the ODSL. The majority of the terminal marine slip would be excavated from current uplands owned by Jordan Cove. For state-owned materials on-site, a sand and gravel lease/license may be required. The upland portion of the proposed marine slip would cover about 36 acres (see Area 12 on figure 2.1-2).

The inside dimensions at the toe of the slope of the slip would measure approximately 800 feet along the north boundary and approximately 1,500 feet and 1,200 feet along the western and eastern boundaries, respectively. The minimum water depth within the slip would be -45 feet NAVD88 (North American Vertical Datum of 1988). The northern side of the slip would be constructed at three feet horizontal to one foot vertical.

This would be a single use slip dedicated to support the LNG terminal. Having the 800-foot slip width provides the flexibility needed for tugs to move the LNG vessel away from a hazard at the terminal or at the LNG loading dock to the relative safety of the west side of the slip.[2]

About 4.3 million cubic yards (mcy) of material would need to be removed to create the slip basin. Of this, about 2.3 mcy would be dry excavated and about 2.0 mcy would be hydraulically dredged. The excavated and dredged materials would be transported to the planned location of the South Dunes Power Plant, where they would be used to raise the elevation of that site. Section 2.1.1.11 provides more details about the dredging operations and disposal of materials. At the end of the construction sequence for the marine slip, sheet pile walls would be installed on the east and west sides. Riprap would be placed on the north side.

The terminal slip would contain an LNG berth on the east side, and a berth for tugboats and escort ships on the north side. A berm would be constructed to an elevation of +31 feet between the western edge of the slip and Henderson Marsh for tsunami resistance. After construction, Jordan Cove would convey the operation and maintenance of the marine slip to the Port, and reimburse the Port the costs of those activities.

Barge Berth

The barge berth would cover about 2.9 acres that is currently a forested sand dune within the Ingram Yard tract, on the west side of the Roseburg property (southeast side of the slip). During terminal construction, Jordan Cove indicated that equipment and large modules would be brought in by both break bulk cargo vessels and barges to the berth. Jordan Cove estimated about 18 barge visits and 92 cargo vessel visits over a two-year period during construction. However, the barge berth would be retained as a permanent feature of the terminal to support eventual maintenance and replacement for large equipment components. Riprap is proposed east and west of the barge berth to prevent scour erosion.

LNG Vessel Berth and Loading Platform

An LNG vessel loading berth would occupy the eastern side of the slip. Although the slip and berth could accommodate LNG vessels as large as 217,000 m^3 in capacity in the future, at present the Coast

[2] Memo from Jordan Coved dated February 23, 2015, and filed February 25, 2015.

Guard LOR and WSR would only allow LNG vessels up to 148,000 m^3 in capacity to dock at the terminal.

The LNG vessel loading berth would consist of open cell sheet pile technology developed and patented by PND Engineers, Inc. (figure 2.1-6). A similar berth design was constructed at the Sabine Pass LNG terminal in Cameron Parish, Louisiana. The open cell sheet piling would allow LNG vessels to be moored about one meter from the side of the slip. This change in design eliminated the need for a dock supported by piles extending from shore into the marine slip to the vessel, as previously proposed for the original Jordan Cove LNG import terminal in Docket No. CP07-444-000. For the new berth, all of the piles would be installed land-side, with the mooring dolphins located onshore and the breasting dolphins attached to the front of the concrete loading platform. The total number of battered steel piles required for the vessel berth and loading platform combined would be 112, as listed below on table 2.1.1.3-1. The battered steel piles would be driven, to a depth of refusal, while the marine slip is isolated from the bay by a berm. The piles would support surface structures (i.e., the loading platform), or provide the foundation for the breasting and mooring dolphins.

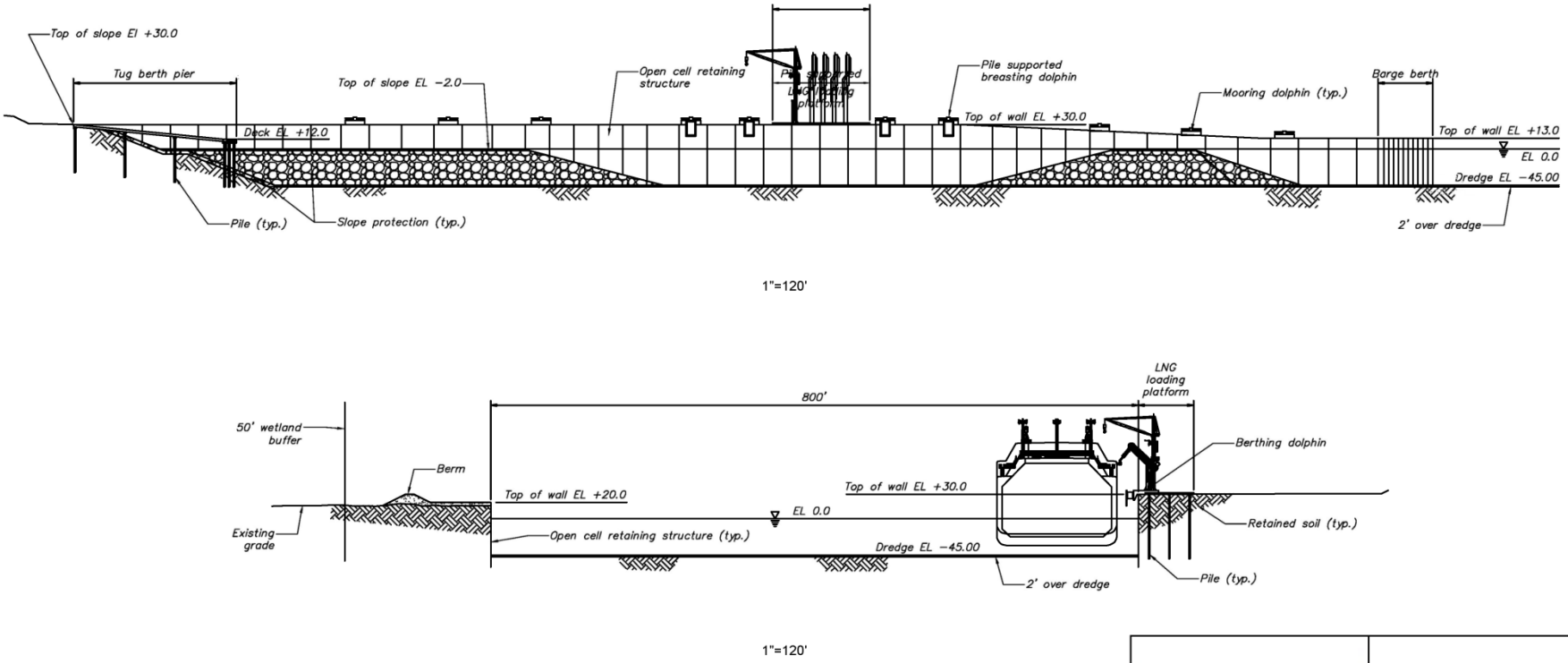
TABLE 2.1.1.3-1

Piles Supporting the LNG Vessel Berth and Loading Platform

Facility	Number of Piles	Diameter of Piles & Wall Thickness
Mooring Dolphins	48	30-inch-diameter & 1-inch wall thickness
Breasting Dolphins	32	30-inch-diameter & 1-inch wall thickness
Loading Platform	32	24-inch-diameter & 5/8-inch wall thickness

The LNG vessel berth would be about 1,249 feet long between the centers of the end mooring dolphins, and 182 feet wide from the center of the mooring dolphins to the edge of the breasting dolphins. The loading platform would be installed directly above the vessel berth, and would be about 120 feet long and 60 feet wide. The top of the LNG vessel loading platform would be at an elevation of 30 feet. Combined, the vessel berth and loading platform would occupy about 9 acres of uplands.

The vessel cargo loading facilities would consist of three 16-inch-diameter loading arms, and one 16-inch-diameter vapor return arm, installed on a concrete base of the platform slab deck (figure 2.1-6). Space would be provided for one additional LNG loading arm. A mezzanine type elevated platform above the concrete support deck would be constructed of steel. The main concrete lower platform level would contain curbs for and sloped to contain spills. The two middle arms would be piped for dual service capable of loading LNG to the ships or returning vapor to the storage tanks. The loading arms would be designed with swivel joints to provide the required range of movement between the ship and the shore connections. Each arm would be fitted with a hydraulically interlocked double ball valve and powered emergency release coupling (DBV/PERC) to isolate the arm and the ship in the event of an emergency condition where rapid disconnection of connected arms is required. Each arm would be fully balanced in the empty condition by a counterweight system and maneuvered by hydraulic cylinder drives.



Sources: David Evans &Associates, Inc.

Figure 2.1-6
Plot Plan of Marine Berth

The LNG cargo loading arms would be designed for a design loading rate of 10,000 m^3/hr. Additional structures at the vessel berth and loading platform would include a ship gangway, area lighting facilities, aids to navigation, firewater monitors, and a dry chemical firefighting system.

Tug and Escort Boat Berth

On the north side of the marine slip would be a berth that could accommodate three tugboats and three Sheriff's escort boats. This dock would be about 480 feet long and 18 feet wide. It would be supported by 98 battered steel piles as listed below in table 2.1.1.3-2. The piles would be driven, to a depth of refusal, while the slip is isolated from the bay. Included as part of the dock would be two boat houses. North of the dock would be a tug operator building.

TABLE 2.1.1.3-2

Piles Supporting the Tug Boat Berth

Tug Boat Dock Facility	Number of Piles	Diameter of Piles & Length of Structure
Pier Structure	44	24-inch-diameter & 5/8-inch wall thickness
Pier Fender Structure	28	12-inch-diameter by 55 feet
Pier Corner Fenders	10	12-inch-diameter by 65 feet
Floating Pier/Boat House	16	24-inch-diameter & 5/8-inch wall thickness

2.1.1.4 LNG Transfer Line

LNG would be fed from the LNG storage tanks to the LNG vessel loading facilities through one 2,300-foot-long, 36-inch-diameter cryogenic transfer line. The area occupied by the transfer pipeline would be within the 9 acres of uplands where the loading berth and platform are located (see Area 3 on figure 2.1-2).

2.1.1.5 LNG Storage Tanks

Once the liquefaction process is complete, the LNG would be stored in two full-containment LNG storage tanks, each designed to store 160,000 m^3 (1,006,000 barrels) of LNG at an approximate temperature of -260°F and atmospheric pressure. Each LNG storage tank would consist of a primary nine percent nickel inner steel container and a secondary post-stressed concrete outer container wall. These tanks would be designed so that both the primary inner container and the secondary outer concrete shell are capable of independently containing the stored LNG.

The two LNG storage tanks and surrounding storm surge barrier would occupy an area of about 27 acres within the terminal processing area, just north of the marine slip (see Area 5 on figure 2.1-2). The base elevation of the storage tanks would be at about +30 feet above mean sea level (MSL). The top of the dome of a tank would be about 180 feet above grade, and the diameter of the outer tank would be about 267 feet wide. Jordan Cove proposes to enclose the LNG storage tanks within an earthen berm or storm surge barrier that would be about +60 feet high. The storm surge barrier would be designed to contain the contents of one 160,000 m^3 storage tank.

The final design and supplier for the LNG storage tanks have not yet been selected by Jordan Cove. The conceptual preliminary design of all facility features is discussed in section 4.13.2 of this EIS. In general, each LNG storage tank would consist of the following elements:

- 9 percent nickel steel open top inner primary container;
- carbon steel liner around the primary container;
- concrete domed roof;

- insulated aluminum deck over the inner container suspended from the roof;
- reinforced concrete bottom slab with pedestals and seismic isolators;
- reinforced concrete tank base slab with carbon steel liner plate; and
- reinforced post-tensioned concrete wall and reinforced concrete roof on the secondary outer container.

Each storage tank would be built on a reinforced concrete slab foundation. The soil beneath the foundation would be improved using methods defined during subsequent geotechnical studies for the final design (see section 4.3 for more details about ground improvement based on geotechnical studies to meet seismic design standards). Base heating would not be necessary, as the tank base slab would be elevated. The load-bearing insulation on top of the base, beneath the inner storage tank container, would be cellular glass, capable of supporting the weight of the inner container and LNG.

The exterior walls of the outer container would be of reinforced concrete, lined with a butt-welded compression ring and welded steel plates, and a reinforced concrete dome poured over a carbon steel framework. The inner liner of the outer container would be carbon steel, while the bottom corner protection would be 9 percent nickel steel. The carbon steel inner liner would serve as a barrier to moisture migrating from the outside atmosphere to the insulation between the containers, and would also prevent vapor from escaping from the inner container during normal operations. An aluminum deck would be suspended from the outer roof by hangers made of stainless steel. The top surface of the deck would be insulated with fiberglass. The outer tank roof and vapor space about the suspended deck would be at ambient temperature.

The space between the inner and outer containers would be insulated with expanded perlite to keep the stored LNG at a temperature of approximately -260°F while maintaining the outer container at near ambient temperature. There would be no penetrations through the inner container or outer container sidewall or bottom below the maximum liquid level. All piping into and out of the tank would enter from the top of the tank. A conceptual design drawing of a typical full containment LNG storage tank is illustrated in figure 2.1-7.

2.1.1.6 Liquefaction Process

Once the feed gas is treated, it would then be sent to four parallel trains of a liquefaction process. The process utilizes a single mixed refrigerant circuit with a two-stage compressor and a refrigerant exchanger. The conditioned gas, at 745 pounds per square inch gauge (psig) and 95°F, is divided equally among the four liquefaction trains.

The refrigerant exchanger consists of 10 brazed aluminum cores arranged in a cold box. The cores are installed vertically inside the cold boxes. The refrigeration is supplied by a closed loop refrigeration cycle in which the refrigerant is compressed, partially condensed, cooled, expanded, and then heated as it supplies refrigeration and flows back to the compressor.

Low pressure refrigerant is compressed in a refrigerant compressor and is cooled by a refrigerant condenser and flows to a refrigerant discharge separator. The partially condensed refrigerant is separated into vapor and liquid in this vessel. The high-pressure refrigerant vapor and liquid from the refrigerant discharge separator flow through separate lines to the cold box. The vapor and liquid are recombined internally in the cold box as they enter each of the brazed aluminum cores.

The high pressure refrigerant flows downward through the cold box and exits each core from the bottom, totally condensed and sub-cooled. It then flows through a Joule-Thompson valve, reducing the pressure. This pressure reduction causes some vaporization of refrigerant, reducing the temperature further. This cold, low-pressure refrigerant reenters the cold box at the cold end and flows upward, removing heat from the feed gas and high pressure refrigerant streams in the exchanger as it vaporizes. The low-pressure refrigerant from the cold box then flows back to the refrigerant compressor inlet.

LNG exits the four trains at 730 psig and -245°F and is directed to an LNG expander where electricity is generated while the pressure is reduced to 30 psig. The LNG is then sent through a second expansion where the pressure is reduced to 1 psig. This expansion lowers the LNG temperature, but also causes approximately 5 percent (volume basis) of the LNG to be vaporized. The two-phase stream exits the valve at around -260°F and would then be sent to the LNG storage tanks.

The four liquefaction trains process area would cover about 20 acres within the terminal tract (see Area 4 on figure 2.1-2). Jordan Cove indicated that the process area would be at an elevation of about +46 feet. The LNG would be conveyed from the liquefaction trains to the storage tanks via piping.

2.1.1.7 Refrigerant Makeup System

During operation, the refrigeration loop components would be replenished periodically. Three of the hydrocarbon refrigerants used in the four closed-loop trains cannot be generated on-site: ethylene, propane and isopentane. These components would be delivered to and stored in pressure vessels on site. At a minimum, the stored refrigerant capacity is equal to the estimated loss of refrigerant from one train in a year of continuous operation. Refrigerants would be stored in bullet-type vessels located in the refrigerant storage area as shown on figure 2.1-5. The ethylene bullet would be approximately 144 inches in diameter and 28 feet in length. The propane bullet would be approximately 132 inches in diameter and 26 feet in length. The isopentane bullet would be approximately 144 inches in diameter and 40 feet in length. The refrigerant storage area would occupy about 2 acres just north of the LNG storage tanks (see Area 2 on figure 2.1-2).

2.1.1.8 Gas Conditioning Plant

Pacific Connector would bring natural gas through its pipeline from near Malin, Oregon, to the Jordan Cove terminal, where it would construct and operate a meter station connecting with the Jordan Cove facility. Once the natural gas is transferred to Jordan Cove, it would go through a treatment plant, situated within an approximately 13-acre area on the west side of the South Dunes Power Plant (see Areas 9 and 9A on figure 2.1-2). The elevation of the gas pretreatment facility would be about +40 feet.

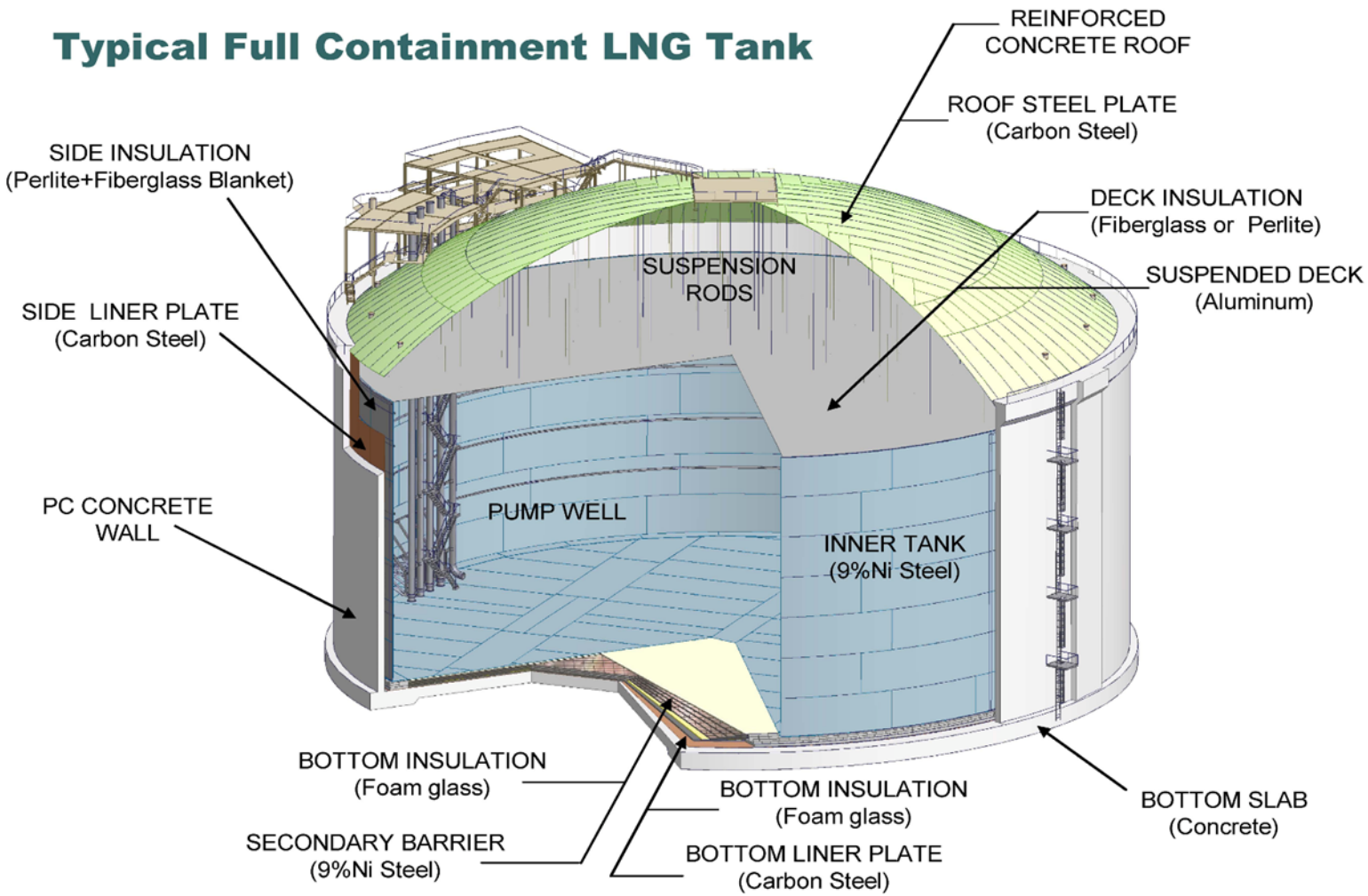


Figure 2.1-7

Conceptual Design of the LNG Storage Tanks

The gas conditioning units would remove substances that would freeze during the liquefaction process, namely CO_2 and water. Mercury would also be removed to prevent corrosion in downstream equipment. Trace amounts of hydrogen sulfide (H_2S) would be removed as well in the CO_2 removal system, due to the characteristics of the absorbent employed. The pipeline gas conditioning unit consists of two parallel trains, each containing two systems in series: a CO_2 removal process which utilizes a primary amine to absorb CO_2, followed by a dehydration system which uses two distinct solid adsorbents to remove water and mercury from the feed gas.

2.1.1.9 Utility Corridor, Haul Road, Access Roads, and Parking Lots

A new utility corridor would be constructed between the LNG terminal tract and the planned South Dunes Power Plant. The corridor would be approximately one mile in length and 150 feet wide (toe of slope to toe of slope). It would be located entirely on property owned by Jordan Cove. The utility corridor would cover about 11 acres (see Area R1 on figure 2.1-2).

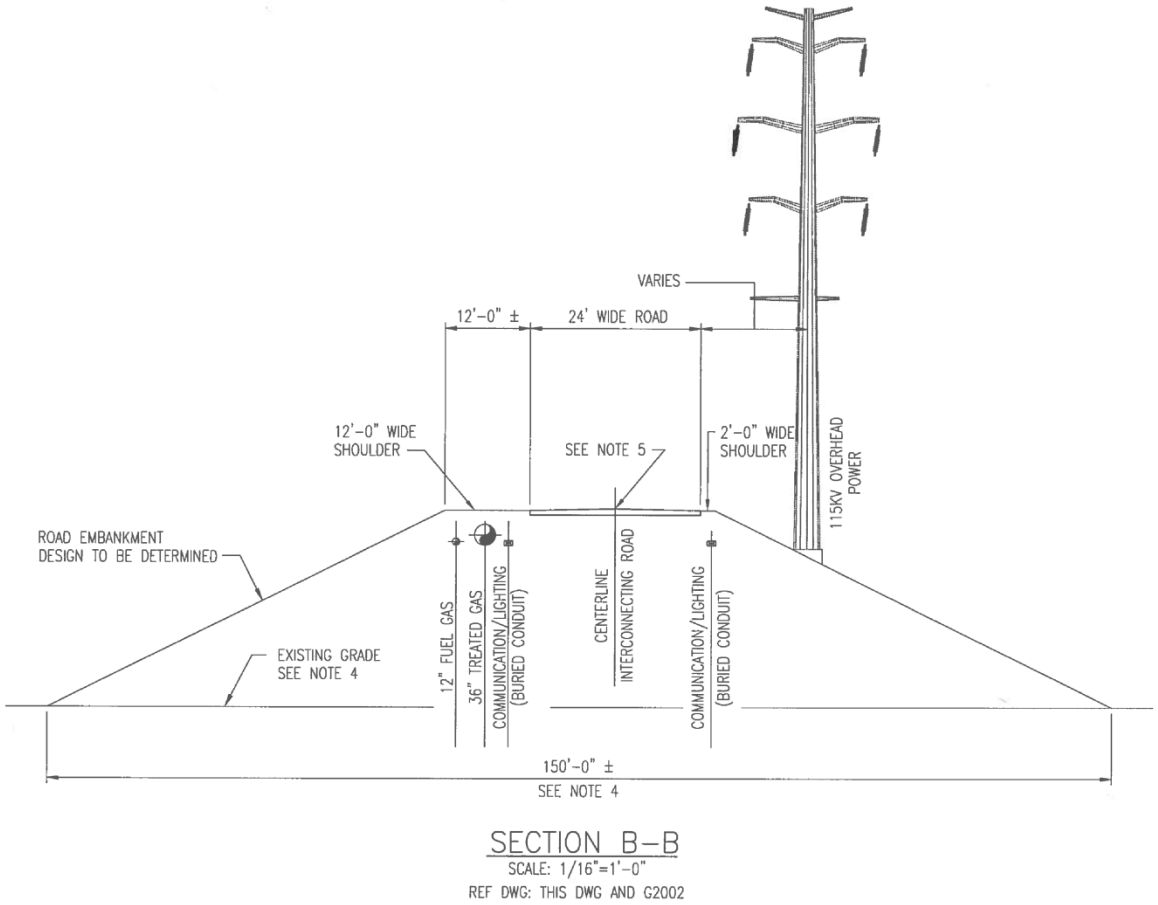
The corridor would be utilized initially during construction for the movement of equipment and materials, then during operations for control of access to the terminal. Use of the corridor for construction traffic and access to the LNG terminal would reduce impacts on the Trans-Pacific Parkway and the existing Roseburg Forest Products facility.

The utility corridor would include a two lane 24-foot-wide roadway, with 12-foot-wide shoulder and bridge structures to reduce impacts to wetlands and to fly-over the access road and rail spur serving the Roseburg Forest Products facility. Additionally, the corridor would contain overhead 115 kV power transmission lines and an underground pipe way corridor that includes the feed gas supply to the LNG terminal, a fuel gas pipeline to the South Dunes Power Plant, backup pilot gas line, telecommunications lines and redundant control circuitry (see figure 2.1-8).

A temporary heavy equipment haul road would be utilized during terminal construction, extending from the barge berth on the east side of the marine slip to the planned South Dunes Power Plant tract. It would cross the Roseburg Forest Products parcel. The haul road would be about 5,925 feet long, 60 feet wide, and cover about 8 acres (see figure 2.1-9). The road would be used to haul materials excavated from the upland portions of the marine slip to the South Dunes Power Plant area.

Another terminal access road would be located within an approximately 4-acre area in the northwestern portion of the tract (Area 1 on figure 2.1-2). This road would extend from the Trans-Pacific Parkway south through the terminal tract to the slip. It would be 25 feet in width and 995 feet long, with 11-foot-wide asphalt paved lanes and 1.5-foot-wide aggregate shoulders. During construction of the terminal, this road would be used for material deliveries and access to the concrete batch plant. During terminal operations, this road would serve mainly for emergency situations, or for occasional deliveries or maintenance activities.

Permanent operational roads within the terminal complex would be graveled or asphalt surfaced. Roads within the liquefaction area would be about 46 feet wide. Roads within the South Dunes Power Plant area would be about 40 feet wide.



SECTION B–B

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Figure 2.1-8
Cross Section Drawing of Access Road and Utility Corridor

Figure 2.1-9
Truck Haul/Hydraulic Transport Pipeline Route

There would be internal permanent operational parking lots. One employee parking lot would be on top of existing Landfill Cell #2, north of the South Dunes Power Plant, east of the South Dunes Administrative Building. The SORSC would have its own parking lot on its north side, east of Jordan Cove Road. Other parking lots would be associated with the Liquefaction Plant and Maintenance Building and Control Building, on the south side of the utility corridor, north of the Roseburg Forest Products property, to the east of the LNG terminal process area.

2.1.1.10 Other Terminal Support Systems

Jordan Cove would have to install a number of other utilities and systems within its LNG terminal tract to support its liquefaction and LNG delivery functions. These other systems include vapor handling, vent stacks and flares, electrical and lighting, control instrumentation, instrument and utility air, inert gas and nitrogen, fire water and fire protection, hazard detection and spill containment, site security, and support buildings.

Vapor Handling System

During liquefaction, a small amount of the produced LNG is vaporized during let-down to storage pressure. The produced LNG would also displace some storage tank vapor. In addition, ambient heat input would cause a small amount of LNG to be vaporized. Some vaporization of LNG would be caused by other factors, such as barometric pressure changes, heat input due to pumping, and vessel flash vapor. The vapor handling system would recover these vapors for use in the facility fuel gas system that supplies the South Dunes Power Plant.

During LNG vessel loading operations, vapors are also released from the vessel cargo tanks due to simple displacement as the tanks are filled. This vapor would be returned to the LNG storage tanks. The BOG compressors would be located between the liquefaction trains, east of the LNG storage tanks.

Ground Flares

There would be two ground flares installed at the complex: one located within a 1-acre area north of the refrigerant storage area within the LNG terminal south of the Trans-Pacific Parkway (Area 7 on figure 2.1-2), and the other within the South Dunes Power Plant area west of the gas conditioning plant and north of geographic Jordan Cove. The flares would each be about 60 feet high and 55 feet wide at the base.

The ground flares would mostly be used on a temporary basis to burn off gas as a relief system during upset conditions, or under the following circumstances:

- initial cool down of the facility;
- extended power outages;
- extended emergency shut-down events; and
- unexpected loss of vapor handling equipment during LNG vessel loading with the LNG storage tanks operating near maximum normal pressure.

Instrument Air and Plant Air Systems

Plant air would be used through the facility to power tools and equipment used during plant operation and maintenance activities. Dry instrument air would be used for instrumentation and

control systems. The plant instrument air packages would be located within the terminal process area, on the east side, between Liquefaction Trains #2 and #3.

Nitrogen

Liquid nitrogen would be trucked to the terminal from outside regional sources, and stored in a tank within the site. The pressure swing adsorption type nitrogen system would occupy an area 35 feet wide by 75 feet long or less than a tenth of an acre. Ambient air vaporizers would supply gaseous nitrogen for various uses in the terminal. The nitrogen would serve as the inert gas necessary for pre-commissioning and start-up, to test the tanks, and for drying out and cool down activities. Nitrogen would also be used to purge piping and equipment in preparation for operation, maintenance, and return to service.

Instrumentation and Process Control System

Overall plant process control and monitoring would be performed at consoles located in the various control rooms. The operator control level would consist of workstations, hardware pushbutton control stations, and peripherals. Operators would monitor liquefaction plant operations in the Liquefaction Control Room (Control Room #1). That control room would also be able to redundantly monitor operations at the South Dunes Power Plant. However, there would be separate South Dunes Site Control Room (Control Room #2), which could also redundantly monitor operations at the liquefaction terminal. The South Dunes Site Control Room would have the primary operator interfaces for the gas treatment plant. Controls for LNG vessel loading operations would be available at the LNG Berth Operator Building. The controls in the building would include the loading arm dedicated control system, ship-to-shore control system, and LNG vessel berthing system.

The terminal would be highly automated. The control systems consist of field instrumentation and a number of microprocessor based sub-systems. Operators would control and monitor the facility through a distributed control system (DCS). The DCS would be configured so that no single failure in a control room would result in a complete plant failure, or failure to inhibit a hazardous condition.

Electrical Systems

Electrical power for the LNG terminal would be provided from dedicated power generation provided by the South Dunes Power Plant. This power generation facility would be rated at approximately 420 MW and would be an independent power generation system exclusively for the terminal and associated facilities. A PacifiCorp connection would be provided by tapping the high voltage side of PacifiCorp's Jordan Point substation, which is currently located on the planned South Dunes Power Plant site but is planned to be relocated to a position adjacent to the Jordan Cove meter station. The PacifiCorp 115-kV feed would be transformed to 13.8-kV distribution to provide basic "house power" to the terminal and power generation sites. The South Dunes 230-kV substation would collect power from the site generators and distribute power to the Jordan Cove Project's 230-kV substation. Each 230-kV substation would have a 13.8-kV area distribution for lower utilization voltages and power distribution within the two process areas.

The total maximum operating load of the LNG terminal would be approximately 310 MW. This electrical load would be experienced during warm weather operations when LNG compression is required and LNG vessels are being loaded. Most of the facility's electrical load is comprised of

motors, with the largest motors (the four liquefaction loop compressor drivers) rated at approximately 65,000 hp each.

Lighting System

Only lighting required for operation and maintenance, safety, security, and meeting FAA requirements would be used on the LNG storage tanks. The light would be localized to minimize offsite effects. The lighting levels would be based on American Petroleum Institute (API) standards. Lighting around equipment and facilities where routine maintenance activities could occur on a 24-hour basis would range from 1 to 20 foot-candles, with 20 foot-candle lighting levels within the compressor enclosures. General process area lighting would be kept to a minimum, on the order of 2 foot-candles. LNG terminal access/utility corridor lighting would be 0.4 foot-candle. Perimeter security would be on the order of 1.3 foot-candles, using evenly spaced 400 watt floodlights. As a point of reference, 20 foot-candles is close to the indoor lighting in a typical home, two foot-candles is typical of that found in a store parking lot, and 0.4 foot-candle is typical of residential street lighting. The lighting plan would use high pressure sodium (HPS) light fixtures during construction and final plant. The final lighting plan would be developed during detailed design.

Fuel Gas System

During normal operation, fuel gas would comprise compressed BOG siphoned off from an LNG vessel during loading, or the LNG storage tanks. After the BOG is compressed, a slip stream would be sent to fuel the incinerator, while the remaining would be combined with the Amine Flash Gas and sent to the South Dunes Power Plant to run its GTG turbines. In the event that the amount of BOG is insufficient for all terminal needs, it would be supplemented by dry fuel gas from the feed gas system. For plant commissioning and start up, fuel gas would be supplied from the local distribution company's existing (Northwest Natural) 12-inch-diameter natural gas pipeline on the North Spit, located adjacent to the Trans-Pacific Parkway. After the terminal is fully operational, the Northwest Natural interconnection would be used solely for facility space heating requirements.

Water Systems

After construction, about 34 acres at Jordan Cove's proposed LNG terminal would be covered by impervious surface materials, such as concrete and asphalt. Jordan Cove would design and construct a stormwater management system to gather runoff from impervious surfaces within the terminal, and direct the flow to designated areas for disposal. Stormwater drainage and collection would be accomplished by a system of ditches and swales. Stormwater collected in areas that have no potential for contamination would be allowed to flow or be pumped to ditches that ultimately drain to the slip. Stormwater collected in areas that are potentially contaminated with oil or grease would be pumped or would flow to the oily water collection sumps. Collected stormwater from these sumps would flow to the oily water separator packages before discharging to the industrial wastewater pipeline. No untreated stormwater would be allowed to enter federal or state waters.

Sanitary waste from the LNG loading berth building would be directed to a holding tank. A sanitary waste contractor would remove the contents of the tank as necessary and dispose of the contents at authorized disposal sites through the contractor's permits. Sanitary waste from the remainder of buildings would be directed to on-site septic systems.

The Coos Bay-North Bend Water Board (CBNBWB), which is the local water utility district, has an existing industrial wastewater pipeline that runs through the proposed Jordan Cove terminal tract. The line connects to an existing permitted ocean discharge that is owned by the Port. It was originally constructed to handle wastewater emitted from the now dismantled Weyerhaeuser mill, and at its peak it took in up to 3.5 million gallons per day (mg/d) of water. The only flow currently through the industrial wastewater line is about 500,000 gallons per day purchased by Weyerhaeuser from CBNBWB that is passed through to keep the ocean diffusers operational. The industrial pipeline transports wastewater discharged from the two treatment basins at the former Weyerhaeuser linerboard mill site (future location of the South Dunes Power Plant). This treatment system has been approved for closure by the ODEQ, and the basins would be filled during construction of the South Dunes Power Plant.

During construction of the Jordan Cove terminal, the CBNBWB industrial wastewater pipeline would be put out-of-service for about one week while it is relocated. The portions of the existing pipeline within Jordan Cove property at the South Dunes Power Plant and Ingram Yard would be removed during site preparation, and the portions within the Roseburg Forest Products property and Henderson Marsh would be abandoned in place. The new replacement pipeline would consist of 16-inch-diameter slip joint PVC. It would run for about two miles from the South Dunes Power Plant along the shoulder of the Trans-Pacific Parkway within an easement owned by the Port to connect with the existing outfall pipe west of the Weyerhaeuser lagoon on the North Spit (see figure 2.1-10). Jordan Cove proposes to use the new industrial wastewater line to discharge water used to hydrostatically test the LNG storage tanks during construction of the terminal. The Port has no other users of this line, therefore it should have sufficient capacity for the 1.8 mg/d flow from the release of Jordan Cove's hydrostatic test water.

The CBNBWB obtains water from groundwater wells on the North Spit, in addition to storing water at two reservoirs (Upper Pony Creek and Joe Ney). It has two raw water lines on the North Spit. One of the raw water lines begins at the well field north of the planned South Dunes Power Plant site (see figure 2.1-11), and was once the source of water for the Menasha-Weyerhaeuser mill. The second raw water line extends from a well field west of the proposed terminal and north of the Trans-Pacific Parkway to a water treatment plant. This 12-inch-diameter mainline adjacent to the highway has a normal static pressure of 40 psig. Jordan Cove proposed to install two taps on this line, one dedicated to replenish the fire water ponds, and the other to provide water for portable and utility requirements once the terminal is in operation.

Jordan Cove would pay for the design and construction of the tap meters and an 8-inch-diameter water pipeline extending about 4,900 feet from the Trans-Pacific Parkway to the terminal. After construction, the CBNBWB would own and operate that line. In addition, Jordan Cove proposed to install a tap and hydrant along the Trans-Pacific Highway mainline at the northwest corner of the terminal tract to supply water for the concrete batch plant, site grading activities, dust suppression, and other construction-related activities.

During construction of the terminal, Jordan Cove would use a total of approximately 1.7 billion gallons of water for various activities, including hydrostatic testing. During terminal operations, about 184 million gallons of water would be consumed annually. Water usage and impacts are more fully discussed in section 4.4 of this EIS.

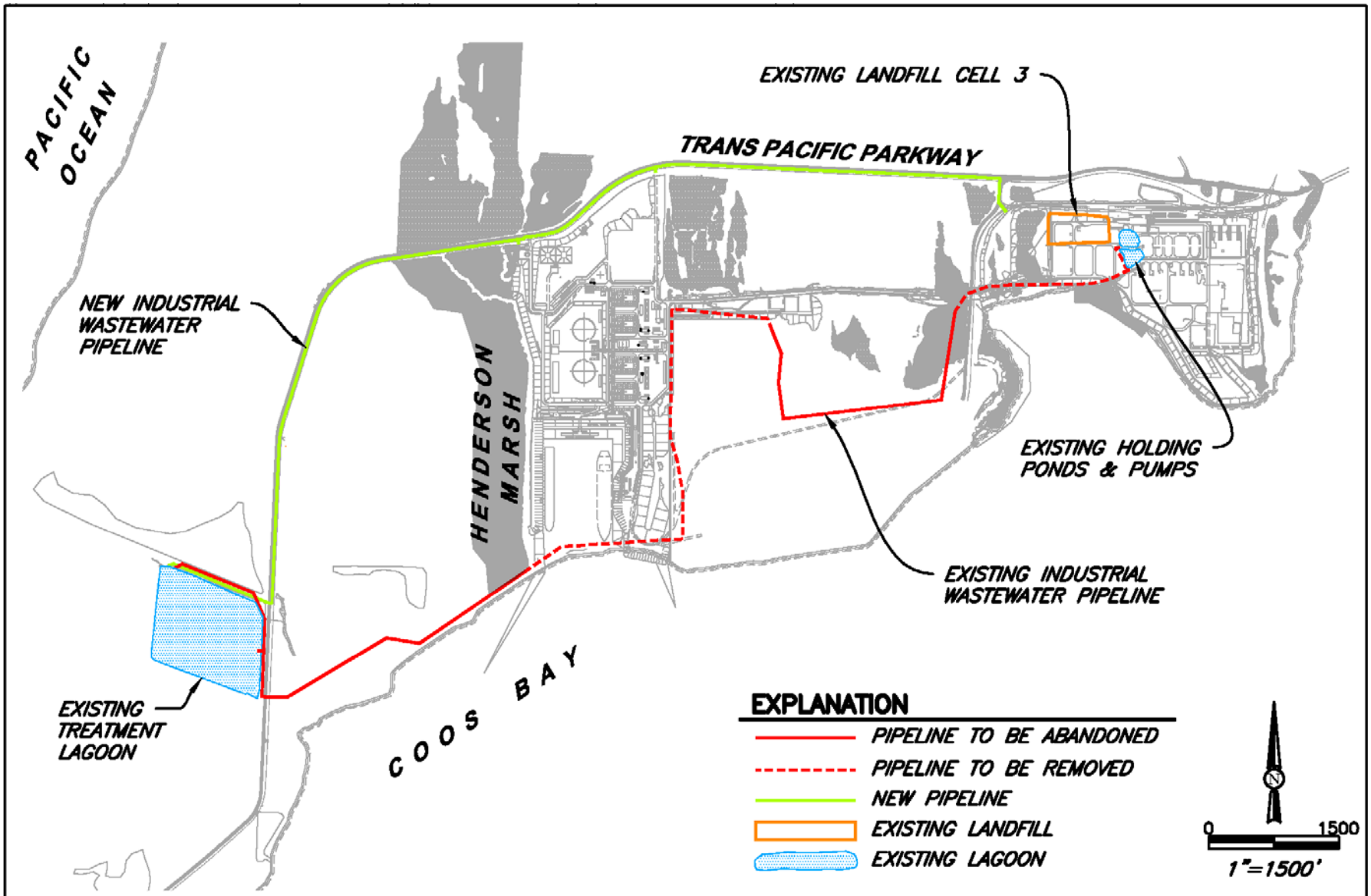


Figure 2.1-10
Pipeline Removal & Abandonment

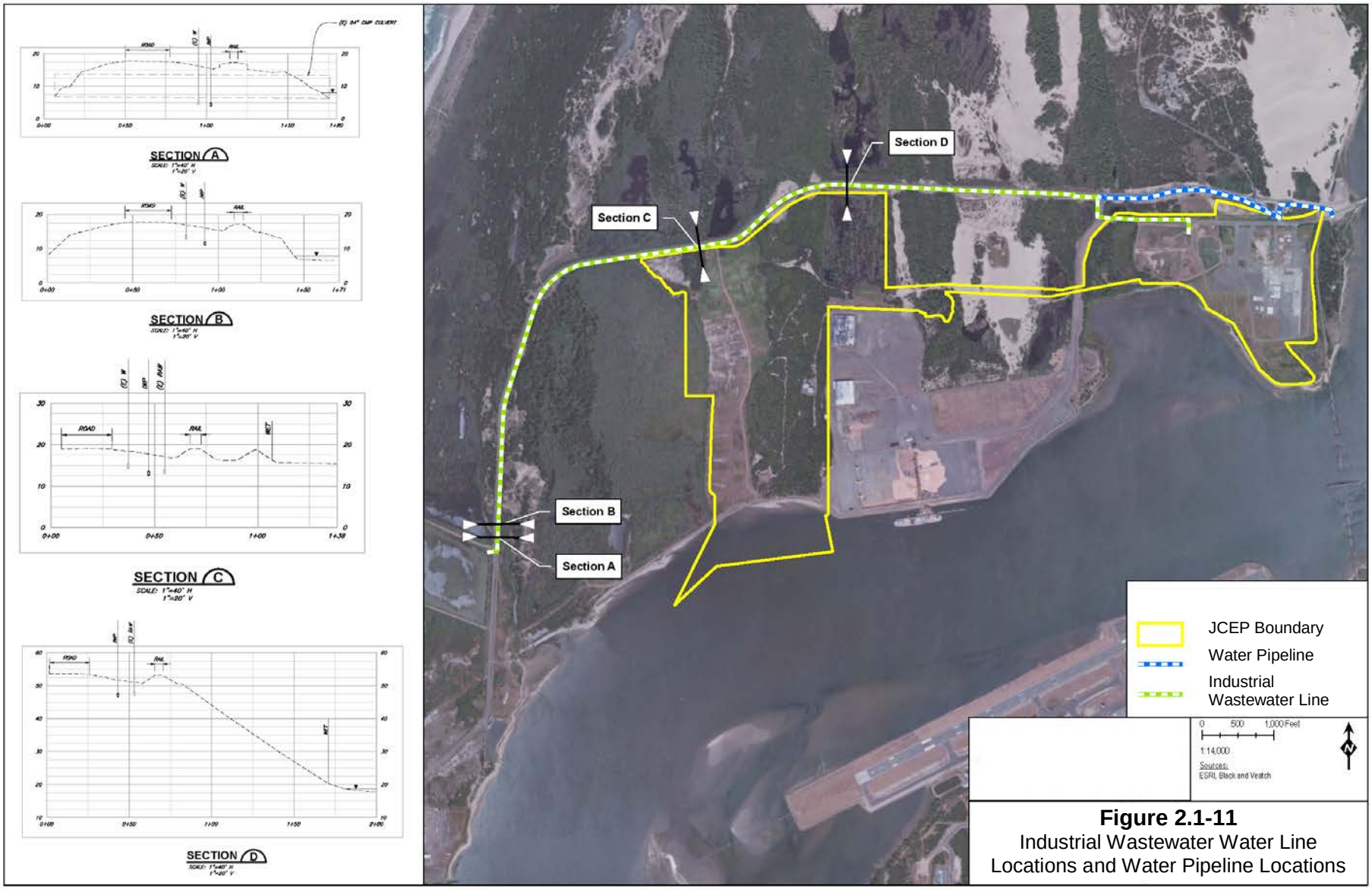


Figure 2.1-11
Industrial Wastewater Water Line Locations and Water Pipeline Locations

At the liquefaction terminal, the fire water pond would be located within a roughly 4 acre area at the northwest corner of the tract, on the south side of the Trans-Pacific Highway (see figure 2.1-2). The pond would be divided into two parts: one for primary water supply, and the second as a backup. Each pond section could hold a minimum of 2,641,000 gallons, for a total capacity of at least 5,282,000 gallons. This would supply approximately 4 hours of fire-fighting water. The liquefaction terminal would include fire water loop mains encompassing the main process area, refrigerant area, LNG storage tanks, and LNG vessel berth.

There are two existing one-million-gallon capacity water tanks on the dune on the west side of the Roseburg Forest Products tract. Both of these tanks are obsolete and would be decommissioned once the Jordan Cove LNG terminal is built. Roseburg Forest Products would then obtain its fire water from the new 12-inch-diameter CBNBWB raw water line extension that would be paid for by Jordan Cove, as mentioned above.

Support Buildings

Jordan Cove plans to construct a non-jurisdictional multi-organizational office complex (SORSC) to provide additional security, safety, and fire-fighting capabilities. That building would house a fire station, offices for the Coos County Sheriff, Coast Guard, and the Port, and a training center for the sheriff and Southwestern Oregon Community College. Jordan Cove has an agreement with the Coos County Sheriff that would allow the company to pay for on-site security personnel.

Table 2.1.1.10-1 lists the proposed support buildings for Jordan Cove's LNG terminal and the South Dunes Power Plant. The South Dunes administration building would be located at the northwest corner of the power plant. Continuing west from the South Dunes administration building along the south side of the power plant access road, there would be an operations building, guard building, and firewater pump house. The hazardous material storage building would be on the south side of the firewater pump building. The SORSC would occupy about 8 acres on the east side of Jordan Cove Road, south of the Trans-Pacific Parkway and north of the Roseburg Forest Products facility.

TABLE 2.1.1.10-1

Support Buildings at the Jordan Cove LNG Terminal and Power Plant Complex

Building	Location	Dimensions	Materials	Other Elements
South Dunes Administration Building	Northwest of the South Dunes Power Plant	Two-story, with 8,500 square feet per floor	Steel exterior frame, masonry or pre-case/pre-stressed wall panels	Building would include vestibule, offices, conference rooms, restrooms, shower-locker room, kitchen, first aid/nurse, file and storage area, and mechanical room

TABLE 2.1.1.10-1

Support Buildings at the Jordan Cove LNG Terminal and Power Plant Complex

Building	Location	Dimensions	Materials	Other Elements
South Dunes Operations Building	West side of Administration Building , east of the South Dunes Guard Building, and north of the South Dunes Control Building	240 feet x 140 feet, two story design with varied eve heights	Pre-engineered structural steel metal roof and siding with sloped roof	Building would include a secured receiving area, warehouse inventory storage, additional storage area, offices, janitorial area and restroom facility in the Warehouse/Receiving. The Operations portions of the building side would contain the offices, conference rooms, men and women's locker facilities, mechanical/electrical rooms, cafeteria and food service, janitorial, and a plant first aid facility. The building would include all interior finishes, HVAC, lighting, building electrical, fire/smoke detection/protection, and plumbing.
South Dunes Control Building	West of the South Dunes Power Plant and south of the Operations Building	104 feet x123 feet x 15 feet high	Reinforced masonry	Building would include control room, offices, conference room, storage, equipment room, break room, lab facility, and battery room
South Dunes Hazardous Material Storage Building	West of the Control Building and South of the Firewater Pump Building	33 feet square x 25 feet high	Pre-engineered structural steel structure, with metal roof and siding	Storage facility with air exchange handling units and sprinkler system to store hazardous materials such as paints, oil, and grease
South Dunes Guard Building	West of South Dunes Operations Building and east of the Firewater Pump Building	To be determined at final design	Pre-engineered structural steel structure, with metal roof and siding	Office for security personnel, storage room, and electrical cabinet
Southwest Oregon Resource Security Center	East side of Jordan Cove Road, south of the Trans-Pacific Parkway	To be determined at final design	To be determined at final design	Fire station, Sheriff office, Southwest Oregon Community College training space, Coast Guard office, and Port office
South Dunes Firewater Pump Shelter	West side of the South Dunes Guard Building	40 feet x 20 feet x 15 feet high	Pre-engineered structural steel structure, with metal siding and roof	Shelter would contain one diesel-driven firewater pump, one electrical firewater pump, and one electrical firewater jockey pump.
South Dunes Electrical Powerhouses (3 total)	Within the gas conditioning processing area	To be determined at final design	Manufactured steel self-enclosed structures	Powerhouses to include switch and control panels, and separate room for batteries
Liquefaction Terminal Maintenance/Warehouse Building	South side of utility corridor, west of terminal process area	150 feet x 170 feet x 30 feet high	Pre-engineered steel frame with metal siding and roof	Building would include storage, offices, conference room, equipment rooms, break room, rest rooms, shop, and crane
Liquefaction Terminal Guard Building	Northwest corner of the terminal tract, south side of Trans-Pacific Parkway, west of the terminal fire water ponds	24 feet x 36 feet x 12 feet high	Pre-engineered structural steel structure, with metal roof and siding	Building would include public access area, office, safety training room, storage room, and rest rooms
Liquefaction Terminal Main Electrical Substation Building	On east side of the Liquefaction Trains process area	95 feet x 170 feet x 30 feet high	Pre-fabricated metal building with metal roof	Building would include GIS Bus and breakers, control and relay panels, 125kV station service battery system

TABLE 2.1.1.10-1

Support Buildings at the Jordan Cove LNG Terminal and Power Plant Complex

Building	Location	Dimensions	Materials	Other Elements
Liquefaction Firewater Pump Building	Northwest corner of the terminal tract, south of the fire water ponds	40 feet x 102 feet x 15 feet high	Pre-engineered steel frame structure with metal siding and roof	Shelter would contain four diesel driven firewater pumps, one electrical firewater pump, and one electrical firewater jockey pump
Tug Boat Operator and Crew Building	North of the tug boat dock, on the northwest corner of the marine slip	45 feet x 60 feet x 15 feet high	Pre-engineered structural steel building with metal siding and roof	Building would include operator area, MCC room, crew berth, and rest rooms
Liquefaction Terminal Compressor Shelters	Within the Liquefaction Trains process area, east of the LNG Storage Tanks	Four Refrigerant Shelters each 65 feet x 110 feet x 72 feet high; one BOG Shelter 80 feet x 135 feet x 72 feet high	Pre-engineered structural steel structures with metal roofing	The buildings provide shelter for refrigerant and BOG compressors, lube oil consoles, and maintenance cranes
Liquefaction Terminal Electrical Powerhouses	Five total, within the terminal liquefaction process area	To be determined at final design	Manufactured steel self-enclosed electrical powerhouses (5 total)	Powerhouses to include switch and control panels, and separate room for batteries

Along the south side of terminal utility corridor, west of Jordan Cove Road and east of the liquefaction process area, would be the terminal warehouse and maintenance building, and control building. The marine control building would be south of the transfer pipeline and LNG vessel berth, on the east side of the slip. The tug boat operations and crew building would be on the north side of the slip, north of the tug dock. The terminal guard building would be at the northwest corner of the property, on the south side of the Trans-Pacific Parkway.

2.1.1.11 Dredged and Excavated Material Disposal

Impacts associated with excavation and dredging activities during construction of Jordan Cove's LNG terminal, and maintenance dredging of the access channel and marine slip during terminal operations are more fully described in section 4.3.1 of this EIS.

Construction of the Marine Facilities

Construction of the access channel and slip for Jordan Cove's terminal would generate about 5.6 mcy of dredged and excavated material (see table 2.1.1.11-1). Of this, about 2.3 mcy would be dry excavated in the proposed slip area north of and behind the earthen berm that would remain in place to separate work in the upland from the bay during Phase 1 of the marine slip construction (see section 2.4.1.5 below). Also in the upland area north of the berth, during "Fresh Water" Phase 2 construction of the slip, up to about 1.5 mcy of material would be dredged in the pocket behind the berm. About 0.5 mcy of material would be dredged during removal of the berm, during the "Salt Water" Phase 3 construction of the slip. Lastly, about 1.3 mcy of material would be dredged from the bay during construction of the access channel between the current Coos Bay navigation channel and the proposed Jordan Cove terminal marine slip.

TABLE 2.1.1.11-1

Materials Excavated and Dredged During Construction of Terminal Marine Facilities

Area	Construction Phase	Activity	Volumes (mcy)
Slip	Upland – Phase 1	Land-based excavation	2.3
Slip	Fresh Water – Phase 2	Dredging in pocket behind berm	Up to 1.5
Slip	Salt Water – Phase 3	Dredging to remove berm	0.5
Access Channel	Salt Water – Phase 3	Dredging in bay	1.3
		Total:	**5.6**

Most of the 5.6 mcy of material excavated and dredged from the slip and access channel would be used to raise the elevation of the proposed terminal facilities above the tsunami inundation zone. A total of about 1.9 mcy would be placed on the LNG terminal upland process area. About 0.5 mcy of material from the removal of the berm between the northern portion of the slip and Coos Bay would be used for restoration of the dune on the east side of the slip area. The remaining materials (about 3.2 mcy) would be deposited at the former Weyerhaeuser linerboard site, which is the proposed location for the pipeline gas treatment facility and South Dunes Power Plant. The elevation of the base of the proposed LNG storage tanks would be raised to +30 feet, while the elevation of the process area at the terminal would be raised to about +46 feet. The elevation of the planned South Dunes Power Plant area would also be raised to about +46 feet.

The excavated materials from the upland portion of the slip would be conveyed to the terminal process area and former linerboard mill site by trucks. The route for trucks hauling excavated materials from the slip to the planned South Dunes Power Plant area would be along the new Jordan Cove–owned road and utility corridor on the north side of the Roseburg Forest Products tract (see figure 2.1-9).

The materials dredged from the proposed terminal slip and access channel would be conveyed to the former Weyerhaeuser linerboard mill site through a slurry pipeline, approximately 8,650 feet long. This slurry pipeline would follow the shoreline of Coos Bay, through the Roseburg Forest Product tract (see figure 2.1-9). This would be a 20-inch-diameter polypropylene seamless pipeline placed directly on the ground; laying on top of the rip-rap along the shore of the Roseburg Forest Products tract. The return water from the planned South Dunes Power Plant would be carried back to the slip through a parallel decant pipeline laid adjacent to the slurry line. After the dredging of the slip and access channel is completed, these temporary slurry and decant pipelines would be dismantled and removed.

Operational Maintenance Dredging

Jordan Cove had Coast and Harbor Engineering (CHE) conduct a study of sedimentation over time in the access channel and slip and come up with estimates for the amount of material that would need to be dredged in the future to maintain the depth of the access channel and slip (CHE 2011a). CHE estimated that the access channel would accumulate about 0.56 feet of sediment per year, equivalent to about 29,200 cubic yards (cy) of material, while the terminal slip would accumulate about 0.16 feet per year of sediment, equivalent to about 8,500 cy of material. Approximately a total of 37,700 cy of material could be dredged for maintenance of the access channel and slip combined in year one of operation of the terminal, and 34,600 cy in year 10. In the first 10 years of operation of the terminal, about 360,000 cy of material would need to be removed to maintain the proper depth of the access channel and slip, while in the next 10 years about 330,000 cy would need to be removed. CHE recommended that the access channel and slip should have maintenance

dredging conducted about every 3 years with about 115,000 cy of material removed for the first 12 years of operation, and after that maintenance dredging could be done about every 5 years with up to 160,000 cy of materials removed. Jordan Cove had a consultant (Moffat & Nichol) prepare a *Slip and Access Channel Excavated & Dredged Material Management Plan* in 2013 that it submitted to the COE.[3]

Disposal of Maintenance Dredging

Site F is located in the Pacific Ocean, about a half mile offshore and 1,000 feet north of the north jetty at the mouth of Coos Bay (figure 2.1-12). The site is owned by the State of Oregon out to the 3-mile territorial limit, and the remainder by the COE. This is an existing EPA-designated offshore placement site, used by the COE since 1986 to disposal of materials dredged during maintenance of the Coos Bay navigation channel. The site was expanded in 1989, 1995, and 2006 (when the current extent of Site F was designated), so that it now encompasses about 3,075 acres, with water depths ranging from 20 to 160 feet.

Jordan Cove would have to obtain a permit from the COE for ocean disposal at Site F of operational maintenance dredged materials from the LNG terminal slip and access channel. As explained in section 1.5.1.4 of this EIS, in accordance with section 103 of the MPRSA, the COE would have to use EPA's criteria when making its decision whether to issue such a permit, and that decision would be subject to EPA's concurrence. The COE has indicated that in order to utilize Site F, Jordan Cove will be required to conduct a capacity analysis of the site. Since 2006, the site has received a substantial volume of dredged material, and the ability of Site F to hold 690,000 cy of material over the next 20 years from Jordan Cove is not clear. In addition, the EPA has indicated that the use of Site F is also dependent on the grain size of the maintenance dredged material. If proposed dredged material is predominantly fine sand, silt, or clay, it would need to be disposed of at Site H (a separate EPA-designated offshore disposal site). Similar to Site F, Site H has received substantial volumes of material in recent years and may not have the capacity for Project material. Depending on the outcome of both grain size evaluation and a capacity analysis of Site H, Jordan Cove may need to work with EPA to designate a new ocean dredged material disposal site for finer-grained material. EPA's designation process is outlined in 40 CFR Part 228. Alternatively, Jordan Cove may seek to dispose of material at an upland site that would be evaluated and permitted separately. However, current analysis of grain size suggests that the sediment to be dredged both for the access channel and slip would be suitable for Site F.

[3] A copy of the dredging plan was filed with the FERC as Appendix H.7 in Resource Report 7 included as part of Jordan Cove's May 2013 application.

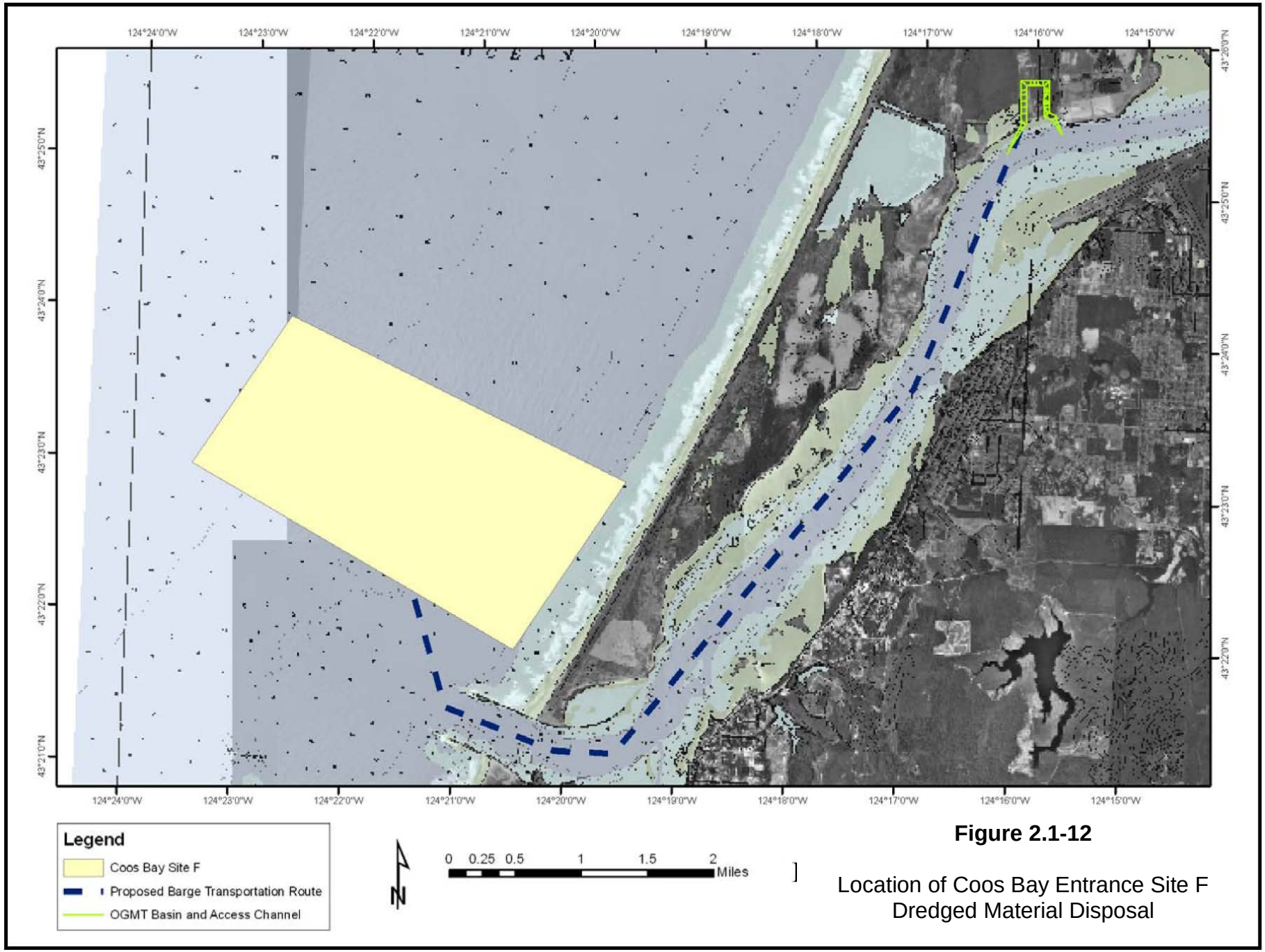


Figure 2.1-12

Location of Coos Bay Entrance Site F Dredged Material Disposal

Suitable disposal sites for large-scale placement of dredged material within the Coos Bay area are limited. The currently approved offshore ocean dredged material disposal sites may be operating near capacity. EPA and the COE are uncertain if disposal Sites F and H can accommodate materials dredged from the Jordan Cove terminal during maintenance operations over the next 20 years. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Jordan Cove should file with the Secretary a revised *Dredged Material Management Plan*, and documentation that the revised plan was developed in consultation with the EPA and COE. The revised plan should include an analysis of alternative dredged material disposal sites in the region in the event that Sites F and H possess insufficient capacity for materials dredged during Jordan Cove's future operational maintenance activities.**

2.1.1.12 Wetland Avoidance and Mitigation Areas

There are a number of wetlands identified adjacent and within the tract of land owned by Jordan Cove at the location of its proposed LNG terminal and the planned South Dunes Power Plant. In most cases, those wetlands would be avoided by construction activities. The largest wetland adjacent to the terminal, on its west side, is Henderson Marsh. Jordan Cove would maintain a 50-foot buffer between development activities and Henderson Marsh. About 10.9 acres of Henderson Marsh within the Ingram Yard property owned by Jordan Cove would be avoided (Area E3 on figure 2.1-2). No construction activities would take place in Henderson Marsh. There is a 27.6-acre wetland parcel on land owned by Jordan Cove on the north side of the proposed utility corridor, at the northeast corner of the terminal tract, which would also be avoided(Area E1 on figure 2.1-2). Lastly, on the east side of Jordan Cove Road, between the planned SORSC and the pipeline gas treatment plant, there is a 6.9-acre wetland on Jordan Cove property that would be avoided (Area E5 on figure 2.1-2).

Jordan Cove has proposed mitigating the loss of aquatic vegetation by funding an eelgrass restoration program in Coos Bay, near the Southwest Oregon Regional Airport in North Bend, including establishing a minimum of 7.5 acres of eelgrass beds. In addition, on the north side of Coos Bay at Kentuck Slough, about 3 miles northeast of its LNG terminal tract, Jordan Cove proposed to use about 43.6 acres of the former Kentuck golf course which it has acquired as an estuarine wetland mitigation area. Also, as part of its freshwater wetland mitigation proposal, Jordan Cove would include about 2.9 acres of wetlands at the West Jordan Cove mitigation site and about 1.6 acres of wetlands and the West Bridge Site, both located on the east side of the Roseburg Forest Products property.[4] Additional information about wetland impacts and mitigation is presented in section 4.4.3.

2.1.1.13 Upland Preservation Areas

During construction and operation of its proposed LNG terminal, Jordan Cove would avoid about 6.5 acres of sand dunes within land owned by Jordan Cove at the north side of the terminal tract, south of the Trans-Pacific Parkway and north of the liquefaction process area (Area E2 on figure 2.1-2). A forested dune between the proposed marine slip and the Roseburg Forest Products property would be affected by removal of the Roseburg Forest Products water tanks, and

[4] See *Jordan Cove Energy Project Compensatory Wetland Mitigation Plan* filed with the FERC in April 2014, revising their original filing from the May 2013 application.

construction of the barge dock and a temporary haul road between the dock and the planned South Dunes Power Plant (Area E-4 on figure 2.1-2). After terminal construction, about 15 acres of the LNG vessel berth dune would be restored. About 7 acres in the northwest corner of the terminal tract, on the south side of the Trans-Pacific Parkway would be used as a fill area, but Jordan Cove has not identified any facilities that would be placed in that location (Area 4F on figure 2.1-2). Existing upland habitats within the LNG terminal tract are discussed in section 4.5.1 of this EIS.

Landfill Cell #3, comprising debris from the demolition of the former Weyerhaeuser liner board mill, currently occupies about 6 acres northwest of the planned South Dunes Power Plant. Jordan Cove indicated it would relocate materials from this landfill, and fill in all but 2 acres. Land use for the Jordan Cove property is discussed in section 4.1.1. Potentially contaminated sediments and landfills at the former Menasha-Weyerhaeuser mill property is discussed in section 4.3.1.

2.1.1.14 Temporary Construction Use Areas

During construction of the South Dunes Power Plant, a number of temporary laydown areas would be utilized, over which permanent facilities would later be built. One construction laydown area of approximately 4 acres would be located west of the gas processing plant (Area 10 on figure 2.1-2). Another construction laydown area of 11 acres would be located south of the power plant, and later replaced by the stormwater pond during operation of the plant (Area 11 on figure 2.1-2). Table 2.3.1-1 in section 2.3 below details the land requirements for the Jordan Cove LNG terminal in acres affected during construction and operation.

Some of the temporary construction areas within the proposed LNG terminal tract process area would also later be replaced by permanent facilities. For example, construction trailers and the tank staging area would be located within the LNG storage tank area. The concrete batch plant would be where the terminal firewater pond would be located. The tank roof assembly area and process staging area used during construction would later be replaced by the liquefaction trains process area. At the north side of the LNG terminal tract, north of the liquefaction process area, Jordan Cove would use about 21 acres for a construction laydown area.

A temporary construction haul road would be built between the construction barge dock and the South Dunes Power Plant area, covering about 8 acres, through the Roseburg Forest Products property. Also, during construction of the terminal marine slip and access channel, a slurry pipeline and return water pipeline would be laid across the Roseburg Forest Products tract to the South Dunes Power Plant parcel, affecting about 1 acre. Jordan Cove would lease about 40 acres from Roseburg Forest Products for temporary construction areas, including offices, craft areas, warehouses and storage, fabrication, laydown, parking lots, and open areas. After construction, these areas would be restored to their previous condition and use.

In addition, Jordan Cove proposes to construct a temporary workers housing facility, the NPWHC, north of the City of North Bend, on the south side of the McCullough Bridge. After the terminal is completed, that facility would be disassembled and removed, and the area restored to its previous condition and use. Section 2.4.1.1 discusses the NPWHC in more detail.

Also during Project construction, Jordan Cove would use two separate off-site temporary lots for construction worker car parking. One lot would be at the Mill Casino in the city of Coos Bay. The other lot would at the vacated Myrtlewood RV park near the community of Hauser. Jordan Cove

would bus commuting employees from the lots to the terminal. After construction of the terminal is completed, the lots would be restored to their former condition and use.

2.1.2 Pacific Connector Pipeline and Associated Aboveground Facilities

Pacific Connector proposes to construct and operate a high-pressure underground welded steel natural gas pipeline, and associated aboveground facilities. All facilities would be designed, constructed, tested, operated, and maintained to conform with or exceed DOT requirements found in 49 CFR Part 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Safety Standards*; the FERC requirements at 18 CFR 380.15, *Site and Maintenance Requirements*; and other applicable federal and state regulations. The location of the proposed pipeline project facilities are shown on detailed maps included in appendix C and described below.

2.1.2.1 Pipeline

Pacific Connector's proposed 36-inch-diameter natural gas pipeline would extend for about 232 miles between interconnections with GTN and Ruby pipelines near Malin and the Jordan Cove LNG terminal at Coos Bay. The pipeline would cross portions of Klamath, Jackson, Douglas, and Coos Counties, Oregon. For about 41 percent of its route (95.3 miles), the pipeline would be adjacent to existing powerlines, roads, and other pipelines with the remaining distance being newly created "green-field" right-of-way. Table D-1 in appendix D lists locations where the Pacific Connector pipeline would be adjacent to existing rights-of-way.

The pipeline would have a design capacity of 1.07 Bcf/d of natural gas, assuming a receipt pressure of about 900 psig at the supply interconnections near Malin, and a delivery pressure of 850 psig at the proposed Jordan Cove LNG terminal at Coos Bay. The maximum allowable operating pressure (MAOP) of the pipeline would be 1,480 psig.

The pipeline would be designed to flow natural gas from east to west, from its beginning point near Malin to the Jordan Cove LNG terminal. However, because the pipeline was originally planned and sited to support an LNG import terminal and flow gas west to east, milepost and station numbers are assigned from west to east. There are numerous years of data collected and review and resource analyses based on the original west to east MPs. For the majority of this EIS, we describe the pipeline, and resources crossed by the pipeline in a west to east direction.

2.1.2.2 Aboveground Facilities

The new aboveground facilities proposed by Pacific Connector include 1 compressor station, 4 meter stations (2 co-located at one site), 5 pig launcher/receiver assemblies (all co-located with other aboveground facilities), 17 MLVs (3 co-located at proposed meter stations), and 11 communication towers (3 co-located at proposed meter stations) (table 2.1.2.2-1).

TABLE 2.1.2.2-1

Pacific Connector's Proposed Aboveground Facilities

Facility	MP	Operational Acres a/	County	Ownership/ Jurisdiction
Jordan Cove Meter Station, MLV #1, Receiver, and Communication Tower	1.5R	0.9	Coos	Private
MLV #2 (Boone Creek Road)	15.5	0.1	Coos	Private
MLV #3 (Myrtle Point Stikum Road)	29.5	0.1	Coos	Private
MLV #4 (Deep Creek Spur)	48.4	0.1	Douglas	BLM
MLV #5 (South of Olalla Creek)	59.6	0.1	Douglas	Private
Clarks Branch Meter Station, MLV #6, Launcher/Receiver, and Communication Tower	71.5	1.0	Douglas	Private
MLV #7 (Pack Saddle Road)	80.0	0.1	Douglas	BLM
MLV #8 (Highway 227)	94.7	0.1	Douglas	Private
MLV #9 (BLM Road 33-2-12)	113.7	0.1	Jackson	Private
MLV #10 (Shady Cove)	122.2	0.1	Jackson	Private
MLV #11 and Launcher/Receiver (Butte Falls)	132.5	0.4	Jackson	Private
MLV #12 (Heppsie Mountain Quarry Spur)	150.7	0.1	Jackson	BLM
MLV #13 (Clover Creek Road)	169.5	0.1	Klamath	Private
MLV #14 and Launcher/Receiver	187.4	0.4	Klamath	Private
MLV #15 (Klamath River)	196.5	0.1	Klamath	Private
MLV #16 (Hill Road)	214.3	0.1	Klamath	Private
Klamath Compressor Station, Klamath-Beaver and Klamath-Eagle Meter Stations, MLV #17, Launcher, and Communications Tower	228.1	30.9	Klamath	Private
Blue Ridge Communication Tower	NA	0.2	Coos	BLM
Signal Tree Communication Tower	NA	0.2	Coos	BLM
Harness Mountain Communication Tower	NA	0.2	Douglas	Private
Winston Communication Tower	NA	0.2	Douglas	Private
Starveout Creek Communication Tower	NA	0.2	Jackson	Private
Flounce Rock Communication Tower	NA	0.2	Jackson	BLM
Robinson Butte Communication Tower	NA	0.2	Jackson	Forest Service
Stukel Mountain Communication Tower b/	NA	0.2	Klamath	BLM

a/ Values are rounded to the nearest tenth of an acre.
b/ Assumes that existing BLM communication Site Plan is sufficient. If not, supplemental environmental compliance may be required.

Jordan Cove Meter Station

Natural gas would be delivered to the proposed Jordan Cove LNG terminal via the newly proposed Jordan Cove Meter Station located at the western end of the Pacific Connector pipeline, at MP 1.5R, in Coos County. The meter station would be within Jordan Cove's property on the North Spit, adjacent to the planned South Dunes Power Plant, on the southeast side of geographic Jordan Cove on the northern shore of Coos Bay. The new meter station would occupy about 1 acre of industrial land, at the former location of the Weyerhaeuser linerboard mill. Access to the meter station would be from the existing Jordan Cove Road.

One building within the meter station would house the gas chromatographs, moister analyzer, communication equipment, and flow computer. Another building would house the control valves and ultrasonic meters. The station would include an MLV, a pig receiver, and a 140-foot-high communication tower. The station would be enclosed by a 7-foot-high chainlink fence, and the interior of the yard would be graveled.

Clarks Branch Meter Station

The newly proposed Clarks Branch Meter Station would be at MP 71.5 along the Pacific Connector pipeline, in Douglas County. At this location, Pacific Connector would interconnect to the existing

Northwest Pipeline's Grants Pass Lateral. The meter station would cover about 1 acre of privately owned land that is currently used for agricultural purposes as cropland and pasture. The new meter station would be about 600 feet east of the western crossing of the South Umpqua River, with access from Dole Road (via permanent access road [PAR] 71.46).

One building would house a gas chromatograph, communications equipment, and flow computer. Another building would house the control valves and ultrasonic meters. Odorizing facilities, a MLV, and a pig/receiver would be located at the meter station. A 26-foot-high communication tower would also be installed. The station would be equipped with outside lighting; but the lights would only be utilized at night when people are working there. During normal operations, night-time work would not usually be scheduled. The station would be surrounded by a 7-foot-high chainlink fence, and the interior of the yard would be graveled.

Klamath-Beaver and Klamath-Eagle Meter Stations

Co-located within the boundaries of the 31-acre Klamath Compressor Station, in Klamath County, would be two newly proposed meter stations: the Klamath-Beaver Meter Station and the Klamath-Eagle Meter Station. The new Klamath-Beaver Meter Station would include an interconnection with the existing GTN pipeline system; while the new Klamath-Eagle Meter Station would serve as the interconnect with the existing Ruby pipeline system. GTN and Ruby would be the main sources of supply for the Pacific Connector pipeline.

Klamath Compressor Station

The newly proposed Klamath Compressor Station would be located approximately 1.8 miles northeast of the town of Malin, at the eastern beginning of the Pacific Connector pipeline, at MP 228.1. The new station site would accessible on the south from Malin Loop Road and on the west from Morelock Road. It would be adjacent to the existing GTN Malin/Tuscarora Meter Station and the Ruby Turquoise Flats facility. The Klamath Compressor Station would occupy a tract of about 31 acres that would also include the proposed Klamath-Eagle Meter Station and Klamath-Beaver Meter Station. The site is on private land that was used for agricultural purposes, as winter pasture. The parcel is relatively flat, and is covered by grasses and sage, with a few scattered juniper trees.

The nearest residence would be within 1,000 feet of the center of the site. Two other residences would be within 1,500 feet of the center of the site. The compressor station would be secured by a 7-foot-high chainlink fence. To minimize visual intrusions on nearby residences, the security fence would have screening slates, and landscaping would be installed along appropriate sides of the station.

Pacific Connector would install 41,000 ISO hp of new compression at the Klamath Falls Compressor Station. Pacific Connector would also install an additional 20,500 ISO hp standby compressor unit at the station. These would be turbine-driven, natural gas fired centrifugal compressor units. We analyze the possibility of using electric compressor units as an alternative in section 3.4.5.3 of this EIS.

The compression units would be installed in a new compressor building. Other facilities would include an inlet filter/separator, lube oil cooler, inlet air silencer/cleaner, and exhaust system. The compressor building would include skid-mounted fuel gas conditioning, measuring, and regulation

equipment. Related suction and discharge headers and piping would be installed between the pipeline and the compressor units. Other buildings inside the station would include a control room/ancillary equipment building, unit valve skid buildings, and an office. The ancillary equipment building would include an air compressor system, hot water boiler, and back-up generator. The office building would include telephone and computer access. The station would also contain aboveground pig launcher equipment, a MLV, and a 26-foot-high communication tower.

Oil storage tanks at the facility would be constructed with appropriately sized secondary containment. Oil-filled operational equipment would be addressed in a manner consistent with the requirements of 40 CFR 112. All compressor station technicians would be trained for proper handling, storage, disposal, and spill response of hazardous fluids, and Pacific Connector would develop a *Spill Prevention, Containment, and Countermeasures Plan* (SPCCP). No process or non-process wastewater is expected from operations, nor stormwater exposed to industrial activity.

The Klamath Compressor Station would be utilized as a maintenance base for operation of the pipeline facilities. The station would not be manned 24 hours per day, but would have emergency pipe, spare parts, portable equipment such as blow-down silencers, and small hand tools stored on site. The facility would be equipped with outside lighting to support night work activities; however, those lights would only be utilized when operations personnel are working after dark at the station, most likely to occur for short periods periodically during the winter.

Mainline Block Valves

Pacific Connector proposes to install 17 MLV along its pipeline route, spaced according to DOT requirements (CFR 192.179) (see table 2.1.2.2-1). Three of the MLVs would be co-located within proposed meter stations (at the Klamath Compressor Station, Clarks Branch Meter Station, and Jordan Cove Meter Station). MLVs would be equipped with actuators and control equipment as necessary to allow operations consistent with any applicable guidelines or rules promulgated by PHMSA for such facilities. Except for the MLVs located within meter stations, the compressor stations, and the two MLVs that also have pig launcher/receivers, each of the other MLVs would individually occupy a site 50 by 50 feet (less than one-tenth of an acre) and would be enclosed by a 7-foot-high chainlink fence. The two MLVs (#11 and #14) that include pig launchers and receivers would each individually occupy an area 95 feet by 200 feet, or less than half an acre. The MLVs would be within the construction and operational right-of-way for the Pacific Connector pipeline, except for the MLVs at meter stations, the compressor station, and that include pig launchers and receivers. Pacific Connector attempted to locate MLVs adjacent to existing roads to allow reliable all-weather access and minimize the length of new PARs. Pacific Connector would paint the aboveground piping in the MLV locations green, unless otherwise dictated by permit conditions.

Pig Launchers/Receivers

Pig launchers and receivers would allow Pacific Connector to maintain the interior of its pipeline using remotely operated pipe inspection and cleaning tools (known as “pigs”). A pig launcher would be within the proposed Klamath Compressor Station, and a pig receiver would be installed at the proposed Jordan Cove Meter Station. There would also be pig launcher and receivers at the proposed Clarks Branch Meter Station and MLVs #11 and #14. At these two MLVs, the pig

launcher and receivers would occupy an area 95 feet by 200 feet, or less than half an acre. The pig launcher and receiver facilities would be located inside the fenced areas at all locations.

Gas Control Communications

The meter stations and compressor station would require a communications link with Williams Pacific Operator's gas control monitoring system in Salt Lake City, Utah. Therefore, new radio towers are proposed at each meter station and the compressor station. Pacific Connector has conducted initial communications studies and determined that in addition to the proposed towers at the meter stations and compressor station, leased space on existing communication towers would be needed for the Pacific Connector Pipeline Project. In addition to the communication facilities at the proposed meter stations and compressor station, Pacific Connector proposes to install communication facilities at eight existing towers (see table 2.1.2.2-2 and figure 2.1-13).

TABLE 2.1.2.2-2

Proposed and Existing Gas Control Communication Towers

Facility	County	Landowner	Tower Height	Operational Acres a/
Proposed New Towers				
Jordan Cove Meter Station b/	Coos	Private (Pacific Connector)	New tower 140-feet-high	<1 c/
Clarks Branch Meter Station	Douglas	Private (Pacific Connector)	New tower 26-feet-high	1
Klamath Compressor Station	Klamath	Private (Pacific Connector)	New tower 26-feet-high	31
Existing Communication Tower Sites				
Blue Ridge	Coos	BLM (Coos District)	Existing American Tower 161-feet-high	<1
Signal Tree	Coos	BLM (Coos District)	Existing American Tower 71-feet-high	<1
Winston	Douglas	Private	Existing tower 250-feet-high	<1
Harness Mountain	Douglas	Private (Northwest Pipeline)	Existing tower 150-feet-high	<1
Starveout Creek	Jackson	Private	Existing tower 60-feet-high	<1
Flounce Rock	Jackson	BLM (Medford District)	New tower 140-feet-high	<1
Robinson Butte	Jackson	Forest Service (Rogue River National Forest)	New tower 140-feet- high	<1
Stukel Mountain	Klamath	BLM (Lakeview District)	New tower 100-feet-high	<1

a/ Acreages are rounded to the nearest whole acre. If less than 1 acre, reported as "<1".
b/ A tower at this site would only be necessary if Pacific Connector is unable to mount an antenna on one of the structures within the LNG terminal site.
c/ The towers at meter or compressor stations would be within the operational easement of the stations.

Pacific Connector prefers to co-locate with existing facilities when possible and would do so if leased space is available within existing facility sites at the time of construction. If leased space is not available on existing facilities and construction of new facilities is required, Pacific Connector would seek to obtain an approximately 100-foot by 100-foot (about one-quarter acre) area for each of the new facility installations in the immediate vicinity of the existing communication tower facilities. The new towers and communication buildings would be enclosed within a 50-foot by 50-foot (less than one-tenth an acre) fenced footprint located within the larger 100 foot by 100 foot area.

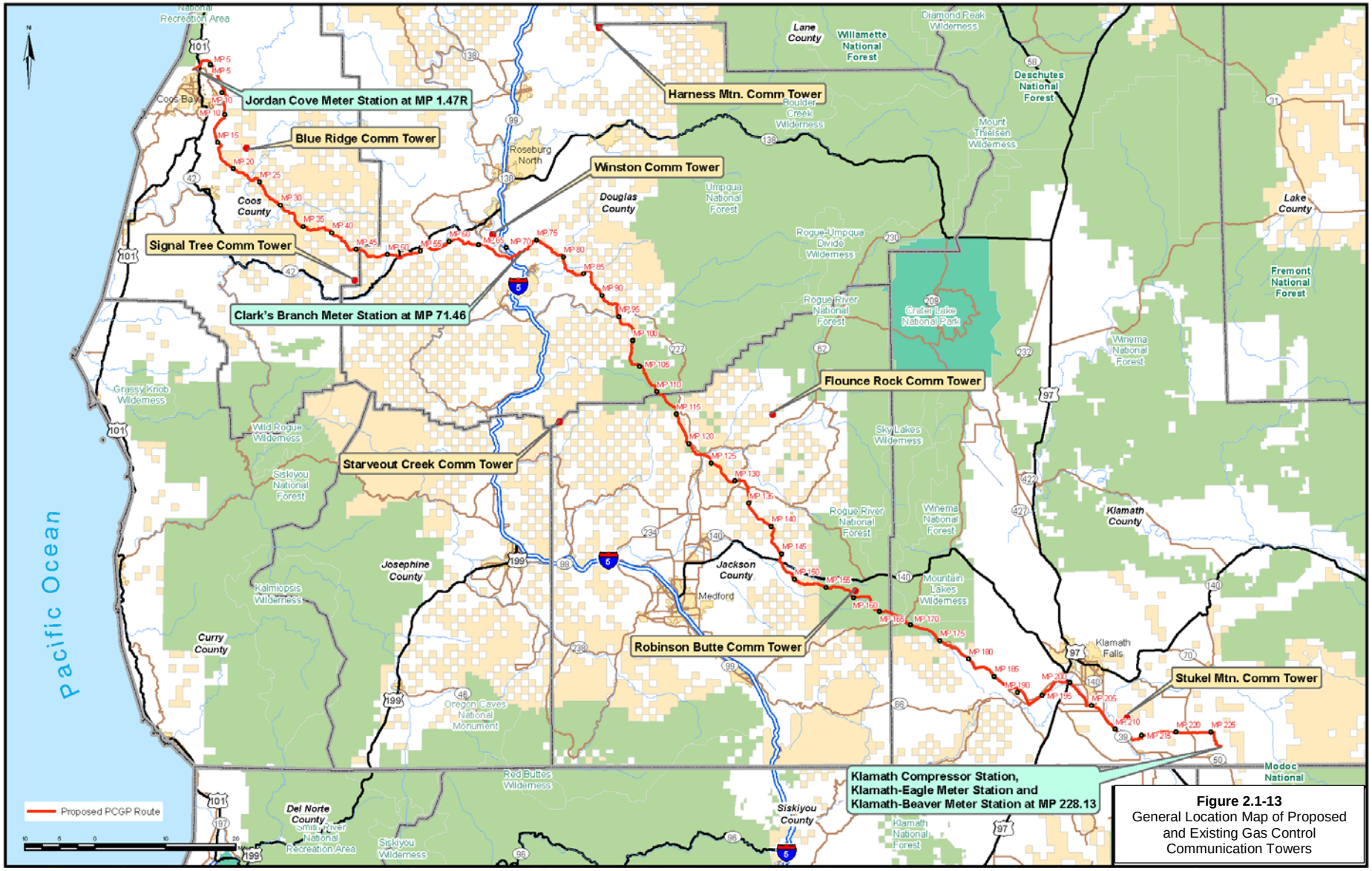


Figure 2.1-13
General Location Map of Proposed and Existing Gas Control Communication Towers

Of the eight existing communication towers, three are on privately owned land, and five are on federal lands. Williams, the managing partner of Pacific Connector, owns the tower at Harness Mountain, in Douglas County, which is currently used for Northwest Pipeline's existing Grants Pass Lateral.

For the five locations on federal lands, Pacific Connector prepared a *Communication Facilities Plan* (dated January 2013) as part of its POD.[5] There are three existing towers on BLM land at Blue Ridge, and Pacific Connector indicated that the tower operated by American Tower has space available and is suitable for co-location. At Signal Tree, on BLM land, there are 14 existing facilities inside the boundary of this communication site. Pacific Connector indicated it may co-locate its new communication facilities at the existing tower of American Tower. There are eight existing communication facilities on BLM land at Flounce Rock. Pacific Connector is investigating co-location on the Telava tower. However, if Pacific Connector is unable to utilize the Telava tower, it would construct a new building and 140-foot-high tower within the boundary of the Flounce Rock communication site. There are two existing towers on Forest Service land at Robinson Butte. However, neither tower is suitable for Pacific Connector, so it proposes to construct a new 140-foot-tower at this location. There are three existing communication facilities on BLM land at Stukel Mountain, but none are suitable for co-locating new Pacific Connector equipment. Therefore, Pacific Connector proposes to build a new 100-foot-high tower at this site, within the boundaries of BLM's site plan for this facility.

2.1.3 BLM and Forest Service Land Management Plan Amendment Actions

Approximately 40 miles of the proposed Pacific Connector pipeline route would cross federal land administered by BLM Coos Bay, Roseburg, Medford Districts and the Klamath Falls Resource Area of the Lakeview District. Approximately 31 miles of the proposed Pacific Connector pipeline route would cross NFS lands administered by the Umpqua, Rogue River, and Winema National Forests. BLM and NFS lands are managed according to current LMPs. The Pacific Connector pipeline route would also cross less than one mile of Reclamation land, and a number of easements and 31 features related to the operation of the Klamath Project administered by the Mid-Pacific Region's Klamath Basin Area Office.

Similar to a county zoning ordinance, projects or activities that occur on BLM or NFS lands must be consistent with the respective LMP where the project or activity occurs. As proposed, the Pacific Connector Pipeline Project would not be consistent with certain elements of the affected BLM and Forest Service LMPs. Before the BLM can consider the Right-of-Way Grant application, the BLM and Forest Service must amend the affected LMPs to make provisions for the Pacific Connector Project. Table 2.1.3-1 describes the amendments to the respective LMPs that would be required to make provision for the Pacific Connector Project. With the exception of amendments to reallocate Matrix lands to LSR, the LMP amendments described in the table below are specific to the Pacific Connector Pipeline Project. The project-specific amendments would not change LMP requirements for other projects or authorize any other actions. With these amendments, the Pacific Connector Project would be a conforming use of the affected BLM Districts and National Forests.

[5] This plan was filed as a stand-alone document with Pacific Connector's June 2013 application to the FERC, as Appendix D of the POD.

TABLE 2.1.3-1

BLM and Forest Service LMP Amendments Associated with the Pacific Connector Pipeline Project

Amendment #	Amendment	Description
BLM/FS-1	Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the BLM Coos Bay District, Roseburg District, Medford District, and Klamath Falls Resource Area of the Lakeview District RMPs, and the Umpqua National Forest, Rogue River National Forest, and Winema National Forest LRMPs	Applicable BLM district RMPs and National Forest LRMPs would be amended to exempt certain known sites within the area of the proposed Pacific Connector Right-of-Way Grant from the Management Recommendations required by the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (Forest Service and BLM 2001). For known sites within the proposed right-of-way that cannot be avoided, the 2001 Management Recommendations for protection of known sites of Survey and Manage species would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer only that portion of the buffer within the right-of-way would be exempt from the protection requirements of the Management Recommendations. Those Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way.
BLM-1	Site-Specific Exemption of Requirement to Protect Marbled Murrelet (MAMU) Habitat on the BLM Coos Bay District and Roseburg District.	The Coos Bay District RMP and Roseburg District RMP would be amended to waive the requirements to protect contiguous existing and recruitment habitat for MAMU within the Pacific Connector right-of-way that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM. This would be a site-specific amendment applicable to the Pacific Connector pipeline right-of-way on the Coos Bay and Roseburg Districts, and would not affect or otherwise authorize any other project.
BLM-2	Site Specific Exemption of Requirement to Retain Habitat in Known Owl Activity Centers (KOAC) on the BLM Roseburg District	The Roseburg District RMP would be amended to exempt the Pacific Connector pipeline project from the requirement to retain habitat in KOAC at three locations. This would be a site-specific amendment applicable to the pipeline right-of-way, and would not affect or otherwise authorize any other project.
BLM-3	Reallocation of Matrix Lands to Late Successional Reserves (LSR) on the BLM Roseburg District	The Roseburg District RMP would be amended to change the designation of approximately 409 acres from the Matrix land allocations to the LSR land allocation in Sections 32 and 34, Township (T.) 29 ½ South (S.), Range (R.) 7 West (W.); and Section 1, T.30S., R.7W., Willamette Meridian (W.M.), Oregon. This change in land allocation is proposed to mitigate the potential adverse impact of the Pacific Connector pipeline project on LSRs in the Roseburg District. The amendment would change future management direction for the lands reallocated from matrix lands to LSR.
BLM-4	Reallocation of Matrix Lands to LSR on the BLM Coos Bay District	The Coos Bay District RMP would be amended to change the designation of approximately 387 acres from the Matrix land allocations to the LSR land allocation in Sections 19 and 29 of T.28S., R.10W., W.M., Oregon. This change in land allocation is proposed to mitigate the potential adverse impact of the Pacific Connector pipeline project on LSRs in the Coos Bay District. The amendment would change future management direction for the lands reallocated from matrix lands to LSR.
UNF-1	Site-Specific Amendment to Allow Removal of Effective Shade on Perennial Streams	The Umpqua National Forest LRMP would be amended to change the Standards and Guidelines for Fisheries (Umpqua National Forest LRMP, page IV-33, Forest-Wide) to allow the removal of effective shading vegetation where perennial streams are crossed by the Pacific Connector right-of-way. This change would potentially affect an estimated total of 3 acres of effective shading vegetation at approximately four perennial stream crossings in the East Fork of Cow Creek sub-watershed from pipeline MPs 109 to 110, in Sections 16 and 21, T.32S., R.2W., W.M., Oregon.
UNF-2	Site-Specific Amendment to Allow Utility Corridors in Riparian Areas	The Umpqua National Forest LRMP would be amended to change prescriptions C2-II (LRMP IV-173) and C2-IV (LRMP IV-177) to allow the Pacific Connector pipeline route to run parallel to the East Fork of Cow Creek for approximately 0.1 mile between about pipeline MPs 109.7 and 109.8, in Section 21, T.32S., R.2W., W. M., Oregon. This change would potentially affect approximately 1 acre of riparian vegetation along the East Fork of Cow Creek.
UNF-3	Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas	The Umpqua National Forest LRMP would be amended to waive limitations on the area affected by detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way. Standards and Guidelines for Soils (LRMP page IV-67) requires that not more than 20 percent of the project area have detrimental compaction, displacement, or puddling after completion of a project.

TABLE 2.1.3-1

BLM and Forest Service LMP Amendments Associated with the Pacific Connector Pipeline Project

Amendment #	Amendment	Description
UNF-4	Reallocation of Matrix Lands to LSR	The Umpqua National Forest LRMP would be amended to change the designation of approximately 588 acres from the Matrix land allocation to the LSR land allocation in Sections 7, 18, and 19, T.32S., R.2W., W.M., Oregon; and Sections 13 and 24, T.32S., R.3W., W.M., Oregon. This change in land allocation is proposed to partially mitigate the potential adverse impact of the Pacific Connector Pipeline Project on LSR 223 on the Umpqua National Forest. This amendment would change future management direction for the lands reallocated from matrix to LSR.
RRNF-2	Site-Specific Amendment of Visual Quality Objectives (VQO) on the Big Elk Road	The Rogue River National Forest LRMP would be amended to change the VQO where the Pacific Connector pipeline route crosses the Big Elk Road at about pipeline MP 161.4 in Section 16, T.37S., R.4E., W.M., Oregon, from Foreground Retention (Management Strategy 6, LRMP page 4-72) to Foreground Partial Retention (Management Strategy 7, LRMP page 4-86) and allow 10-15 years for amended visual quality objectives to be attained. The existing Standards and Guidelines for VQO in Foreground Retention where the Pacific Connector pipeline route crosses the Big Elk Road require that VQOs be met within one year of completion of the project and that management activities not be visually evident.
RRNF-3	Site-Specific Amendment of VQO on the Pacific Crest Trail (PCT)	The Rogue River National Forest LRMP would be amended to change the VQO where the Pacific Connector pipeline route crosses the PCT at about MP 168 in Section 32, T.37S., R.5E., W.M., Oregon, from Foreground Partial Retention (Management Strategy 7, LRMP page 4-86) to Modification (USDA Forest Service Agricultural Handbook 478) and to allow 5 years for amended VQOs to be attained. The existing Standards and Guidelines for VQOs in Foreground Partial Retention in the area where the Pacific Connector pipeline route crosses the PCT require that visual mitigation measures meet the stated VQO within three years of the completion of the project and that management activities be visually subordinate to the landscape.
RRNF-4	Site-Specific Amendment of VQO Adjacent to Highway 140	The Rogue River National Forest LRMP would be amended to allow 10-15 years to meet the VQO of Middleground Partial Retention between Pacific Connector pipeline MPs 156.3 to 156.8 and 157.2 to 157.5 in Sections 11 and 12, T.37S., R.3E., W.M., Oregon. Standards and Guidelines for Middleground Partial Retention (Management Strategy 9, LRMP page 4-112) require that VQOs for a given location be achieved within three years of completion of the project. Approximately 0.8 miles or 9 acres of the Pacific Connector right-of-way in the Middleground Partial Retention VQO visible at distances of about 0.8 to 5 miles from State Highway 140 would be affected by this amendment.
RRNF-5	Site-Specific Amendment to Allow Utility Transmission Corridors in Management Strategy 26, Restricted Riparian Areas	The Rogue River National Forest LRMP would be amended to allow the Pacific Connector right-of-way to cross the Restricted Riparian land allocation. This would potentially affect approximately 2.5 acres of the Restricted Riparian Management Strategy at one perennial stream crossing on the South Fork of Little Butte Creek at about pipeline MP 162.45 in Section 15, T.37S., R.4E., W.M., Oregon. Standards and Guidelines for the Restricted Riparian land allocation prescribe locating transmission corridors outside of this land allocation (Management Strategy 26, LRMP page 4-308).
RRNF-6	Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas	The Rogue River National Forest LRMP would be amended to waive limitations on areas affected by detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in all affected Management Strategies. Standards and Guidelines for detrimental soil impacts in affected Management Strategies require that no more than 10 percent of an activity area should be compacted, puddled, or displaced upon completion of project (not including permanent roads or landings). No more than 20 percent of the area should be displaced or compacted under circumstances resulting from previous management practices including roads and landings. Permanent recreation facilities or other permanent facilities are exempt (RRNF LRMP 4-41, 4-83, 4-97, 4-123, 4-177, 4-307).
RRNF-7	Reallocation of Matrix Lands to LSR	The Rogue River National Forest LRMP would be amended to change the designation of approximately 512 acres from the Matrix land allocation to the LSR land allocation in Section 32, T.36S., R.4E. W.M., Oregon. This change in land allocation is proposed to partially mitigate the potential adverse impact of the Pacific Connector pipeline project on LSR 227 on the Rogue River National Forest. This amendment would change future management direction for the lands reallocated from Matrix to LSR.

TABLE 2.1.3-1

BLM and Forest Service LMP Amendments Associated with the Pacific Connector Pipeline Project

Amendment #	Amendment	Description
WNF-1	Site-Specific Amendment to Allow Utility Corridors in Management Area 3	The Winema National Forest LRMP would be amended to change the Standards and Guidelines for Management Area 3 (MA-3) (LRMP page 4-103-4, Lands) to allow the Pacific Connector pipeline corridor in MA-3 from the Forest Boundary in Section 32, T.37S., R.5E., W.M., Oregon, to the Clover Creek Road corridor in Section 4, T.38S, R.5E., W.M., Oregon. Standards and Guidelines for MA-3 state that the area is currently an avoidance area for new utility corridors. This proposed new utility corridor is approximately 1.5 miles long and occupies approximately 17 acres.
WNF-2	Site-Specific Amendment of VQO on the Dead Indian Memorial Highway	The Winema National Forest LRMP would be amended to allow 10-15 years to achieve the VQO of Foreground Retention where the Pacific Connector right-of-way crosses the Dead Indian Memorial Highway at approximately pipeline MP 168.8 in Section 33, T.37S., R.5E., W. M., Oregon. Standards and Guidelines for Scenic Management, Foreground Retention (LRMP 4-103, MA 3A, Foreground Retention) requires VQOs for a given location be achieved within one year of completion of the project. The Forest Service proposes to allow 10-15 years to meet the specified VQO at this location.
WNF-3	Site-Specific Amendment of VQO Adjacent to the Clover Creek Road	The Winema National Forest LRMP would be amended to allow 10-15 years to meet the VQO for Scenic Management, Foreground Partial Retention, where the Pacific Connector right-of-way is adjacent to the Clover Creek Road from approximately pipeline MPs 170 to 175 in Sections 2, 3, 4, 11, and 12, T.38S., R.5E., W.M., Oregon, and Sections 7 and 18, T.38S., R.6E., W.M., Oregon. This change would potentially affect approximately 50 acres. Standards and Guidelines for Foreground Partial Retention (LRMP, page 4-107, MA 3B) require that VQOs be met within 3 years of completion of a project.
WNF-4	Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas	The Winema National Forest LRMP would be amended to waive restrictions on detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in all affected management areas. Standards and Guidelines for detrimental soil impacts in all affected management areas require that no more than 20 percent of the activity area be detrimentally compacted, puddled, or displaced upon completion of a project (LRMP page 4-73, 12-5).
WNF-5	Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in Management Area 8 (Riparian Area MA-8)	The Winema National Forest LRMP would be amended to waive restrictions on detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way within the Management Area 8 (MA-8), Riparian Area. This change would potentially affect approximately 0.5 mile or an estimated 9.6 acres of MA-8. Standards and Guidelines for Soil and Water, MA-8 require that not more than 10 percent of the total riparian zone in an activity area be in a detrimental soil condition upon the completion of a project (LRMP page 4-137, 2).

2.1.3.1 Proposed Amendments of the BLM Coos Bay District RMP

The BLM proposes to amend the Coos Bay RMP as follows:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species on the BLM Coos Bay District

Current Resource Management Plan: Management direction for S&M species in the Coos Bay RMP (page 33) as amended by Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Coos Bay District RMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species, as amended, in the Coos Bay District RMP by adding by the following text to page 33:

The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Coos Bay District. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the BLM from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Coos Bay District of BLM and would not affect or otherwise authorize any other project.

BLM-1: Site-Specific Exemption of Requirement to Protect MAMU Habitat on the BLM Coos Bay District

Current Resource Management Plan: The Coos Bay District RMP requires protection of contiguous existing and recruitment habitat for MAMU that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM (page 36).

Proposed Amendment: This proposal would amend the Coos Bay District RMP management direction for MAMU (page 36) by adding the following text to page 36:

The requirement to protect contiguous existing and recruitment habitat for marbled murrelets that is within the Pacific Connector right-of-way is waived for the Pacific Connector Gas Pipeline Project. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Coos Bay District of BLM and would not affect or otherwise authorize any other project.

BLM-4: Reallocation of Matrix Lands to LSRs on the Coos Bay District

Current Resource Management Plan: Standards and Guidelines for Developments in LSRs on the Coos Bay District require that new developments that may adversely affect LSRs be minimized or mitigated (page 20). This change in land allocation is proposed to mitigate the potential adverse impact of the Pacific Connector pipeline on LSRs on the Coos Bay District.

Proposed Amendment: The proposal would amend the Coos Bay RMP as follows**:**

The Coos Bay District RMP and District Strategy Map (Map 3) are amended to change the designation of approximately 387 acres from the Matrix land allocations to the LSR land allocation in Sections 19 and 29 of T. 28 S., R. 10 W., W. M., Oregon. The amendment would change future management direction for the lands reallocated from Matrix lands to LSR.

2.1.3.2 Proposed Amendments of the BLM Roseburg District RMP

The BLM proposes to amend the Roseburg District RMP as follows:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species on the BLM Roseburg District

Current Resource Management Plan: Management direction for S&M species in the Roseburg District RMP (page 23) as amended by Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Roseburg District RMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species in the Roseburg District RMP by adding by the following text to page 23:

> *The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Roseburg District. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the BLM from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Roseburg District of BLM and would not affect or otherwise authorize any other project.*

BLM-1: Site-Specific Exemption of Requirement to Protect MAMU Habitat on the BLM Roseburg District

Current Forest Plan: The Roseburg District RMP requires protection of contiguous existing and recruitment habitat for MAMU that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM (page 48).

Proposed Amendment: This proposal would amend the Roseburg District RMP management direction for MAMU (page 48) by adding the following:

> *This requirement to protect marbled murrelet habitat is waived for the Pacific Connector Gas Pipeline. This would be a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Roseburg District of BLM and would not affect or otherwise authorize any other project.*

BLM-2: Site Specific Exemption of Requirement to Retain Habitat in KOAC on the BLM Roseburg District

Current Resource Management Plan: The Roseburg District RMP requires retention of habitat in KOAC (page 48).

Proposed Amendment: This proposal would waive management direction in the Roseburg District RMP to protect habitat in KOAC for the NSO (page 48) by adding the following text:

This requirement to retain habitat in Known Owl Activity Centers is waived for the Pacific Connector Gas Pipeline. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Pipeline on the Roseburg District of BLM and would not affect or otherwise authorize any other project.

BLM-3: Reallocation of Matrix Lands to LSR on the BLM Roseburg District

Current Resource Management Plan: Standards and Guidelines for Developments in LSRs on the Roseburg District require that new developments that may adversely affect LSRs be minimized or mitigated (page 30). This change in land allocation is proposed to partially mitigate the potential adverse impact of the Pacific Connector pipeline on LSRs on the Roseburg District.

Proposed Amendment: The proposal would amend the Roseburg RMP as follows**:**

The Roseburg District RMP District Strategy Map is amended to change the designation of approximately 409 acres from the Matrix land allocations to the LSR land allocation in Sections 32 and 34, T. 29 S., R. 7 W.; and Section 1, T. 30 S., R. 7 W., W.M., Oregon. The amendment would change future management direction for the lands reallocated from Matrix lands to LSR.

2.1.3.3 Proposed Amendments of the BLM Medford District RMP

The BLM proposes to amend the Medford District RMP as follows:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the BLM Medford District

Current Resource Management Plan: Management direction for S&M species (page 25) as amended by Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Medford District RMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species in the Medford District RMP by adding by the following text to page 25:

The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way

for the Pacific Connector Gas Pipeline on the Medford District. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the BLM from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Medford District of BLM and would not affect or otherwise authorize any other project.

2.1.3.4 Proposed Amendment of the BLM Klamath Falls Resource Area RMP

The BLM proposes to amend the Klamath Falls Resource Area of the Lakeview District RMP as follows:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the Klamath Falls Resource Area RMP

Current Resource Management Plan: Management direction for S&M species (page 11) as amended by Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Klamath Falls Resource Area RMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species in the Klamath Falls Resource Area RMP by adding the following text to page 12:

The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Klamath Falls Resource Area of the Lakeview District. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the BLM from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way

for the Pacific Connector Gas Pipeline and would not affect or otherwise authorize any other project.

2.1.3.5 Proposed Amendments of the Umpqua National Forest LRMP

The Forest Service proposes to amend the Umpqua National Forest LRMP as follows:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the Umpqua National Forest LRMP

Current Land and Resource Management Plan: Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, amended the Umpqua National Forest LRMP to require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Umpqua National Forest LRMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species by adding the following text to the Umpqua National Forest LRMP, page IV-3, Standards and Guidelines:

The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Umpqua National Forest. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the Forest Service from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Umpqua National Forest and would not affect or otherwise authorize any other project.

UNF-1: Site-Specific Amendment To Allow Removal of Effective Shade on Perennial Streams

Current Land and Resource Management Plan: The Pacific Connector pipeline would cross four perennial streams on the Umpqua National Forest. Forest wide Standards and Guidelines for Fisheries prohibit removal of effective shading vegetation on perennial streams (LRMP, page IV-33 S&G #1). Forest-wide Standards and Guidelines for water quality require retention of shade unless a site-specific assessment shows that shade removal would not result in an increase in water temperature (LRMP, page IV-60, S&G #1).

Proposed Amendment: The proposed amendment would change Forest Wide Standards and Guidelines for Fisheries, S&G #1 on page IV-33 and Standards and Guidelines for Water Quality, S&G #1 on page IV-60 by adding the following text:

> *Removal of effective shade is permitted where the Pacific Connector Gas Pipeline corridor crosses perennial streams. This amendment applies only to the corridor of the Pacific Connector Gas Pipeline where it crosses perennial streams on the Umpqua National Forest. It does not affect any other project, or establish future management direction.*

UNF-2: Site-Specific Amendment To Allow Utility Corridors in Riparian Areas

Current Land and Resource Management Plan: Facilities prescriptions C2-II on page IV-173 and C2-IV on page IV-177 restrict utility corridors from running parallel to Class II streams.

Proposed Amendment: This amendment would add the following language to Facilities prescriptions C2-II on page IV-173 and C2-IV on page IV-177 by adding the following text:

> *The Pacific Connector Gas Pipeline corridor would parallel a Class II stream in the East Fork of Cow Creek for approximately 0.1 mile. This amendment applies only to the project area of the Pacific Connector Gas Pipeline and does not change future management direction.*

UNF-3: Site-Specific Amendment To Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas

Current Land and Resource Management Plan: Forest Wide Standards and Guidelines for Soils (Umpqua NF LRMP, page IV-67, S&G #1) requires that not more than 20 percent of the project area should have detrimental compaction, displacement or puddling after completion of the project.

Proposed Amendment: This amendment would change Soils Forest Wide Standards and Guideline #1 on Page IV-67 by adding the following text:

> *The Pacific Connector Gas Pipeline may exceed the restriction on detrimental soil conditions. This amendment applies only to the right-of-way and associated work areas of the Pacific Connector Gas Pipeline. It does not affect other projects, or change any future management direction.*

UNF-4: Reallocation of Matrix Lands to LSRs on the Umpqua National Forest

Current Land and Resource Management Plan: Standards and Guidelines for Developments in LSRs require that new developments that may adversely affect LSRs be minimized or mitigated (see *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl*, Page C-17). This change in land allocation is proposed to partially mitigate the potential adverse impact of the PCGP on LSR 223 on the Umpqua National Forest.

Proposed Amendment: The proposal would amend the Umpqua Forest LRMP as follows**:**

The Umpqua National Forest LRMP is amended to change the designation of approximately 588 acres from Matrix land allocations to the LSR land allocation in Sections 7, 18, and 19, T.32S., R.2W., and Sections 13 and 24, T.32S., R.3W., W.M., OR.

2.1.3.6 Proposed Amendments of the Rogue River National Forest LRMP

The Forest Service proposes to amend the Rogue River National Forest LRMP as follows[6]:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the Rogue River National Forest LRMP

Current Land and Resource Management Plan: Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, amended the Rogue River National Forest LRMP to require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Rogue River National Forest LRMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species by adding the following text to the Rogue River National Forest LRMP on page 4-31 – Standards and Guidelines:

The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Rogue River National Forest. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the Forest Service from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Rogue River National Forest and would not affect or otherwise authorize any other project.

RRNF-2: Site-Specific Amendment of VQO on the Big Elk Road

Current Land and Resource Management Plan: The location where the Pacific Connector pipeline intersects the Big Elk Road is in Management Strategy 6, where the VQO is Foreground

[6] RRNF-1 to establish a goal for energy transmission related to the Pacific Connector pipeline was included in the NOI for this project. The Forest Supervisor of the Rogue River National Forest has determined this amendment was not necessary.

Retention. This VQO must be met within one year of completion of the Pacific Connector Pipeline Project and management activities must not be visually evident (Rogue River National Forest LRMP, Page 4-72).

Proposed Amendment: This amendment proposes to change the VQO for Management Strategy 6 on page 4-72 of the Rogue River National Forest LRMP (Description) and to allow additional time to meet the VQO, as follows:

> *In the vicinity where the Pacific Connector Gas Pipeline right-of-way crosses the Big Elk Road, the Visual Quality Objective is amended from Foreground Retention to Foreground Partial Retention and 10 to 15 years will be allowed for the amended Visual Quality Objectives to be attained. This amendment applies only to the right-of-way of the Pacific Connector Gas Pipeline in the vicinity of the Big Elk Road and does not change future management direction for any other project.*

RRNF-3: Site-Specific Amendment of VQO on the PCT

Current Land and Resource Management Plan: The location where the Pacific Connector pipeline crosses the PCT is in Management Strategy 7, where the VQO is Foreground Partial Retention. VQOs must be met within three years of completion of an activity, and the management activity should be visually subordinate to the landscape.

Proposed Amendment: This amendment proposes to change the VQO for Management Strategy 7 on page 4-86 of the Rogue River National Forest LRMP (Description) to read as follows:

> *In the vicinity where the Pacific Connector Gas Pipeline right-of-way crosses the Pacific Crest Trail (PCT) the VQO is amended from Foreground Partial Retention to Modification and up to five years will be allowed for VQOs to be attained. This amendment applies only to the right-of-way of the Pacific Connector Gas Pipeline in the vicinity of the Pacific Crest Trail and does not change future management direction.* [7]

RRNF-4: Site-Specific Amendment of VQO Adjacent to Highway 140

Current Land and Resource Management Plan: The ridgetop where the Pacific Connector pipeline runs adjacent to Highway 140 is in Management Strategy 9, where the VQO is Middleground Partial Retention. Management activities may be evident but visually subordinate to the natural landscape and VQOs must be met within three years of completion of an activity.

Proposed Amendment: This amendment proposes to change the VQO for Management Strategy 9 on page 4-112 of the Rogue River National Forest LRMP (Description) to read as follows:

> *In the vicinity where the Pacific Connector Gas Pipeline right-of-way runs along Highway 140, 10 to 15 years will be allowed for VQOs to be attained. This amendment applies only to the right-of-way of the Pacific Connector Gas Pipeline in the vicinity of Highway 140 and does not change future management direction.*

[7] This amendment has been revised to address comments provided on the DEIS with respect to timeframe to achieve VQOs.

RRNF-5: Site-Specific Amendment to Allow Utility Transmission Corridors in Management Strategy 26, Restricted Riparian Areas

Current Land and Resource Management Plan: Restricted Riparian, Management Strategy 26, extends at least 100 feet or to the extent of the riparian vegetation on each side of perennial streams. The Pacific Connector pipeline route crosses Management Strategy 26 lands at the South Fork of Little Butte Creek. Standards and Guidelines for the Restricted Riparian Management Strategy (Rogue River National Forest LRMP, page 4-308) states that transmission corridors should be located outside of this management strategy.

Proposed Amendment: This amendment proposes to change Standards and Guidelines for MA 26 on page 4-308 by adding the following text:

> *The Pacific Connector Gas Pipeline corridor is allowed to cross the Restricted Riparian land allocation at the South Fork of Little Butte Creek. This amendment applies only to the right-of-way and associated work areas of the Pacific Connector Gas Pipeline where they cross the Restricted Riparian land allocation. It does not affect any other project or establish future management direction.*

RRNF-6: Site-Specific Amendment To Waive Limitations on Detrimental Soil Conditions Within the Pacific Connector Right-of-Way in All Management Areas

Current Land and Resource Management Plan: Standards and Guidelines for soils in all Management Areas require that no more than 10 percent of the activity area be detrimentally compacted, puddled or displaced upon completion of a project or activity.

Proposed Amendment: This amendment proposes allow the Pacific Connector Pipeline Project to exceed restrictions on detrimental soil conditions. The following language would amend existing LRMP direction for soils in all Management Areas:

> *Standards and Guidelines for detrimental soil conditions may be exceeded in all management areas crossed by the Pacific Connector Gas Pipeline. This amendment applies only to the right-of-way and associated work areas of the Pacific Connector Gas Pipeline. It does not affect other projects, or change any future management direction.*

RRNF-7: Reallocation of Matrix Lands to LSR

Current Land and Resource Management Plan: Standards and Guidelines for Developments in LSRs require that new developments that may adversely affect LSRs be minimized or mitigated (see *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species Within the Range of the Northern Spotted Owl*, Page C-17). This change in land allocation is proposed to partially mitigate the potential adverse impact of the Pacific Connector Project on LSR 227 on the Rogue River National Forest.

Proposed Amendment: The proposal would amend the Rogue River National Forest LRMP as follows**:**

> *The Rogue River National Forest LRMP is amended to change the designation of approximately 512 acres from Matrix land allocations to the LSR land allocation in Section 32, T.36S., R.4E. W.M., OR.*

2.1.3.7 Proposed Amendments of the Winema National Forest LRMP

The Forest Service proposes to amend the Winema National Forest LMRP as follows:

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the Winema National Forest LRMP

Current Land and Resource Management Plan: Management Recommendations (S&G, Section V) of the 2001 *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines*, amended the Winema National Forest LRMP to require protection of known S&M species sites.

Proposed Amendment: This proposal would amend the Winema National Forest LRMP to exempt S&M species sites within the area of the proposed right-of-way for the Pacific Connector pipeline from the management direction for S&M species by adding the following text to the Winema National Forest LRMP on page 4-38, Forestwide Standards and Guidelines:

The Management Recommendations to protect Survey and Manage species sites (S&G, Section V of the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,") are waived for the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Winema National Forest. For known sites within the proposed right-of-way that cannot be avoided, the Management Recommendations would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that portion of the buffer within the right-of-way would be exempt from the protection requirements. These Management Recommendations would remain in effect for that portion of the protection buffer that is outside of the right-of-way. This waiver of Management Recommendations does not exempt the Forest Service from the requirements of the 2001 Survey and Manage Record of Decision to maintain species persistence for affected Survey and Manage species within the range of the northern spotted owl. This is a site-specific amendment applicable to the lands occupied as authorized under a right-of-way for the Pacific Connector Gas Pipeline on the Winema National Forest and would not affect or otherwise authorize any other project.

WNF-1: Site-Specific Amendment To Allow Utility Corridors in Management Area (MA) 3

Current Land and Resource Management Plan: The Pacific Connector pipeline route crosses MA 3 – Scenic Management between the Forest Boundary with the Rogue River and the Clover Creek Road. Standards and Guidelines for Lands in MA 3 on page LRMP pages 4-103 and 4-104, Lands state that MA 3 is an avoidance area for new utility corridors.

Proposed Amendment: This amendment would add the following text to MA 3 under Lands on pages 4-103 and 4-104:

The Pacific Connector Gas Pipeline may create a corridor in MA 3 from the Forest Boundary to the Clover Creek Road. This amendment applies only to the project area of the Pacific Connector Gas Pipeline and does not change future management direction.

WNF-2: Site-Specific Amendment of VQO on the Dead Indian Memorial Highway

Current Land and Resource Management Plan: At the location where the Pacific Connector pipeline route crosses the Dead Indian Memorial Highway the VQO is Foreground Retention. Standards and Guidelines for Scenic Management, Foreground Retention (Management Area 3A, LRMP page 4-104) require VQO for a given location to be achieved within one year of completion of the Pacific Connector Pipeline Project.

Proposed Amendment: The Forest Service proposes to allow a longer time frame to meet the specified VQO where the Pacific Connector pipeline route crosses the Dead Indian Memorial Highway. The following language would be added under MA 3A Standards and Guideline Scenic 1 Page 4-104, item 2:

> *In the vicinity of the 75 foot wide Pacific Connector Gas Pipeline corridor crossing of the Dead Indian Memorial Highway, 10 to 15 years will be allowed for VQOs to be attained. This amendment applies only to the project area of the Pacific Connector Gas Pipeline and does not change any future management direction.*

WNF-3: Site-Specific Amendment of VQO Adjacent to the Clover Creek Road:

Current Land and Resource Management Plan: Where the Pacific Connector pipeline is adjacent to the Clover Creek Road, the VQO is Foreground Partial Retention. Standards and Guidelines for Scenic Management, Foreground Partial Retention (Management Area 3B, Scenic Standard & Guideline 1, page 4-107) requires that visual quality objectives be met within three years of completion of the Pacific Connector pipeline.

Proposed Amendment: The Forest Service proposes to allow a longer time frame to meet the amended VQO where the Pacific Connector pipeline is adjacent to the Clover Creek Road. The following text would be added under MA 3B Standard and Guideline Scenic 1 Page 4-107, item 2:

> *In the vicinity where the Pacific Connector Gas Pipeline corridor runs adjacent to Clover Creek Road, ten to fifteen years will be allowed for VQOs to be attained. This amendment applies only to the project area of the Pacific Connector Gas Pipeline in the vicinity of the Clover Creek Road and does not change future management direction.*

WNF-4: Site-Specific Amendment To Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas

Current Land and Resource Management Plan: Standards and Guidelines for Detrimental Soil Conditions (LRMP, page 4-73, 12-5) in all affected management areas require that no more than 20 percent of the activity area be detrimentally compacted, puddled, or displaced upon completion of a project.

Proposed Amendment: This amendment would change Standard and Guideline 12-5 on page 4-73 by adding:

> *The Pacific Connector Gas Pipeline may exceed this restriction on detrimental soil conditions. This amendment applies only to construction clearing limits and work/storage areas within the project area of the Pacific Connector Gas Pipeline and does not change any future management direction.*

WNF-5: Site-Specific Amendment To Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in Management Area (MA) 8

Current Land and Resource Management Plan: Standards and Guidelines for Soil and Water 2 in MA 8 Riparian Area (LRMP, page 4-137) requires that detrimental soil condition not exceed 10 percent of the total riparian acreage within an activity area.

Proposed Amendment: This amendment would change Soil and Water Standard and Guideline 2 on page 4-137 by adding:

> *The Pacific Connector Gas Pipeline may exceed this restriction on detrimental soil conditions within the project right of way. This amendment applies only to the construction clearing limits of the Pacific Connector Gas Pipeline and does not change future management direction.*

2.1.4 Mitigation Plan Specific to Federal Lands

Mitigation measures reduce or compensate for environmental consequences of an action. All relevant, reasonable mitigation measures are to be identified, even if they are outside of the jurisdiction of the lead agencies or cooperating agencies (CEQ 1981: 12-13). Table 2.1.4-1 summarizes the mitigation program by project types for both agencies. Table 2.1.4.3-1 lists the individual mitigation proposed for BLM and Forest Service.

Many of the individual projects listed in table 2.1.4.3-1 lack the site-specific surveys needed for implementation and, as a result, are not ripe for decision at this time. These mitigation projects are therefore being analyzed programmatically as a part of the Proposed Action in this EIS, and they would require a secondary site-specific project-level NEPA analysis prior to implementation. The CEQ regulations for NEPA specifically provide for the second phase of a project, such as mitigation, to tier to the EIS of a larger specific action when those subsequent actions are ripe for decision (40 CFR 1508.28). It is anticipated that the NEPA analysis for the proposed mitigation actions would tier to this EIS as site-specific assessments and final project designs are completed. The public would have opportunity to comment on specific project proposals at that time.

These mitigation programs would be required as a condition of the Right-of-Way Grant, if one were issued for this project. CEQ regulations require that a monitoring and enforcement program be adopted where applicable for any mitigation (40 CFR 1505.2(c)). Section 2.6 describes the monitoring and enforcement requirements associated with this mitigation program.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
Aquatic and Riparian Habitat			The Pacific Connector Pipeline Project would remove riparian vegetation and cross streams. Aquatic restorations are aimed accomplishing objectives of the Aquatic Conservation Strategy (ACS) and offsetting project impacts at the watershed scale. Proposed mitigation projects are located in the fifth-field watersheds that would be crossed by the pipeline; however, feasible projects may not be located in the same sub-watersheds as the pipeline project.	
	Large Woody Debris (LWD) In-stream	28.2 Miles	Placement of LWD in streams adds structural complexity to aquatic systems by creating pools and riffles, trapping fine sediments and can contribute to reductions in stream temperatures over time (Tippery et al. 2010). This is responsive to Aquatic Conservation Strategy (ACS) objectives 2, 3, 4, and 5.	**Short-term adverse effects**: LWD in-stream refers to logs (typically greater than 20 inches in diameter), limbs, or root wads that intrude into a stream channel. Placing this material in-stream can be accomplished with ground equipment such as excavators and/or helicopters. These activities have the potential to increase suspended sediment in streams and impact riparian vegetation as a result of heavy equipment use or the dragging of materials (e.g. logs) in the stream channel. Short-term impacts to water quality would occur in the form of suspended sediment and turbidity increases during in-stream implementation. However, no lasting measureable effect to water quality would occur as any sediment plume created, would quickly dissipate as soon as in-stream activities stop. In-stream work is done during summer low flow periods when turbidity plumes are an infrequently occurring event. Project design features (PDF) would include Best Management Practices (BMP) that would prevent any indirect effects to salmonids and other stream fish from project related sediment. The placement of LWD materials in the stream by using cable systems, excavators, or helicopters would create noise that could disturb both NSO and MAMU. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for both NSO and MAMU. These PDFs would reduce impacts from noise to acceptable levels. **Long-term beneficial effects**: Placing LWD in streams affects channel morphology, the routing and storage of water and sediment, and provides structure and complexity to stream systems. Complex pools and side channels created by instream wood provide overwintering habitat to stream salmonids and other aquatic organisms (Solazzi 2000). They also provide cover from predators during summer low flow periods when predation is at its highest. Providing more stream channel structure results in better over wintering habitat, improved summer pool habitat, and more abundant spawning gravels.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	Fish Passage	13 sites	Old culverts may block fish passage either by poor design or by failure over time. Removing these blockages and replacing them with fish-friendly designs can allow fish and other aquatic organisms to access previously unavailable habitat. This is responsive to ACS Objectives 1, 2, 3, and 9 (see appendix J).	**Short-term adverse effects:** Removing old culverts and restoring stream/road crossings would result in short-term adverse effects similar to the effects described for LWD above since both involve the use of heavy equipment in and around the stream channel. Similarly the work would be done during low summer flow periods to minimize impacts to aquatic species and PDFs would be designed to minimize disturbance for Northern Spotted Owl (NSO) and Marbled Murrelet (MAMU).
	Stream / Road Crossings	58 Sites	Restoring stream crossings reconnects aquatic habitats by allowing the passage of aquatic biota and restoring riparian vegetation. Over time, these actions reduce sediment and restore shade. Restoration of these crossings includes riparian planting as a mitigation which would help offset the impact of shade removal at pipeline crossings. This work is typically accomplished in association with road improvement and decommissioning efforts.	**Long-term beneficial effects:** Stream crossing replacement would directly improve stream connectivity and habitat for aquatic species by immediately restoring access to formerly inaccessible habitats. Indirectly, these projects would reduce potential sediment levels in the long term by decreasing the potential for road failure. Stream crossing projects also reduce stream velocities by increasing stream crossing sizes, eliminating flow restrictions and allowing passage to additional reaches of habitat by removing barriers to aquatic species which improves access to spawning and rearing habitat and allows unrestricted movement throughout stream reaches during seasonal changes in water levels (Hoffman 2007).
	Riparian Planting	0.5 Miles	Riparian planting reestablishes willows and other riparian vegetation in areas where prior land use has removed existing vegetation. Riparian plantings reestablish shade, increase bank stability and, over time, contribute to restored riparian plan plant communities.	**Short-term adverse effects:** Riparian planting and fencing are typically done by hand and as such would not measurably impact stream sedimentation of erosion, riparian vegetation, water quality, aquatic habitats or any T&E species. Riparian fencing may require vegetation removal along the fence line but would not adversely affect water

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	Fencing	6.4 Miles	Fencing restricts cattle grazing in sensitive riparian ecosystems. This allows riparian vegetation to be reestablished and eliminates hoof damage to stream banks.	quality, channel substrate or bank conditions. **Long-term beneficial effects:** These projects directly affect riparian vegetation and would increase the health of riparian areas by promoting species diversity. Planting riparian vegetation decreases areas of bare soil and provides a sediment filtering buffer. A diverse native riparian plant community consisting of annuals, perennials, woody shrubs, and trees, provides a large variety of habitat features including food sources, shade, and large wood, and rooting depths which provide stream bank stability. Diverse, healthy vegetation has a major influence on stream channel shape and size; well-vegetated streams tend to be narrow and deep due to the binding nature of plants and their root systems (Comfort 2005). Excluding livestock access from the stream channel and riparian area would improve ecological conditions within the riparian areas. Livestock tend to congregate in riparian areas due to the presence of water and green vegetation and cooler temperatures throughout the drier months. Livestock trample and graze riparian vegetation, resulting in stream bank erosion and loss of biological diversity (Belsky 1999). Excluding livestock from the riparian area would allow vegetation to reestablish and increase the likelihood of success of native shrub and tree plantings (Sarr 2002).
Road Sediment Reduction			The pipeline project may cause sediment transport from construction clearing and use of roads by the project. Road sediment reduction projects are aimed at reducing the chronic contributions of fine-grained sediment from road surfaces and fill failures to stream systems.	
	Road Decommissioning b/	85.2 Miles	Decommissioning roads can substantially reduce sediment delivery to streams (Madej 2000; Keppeler et al. 2007). Proposed road decommissioning would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Project occur. This mitigation is responsive to ACS objectives 2, 3, 4, and 5 and Standards and Guidelines for Key Watersheds (Forest Service and BLM 1994b: p. B-11, C-7).	**Short-term adverse effects:** Road decommissioning methods generally include actions utilizing mechanized construction equipment to physically stabilize the road prism, restore natural drainage patterns, and allow for revegetation of the roadbed. Mechanized construction equipment might include excavators, backhoes and truck mounted loaders. Road closure is a method of preventing access to a road so that regular maintenance is no longer needed and future erosion is largely prevented by restoring drainage patterns if necessary and eliminating road traffic.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	Road Closure	6.0 Miles	Road closure reduces fine grained sediments by eliminating traffic impacts.	Road decommissioning has the potential to cause short-term degradation of water quality by increasing sediment delivery to streams as roads are de-compacted by heavy equipment, culverts and cross drains are removed, and other restoration activities are implemented. The use of heavy mechanized equipment near streams could disturb the stream influence zone, deliver sediment, create turbidity, and cause stream bank erosion. There is also the potential of an accidental fuel/oil spill. These projects may cause a short-term degradation of water quality due to sediment input and chemical contamination. Stream bank condition and habitat substrate may also be adversely affected in the short term. However with careful project design and seasonal timing, these affects are expected to be of a limited extent and duration. Road decommissioning would create noise from heavy equipment that could disturb both NSO and MAMU. The potential for disturbance is mainly associated with breeding behavior at active nest sites. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for both NSO and MAMU. These PDFs would reduce impacts from noise to acceptable levels. **Long-term beneficial effects:** Proposed road decommissioning would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Project would occur. Decommissioning roads would restore natural drainage patterns and thereby avoid large volumes of added sediment to the stream network that would be likely to eventually occur. In addition limited road maintenance dollars could be focused on the remaining road systems resulting in more maintenance of culverts and ditchlines resulting in less potential for catastrophic failure. Madej (2001) concluded that by eliminating the risk of stream diversions and culvert failures, road removal treatments significantly reduce long-term sediment production from retired logging roads. Beneficial effects to fisheries include long-term improvements to fish habitat and riparian areas, restored fish passage for all life histories of threatened and proposed species, re-established connectivity of fish populations above and below man-made barriers, restoration of hydrologic function, more natural routing of wood and sediment through stream systems. Road decommissioning would also benefit many species of wildlife including the NSO and MAMU thru reduced disturbance from the elimination of road traffic and long-term benefits as decommissioned roads become reforested reducing fragmentation of habitat.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	Road Surfacing and Drainage Improvement	60.9 Miles	Road surfacing reduces sediment by capping existing fine textured sediments in the running surface of a gravel road with coarser rock or by paving. Paving all but eliminates traffic-generated sediments. Drainage repair reestablishes out-sloping, cross-drains and in some cases ditchlines to ditch-relief culverts. These actions have the effect of getting water off the road before it can enter stream courses. This mitigation is responsive to ACS objectives 2, 3, 4 and 5 and Standards and Guidelines for Key Watersheds (Forest Service and BLM 1994b: p. B-11, C-7).	**Short-term adverse effects:** Road improvements including surfacing, drainage repair, storm proofing, stabilization, and culvert replacement may result in short-term, construction-related increases in sediment. Sediment is expected to be of limited extent and duration and can be minimized or eliminated through the application of PDFs and BMPs. Road improvements would create noise from heavy equipment that could disturb both NSO and MAMU. The potential for disturbance is mainly associated with breeding behavior at active nest sites. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for both NSO and MAMU. These PDFs would reduce impacts from noise to acceptable levels. **Long-term beneficial effects:** Road improvement projects reduce erosion from existing road surfaces, cut banks and fill slopes, and reduce the probability of failure through improvement of road surface stability and drainage. In the long term, road improvements reduce both chronic and episodic erosion and sedimentation. Drainage improvements, such as out-sloping, reduce or eliminate chronic sources of road erosion and fine sediment delivery resulting in long-term improvements in water quality and aquatic habitat.
	Storm-proofing	13.8 Miles	Storm-proofing reduces sediment from roads by increasing the resistance of a road to failure during high intensity rainfall events. Storm-proofing strategies include improving drainage, reducing diversion potential at culverts, outsloping road surfaces, and replacing culverts with hardened low water fords.	
	Stabilization and Culvert Replacement	5 sites	Road stabilization and culvert replacement reduce road-related sediment by stabilizing or removing failing cut and fill slopes. Culvert replacement reduces sediment by replacing undersized or failing culverts with culverts that are appropriate to pass debris at higher flows. This reduces the probability of fill failure associated with plugged culverts.	

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
Fire Suppression	Suppression Capacity	15 Sites	The pipeline project would create fire suppression complexity by creation of a continuous corridor of early seral plant communities. High intensity stand-replacement fire has been identified as the single largest factor causing the loss of LSOG forests in the first 15 years of implementation of the Northwest Forest Plan (NWFP; Moeur et al. 2011). These projects include heli-ponds (3) and pumper access / dry hydrant pumper connections at water sources. High intensity fire has been identified as the single factor most impacting LSOG forest habitats on federal lands in the area of the NWFP. Fire control is necessary to protect LSRs and endangered species habitat should a wildfire occur. Construction of the pipeline and associated activities would remove both mature and developing stands and would increase fire suppression complexity however the corridor also provides a fuel break. Quick response time is imperative for successful control in wildfire situations during initial attack. Pump chance developments and helicopter dipping ponds provide readily available water sources to support fire suppression efforts.	**Short-term adverse effects:** Fire suppression capacity projects include the use of heavy equipment especially for the construction of heli-ponds which may be as large as 500,000 gallons. Soil erosion risk would increase with the proposed activities because bare soil would be exposed during implementation. Impacts caused by heavy equipment would increase the amount of detrimental soil damage within the treatment areas. By employing appropriate BMPs and PDFs, the risk of erosion, sediment delivery, and detrimental soil damage within the treatment areas is expected to be minimal and within LMP standards and guidelines. Fire suppression capacity projects would create noise from heavy equipment that could disturb both NSO and MAMU. The potential for disturbance is mainly associated with breeding behavior at active nest sites. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for both NSO and MAMU. These PDFs would reduce impacts from noise to acceptable levels. **Long-term beneficial effects:** Pump chance developments and helicopter dipping ponds provide readily available water sources to support fire suppression efforts. These projects would help to reduce the threat of losing late-successional habitat to stand-replacement fire.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
Stand Density and Fuels Reduction and Fuel Break			The pipeline project would create fire suppression complexity by creation of a continuous corridor of early seral plant communities. The pipeline project would also remove LSOG stands in the corridor construction areas and indirectly affect LSOG habitat in stands adjacent to the pipeline. Both mature stands and developing stands would be removed during pipeline construction. Density management integrated with fuels reduction would increase longevity of existing mature stands by reducing losses from disease, insects, and fire. Density management in younger stands would accelerate development of LSOG habitat. Associated fuel reductions would reduce risk of loss to fire and reduce potential fire size and intensity. Impacts to mature and developing stands would exceed the life of this project by many decades. LSR Assessments have identified the importance of density management to control losses to stand replacing fire. The proposed route of the pipeline project intersects an area that has had reoccurring lighting strikes and has potential for stand replacement fires. These mitigation projects would assist in protection and restoration of the late-seral forest values. These mitigation projects would provide multiple resources values for the LSR, Forest, adjacent private landowners, and public.	

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	Integrated Stand Density and Fuels Reduction	5,994 Acres	Watershed assessments and LSR assessments in Southwest Oregon have noted shifts from forests dominated by fire-resistant LSOG stands to fire-prone early and mid-seral forests (Forest Service, BLM et al. 1998; Forest Service and BLM 1998, 1999). Use of fuels reduction and stand density management are appropriate tools to reduce the risk of high intensity stand replacement fires in these forests (Forest Service and BLM 1994b). Management activities that reduce the risk of natural disturbance adjacent to Known Owl Activity Centers (KOAC) are also appropriate (Forest Service and BLM 1994b: p. C-11). Stand density reductions in riparian zones have the dual benefit of reducing the risk of stand-replacing fire, while also accelerating the development of late successional stand conditions by accelerating growth of remaining trees. This project would create a fuel break on federal lands that stretches from Milo to Shady Cove.	**Short-term adverse effects:** Integrated stand density and fuels reduction activities include the use of heavy equipment for cutting, skidding, slash piling, under-burning and hauling forest vegetation. Soil erosion risk would increase with the proposed activities because bare soil would be exposed during implementation. As the amount of bare/compacted soil increases, so does the risk of soil movement. Impacts caused by heavy equipment would increase the amount of detrimental soil damage within the treatment areas. By maintaining proper amounts of protective groundcover along with appropriate BMPs and PDFs, the risk of erosion, sediment delivery, and detrimental soil damage within the treatment areas is expected to be minimal and within LMP standards and guidelines. Stand density fuels reduction treatments would not be expected to adversely affect nesting habitat for the NSO since the treatments would not remove constituent elements of their nesting habitat. The proposed treatments could temporarily impact acres of dispersal habitat. This habitat would be impacted by reduction of canopy cover as well as the loss of some down wood, shrubs and snags, which provide habitat for prey species. Although the dispersal habitat within these treatment areas would be reduced in quality, the projects would be designed so that the areas would still function as dispersal habitat. Integrated stand density treatments would create noise from heavy equipment that could disturb the NSO. The potential for disturbance is mainly associated with breeding behavior at active nest sites. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for NSO. These PDFs would reduce impacts from noise to acceptable levels. Under-burning and burning of slash piles can impact air and visual quality during burning activities. All burning would be scheduled in conjunction with the State of Oregon to comply with the Oregon Smoke Implementation Plan and to minimize any adverse effects on air quality. Burning prescriptions would be developed to minimize the potential for adverse effects. Implementation of these measures would ensure compliance with the Clean Air Act. **Long-term beneficial effects:** By creating less dense stands with less tree competition, residual trees would benefit from the increased availability of sunlight, nutrients, and water. With the increase of available nutrients, trees should be more vigorous and less susceptible to large scale insect/disease outbreaks. The proposed treatments would move the vegetation towards conditions that would have occurred under a natural disturbance regime. This would lower flame lengths, reduce fire spread and lower the probability of tree mortality in the event of a wildfire, leading to more successful suppression efforts. Aerial delivered retardant or water would be more effective in lighter fuels and a more open canopy, making it safer for firefighters to successfully anchor and contain wildfires. These actions would reduce the threat of losing late-successional habitat to fire.
	Under-burning	2,035 Acres	Under-burning is a component of the integrated stand density reduction. This provides a mechanism to maintain shaded fuel breaks created by mechanically thinning stands. It also reintroduces fire on selected landscapes as recommended in various watershed and LSR assessments.	
	Pre-commercial Thinning	1,039 Acres	Pre-commercial thinning reduces stand density in overstocked young stands. This reduces the risk of stand replacing fire, increases the resilience of remaining trees to low intensity fire and accelerates the development of late successional stand characteristics.	
	Riparian Vegetation Fuels Reduction	70 Acres/ 6 Miles	Fuels reduction in riparian areas reduces the risk of stand replacement fire and accelerates the development of late successional stand characteristics.	

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
Terrestrial / Upland Habitat Improvement			The Pacific Connector Pipeline Project would remove snags and LSOG upland habitats, and would create a vector for noxious weeds. Terrestrial mitigations are intended to offset the loss of snags, future recruitment of LWD and eradicate noxious weed populations.	
	Habitat Planting	620 Acres	The Dead Indian Plateau region is one of four known sites for Mardon Skipper butterflies in the world: southern Oregon Cascades, northern California/Southern Oregon coast, southern Washington Cascades, and Puget Trough on Joint Base Lewis-McChord. It is also adjacent to a known site for Short-horned Grasshoppers. Both species are on the Regional Forester's Sensitive Species list. As a long-term opening, the pipeline corridor would provide a unique opportunity to develop habitat for these two species. Planting the corridor with plants preferred by these species has the potential to increase the habitat and local range for both species. This action would provide both short-term and long-term habitat for the local population of Mardon skipper butterflies and short-horned grasshoppers since it would be in the 30-year maintenance corridor. The pipeline project may also impact habitat of *Fritillaria gentneri,* which is listed as Endangered under the federal Endangered Species Act. Out-planting to suitable habitat locations is recommended in the recovery plan for *Fritillaria gentneri*.	**Short-term adverse effects:** This activity would take place within the Pacific Connector pipeline corridor and would not result in any additional adverse impacts. **Long-term beneficial effects:** Beneficial impacts include helping to re-vegetate and stabilize the pipeline corridor and improving habitat for several listed or sensitive insect species.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	LWD Upland Placement	470 Acres	These projects are intended to mitigate for the loss of recruitment of LWD to adjacent stands and within the construction clearing zone. The pipeline project would forgo the development of LWD for the life of the project and for decades after. LWD is a constituent element of habitat for NSO and is a significant component of LSOG habitat. Replacement of LWD would partially mitigate for the barrier effect of the corridor by creating structure across the corridor for use by various wildlife species. Placement in wood deficient areas adjacent to the corridor allows for scattering of stockpiled wood, reducing localized fuel loads while improving habitat in deficient stands. Larger logs maintain moisture longer and are less likely to be fully consumed by fire. Managing for the proposed levels provide for a greater assurance of species abundance (DecAID snag model). This type of project is consistent with NWFP Standards and Guidelines page C-11 (Forest Service and BLM 1994b). Acres that can be treated are necessarily limited by material available from the corridor.	**Short-term adverse effects:** Placement of LWD within and adjacent to the pipeline corridor would typically be done with heavy equipment that would drag the material into place. Heavy equipment use would increase the amount of detrimental soil damage within the treatment areas. By maintaining proper amounts of protective groundcover along with appropriate BMPs and PDFs, the risk of erosion, sediment delivery, and detrimental soil damage within the treatment areas is expected to be minimal and within LMP standards and guidelines. LWD placement would create noise from heavy equipment that could disturb the NSO. The potential for disturbance is mainly associated with breeding behavior at active nest sites. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for NSO. These PDFs would reduce impacts from noise to acceptable levels. **Long-term beneficial effects:** Beneficial effects include improving habitat for late-successional and other species and providing for long-term soil productivity.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
	Snag Creation	963 Acres	The creation of snags is intended to mitigate the loss of snag habitats within, and adjacent to the pipeline corridor. The pipeline project would prevent development of large snags during the life of the project and for decades after. Corridor construction would result in loss of snag habitat on approximately 1,074 acres associated with corridor construction. Various watershed analyses and LSR assessments indicate many areas traversed by the pipeline project are well below historic levels of snag habitat due to past management actions. The pipeline project would add to those cumulative impacts. As snags are a critical component of LSRs, replacement is needed. Snag requirements are specifically outlined in the BLM and Forests Service LMPs. Replacement would be immediate, though there would be a 10 year delay as snag decay occurs. Snag management is discussed in the NWFP for LSRs on pages C-14 and 15 (Forest Service and BLM 1994b). Snag management levels incorporated into these projects are based on the Forest's Plant Association Guidelines. The function and benefits of snags are also discussed in the South Cascades LSR Assessment (Forest Service, BLM et al. 1998: Chapter 3).	**Short-term adverse effects:** Snag creation typically employs the use of chainsaws or inoculum to kill live trees. As such there is little if any ground disturbance and only minimal noise disturbance. The potential for noise disturbance is mainly associated with breeding behavior at active NSO nest sites. The PDFs would focus disturbance outside the critical nesting period and beyond critical distances for NSO. These PDFs would reduce impacts from noise to acceptable levels. Any adverse environmental impacts would be de minimus and very short term. **Long-term beneficial effects:** Beneficial impacts include the improvement of habitat for snag dependent species and in particular those species dependent on LSOG forests. Long-term benefits would also accrue as the created snags decay over time and eventually provide for LWD on the forest floor improving habitat for many other species and contributing to long-term soil productivity.
	Noxious Weed Treatments	6 Road Miles, 127 Acres	The construction and operation of the pipeline project has the potential to create vectors for noxious weeds. These treatments are intended to reduce populations of noxious weeds that are in close proximity to the pipeline project right-of-way, as well as restore meadow habitats in the fifth-field watersheds that are currently impacted by noxious weeds.	**Short-term adverse effects:** Treatments typically involve the cutting, pulling or spraying of noxious weeds. Since the work is typically done by hand there is minimal if any ground or noise disturbance. All activities would be conducted consistent with the most recent direction and plans for weed management and integrated vegetation management on BLM and Forest Service lands to minimize adverse impacts to plant and animal communities as well as water quality and aquatic habitats. **Long-term beneficial effects:** Long-term benefits would include the restoring of native plant populations and species diversity. Restoring native plant communities and increasing vegetation diversity generally contributes to restoring habitat for a broad group of animal species.

TABLE 2.1.4-1

Summary of BLM and Forest Service Mitigation Projects by Mitigation Group and Project Type

Mitigation Group	Project Type	Amount	Rationale	Environmental Consequences a/
Visual Impacts on the Clover Creek Road		113 Acres	The pipeline project would create a hard visual line along the timbered edge of the corridor that does not fit with the agency's visual objectives for the Clover Creek Road or the Dead Indian Memorial Highway. Thinning and fuels treatments would be used to soften the edge to a more natural appearing texture by restoring stand density to more natural levels and creating small openings that are consistent with landscape.	**Short-term adverse effects:** The thinning and fuels treatment activities and resulting short-term adverse impacts would be similar to the impacts of the integrated stand density treatments described above. **Long-term beneficial effects:** The proposed activity would help mitigate the adverse visual impacts of the Pacific Connector pipeline along these road segments and would also create a fuel break and defensible space that could be used in helping to suppress high intensity wildfires.
Reallocation of Matrix Lands to Late Successional Reserves		1,896 Acres	This mitigation group contributes to the "neutral to beneficial" standard for new developments in mapped and unmapped LSRs by adding acres to the LSR land allocation to offset the long-term loss of habitat due to the construction and operation of the pipeline project. It also compensates for the removal of occupied MAMU habitat and suitable roosting, nesting and foraging NSO habitat. In addition, the selected parcels reduce the potential edge effects caused by management of matrix lands adjacent to occupied MAMU sites by reallocating the entire parcel to LSR. Reallocation of matrix lands to LSR also contributes to ACS objectives and may benefit Survey and Manage species by providing additional habitat that is managed to create LSOG stand conditions over time. Since the land reallocated to LSR on BLM-managed land comes out of the matrix, there is a need to replace those lands with other timber-producing lands to ensure that BLM continues to comply with requirements related to management of either Coos Bay Wagon Road or Oregon & California Railroad (O&C) lands. It is expected these lands would be acquired by the applicant and conveyed to the BLM to be managed as part of the matrix as either Coos Bay Wagon Road or O&C lands.	**Short-term adverse effects:** The reallocation of matrix lands to LSR is an administrative action that would not have any immediate environmental consequences on the ground. **Long-term beneficial effects:** The proposed reallocation would change the management direction of approximately 1,896 acres from one of multiple uses with an emphasis on timber management to a management emphasis focusing on the creation and maintenance of late-successional forest habitat. Over time, this reallocation would benefit species dependent on late-successional forests through management actions that would be designed to improve or maintain late-successional habitat conditions.

a/ For all project types additional field surveys for T&E species, Special Status species, and Heritage Resources would be completed where necessary before implementation. In addition, consultations with the FWS and NMFS as necessary would also be completed prior to implementation. All future decision making under NEPA for these projects would be completed consistent with the CEQ Regulations (40 CFR 1500-1508) and would tier to this EIS.

b/ The Northwest Forest Plan defines decommissioning as "To remove those elements of a road that reroute hillslope drainage and present slope stability hazards." Decommissioning generally restores natural drainage, removes unstable fill material, and establishes vegetation cover on the road surface to reduce erosion.

c/ The BLM and Forest Service use the term "project design features" or "project requirements" rather than "mitigation" to describe elements of a plan that occur within a project area and are standard requirements of a project. The BLM and Forest Service reserve the term "mitigation" to describe measures taken to reduce or compensate for otherwise unavoidable impacts.

2.1.4.1 Mitigation Specific to BLM and Forest Service

An extensive off-site mitigation program on BLM and NFS lands is included in the Proposed Action to ensure that the objectives of the affected LMPs are achieved. Appendix F of this FEIS has been revised and updated to provide an assessment of off-site mitigation actions on BLM and NFS lands.

2.1.4.2 Commercial Logging on Federal Lands

We received comments during scoping and on the DEIS requesting that commercial logging, which would generate income, or replanting, law enforcement, and other projects that would be funded without this project, not be used as mitigation. In addition, a comment letter received on the DEIS expressed a concern that commercial logging has been proposed as mitigation for take of NSOs and MAMUs, and that between 7,560 and 9,649 acres would be commercially logged. The commenter also expressed a concern about whether receipts from commercial timber sales would be used to reduce Pacific Connector's expenses, requested clarification of the NEPA pathway for these projects, and questioned the applicability of fuels reductions in native, mature, or old-growth forests. We are addressing these comments here to clarify possible misunderstandings.

Commercial logging is not being used as mitigation for take of NSOs and MAMUs. Commercial logging is one tool that may be used to remove commercial-sized material to accomplish fuels reduction objectives, intended to mitigate the Project impacts to LSOG forests by reducing the risk of stand-replacing fires in LSOG forests.

NSO are dependent on LSOG forests. Monitoring of the NWFP for the past 15 years has shown that the largest single factor contributing to the loss of LSOG forests (and hence NSO habitat) has been high-intensity stand replacement fire (Moeur et al. 2011). The NWFP anticipated the need to reduce fuels to reduce the risk of stand replacement fire in LSOG forests, particularly in the Klamath Province (Forest Service and BLM 1994b: C-12). The Recovery Plan for the NSO also recognized the need for fuels reduction in dry forest habitats of the Klamath Province (FWS 2011a: III-20). Late Successional Reserve Assessments for LSR 223 and 261 have also documented the need for fuels reduction to reduce the risk of stand replacement fire in LSOG forests in the Klamath Province of southwest Oregon (Forest Service et al. 1998; BLM and Forest Service 1998).

The Pacific Connector Project would remove approximately 188 acres[8] of LSOG forest on BLM and Forest Service lands in the Klamath and Western Cascade Provinces. Additional acres would be directly impacted from the use of UCSA and indirectly affected by edge effects and fragmentation. As a partial mitigation for this impact, the BLM and Forest Service propose to accomplish approximately 6,000 acres (table 2.1.4-1) of integrated fuels reduction in overstocked stands along the Pacific Connector corridor on ridge top locations between the community of Milo on the South Umpqua River and the community of Trail on the Rogue River. The primary purpose of these fuels reduction projects is not to have commercial timber sales; it is to reduce the risk of stand-replacement fire and possible losses of LSOG forest / NSO habitat in an area that has a history of lightning fires. No estimate has been made of the total acres of fuels reduction projects that may involve commercial timber removal. Subsequent site-specific environmental analysis

[8] GNN data set clipped to the Pacific Connector Right of Way in the Klamath and Western Oregon Cascades Provinces.

would further define the details of these proposed projects. Amendments to the LMPs have not been proposed for the mitigation actions outlined in section 2.1.4 of the DEIS. The mitigation actions are being designed to be consistent with the LMPs as well as the recommendations in watershed assessments and the LSR assessments. With the proposed amendments, the Project would not violate the LMPs.

Several comments were received on the DEIS questioning the efficacy of the proposed fuel treatments and suggested the treatments were not necessary and would be detrimental to LSOG habitat. In one comment letter two recent studies were mentioned in support of their comments. One study titled *Historical Northern spotted owl habitat and old-growth dry forests maintained by mixed-severity wildfires* was authored by William L. Baker (2015) and looked at the importance of mixed severity fires to NSO habitat in the Eastern Oregon Province. The author concluded that efforts to reduce fuels and to prevent these fires in all areas will likely reduce future NSO habitat. It should be noted that the NWFP and the LSR assessments also recognized the importance of fire and other natural disturbances in shaping habitat for LSOG-dependent species. The proposed fuel treatments are strategically located in a limited area and are not designed to remove all fire. The treatments are focused on reducing the risk of high intensity stand replacement fire. In the study the author also stated that to maintain NSO habitat likely first requires restoration of historical fuels. The proposed fuel treatments are in areas that have high fuel loadings above historical levels due to fire suppression activities over the last century. The treatments are designed to bring fuel levels closer to historic levels and in some of the area fire would be re-introduced through proposed underburning.

The other recent study that was mentioned is titled *Effects of Fire and Commercial Thinning on Future Habitat of the Northern Spotted Owl* by Dennis Odion and others (2014). This study assessed whether the beneficial effects of commercial thinning from reduced fire risk outweighed the adverse effects of the thinning on NSO habitat. The authors concluded the long-term benefits of commercial thinning would not outweigh the adverse impacts on NSO habitat. This study, however, was looking at commercial thinning prescriptions that reduced the basal area of dense late successional forest by nearly half and mostly well below the minimum level known to function as nesting and roosting habitat for the NSO. The fuel treatments that have been proposed are focused on reducing fuels and would remove primarily smaller trees and shrubs.

A number of comments on the DEIS suggested that it did not account for the receipts from commercial timber sales that may occur in conjunction with off-site mitigation measures. The purpose of the proposed mitigation is to reduce the risk of stand-replacing fires and to enhance the development of LSRs. Projects proposed to meet these objectives could result in commercial size trees being removed. This removal of commercial size trees would be incidental to achieving these objectives. This is discussed in the DEIS on pages 2-51 through 2-54. Pacific Connector would not perform the compensatory mitigation actions and would not receive any receipts from this work. All of the off-site mitigation measures incorporated into the proposed action would have costs that the agencies do not otherwise have funding for. The BLM and Forest Service would plan these activities consistent with the standards in the current LRMPs. Any timber sale receipts from these projects would be subject to the normal contract payment provisions and timber sale receipt regulations of the BLM and Forest Service.

2.1.4.3 Specific Off-Site Mitigation Projects on BLM and NFS Lands

Table 2.1.4.3-1 describes the individual mitigation projects related to LMP objectives on BLM and NFS lands that are included in the proposed action. These projects would be implemented by the BLM and Forest Service as a subsequent phase of the Pacific Connector Pipeline Project with funding provided by the applicant. The applicant is also responsible for providing funding to BLM and the Forest Service for planning efforts related to these mitigation actions.

TABLE 2.1.4.3-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity a/	Unit
Coos Bay BLM	East Fork Coquille River	Reallocation of Matrix Lands to LSR and Acquisition	Land Re-Allocation from Matrix to LSR, Non-Federal Land Acquisition	RMP Amendment BLM – 4, LSR Reallocation and Land Acquisition	180	acres
		Aquatic and Riparian Habitat	LWD instream	Yankee Run In-stream Large Wood Placement	2.8	miles
		Fire suppression	Fire Suppression	Heli-Pond Construction	2	ea.
		Road Sediment Reduction	Road Surfacing	Road Surfacing –Yankee Run Spurs	0.9	miles
		Road Sediment Reduction	Road Surfacing	Road Surfacing –South Fork Elk Creek	2.6	miles
		Road Sediment Reduction	Road Surfacing	Road Surfacing –Yankee Run Mainline	2.0	miles
	Middle Fork Coquille River	Reallocation of Matrix Lands to LSR and Acquisition	Land Re-Allocation from Matrix to LSR, Non-Federal Land Acquisition	RMP Amendment BLM -4, LSR Reallocation and Land Acquisition	207	acres
		Aquatic and Riparian Habitat	LWD in-stream	Upper Rock Creek Instream LWD	2.1	miles
		Fire suppression	Fire Suppression	Heli-Pond Construction	1	ea.
		Road Sediment Reduction	Road Surfacing	Road Surfacing –Fall Creek System	0.9	miles
		Road Sediment Reduction	Road Surfacing	Bridge Approach paving –Sandy & Jones Creek Roads	2	ea.
	North Fork Coquille River	Aquatic and Riparian Habitat	LWD in-stream	Steinnon Creek In-stream LWD	1.5	miles
		Aquatic and Riparian Habitat	LWD in-stream	Upper North Fork Coquille In-stream LWD	2.2	miles
		Road Sediment Reduction	Road Surfacing	Bridge Approach paving – Woodward & Alder Creek Roads	2	ea.
Roseburg BLM	Clarks Branch South Umpqua	Aquatic and Riparian Habitat	Fish Passage	Rice Creek Culvert Replacements	2	sites
		Road Sediment Reduction	Road Drainage – Culvert Replacement	East Fork Willis Creek Tributary Culvert Replacement	1	project
		Road Sediment Reduction	Road Drainage – Culvert Replacement	Judd Creek Culvert Removal	1	project
	Days Creek - South Umpqua	Aquatic and Riparian Habitat	Fish Passage	Beal Creek Culvert Replacement	2	sites
		Aquatic and Riparian Habitat	LWD in-stream	West Fork Canyon Creek In-stream LWD	0.8	miles
		Road Sediment Reduction	Road storm-proofing	31-4-3.2 Road Storm-proofing	1	project
		Road Sediment Reduction	Road Drainage and Surface Enhancement	South Umpqua Road Drainage and Surface Enhancement	10.0	miles
		Stand Density Fuel Break	Fuels Reduction	Days Creek- South Umpqua Hazardous Fuel Reduction	1,000	acres

TABLE 2.1.4.3-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity a/	Unit
	Days Creek - South Umpqua (1710030205), Myrtle Creek (1710030211), and Clarks Branch - South Umpqua (1710030210)	Fire Suppression	Suppression Capacity	Dry Hydrants	6	sites
	Middle Fork Coquille River	Road Sediment Reduction	Road Surfacing and Cross Drain Replacement	Dice, Boulder, and Twelvemile Creek road systems	11	miles
		Aquatic and Riparian Habitat	LWD in-stream	Middle Fork Coquille In-stream LWD Placement	0.6	miles
		Aquatic and Riparian Habitat	LWD in-stream	Twelvemile Creek Instream LWD	2.0	miles
		Road Sediment Reduction	Road Drainage and Surface Enhancement	Camas Mountain Road Drainage and Surface Enhancement	3.5	miles
	Myrtle Creek	Aquatic and Riparian Habitat	Fish Passage	Slide Creek Culvert Replacement	1	project
		Road Sediment Reduction	Road Drainage and Surface Enhancement	Slide Creek Road Drainage and Surface Enhancement	1.0	miles
		Road Sediment Reduction	Road Stabilization	South Myrtle Hill Slide Repair	1	project
	Olalla-Looking Glass	Acquisition	Land Re-Allocation from Matrix to LSR, Non-Federal Land Acquisition	RMP Amendment BLM-3, LSR Reallocation and Land Acquisition	409	acres
		Road Sediment Reduction	Culvert Replacement	Unnamed Tributary to Lower Olalla Creek	1	project
		Road Sediment Reduction	Road Stabilization	Olalla Tie Road Renovation	1	project
Medford BLM	Big Butte Creek	Fire suppression	Fire Suppression	Big Butte Creek Pump Chance	1	sites
		Road Sediment Reduction	Road storm-proofing	Big Butte Creek Road Storm-proofing	6.4	miles
		Terrestrial Habitat Improvement	Habitat Planting	Big Butte Creek Fritillaria Habitat	600	acres
	Little Butte Creek	Aquatic and Riparian Habitat	Fish Passage	Little Butte Creek Fish Screen	1	site
		Aquatic and Riparian Habitat	LWD in-stream	Lost Creek In-stream LWD	8.6	miles
		Fire suppression	Fire Suppression	Little Butte Creek Pump Chance	2	sites
		Road Sediment Reduction	Road Drainage and Surface Enhancement	Little Butte Creek Road Improvement	3.5	miles
		Road Sediment Reduction	Road Decommissioning	Little Butte Creek Road Decommissioning - Butte Falls RA	2.4	miles
		Road Sediment Reduction	Road Surfacing	Little Butte Creek Road Resurfacing - Ashland Resource Area	9.0	miles
	Shady Cove–Rogue River	Aquatic and Riparian Habitat	LWD in-stream	Shady Cove LWD	2.5	miles
		Road Sediment Reduction	Road Drainage and Surface Enhancement	Shady Cove Road Improvement	1.3	mile
		Road Sediment Reduction	Road Surfacing	Shady Cove Road Resurface	1.5	miles
		Stand Density Fuel Break	Fuels Reduction	Shady Cove Fuel Hazard Reduction	866	acres
		Stand Density Fuel Break	Fuels Reduction	Shady Cove Fuel Hazard Maintenance	866	acres
	Trail Creek	Aquatic and Riparian Habitat	LWD in-stream	Trail Creek LWD	2.6	miles
		Fire suppression	Suppression Capacity	Trail Creek Pump Chance	3	sites

TABLE 2.1.4.3-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity a/	Unit
		Road Sediment Reduction	Road storm-proofing	Trail Creek Road Storm-proofing	4.3	miles
		Road Sediment Reduction	Road Surfacing	Trail Creek Road Resurface	16.3	miles
		Stand Density Fuel Break	Fuels Reduction	Trail Creek Fuel Hazard Reduction	687	acres
		Stand Density Fuel Break	Fuels Reduction	Trail Creek Fuels Hazard Maintenance	687	acres
Lakeview BLM	Spencer Creek	Riparian Stand Density	Riparian Vegetation	Upper Spencer Creek LSR/Riparian treatment	3.0	miles
		Riparian Stand Density	Riparian Vegetation	Miners Creek LSR, Riparian Treatment	3.0	miles
		Road Sediment Reduction	Road Drainage – Culvert Replacement	Keno Access Road Repair and Culvert Replacement	1	site
		Road Sediment Reduction	Road Drainage	Spencer Creek Drainage Improvements and Sediment Trap Removal	15	sites
		Road Sediment Reduction	Road Closure	Spencer Creek Repair Existing Road Closure	12	sites
Umpqua National Forest	Days Creek - South Umpqua	Road sediment reduction	Road Closure	Days Creek -South Umpqua Road Closure	0.5	miles
		Stand Density Fuel Break	Fuels Reduction	Days Creek - South Umpqua Matrix Integrated Fuels Reduction	150	acres
		Stand Density Fuel Break	Fuels Reduction	Days Creek - South Umpqua LSR Integrated Fuels Reduction	232	acres
		Stand Density Fuel Break	Pre-commercial Thinning	Days Creek - South Umpqua. LSR Pre-commercial Thinning	53	acres
		Stand Density Fuel Break	Under-burn	Days Creek - South Umpqua LSR Under-burn	125	Acres
		Stand Density Fuel Break	Under-burn	Days Creek - South Umpqua Matrix Under-burn	102	acres
		Terrestrial Habitat Improvement	Snag Creation	Days Creek - South Umpqua LSR Snag Creation	32	acres
		Terrestrial Habitat Improvement	Snag Creation	Days Creek - South Umpqua Snag Creation	16	acres
	Elk Creek - South Umpqua	Aquatic and Riparian Habitat	Fish Passage	Elk Creek Fish Passage Culverts	3	sites
		Road sediment reduction	Road Storm-proofing	Elk Creek Road Storm-proofing	1.6	miles
		Road sediment reduction	Road Closure	Elk Creek Road Closure	2.8	miles
		Road sediment reduction	Road Decommissioning	Elk Cr. Road Decommissioning	2.8	miles
		Stand Density Fuel Break	Fuels Reduction	Elk Creek LSR Integrated fuels	897	acres
		Stand Density Fuel Break	Fuels Reduction	Elk Creek Matrix Integrated Fuels Reduction	170	acres
		Stand Density Fuel Break	Pre-commercial Thinning	Elk Creek LSR Pre-commercial thinning	368	acres
		Stand Density Fuel Break	Under-burn	Elk Creek LSR Under-burn	472	acres
		Stand Density Fuel Break	Under-burn	Elk Creek Matrix Under-burn	115	acres
		Terrestrial Habitat Improvement	LWD Upland Placement	Elk Creek LSR LWD Placement	103	acres
		Terrestrial Habitat Improvement	Meadow Restoration	Elk Creek Meadow Restoration	106	acres
		Terrestrial Habitat Improvement	Noxious Weed Treatment	Elk Creek Roadside Noxious Weeds	6.7	miles
		Terrestrial Habitat Improvement	Snag Creation	Elk Creek LSR Snag Creation	66	acres
		Terrestrial Habitat Improvement	Snag Creation	Elk Creek Matrix Snag Creation	13	acres

TABLE 2.1.4.3-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity a/	Unit
	Trail Creek	Road sediment reduction	Road Decommissioning	Trail Creek Road Decommissioning	1.1	miles
		Road sediment reduction	Road Storm-proofing	Trail Creek Storm-proofing	0.5	miles
		Stand Density Fuel Break	Fuels Reduction	Trail Creek Matrix Integrated Fuels Reduction	414	acres
		Stand Density Fuel Break	Under-burn	Trail Creek Matrix Under-burn	280	acres
		Terrestrial Habitat Improvement	Snag Creation	Trail Creek Matrix Snag Creation	109	acres
	Upper Cow Creek	Aquatic and Riparian Habitat	Fish Passage	Upper Cow Creek Fish Passage Culverts	4	sites
		Road sediment reduction	Road Closure	Upper Cow Creek Road Closure	2.6	miles
		Road sediment reduction	Road Decommissioning	Upper Cow Creek Road Decommissioning	4.3	miles
		Stand Density Fuel Break	Fuels Reduction	Upper Cow Creek LSR Integrated Fuels Reduction	972	acres
		Stand Density Fuel Break	Fuels Reduction	Upper Cow Creek Matrix Integrated Fuels Reduction	606	acres
		Stand Density Fuel Break	Under-burn	Upper Cow Creek LSR Under-burn	531	acres
		Stand Density Fuel Break	Under-burn	Upper Cow Creek Matrix Under-burn	410	acres
		Terrestrial Habitat Improvement	LWD Upland Placement	Upper Cow Creek LSR LWD Placement	62	acres
		Terrestrial Habitat Improvement	Noxious Weed Treatment	Upper Cow Creek Meadow Noxious Weeds	21	acres
		Terrestrial Habitat Improvement	Snag Creation	Upper Cow Creek LSR Snag Creation	91	acres
		Terrestrial Habitat Improvement	Snag Creation	Upper Cow Creek Matrix Snag Creation	14	acres
		Reallocation of Matrix Lands to LSR	Land Re-Allocation from Matrix to LSR	LRMP Amendment UNF -4, LSR 223 Reallocation	588	acres
Rogue River National Forest	Little Butte Creek	Aquatic and Riparian Habitat	LWD In-stream	South Fork Little Butte Creek. LWD	1.5	mile
		Aquatic and Riparian Habitat	Stream Crossing Repair	Little Butte Creek Stream Crossing Decommissioning	32	sites
		Road sediment reduction	Road Decommissioning	Little Butte Creek Road Decommissioning	53.2	miles
		Stand Density Fuel Break	Pre-commercial Thinning	Little Butte Creek LSR Pre-commercial Thin	618	acres
		Terrestrial Habitat Improvement	Habitat Planting	Little Butte Creek Mardon Skipper Butterfly	20	acres
		Terrestrial Habitat Improvement	LWD Upland Placement	Little Butte Creek LSR LWD Placement	306	acres
		Terrestrial Habitat Improvement	Snag Creation	Little Butte Creek LSR Snag Creation	622	acres
		Reallocation of Matrix Lands to LSR	Land Reallocation from Matrix to LSR	LRMP Amendment RRNF 7, LSR 227 Reallocation	12	acres
	Big Butte Creek	Reallocation of Matrix Lands to LSR	Land Reallocation from Matrix to LSR	LRMP Amendment RRNF 7, LSR 227 Reallocation	500	acres
Winema National Forest	Spencer Creek	Aquatic and Riparian Habitat	Riparian Planting	Spencer Creek Riparian Planting	0.5	miles
		Aquatic and Riparian Habitat	Fencing	Spencer Creek Fencing	6.4	miles
		Aquatic and Riparian Habitat	LWD In-stream	Spencer Creek In-stream LWD	1.0	miles
		Aquatic and Riparian Habitat	Stream Crossing Repair	Spencer Creek Ford Hardening and Interpretive Sign	1	sites

TABLE 2.1.4.3-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity a/	Unit
		Aquatic and Riparian Habitat	Stream Crossing Repair	Spencer Creek Stream Crossing Decommissioning	25	sites
		Road sediment reduction	Road Decommissioning	Spencer Creek Road Decommissioning	21.4	miles
		Visuals	Stand Density Reduction	Clover Creek Visual Management.	114	acres

a/ Acres are rounded to the nearest whole acre and miles to the nearest tenth of a mile.

2.1.5 Specific Off-site Mitigation Projects for Reclamation

Off-site mitigation on Reclamation lands may be included in the Proposed Action to ensure that the objectives of the Klamath Project are achieved and as necessary for Reclamation to consider concurrence in the BLM Right-of-Way, if authorized.

2.1.6 Right-of-Way Grant to Cross Federal Lands

Pursuant to the Mineral Leasing Act of 1920 and in accordance with federal regulation 43 CFR Part 2880, the Pacific Connector Pipeline Project must secure a Right-of-Way Grant from the BLM to cross BLM, NFS, and Reclamation lands. Pacific Connector has applied to the BLM for a Right-of-Way Grant to cross federal lands. The BLM proposes to consider issuance of a Right-of-Way Grant that provides terms and conditions for construction and operation of the Pacific Connector Pipeline Project on federal lands in response to the proponent's application. Issuance of the Right-of-Way Grant must be in accordance with 43 CFR Parts 2800 and 2880 and relevant BLM manual and handbook direction. In making this decision, BLM would consider several factors including conformance with LMPs and impacts on resources and programs. Following adoption of this EIS and receipt of concurrence from the Forest Service and Reclamation, the BLM would issue a ROD that documents the decision whether to issue the Right-of-Way Grant.

This Right-of-Way Grant would be in addition to any authorization for the Project issued by the FERC. The Right-of-Way Grant, if approved, would be authorized by issuance of a Temporary Use Permit for up to three years for the pipeline clearing and construction, which would terminate upon completion of construction, and issuance of a Right-of-Way Grant for ongoing pipeline operations and maintenance for a 30-year term. The Temporary Use Permit contains the specific temporary construction and work areas necessary to build the Project. Once the Pacific Connector pipeline is constructed and in operation, the Right-of-Way Grant would be modified to reflect the final location of the project and the associated 50-foot-wide maintenance corridor[9] plus any roads on federal lands or under federal easements that are necessary for operations.

2.1.6.1 Implementation and Monitoring of the BLM Right-of-Way Grant on Federal Lands

Monitoring is an essential element of project implementation (CEQ 2011). If the BLM issues a Temporary Use Permit and a Right-of-Way Grant for the Pacific Connector Pipeline Project, those

[9] In this EIS, the 50-foot wide corridor may be referred to as the "operational maintenance corridor", "permanent maintenance corridor", "permanent pipeline easement", "permanent pipeline right-of-way" or similar, depending on the resource discussion and context. To be clear, on all federal lands, the 50-foot wide corridor would be based on a 30-year Right-of-Way that would be neither permanent nor an easement on federal lands.

authorizations would provide the terms and conditions for construction, operation, maintenance, and eventual termination of the facility on federal public lands. As cooperating agencies with jurisdiction by law for activities that occur on lands they administer, the BLM, Forest Service, and Reclamation have a responsibility to monitor implementation of the Pacific Connector Pipeline Project to assure that the terms and conditions of the Right-of-Way Grant are carried out (40 CFR 1505.3).

CEQ Regulations for NEPA (40 CFR 1505.2(c)) also require that a monitoring and enforcement program should be adopted for any mitigation measures adopted as part of the decision to implement the Project. Many of the requirements of the POD that are a part of the BLM Right-of-Way Grant on federal lands are project design measures that reduce the environmental consequences of the Project on-site. The BLM and Forest Service have also proposed an extensive off-site mitigation program. In addition to monitoring implementation of the Temporary Use Permit and the Right-of-Way Grant, the BLM, Forest Service, and Reclamation also have a responsibility to monitor authorized actions, whether they are PDFs described in the POD or off-site mitigation measures included in BLM, Forest Service, and Reclamation mitigation programs.

There are two types of monitoring that would be associated with administering the Right-of-Way Grant. "Implementation monitoring" seeks to verify that the project was implemented according to the terms of the Right-of-Way Grant. Implementation monitoring is typically a checklist exercise to verify that a project is implemented as planned and that requirements, terms, and conditions associated with the project are met. Many of these elements would be addressed by FERC in the construction inspection process. As needed, agency representatives of the BLM, Forest Service, and Reclamation would participate in this process to assure that agency priorities are accomplished and agency obligations are fulfilled. Reclamation agency representatives would be on-site during all crossings of Reclamation facilities. Reclamation would require a minimum 48-hour notice for each crossing to ensure that Reclamation agency representatives are able to be on-site during the crossing installations.

"Effectiveness monitoring" is the second type of monitoring. Effectiveness monitoring seeks to verify that the specific requirements in the POD and in the off-site mitigation plans accomplished the desired objective. While virtually every important aspect of the project is subject to implementation monitoring, effectiveness monitoring is typically done on a smaller subset of actions. Where the outcomes of an action are well known and likely to be accomplished merely through implementation, effectiveness monitoring may not be needed, or may only be done on a sample basis. For example, the effects of surfacing roads are well known and not in question, so little if any effectiveness monitoring would be required for this activity. Conversely, some POD requirements or mitigation projects may have less certain outcomes or may be associated with thresholds such as water temperature. In those cases, effectiveness monitoring would be appropriate to ensure that the desired outcome is achieved. For example, in the East Fork of Cow Creek, the State of Oregon has established a threshold for water temperature impacts from management activities. Placing logs in and adjacent to perennial streams and planting shading vegetation is proposed to replace shade lost during construction clearing so that stream temperatures do not increase beyond established thresholds. Effectiveness monitoring would be appropriate in this circumstance to verify that stream temperatures in fact are not increased beyond the threshold. This also provides a trigger for adaptive management if the proposed mitigation is not entirely effective. Effectiveness monitoring requires interpretation of land management plan direction and objectives. Therefore, most effectiveness monitoring on federal lands would be accomplished by the agency having jurisdiction over the land being monitored.

Public comments received in response to the DEIS were used to focus monitoring efforts. The BLM, Forest Service, and Reclamation are developing a monitoring plan based on the "implementation" and "effectiveness" framework. Work on the monitoring plan is ongoing. Key items that require specific monitoring include LMP elements for:

- LSRs;
- Riparian Reserves;
- Matrix Lands;
- Key Watersheds;
- specific elements of National Forest LRMPs that may be more restrictive than the requirements of the NWFP; and
- specific recommendations of watershed analyses and LSR assessments.

The specifications of the POD were developed in part to ensure that the standards and guidelines of the agencies' LMPs, as amended, would be met. Implementation monitoring of the POD would be evidence of compliance with these respective LMPs. For example, implementation monitoring would show that:

- measures specified in the POD to reestablish effective ground cover were accomplished and that additional steps were taken if the agencies' standards were not met;
- measures in the POD for wetland and water body crossings designed to protect the aquatic environment, such as maintaining sediment barriers at stream crossings, were taken;
- de-compaction measures in the POD designed to avoid or mitigate detrimental soil compaction, were undertaken; and
- the BLM and Forest Service off-site mitigation programs associated with the Pacific Connector Pipeline Project were accomplished as planned.

Effectiveness monitoring focuses on key resources and evaluates whether measures taken to protect the resource in question accomplished the desired objective. Implicit in effectiveness monitoring is a framework of adaptive management to ensure that objectives are achieved. Following are three examples.

- Sediment barriers would be required at stream crossings. If sediment barriers are installed, but effectiveness monitoring shows that the sediment barrier used did not work as planned, then additional measures would need to be taken to keep sediment from reaching stream channels.
- Application of spatial buffer and timing restrictions for NSO nest sites. Effectiveness monitoring would be used to determine if that nest site was disturbed and/or reproductive success occurred.
- Measures to reestablish shade would be required at selected stream crossings where the analysis shows temperature is a potential issue. If the measures proposed are implemented, but prove to be ineffective, then additional actions to establish effective shade would be required.

Reporting results is a key element of a monitoring plan. The monitoring plan developed by the BLM, Forest Service, and Reclamation will include a reporting schedule and detailed criteria for judging completion and success of the actions being monitored. Implementation monitoring would typically be deemed complete when the action being monitored has been completely implemented.

Effectiveness monitoring would not be complete until the project objectives have been accomplished.

2.1.7 Plan of Development on Federal Lands

Pacific Connector's right-of-way application to the BLM included a POD. The POD is a detailed description of the proposed action on federally administered lands and facilities and would be made a part of the Right-of-Way Grant. The POD includes 29 attachments that were developed in cooperation with the BLM, Forest Service, and Reclamation. Twenty-eight of these attachments are individual plans detailing the Pacific Connector's proposed method for construction and operation of the proposed pipeline on federal lands (table 2.1.7-1). The POD also contains two unique agreements in principle for comprehensive mitigation plans developed collaboratively between the BLM and the Forest Service and Pacific Connector. Wherever applicable, Pacific Connector has committed to following the BMPs and PDFs outlined in the POD on non-federal lands as well.

Table 2.1.7-1 lists the POD attachments. The draft POD was filed as a stand-alone document with Pacific Connector's application to the FERC, and is available for public review.

TABLE 2.1.7-1

Pacific Connector's POD Attachments

Attachment #	Attachment Title	FERC Stand-Alone Document Appendix Letter a/
1	Aesthetics Management Plan for Federal Lands	A
2	Air, Noise and Fugitive Dust Control Plan	B
3	Blasting Plan	C
4	Communication Facilities Plan	D
5	Contaminated Substances Discovery Plan	E
6	Corrosion Control Plan	F
7	Emergency Response Plan	G
8	Environmental Briefings Plan	H
9	Erosion Control and Revegetation Plan	I
10	Federally-listed Plant Conservation Plan	J
11	Fire Prevention and Suppression Plan	K
12	Fish Salvage Plan	L
13	Hydrostatic Test Plan	M
14	Integrated Pest Management Plan	N
15	Klamath Project Facilities Crossing Plan	O
16	Leave Tree Protection Plan	P
17	Overburden and Excess Material Disposal Plan	Q
18	Prescribed Burning Plan	R
19	Recreation Management Plan	S
20	Right-of-Way Clearing Plan for Federal Lands	T
21	Right-of-Way Marking Plan	U
22	Safety & Security Plan	V
23	Sanitation and Waste Management Plan	W
24	Spill Prevention, Containment and Countermeasures Plan	X
25	Transportation Management Plan	Y
26	Unanticipated Discovery Plan	Z
27	Upper Rock Creek ACEC	AA
28	Wetland and Waterbody Crossing Plan	BB
29	Compensatory Mitigation Plan b/	CC
	Environmental Alignment Sheets	DD

a/ Pacific Connector included the POD Attachments in its application to the FERC by these letters.
b/ The measures outlines in the applicant's Compensatory Mitigation Plan would be implemented on private and state lands; however, the BLM/Forest-Service mitigation measures outlined in appendix F of this EIS would be implemented on federally-managed lands. The federal land-management agencies and the applicants will continue to work together to revise the CMP to include all mitigation measures that would be implemented by the Project on private, state, and federal lands.

2.1.8 Mitigation on Non-Federal Lands

Both Jordan Cove and Pacific Connector have developed mitigation plans for environmental impacts occurring on non-federal lands as part of their proposed action (table 2.1.8-1). In addition, unless otherwise stated, most of the POD attachments apply to non-federal lands as well. Mitigation and BMPs are discussed in conjunction with the respective affected resources in chapter 4 of this EIS.

TABLE 2.1.8-1

Proposed Mitigation Plans

Mitigation Plan	EIS Section(s)	Description	Reference
Jordan Cove LNG Terminal and Pacific Connector Pipeline			
Compensatory Mitigation Plan (CMP), Jordan Cove LNG Terminal, Marine Facilities, and Pacific Pipeline Project	Sections 2.1.6, 4.6.1, 4.6.2	Developed to compensate for impacts of the Jordan Cove Liquefaction and Pacific Connector Pipeline Project that cannot be avoided, further minimized, or otherwise mitigated, in conjunction with the other avoidance and mitigation strategies and commitments that are currently embedded in the Proposed Action.	Appendix CC to Pacific Connector's POD; updated version included as Appendix O of the applicant-prepared BA filed with FERC on April 16, 2014
Migratory Bird Conservation Plan	Section 4.6.1	Addresses requirements of the MBTA, the BGEPA, and EO 13186 to avoid and minimize adverse effects to birds and habitats, and propose compensatory measures to conserve and enhance migratory birds and habitats.	Filed draft plan on February 13, 2015.
Jordan Cove LNG Terminal			
Wildlife Habitat Mitigation Plan	Section 4.6.1, appendix S	Developed to comply with the ODFW Fish and Wildlife Habitat Mitigation Policy under OAR 635-415-000 to 00025. Provides for long-term preservation of habitat off-site from the Project.	Filed with FERC t on May 22, 2014.
Compensatory Wetland Mitigation Plan	Section 4.4.3	To offset unavoidable impacts to wetland habitats as required by CWA Sections 401 and 404.	Attached as Appendix M.2 of Resource Report 2, included in Jordan Cove's May 2013 application; updated version filed with FERC on April 17, 2015 and supplemented February 13, 2015
Pacific Connector Pipeline			
Mitigation Plan for Federal Lands	Section 2.1.4, appendix F	Identifies extensive off-site mitigation program on BLM and NFS lands. These projects are included as part of the Proposed Action to ensure that the objectives of the affected BLM and Forest Service land management plans are achieved.	Attached as appendix F to this EIS
Olympia Oyster Mitigation Plan	Section 4.6.2	Describes the Pacific Pipeline Project's opportunity to protect existing populations of Olympia oysters and to have a net benefit to Olympia oysters within Coos Bay.	Within CMP in Appendix O, Attachment 8 of the FERC's February 24, 2015 BA
Groundwater Supply Monitoring and Mitigation Plan	Section 4.4.1	Includes a discussion of identification of groundwater resources, determination of susceptibility to impacts and monitoring and mitigation if required for the protection of groundwater supply wells and springs and seeps.	Appendix 2F of Resource Report 2 of Pacific Connector's June 2013 application
Site-Specific Residential Mitigation Plans	Section 4.1.2 and appendix I	For the residences within 50 feet of construction work areas, Pacific Connector has developed site-specific drawings depicting the temporary and operational rights-of-way and has noted special construction techniques and mitigation measures	Appendix 8F of Resource Report 8 of Pacific Connector's June 2013 application
Compensatory Wetland Mitigation Plan	Section 4.4.3	To offset unavoidable impacts to wetland habitats as required by Section 401 and 404 of the CWA.	Within CMP in Appendix O, Attachment 9 of the FERC's BA
Estuarine Wetland Mitigation Plan	Section 4.4.3	To offset unavoidable impacts to estuarine wetland habitats.	Attachment 7 of the FERC's BA
Large Woody Debris Plan	Sections 4.6.2 and 4.7.1	Specifies placement of LWD within the construction right-of-way at stream crossings or in riparian zones within ranges of the SONCC and Oregon Coast coho ESUs	Within CMP in Appendix O, Attachment 6 of the FERC's BA
Federally-Listed Plant Conservation Plan	Section 4.7.1	Includes botanical mitigation plans for: Applegate's milk-vetch, Gentner's fritillary, Kincaid's lupine, and Cox's mariposa-lily.	Within CMP in Appendix O, Attachment 5 of the FERC's BA
Wildlife Habitat Mitigation Plan	Section 4.6.1	Developed to comply with the ODFW Fish and Wildlife Habitat Mitigation Policy under OAR 635-415-000 to 00025. Provides for long-term preservation of habitat off-site from the Project.	February 13, 2015, filed draft plan

TABLE 2.1.8-1

Proposed Mitigation Plans

Mitigation Plan	EIS Section(s)	Description	Reference
Historic Properties Management Plan (HPMP)	Section 4.11.1	Specifies measures to be implemented to evaluate sites for the NRHP, avoid historic properties, or treat historic properties that would be affected. Final HPMP required by MOA executed August 2011.	A draft HPMP was filed in 2010 under Docket No. CP07-441-000. A final HPMP would be filed with the FERC prior to any Project-related construction.

2.2 NON-JURISDICTIONAL FACILITIES

In addition to the facilities discussed in section 2.1, the JCE & PCGP Project would require construction of facilities that do not fall under the Commission's jurisdiction. These include a power plant associated with the proposed LNG terminal, the SORSC, facilities constructed to provide utility service to various jurisdictional meter stations and a compressor station, and activities conducted by the Port. Because the non-jurisdictional power plant, SORSC, and utility services to Pacific Connector meter stations are directly related to the Project, we will analyze the environmental impacts of their construction and operation throughout chapter 4 of this EIS. The Port activities are not fully developed and are not related to the Project, and therefore will only be discussed in the Cumulative Impacts section (4.14) of this EIS.

2.2.1 LNG Vessels

LNG to be exported from the Jordan Cove terminal to overseas markets would be transported in vessels specially designed and built for that task. Jordan Cove expects that its terminal would be visited by about 90 LNG vessels per year. These vessels would be loaded with LNG at the terminal and deliver the cargo to customers, most likely around the Pacific Rim. LNG vessels would be under the ownership and control of third-parties, not Jordan Cove, and would not be regulated by the FERC. The third-party owners and operators of the LNG vessels would have agreements with Jordan Cove for the transportation of the LNG to designated ports or customers. We do not have any information about the exact vessels that would be used to transport the LNG from the terminal. However, the Coast Guard WSR and LOR limit the size of LNG vessels that would call at the Jordan Cove terminal to not larger than 148,000 m^3 in capacity. Neither do we know the exact destinations for the LNG cargo, nor the specific routes across the Pacific Ocean to customers that would be taken by LNG vessels, outside of the waterway within 12 miles of the Oregon Coast. Therefore, LNG vessel design and ocean transportation routes outside of the waterway close to shore will not be further analyzed in this EIS.

2.2.2 South Dunes Power Plant

To provide power to the LNG terminal, Jordan Cove would construct and operate the South Dunes Power Plant. As discussed in section 1.5.4.2 of this EIS, the South Dunes Power Plant would be authorized by the ODOE-EFSC. Jordan Cove filed its final application for a site certificate for the power plant with EFSC on December 29, 2014. The ODOE-EFSC issued a Draft Proposed Order on the application on May 27, 2015, which recommends EFSC approve the application and grant a Site Certificate, subject to conditions listed in the order. The power plant would still need a Final Order and Site Certificate to proceed.[10]

[10] More information about the EFSC process and status for the South Dunes Power Plant is available on the ODOE website: http://www.oregon.gov/energy/Siting/Pages/SDP.aspx.

This new power plant would be located on about 58 acres on the northeast side of geographic Jordan Cove, at the former site of the Menasha-Weyerhaeuser linerboard mill, closed in 2003 and since demolished. The site is currently clear of any standing structures, with the exception of a water tank and the PacifiCorp Jordan Point electric substation. The substation would be relocated after construction of the new power plant.

The South Dunes Power Plant would produce a nominal 420 MW of electrical power and process steam for gas conditioning prior to delivery to the terminal liquefaction trains. The electric line between the power plant and the LNG terminal would be located within Jordan Cove's utility corridor.

The power plant would consist of two 210-MW blocks of high efficiency combined cycle combustion turbine generation. Three combustion turbine generators (CTG), three heat recovery steam generators (HRSG), and one steam turbine generator (STG), would collectively compose each power block. Each CTG would produce electricity, with the exhaust gases from the CTGs supplying heat to the HRSGs. Steam produced in the HRSGs would be used to power the STGs to produce additional electricity and process steam. Duct burners fueled by natural gas in the HRSGs would allow for production of additional steam and additional electricity from the STGs when needed. Steam exhausted from the STGs would be condensed in air-cooled condensers, with the resultant condensate returned to the HRSGs to remake steam.

The CTGs, HRSGs, and STGs would be outdoor units, given the relatively moderate ambient conditions of the area. The HRSGs would be the tallest structures on the South Dunes Power Plant site at approximately 100 feet tall. A control and administrative building would provide space for plant controls and offices for plant personnel (these buildings are listed on table 2.1.1.10-1 above).

Fuel would be supplied primarily in the form of BOG from the LNG terminal, conveyed by a 10-inch-diameter pipeline. Some additional natural gas would be supplied from the Pacific Connector pipeline, which would connect to a metering station to be located in the southern portion of the South Dunes Power Plant site. Jordan Cove's pipeline natural gas conditional facility would be situated on the west side of the power plant.

Raw water would be supplied to the power plant by the CBNBWB through an existing pipeline (as discussed above in section 2.1.1.10). A separate water treatment area would provide a location for the equipment necessary to purify the raw water, producing demineralized water for use in the power plant steam cycle and amine solution for CO_2 removal.

A fire protection system would be provided and designed to meet the requirements of the Oregon Structural Specialty Code, Oregon Fire Code, and all other applicable fire protection codes and standards in effect at the time of construction. The system would include, among other elements, building smoke detection, a manual alarm, sprinkler systems, fire water system, carbon dioxide extinguishing system, portable fire extinguishers within all buildings and at key outdoor locations, and a smoke detection system. Road access at the site would include sufficient turning radius for firefighting equipment.

Other related facilities at the power plant complex would include:

- relocated Pacific Power electric substation at the southeast portion of the site, which would provide an alternate source for power on-site;

- 115-kV, AC, open-air switchyard serving both power blocks, including a small building to provide a controlled environment for the protective relaying and communication equipment;
- one-mile, double-circuit, 115-kV power line connecting the switchyard to the gas-insulated substation at the LNG terminal, and a second 115-kV transmission line 2,024 feet in length that would connect the switchyard to the relocated Pacific Power substation;
- double-walled steel 5,000-gallon aboveground diesel fuel storage tank to be used for refueling site vehicles and emergency equipment;
- wastewater treatment plant for treating domestic sewage generated at the power plant;
- stormwater and fire water ponds; and
- security, administration, control, and operation buildings (see table 2.1.1.10-1), and related roads and parking lots.

2.2.3 Southwest Oregon Regional Safety Center

The SORSC would occupy approximately 8 acres on the east side of Jordan Cove Road, between the Trans-Pacific Parkway and the Roseburg Forest Products property, west of the South Dunes Power Plant. The building would house the Jordan Cove Fire Company, offices for the Coos County Sherriff, Coast Guard, and the Port, and a training facility for the Southwestern Oregon Community College. Although this building does not come under the jurisdiction of the FERC, this EIS analyzes impacts resulting from its construction.

2.2.4 Utility Connections

Electrical power and telephone service would be required for each of the meter and compressor stations. Installation of the utility connections is not regulated by the FERC. Pacific Connector stated that no permits are required for the purchase of power or telephone service to the compressor station and meter stations.

Both electric power and telephone infrastructure currently exist along Malin Loop Road and More Lock Road, to the south and west of the proposed Klamath Compressor Station and its associated meter stations. Pacific Connector could purchase electricity from Pacific Power, which would have to install a standard single phase 400 amp meter base for the service drop from the existing distribution line. For telephone service, a standard telephone service pedestal would have to be installed by Cal-Ore Telecommunications (figure 2.2-1).

There is existing electric power available on the west side of the newly proposed location for the Clarks Branch Meter Station. Power would be purchased from Pacific Power, which would need to install a standard single phase 200 amp meter base to tie-into the distribution line. A new telephone cable would have to be installed by Qwest from its existing line along Dole Road up the newly proposed PAR 71.46 to the meter station (figure 2.2-2).

Electric power and telephone service would be available to Pacific Connector's proposed new Jordan Cove Meter Station from facilities already in place within the Jordan Cove terminal. The Pacific Power substation would be relocated by Jordan Cove east of the proposed meter station, and a service drop would consist of a standard single phase 200 amp meter base. Jordan Cove would provide voice and data communications directly to the meter station (figure 2.2-3).

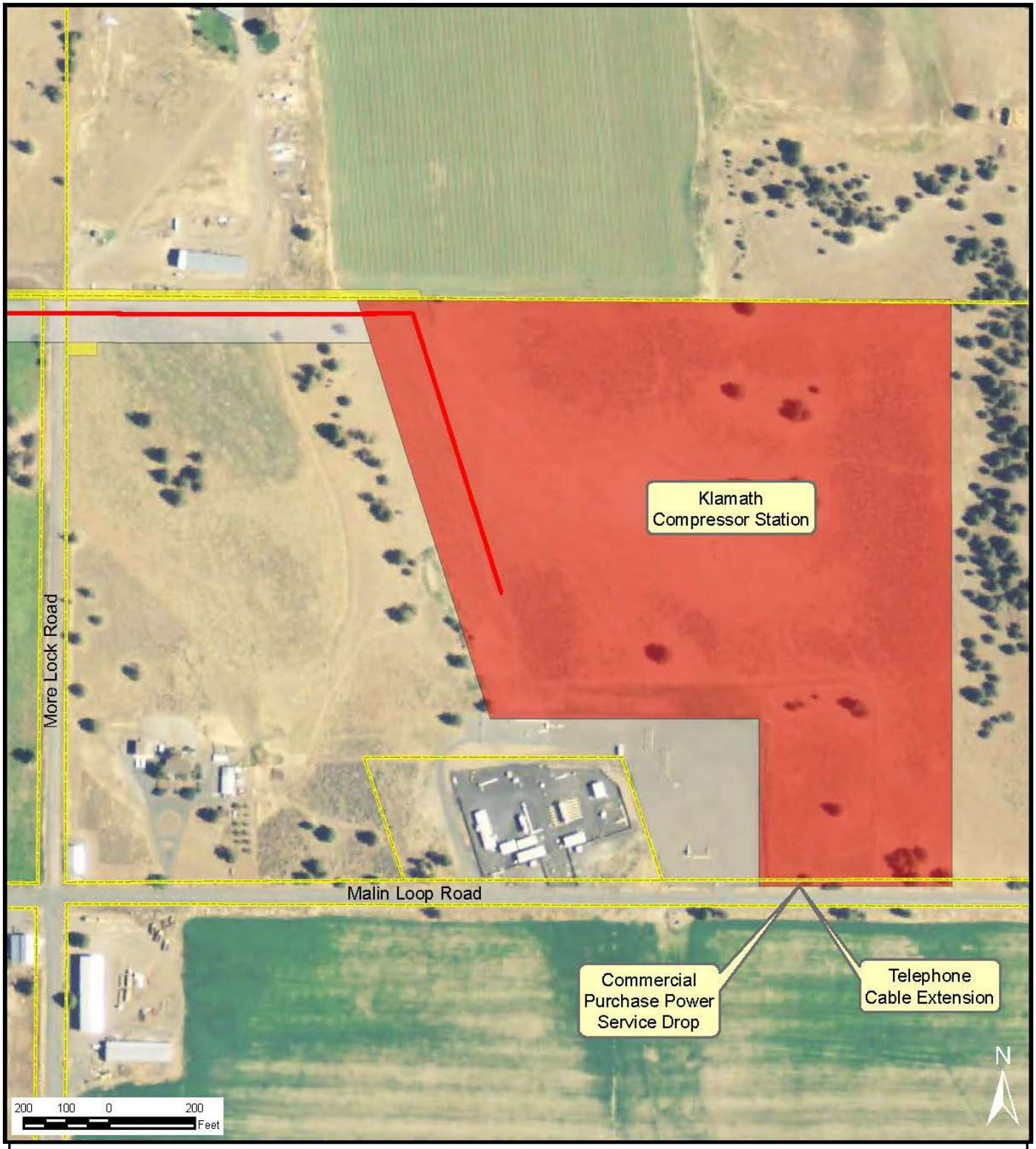


Figure 2.2-1
Non-jurisdictional Facilities Associated with Klamath Compressor Station T.41S., R.12W, Section 11

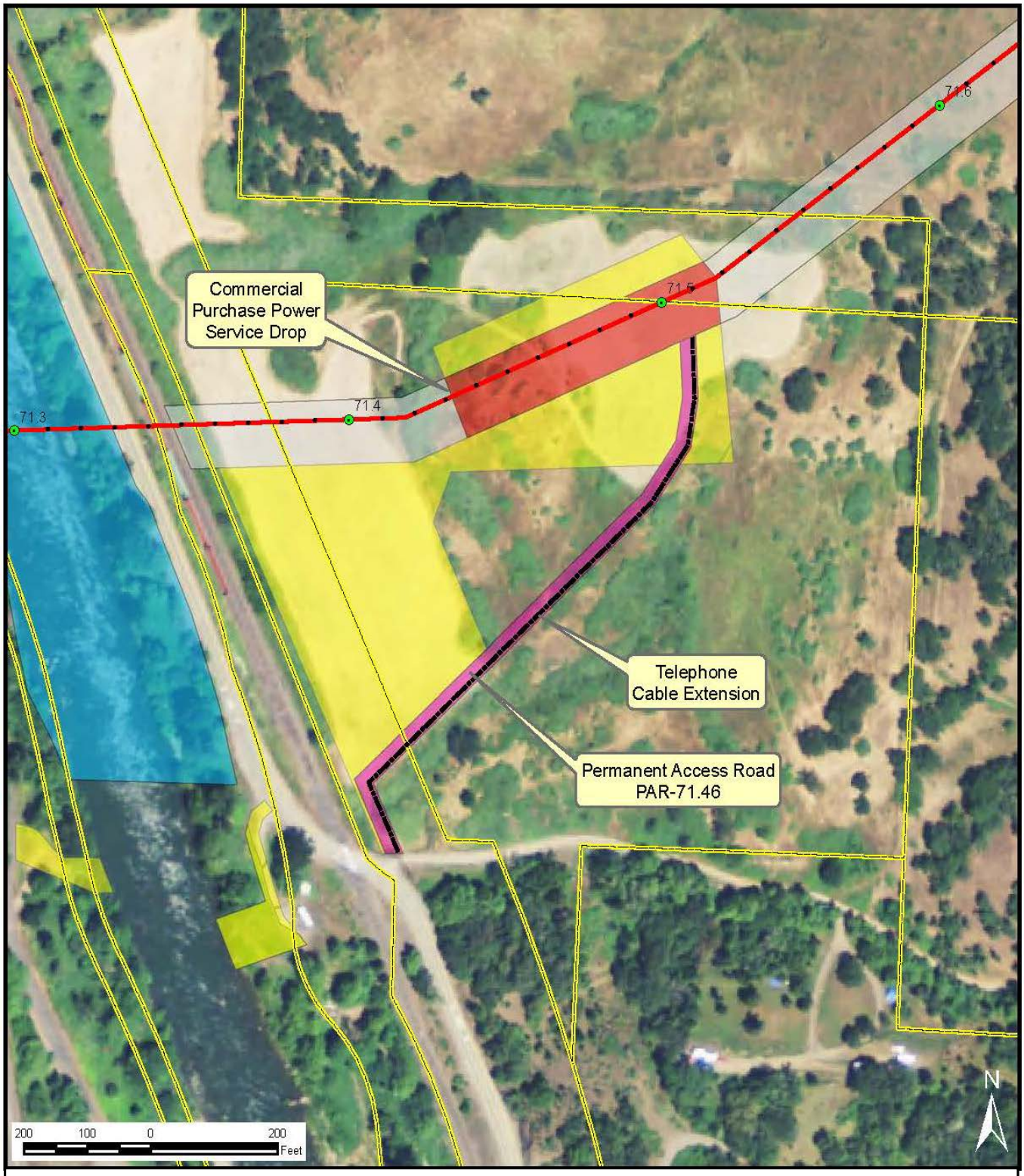


Figure 2.2-2
Non-jurisdictional Facilities Associated with Clarks Branch Meter Station T.29S., R.6W., Section 2

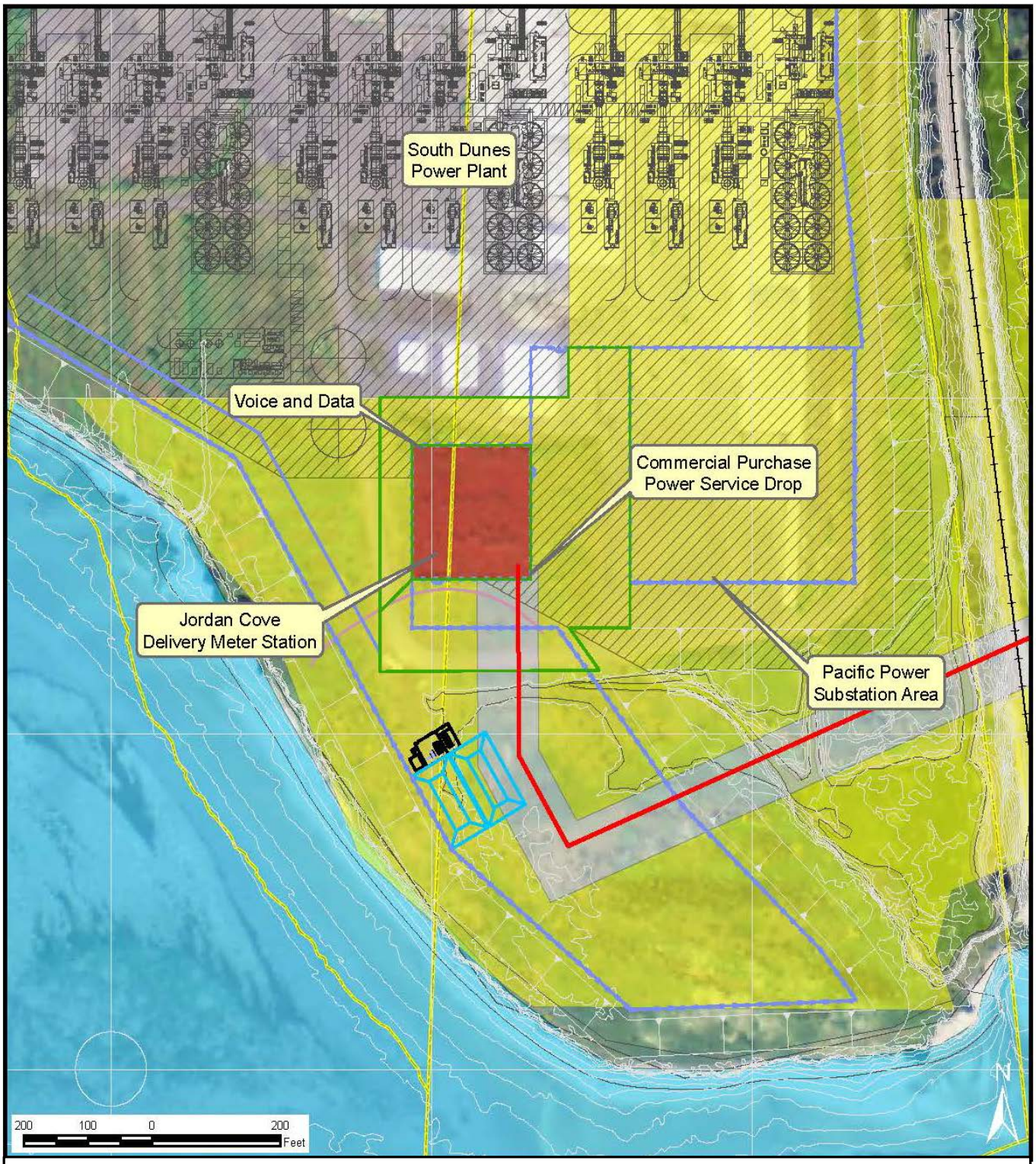


Figure 2.2-3
Non-jurisdictional Facilities Associated with Jordan Cove Meter Station T.25S., R.13W., Section 3

2.2.5 Port Activities

The Port is pursuing multiple different future marine terminal development projects within Coos Bay. One of those projects is called the "Oregon Gateway Marine Terminal Complex." At one time, the Port considered using the west side of the Jordan Cove marine slip as an unspecified commercial berth. The Port indicated that it would use the west berth for a dry bulk terminal for silo-storage cargos (i.e., grain, soy beans, etc.). The Port's conceptual drawing on its webpage of this dry bulk cargo terminal on the west side of the Jordan Cove marine slip shows it overlapping Henderson Marsh. However, Jordan Cove is now proposing a single-user slip, with no commercial berth on the west side. Also, Jordan Cove would construct a tsunami berm on the west side of the slip between the terminal and Henderson Marsh, which may preclude future commercial development in this area.

The Port also proposed an intermodal container terminal complex, to cover about 293 acres at Henderson Marsh, on the east side of the Jordan Cove LNG terminal. The conceptual drawing of the container terminal, posted on the Port webpage, shows a ship berth within Coos Bay, on the north side of the existing navigation channel, east of Jordan Cove's marine slip. In 2011, the Port entered into an exclusive arrangement with unnamed partners to export coal brought by train to Coos Bay. However, in May 2013 those partners backed out of the agreement. D.B. Western is still pursuing the concept of establishing a coal shipping terminal adjacent to its facility on the North Spit (as later discussed in section 3.3.1.2 of this EIS).

In January 2008, the Port entered into a MOA with the COE for guidance related to analyzing channel improvements in Coos Bay under Section 203 of the Water Resources and Development Act. In January 2014, the Port informed the COE of its intent to convert the project into an evaluation under Section 204 of the Water Resources and Development Act, and began negotiating a new MOA. At this time, neither the Port nor the COE have produced an environmental analysis of the future channel expansion project.[11]

In March 2012, the Port signed an agreement with Principal Power to use the west side of the Jordan Cove slip, including a portion of Henderson Marsh, for the on-site manufacture and assembly of five semi-submersible wind platforms, that would then be towed to sea. As discussed in section 3.3.2.2, Principal Power was awarded a grant for a pilot study of the potential to anchor five 6 MW wind turbines about 3 miles off the Oregon coast opposite Coos Bay. The Principal Power proposal is one of seven DOE grants, and it is not yet clear if it would be selected for full project funding.

There is no direct relationship between the Port's planned channel improvement project and the Jordan Cove LNG Project. The LNG vessels that would use the Coos Bay waterway to Jordan Cove's terminal are limited by the Coast Guard to under 148,000 m^3 in capacity, and those vessels can transit through the existing Coos Bay navigation channel without it being made any deeper or wider. However, the Port's proposed future activities are further considered in this EIS under Cumulative Impacts in section 4.14.

[11] Under Section 204 of the Water Resources and Development Act, a non-federal sponsor can fund the project. In June 2014, the Port indicated that it would have a consultant produce an Administrative Draft EIS for the channel improvement project in 2016.

2.3 LAND REQUIREMENTS

Tables 2.3.1-1 and 2.3.2-1 summarize the land requirements for the facilities proposed as part of the JCE & PCGP Project. Land requirements for each component of the Project are described below. Land use is further discussed in section 4.1.

2.3.1 Jordan Cove Liquefaction Project Facilities

The upland facilities of Jordan Cove's liquefaction and LNG export terminal, excluding the access channel and marine slip, eastern utility corridor, gas processing and South Dunes Power Plant area, the relocated industrial and raw water pipelines, and avoided wetlands and sand dunes, would occupy about 89 acres of open grasslands and brush and forested dunes west of the existing Roseburg Forest Products property, east of Henderson Marsh, and south of the Trans-Pacific Parkway. This area, when owned by Weyerhaeuser, was called the Ingram Yard, but was once historically part of what was known as the Henderson Ranch. In addition, the Jordan Cove terminal would include support buildings and a utility corridor totaling about 19 acres on the north side of the Roseburg Forest Products tract. On the northern and eastern shore of geographic Jordan Cove, east of the Roseburg Forest Products tract, about 79 acres would be used for the Jordan Cove natural gas processing area, and its non-jurisdictional South Dunes Power Plant and associated facilities, including the SORSC, excluding avoided wetlands. This area was once historically part of what was known as the Jordan Ranch. Between 1961 and 2003, it was the location of the Menesha-Weyerhaeuser linerboard mill, which has since been demolished.

During construction of the combined Jordan Cove liquefaction and LNG export terminal, and related power plant complex, about 397 acres would be disturbed. An additional 49.3 acres would be disturbed as part of wetland mitigation activities. About 251 acres would be retained for operational facilities. Jordan Cove owns about 295 acres at the terminal and power plant complex, with additional temporary construction areas leased from other private landowners. Table 2.3.1-1 lists the land requirements for the Jordan Cove Liquefaction Project.

TABLE 2.3.1-1

Land Requirements for the Jordan Cove Liquefaction Project

Facilities	Land Area (acres) a/	Acres Affected During Construction	Acres Affected During Operation
JURISDICTIONAL FACILITIES			
Access Channel and Marine Slip	66	66	66
LNG Loading Berth/Platform and Transfer Line	9	9	9
LNG Storage Tank Area	27	27	27
Liquefaction Process Area	20	20	20
Refrigerant Storage Area	2	2	2
Ground Flare	1	1	1
Terminal Fire Water Ponds	4	4	4
Terminal Site Access	4	4	4
Barge Berth	3	3	3
Terminal Operator Building and Warehouse	8	8	8
Utility Corridor and East Access Road	11	11	11
Gas Treatment Plant	13	13	13
Stormwater Pond	11	11	11
Jordan Cove Meter Station b/	0	0	--
Industrial Wastewater Pipeline Relocation	13	13	5
Raw Water Pipeline Extension	3	3	1
North Point Workforce Housing Complex Bridge	<1	<1	<1
Total Acres for Terminal Facilities	**195**	**195**	**185**
NON-JURISDICTIONAL FACILITIES			
South Dunes Power Plant	58	58	58
Southwest Oregon Regional Safety Center	8	8	8

TABLE 2.3.1-1

Land Requirements for the Jordan Cove Liquefaction Project

Facilities	Land Area (acres) a/	Acres Affected During Construction	Acres Affected During Operation
Total Acres for Non-Jurisdictional Facilities	**66**	**66**	**66**
TEMPORARY CONSTRUCTION AREAS			
Heavy Equipment Haul Road at Roseburg Forest Products Property	8	8	0
Slurry and Return Water Pipelines at Roseburg Property	1	1	0
Terminal Construction Trailers c/	0	0	0
Tank Staging Area **c/**	0	0	0
Concrete Batch Plant Area d/	0	0	0
Tank Roof Fabrication Area e/	0	0	0
Process Staging Area e/	0	0	0
Construction Offices at Roseburg Property	1	1	0
Laydown Area at Roseburg Property	13	13	0
Open Areas	11	11	0
Parking at Roseburg Property	<1	<1	0
Craft Areas at Roseburg Property	<1	<1	0
Warehouse/Storage at Roseburg Property	1	1	0
Fabrication Areas at Roseburg Property	4	4	0
LNG Vessel Berth Dune Area f/	15	15	0
Northern Terminal Sand Dune Area	7	7	0
Laydown Area	21	21	0
Gas Processing Plant Laydown Area	4	4	0
North Point Workforce Housing Complex g/	48	48	0
Total Acres for Temporary Construction Areas	**136**	**136**	0
AVOIDED WETLAND AREAS			
Eastern Henderson Marsh	11	0	0
Northeastern Terminal Wetlands Area	28	0	0
Western South Dunes Power Plant Wetlands Area	7	0	0
Total Acres for Avoided Wetland Areas	**45**	**0**	**0**
MITIGATION SITES h/			
West Jordan Cove Wetland Mitigation Site i/	3.7	3.7	0.0
West Bridge Wetland Mitigation Site i/	2.0	2.0	0.0
Kentuck Slough Mitigation Site	43.6	43.6	0.0
Wildlife Habitat Mitigation Areas j/	259.4	0.0	0.0
Total Acres for Wetland Mitigation Sites	**308.7**	**49.3**	**0.0**
GRAND TOTAL	**706**	**446**	**251**

a/ Acres rounded to the nearest whole acre, except for mitigation sites. If acreage is less than 1 acre, reported as "<1". Columns may not sum correctly due to rounding.
b/ Acres impacted by the Jordan Cove Meter Station are accounted for by the Pacific Connector pipeline and associated aboveground facilities in section 2.3.2.
c/ Within LNG Storage Tanks Area
d/ Within Terminal Firewater Pond Area
e/ Within Liquefaction Trains Process Area
f/ Includes 1.5 acres for removal of the existing Roseburg Water Tanks
g/ Jordan Cove indicated that 2 additional acres of construction impact may occur to areas classified as "industrial" for the NPWHC. Jordan Cove would also use existing offsite lots for parking for commuting construction workers at Mill Casino (approx. 15 acres) and Myrtlewood RV park (approx. 6 acres)
h/ Acreages here rounded to nearest tenth of an acre.
i/ Acreage greater than total compensatory mitigation acreage due to additional land disturbance.
j/ Jordan Cove is acquiring a total of 581 acres at three off-terminal locations; however, only 259.4 acres are planned for mitigation use.

2.3.2 Pacific Connector Pipeline and Associated Aboveground Facilities

Pacific Connector would use about 5,565 acres to construct its proposed project, and about 1,438 acres would be retained for the operational corridor. Table 2.3.2-1 lists the land requirements for the proposed Pacific Connector Pipeline Project.

TABLE 2.3.2-1

Land Requirements for the Pacific Connector Pipeline Project

Project Component	Length (miles) or Number of Sites a/	Land Affected During Construction (acres)	Land Affected During Operation (acres)
Pipeline Right-of-Way	232 miles b/	2,694	1,404 c/
Temporary Extra Work Areas	1,693 sites	1,030	(88) d/
Uncleared Storage Areas	287 sites	676	0
Rock Source & Disposal Sites e/	42 sites e/	87	(87) e/
Contractor and Pipe Storage Yards h/	34 sites	1,024	0
Existing Roads/Sites Needing Improvements	73 roads	14	(14) f/
Temporary Access Roads	13 roads	5	0
Permanent Access Roads	15 roads	2	2
Aboveground Facilities	17 sites	32 g/	32 g/
Hydrostatic Discharge Locations Outside Right-of-Way	6	1	0
Totals	**–**	**5,565**	**1,438**

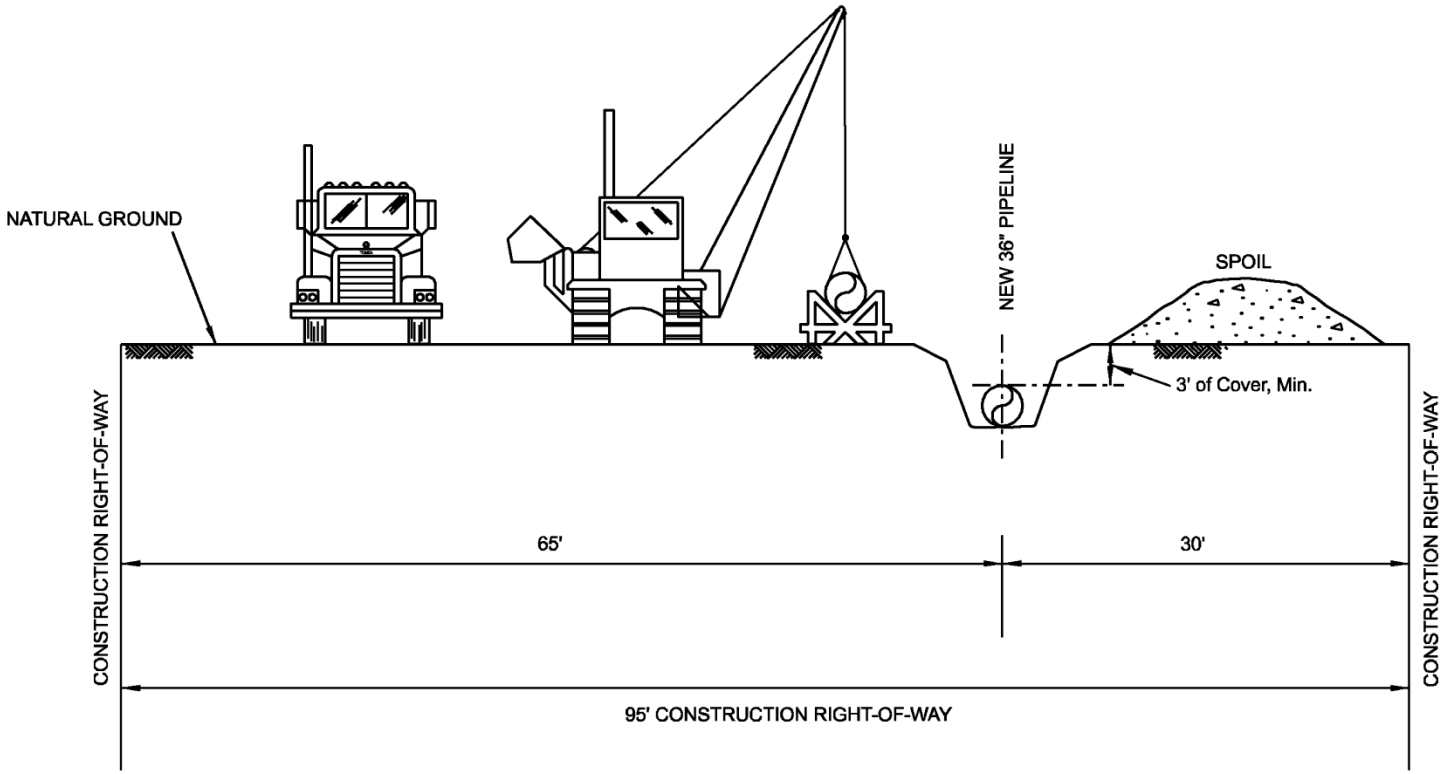
a/ All miles and acres are rounded up to a whole number.
b/ Because of realignments, the length of the pipeline is different from the MPs in the 2014 DEIS due to a number of route variations.
c/ 50-foot-wide permanent pipeline easement (on federal lands, 30-year maintenance corridor). (Approximately 6 acres of the 1,404 acres affected during operations would not be disturbed because of subsurface HDD and direct pipe procedures).
d/ Includes TEWAs, existing quarries, rock sources, and disposal areas that may be used as permanent storage areas. These areas would not be used during operation of the Project, and therefore are not included in the operational total.
e/ Rock Source and Disposal sites total 175 acres and are associated with 42 sites; 88 acres (22 sites) are associated with dual use TEWA and Rock Source and Disposal sites, and 87 acres (20 sites) are stand-alone Rock Source and Disposal sites. These areas would not be used during operation of the Project and therefore are not included in the operational total.
f/ While the improvements would not be reclaimed, these roads would not be used for operations and the acres are not included in the total operational acreage.
g/ Construction impacts associated with the aboveground facilities are included in the construction land requirement for the pipeline right-of-way and TEWAs except the potential communication tower sites and the Klamath Compressor station, which are included here (approximately 1 acre and 31 acres).
h/ There are a total of 34 yards: 31 yards (1,024 acres) are stand-alone yards and 3 yards (73 acres) are dual use TEWA/yards that are accounted for as TEWAs.

2.3.2.1 Pipeline

Construction Right-of-Way

Pacific Connector proposes to use a standard 95-foot-wide construction right-of-way to install the pipeline. This width for the construction right-of-way would be needed to accommodate clearing and grading activities, store spoil, and provide a passing lane for equipment. The right-of-way would be used as the primary transportation corridor during construction. A typical right-of-way cross section is shown in figure 2.3-1.

Where feasible (i.e., where topographic conditions allow) at wetland crossings, the construction right-of-way would be narrowed to 75 feet in width to reduce impacts. See additional discussion in section 4.4 of this EIS.



NOTE: 95' CONSTRUCTION RIGHT-OF-WAY
TYPICAL FOR LEVEL TERRAIN WITH NO
CONSTRUCTION OBSTACLES.

LOCATIONS REQUIRING ADDITIONAL WORK SPACE ARE
- TOP SOIL AREAS
- UNLEVEL TERRAIN
- ROAD AND STREAM CROSSINGS
- HORIZONTAL DRILLING

Figure 2.3-1

Typical Pipeline Right-of-Way
Cross Section

About 2,694 acres would be affected during construction of the pipeline, within the standard right-of-way. Temporary construction workspace outside of the 50-foot-wide operations and maintenance easement would be restored after construction to its original use. The restoration and revegetation of the temporary construction right-of-way would be done in accordance with Pacific Connector's *Erosion Control and Revegetation Plan* (ECRP).[12]

Temporary Extra Work Areas

In addition to the standard 95-foot-wide construction right-of-way, Pacific Connector would use TEWAs where site-specific characteristics would require additional space. Most TEWAs would be cleared of vegetation, and some would be graded as necessary to create safe work space for construction activities. Generally, TEWAs would be required for (but not limited to) the following:

- steep slopes and side sloping areas to accommodate cuts and spoil storage requirements;
- bore pits and spoil storage at road and railroad crossings;
- spoil storage, staging, and construction of specialized pipeline drag sections such as at wetland crossings, residential/industrial areas, and road crossings;
- waterbody and wetland crossings;
- road crossings;
- pipe and equipment staging;
- areas where tie-ins require additional trench widths to allow workers to enter the trench and perform welds and to ensure Occupational Safety and Health Administration (OSHA) trench safety requirements are met;
- sharp angles or points of intersection (PIs) where additional area is required to account for the wide turning radius of pipe stringing trucks (which are more than 100 feet in length);
- topsoil segregation areas to ensure stockpiled topsoil and subsoils are not mixed;
- off right-of-way dewatering areas; and
- timber staging/decking during right-of-way clearing.

About 1,693 TEWA sites, totaling approximately 1,030 acres, would be required to install the pipeline. All of these areas would be disturbed only temporarily during pipeline construction, and would be restored and revegetated afterwards, in accordance with Pacific Connector's ECRP.

Uncleared Storage Areas

During design of the construction area requirements for the pipeline, Pacific Connector identified the need for additional work areas in various locations such as forested areas; in areas of steep slopes; and in areas where the route follows narrow ridgelines. In an attempt to minimize forest clearing, especially in areas of older forest, Pacific Connector proposes to use some of these temporary work areas as uncleared storage areas (UCSA) rather than TEWAs. Unlike TEWAs, UCSAs would not be cleared of trees during construction. UCSAs would be used to store forest slash, stumps, dead and downed log materials that would be removed from the construction work area before construction, and then scattered back across the right-of-way after construction. Pacific Connector anticipates that the amount of this type of material encountered within the

[12] The ECRP was attached as Appendix 1B in Resource Report 1 of Pacific Connector's June 2013 application to the FERC, and included as Appendix I of Pacific Connector's POD.

construction right-of-way would be large enough to hinder construction activities if it were stored on the right-of-way.

In some locations, the UCSAs may be used to store spoil or to temporarily park equipment between the mature trees. However, storage and temporary parking of equipment/vehicles would not occur immediately adjacent to any trees so as to minimize impacts (soil compaction or tree damage). In extremely steep and side sloping topography, the UCSAs may be required as a contingency location to contain rock, which rolls beyond the construction limits. Along extremely steep and narrow ridgeline areas, logs, slash, and dead and downed material may be used as cribbing to contain excavated materials during construction (right-of-way grading and trenching activities). During restoration, some of the materials that are pulled out of the cribbing may roll beyond the construction limits. Where feasible, Pacific Connector would retrieve materials that have rolled downhill using cables and chokers attached to standard on-site restoration equipment (i.e., bulldozers and trackhoes) to winch the material back to the right-of-way. There may be some cases where retrieval of the lost cribbing material may cause more harm to resources than allowing it to remain where it settled. On federal lands, Pacific Connector would protect trees within the UCSAs in accordance with the procedures outlined in its *Leave Tree Protection Plan* (Appendix P of its POD).

Pacific Connector has identified 287 UCSA locations adjacent to the construction right-of-way, affecting a total of about 676 acres. The amount of spoil or woody debris that would be stored within UCSAs, or which pieces of equipment may be temporarily parked within UCSAs is not possible to estimate at this time, but would be determined as construction progresses. After construction, the UCSAs would be restored to their previous condition and use.

Hydrostatic Test Water Discharge Sites

Pacific Connector has identified 75 locations along the proposed route where hydrostatic test water would be released within the construction right-of-way during testing of the pipeline. At these locations, the hydrostatic test water would be discharged into temporary erosion control basins, typically constructed of hale bales and silt fence, in upland areas (see section 4.4.2 for a full discussion of hydrostatic testing).

Pacific Connector identified six hydrostatic test water discharge locations that would be outside of the construction right-of-way, TEWAs, or UCSAs. At those six locations, small brush or trees may be cleared by a rubber-tired rotary or flail motor (brush hog) or by hand with machetes or chainsaws. A rubber-tired or track hoe would be used to lay the discharge line and to remove the saturated hay bales or filter bags upon completion of hydrostatic discharge. About 1 acre would be affected by hydrostatic discharge outside of the right-of-way.

Operational Pipeline Right-of-Way

Pacific Connector would retain a 50-foot-wide permanent easement for the long-term operation and maintenance of the pipeline on non-federal lands. On federal lands, an operational right-of-way may be issued for a specific period of use, with potential for extension. This 50-foot-wide corridor equates to approximately 1,399 acres.

Existing Access Roads

About 709 existing roads would be used for access to the pipeline right-of-way during construction. Existing roads that would be used for construction access are listed in table D-2 in appendix D of this EIS. Construction access roads are also shown on the pipeline facility maps in appendix C. The use and crossing of access roads are more fully discussed in section 4.10.

Pacific Connector would obtain the necessary permits or approvals from appropriate federal, state, and county government agencies prior to use of the roads, and would obtain landowner permission for the use of existing private roads. As part of its application to the FERC, Pacific Connector filed a *Transportation Management Plan* (TMP) for federal lands as Appendix Y of its POD, and as Appendix 8H to Resource Report 8 for non-federal lands. The TMPs detail the measures, standards, and stipulations to be employed in the construction, use, improvement, and maintenance of roads.

Pacific Connector may need to widen or improve portions of some existing access roads to accommodate construction equipment. Pacific Connector has estimated that modifications of 60 miles of existing access roads may be required outside of the existing road bed (e.g., widening corners to allow for the longer turning radius of larger vehicles), resulting in about 22 acres of disturbance.

During use of existing roads for construction, paved surfaces would be kept clear of large accumulations of mud and other debris. Dirt roads may be maintained by grading, or covered by aggregate. Appropriate sediment and erosion control devices would be installed along dirt roads used during wet weather or the rainy season to contain potential impacts to the road surface.

New Temporary Access Roads

Pacific Connector has identified 13 locations where it would be necessary to construct new temporary access roads (TARs), totaling approximately 2.2 miles in length. Construction of the new TARs would impact a total of about 5 acres. Following construction, TARs would be removed and the affected areas restored to pre-construction conditions.

New Permanent Access Roads

Pacific Connector proposes to construct 15 new PARs for access to the pipeline right-of-way and aboveground facilities. These roads, totaling about 0.6 mile, would provide access during construction as well as during operations and maintenance activities. Most of the new PARs would be within Pacific Connector's operational pipeline easement. Construction and operation of the PARs would impact a total of about 2 acres.

Contractor and Pipe Storage Yards

Pacific Connector has identified 34 potential sites for yards and rail ports that may be used during construction to off-load and store pipe and stage contractor equipment in the pipeline project area (see table D-9 in appendix D). These sites are generally not along or immediately adjacent to the proposed pipeline. Criteria for identification of potential contractor and pipe yards were existing industrial sites that have been previously graded and graveled, are near the proposed pipeline, and which have rail service to the yard. All of the sites are privately owned. Pacific Connector would secure the pipe storage yards and rail ports that would be used for construction during the easement

acquisition phase. Use of all of the identified sites would affect an estimated 1,024 acres. Actual use of the potential sites would depend on the availability of these sites at the time of easement negotiations.

Rock Source and Permanent Disposal Sites

Pacific Connector has identified 42 potential rock source/disposal sites, which total approximately 175 acres. These sites are indicated on the Mapping Supplement included as appendix C of this EIS. Of these locations, 26 sites are existing quarries/gravel pits or abandoned quarries/gravel pits. Although some of the existing/abandoned sites appear to have land use types other than quarries/gravel pits, Pacific Connector would not expand these sites beyond the existing or previously disturbed footprints.

Cathodic Protection System

Pacific Connector would protect its pipeline from corrosion over time through a cathodic protection (CP) system. The CP system would consist of a number of sites where below ground rectifier/anode beds would be installed that input a low voltage electrical charge into the pipeline. These rectifier/anode beds would typically be spaced about 15 to 20 miles apart, usually installed within the previously disturbed pipeline construction right-of-way. Each CP site would use electric power from a nearby local utility source. If a deep well would be installed, it would require a truck-mounted drill rig to drill up to 300 feet deep within a 10-inch diameter area. A horizontal anode bed would require the use of a standard backhoe for installation within an area up to 500 feet long by 15 feet wide and 5 feet deep. The CP system would be installed about one year after the pipeline would be constructed, to allow the trench to stabilize and for collection of post-construction data on electro-conductivity soil potentials, which is required before the system can be designed and installed. Pacific Connector would consult with appropriate federal, state, and local regulatory agencies after pipeline construction to determine the level of environmental compliance and agency authorizations necessary for the installation and maintenance of the CP system. On federal lands, any ground-disturbing construction and installation work to install the CP system will require separate authorization and environmental review.

2.3.2.2 Aboveground Facilities

Land required for construction and operation of the proposed aboveground facilities is listed in table 2.3.2-1 above. Operation of the aboveground facilities would require about 35 acres.

2.3.2.3 Pipeline Facilities on Federal Lands

Tables 2.3.2.3-1, 2.3.2.3-2, and 2.3.2.3-3 list land requirements for those portions of the Pacific Connector pipeline and associated facilities that would be within or would affect lands administered by the BLM, Forest Service, and Reclamation, respectively. The land requirements are based on an overall width of 50 feet for the operational and maintenance right-of-way, and within that width, a 30-foot-wide corridor of controlled vegetation subject to inspection.

TABLE 2.3.2.3-1

Land Administered by the BLM Affected by the Pacific Connector Pipeline Project

Facilities	Length or Number of Sites	Land Affected During Construction (acres) a/	Land Affected During Operation (acres)
Pipeline right-of-way	40.3 miles	460	244/147 b/
Hydrostatic test water discharge locations outside the right-of-way	1	<1	0
TEWAs	319	161	0
UCSAs	110	173	0
Rock source and disposal sites	5	7	0
Existing roads sites needing improvements in limited locations	15	2	0
Temporary access roads (TARs)	1	<1	0
Permanent access roads (PARs)	3	<1	<1
MLVs	3	<1	<1
Communication Sites	4	<1	<1
Total	**—**	**803**	**244**

a/ Acreages are rounded to nearest whole acre. If acreage is less than 1 acre, reported as "<1." Columns may not sum correctly due to rounding.
b/ The first value is the area within the operational right-of-way. The second value is the area that would be affected by the 30-foot corridor where brush control would be performed during operation of the pipeline.

TABLE 2.3.2.3-2

Land Administered by the Forest Service Affected by the Pacific Connector Pipeline Project

Facilities	Length or Number of Sites	Land Affected During Construction (acres) a/	Land Affected During Operation (acres)
Pipeline right-of-way	30.6 miles	350	185/111 b/
Hydrostatic discharge locations outside the right-of-way	0	0	0
TEWAs	206	103	0
UCSAs	68	124	0
Rock source and disposal sites	3	9	0
Existing roads needing improvements in limited locations	7	1	0
Temporary access roads (TARs)	0	0	0
Permanent access roads (PARs) c/	0	0	0
MLVs c/	0	0	0
Communication Sites	1	<1	<1
Total	**—**	**587**	**186**

a/ Acreages are rounded to nearest whole acre. If acreage is less than 1 acre, reported as "<1." Columns may not sum correctly due to rounding.
b/ The first value is area within the operational right-of-way. The second value is area that would be affected by the 30-foot corridor where brush control would be performed during operation of the pipeline.
c/ Pacific Connector has agreed to move MLV #9 off of Forest Service land and therefore the associated PAR is no longer needed.

TABLE 2.3.2.3-3

Land Administered by Reclamation Affected by the Pacific Connector Pipeline Project

Facilities	Length or Number of Sites	Land Affected During Construction (acres) a/	Land Affected During Operation (acres)
Pipeline right-of-way	1 mile	4	2/1 b/
Hydrostatic discharge locations outside the right-of-way	0	0	0
TEWAs	0	<1	0
UCSAs	0	0	0
Rock source and disposal sites	0	0	0
Existing roads needing improvements in limited locations	0	0	0
Temporary access roads (TARs)	0	0	0
Permanent access roads (PARs)	0	0	0
MLVs	0	0	0
Communication Sites	0	0	0
Total	**—**	**4**	**2**

a/ Acreages are rounded to nearest whole acre. If acreage is less than 1 acre, reported as "<1." Columns may not sum correctly due to rounding.
b/ The first figure is the area within the operational right-of-way. The second figure is the area that would be affected by the 30-foot corridor where brush control would be performed during operation of the pipeline.

Pacific Connector Pipeline

The Pacific Connector pipeline would cross about 40 miles of BLM lands, 31 miles of NFS lands, and about 1 mile of land administered by Reclamation. However, between MPs 200.5 and 214.2 the pipeline would cross 26 irrigation facilities under Reclamation's jurisdiction. We estimate that the nominal pipeline construction right-of-way of 95 feet would affect about 460 acres of BLM lands, 350 acres of NFS lands, and 4 acres of Reclamation lands, not including Reclamation's Klamath Project irrigation facilities. The 50-foot operational right-of-way would affect about 244 acres of BLM lands, 185 acres of NFS lands, and 2 acres of Reclamation lands.

We identified 319 TEWAs on BLM lands, affecting a total of about 161 acres, and 206 TEWAs on NFS lands, affecting about 103 acres. We counted 110 UCSAs located on BLM lands, affecting about 173 acres, and 68 UCSAs on NFS lands, affecting about 124 acres. No TEWAs or UCSAs would be located on Reclamation lands.

Nineteen of the discharge locations for hydrostatic test water within the pipeline construction right-of-way would be on BLM land, and 7 would be on NFS lands. Of the hydrostatic test water release areas outside of the pipeline construction right-of-way, one location would be on BLM land affecting less than one-tenth of an acre.

All or portions of 138 existing roads that would be used to access the pipeline right-of-way are on BLM lands, 58 access roads are on NFS lands, and 11 roads under Reclamation jurisdiction. Pacific Connector would make modifications to 15 existing roads on BLM lands, affecting about 2 acres, and disturb an acre along 7 existing roads crossing NFS lands. See additional discussion of access roads in section 4.10.

Pacific Connector proposes to construct one new TAR across BLM lands affecting about less than 1 acre. Three new PARs would be constructed across BLM lands, permanently affecting about one-quarter of an acre. There would be no new PARs on Forest Service land.

Five of the rock source or disposal areas outside of identified TEWAs proposed for use by Pacific Connector during pipeline construction are located on BLM land, covering a total of about 7 acres.

There are three rock source or disposal location on NFS lands outside of identified TEWAs, totaling about 9 acres.

Aboveground Facilities

Three MLVs would be on BLM lands, affecting a total of about 0.3 acre. These include MLV #4 and MLV #7 within the Roseburg District, and MLV #12 within the Medford District. Four of the communication tower sites (Blue Ridge, Signal Tree, Flounce Rock, and Stukel Mountain) are on BLM lands, affecting a total of about 0.8 acre. Blue Ridge and Signal Tree are managed by the Roseburg District, Flounce Rock by the Medford District, and Stukel Mountain by the Lakeview District. One communication tower site (Robinson Butte), affecting about a quarter acre, would be within the Rogue River National Forest.

2.4 CONSTRUCTION PROCEDURES

This section describes the general procedures proposed by Jordan Cove and Pacific Connector for construction of the LNG terminal and pipeline facilities. Refer to section 4 of this EIS for more detailed discussions of proposed construction and restoration procedures as well as measures that we are recommending to mitigate environmental impacts.

Under the provisions of the Natural Gas Pipeline Safety Act of 1968, as amended, Jordan Cove would design, construct, operate, and maintain the LNG terminal facilities in accordance with the DOT's Liquefied Natural Gas Facilities: Federal Safety Standards (49 CFR 193). The loading facilities and any appurtenances located between the LNG vessels and the last valve immediately before the LNG storage tank would be required to comply with applicable sections of the Coast Guard regulations in Waterfront Facilities Handling Liquefied Natural Gas (33 CFR 127).

The proposed pipeline facilities would be designed, constructed, operated, and maintained in accordance with DOT regulations in Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards (49 CFR 192). Among other design standards, these regulations specify pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel. In addition, Pacific Connector would comply with the siting and maintenance requirements of the FERC's regulations at 18 CFR 380.15, and other applicable federal and state regulations.

Jordan Cove would construct the terminal facilities in accordance with its project-specific *Erosion and Sediment Control Plan* (ESCP), its *Upland Erosion Control, Revegetation, and Maintenance Plan* (Jordan Cove's *Plan*) and its *Wetland and Waterbody Construction and Mitigation Procedures* (Jordan Cove's *Procedures*).[13] Jordan Cove adopted the FERC's *Plan* and *Procedures* (May 2013 versions) into its *Plan* and *Procedures* in their entirety; therefore, there are no

[13] Jordan Cove's ESCP was attached as Appendix B.7 in Resource Report 7 and Jordan Cove's *Procedures* attached as Appendix C.2 in Resource Report 2, as part of the Environmental Report included with Jordan Cove's application to the FERC filed May 21, 2013.

differences between Jordan Cove's and FERC's *Plan* and *Procedures*. In addition, Jordan Cove has prepared a Construction Spill Plan and operations SPCCP.[14]

Pacific Connector would construct its facilities in accordance with the FERC's *Plan* and *Procedures* except where they have requested site-specific modifications. The locations for which Pacific Connector is requesting modifications are listed in appendix P of this EIS. Pursuant to the FERC's *Procedures*, Pacific Connector prepared an SPCCP.[15] Also in accordance with the FERC's *Procedures*, Pacific Connector would apply for an individual National Pollutant Discharge Elimination System (NPDES) permit from ODEQ. In conjunction with the NPDES application, Pacific Connector would prepare an *Erosion and Sediment Control Plan* (ESCP). That permit application would be made one year prior to scheduled pipeline construction; therefore, Pacific Connector has not yet provided a draft for our review.

Jordan Cove's proposed LNG terminal and Pacific Connector's proposed pipeline and associated aboveground facilities would be constructed in various phases. A description of the primary construction phases is provided below.

2.4.1 Jordan Cove's LNG Terminal

2.4.1.1 North Point Workforce Housing Complex

Prior to construction of any terminal facilities, Jordan Cove would construct a temporary workers camp in North Bend, at the south side of the McCullough Bridge, referred to as the NPWHC (figure 2.4-1). Jordan Cove would lease this property. The land is currently owned by Al Pierce Lumber Company, zoned for heavy industrial use, and used for staging piles of logs prior to further transport. In the 1960s, dredged materials were deposited to a depth of 25 feet on tidal mud flats at this location, resulting in the creation of the two current adjacent fill islands. In 2014, Jordan Cove obtained conditional use permits and amendments to land use zoning from the City of North Bend for the housing complex, as listed on table 1.4.1-1.

Jordan Cove would make improvements to the site such as a connection to the City of North Bend sanitary sewer and road work, including a bridge to connect one part of the property to another across a small creek. The parking area would be developed at the existing elevation of +22 to +30 feet, while the housing area would be graded from the current range of +28 to +40 feet to a more even +32 to +35 feet.

Development of the NPWHC would occur in two phases. Phase 1 would develop the east side of the property including the roadway, access improvements, utility corridor, and bridge crossing to the west side. Phase 2 would involve the installation of the housing units and support facilities on the west side, as well as parking on the east side.

[14] Filed with the FERC on July 14, 2015.

[15] Pacific Connector attached its SPCCP as Appendix 2B to Resource Report 2 in its June 2013 application to the FERC. Pursuant to FERC's recommendation in the DEIS, Pacific Connector updated its SPCCP and filed the revised version on February 13, 2015.

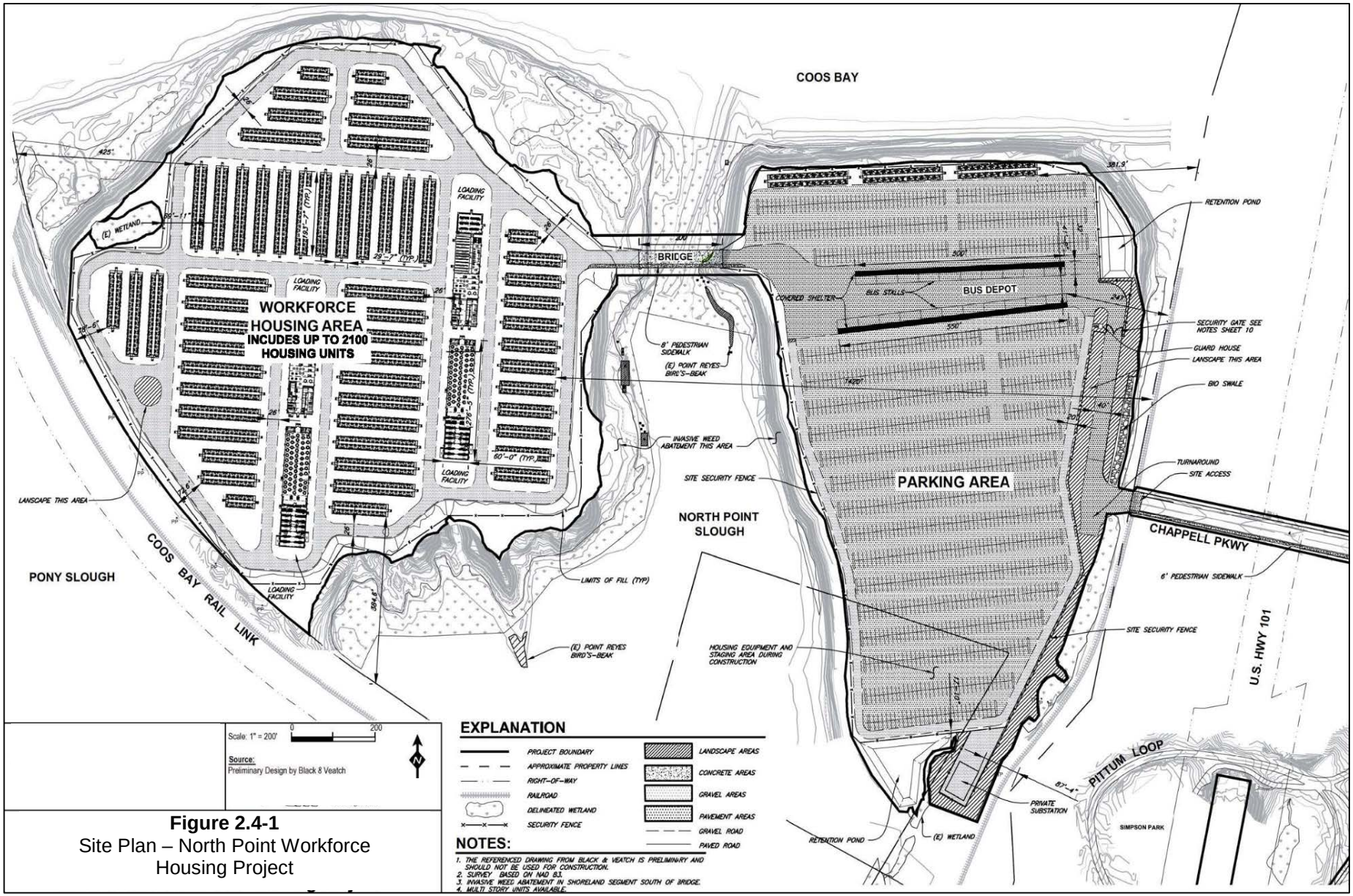


Figure 2.4-1
Site Plan – North Point Workforce Housing Project

The NPWHC would start with approximately 100 living units and the common facilities. Additional living units would be assembled as required to accommodate the growth of the work force. As the workforce declines, housing sections would vacate and the units would be moved out. Housing units and central accommodation facilities would be constructed similar to modular housing using conventional wood framing construction methods. Modules would be pre-manufactured off-site and delivered to the site via truck.

The camp would be designed to accommodate approximately 2,100 workers during peak construction months (300 more than the peak estimate of non-local workers, see section 4.9). Jordan Cove estimates an average construction workforce of almost 800 workers over the life of the construction phase (42 months), with an average of 40 to 50 lodging staff needed on the site during the same time period. All non-local workers would be offered housing at the NPWHC as an included benefit of employment on the Project; however, it would not be a requirement. No families or guests would be allowed in the NPWHC. Security would be provided by a private security force hired by Jordan Cove, further discussed in section 4.9.

Daily functions at the NPWHC will include operating and maintaining a dining hall, recreation facility, laundry facilities, bussing areas, landscaping, and parking areas. Housekeeping for the entire facility is also included in normal operations. On-site utilities for the workforce housing would include a potable water system, firewater and hydrant loop system, wastewater collection and pumping system, and electrical service for power. The parking lot on the east side of the NPWHC would cover about 17 acres, and this area would also include a bus depot. Workers staying at the NPWHC could park their personal vehicles at the lot, but Jordan Cove would provide buses to transport employees to the terminal location.

Stormwater BMPs for the NPWHC would incorporate percolation for treatment and disposal of stormwater. Parking surfaces would be constructed with permeable asphaltic pavement to let stormwater percolate through the surface into a gravel base thereunder and then into the sandy substrate. Surfacing for the bus depot area will receive a more durable but less permeable AC surface treatment. Consequently, the bus depot area would be equipped with a storm system designed to capture runoff and treat the two year storm event before being discharged to the environment. The bus depot storm system would incorporate oil water separators in catch basins and a stormwater detention pond to capture and retain the 2 year rainfall event. Larger storm events would be detained and slowly released via percolation and overflow to the existing north point bioswale/drainage system. With the exception of the bus depot, all other roadways for the NPWHC would be constructed to accommodate local fire vehicles (and food service truck deliveries, etc.) using an open graded durable rock surfacing that infiltrates all incipient rainfall into the sandy substrate. Housing units would utilize “on-site infiltration sumps” installed alongside each housing unit to percolate downspout drainage. Sump installations would follow local standards of practice and will accommodate the 10-year storm event before allowing drainage into retention ponds installed by Jordan Cove on the property. All NPWHC onsite improvements would maintain a 50-foot separation from the estuary with a vegetated buffer for any runoff not captured by onsite stormwater facilities.

Prior to construction, an appropriate stormwater control plan would be developed in coordination with ODEQ to support 401 Water Quality Certification and would have to be in compliance with Clean Water Act Section 401 and 404 and NPDES requirements. An easement from the ODSL would be required for proposed bridge as it crosses state-owned tidal channels. For state-owned

materials on site, a sand and gravel lease/license would be required. The City of North Bend issued a conditional use permit and variance permits for the NPWHC on April 21, 2014.

Upon completion of Project construction, all NPWHC housing facilities and buildings would be dismantled and removed. The underground utilities including fire hydrants would remain in place along with the roads, parking areas and bridge. Any bare ground would be seeded with a plant mix appropriate for the sandy soils typical of the local dune environment.

2.4.1.2 Other Pre-Construction Activities and Temporary Construction Facilities

Jordan Cove would have to establish some temporary construction facilities at the terminal site prior to constructing the terminal facilities. A concrete batch plant would be situated on the south side of the Trans-Pacific Parkway, north of where the LNG storage tanks would be located. Field supervision trailers would be set up south of the location of the LNG storage tanks and north of the proposed marine slip. On land leased temporarily from Roseburg Forest Project, Jordan Cove would erect field construction management offices, subcontractor staff offices, warehouse and storage buildings, craft trailers, and craft breakroom.

Off-Site Temporary Construction Parking Lots

For its employees who would not be residing at the NPWHC, Jordan Cove would establish two temporary off-site parking lots. Workers could park their personal vehicles at those lots and take buses to the terminal. One parking lot would be located at the Mill Casino in the city of Coos Bay (approximately 15 acres). The other parking lot would be at the abandoned Myrtlewood Recreation Vehicle Park on the west side of Highway 101 south of the community of Hauser (approximately 6 acres). After the terminal is constructed, the lots would be restored to their former condition and use.

2.4.1.3 Materials and Equipment Deliveries

Transportation issues are discussed in more detail in section 4.10.1 of this EIS. Below, we summarize how materials and equipment would be transported to the LNG terminal and power plant. Jordan Cove would deliver materials and equipment by truck, rail, or marine transport.

A *Transportation Impact Analysis* produced for Jordan Cove studied the impacts on local roads and other travelers resulting from worker, material, and equipment transit to the terminal.[16] Trucks would likely travel on I-5 to Highway 42 to reach Coos Bay. Roads to the Jordan Cove LNG terminal include U.S. Highway 101 and the Trans-Pacific Parkway. Jordan Cove acknowledged that the intersection of Highway 101 and the Trans-Pacific Parkway would need to be improved to handle additional construction traffic and equipment deliveries by truck. The Trans-Pacific Parkway would be widened for approximately 900 feet to provide a left-turn lane onto northbound Highway 101. Riprap would be extended approximately 40 feet north into the bay from the existing riprap toe of slope, but would not increase the length of riprap shoreline in Coos Bay.

[16] The transportation study was attached as Appendix B.5 of Resource Report 5 in Jordan Cove's May 2013 application to the FERC. The study was revised in a memo filed April 22, 2015.

It is expected that most normal shipments of materials, whether structural steel, piping spools, and smaller equipment would be shipped to the site via truck. The types of equipment that can be transported by truck to the terminal include[17]:

- regeneration gas cooler;
- refrigerant compressor interstage cooler;
- refrigerant condenser;
- BOG compressor interstage cooler;
- amine flash gas compressor interstage cooler;
- amine flash gas compressor discharge cooler;
- amine reboiler;
- LNG loading arms;
- stripper reflux condenser;
- amine cooler;
- lube oil console;
- condensate cooler; and
- BOG compressor discharge cooler.

Jordan Cove originally estimated there would be an average of about 21 material delivery truck trips to and from the terminal per day, with a peak of 40 deliveries per day. However, in a filing on May 1, 2015, Jordan Cove revised its estimate of deliveries by truck. Shipments would number 1,600 in construction year one; 12,900 in year two; 67,900 in year three; and 128,600 in year four.

There is an existing railroad to the terminal, known as the Coos Bay Rail Link (CBRL), that is owned and operated by the Port. Jordan Cove may bring in materials and equipment to the terminal on this railroad. At this time, the only material planned to come to the project site by rail would be sheet pile, which would be delivered by approximately 25 railcars. Rail shipments may be off-loaded at an existing rail spur at the Roseburg Forest Products yard, which runs into the construction laydown area. Minor improvements may occur at this existing facility. No new rail construction is anticipated for the purpose of transporting materials and equipment to the site.

Larger equipment and materials could also be brought to the terminal by marine transport, via ocean-going break bulk cargo ships or coastal barges, using the existing Coos Bay navigation channel. The large drums, towers, dehydration vessels, and the cold boxes are too large to be shipped via road to the site. Pipe rack modules and equipment modules are assumed to come from across the Pacific Ocean by way of break bulk cargo vessels directly to the terminal dock. For items that are manufactured overseas there is the possibility for large ships to off-load at an interim port, such as Stockton or Portland. Barges are likely to be coming from either the north (Portland) or south (San Francisco) to the Jordan Cove terminal. Some of the large equipment that would come in via marine transport includes:

- refrigerant suction drum;
- refrigerant compressor skid;
- BOG compressor;

[17] See Black and Veatch, 7 January 2014, *Equipment and Transportation Study*, filed with the FERC by Jordan Cove on May 1, 2015.

- refrigerant discharge drum;
- refrigerant exchanger;
- amine contactor;
- steam turbines; and
- HRSG sections.

Jordan Cove expects deliveries from about 82 break bulk cargo ships and 18 barges over a two-year period during terminal construction. Barges and cargo vessels would be in at the dock only long enough to unload cargo and depart as soon as practical; it is not anticipated that barges would be moored for extended periods.

2.4.1.4 Industrial Wastewater and Raw Water Lines

Prior to any other construction work on the upland portion of the slip, Jordan Cove would locate, excavate, and remove the existing CBNBWB industrial wastewater pipeline that currently runs through the terminal property across the planned access channel and then generally along the same route proposed for the gas pipeline. A new industrial wastewater pipeline would then be installed running parallel to the Trans-Pacific Parkway (figure 2.1-11). Water discharged through this pipeline would be temporarily halted for about a week during the relocation. Relocation of the industrial wastewater pipeline would affect about 13 acres (see table 2.3.1-1).

Roseburg Forest Products currently uses two 1 million gallon water tanks located on the forested dune on the west side of its property. Jordan Cove proposes to remove those water tanks. Roseburg Forest Products would then tap into the new 12-inch-diameter CBNBWB raw water pipeline on the North Spit for its water supply needs. However, if an analysis proves that the new CBNBWB water line cannot sufficiently supply the needs of Roseburg Forest Products, Jordan Cove may decide to leave the two existing water tanks in place.

2.4.1.5 Access Channel and Slip

Jordan Cove proposes to construct the terminal marine slip and access channel in three phases, to reduce turbidity and impacts on aquatic resources in Coos Bay. The first phase would be the dry excavation of the upper level of the upland portion of the proposed marine berth, above the underground water table. The second phase, known as the "fresh water" phase, would be the dredging of the lower level of the upland portion of the marine slip, below the underground water table, north of a berm retained to separate the upland from the bay. The third phase, known as the "salt water" phase, would include the removal of the berm, and the dredging of the far southern portion of the slip and the entire access channel in the bay.

Phase 1 – Dry Excavation of the Slip

Clearing and Grubbing

The upland portion of the proposed terminal marine slip currently consists of two types of topography: (1) natural forested sand dunes on the east; and (2) a level area on the west, created from materials dredged from Coos Bay and placed on the site by the COE during the early 1970s, covered with low scrubs and grasses. The merchantable timber from the portions of the forested dunes to be removed would be salvage logged and sold, while the unmerchantable timber, timber slash and brush would be pulverized in a tub grinder and stockpiled as mulch. The mulch would be saved for future erosion control of recontoured sand dunes created during the construction

process. Only surfaces that need to be recontoured to accommodate the slip or supporting structures would be grubbed and cleared.

Dry Excavation

The existing ground surface in the flat area is at an elevation of approximately +20 feet NAVD88. The water table across the proposed slip occurs at an elevation of approximately +10 feet NAVD88. All excavated material above an elevation of approximately +10 feet NAVD88 would be removed by conventional earthmoving equipment such as scrapers, bulldozers, and front-end loaders. A berm would be maintained on the south side of the slip area, as a barrier to the bay during this construction phase. Contouring of the slip perimeter above +10 feet NAVD88 would be performed during this step. Side slopes of 3 feet horizontal to 1 foot vertical (3H:1V) would be maintained around the perimeter of the slip to maintain slope stability; except where the LNG berth sheet pile would be installed. The materials stockpiled for future mulching operations would be applied as ground cover to the newly exposed sandy slopes to prevent erosion upon completion of the site contouring of elevations above +10 feet NAVD88.

The excavated material would be transported by trucks to the process area on the north side of the terminal parcel and to the South Dunes Power Plant area, to raise the elevations of these areas. The trucks to the South Dunes Power Plant area would use the proposed haul road across the Roseburg Forest Products tract (see figure 2.1-9).

Phase 2 – Fresh Water Dredging of the Slip

Excavation of Dredge Launch Pond

Several wide-tread excavators would be used to remove material down to elevation 0.0 feet NAVD88, thereby creating a 300-foot-long by 200-foot-wide by 10-foot-deep launch pond. The launch pond would be located near the slip perimeter and road access. The material would be moved to the upland disposal sites by trucks as described above. The launch pond would receive the equipment that would be used to complete the dredging of the upland portion or slip.

Dredging the Upland Portion of the Slip North of the Berm

One or more disassembled hydraulic dredge plants would be transported to the terminal slip area by truck. The hydraulic dredge plants may be in the 18-inch to 24-inch size range, since this is the maximum size range for transportability and the minimum size range capable of dredging to an elevation of -45 feet NAVD88. The plants would be assembled on-site and lifted by crane into the dredge launch pond.

The hydraulic dredges would create an ever increasing deep prism that would, in the end, fully define the dimensions of the slip north of the berm. The slip would be dredged to its final depth of -45 feet NAVD88[18], with side slopes at a ratio of 3H:1V. Dredging of the slip north of the berm could be done any time of the year, with no effects on the bay and its resources.

A total of about 1.5 mcy of material would be dredged from the upland portion of the slip north of the berm (see table 2.1.1.11-1). The hydraulic dredges are capable of generating a slurry of 30 percent solids by weight at a flow rate of 6,000 gpm or greater. All the material dredged below

[18] Jordan Cove's proposed action includes dredging the slip and access channel to -45 feet NAVD88 with a 2-foot overdredge allowance.

the water table north of the berm would be hydraulically transported to the South Dunes Power Plant area through a 20-inch-diameter fused polypropylene (seamless) slurry pipeline. The slurry pipeline would be about 8,650 feet in length, and would be laid on the ground surface, on top of the rip-rap along the southern shore across the Roseburg Forest Products tract.

The dredged material would be deposited at the former Weyerhaeuser linerboard mill site, to raise the elevation for the proposed Jordan Cove facilities at that location, including the gas treatment plant and the South Dunes Power Plant. Once the slurry has settled, decant water would be removed and transported back to the terminal slip via a 20-inch-diameter fused polypropylene (seamless) pipeline. The decant water pipeline would be placed on the ground adjacent to the slurry pipeline. Together installation of the slurry and decant water pipelines would affect about 1 acre.

Driving Piles for Slip Structures

The LNG vessel berth would include four breasting structures and six mooring structures. All of the mooring dolphins for the LNG vessel berth would be constructed "in-the-dry" and as such, piles would be driven prior to or concurrent with the dredging of the slip, while the berm is still in place. Land based mobile cranes with pile driving equipment would be located on the land-side of the LNG vessel berth sheet pile walls.

In addition, the loading platform above the LNG vessel berth would require thirty-two 24-inch-diameter piles. All platform piles would be installed on the land side of the berth, while the marine slip is still isolated from the bay by a berm.

Construction of the tug boat dock and floating boat house would require 98 piles. These would be driven in while the marine slip is still isolated from the bay.

Slope Armoring

The northern slip face would be armored after the slip is dredged but before the berm is removed. The south slip would remain unarmored because the berm would be removed during Phase 3 of slip construction.

Phase 3 – Salt Water Dredging for the Slip and Access Channel

Breaching and Removing the Berm

After the Fresh Water Phase of dredging the upland portion of the slip is completed, the berm separating the northern portion of the slip from the bay would be breached and removed. Dredging to remove the berm may be done from both the northern side of the slip and the bay side. In total, about 500,000 cy of material would be dredged during removal of the berm. That material would be used to rebuild the dune on the eastern side of the LNG vessel berth (area E4 on figure 2.1-2).

Final Contouring and Slope Armoring

Final contouring and armoring of the remaining slip side slopes would be completed after the berm is removed. In-water work would be performed during the ODFW's allowable construction window in Coos Bay between October 1 and February 15. The marine slip would be protected from wave action and wind erosion by the installation of stone or articulated block reinforcement (permanent riprap). The north and east sides of the slip would be protected from the toe trench to above the waterline. Portions of the slip not expected to be subject to water or wind erosion, above about +25 feet NAVD88, would be protected by other means, including concrete cellular

mattresses, grout injected geotextile fabric mattresses, and geotextile reinforced vegetative plantings.

Dredging the Access Channel

The access channel between the Jordan Cove LNG terminal proposed marine slip and the existing Coos Bay navigation channel would be dredged either before or after the berm is removed. Work in the bay south of the slip would be done during the ODFW's allowable construction window between October 1 and February 15. It is estimated that dredging of the access channel would remove about 1.3 mcy of material, which would be conveyed through the slurry pipeline to the South Dunes Power Plant area. Site investigation suggests that certain portions of the near-shore access channel may require use of a clamshell dredging operation due to buried woody debris, which precludes the use of the preferred hydraulic dredge operation. Potential effects related to both forms of dredging operation are assessed in sections 4.4 and 4.6.

Restoration

Following the dredging activities, the slurry and decant water pipelines would be dismantled and removed, and all disturbed areas along the right-of-way for those lines would be restored to their previous condition and use. In addition, part of the dune on the east side of the marine slip, west of the Roseburg Forest Products tract, would be reconstructed.

2.4.1.6 Barge Berth

Jordan Cove would install a barge berth on 3 acres at the southeast corner of the marine slip. The barge berth at the terminal could accommodate large break bulk ships (with self- loading and unloading cranes) as well as barges to off-load equipment at the site. The barge berth would be designed for roll-on and roll-off barge capabilities.[19]

2.4.1.7 LNG Vessel Berth and Tugboat Berth

On the east side of the marine slip, Jordan Cove would install a berth that can dock a single LNG vessel at a time. The open cell sheet pile structure is designed to uniformly deform into a scalloped face as the land side static loads are applied. The sheet piles, including the tie-back walls, are driven in first, then materials would be excavated from the water side. When the sheets are driven in, the wall would initially be straight. After the removal of the water side materials, the shore side load would stretch the piled walls, locking them in place.

On the north side of the marine slip, Jordan Cove would construct a berth that could accommodate three tugboats and three escort boats. The berth would be supported by 98 piles, driven while the slip is being excavated and still separated from the bay by the earthen berm, as described in section 2.4.1.5 above. Associated with the tug berth would be two boat houses.[20]

2.4.1.8 LNG Loading Platform and Facilities

The LNG vessel loading facilities would be constructed once the eastern side of the slip is formed. All of the loading facilities would be on the shore side of the slip, with no facilities located in the

[19] A drawing of a cargo ship at the barge berth was filed on May 1, 2015, as part of the Black and Veatch *Equipment and Transportation Study* from January 2014.

[20] The tug berth plan view and cross section drawings were filed by Jordan Cove on August 29, 2013.

water of the slip. The platform with the loading arms (inclusive of the loading and vapor return arms) would be constructed on a concrete pad located at the edge of the slip. The loading arm platform would be constructed on columns raised from the concrete pad and accessed through stairways to the ground surface. The foundation of the pad would contain a number of piles that would be tied into the concrete pad to provide a stable foundation for the breasting dolphins and the loading arm platform. Separate piles would be driven for the breasting dolphin and the loading arm platform.

The LNG vessel loading facilities would be constructed using land-based equipment to install the required structural elements for the loading platform and mooring dolphin. Actual installation of berth piping and equipment, and hookup and commissioning of the loading system and utilities would follow.

2.4.1.9 LNG Transfer Pipeline

The LNG transfer pipeline would be a 36-inch-diameter stainless steel aboveground pipeline between the LNG storage tanks and the vessel loading platform. It would be insulated, and supported on steel sleeper-style structures. Beneath the pipeline would be a 3-foot-wide reinforced concrete trench with metal grating cover.

2.4.1.10 LNG Storage, Liquefaction, and Support Facilities

Site Preparation

Construction site preparation would require clearing, filling, and grading of the site to an approximate elevation of +30 feet NAVD88 for the base of the LNG storage tank area and approximately +46 feet NAVD88 for the process areas. Temporary ditches, sediment fences, and silt traps would be installed as necessary. Individual excavations would then be made for equipment foundations. Following completion of foundations, the site would be brought up to final grade. Final grading and landscaping would consist of gravel surfaced areas, asphalt surfaced areas, concrete paved surfaces, grass areas, and construction of the storm surge barrier.

Grading the terminal process areas would entail approximately 2.5 million cy of cut and fill. Any material remaining from that work, including final grading and landscaping, would be used to raise the South Dunes Power Plant site and raise the access/utility corridor. Approximately 3.5 million cy of material would be available for the South Dunes Power Plant and access/utility corridor to raise the existing elevation to approximately +46 NAVD88. The material available to raise the elevation of these areas would come from the excavation and dredging of the slip and access channel.

LNG Storage Tank Construction

Construction of the LNG storage tanks would be the most time-consuming element in the development of the LNG terminal. General steps taken during construction of each LNG storage tank would include installation of the foundations and tank bottom slab, construction of the outer concrete container wall, insertion of the bottom carbon steel vapor liner, construction of the steel dome roof and suspended deck, installation of the 9 percent nickel steel inner tank, installation of the internal tank accessories (pump columns, instrumentation, and piping), installation of external tank accessories, installation of insulation, and installation of LNG pumps. Following a successful inner container hydrotest (see below), the tank would be washed down and cleaned. After installation of the LNG pumps, the tank would be closed and purged with nitrogen to a positive

gauge pressure. At this point in the construction process, the tank would be ready for cooldown with LNG.

Support Facilities

Construction of foundations for buildings and installation of major mechanical equipment would occur once LNG storage tank construction is underway. Large equipment items would be set on their foundations upon delivery. After the pipe racks are completed, work would commence on the installation of the process and utility piping. The installation of mechanical equipment would be followed by electrical and instrumentation installation. Once the piping is completed and tested, piping insulation would be installed. As the construction of the process portion of the LNG terminal progresses, work would commence on the pre-commissioning activities, so that these activities would be completed concurrently with the completion of the LNG storage tanks and be ready for nitrogen purging.

2.4.1.11 South Dunes Power Plant

The location of the South Dunes Power Plant was formerly the Weyerhaeuser mill, which has been removed. Outside of some foundations and asphalt pavement, the only major aboveground structures still extant at this location includes a water tank and the PacifiCorp electric substation. The substation would be relocated. The elevation of this site would be raised to a final grade of about +46 feet, using material excavated and dredged from the Jordan Cove marine slip and access channel. Spread footings and slab on grade foundations would be used to support plant buildings and equipment.

2.4.1.12 Testing

Jordan Cove would conduct testing of the LNG storage tanks and other terminal facilities in accordance with applicable codes and requirements. The storage tanks would be tested in accordance with API 620, while piping would be tested in accordance with the ASME B31.3. Some of the tests to be carried out are described below.

Testing of the LNG Storage Tanks

The inner container of each LNG storage tank would be hydraulically tested by filling the tank with water, and then pressurizing the tank. Jordan Cove would obtain the water for the hydrostatic test of the storage tanks from three sources: the firewater pond, raw water line, and potable water line. Water withdrawn from the CBNBWB lines would be limited to 1,000 gpm to reduce stress on the lines. It would take approximately 10 days to fill one tank with the 28 million gallons necessary for testing. No biocides or chemicals would be added to the test water; however, water from the CBNBWB system contains residual chlorine.

To minimize water usage, the two tanks would be hydrotested with the same water by transferring the water at the conclusion of the hydrotesting of one tank to the other tank. Due to the inability to transfer residual water from the heel of the first tank, about 0.25 million gallons of additional water would be added during the test of the second tank. Therefore, for both tanks combined, about 28.25 million gallons would be used during hydrostatic testing. Water would be introduced into the inner tank container through a manhole in the outer container's concrete roof. The duration that the water remains in the tanks would be strictly controlled; therefore, it is not expected that any contamination or discoloration would be present on discharge, even after being passed through

both LNG storage tanks. However, the water would be tested to confirm composition prior to the water being transferred between each individual tank and before the water is discharged from the last tank. Jordan Cove estimated the total duration of the hydrotest of the first tank from start of filling to emptying would be approximately 34 days, with the second tank taking approximately 21 days. The CBNBWB informed Jordan Cove that the existing 12-inch-diameter main raw water line has the necessary pressure and capacity to supply 20 million gallons over 2 weeks during a low demand period (September to May), and the same quantity could be obtained during 3 weeks during the high demand period (May to September).

On completion of hydrotesting the final tank, the water would be pumped from the tank to the firewater pond. The rate of discharge is expected to be approximately 1.8 mg/d for the bulk pumping operation with substantially lower rates being achieved when removing the final amounts of water from the tank bottom. From the firewater pond, the hydrotest water would be discharged into the industrial wastewater pipeline via an overflow, which connects to a previously existing, permitted ocean discharge. Water would be sampled and tested for suitability prior to discharge. If treatment is found to be required, treatment procedures would be developed prior to discharge. Jordan Cove would retain about 5 million gallons in the firewater pond to support operation of the terminal facilities. Therefore, about 23.25 million gallons would be discharged through the industrial wastewater pipeline after the hydrostatic testing of the two LNG storage tanks.

Jordan Cove would use a pneumatic test on the outer container for each LNG storage tank. During that test, the outer container would be held at 1.25 times design pressure for one hour.

Testing of Pipework

Piping within the LNG terminal facility would be tested using hydrostatic or pneumatic methods. In general, cryogenic piping (piping that would transfer LNG) would be pneumatically tested with dry air or nitrogen at 1.1 times design pressure. Non-cryogenic piping (e.g., piping that would transfer natural gas) would be hydrotested using clean water at 1.5 times design pressure.

2.4.2 Pacific Connector Pipeline and Associated Aboveground Facilities

Construction of the proposed pipeline would primarily involve standard cross-country pipeline construction techniques as described in section 2.4.2.1. Special construction techniques would also be used when constructing the pipelines across wetlands; waterbodies; roads, railroads, and other utilities; agricultural and residential areas; and areas of rugged terrain. These special construction techniques are described in section 2.4.2.2. Construction of the aboveground facilities is discussed in section 2.4.2.3.

2.4.2.1 General Pipeline Construction Techniques

Figure 2.4-2 shows the typical steps of cross-country pipeline construction. Standard pipeline construction proceeds in the manner of an outdoor assembly line composed of specific activities that make up the linear construction sequence. These operations collectively include survey and staking of the right-of-way, clearing and grading, trenching, pipe stringing and bending, welding and coating pipe, lowering-in pipe and backfilling, hydrostatic testing, right-of-way cleanup, and restoration.

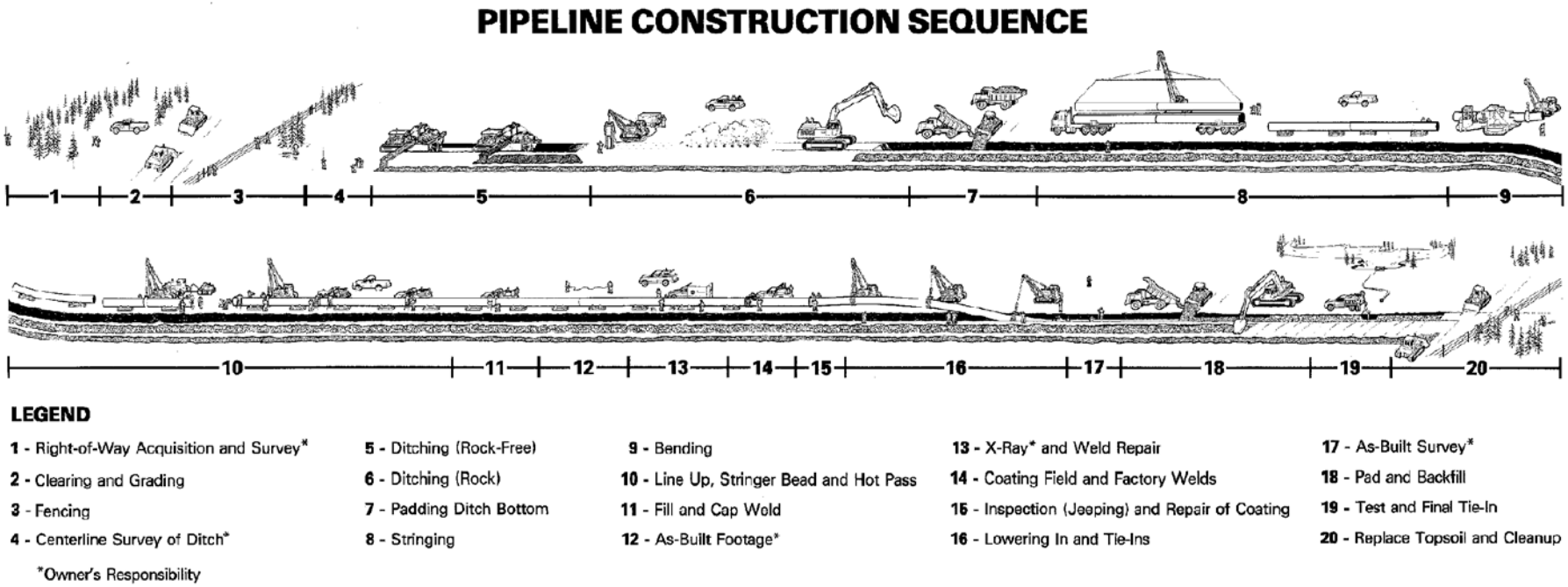


Figure 2.4-2

Typical Pipeline Construction Sequence

Pacific Connector has determined that to efficiently construct the pipeline, construction would be divided into at least five separate construction spreads. Each spread would consist of all construction activities necessary to construct the pipeline in the area designated for that spread.

Preliminary locations of construction spreads identified by Pacific Connector include the following:

- Spread 1 – MPs 1.5R-49.7;
- Spread 2 – MPs 49.7-94.7;
- Spread 3 – MPs 94.7-132.1;
- Spread 4 – MPs 132.1-188.0; and
- Spread 5 – MPs 188.0-228.1.

The subbasins and fifth-field watersheds directly crossed by the proposed pipeline centerline, and the associated construction spread, are listed in table 2.4.2.1-1. Five additional watersheds would be impacted by the pipeyard storage areas; however, these watersheds would not be crossed by the project's centerline. The watersheds include the Deer Creek–South Umpqua River, Gold Hill-Rogue River, Lower Cow Creek, Lower North Umpqua River, and Middle Cow Creek watersheds. Impacts to all watersheds affected by the pipeline project are assessed in section 4.4 of this EIS.

TABLE 2.4.2.1-1

Subbasins and Fifth-Field Watershed Crossed by the Pacific Connector Pipeline Project

	Fifth Field Watershed			
Subbasin	**Name**	**HUC**	**Miles Crossed**	**Construction Spread**
Coos	Coos Bay-Frontal Pacific Ocean	1710030403	20.6	1
Coquille	Coquille (Middle Main) River	1710030505	2.0	1
	North Fork Coquille River	1710030504	8.3	1
	East Fork Coquille River	1710030503	9.7	1
	Middle Fork Coquille River	1710030501	15.8	1,2
South Umpqua	Olalla Creek-Lookingglass Creek	1710030212	8.8	2
	Clark Branch–South Umpqua River	1710030211	13.5	2
	Myrtle Creek	1710030210	8.7	2
	Days Creek–South Umpqua River	1710030205	19.8	2,3
	Elk Creek	1710030204	3.3	3
	Upper Cow Creek	1710030206	5.3	3
Upper Rogue	Trail Creek	1710030706	10.7	3
	Shady Cove–Rogue River	1710030707	8.1	3
	Big Butte Creek	1710030704	5.1	3,4
	Little Butte Creek	1710030708	32.9	4
Upper Klamath	Spencer Creek	1801020601	15.1	4,5
	John C. Boyle Reservoir–Klamath River	1801020602 a/	5.4	5
Lost River	Lake Ewauna–Upper Klamath River	1801020412	16.1	5
	Mills Creek–Lost River	1801020409	22.6	5
Total b/			**231.8**	

Note: Miles are rounded to the nearest tenth of a mile. Column may not sum correctly due to rounding.
a/ There are no waterbodies crossed in the Klamath River-John C. Boyle Reservoir Fifth Field Watershed.
b/ Five additional watersheds would be affected by the pipeline project (e.g., access road), but not directly crossed by the centerline: Deer Creek–South Umpqua River, Gold Hill–Rogue River, Lower Cow Creek, Lower North Umpqua River, and Middle Cow Creek watersheds.

Surveying and Staking

Prior to the start of construction, the exterior limits of the approved construction right-of-way and boundaries of TEWAs would be civil surveyed and clearly staked and signed. Civil survey is generally performed on foot or using all-terrain vehicles (ATV) or off-highway vehicles (OHV) from existing access points to the pipeline right-of-way. All work would be performed by professional land surveyors licensed in the State of Oregon and which hold a valid and current Certified Federal Surveyor certificate.

The survey stakes would be maintained throughout construction, and monitored by Pacific Connector's environmental inspectors (EI). Any pre-existing property line or survey monuments that occur within the construction right-of-way would be protected where possible, and if damage occurs during construction, these monuments would be replaced according to state and federal standards. Civil surveys on federal lands would adhere to guidelines established by the BLM, Forest Service, and Reclamation that were provided to Pacific Connector during the pre-filing review period. Pacific Connector produced a *Right-of-Way Marking Plan*, included as Appendix T of its POD.

Fences would not be used to mark the right-of-way; however, some fencing may be used as requested or approved by landowners to reduce damage to property and resources (e.g., to prevent unauthorized access by OHVs). The limits of the right-of-way and TEWAs would be marked by wooden stakes and flagging. Approved access roads would be signed. Also signed would be sensitive environmental areas that would be off-limits to construction crews.

Access to the Construction Right-of-Way

Roads that would be used for access to the right-of-way during construction are more fully discussed in section 4.10 (Transportation) of this EIS. There are three types of roads that would be utilized for this Project: 1) existing roads; 2) new TARs; and 3) new PARs.

Equipment involved in pipeline construction would be moved onto the right-of-way using approved access roads, and would then generally proceed down the right-of-way performing their job tasks. Part of the construction right-of-way would include a travel lane for construction equipment and related Project vehicles, accommodated within the standard 95-foot-wide construction right-of-way. Pacific Connector would place mats over wetlands and bridges over waterbodies along the travel lane, in accordance with the FERC's *Plan* and *Procedures*, including modifications, and install temporary erosion control devices in accordance with its ERCP. After the pipeline is installed, the right-of-way would be restored and revegetated, including the removal of the travel lane and TARs.

Typical pipeline construction equipment that would travel down the right-of-way include pipe trucks, flat-bed trucks, mowers, bulldozers, graders, front-end loaders, backhoes, trenching machines, bending machines, side-booms, welding machines, fork lifts, rock hammer machines, padding machines, winch trucks, water trucks, dump trucks, pick-up trucks, and other miscellaneous equipment. A list of typical pipeline construction equipment and noise levels can be found in table 4.12.2.4-5 in section 4.12, Air Quality and Noise. Pacific Connector has produced a TMP for federal lands as Appendix Y of its POD, and included a TMP for non-federal lands as Appendix 8H in Resource Report 8 of its June 2013 application to the FERC.

Clearing and Grading

The construction right-of-way and TEWAs would be cleared of brush and trees. Pacific Connector has produced a *Right-of-Way Clearing Plan for Federal Lands* as Appendix T of its POD. The general clearing procedures outlined in that plan would also apply to non-federal lands. During clearing operations, existing fences crossed by the pipeline route would be cut and braced, and temporary gates installed to control livestock and limit public access to the right-of-way. Temporary erosion control devices would be installed at the end of clearing activities. Details about erosion control devices can be found in Pacific Connector's project-specific ECRP, in the FERC's *Plan*, and the POD. Erosion control is more fully discussed in section 4.3.1.3 of this EIS.

Hayfields, pastures, and grassy areas would not be cleared except in areas directly over the trench or where grading would be required to create a level working surface. Tall shrubs, such as sagebrush, would be mowed or scalped off with a motor-grader or a bulldozer. Cleared grasses and brush would be stockpiled along the edge of the right-of-way or within TEWAs or UCSAs, then mulched and spread back over disturbed areas during final cleanup and restoration.

In forested areas, timber would be cut and cleared from the right-of-way and TEWAs using standard logging techniques, in accordance with landowner requirements including time-of-year restrictions. Through consultation with FWS, BLM, and the Forest Service, as well as timber clearing and construction contractors, Pacific Connector has developed seasonal timing restrictions for timber felling, logging, clearing and construction activities to minimize and avoid potential effects to the various bird species in the Project area. These seasonal timing restrictions are further discussed in section 4.6 (Wildlife and Aquatic Resources). Merchantable timber would be removed and/or sold according to landowner stipulations. Pacific Connector indicated that specific logging methods may not be fully determined until a contractor has been selected for construction of its pipeline. In general, ground-based skidding and cable (where feasible) logging methods would likely be the standard method; however, in some isolated rugged topographic areas with poor access, helicopter logging may be used. Impacts on timber are more fully discussed in section 4.5.2 of this EIS.

Following clearing, the right-of-way would be graded where necessary to create a reasonably level working surface to allow safe passage of construction equipment and materials. During grading activities, topsoils would be separated from subsoils, and each would be stored in segregated piles within the construction right-of-way and TEWAs. The FERC's *Plan* requires topsoil segregation in residential areas, crop lands, pastures and hayfields, and in other areas as required by the landowner. The topsoil should be stripped either across the entire construction right-of-way, or over the trench line and soil storage areas. In wetlands, the FERC's *Procedures* require that the top foot of soil over the trench line be salvaged, except in areas of standing water or saturated soils. Where topsoil would be segregated on non-federal lands, Pacific Connector has requested 10 additional feet of TEWA in addition to its nominal 95-foot-wide construction right-of-way in uplands.

The BLM and Forest Service have stipulated that topsoil should be salvaged where the pipeline route would cross BLM and NFS lands. However, Pacific Connector has requested a modification from the FERC staff's *Plan* and does not want to segregate topsoil on BLM and NFS lands to avoid additional TEWAs in LSRs. This issue is further discussed under section 4.3.2.1.

Trenching

A rotary trenching machine, rock trencher, track-mounted backhoe, or similar equipment would be used to excavate a trench for the pipeline. Spoil excavated during trenching would be temporarily stockpiled to one side of the right-of-way adjacent to the trench.

The depth of the trench would vary according to site-specific conditions. According to the DOT requirements in 49 CFR 192.327, the minimum depth of cover for a buried natural gas transportation pipeline must be:

- 30 inches in normal soil and 18 inches in consolidated (solid) rock for Class 1 locations; and
- 36 inches in normal soil and 24 inches in consolidated rock for Class 2, 3, and 4 locations, and under drainage ditches, public roads, and railroad crossings.

Pacific Connector intends to exceed DOT requirements where possible, and bury its pipeline up to 36 inches deep in Class 1 areas with normal soils and 24 inches deep in Class 1 areas with consolidated rock. The trench may be deeper at stream crossings with scour concerns, or areas with geological hazards. Pacific Connector committed to burying the pipeline below the estimated 100-year scour depth or into competent bedrock, whichever is shallower. Pacific Connector's geological consultant estimated depth to bedrock at the crossing of Middle (Park) Creek to be about 7 feet, and about 9 feet at the eastern crossing of the South Umpqua River. At South Fork Elk Creek, Olalla Creek, and North Myrtle Creek, 100-year scour depths were estimated between 6 and 11 feet. Pacific Connector committed to complying with Reclamation's Engineering and O&M Guidelines for Crossings – Bureau of Reclamation Water Conveyance Facilities (Canals, Pipelines, and Similar Facilities) unless otherwise described in the *Klamath Project Facilities Crossing Plan* (Appendix O of its POD). All crossings would require Professional Engineer stamped design drawings approved by Reclamation prior to installation.

In areas where bedrock is found close to the surface within the proposed trench depth, Pacific Connector would first attempt to dig the trench with specialized equipment, such as rock saws, or ripping using hydraulic hammers. However, if these methods are ineffective, blasting may be necessary to achieve the required trench depth. Pacific Connector prepared a *Geologic Hazards and Mineral Resources Report*, filed as part of its application to the FERC, which classifies blasting potential along the route based on existing soil and bedrock data. Blasting potential was classified as high for about 100 miles of the proposed pipeline route. All blasting would be done by licensed contractors under the terms of applicable regulatory requirements. Pacific Connector produced a *Blasting Plan* as Appendix C of its POD. Blasting is further discussed in section 4.2.2 of this EIS.

Stringing, Bending, and Welding

After trenching, pipe sections would be trucked to the right-of-way, and strung along the route, using side-booms to unload the joints from the flatbed trucks. A hydraulic bending machine would bend some pipe joints to fit the contour of the trench bottom (where there are changes in the natural ground contours or where the pipeline changes direction). In other situations, pipe sections would be factory bent, or special pre-fabricated pieces would be used.

The pipe joints would be welded together by a separate trained crew of welders, and placed on wooden skids adjacent to the trench. All welds would be visually inspected, nondestructively tested (using radiographic or equivalent methods), and repaired, if necessary. Line pipe, normally mill-coated prior to stringing, would require field applied coating at the welded joints prior to final inspection. The entire pipeline coating would be inspected and tested to locate and repair any flaws or voids.

Lowering-in and Backfilling

After welding and coating are completed, the pipe would be lowered into the trench by side-boom tractors and excavators. Before lowering the pipe, the trench would be inspected to ensure that it is free of rocks and other debris that could damage the pipe or the coating. In addition, the pipe and trench would be inspected to ensure that the configurations of the pipe and trench configurations are compatible. Padding, sometimes sandbags, would be placed at the bottom of the trench, with the pipe put on top of the padding.

To prevent water from the trench from entering wetlands or waterbodies, Pacific Connector would install permanent trench plugs, consisting of sandbags, foam, or bentonite, at the base of slopes adjacent to wetlands and waterbodies, in accordance with its ECRP, and consistent with the requirements of the FERC's *Plan*. In accordance with the FERC's *Procedures*, the trench would be dewatered in a manner that does not cause erosion and does not allow silt-laden water to flow into any adjacent wetland or waterbody.

Bladed equipment or a backfilling machine would be used to backfill the trench. No foreign substance, including skids, welding rods, containers, brush, trees, or refuse of any kind, would be permitted in the backfill. Segregated topsoil, where applicable, would be replaced after backfilling the trench with subsoil. Following backfilling, a small crown of material would be left to account for any future soil settling that might occur.

Hydrostatic Testing

After backfilling, the pipeline would be hydrostatically tested in accordance with DOT regulations to ensure that is capable of operating at the MAOP. During the test, sections of the pipeline would be filled with water and pressurized to 550 psig. Should a leak or break occur during testing, the line would be repaired and retested until the specifications are achieved. Pacific Connector produced a *Hydrostatic Testing Plan* as Appendix M of its POD.

The pipeline would be tested in approximately 75 sections, each with varying lengths and water volume requirements. Approximately 62 million gallons of water would be required to test the pipeline. Water for hydrostatic testing would be obtained from commercial or municipal sources or from surface water right owners. If water for hydrostatic testing is acquired from surface water sources, Pacific Connector would obtain all necessary appropriations and withdrawal permits prior to construction, including permits through the Oregon Water Resources Department (OWRD). As part of this process, OWRD would have the applications reviewed by ODEQ and ODFW to determine if there are concerns about the impact water withdrawals may have on water quality, and fish and wildlife and their habitats. Pacific Connector would negotiate water appropriations with private owners in the year prior to construction.

Pumps used to withdraw surface water would be screened according to ODFW and NMFS standards to prevent entrainment of aquatic species. In addition, Pacific Connector included BMPs in its *Hydrostatic Testing Plan* to avoid the potential spread of aquatic invasive species and pathogens of concern. BMPs were developed in consultation with the BLM, Forest Service, Reclamation, and the Center for Lakes and Reservoirs and Aquatic Bioinvasion Research and Policy Institute.

Permission to discharge the hydrostatic test water would be applied for concurrently with the request for coverage under the ODEQ General Stormwater Discharge Permit and permitted through a separate letter of approval. Hydrostatic test water would be discharged in upland settings, into erosion control devises, to minimize the potential for scour, erosion, and sedimentation into nearby wetlands and waterbodies, in accordance with Pacific Connector's ECRP and the POD. Water discharged during testing would not be used to fill existing or proposed fire suppression sources (e.g., heli-ponds). Straw bale barriers and silt fence would typically be used to retain sediment and reduce velocity. Additional discussion of hydrostatic testing discharges can be found in section 4.4.2 of this EIS.

Dust Control

Fugitive dust may be created by pipeline construction activities. To control dust, Pacific Connector would use water trucks to spray the right-of-way. Water for dust control purposes would be obtained from commercial or municipal sources, and all appropriate approvals and/or permits would need to be obtained prior to withdrawal. Pacific Connector produced an *Air, Noise, and Fugitive Dust Control Plan* as Appendix B to its POD. The amount and sources of water for dust control are discussed in section 4.4.2 of this EIS. Section 4.12.1.2 discusses impacts and mitigation measures to reduce fugitive dust.

Cleanup and Permanent Erosion Control Devices

After the pipeline is installed in the trench and backfilled, Pacific Connector would complete final grading, returning the right-of-way to its previous contours. Drain tiles crossed by the pipeline would be checked, and if damaged, they would be repaired before backfilling. During final cleanup and initial restoration, fences, gates, drainage ditches, culverts, and other structures that may have been temporarily removed or damaged during construction would be permanently repaired, returned to their pre-construction condition, or replaced. All construction debris, including excess rock, would be removed from the right-of-way and placed in authorized disposal locations. On federal lands, site-specific crossing restoration plans would be implemented for perennial stream crossings (e.g., Middle Creek, East Fork Cow Creek). Streambanks would be stabilized, and permanent erosion control devices would be installed. The right-of-way would be mulched, seeded, and revegetated in accordance with Pacific Connector's ECRP.

Pacific Connector would install permanent erosion control devices consistent with the requirements of Section V.B. of FERC's *Plan* and as described in its ECRP. The permanent erosion control measures include trench breakers, slope breakers, and revegetation to stabilize disturbed areas. Pacific Connector would consult with the BLM, Forest Service, and Reclamation regarding the installation of permanent erosion control structures on federal lands, and with the NRCS regarding such structures on non-federal lands. The permanent erosion control measures developed by Pacific Connector in its ECRP are generalized to be consistent with different agency

requirements based on slope and soil types crossed by the proposed pipeline. Table 2.4.2.1-2 lists specifics from Pacific Connector's ECRP for the installation of slope breakers.

TABLE 2.4.2.1-2

Permanent Slope Breaker Spacing From Pacific Connector's ECRP a/

Slope	Highly Erosive Granitic Soils b/	Soils With Moderate or Low Potential for Erosion
0 to 5 percent	None required	None required
5 to 15 percent	100 feet	200 to 300 feet
15 to 30 percent	50 to 75 feet	75 to 100 feet
Greater than 30 percent	50 feet	50 feet

a/ Actual spacing would be determined at the time of installation based on site-specific topographic conditions on the right-of-way to ensure proper slope breaker construction and proper drainage to stable off-site areas. On the Umpqua National Forest between about MPs 109 and 110, where the alignment would cross the historic Thomason cinnabar claim group, waterbars would be installed at 50-foot intervals as recommended by the Forest Service.

b/ Granitic formations would be crossed by the pipeline between: MPs 79.1 to 80.5; MPs 81.6 to 82.2; MPs 87 to 88.8; MPs 97 to 101.2; MPs 103 to 105.4; and MPs 114.8 to 115.

Revegetation

All areas disturbed by construction, including the construction right-of-way, TEWAs, UCSAs, and contractor yards as necessary, would be restored and revegetated in accordance with Pacific Connector's ECRP. The right-of-way would be regraded and topographic contours and drainage patterns returned to as close as preconstruction conditions as possible. Erosion control fabric would be used on streambanks.

Segregated topsoil would be spread over the right-of-way where it was salvaged. A seedbed would be established to a depth of up to four inches where necessary. In most areas, typical regrading and contouring would create a suitable rough, yet firm, seedbed, conducive to capturing seeds when broadcast and retaining soil moisture. Consistent with the FERC's *Plan*, if final grading occurs more than 20 days after pipe installation and backfilling, Pacific Connector would apply mulch on all disturbed areas prior to seeding.

Based on Oregon State University Extension Service recommendations for fertilization rates for nitrogen fertilizer on new pasture seedlings, Pacific Connector intends to use a standard fertilization rate of 200 pounds per acre bulk triple-16 fertilizer on disturbed areas to be seeded. The NRCS did not recommend the addition of lime or other soil pH modifiers. Fertilizer would not be used in wetlands, unless required by the land-managing agencies, and would not be applied within at least 100 feet of streams. The fertilizer would be stored outside of riparian reserves and away from streams, and would not be applied during heavy rains or high wind conditions. It could be either broadcast, or incorporated in the slurry for hydroseeding.

It is expected that seeding would be timed to begin in August and could extend into the winter months at lower elevations. Disturbed areas would be seeded within six working days of final grading, weather and soil conditions permitting. Seeding may be done by broadcast methods, drilling, or hydroseeding. Broadcast seeding, using a mechanical broadcaster seeder, is the preferred method of seeding on steep slopes. After broadcast, the seedbed would be lightly dragged by chains or other appropriate harrows to cover the seeds thinly with soil. Hydroseeding would be done in accessible upland areas. Hydroseeding equipment would include tanks, pumps, nozzles, and other devises for mixing the seed hydraulically with wood fiber mulch and tackifier.

A built-in agitator would keep the seed, mulch, tackifier, and water mixed together homogeneously until pumped from the tank. A drill seeder pulled by a plow may be used as an alternative to broadcast seeding in gently sloping areas.

Seed mixtures were determined in consultations with land-managing agencies and the NRCS. The seed mixtures were listed in Pacific Connector's ECRP, and are further discussed in section 4.5.1 of this EIS. There are special seed mixes for areas that contain federally-listed threatened or endangered plant species, including Kincaid's lupine, Applegate's milk-vetch, Gentner's fritillary, and Cox's mariposa lily; those seed mixes were listed in Pacific Connector's *Federally-Listed Plant Conservation Plan* (Appendix J of the POD). Seeding rates are based on Pure Live Seed.[21] The mixture would be free of noxious weed seeds. During right-of-way easement negotiations, private landowners may select their own seed mixtures other than those proposed for elsewhere along the pipeline route. The seed mixtures on BLM land were developed based on BLM Instruction Memo-2001-014, which specifies the use of native species, if possible. Pacific Connector's ECRP stated that native seeds would be collected during a two-year period prior to construction, and local vendors have indicated they could supply the necessary seeds during that period. The POD has additional requirements for revegetation on federal lands.

Mulch would be applied on slopes were necessary to stabilize the right-of-way after seeding. Mulch would consist of native wood, straw, or hydromulch, and certified weed-free straw. It is anticipated that native wood mulch and manufactured wood fiber mulch would be the major sources of mulch applied. In non-forested areas, straw mulch would be spread at 2 tons/acre, except on slopes within 100 feet of waterbodies and wetlands where application rates would be increased to 3 tons/acre. During hydroseeding, manufactured wood fiber mulch would be applied at 2,000 pounds per acre. On slopes greater than 2.5 to 1 (i.e., 40 percent grade), Pacific Connector would use a bonded fiber matrix for mulch. In forested areas, native wood mulch would consist of slash, brush, chips, and non-merchantable timber cleared from the right-of-way and stored in TEWAs and UCSAs. The BLM and Forest Service have established ground cover standards and fuel loading requirements that are further discussed in section 4.5.1 of this EIS.

In forested lands, Pacific Connector would replant vegetation according to state and federal reforestation requirements. Reforestation efforts would occur in any given area the first winter/spring (between December and April) after the pipeline is installed in that area. Trees would be replanted across the construction right-of-way up to 15 feet from either side of the pipeline centerline. In riparian areas, shrubs and trees would be replanted across the right-of-way for a width of 25 feet from the waterbody bank. Within Riparian Reserves, Pacific Connector would replant shrubs and trees to within 100 feet of the ordinary high water mark (OHWM). A list of species to be replanted was included in Pacific Connector's ECRP, and revegetation is further discussed in section 4.5.1 of this EIS.

2.4.2.2 Special Pipeline Construction Techniques

Construction in rugged topography; across wetlands and waterbodies; through agricultural, residential, commercial, and industrial areas; at road and railroad crossings, and across foreign

[21] In addition to the live seed from the desired plant species, bulk seed contains dust, chaff, and dead seed, and may contain seeds from other plant species. Pure Live Seed refers to the amount of live seed of the desired species in a lot of bulk seed.

pipelines and other utilities may require special construction techniques. Special techniques would also be used if blasting is required. These techniques are described below.

Rugged Topography

The Pacific Connector pipeline route would cross several mountain ranges, with steep and rugged topography. Through those mountains, the pipeline route would utilize ridgelines, where feasible, to minimize the amount of cut and fill, and to avoid steep slopes, geologic hazards, and waterbody crossings, and to reduce erosion potential. In areas of steep slopes, two-tone construction techniques may be necessary, creating two step-wise level surfaces within the construction right-of-way (see Drawing #3430.34-X-0019 in Attachment C of Pacific Connector's ECRP, included with Resource Report 1). In addition, Pacific Connector's *Geological Hazards and Mineral Resources Report* identified geological hazards along the pipeline route. Site-specific mitigation measures for the crossing of some of these hazards are discussed in more detail in section 4.2.2.

During construction through rugged topography, Pacific Connector would consider the following factors:

- design adequate construction work spaces;
- provide a safe working grade;
- utilize appropriate construction techniques for site-specific situations;
- construct during the dry season as much as possible;
- install temporary erosion control devices during construction;
- install trench breakers, as appropriate, on slopes and near waterbody and road crossings;
- backfill the trench immediately after pipe installation;
- install permanent erosion controls soon after completing rough grading; and
- revegetate slopes with quick germinating seed mixtures.

Additionally, Pacific Connector's ECRP outlines procedures for fill on slopes exceeding a gradient of 3H:1V, including fill materials, slope preparation, and fill placement and compaction. The POD includes additional factors that would be considered on federal lands.

Waterbody Crossings

Construction of the proposed Pacific Connector pipeline would affect 400 waterbodies (including ditches, canals, drains, and other water conveyance features). Waterbodies would be crossed in accordance with the FERC's *Procedures* and applicable permits or approvals from other agencies. Pacific Connector filed a *Wetland and Waterbody Crossing Plan* as Appendix BB of its POD. Crossings of perennial streams on BLM and NFS lands would be subject to site-specific plans that include construction restoration and monitoring requirements to ensure consistency with the Aquatic Conservation Strategy (ACS). A more detailed discussion of impacts on waterbodies is provided in section 4.4.2 of this EIS.

TEWAs would be located more than 50 feet away from the edge of waterbodies where possible, and Pacific Connector has identified locations where site-specific conditions or other constraints prevent a 50-foot setback. Hazardous materials, chemicals, fuels, and oils would be stored at least 100 feet from the edge of waterbodies and wetlands (150 feet on federal lands).

Construction equipment would cross waterbodies on temporary bridges. The bridges would be designed to span the entire OHWM of the waterbody, wherever possible. Soil would not be used to stabilize bridges. On BLM and NFS lands, all streams, whether wet or dry, would be crossed with (1) a bridge, (2) a temporary culvert, or (3) a low water ford with a rock mat.

Pipeline crossings of perennial waterbodies would be made perpendicular to the axis of the waterbody channel, where feasible. The pipeline route would avoid paralleling a waterbody within 15 feet or less, where feasible.

All waterbodies would be crossed during the in-water work window recommended by the ODFW. Pacific Connector would attempt to cross intermittent flowing streams, and irrigation canals and ditches when they are dry, using standard upland, cross-country pipeline construction methods. The standard depth of cover would be 5 feet below intermittent flowing streams and ditches.

Pacific Connector would use the following methods to cross flowing streams: wet open cut, diverted open cut, dry open cut, convention boring, DP technique, and HDD. These are briefly described below.

Wet Open Cut

Pacific Connector proposes to use wet open cut pipeline construction methods within the Coos Bay estuary, from about MPs 1.7R to 4.1R. The plan for crossing Haynes Inlet was included with the JPA stand-alone document filed with Pacific Connector's application to the FERC (JPA-9). Water depth along this route is shallow, varying from 3 to 10 feet. During ebb tide, marsh excavators with tracks around pontoons would dig the pre-lay trench. A bucket dredge may be used where greater water depth allow. The spoil would be set aside next to the trench, and turbidity curtains may be deployed. Concrete coated pipe would be placed on lay barges, from which 40-foot-long joints would be installed in the trench by the push-pull method. Welding would occur on the barges. Backfilling would allow for 5 feet of cover over the pipe. Construction in Coos Bay would occur between October 1 and February 15.

Diverted Open Cut Crossing

Pacific Connector would use a diverted open cut for the eastern crossing of the South Umpqua River at about MP 94.7, because the river is too wide for a typical dry crossing using either dam and pump or flume methods, and geotechnical studies indicated that subsurface conditions are not suitable for an HDD or conventional boring. At MP 94.7, the South Umpqua River channel is sufficiently flat, wide (175 feet bank to bank), and shallow (varying from a few inches to 15 feet deep), with flow slow enough to allow water to be diverted to one side while work is conducted on the opposite bank. A site-specific plan for the eastern crossing of the South Umpqua River at MP 94.7 was included in Appendix 2E of Resource Report 2 of Pacific Connector's application to the FERC.

A temporary diversion structure, comprised of porta dams, aqua dams, steel plates, plastic sheeting, sandbags, or similar devices would be placed in the river upstream of the crossing. It may be necessary for equipment to work in the river to install the diversion structure. Once the work area is isolated, fish would be salvaged by an ODFW-approved biological contractor, and the area dewatered using discharge pumps. The trench would be excavated and spoil stored adjacent; behind the diversion structure or other sediment control devices. Bedrock may be encountered between 0.7 and 8.7 feet below the channel floor, and the top of the pipe would be

buried at least 24 inches below the top of bedrock. The pipe string would be installed in the trench and backfilled. A bell hole would be left open at the end of the first section to allow a tie-in to the second section. After the installation of the first section of pipe, the diversion structure would be moved to the opposite side of the river. Water would be diverted to the first section, while the second section would be installed. The crossing would be completed over a 14-day period between July 1 and August 31, which coincides with both the ODFW preferred in-water work window and the lowest season groundwater levels.

Dry Open Cut

Flume

The flume method would be used to cross streams less than 100 feet across. Water would be diverted across the work area through one or more flume pipes. No equipment would be placed in the stream, with flumes installed by hand or using equipment from the upland banks. Sandbag and plastic sheeting would be used to support and seal the ends of the flume and to direct stream flow into the flume and over the construction area. Temporary dams at both the upstream (inlet) and downstream (outlet) sections of the flume would create a containment area in between where turbid water would be confined. After fish are salvaged from the confined area between the dams, water would be pumped out, through an upland dewatering structure, to create a dry work area for pipeline installation. Spoil from trenching would be stored in TEWAs located at least 10 feet away from the stream banks; with piles surrounded by silt fence. All in-stream work (trenching, pipeline installation, and backfilling) would be conducted while the flume is in place, and the flume would be removed immediately after backfilling and bottom recontouring is completed. Appropriate-sized gravel would be placed in the streambed, and stream banks would be re-established to pre-construction conditions, and stabilized using the erosion control measures outlined in Pacific Connector's ECRP or those outlined in site-specific plans for perennial crossings on BLM and NFS lands. Details about stream fluming procedures were attached as Appendix 2C in Resource Report 2 of Pacific Connector's application to the FERC.

Dam-and-Pump

The dam-and-pump method is an alternative dry construction technique that can be used to cross small or intermediate width waterbodies that are classified as coldwater fisheries. This method is preferred where the stream bottom is bedrock, and blasting may be necessary during trench excavation. Two temporary in-stream dams would be installed, with sandbags with plastic liner or other structures such as steel plates or water bladders. Stream flow would be diverted around the work area by pumping water through hoses. Intakes would be screened to prevent the entrainment of aquatic species. An energy-dissipation device would be used to prevent scouring of the streambed at the discharge location. The area between the dams would be dewatered, and the trench then excavated by trackhoes or draglines. Spoil would be stored in TEWAs located at least 10 feet from the banks; surrounded by silt fence. After pipeline installation and backfilling, the dams would be removed and stream banks restored and stabilized. Pacific Connector would cross streams using the dam and pump method during the ODFW recommended in-water work windows. Details about dam and pump procedures were attached as Appendix 2D in Resource Report 2 of Pacific Connector's application to the FERC.

Conventional Boring

Pacific Connector intends to cross three waterbodies (Kentuck Slough at MP 6.3R, Catching Slough at MP 11.1, and Medford Aqueduct at MP 133.4) using conventional bore methods. There

are different kinds of boring methods, including jack and bore, slick bore, and hammer bore. The type of method to be used at these specific locations has not yet been determined by Pacific Connector. During a standard boring operation, pits are excavated on both ends, with spoil from the bore passed into the pit and removed by trackhoe. The walls of the bore pits may have to be supported by trench boxes or metal sheet piling. If groundwater seeps in to the bore or bore pits, a dewatering system would need to be used. Pipe would be welded in the pit, and passed through the bore hole.

Horizontal Directional Drilling

Pacific Connector proposes to cross three major waterbodies (Coos River, MP 11.1R; Rogue River, MP 122.7; and Klamath River, MP 199.4) using the HDD construction method. This technique involves drilling a pilot hole, then enlarging that hole through successive reaming. High pressure drilling fluids, usually consisting of a slurry made of bentonite clay mixed with water would be jetted at the drill head to advance the hole. Pipe sections long enough to span the entire crossing would be staged and welded along the construction work area on the opposite side of the waterbody, hydrostatically tested, and then pulled through the drilled hole. The right-of-way between the entry and exit hole of an HDD would generally not need to be cleared or graded, except for the area of the guide wires, and direct impacts on the waterbody, adjacent riparian vegetation, and associated aquatic resources would be avoided through an HDD.

Pacific Connector included an HDD Feasibility Analysis in Appendix 2G of Resource Report 2 in its application to the FERC. That study showed that the HDD under the Coos River would be about 1,602 feet long with a maximum depth of -65 feet; while the HDD under the Rogue River would be about 3,050 feet long with a maximum depth of -76 feet; and the HDD under the Klamath River would be about 2,309 feet long with a maximum depth of -71 feet. In case of an HDD failure, or the unanticipated release of drilling mud, Pacific Connector prepared a contingency plan attached as Appendix 2H to Resource Report 2 of its application to the FERC.

Direct Pipe Technology

Direct pipe (DP) technology is a trenchless construction method that can be used to install pipelines underneath rivers or roads without surface impacts. It is a combination of a micro-tunneling process and HDD. DPs are completed using an articulated, steerable micro-tunnel boring machine (MTBM) mounted on the leading end of the product pipe or casing which is jacked into position with a pipe thrusting machine mounted at or near the ground surface. Soil and rock are excavated by the cutting head on the MTBM and removed through pressurized slurry pipes to the launching pit. Bentonite slurry is used to increase lubrication and advance the MTBM. Overcutting is employed to create a space between the pipe and the soil. The pipeline is pre-fabricated and welded in sections to the back of subsequent sections as the MTBM advances.

Pacific Connector proposes to use DP technology to install its pipeline under the western crossing of the South Umpqua River at about MP 71.3 and the associated crossings under I-5, Dole Road, and the Central Oregon & Pacific Railroad. This DP crossing would be about 1,680 feet long, with a maximum depth of -90 feet. Pacific Connector attached its I-5/South Umpqua River Direct Pipe Feasibility Evaluation as Appendix 2I to Resource Report 2 of its application to the FERC.

Wetland Crossings

The proposed pipeline route and associated facilities and construction areas would cross about 11.6 miles of wetlands. Pacific Connector would construct its pipeline across wetlands in accordance with the FERC's *Procedures*. In general, the construction right-of-way through wetlands would be limited to 75 feet or less, where possible. TEWAs would be located at least 50 feet away from wetlands, except where topographic constraints prevent this. Grading and stump removal in wetlands would only occur over the trench. Silt fence and straw bales would be installed at the edges of the construction right-of-way through wetlands. Trench plugs would be put in where the pipeline enters and exits wetlands.

In saturated wetlands, Pacific Connector may use low ground weight equipment operating off of pre-fabricated wooden mats. It may not be possible to segregate topsoil under saturated conditions. Pipe stringing in saturated wetlands may be done next to the trench or in adjacent TEWAs. If the wetland is flooded, Pacific Connector may use "push-pull" or "float" techniques. Pipeline installation through wetlands is further discussed in section 4.4.2.3 of this EIS.

Agricultural and Residential Areas

Pacific Connector estimated that the pipeline would cross about 37.2 miles of agricultural land, and 0.2 mile of residential land. The FERC's *Plan* requires topsoil segregation in all residential areas, annually cultivated or rotated agricultural lands, pasture, and hayfields, or where requested by landowners. In these areas, topsoil should be stripped and segregated from either the full construction right-of-way, or over the trench line and subsoil storage area. Pacific Connector identified about 70 places, in addition to most wetlands, where it intends to salvage and segregate topsoil along the pipeline route (see table D-4 in appendix D). Along the alignment where topsoil segregation is proposed, Pacific Connector has requested 10 feet of TEWA in addition to the 95-foot construction right-of-way, to stockpile segregated soils.

Another requirement of the FERC's *Plan* is that excess rock should be removed from at least the top foot of soil in all actively cultivated or rotated cropland, pasture, hayfields, and agricultural lands. Pacific Connector would use rock pickers where necessary to remove excess rocks from these areas during cleanup. Rocks would be removed consistent with the size, density, and distribution found in areas adjacent to the right-of-way. Excess rocks would be distributed along the construction right-of-way or disposed of in existing rock quarries and permanent disposal sites (see table D-7 in appendix D). Pacific Connector also attached an *Overburden and Excess Material Disposal Plan* as Appendix Q to its POD. Some excess rocks may be used to create OHV barriers or special habitat features.

The FERC's *Plan* requires that soils in agricultural and residential areas be tested for compaction after construction, and any compaction should be alleviated. According to Pacific Connector's ECRP, during restoration activities soil compaction would be relieved by regrading and scarifying. This may include ripping and chisel plowing up to 18 inches deep.

Pacific Connector would work with individual landowners in agricultural areas to determine how the right-of-way would be restored where the pipeline would cross cropland, orchards, nurseries, or vineyards. Usually, in agricultural areas, the landowner determines whether or not Pacific Connector would be responsible for seeding. In some situations, the owner of agricultural land may do the final restoration and seeding and Pacific Connector would compensate the landowner

for those efforts. In residential areas, Pacific Connector would restore disturbed lawns, ornamental shrubs, gardens, and other landscape features in accordance with their agreement with the landowner. The restoration work in residential areas would be done by a contractor familiar with local horticultural or landscape practices, or Pacific Connector may choose to compensate a landowner to restore their property.

Pacific Connector has developed site-specific construction mitigation plans for the residences within 50 feet of work areas. Some of the typical measures to be taken in residential areas include notification of landowners, limiting hours of construction, dust control, maintaining access, fencing, reducing the width of the right-of-way to increase the buffer to the pipeline, and replacing landscaping (see section 4.1.2.3).

Road, Railroad, and Utility Crossings

The proposed route of the Pacific Connector pipeline would include about 630 road crossings and 6 railroad crossings. Conventional bores are typically used to cross under railroads, with DP and HDD technology proposed for one crossing each (see table D-2 in appendix D). Roads would either be bored or open cut. At least 5 feet of cover would be maintained over pipeline crossings of paved county, city, and state roads, as well as railroad crossings.

Pacific Connector would obtain all necessary permits from applicable county, state, or federal land-managing agencies for public roads to be crossed, and permission to cross private roads from the landowners. Pacific Connector produced a TMP for federal lands as Appendix Y to the POD, and a TMP for non-federal lands was attached as Appendix 8H in Resource Report 8 of Pacific Connector's application to the FERC. Transportation management is discussed in more detail in section 4.10 of this EIS.

Pacific Connector would endeavor to notify agencies and private landowners at least seven days in advance of any road work or closures caused by pipeline construction activities. During an open cut crossing, Pacific Connector would try to keep one lane of the road open for traffic, with detours around construction, plating over the open trench, or other methods. However, in some situations the road may have to be closed for a day when the pipeline would be installed across it. Where road closures occur, Pacific Connector would provide access around the construction site for local residents and emergency vehicles. Advanced signage would be used to provide notice of construction activities. In addition, Pacific Connector would utilize traffic control measures, such as signs, lights, barriers, and flaggers to ensure public safety and provide for efficient movement of traffic through or around the construction area, and to protect workers.

Pacific Connector's proposed pipeline route would cross numerous existing utilities, including other pipelines, powerlines, and cables. Prior to construction, Pacific Connector would contact the local "One Call" or "Call Before You Dig" system to determine the location of utilities to be crossed. These utility crossings would then be marked in the field during pre-construction surveys. Pacific Connector would coordinate with each utility owner/operator to design crossings. In most instances, the new pipeline would have to be installed beneath the existing buried utility to maintain the necessary depth of cover.

2.4.2.3 Aboveground Facility Construction

Aboveground sites would be cleared and graded as applicable to accommodate the planned facilities. Excavation would be performed as necessary to accommodate the new reinforced concrete foundations for meter and compressor station equipment. Forms would be set, rebar installed, and the concrete poured, finished, and cured in accordance with applicable standards. Concrete pours would be randomly sampled to verify compliance with minimum strength requirements. Backfill would be compacted in place, and excess soil would be used elsewhere or distributed around the site.

The meter and compressor station equipment would be shipped to the site by truck. The equipment would be off-loaded using booms, lifts, or cranes. The equipment would then be positioned on the foundation, leveled, grouted (if necessary), and secured with anchor bolts.

All non-screwed piping associated with the meter and compressor stations would be welded, except where connected to flanged components. All welds in high-pressure gas piping systems would be visually inspected and radiographically tested (or other non-destructive testing method) to ensure compliance with code requirements.

All components in high-pressure natural gas service would be strength tested prior to placing in service. Before being placed in service, all controls and safety equipment and systems would be checked and tested.

In all cases, MLVs would be installed within Pacific Connector's operational easement. The installation of the MLVs would meet the same standards and requirements established for pipeline construction.

2.5 ENVIRONMENTAL COMPLIANCE AND MONITORING

2.5.1 FERC Environmental Compliance Monitoring

In preparing construction drawings and specifications for the Project, Jordan Cove and Pacific Connector would incorporate proposed mitigation measures identified in their applications, as specified in the Commission Order, and requirements of other federal, state, and local agencies. Jordan Cove's and Pacific Connector's construction contractors would also be provided copies of applicable environmental permits. Jordan Cove and Pacific Connector would conduct training for construction personnel regarding implementation of environmental permit requirements, and measures of specific mitigation plans. Environmental training would be conducted before and during construction.

During pipeline construction, Pacific Connector would be represented on each pipeline spread by a Chief Inspector, who would be responsible for quality assurance and compliance with mitigation measures, other applicable regulatory requirements, and company specifications. In accordance with the FERC's *Plan*, the Chief Inspector would be assisted by at least one full-time EI per construction spread. The EI would report directly to the Chief Inspector and would have stop-work authority. The EI's responsibilities would include:

- identifying, documenting, and overseeing corrective actions, as necessary to bring an activity back into compliance;

- ensuring compliance with the requirements of the FERC's *Plan* and *Procedures* (including modifications), the environmental conditions of the section 3 and Certificate authorization, the mitigation measures proposed by the applicant (as approved and/or modified by FERC's authorization), other environmental permits and approvals, and environmental requirements in landowner easement agreements;
- verifying that the limits of authorized construction work areas and locations of access roads are properly marked before clearing;
- verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;
- identifying erosion/sediment control and soil stabilization needs in all areas;
- ensuring that the location of dewatering structures and slope breakers would not direct water into known cultural resources sites or locations of sensitive species;
- verifying that trench dewatering activities do not result in the deposition of sand, silt, and/or sediment near the point of discharge into a wetland or waterbody. If such deposition is occurring, the dewatering activity would be stopped and the design of the discharge would be changed to prevent reoccurrence;
- ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;
- advising the Chief Inspector when conditions (such as wet weather) make it advisable to restrict construction activities to avoid excessive rutting;
- ensuring restoration of contours and topsoil;
- verifying that the soils imported for agricultural or residential use have been certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;
- approving straw bales for use in dewatering structures, mulch, and/or erosion control and verifying that the straw is certified free of noxious weeds and soil pests;
- determining the need for and ensuring that erosion controls are properly installed, as necessary, to prevent sediment flow into wetlands, waterbodies, sensitive areas, and onto roads;
- inspecting and ensuring the maintenance of temporary erosion control measures at least:
  - on a daily basis in areas of active construction or equipment operation;
  - on a weekly basis in areas with no construction or equipment operation; and
  - within 24 hours of each 0.5 inch of rainfall;
- ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification;
- keeping records of compliance with the environmental conditions of the FERC Certificate, and the mitigation measures proposed by the Project sponsor in the application submitted to the FERC, and other federal or state environmental permits during active construction and restoration;
- identifying areas that should be given special attention to ensure stabilization; and
- completing restoration after the construction phase.

In addition, the FERC staff would conduct inspections to monitor the Project for compliance with the Commission's environmental conditions and Project mitigation measures proposed by Jordan Cove and Pacific Connector, or required by regulatory and land management agencies. Pacific

Connector has agreed to fund third-party environmental monitors to the extent determined necessary by FERC staff and the federal land-managing agencies during Project construction. The third-party environmental monitors would report directly to the FERC staff, the BLM designated official, and the land-managing agency with jurisdictional interest. Environmental monitors would be available on site during all phases of construction. The details of the scope-of-work and selection of the third-party contractor would be finalized prior to the start of construction.

2.5.2 Monitoring by Land Managing Agencies on Federal Lands

The POD developed by Pacific Connector[22] is part of the Right-of-Way Grant application and includes extensive monitoring requirements to ensure that impacts from construction and operation of the Project are minimized and that objectives of the respective land management plans are accomplished. The requirements from the 2013 POD are summarized in table 2.5.2-1. Ongoing discussion between the applicant and agencies are expected to result in revisions to the POD. Because the proposed actions specific to federal lands include amendments to LMPs, the regular monitoring and reporting programs of the respective BLM and Forest Service LMPs would be used in addition to those identified in table 2.5.2-1.

[22] Filed as a stand-alone report with Pacific Connector's June 2013 application to the FERC.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
A	Aesthetics Management Plan for Federal Lands	3.4.1 Key Observation Points (KOP)	These KOPs will provide a baseline from which to monitor mitigation implementation and success. Mitigation techniques may vary from what is listed below, depending on ongoing monitoring and consultation with agency land managers. Mitigation for KOPs would also include all general mitigation measures detailed in Sections 3.1 through 3.3 of POD Appendix A.
B	Air, Noise and Fugitive Dust Control Plan	—	No requirements except reference to federal and state regulations that could include such monitoring requirements.
C	Blasting Plan	3.6 Monitoring of Blasting During Pipeline Construction (See also Sec. 3.3, Federal, State, County and Local Regulations/Restrictions)	Drilling and blasting would be completed in presence of, and following approval by Company inspector(s) present. Seismograph equipment would be used to measure blast induced vibration (peak particle velocity or PPV) in the vertical, horizontal, and longitudinal directions. Seismic monitoring may be discontinued at Company's discretion if the blasting schedule and blasting performance consistently produce PPVs lower than the maximum allowable limit. PPV would be recorded at any adjacent utility, water wells, potable springs and any aboveground structure within 200 feet of the blasting. Pacific Connector may photograph structures or facilities near blasting locations to document pre-blast conditions. Similarly, Pacific Connector may video record blast events. When blasting is completed in noise sensitive areas, peak noise and overpressure would be monitored and recorded in compliance with the stipulations outlined in the FERC's BA. A blasting log would be recorded immediately after each blast. Ground-motion monitoring would comply with applicable federal, state, and local regulations and permit conditions. See Section 5.0 of POD Appendix C for monitoring requirements for third party blasting within 200 feet of operational pipeline.
D	Communication Facilities Plan	2.0 Purpose	Each meter station and the compressor station would require a communications link with Williams Pacific Operator's gas control monitoring system in Salt Lake City. Therefore, radio antennas and towers would be required at each meter station, the compressor station, and on existing mountain top radio communication sites as required to create a communication link with Salt Lake City.
E	Contaminated Substances Discovery Plan	Page 1, paragraph 5	In response to Forest Service concern for the potential for naturally occurring mercury to reach the aquatic environment during construction of the pipeline near the historic Thomason mining property (see Attachment 1 to POD Appendix E – Potential for natural-occurring mercury mineralization to enter the aquatic environment between M.P. 109 and East Fork Cow Creek), additional temporary or short-term erosion control measures would be conducted at these sites throughout the construction phase and routinely monitored by an environmental inspector (EI) or authorized Company representative. See Figure 5 of Attachment 1 to POD Appendix E to this plan for the location of hydrologic features G, J and K where erosion control measures would be in place before the fall rains and monitored for riling, gullying and other forms of erosion that may transport sediment into the aquatic environment (recommendations developed in consultation with ODEQ).
F	Corrosion Control Plan	2.1.3 Cathodic Protection Monitoring	The CP system would be tested and if necessary, adjusted at least once each calendar year, but not exceeding 15 months to ensure the CP system is providing acceptable levels of protection as outlined in DOT 49 CFR 192.465. Tests would be completed including Close Interval Survey (CIS) that measures pipe to soil potentials, electromagnetics, and guided wave ultrasonics. CP test stations would be located along the pipeline to allow Pacific Connector to routinely monitor voltage and current levels. See Attachment C to POD Appendix F for a sample test station drawing. See also POD Attachment 6, Sections. 2.2 (Atmospheric Corrosion), 2.3 (Internal Corrosion Control) and 2.4 (Inline Inspection) for additional pipeline corrosion inspection requirements, per DOT 49 CFR 192.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
G	Emergency Response Plan	1.0 Introduction	No specific monitoring requirements are identified, but reference is made to DOT 49 CFR 192.615 and 192.617, which includes requirements to minimize the hazards during pipeline operation resulting from a gas pipeline emergency. The required Public Safety Response Manual, to be distributed to the appropriate agencies and local authorities includes information on how to identify a gas leak.
H	Environmental Briefings Plan	2.0 Pre-Construction Reporting	Within 60 days of the acceptance of the BLM Right-of-Way Grant and before construction begins, Pacific Connector would file an initial *Environmental Inspection, BMP and Construction Compliance Implementation Plan* with the federal land-managing agencies' Authorized Office for review and written approval in accordance with the POD stipulations. The Company would file revisions to the plan as schedules change. This plan would include the number of EIs per spread and training procedures to ensure non-compliance problems are identified in a timely manner.
		4.0 Post Construction Reporting	After restoration is completed and the pipeline is in-service, Pacific Connector would initiate monitoring and reporting to the federal land-managing agencies on a quarterly basis, and continue such activities until all disturbed areas have been successfully stabilized and restoration is complete.
I	Erosion Control and Revegetation Plan (excluding FERC Plans in Appendices A and B)	3.3.1 Preconstruction Survey	EIs would verify the limits of the staked construction areas.
		3.3.3 Clearing and Grading	The flagged limits of disturbance would be maintained throughout all construction phases and would be monitored by EIs so activities are restricted to certificated limits.
		3.3.4 Installation of Erosion Control BMPs	All erosion control devices would be routinely inspected and any damaged or temporarily removed structures would be replaced at the end of each working day.
		3.3.8 Welding and Coating Pipe	All welds would be visually and radiographically inspected and repaired, as necessary. Prior to the final installation, the entire pipeline coating would be inspected and tested to locate and repair any faults or voids.
		3.3.10 Hydrostatic Testing	Pacific Connector would follow the procedures outlined in the *Hydrostatic Testing Pla*n (see POD Appendix M) and POD Appendix BB, FERC's *Procedures,* to minimize potential effects from these activities (includes monitoring requirements).
		4.0 Best Management Practices	EIs would verify that turbid water does not reach a waters of the state and dewatering does not result in the deposition of sand, silt, and/or sediment. EIs would inspect and ensure the maintenance of temporary erosion control measures at least daily in areas of active construction or equipment operation, on a weekly basis in areas with no construction or equipment operation and within 24 hours of each 0.5 inch or greater rainfall. Inspections would be recorded and records maintained for review upon request.
		4.1.2 Sediment Barrier	The EI would inspect temporary erosion control structures at least on a daily basis in areas of active construction and equipment operation. In areas where active construction and equipment operation are not occurring, inspections would be made at least weekly. All structures would be inspected by the EI within 24 hours of 0.5 inch or greater of rainfall. The EI would be responsible for ensuring that ineffective temporary erosion control measures are repaired as soon as possible but no more than 24 hours after discovery. Whenever possible, the EI would inspect erosion control measures in advance of predicted storm events and take preventative measures to minimize the potential for off right-of-way sedimentation.
		4.1.5 Dust Control	The EI would direct watering along the right-of-way, as necessary and would determine if water needs to be sprayed to control dust during sweeping operations on paved roads.
		4.2.3 Soil Compaction	Pacific Connector would test for soil compaction in agricultural and residential areas and on Forest Service and BLM lands, as specified in FERC's *Plan*. The EI would also test for soil compaction on UCSAs on federal lands to determine appropriate measures necessary to mitigate compacted areas.
		5.0 Waterbody Crossings	Any equipment required to enter a waterbody would be inspected to ensure it is clean and free aquatic invasive species, noxious weeds, dirt or hydrocarbons.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
I		6.0 Wetland Crossings	Sediment barriers would be properly maintained throughout construction and until effective ground cover is reestablished.
		7.0 Maintenance and Periodic Evaluation	The EI would inspect temporary erosion control structures at least daily in areas of active construction. In areas where active construction is not occurring, inspections would be made at least weekly. All structures would be inspected by the EI within 24 hours of 0.5 inch or greater of rainfall or as required by state and local jurisdictions. Whenever possible, the EI would evaluate erosion control measures prior to a predicted storm event and implement measures needed to prevent off right-of-way sedimentation. Inspections would be documented and available for agency review upon request.
		8.3 Water Discharge	EIs would visually monitor the release of hydrostatic test water and trench dewatering activities to ensure that no erosion or sedimentation occurs and that turbid water is not discharged to waters of the state. If an EI determines that a discharge is occurring from trench dewatering, the receiving water would be visually monitored for turbidity. Additionally, if a discharge to surface water occurs, the dewatering operations will be immediately adjusted/reinstalled/maintained to ensure that discharge is stopped and water quality standards are not exceeded.
		10.0 Restoration and Revegetation	Pacific Connector would use a qualified specialist to test tiles for damage and to conduct any necessary repairs.
		10.12 Supplemental Wetland and Riparian Plantings	The transplanted root-pruned trees would be monitored annually according to FERC's *Procedures*. If the success rate drops below 80 percent a Forest Service authorized representative would be informed and a plan would be developed between the Forest Service and Pacific Connector to restock these sites.
		10.13 Supplemental Forest Plantings, Table 10.13-1	On BLM Districts (other than Lakeview) seedling growth/survival must be monitored the first fall following planting. Replant/interplant areas where tree stocking falls below minimal acceptable levels (300 trees per acre). On Forest Service land, monitor seedling growth/survival the first fall and third growing seasons following construction to ensure target stocking of 100-150 trees per acre. Replant/interplant areas where tree stocking falls below minimal acceptable levels in accordance with Oregon Department of Agriculture (ODA) requirements (ODA 629-610-00200).
		10.15 Mulch, Straw Mulch	Only certified weed-free straw and mulch would be used. However, if the certification program is not in place at the time of construction, or if there are not sufficient quantities of certified weed free straw available for the Project, Pacific Connector would request review/inspection of the straw by the local soil and water conservation district, county agent, or other appropriate official or authorized agency representative on federal lands.
		11.0 Steep and Rugged Terrain	During construction of the Project across rugged topography, Pacific Connector would be responsible for monitoring and maintaining right-of-way as necessary to ensure stability.
		12.0 Noxious Weeds, Soil Pests, and Forest Pathogens Control Plan	The ODA, BLM, and Forest Service have recommended that reconnaissance surveys be conducted along the pipeline route to determine the presence of noxious weeds and forest pathogens so that appropriate BMPs can be developed and applied prior to and during construction to prevent the introduction, establishment, or spread of noxious weeds and forest pathogens. Additionally, these agencies have recommended that construction equipment and vehicles be cleaned prior to moving them onto the construction right-of-way to prevent the import and spread of weeds and that vegetation clearing and grading equipment be cleaned if they pass through known noxious weed infestations. The ROW would be monitored after construction, and any noxious weed infestations would be controlled in accordance with permit and landowner stipulations.
		12.3 Equipment Inspection	Prior to transporting construction equipment to the right-of-way, allowing project inspector and construction contractor vehicles on the ROW, or allowing maintenance equipment on the right-of-way on federal lands, the EI or Company authorized representative would perform inspections and register or tag the equipment to ensure that it is clean and free of potential weed seed or propagules (using POD Appendix N, Appendix 4 checklist). The EIs would also be responsible for random verification inspections during construction. To ensure the equipment is thoroughly inspected, the EI or authorized representative would use the inspection checklist provided in POD Appendix N, Attachment D (Equipment Cleaning).

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
		12.4 Clearing and Grading	Infested areas and cleaning station locations would be mapped to ensure that they are monitored during construction (and on federal lands post construction). The infested areas and cleaning station locations would be mapped for future monitoring efforts to determine if potential infestations occur at these sites and, if they do, to ensure that appropriate treatments are applied.
		12.5 Weed-free Materials	If this certification process is not formalized at the time of construction, the straw can be inspected by the county extension agent or qualified conservation district personnel. Where straw is to be used on federal lands, the BLM's or Forest Service's authorized officer may also inspect and approve straw materials to verify that the straw is weed-free.
		12.6 Weed Control	The applicator would ensure that the herbicides are used according to the labeling restrictions and according to all applicable laws and restrictions and according to the appropriate land managing agency decision documents.
		12.9 Monitoring (Noxious Weeds and Pathogens)	Pacific Connector would implement three to five years of post-construction monitoring in areas of federal land where noxious weeds were identified and mapped prior to construction, as well as at equipment cleaning stations and hydrostatic dewatering sites. Monitoring would also occur in areas where rock, soil and straw was used on NFS Lands. Monitoring other areas of the right-of-way where noxious weeds were not known to occur prior to construction would occur as an ongoing function of Pacific Connector's operational personnel during the life of the Project. Pacific Connector's operational staff would also investigate noxious weed issues raised by landowners during operation of the pipeline.
		13.0 Maintenance	Pacific Connector would conduct follow-up inspections of all disturbed areas after the first and second growing seasons to determine revegetation success (in upland areas, if upon visual survey the density and cover of non-nuisance vegetation are similar in to adjacent undisturbed lands). If revegetation is not successful or there are excessive weeds, a professional agronomist shall determine the need for additional restoration measures. In wetland areas, revegetation would be considered successful if the cover of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution of the vegetation in adjacent undisturbed wetland areas. If revegetation is not successful at the end of three years, Pacific Connector would develop and implement (in consultation with a professional wetland ecologist) a remedial revegetation plan to actively revegetate the wetland and would continue revegetation efforts until wetland revegetation is successful. Pacific Connector would monitor crops for at least two years to determine the need for additional restoration and would monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in active agricultural areas until restoration is deemed successful.
J	Federally-listed Plant Conservation Plan	3.0 (of Conservation Plan) Mitigation Plans for Federally-listed Plants	Pacific Connector would conduct environmental surveys of the pipeline right-way and authorized work areas in areas not previously surveyed where suitable habitat is present prior to construction once survey permission is granted. If populations of federally listed threatened or endangered species are identified, the EI would, where feasible, monitor the survey and flagging of the construction right-of-way and temporary extra work areas to clearly mark the limits of construction disturbance (i.e., clearing/grading), and would provide additional protective buffers or neck-downs to ensure protection of adjacent plant populations or provide additional avoidance. As applicable (for bulb salvaging), the EI would also monitor topsoil salvaging efforts during construction. Planting (reseeding) areas would be mapped (GPS) for subsequent monitoring purposes.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
J		5.0 or 6.0 (of Mitigation Plans) Monitoring	Pacific Connector would monitor revegetation success in the areas of restored federally listed threatened or endangered species populations for three to five years after construction, depending on the species. Where applicable, this monitoring would also determine the need for additional monitoring. Monitoring would occur where salvaged plants are transplanted from nursery condition stock to assess the success of the transplanting efforts as well as where collected threatened or endangered species seed is replanted. Monitoring would also occur for noxious or invasive weed infestations within disturbed areas of the construction right-of-way that could hinder revegetation success and threatened or endangered species populations in the area, as well as on portions of the construction right-of-way that were formerly considered as suitable habitat and are returned to, and maintained as, suitable habitat through planting of associated compatible native species. An annual monitoring report would be submitted to FERC and FWS by the end of each monitoring year.
K	Fire Prevention and Suppression Plan	1.2.1 Agency and Pacific Connector Roles and Responsibilities	Pacific Connector would accompany agency representatives on fire tool and equipment inspections and take corrective action upon notification of any fire protection requirements that are not in compliance.
		3.2.1 FS IFPR	During fire season, all Pacific Connector contractors would have their fire equipment inspected by an authorized Forest Service representative prior to work on NFS lands. All fire equipment used on the Project would be inspected annually by an authorized Forest Service representative.
		3.2.13 Monitoring (Construction)	Pacific Connector inspectors would inspect the construction right-of-way and Contractor operations for compliance with all provisions of this plan. In addition, federal, state, and local fire control agencies may perform monitoring inspections in areas under their jurisdiction
		4.2.2 Communications (Emergency Coordination, Suppression)	Upon discovery or notification of a fire in the project area during construction, all aircraft pilots controlled by Pacific Connector or its Contractor would monitor VHF frequency 122.85 when within 5 miles of a fire and broadcast their intentions.
		4.3 Monitoring (Emergency Coordination)	Extinguished fire sites would be monitored for a minimum of 24 hours or as required by the appropriate agency.
L	Fish Salvage Plan	2.1 Fish Exclusion	Both upstream and downstream block nets would be monitored for accumulated litter and debris that would be removed during the entire waterbody construction operation.
		2.2 Dewatering and Fish Removal	During dewatering, the construction site would be monitored to prevent stranding organisms.
		2.3 Fish Handling, Holding and Release	Holding container temperature and well-being of specimens would be frequently monitored to assure that all specimens would be released unharmed.
M	Hydrostatic Test Plan	2.6 Dewatering	Where water is being discharged in an upland area, Pacific Connector's Contractor is responsible for taking water samples, if required, for analysis.
		3.0 Source Water	The targeted ramping rate would be managed such that there is no significant decrease of river flows.
		6.0 Test Failure	EIs would monitor the length of the test section if a failure occurs to ensure that water released does not create erosion or sedimentation into sensitive areas.
		7.2.5 Temperature and Flow Effects	Where water source locations are proposed to be withdrawn from waterbodies, Pacific Connector's EIs would monitor the streamflows prior to withdrawal to ensure that aquatic biota within the streams are not adversely affected.
		7.3 Water Discharge	Hydrostatic test water would not be allowed to discharge directly to wetlands or waterbodies. If an EI determines that a discharge to surface water is occurring the receiving water would be visually monitored for turbidity. Additionally, if a discharge to surface water occurs, the dewatering operations would be immediately adjusted/reinstalled/maintained to ensure that the discharge to surface water is stopped and water quality standards are not exceeded.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
			EIs would monitor discharge activities (rate, and quality) and make appropriate adjustments to facilitate proper infiltration through the discharge structures to stay in compliance with permit conditions. EIs would also monitor the structures to prevent any potential failures or "break outs" from occurring to the structure. Pacific Connector's EIs would ensure all structures meet the performance standard of 100 percent. Pacific Connector's EIs would also ensure that all threaded valves and fittings that may be used on the hydrostatic test headers are cleaned of potential incidental oil and grease before the hydrostatic operations are conducted to minimize the potential for oil and grease contact from these potential incidental sources. If an EI determines that a discharge to a surface water is occurring, the receiving water would be visually monitored for turbidity.
		8.0 Monitoring	For a period of three to five years following completion of construction, operations personnel would inspect the right-of-way in areas where noxious weeds were identified and mapped prior to construction to ensure that potential infestations do not reestablish and spread. Monitoring would also occur in areas along the right-of-way where equipment cleaning stations and hydrostatic dewatering sites were located to ensure that infestations at these locations do not occur (see also POD Appendix M, Section 7.2.4, pp. 15 and 17).
N	Integrated Pest Management Plan	1.0 Introduction	All disturbed areas of the construction right-of-way would be monitored after construction, and any noxious weed infestations would be controlled in accordance with permit and landowner stipulations.
		2.3 Equipment Inspection	Prior to transporting construction equipment to the right-of-way, allowing project inspector and construction contractor vehicles on the right-of-way, or allowing maintenance equipment on the right-of-way on federal lands, the EI or Company authorized representative would perform inspections and register or tag the equipment to ensure that it is clean and free of potential weed seed or propagules (POD Appendix N, Appendix 4 checklist). The EIs would also be responsible for random verification inspections during construction.
		2.4 Clearing and Grading	Infested areas and cleaning station locations would be mapped to ensure that they are monitored during construction. These areas would also be mapped on federal lands post construction.
		During dewatering, the construction site would be monitored to prevent stranding organisms.	After construction and restoration, Pacific Connector would monitor (three to five years) all disturbed areas of the construction right-of-way for infestation of noxious and invasive weeds. Special attention would be given to areas where noxious weeds were identified and mapped prior to construction, as well to equipment cleaning stations and hydrostatic dewatering sites. Where treatment is required, monitoring would occur for three years following eradication. Monitoring report and agency siting forms (POD Appendix N4, Appendix 5) would be submitted to the appropriate federal land-managing agency annually. Pacific Connector may enter into cost-recovery agreements with federal land-managing agencies to conduct/participate in related monitoring efforts. Monitoring of all disturbed areas of the construction right-of-way where noxious weeds were not known to occur prior to construction would occur as an ongoing function of Pacific Connector's operational personnel during the life of the project. Pacific Connector's operational staff would also investigate noxious weed issues raised by landowners and land-managing agencies during operation of the pipeline. When landowners raise noxious weed issues, operational staff would conduct a site assessment (see POD Appendix N, Appendix 5) and provide a proposed treatment plan (to the landowner or land-managing agency), if necessary.
		Appendix 3 Pesticide – Use Proposal (FSM 2150)	This and similar forms (for BLM) are to be used on federal land when pesticides are proposed for weed control. POD Appendix N, Appendix 5) – Item 9e would be used to describe any monitoring of the operation.
		Appendix 5 Weed Monitoring Report Form	Used for annual monitoring at specific identified locations.
O	Klamath Project Facilities Crossing Plan		No requirements except reference to other plans that include monitoring requirements.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
P	Leave Tree Protection Plan	4.0 Uncleared Storage Areas	Pacific Connector Els or Utility Inspectors would monitor the use of uncleared storage areas (USCAs) that are in a regenerating age class and which could be more susceptible to tree damage to ensure potential impacts from their use are minimized. Following completion of construction, Pacific Connector, BLM and Forest Service authorized representatives would assess tree damage (on their respective federal lands) within the UCSA's and other project areas for excessive live tree damage.
Q	Overburden and Excess Material Disposal Plan		No specific reference to monitoring.
R	Prescribed Burning Plan	3.1 Private Lands and BLM-Managed Lands	POD Appendix R, Item 4 is a specific reference to monitoring protocols for prescribed burning, which states: Before any prescribed burning is initiated burn bosses should have a well thought-out plan that takes into account "How weather would be monitored."
		Appendix H. Interagency Prescribed Fire Planning and Implementation Procedures Guide	Activity-specific Burn Plans are included as Appendix H to POD Appendix R (Prescribed Burning Plan). POD Appendix R references the Interagency Prescribed Fire Planning and Implementation Procedures Guide (USDA and USDI 2008). That document includes the following on monitoring on federal land: Fire Effects Monitor (FEMO): "The FEMO is responsible for collecting the onsite weather, fire behavior, and fire effects information needed to assess whether the fire is achieving established resource management objectives. The FEMO is responsible to: 1. Review the monitoring plan prior to implementation. 2. Monitor, obtain, and record weather data. 3. Monitor and record fire behavior data throughout the burn operations. 4. Recon the burn unit/area assigned. 5. Plot the burn area and perimeter on a map. 6. Monitor and record smoke management information. 7. Monitor first order fire effects. 8. Provide monitoring summary of the fire. 9. Provide fire behavior and weather information to burn personnel as appropriate." POD Appendix R, Element 20. Monitoring: "Prescribed fire monitoring is defined as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective. Describe the monitoring that will be required to ensure that Prescribed Fire Plan objectives are met. For the prescribed fire, at a minimum specify the weather (forecast and observed), fire behavior and fuels information and smoke dispersal monitoring required during all phases of the project and the procedures for acquiring it, including who and when."
S	Recreation Management Plan	3.0 Mitigation	After construction, pipeline monitoring would be conducted. Monitoring-related impacts to recreation would be minimized by (1): conducting inspections of pipeline sections on foot instead of by vehicle, where steep pipeline corridor sections are visible from nearby roads; and (2) conduct vehicle monitoring only during dry conditions.
		3.1 Specific Mitigation for Recreation Sites/Types	OHV Control and right-of-way access: Following construction, the effectiveness of the site-specific measures would be assessed in consultation with the land management agencies, on a periodic basis. Generally, these assessments would be made in conjunction with revegetation monitoring and in response to identified problem areas. Pacific Connector would be responsible for monitoring and managing unauthorized OHV use during the life of the Project. Brown Mountain Multi-Use Trails: Pacific Connector would engage in ongoing consultation and monitoring with local recreation groups and land managers during the construction phases and, if necessary, following construction to assess and modify the mitigation (i.e., OHV and snowmobile control measures).

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
T	ROW Clearing Plan for Federal Lands	2.1 Roles and Responsibilities	The BLM and Forest Service would be responsible for monitoring payment, log accountability, and trespass.
		2.1.1 Timber Cruise and Valuation	Pacific Connector would complete a check cruise on the cruises and appraisals completed by the BLM and Forest Service.
		2.1.3 Hazard Trees	FERC Compliance monitors in the field would review and approve as appropriate requests to remove hazard trees outside the approved construction area.
		2.2 Felling and Yarding	The BLM would be responsible for monitoring logging activities on BLM lands. The Forest Service would be responsible for monitoring logging activities on NFS lands.
		2.6 Best Management Practices	Each construction spread would have one lead EI and several assistant EIs to ensure compliance with federal, state, and local regulations and permit requirements.
		2.7 Timing Restrictions for ROW Clearing	Prior to timber clearing, Pacific Connector would have (1) experienced MAMU biologists survey both the occupied and unoccupied suitable habitat stands in which habitat would be modified by Pacific Connector construction and mark trees that currently have nest platforms or potential for nests, and (2) experienced NSO biologists survey known and potential NSO nest sites to determine occupied nesting activity so that appropriate seasonal timing restrictions could be applied during Year 1 timber clearing activities.
U	ROW Marking Plan	3.9 Permanent Marking	Pipeline markers would be maintained by replacing damaged line markers during pipeline patrols and surveys, which shall be at intervals of at least once each calendar year, but not to exceed 15 months.
V	Safety and Security Plan	2.1 Pacific Connector (Responsibilities)	Pacific Connector would observe and monitor Contractor's practices and procedures and would inform the Contractor of violations to the aforementioned regulations. Pacific Connector's Inspection Staff would also be trained to identify and report security issues to the Federal, State, and local law enforcement agencies. The construction right-of-way would be closed to the general public and monitored by Pacific Connector on a regular basis during all construction activities. After the pipeline has been put in service, Pacific Connector would conduct routine inspections of the operation and maintenance corridor (aerial fly overs, on the ground visits, etc.) to identify and correct any security or safety concerns. All visitors, workers, or monitors to the project site during construction shall be required to attend safety training.
		2.4 Construction Inspectors (Responsibilities)	It is the Construction Inspectors' responsibility to be an attentive, willing and proactive monitor, and observer of the Contractor's work practices and to record, report and if necessary halt all seemingly unsafe work practices.
		3.8 Damaged Pipe	Any dents, gouges, scratches or other similar defects would be brought to the attention of Pacific Connector's EIs as soon as they are detected.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
W	Sanitation and Waste Management Plan	3.1 Pacific Connector (Responsibilities)	Pacific Connector would be responsible for: • Ensuring that all company and Contractor management personnel understand and follow the sanitation and waste management requirements for the Project. • Ensuring that all wastes generated during the project are properly characterized/classified. • Ensuring that all waste and spills are handled in a manner consistent with the health and safety standards set by federal, state, and local waste regulations, and the Project's waste management requirements (see POD Appendix X, SPCC Plan).
		6.0 Trash, Food Wastes, and Other Construction Debris	Pacific Connector's EIs and Utility Inspectors would ensure that these daily "house-keeping" measures are being conducted.
		9.0 Hazardous Wastes	Pacific Connector's EI(s) would inspect these storage areas on a weekly basis to ensure that the waste materials are properly packaged, labeled, and stored according to federal, state, and local regulations. Pacific Connector would ensure that the Contractor(s) disposes of all hazardous waste materials in approved facilities according to applicable federal, state, and local hazardous waste regulations and the SPPC Plan. Pacific Connector would also ensure that the Contractor(s) transports all waste materials with the proper shipping papers, placards, labels, and manifests, as required by transportation regulations.
X	SPCC Plan	IV.A.3. Leaks in hoses or fittings on equipment.	a. The contractor would visually inspect all equipment for leaks and repair all leaks prior to moving the equipment onto the construction ROW.
		IV.A.5. Fuel storage tanks and hazardous materials containers 55-gallons or greater.	b. Prior to their use, the contractor would visually inspect each tank for cracks, excessive corrosion, or other flaws which may compromise the integrity of the tank. Hoses and valves would be similarly inspected. c. The contractor would inspect the integrity of all dikes and the liner at least daily and repair the dikes or replace the liner immediately if they become breached or torn.
		IV.B.1. Material locations:	Each work site would have on hand and maintain emergency response equipment. While construction activities are ongoing, all such equipment would be inspected daily for operability and accessibility.
		V.F Spill Response	Pacific Connector's Environmental Representative would conduct clean-up inspection if required.
		VI.4 Cleanup and Disposal of Spills	If necessary, the EI may require the contractor to collect samples of soil strata below the spill to assure that all contaminated soils have been removed from the site.
		VI.4 Cleanup and Disposal of Spills	All materials used to clean up the spill would be double bagged and inspected prior to removal from the spill site.
		VII. Response to Hydrostatic Test Failure	On federal lands, all hydrostatic test failure sites resulting in any breach shall be reviewed by a federal inspector in conjunction with EI.
Y	Transportation Management Plan	1.0 Introduction	A final TMP would be submitted by Pacific Connector to the Agencies for approval prior to issuance of the Grant. It includes a plan for monitoring roads and bridges.
		2.2.2 Straightening, Widening, Cut and Fill, Culverts and Bridges	Pacific Connector would be responsible for all expenses incurred in the use of existing roads and provide funding to reimburse the federal land managing agency for expenses incurred by the agency in required design reviews, monitoring, and approvals during project planning and construction. Pacific Connector's Contractors would conduct an assessment of major culverts crossed by Pacific Connector access roads to determine those that may require modifications or replacement for necessary equipment access.
		2.3 Wet Weather Access	To minimize the potential for both road-related and off-road resource damage, Pacific Connector would perform road surfacing structural capacity assessments and place additional road surfacing (aggregate or bituminous) as needed for the planned use. All work necessary to place the roads in a useable condition for wet weather traffic would be completed prior to use and monitored during use.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
		2.4 Controlling Off-Highway Vehicle Use and the ROW	Pacific Connector would be responsible to monitor and control unauthorized OHV use during the life of the Grant and would implement additional measures as necessary to control OHV access.
		3.0 Transportation Management Practices	Such (noxious weed control) measures include requirements for equipment cleaning and inspections and the use of noxious weed free materials.
Z	Unanticipated Discovery Plan	2.0 Training	Training would occur as part of the preconstruction on-site training program for foremen, EIs, construction supervisors, and all other supervisory personnel who supervise any construction or inspection activities.
		3.0 Procedures for the Inadvertent Discovery of Human Skeletal Materials, Item # 8	If an avoidance technique is possible, construction shall resume and would be monitored by a professional archaeologist and the appropriate Tribe(s) if they request to do so.
		4.0 Procedures for the Inadvertent Discovery of Archaeological Materials, Item # 5	(a) If such a technique is possible, construction shall resume and would be monitored by a professional archaeologist and the appropriate Tribe(s) if they request to do so.
AA	Upper Rock Creek ACEC	Page 2, paragraph 2	To further minimize potential impacts to the ACEC and to ensure that effects to the values of the ACEC are avoided, the following construction and restoration measures would be implemented: • Prior to construction, Pacific Connector would survey and clearly mark the limits of the construction ROW, TEWAs, and USCAs to ensure all project disturbance is minimized and confined to the certificated working limits. • Pacific Connector would monitor restoration efforts after construction to ensure erosion control and revegetation efforts are successful and to treat any noxious weed infestation if necessary.
BB	Wetland and Waterbody Crossing Plan	2.0 Waterbody Crossings (page 14, last paragraph)	Any equipment required to enter a waterbody would be inspected to ensure it is clean and free of dirt or hydrocarbons.
		5.0 Monitoring	Consistent with FERC's *Procedures*, monitoring of restored wetlands would be conducted by a qualified biologist during the growing season annually for a minimum of three years following construction. Information on plant survival, percent vegetative cover, as well as hydrologic conditions would be collected. Vegetation cover would be estimated (ocular) within a 2.5-meter radius that is representative of the site. All species would be listed by stratum and percent cover for each species. Hydrologic indicators and conditions (i.e., water marks or drift lines, sediment deposits, evidence of ponding, etc.) would be visually monitored to determine if wetland hydrology has been reestablished. Photographs would be taken to support the monitoring efforts. Wetland revegetation shall be considered successful if the cover of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution of the vegetation in adjacent undisturbed wetlands. If performance standards are not met in three years, additional monitoring and mitigation may be required (e.g., replanting, soil amendments, selection of alternative species, etc.). Annual reports would be prepared and submitted to the COE, ODSL, and the federal land managing agency by December 31.
		Attachments 2 / 3 1.0 Purpose of Flumed/Dam and Pump Stream Crossings	Flumes/dams require monitoring and occasional repair during the crossing period to ensure the integrity of the structure(s).
		4.0 Material Required to Install and Maintain a Flumed Stream Crossing	Before the flume pipe is installed in the stream, it would be inspected to assure that it is free of grease, oil or other pollutants. In addition, excessive dirt would be removed from the flume pipe. If oil or grease is present on the flume pipe, it would be steam-cleaned before the flume pipe is placed in the stream.
		6.0/5.0 Installation of the Flume Pipe/Dams	Turbidity sampling would be conducted during all flumed/dam and pump crossings in accordance with the Stormwater Pollution Prevention Plan.

TABLE 2.5.2-1

Monitoring Requirements Associated with Pacific Connector's Plan of Development

Appendix	Appendix Title	Appendix Section	Monitoring Requirement
CC	Wetland and Waterbody Crossing Plan	7.0/6.0 Maintenance of the Flume/Dam and Pumps During Construction	Flumed/dam-and-pump crossings require constant monitoring and occasional repair during the crossing process. While the flume/dam and pumps are in place, the contractor would provide a sufficient crew that would be responsible for maintaining the flume/dam and pump crossing.
		13.0/11.0 Dewatering the Construction Area	If the water level in the construction area exceeds the upstream or downstream level of the dams, the environmental inspectors would notice small amounts of turbid water escaping into the stream either upstream or downstream of the dams. The contractor would carefully inspect each pump prior to its delivery to the crossing site. In particular, any frayed hoses or apparent leaks would be repaired before the pumps are delivered to the crossing site. Pump heads and the hoses would be cleaned of any free hydraulic oil prior to placing the pump heads into the stream.
		14.0/13.0 Backfilling the Ditch	The contractor must carefully monitor the effectiveness of the pumps and control the rate of backfill to preclude bleeding through the downstream dam.

2.6 OPERATION AND MAINTENANCE PROCEDURES

2.6.1 LNG Terminal Facilities

Jordan Cove would operate and maintain its facilities in compliance with 49 CFR 193, 33 CFR 127, and other applicable federal and state regulations. Before commencing operation of the LNG terminal, Jordan Cove would prepare and submit for approval operation and maintenance manuals that address specific procedures for the safe operation and maintenance of the LNG storage and processing facilities. Jordan Cove would also prepare an operations manual that addresses specific procedures for the safe operation of the ship unloading facilities in accordance with 33 CFR 127.305. Operating procedures would address normal operations as well as safe startup, shutdown, and emergency conditions.

All operations and maintenance personnel at the terminal would be trained to properly and safely perform their jobs. The terminal operators would be trained in the potential hazards associated with LNG, cryogenic operations, and the proper operations of all the equipment. Jordan Cove states that the operators would meet all the training requirements of the Coast Guard, DOT, ODOE, Oregon State Fire Marshall, Coos Bay, Coos County Fire Department, and other regulatory entities. The SORSC would provide on-site resources and assets, including a Sherriff's office and fire department.

The LNG terminal and related facilities would be staffed with about 145 full-time employees working three shifts, so there would be coverage 24 hours a day, 365 days a year. The terminal's full-time staff would conduct routine maintenance and minor overhauls. Major overhauls and other major maintenance would be handled by bringing in maintenance personnel specifically trained to perform the maintenance. All scheduled and unscheduled maintenance would be entered into a computerized maintenance management system.

2.6.2 Pipeline and Associated Aboveground Facilities

Pacific Connector would test, operate, and maintain the proposed facilities in accordance with DOT regulations provided in 49 CFR Part 192; FERC's guidance at 18 CFR 380.15; rules and regulations promulgated by PHMSA; and maintenance provisions of FERC's *Plan* and *Procedures* (including modifications). The pipeline right-of-way would be clearly marked where it crosses public roads, waterbodies, fenced property lines, and other locations as necessary. All pipeline facilities would be marked and identified in accordance with applicable regulations.

The aboveground facilities would be inspected for the life of the pipeline at intervals that meet DOT requirements. Pipeline personnel would perform routine checks of the facilities, including calibration of equipment and instrumentation, inspection of critical components, and scheduled and routine maintenance of equipment. Safety equipment, such as pressure-relief devices, fire detection and suppression systems, and gas detection systems, would be tested for proper operation. Corrective actions would be taken for any identified problem. Vegetation at aboveground facilities would be periodically maintained using mowing, cutting, trimming and the selective use of herbicides.

To facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide would be maintained in an herbaceous state, with no vegetation greater than 6 feet in

height. Trees that are located within 15 feet of the pipeline and that are greater than 15 feet in height would be cut and removed from the right-of-way. Vegetation within the permanent easement would be periodically maintained by mowing, cutting, and trimming (either by mechanical or hand methods). Maintenance activities are expected to occur approximately every three to five years depending on the growth rate. During maintenance, trimmed or cut vegetation would be across the operational easement to naturally decompose and to discourage OHV traffic. Occasionally, where site conditions allow, chipping of this material may also occur. Herbicides would not be used in or within 100 feet of a waterbody's mean high water mark. Vegetation at aboveground facilities would be periodically maintained using mowing, cutting, trimming, and herbicides (selectively).

Pacific Connector would employ a permanent staff of five employees. These permanent operational employees would be stationed and reside at different locations along the pipeline route, but would report to a main office in Eugene, Oregon. In addition, the pipeline and aboveground facilities would be monitored all the time using Pacific Connector's gas control communication system and radio towers reporting back to a command center at the Williams' office in Salt Lake City, Utah.

2.7 FUTURE PLANS AND ABANDONMENT

Jordan Cove has no current plans that would result in the future expansion of its proposed LNG export terminal. Jordan Cove has, however, retained the capability within the proposed design to add the equipment necessary for import of LNG should natural gas market conditions change in the future. In order to either expand the LNG terminal or convert it into an import facility, Jordan Cove would have to file a new and separate application with the FERC, and the proposal outlined in the application would be considered a new undertaking. That new, separate application would be subject to an independent environmental review by the FERC staff, with appropriate input from stakeholders, and the Commission would have to issue a new, separate Order providing authorization if it found the proposal acceptable. That Order may contain new and different environmental conditions.

Jordan Cove does not anticipate abandonment of the proposed LNG export terminal facility in the foreseeable future (more than 30 years). If at some point Jordan Cove did propose to abandon the LNG terminal, it would seek authorization from the FERC to do so. This would involve filing a new and separate application for abandonment under section 7b of the NGA. The FERC staff would then conduct a new environmental review, including input from stakeholders. Again, after the environment review is completed, the Commission would consider whether or not to grant abandonment through the issuance of a new Order.

In its June 10, 2014, MOU with the ODE, Jordan Cove committed to providing a retirement cost estimate and funding surety that is consistent with the EFSC Retirement and Financial Assurance Standard at OAR Chapter 345 Divisions 21 and 22. The MOU stipulates that Jordan Cove would do the following:

- before beginning construction of the LNG terminal, Jordan Cove would submit to the ODE a detailed engineering estimate of the cost to retire and restore the facility;
- before beginning construction, Jordan Cove would post with the ODE a bond or letter of credit to cover the amount in the estimate to retire the facility;

- two years prior to closure of the LNG terminal and the associated power plant, Jordan Cove would develop a final retirement plan, in consultation with Coos County, to be approved by the ODE; and
- Jordan Cove would retire the facility in a nonhazardous condition, so that the land could be restored to future productive use.

At this time, Pacific Connector has no foreseeable plans for future expansion of the facilities. The present design allows for significant future expansion by installation of additional compression only.

In the future, if Pacific Connector proposed to abandon the pipeline facilities, a new separate application would be made to the FERC, under Section 7(b) of the NGA. The application must contain a statement providing in detail the reasons for the abandonment and the impact to customers whose service would be terminated. The application would include an environmental report as specified by 18 CFR § 380.3(c)(2). The FERC staff would conduct an environmental review, including input from stakeholders, before the Commission would consider authorizing abandonment in an Order.

The federal land-managing agencies would need to evaluate any proposed abandonment under the terms of the Right-of-Way Grant. The BLM must consider the final disposition of the pipeline facilities in accordance with 43 CFR 2886, and would require Pacific Connector to address termination and restoration issues in its final POD.

3.0 ALTERNATIVES

To adhere to the CEQ regulations for complying with the NEPA (at 40 CFR Part 1502.14), the EIS must evaluate reasonable alternatives. This EIS compares the environmental impacts of the proposed action against a range of alternatives.

Each of the cooperating agencies with obligations under NEPA can use this alternatives analysis as part of their decision making process. Individual agencies would ensure consistency with their own administrative procedures prior to accepting the recommendations in this EIS.

In accordance with the NEPA and Commission policy, we have evaluated a number of alternatives to the JCE & PCGP Project to determine if any are reasonable and environmentally preferable to Jordan Cove's and Pacific Connector's proposed action. Alternatives considered, which are described in more detail below, include the No Action Alternative, system alternatives, LNG terminal alternatives, pipeline route alternatives, and aboveground facilities alternatives.

Alternatives were evaluated against the purpose and objectives of the JCE & PCGP Project, as described in section 1.3 of this EIS. Jordan Cove's primary objective is to construct and operate a West Coast terminal that can export up to 6 MMTPA of LNG to overseas markets. Pacific Connector's primary objective is to transport at least 0.9 Bcf/d of natural gas to the Jordan Cove terminal, from western Canadian and Rocky Mountain sources received at the Malin hub. In addition, Pacific Connector could service customers in southern Oregon through an interconnection with Northwest's existing Grants Pass Lateral.

The FERC's evaluation criteria for selecting alternatives include whether they:

- are technically and economically feasible, reasonable, and practical;
- offer a significant environmental advantage over the proposed action; and
- have the ability to meet the objectives of the Project.

With respect to the first criterion, it is important to recognize that not all conceivable alternatives are technically and economically feasible and practical. Some alternatives may be impracticable because they are unavailable and/or incapable of being implemented after taking into consideration costs, existing technologies, and the overall Project purpose. In assessing route alternatives, the pipeline must be buildable and safe.

For pipeline route alternatives, in most cases we used desktop data for comparisons, including USGS topographic quadrangle maps, aerial photography, NWI maps, site file searches, and literature reviews. However, in some cases, where a previously proposed route is now an alternative, Pacific Connector may have conducted on-the-ground environmental surveys. We requested additional surveys for the Blue Ridge Alternative (see section 3.4.2.2) due to comments received on the DEIS. While the raw data were collected by the applicants, the FERC staff and cooperating agencies performed the alternatives analyses, which included validation of data supplied by the applicants.

The narrative below explains why a particular alternative was found to be environmentally preferable. In conducting a reasonable analysis, we considered environmental advantages and disadvantages, and focused the assessment on those alternatives that may minimize impacts on specific resources. In general, shorter is better. One mile of a 95-foot-wide corridor would impact about 12 acres. Other elements that may influence the selection of an alternative route included the avoidance of historic properties or habitat for federally-listed threatened or

endangered species, reduction of crossings of waterbodies or wetlands, minimization of impacts to LSRs and Riparian Reserves, avoidance of geological hazards, distances from residences, and lessening of forest clearing, or impacts on agricultural land and specialty crops. In some cases, there were tradeoffs between environmental resources identified during analyses of route alternatives, as minimization of impacts on one suite of resources had to be compared to increased impacts on a different set of resources.

We considered a range of alternatives in light of the Project's objectives, feasibility, and environmental consequences. Each alternative is considered until it is clear that the alternative would not satisfy one or more of the evaluation criteria.

3.1 NO ACTION ALTERNATIVE

3.1.1 Federal Energy Regulatory Commission's No Action Alternative

If the Commission denies the application or the applicants choose to not construct the Project (the No Action Alternative), the objectives of the proposed Project would not be met and the resource impacts disclosed in this EIS would not occur. However, the selection of the No Action Alternative could result in the use or expansion of other existing or proposed LNG facilities and associated interstate natural gas pipeline systems, or the construction of new infrastructure to meet the objectives of this proposed Project (i.e., to make natural gas available for export to Asian as well as Hawaiian and Alaskan markets). In section 3.2 below, we examine natural gas and LNG system alternatives. Any expansion of existing systems or construction of new facilities would result in specific environmental impacts that could be less than, similar to, or greater than those associated with the proposed Project.

3.1.2 Federal Land Management Agencies' No Action Alternative

The BLM and Forest Service alternatives are specific to agency actions as they pertain to the FERC's proposed route and the No Action Alternative. The No Action Alternative is the same for each of the affected BLM Districts and National Forests with respect to amendment of LMPs. Under the No Action Alternative, the RMPs of the Coos Bay, Roseburg, Medford, and Klamath Falls Resource Area of the Lakeview District and the LRMPs of the Rogue River, Umpqua, and Winema National Forests would not be amended to make provision for the Project. Under the No Action Alternative, the Forest Service would not consent to the BLM to grant an easement since construction of the Project would not be consistent with the National Forest LRMPs. The BLM would not issue a Right-of-Way Grant for the Project because the Project would not be a conforming use of federal land. Under the No Action Alternative, there would be no need for Reclamation to concur with BLM with respect to issuance of a Right-of-Way Grant.

Because the application for a Right-of-Way Grant for the Project involves lands managed by two or more federal agencies, the BLM is the lead agency for issuance of the Right-of-Way Grant for occupancy of federal lands under the provisions of the FLPMA. BLM may not issue the grant until the designated federal officials administering the federal lands involved have concurred with issuance. Where concurrence is not reached, the Secretary of the Interior, after consultation with these agencies, may issue the grant, but not through lands within a federal reservation where doing so would be inconsistent with the purposes of the reservation (43 CFR 2884.26). Under the No Action Alternative, the Secretary of the Interior could issue the Right-of-Way Grant without the concurrence of the BLM, Forest Service, and Reclamation if the Secretary determined the Project was not inconsistent with the purposes of the reservations.

3.1.3 U.S. Army Corps of Engineers' No Action Alternative

There are three scenarios that the COE would consider under the No Action Alternative. The first would be that no COE permit would be necessary under the RHA and Section 404 of the CWA because no wetlands or waters of the U.S. would be crossed or affected. Under the second scenario, other alternatives would be adopted so that impacts on aquatic resources would be avoided, as in the case where the pipeline route would be entirely moved to upland locations. The third scenario would be that the Project would not be authorized or would not be built or operated.

3.1.4 Renewable Energy Alternatives

Commenters[1] have suggested that the Project could be replaced by renewable energy resources alternatives. Renewable energy resources include, but are not limited to, wind power, solar power, tidal power, and hydropower. All of these alternatives represent alternative means of producing electrical power. Because the Project's purpose is to prepare natural gas for export to overseas markets, the development or use of renewable energy technology domestically would not be a reasonable alternative to the proposed action.

3.2 SYSTEM ALTERNATIVES

System alternatives could make use of other existing or proposed pipelines and LNG facilities to meet the objectives of the proposed Project. We reviewed system alternatives to evaluate the ability of other existing, modified, approved, planned, or proposed facilities to meet the stated objectives of the project and to determine if a system alternative exists that would have less significant adverse environmental impacts than those associated with the project.[2] The status identified for each system alternative (e.g., planned, proposed, or approved) is current as of the time this EIS is written, and is subject to change over time. Our analyses of system alternatives for the proposed pipeline and LNG facilities are presented in sections 3.2.1 and 3.2.2, respectively. By definition, implementation of a system alternative would make construction of all or some of the proposed facilities unnecessary; conversely, infrastructure additions or other modifications to the system alternative may be required to increase capacity or provide receipt and delivery capability consistent with that of the proposed facilities. Such modifications may result in environmental impacts that are less than, comparable to, or greater than those associated with construction and operation of the proposed facilities.

3.2.1 Pipeline System Alternatives

Existing pipeline system alternatives would involve the use of all or portions of other natural gas transmission systems in lieu of construction of the proposed Pacific Connector pipeline. Existing natural gas pipelines in southwestern Oregon include jurisdictional interstate transportation systems operated by Northwest, GTN, and Ruby, and the non-jurisdictional intrastate Coos County Pipeline. These existing pipelines are illustrated on figure 3.2-1, and are further discussed below. As the narrative discussion below explains, we did not find any existing pipeline systems that could replace the proposed Pacific Connector pipeline, and did not identify any existing systems that could be considered reasonable, feasible, or practicable alternatives to the proposed Project, and none that could achieve the Project objectives with significantly fewer environmental impacts.

[1] See, for example, the October 30, 2012, filing in this proceeding by Citizens Against LNG.
[2] Proposed projects are projects for which the proponent has submitted a formal application to the FERC; planned projects are projects that are either in pre-filing or have been announced, but have not been proposed.

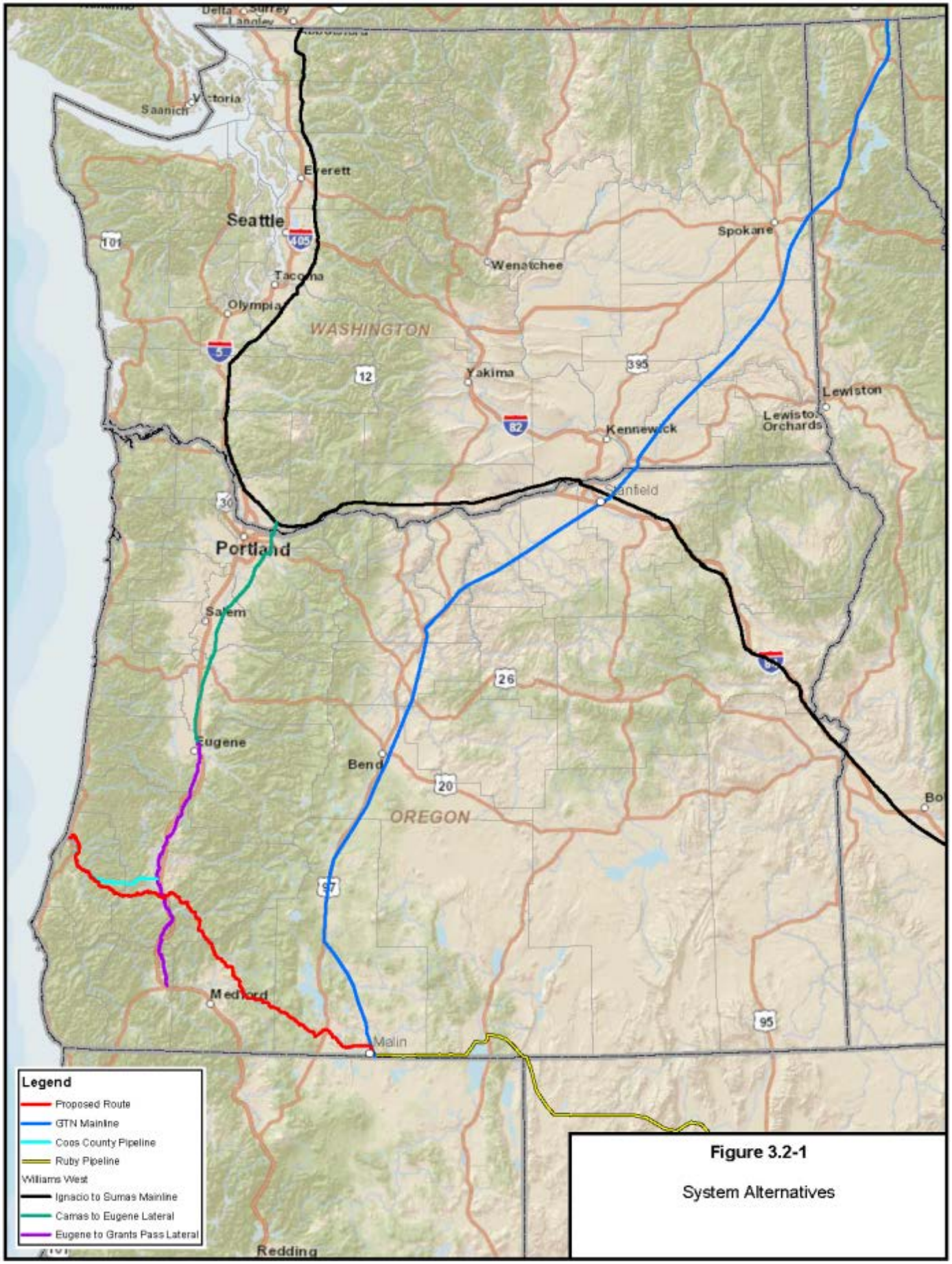


Figure 3.2-1

System Alternatives

Northwest is a 3,900-mile-long bi-directional transmission system crossing the states of Washington, Oregon, Idaho, Wyoming, Utah, and Colorado. This system provides access to British Columbia, Alberta, Rocky Mountain, and San Juan Basin natural gas supplies. The Northwest system has a peak design capacity of 3.4 Bcf/d (Williams Northwest Pipeline 2008). Northwest's Grants Pass Lateral extends from Eugene to Grants Pass, Oregon, roughly parallel to the route of I-5. The lateral includes 131 miles of 16-inch and 10-inch-diameter pipelines. Pacific Connector indicated that Northwest's Grants Pass Lateral does not have the capacity to deliver the volumes necessary to meet its Project objectives. Nor does the Grants Pass Lateral traverse from near the Malin hub, where available volumes of western Canadian and Rocky Mountain natural gas supplies could be accessed. Therefore, the Grants Pass Lateral does not have the ability to meet the objectives of the Project and we have not evaluated it any further in our analysis of pipeline system alternatives. However, we have examined the route of the Grants Pass Lateral as a partial pipeline route alternative in section 3.4.1 of this EIS.

The GTN system includes 612 miles of pipeline beginning at Kingsgate, British Columbia, traversing through northern Idaho, southeastern Washington, and central Oregon, and terminating near Malin, Oregon (where it interconnects with Tuscarora and PG&E lines). Natural gas for the GTN pipeline originates primarily from western Canadian supplies; although it can receive Rocky Mountain gas through interconnections with Northwest near Spokane and Palouse, Washington and Stanfield, Oregon. The GTN system can transport about 2.9 Bcf/d (GTN 2008).

The Ruby pipeline was constructed by the El Paso subsidiary of Kinder Morgan, Inc., extending about 680 miles from near Opal, Wyoming, to Malin, Oregon. The 42-inch-diameter pipeline, placed into service in July 2011, has a capacity of about 1.5 Bcf/d at an operating pressure of 1,440 psig. The purpose of the pipeline is to transport Rocky Mountain gas to markets in southern Oregon, northern Nevada, and northern California. At Malin, Ruby interconnects with Tuscarora and PG&E. It was reported in September 2013 that deliveries from Ruby were down to an average of 684 million cubic feet per day (MMcf/d).

Neither GTN nor Ruby can meet the proposed Pacific Connector pipeline objectives. Both GTN and Ruby terminate at Malin. The purpose of Pacific Connector is to extend a pipeline between Malin and Coos Bay to the Jordan Cove terminal. Any expansions of the GTN or Ruby pipelines to Coos Bay would have similar environmental impacts to the Pacific Connector pipeline.

There is an existing non-jurisdictional 12-inch-diameter pipeline that extends some 60 miles, over the Coast Range, from the Northwest Grants Pass lateral, near Roseburg, to Coos Bay. This pipeline was constructed by Coos County and is operated by Northwest Natural as a local distribution company (LDC). The Coos County Pipeline has a MAOP of 1,000 psig and was designed to bring gas to the communities around Coos Bay. The terminus of the Coos County Pipeline is approximately 7.7 miles south of the proposed Jordan Cove LNG terminal. Northwest Natural built a line from the terminus of the Coos County pipeline across Coos Bay to the North Spit, as part of its LDC system. LDCs are intrastate systems that are regulated by the state, and do not come under the jurisdiction of the FERC.

It is possible that the Coos County Pipeline could be converted into a jurisdictional facility, and used as a system alternative to the proposed Pacific Connector pipeline, assuming the necessary modifications were made to the Coos County Pipeline to allow gas flow to the Jordan Cove LNG

terminal from Northwest's Grants Pass Lateral. However, the maximum gas flow through the Coos County Pipeline would be a very small fraction of the capacity required for the proposed Jordan Cove LNG terminal. At a normal operating pressure of 600 psig on Northwest's Grants Pass Lateral, the maximum volume of natural gas that can be transported on the Coos County Pipeline to the city of Coos Bay and on the Northwest Natural pipeline to the North Spit is 0.018 Bcf/d at a delivery pressure of 554 psig. At an operating pressure of 800 psig on Northwest's Grants Pass Lateral, the maximum volume of natural gas that can be transported on the Coos County Pipeline to the city of Coos Bay and on Northwest Natural's pipeline to the North Spit is 0.036 Bcf/d at a delivery pressure of 680 psig. Because the diameter and available capacity of the Coos County Pipeline are too small, it could not meet the objectives of the Project.

3.2.2 LNG System Alternatives

For an LNG system alternative to be viable, it must be technically and economically feasible, as well as offer a significant environmental advantage over the proposed project. In the case of the Jordan Cove Project, it must also be compatible with Jordan Cove's contractual agreements for LNG export. Jordan Cove is proposing to export LNG to FTA and non-FTA countries. The volume of gas for FTA and non-FTA countries has already been approved by the DOE (and therefore is determined to be in the public interest). The other approved, planned, or proposed LNG export facilities have also either obtained or applied for DOE approval for the export of LNG associated with the production capacity in the respective project plans/proposals. Therefore, for Jordan Cove's customers to obtain LNG from other facilities that have DOE approval for export, those facilities would need to construct additional liquefaction facilities to meet the export capacity proposed by Jordan Cove, and as approved by the DOE authorizations. We recognize that liquefaction capacity may not be fully subscribed at all facilities based on contracts executed as of the writing of this EIS. However, because the DOE's export approval is a determination that the export is in the public interest, we will not speculate that any portion of other LNG terminals' liquefaction capacity is in "excess" or available for use by Jordan Cove to meet its project objectives.

An expansion of existing facilities would need a similar scope of pre-treatment and liquefaction facilities and possibly additional storage and marine transfer facilities, while any new facility would need a similar scope of pre-treatment, liquefaction, storage, and marine transfer facilities. These additional facilities would result in environmental impacts that are less than, equal to, or greater than the environmental impacts of the proposed facility and may not provide a significant environmental advantage over the proposed project. Each of the planned, proposed, or authorized projects described in sections 3.2.2.1 to 3.2.2.4 was considered as a potential system alternative (see section 4.13 for additional information on project locations). Our analysis was predicated on the assumption that each project has an equal chance of being constructed and would therefore be available as a potential alternative. However, future Commission review and market forces would ultimately decide which and how many of these facilities are built.

3.2.2.1 LNG Terminals on the U.S. Gulf and East Coasts

There are nine existing on-shore FERC-jurisdictional LNG import terminals on the East Coast and Gulf Coast of the United States.[3] The FERC has approved the conversion of five of the existing terminals to export LNG (Cheniere Sabine Pass [Docket No. CP11-72-000], Sabine Pass Liquefaction [in Docket No. CP13-552-000], and Cameron-Hackberry [Docket Nos. CP13-25-000 and CP13-27-000] in Louisiana; Freeport LNG Development on Quintana Island [Docket Nos. CP12-29-00 and CP12-509-000] in Texas; and Dominion Cove Point in Maryland [Docket No. CP13-113-000]), and authorized a new LNG export terminal in Corpus Christi, Texas (Cheniere in Docket No. CP12-507-000). There are four formal applications currently under review by the FERC for LNG export terminals along the Gulf Coast or East Coast (Golden Pass-Sabine Pass [Docket No. CP14-517-000] in Texas; Trunkline-Lake Charles (CP14-120-000) and Magnola-Lake Charles (CP14-347-000) in Louisiana; and Elba Island in Georgia (CP14-103-000).[4] As of April 2015, there were 10 newly proposed LNG export terminals currently under review through the FERC's pre-filing process along the Eastern and Gulf Coasts (Downeast LNG [PF14-19-000] in Maine;Eagle LNG [PF15-7-000] in Jacksonville, Florida; CE FLNG [PF13-11-000], Louisiana LNG [PF14-17-000], and Venture Global [PF15-2-000] in Louisiana; Gulf LNG [PF13-4-000] in Mississippi; and Port Arthur LNG [PF15-18-000], Texas LNG-Brownsville [PF15-14-000], Annova LNG-Brownsville [PF15-15-000], and Rio Grande LNG-Brownsville [PF15-20-000] in Texas).

As stated above, each of these planned, proposed, or authorized projects on the U.S. Gulf and East Coasts was considered as a potential system alternative. An expansion of existing facilities would need a similar scope of pre-treatment and liquefaction facilities and possibly additional storage and marine transfer facilities, while any new facility would need a similar scope of pre-treatment, liquefaction, storage, and marine transfer facilities. These additional facilities would result in environmental impacts that are less than, equal to, or greater than the environmental impacts of the proposed facility and may not provide a significant environmental advantage over the proposed project. Our analysis was predicated on the assumption that each project has an equal chance of being constructed and would therefore be available as a potential alternative. However, future Commission review and market forces would ultimately decide which and how many of these facilities are built.

3.2.2.2 Existing LNG Terminals on the West Coast of North America

Alaska

There is only one existing onshore LNG export terminal on the West Coast of North America: the plant located on the Kenai Peninsula Borough, Alaska. This facility was constructed in 1969 and lately was being operated by ConocoPhillips Natural Gas Corporation and Marathon Oil Company to export LNG primarily to Japanese markets. However, it was recently shuttered, due to declining natural gas reserves and wellhead deliverability in the Cook Inlet region.

[3] The existing LNG import terminals on the East Coast and Gulf Coast of the United States are: Everett, Massachusetts; Cove Point, Maryland; Elba Island, Georgia; Pascagoula, Mississippi; Sabine , Louisiana; Cameron, Louisiana; Lake Charles, Louisiana; Sabine Pass, Texas; and Freeport, Texas.

[4] Golden Pass-Sabine Pass, Trunkline-Lake Charles and Elba Island are existing LNG import terminals, while Excelerate-Lavaca, and Magnola-Lake Charles would be new facilities.

Because the export authorization for Kenai expired on March 31, 2013, ConocoPhillips recently submitted two applications to the DOE. One was for a blanket (two-year) authorization to export LNG to FTA nations. This was approved in DOE/FE Order No. 3392 on February 19, 2014. The second application was for a blanket (two-year) authorization to export LNG to non-FTA nations. This was approved in DOE/FE Order No. 3418 on April 14, 2014.

Mexico

There are two existing LNG import terminals on the West Coast of Mexico. One is known as Costa Azul LNG, located about 14 miles north of Ensenada, Baja Mexico. Owned by Sempra Energy, this import terminal started operations in May 2008. It has the capacity to send out about 1 Bcf/d of natural gas, intended to supply customers in northwest Mexico.

The other LNG import terminal on the West Coast of Mexico is farther south, at the port of Manzanillo. This terminal, jointly owned by Samsung C&T, Mitsui Trading, and Korea Gas, went into operation in 2012, and has the capacity to take in 3 million tons of LNG per year.

Sempra Energy has recently entered into an MOU with Pemex, the Mexican government owned oil and gas company, to develop a natural gas liquefaction project at the existing Costa Azul terminal. It may be possible to liquefy 2.5 Bcf/d at Costa Azul for export. However, the natural gas would come from Mexican sources developed by Pemex.

As stated above, each of the existing projects on the U.S. West Coast was considered as a potential system alternative. An expansion of existing facilities would need a similar scope of pre-treatment and liquefaction facilities and possibly additional storage and marine transfer facilities, and these additional facilities would result in environmental impacts that are less than, equal to, or greater than the environmental impacts of the proposed facility and may not provide a significant environmental advantage over the proposed project.

3.2.2.3 Existing LNG Storage Facilities in the Pacific Northwest

Four LNG storage facilities currently exist in the Pacific Northwest. These are peak shaving plants that liquefy natural gas, store it as LNG, and then vaporize the LNG back into natural gas for use during periods of peak demand.

In Oregon, Northwest Natural owns and operates two peak shaving LNG storage plants. One is located in Portland, and has a 28,000 m^3 tank with a storage capacity of 600 MMcf/d. The other is located in Newport and has a 48,000 m^3 tank and a storage capacity of 1.0 Bcf/d. In Washington, Northwest owns and operates a peak shaving LNG storage plant in Plymouth with a liquefaction capacity of 19.7 MMcf/d, a storage capacity of 60,000 m^3, and a vaporization capacity of 300 MMcf/d. In Gig Harbor, Washington, Puget Sound Energy (PSE) operates a small LNG peak shaving plant with a capacity of 31 Bcf, and a maximum withdrawal rate of 3 Bcf/d.

We considered the possibility of converting one of the existing peak shaving LNG storage plants into an LNG export terminal as a system alternative to the proposed Project. The Northwest Plymouth, Washington peak shaving plant is located on the Columbia River, but is upriver of several dams, and so it would not be accessible to LNG vessels. The PSE peak shaving plant at Gig Harbor, Washington is located about 1 mile from the harbor and would not be accessible to LNG vessels. While it may be feasible to construct a pipeline to transmit LNG from the harbor to the PSE peak shaving facility, such a pipeline would have additional associated environmental

impacts. The Northwest Natural Portland, Oregon peak shaving plant is located on the Willamette River and would potentially be accessible to LNG vessels. However, the waterway for LNG marine transit would be over 100 miles long and the navigation channel is obstructed by a bridge at Ross Island that only has clearances of 120 feet high and 100 feet wide. The Northwest Natural Newport, Oregon, peak shaving plant is on the coast; however, the port of Newport is relatively small, with channel depths ranging from 20 to 30 feet. The port at Newport could not accommodate LNG vessels without extensive dredging. Therefore, we conclude that converting any of the existing peak shaving LNG storage plants in the Pacific Northwest into LNG export terminals would not provide a significant environmental advantage to the proposed Project.

3.2.2.4 Proposed West Coast LNG Export Terminals

There are current proposals to construct LNG export terminals in British Columbia, Canada, and Alaska and Oregon in the United States. These other alternative LNG export proposals are in various stages of planning and review, as discussed below.

Proposed LNG Export Terminals in Oregon

There is one other proposed LNG terminal in Oregon, near Warrenton, in Clatsop County. On October 10, 2008, LNG Development Company LLC and the Oregon Pipeline Company (hereafter referred to together as Oregon LNG), filed applications with the FERC under Docket Nos. CP09-6-000 and CP09-7-000. In July 2012, Oregon LNG re-initiated the FERC's pre-filing environmental review process in Docket No. PF12-18-000, to modify its pending LNG terminal to a bi-directional facility that would also be capable of exporting LNG, with a revised pipeline route. At the same time, a companion proposal was submitted by Northwest for its Washington Expansion Project (WEP) in Docket No. PF12-20-000, to supply natural gas to the Oregon LNG terminal. On June 7, 2013, Oregon LNG filed formal applications with the FERC in Docket Nos. CP09-6-001 and CP09-7-001 for its proposed import/export terminal and its associated pipeline to connect to the Northwest system. On June 25, 2013, Northwest filed its formal application with the FERC in Docket No. CP13-507-000 for its WEP.

On May 31, 2012, Oregon LNG received DOE approval to export up to 9.6 MMTPA of LNG (equivalent of 1.3 Bcf/d of natural gas) to FTA nations in FE Docket No. 12-48-LNG. Oregon LNG received permission from DOE to export LNG to non-FTA nations on July 31, 2014, in FE Docket No. 12-77-LNG.

The Oregon LNG terminal would be located on the East Skipanon Peninsula, at about Columbia River Mile 11.5. Oregon LNG's proposed marine facilities would include a 135-acre turning basin in the Columbia River. The associated berth would be designed to handle one LNG vessel at a time, located in water now about 30 feet deep at MLLW. Oregon LNG anticipates that its terminal would be visited by about 125 LNG vessels per year. The turning basin and berth would have to be dredged to a maximum of -48 feet MLLW, requiring the removal of about 1.2 mcy of material. Oregon LNG proposes to dispose of the dredged material at the EPA Deepwater Site about 9 nautical miles southwest the mouth of the Columbia River. The berth would be connected to the onshore facilities via a 2,128-foot-long trestle, including a roadway and an LNG transfer pipeline.

Onshore, the LNG terminal facilities would occupy 74 acres within a 96-acre tract controlled by Oregon LNG. The terminal facilities would include a feed gas pretreatment plant, two liquefaction trains capable of producing 4.5 MTPY of LNG each, and two 160,000 m^3 LNG storage tanks. The terminal would also have a vaporization system consisting of shell and tube heat exchangers, with a natural gas sendout capacity of 0.5 Bcf/d.

Oregon LNG would install a new 36-inch-diameter 86.8-mile-long natural gas bidirectional pipeline to connect the LNG terminal with the Northwest system near Woodland, Washington. The proposed pipeline would have a capacity of 1.25 Bcf/d of natural gas. The route would cross through Clatsop, Tillamook, and Columbia Counties, Oregon, and Cowlitz County, Washington, with about 11 percent (9.9 miles) following existing right-of-ways for roads, railroads, and powerlines. Aboveground facilities would include a meter station at the LNG terminal, another at the interconnection with Northwest, and a single 48,000 hp electric-drive gas compressor station within a 19-acre tract at about MP 80.9.

Northwest proposes to construct and operate about 141 miles of 36-inch-diameter pipeline looping for its WEP. The loops would be divided into 10 segments, adjacent to Northwest's existing pipeline system between Sumas and Woodland, Washington, and would cross portions of Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Lewis, and Cowlitz Counties. In addition, Northwest would modify five existing compressor stations (Sumas, Mt. Vernon, Snohomish, Sumner, and Chehalis) to add a total of 96,000 hp. A new meter station would be installed at the Sumas Compressor Station, and new MLVs and launchers and receivers would be put in at 35 locations. The WEP could provide about 750,000 dekatherms per day in incremental transportation capacity on Northwest's system between Sumas and Woodland.

On August 5, 2015, the FERC issued a draft EIS for the Oregon LNG Project and the Northwest WEP. It does not appear that the Oregon LNG Project and Northwest WEP would have significant environmental advantages over the JCE & PCGP Project. Construction of the Oregon LNG terminal would affect about 1,427 acres, while construction of the associated pipeline and related facilities would impact about 1,198 acres. Construction of the WEP would disturb about 2,052 acres. Like the JCE & PCGP Project, both the Oregon LNG Project and the WEP are located in the vicinity of the Cascadia Subduction Zone (CSZ), and the pipeline routes on steep slopes may be susceptible to landslides, so geological hazards would require mitigation. The Oregon LNG pipeline would cross 184 waterbodies, and 340 wetlands totaling 387 acres. The WEP would cross 271 waterbodies, and construction would affect about 177 acres of wetlands. Construction of the Oregon LNG terminal would remove about 25 acres of forest, while construction of the associated pipeline would clear about 930 acres of forest. Construction of the WEP would affect about 349 acres of forest. The Oregon LNG Project may affect 38 federally listed threatened or endangered species, including 8 marine mammals, 4 sea turtles, 16 fish species, 4 birds, 1 upland mammal, 1 upland invertebrate, and 3 upland plant species. The WEP may affect 18 federally listed threatened or endangered species, including 4 fish species, 1 amphibian, 4 birds, 2 mammals, and 4 plant species. Along the route of the Oregon LNG pipeline, 6 archaeological sites were identified, while along the WEP facilities 16 previously recorded sites and 5 newly recorded sites were identified.

Proposed LNG Export Terminals in British Columbia, Canada

Limited information is available regarding 19 LNG export projects being considered in British Columbia (table 3.2.2.4-1).

TABLE 3.2.2.4-1.

Canadian Projects Under Consideration

Project	Terminal Location	Gas Source	Permit Status	Output (Bcf/d)
Douglas Channel LNG Project	Douglas Island (barge based), near Kitimat, B.C.	Western Canada	Approved	0.95
Cedar LNG Project	Near Kitimat, B.C.	Western Canada	Under Review	1.85
LNG Canada Project	Port Edward, Prince Rupert Island, B.C.	Western Canada	Starting Process	1.54
Pacific Northwest LNG Project	Lelu Island, near Kitimat, B.C.	Western Canada	Starting Process	0.95
Kitimat LNG Project	Kitimat, B.C.	Western Canada	Approved	0.70
Prince Rupert LNG Project	Ridley Island, near Prince Rupert, B.C.	Western Canada	Under Review	2.69
WCC Ltd.	Tsimshian Peninsula, near Prince Rupert, B.C.	Western Canada	Under Review	3.84
Aurora LNG Project	Digby Island, near Prince Rupert, B.C.	Western Canada	Under Review	3.07
Woodside Energy LNG	Grassy Point, near Prince Rupert, B.C.	Western Canada	Under Review	2.56
NewTimes Energy Ltd.	Prince Rupert area, B.C.	Western Canada	Under Review	1.54
Orca LNG Project	Prince Rupert area, B.C.	Western Canada	Under Review	3.07
WesPac LNG Project	Fraser River, near Vancouver, B.C.	Western Canada	Under Review	0.38
Steelhead LNG Project	Sarita Bay, Vancouver Island, B.C.	Western Canada	Under Review	3.07
Woodfibre LNG Project	Near Squamish, B.C.	Western Canada	Under Review	0.27
Canada Stewart Energy Project	Stewart, B.C.	Western Canada	Under Review	3.84
Discovery LNG Project	Campbell River, Vancouver Island, B.C.	Western Canada	Preliminary Stage	2.56
Kitsault Energy Project	Kitsault, B.C.	Western Canada	Preliminary Stage	2.56
Triton LNG Project	Floating facility – TBD near Kitimat or Prince Rupert, B.C.	Western Canada	Preliminary Stage	0.29
Watson Island LNG	Watson Island, near Prince Rupert, B.C.	Western Canada	Unknown	Unknown

Like the Jordan Cove Project, the proposed British Columbia LNG export terminals would be located on the Pacific Coast of North America, and could potentially serve markets in Asia, as well as customers in Hawaii and Alaska. The main source of the natural gas for the British Columbia terminals would be from the Canadian province of Alberta. There are unresolved environmental, construction-related, and monetary issues regarding building new pipelines over the Canadian Rockies from the gas-producing regions in the interior to the terminals located on the coast. In addition, there are regulatory and First Nation issues that are unique to Canada. The timeframe for obtaining permits and constructing facilities so that the British Columbia LNG export terminals could operate is still unclear.

Proposed LNG Export Terminals in Alaska

Alaska LNG

On September 5, 2014, Alaska LNG filed an application with the FERC to begin the environmental and safety review needed for federal authorization to build their project (PF14-21-000). The project sponsors are North Slope producers ExxonMobil, ConocoPhillips, and BP, as well as pipeline company TransCanada and the State of Alaska. The project includes a facility to

cleanse produced gas of carbon dioxide and other impurities; an approximately 800-mile pipeline from Alaska's North Slope to the liquefaction plant; and an LNG plant, storage, and shipping terminal at Nikiski, 60 air miles southwest of Anchorage along Cook Inlet.

The 42-inch-diameter pipeline would be built to carry 3.0 to 3.5 Bcf/d of natural gas. Alaskans would use some of this gas, and running the pipeline and LNG plant would consume some. The plant would have the capacity to make up to 20 MMTPA of LNG, processing 2.5 Bcf/d of gas. The pre-front-end engineering design (FEED) is expected to be completed in late 2015 or 2016.

The Alaska LNG Project is still in FERC's pre-filing review. A formal application has not yet been filed with the FERC. Nor has the FERC produced a draft EIS for that project, so we do not know all of the environmental impacts associated with the construction and operation of that project. The Alaska pipeline would be about 570 miles longer than the Pacific Connector pipeline.

Alaska Gasline Port Authority LNG Project

In July 2012, the Alaska Gasline Port Authority (AGPA) filed for DOE approval to export approximately 2.5 Bcf/d of LNG to FTA nations. The AGPA is proposing to develop liquefaction facilities and an export terminal in Port Valdez, Alaska. The exact location of this export facility is unknown at this time; however, the AGPA's preferred site for the facility would be in Anderson Bay. The source of the gas for this export facility would be Prudhoe Bay and Point Thomson fields in Alaska's North Slope. Per an information request by the DOE, AGPA has stated that "a process was in place for construction of a pipeline to deliver gas to Port Valdez." Following AGPA's response to the DOE information request, DOE found that AGPA's FTA application was deficient and therefore was dismissed without prejudice on March 7, 2013. AGPA may re-file at a future time; however, no application has been submitted to date.

Lacking a current application, the AGPA inherently cannot meet all of the objectives of the proposed Jordan Cove LNG Project and therefore is not a reasonable alternative.

3.3 LNG TERMINAL ALTERNATIVES AT COOS BAY

The Project applicant selects the location of its facilities. The FERC then conducts an environmental review of that location, and compares the proposed facilities against other identified feasible and reasonable alternatives to determine if any alternative may be environmentally preferable.

3.3.1 Regional Review of Potential Ports on the Continental West Coast

An alternative port location along the West Coast of the continental United States could meet one of the primary goals of the Jordan Cove Project. However, that alternative terminal location must also be able to receive natural gas from Canadian and Rocky Mountain sources in order to meet one of the other goals of the Project.

Section 3.3 of the FERC's May 2009 FEIS for the import proposal in Docket No. CP07-444-000 explained how Jordan Cove selected the Coos Bay location for its LNG terminal. Jordan Cove's alternative analysis of other West Coast ports was provided in Resource Report 10 (section 10.3.4) of its May 2013 application to the FERC for its current liquefaction project in Docket No. CP13-483-000, and repeated in a filing with the FERC on May 26, 2015, addressing

questions raised by the COE in response to its Section 10 RHA and Section 404 CWA permit application. The selection process is briefly summarized below.

Jordan Cove started by examining seven ports in California, 15 in Oregon, and 17 in Washington. The company then identified ports on the continental West Coast of the United States with deep enough channels for LNG vessels. Jordan Cove indicated that it needed a minimum channel depth of -36 feet MLLW to allow vessels as large as 148,000 m^3 in capacity to reach its terminal. This reduced the potential ports to two in California (Sacramento and Humboldt), six in Oregon (Portland, St. Helens, Port Westward, Wauna, Astoria, and Coos Bay), and seven in Washington (Port Angeles, Port Townsend, Grays Harbor, Aberdeen, Skamokawa, Longview, Kalama, and Vancouver). The next set of criteria included high population densities, and transit restrictions. This brought the pool of potential ports down to five candidates (Gray Harbor, Port Westward, Wauna, Astoria, and Coos Bay).

Lastly, Jordan Cove used a scoring system that resulted in the selection of Coos Bay as the most desirable port. The scoring system included such factors as distance of transit, impacts on existing port users, availability of large enough parcel, and zoning. Port Westward is located about 54 miles up the Columbia River and Wauna is about 40 miles upriver. Another LNG project is proposed near Astoria (Oregon LNG at Warrenton, discussed above in section 3.2.2.4). The site at Gray Harbor would be less than a mile from a general aviation airport (Bowerman Field).

At Coos Bay, Oregon, Jordan Cove found a deep-water port that could accommodate the draft of LNG vessels. The transit for LNG vessels within the waterway would be relatively short: 7.5 miles along the navigation channel to the terminal. There are no obstructions along the waterway. There has been declining commercial shipping at the Port of Coos Bay over the last 20 years, so there would not be significant conflicts with other Port users, and the Port is taking an active role in encouraging the location of an LNG terminal. There are no residences within 1 mile of the proposed terminal. The Jordan Cove property is currently open land zoned for industrial development, and is large enough to accommodate all proposed facilities and the surrounding vapor hazard zone. After reviewing these data, the FERC was unable to identify any other alternative port location on the Northwest Pacific Coast that could meet the objectives of the Jordan Cove Project and that would have significant environmental advantages over Coos Bay.

3.3.2 Coos Bay Terminal Alternatives

3.3.2.1 Sites on the North Spit

Within Coos Bay, Jordan Cove originally looked at four tracts of industrial land on the North Spit as potential LNG terminal locations (figure 3.3-1). No sites were considered by Jordan Cove north of these four areas because the existing railroad bridge across Haynes Inlet would be a constraint to LNG vessels. Jordan Cove's criteria included that the tract be 200 acres in size or larger, and be zoned for industrial use. The sites considered by Jordan Cove as potential locations for its terminal include the following:

Parcel A – Southport Forest Products

This parcel, comprising less than 100 acres, was eliminated from further consideration by Jordan Cove because of its limited size.

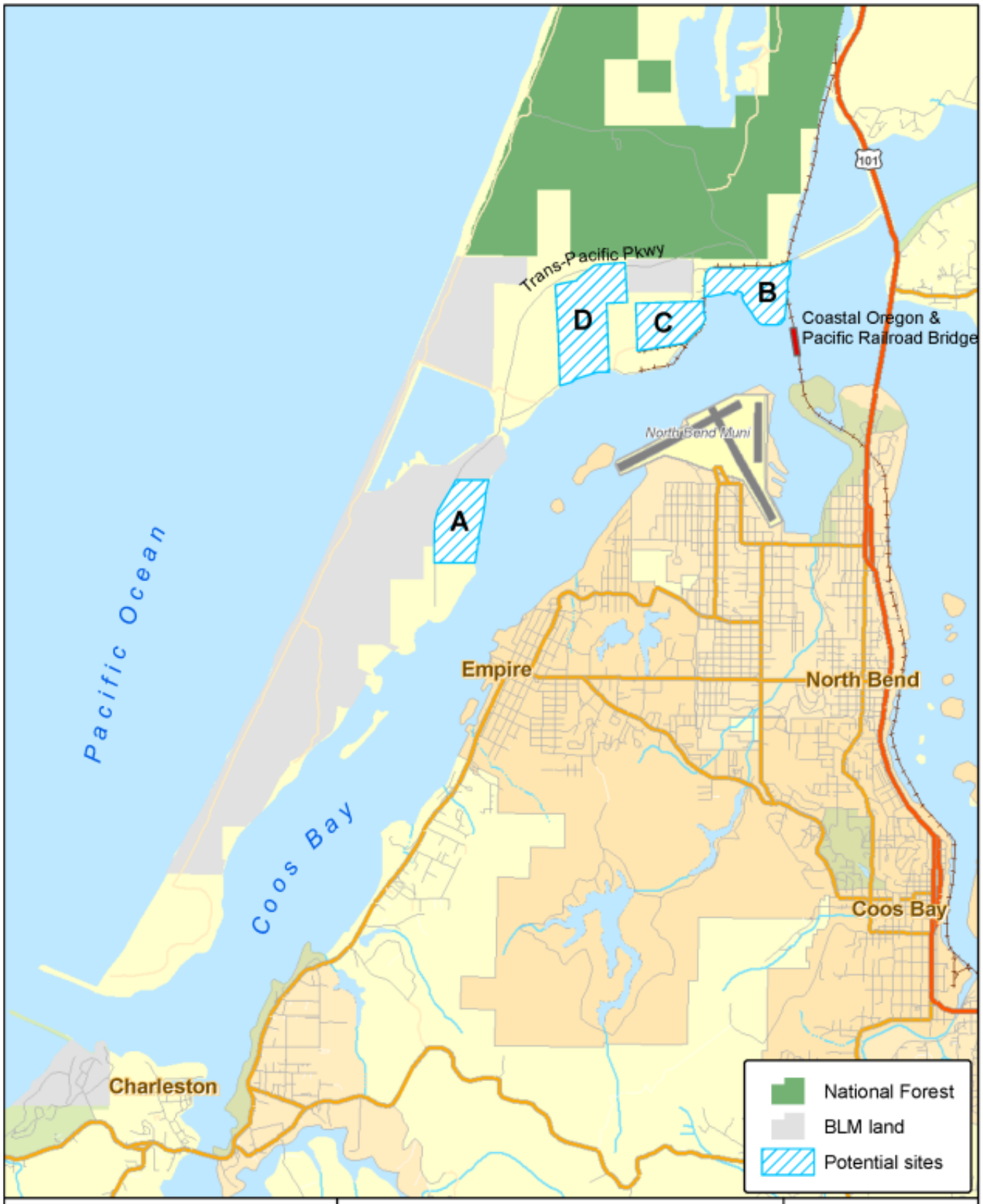


Figure 3.3-1
Potential Coos Bay
Area Project Sites

0 0.3 0.6 1.2 mi
1:60,000
source: ESRI, Oregon DAS
map by R. Carlisle Haworth

Parcel B – Former Weyerhaeuser Linerboard Mill

This parcel was once part of the historic Jordan Ranch, dating back to the 1860s. Between 1961 and 2003, it was the site of a mill operated by Menasha and then Weyerhaeuser, which has since been removed. This site is too close to the railroad bridge over Coos Bay at NCM 9 to allow for the creation of an access channel and berth to handle LNG vessels. However, Jordan Cove has acquired this parcel from Weyerhaeuser, and intends to construct and operate its non-jurisdictional South Dunes Power Plant at this location, together with associated facilities and its gas processing plant.

Parcel C – Roseburg Forest Products

The Roseburg Forest Products site is not large enough to accommodate two 160,000 m^3 full containment LNG storage tanks, while maintaining thermal and vapor exclusion zones within the site property and conforming to the property set-back requirements established under National Fire Protection Association (NFPA) 59A. Jordan Cove would locate temporary construction work areas, and a haul road, within the Roseburg tract.

Parcel D – Henderson Ranch/Ingram Yard

Parcel D is Jordan Cove's proposed terminal location. Historically, this tract was part of the Henderson Ranch dating to the 1860s, and is located immediately to the west of the Roseburg property. When this parcel was owned by Weyerhaeuser, it was known as the Ingram Yard and used to store logs for the linerboard mill. During the 1970s, the COE deposited materials dredged from the Coos Bay navigation channel at this site. This parcel was recently purchased by Jordan Cove, and was selected as the site of its liquefaction processing plant and LNG export terminal. The parcel is large enough to contain the proposed marine slip, LNG storage tanks, liquefaction trains, and any vapor released from facilities within property Jordan Cove owns or controls.

Other Coos Bay Potential Sites

D.B. Western has a manufacturing plant located on the North Spit of Coos Bay below the Southport property at NCM 5.6, about 2 miles southwest of the proposed Jordan Cove LNG terminal site. This tract is just south of Parcel A, which is shown on figure 3.3-2. D.B. Western is currently negotiating with potential clients regarding the possibility of serving as a coal depot and overseas shipping terminal. Previously, this concept was pursued by the Port, but its partners dropped out in April 2013. The idea was to transport coal from Montana and Wyoming via railroad to Coos Bay, where it would be stored and then shipped overseas to markets in Asia. D.B. Western has indicated that if it could reach an agreement with the Port and the COE to deepen and widen the Coos Bay navigation channel and build a new access channel and slip for coal ships at its North Spit plant site, it would willing to include a berth for LNG vessels.[5]

As an alternative to its current proposal, Jordan Cove could relocate its LNG export terminal to the D.B. Western property and an adjacent Port tract. The Port owns a parcel of at least 68 acres to the northeast of the D.B. Western plant that Jordan Cove originally sought to use to store materials dredged from Coos Bay during creation of the access channel for its LNG import

[5] The Port's proposed coal depot was discussed in Jeff Barnard, April 1, 2013, "Coos Bay Coal Port's Last Partner Drops Out of Proposal," *Huffington Post*. D.B. Western's plans to revive the coal depot were provided to staff by personal communication on September 20, 2013, with Dennis Beetham, CEO of D.B. Western, Inc.

terminal proposal in Docket No. CP07-444-000. The Port Commercial Sand Stockpile Site was eliminated from the currently proposed LNG export terminal in Docket No. CP13-4830-000, because now Jordan Cove intends to place materials dredged during creation of the access channel to raise the elevation at the site of its South Dunes Power Plant. The Port refers to its currently undeveloped property at NCM 5.7 on the North Spit as the North Bay Marine Industrial Park. We eliminated the D.B. Western and North Bay Marine Industrial Park from further consideration as an alternative site for the LNG terminal because even combined these two tracts are probably not large enough to contain all of Jordan Cove's proposed facilities, including a multi-user slip, storage tanks, liquefaction trains, electric plant, and gas treatment plant.

3.3.2.2 Alternative Marine Slip Design

The COE suggested that we examine the possibility of a smaller marine slip at the Jordan Cove terminal. The COE believes that the size of the marine slip could be reduced because the Coast Guard's WSA and LOR limited the size of LNG vessels calling on the Jordan Cove terminal to not larger than 148,000 m^3 in capacity. The Coast Guard determined that the 800-foot slip width would be needed in order to be able to move an LNG vessel off of the LNG berth on the east side of the slip in the event of an incident within the LNG upland facilities that might threaten the safety of the LNG vessel at berth. Having the 800-foot slip width provides the flexibility needed for tugs to move the LNG vessel away from a potential hazard at the terminal or at the LNG loading dock to the relative safety of the west side of the slip. Therefore, Jordan Cove is currently proposing a single-use slip and access channel that solely supports LNG operations (Memo from Jordan Cove dated February 23, 2015 and filed with the FERC on February 25, 2015).

3.3.2.3 LNG Storage Tank Design Alternatives

Commenters recommended that the LNG storage tanks should be reduced in height, or placed underground, for greater safety, and to reduce their visual impacts. Lower tank heights would be less of an obstruction to aircraft landing or taking off from the Southwest Oregon Regional Airport, where the end of the runways are located about 1.1 miles from the Jordan Cove terminal LNG storage tank locations.

In a filing on August 3, 2015, Jordan Cove explained why it could not lower the height of the proposed LNG storage tanks, or use three smaller tanks instead of two larger ones. The required 320,000 m^3 in total LNG storage capacity necessary for the economic viability of the Project established the tank aspect ratio (height/diameter). The tank diameter was set by the maximum acceptable radiation isopleth that can be contained within the Jordan Cove property lines. If a shorter tank were to be used, it would need to be of a greater diameter in order to hold the required 160,000 m^3 of LNG per tank. However, increasing the diameter of an LNG tank would enlarge the radiation isopleth to extend beyond the Jordan Cove property boundary. In order to meet DOT requirements, the extent of vapor modeled must be contained within land owned or controlled by Jordan Cove (see section 4.13). Increasing the number of LNG storage tanks from two to three creates the same radiation problem due to requirements for tank spacing and the limitations of real estate owned or controlled by Jordan Cove. The two 160,000 m^3 LNG storage tanks have been designed to fit within the long and narrow Ingram Yard terminal site.

While burying tanks is an established technique in many parts of the world, local soils and geologic conditions determine the feasibility of such an approach at the Jordan Cove terminal. In the case of the Ingram Yard tract, the geotechnical investigation, performed to identify surface

and subsurface soils conditions, indicated that the water table is about 10 feet below the existing ground surface. With the thickness of the tank foundation slab established at approximately 5 feet, any burying of the tank below the present design configuration would cause the foundation to be below the water table. This raises serious engineering and environmental problems. The groundwater would need to be continually pumped from the subsurface area in the vicinity of the LNG tanks to avoid the potential for contact with the underground tank heat coils, resulting in potential disruptions to groundwater flow, as well as, an additional water discharge from the Project. The high heat transfer coefficient of water would result in an excessive amount of power being used to energize the heat coils. The mobility of the water would greatly exacerbate this problem because as the water was warmed it would flow away from the coils due to the natural groundwater migration pattern in this area. The warmed water would then be replaced by cold water resulting in still greater power consumption requirements. Therefore, we do not find that burying the tanks would offer significant environmental advantage over Jordan Cove's currently proposed design.

3.3.2.4 SORSC Alternatives

The SORSC building would house the Jordan Cove Fire Station, the Jordan Cove Security Center, and the Fire Training Center. Each of the above functions is important to the daily function of the LNG complex. The COE requested an analysis of alternative locations for the SORSC in uplands, because the currently proposed location would impact about 0.6 acre of Palustrine Forested wetlands. In response to an April 10, 2105, data request from the FERC, on May 1, 2015, Jordan Cove filed information on three potential locations (A, B, C) where the SORSC could be sited. The site needs to be on the North Spit and within or near the Jordan Cove terminal for the following reasons:

- The SORSC has to be in relatively close proximity to a potential incident in order to comply with State of Oregon standards for response to industrial fire incidents. Existing emergency response facilities are all too far away with professional firefighters staffing that only the Cities of Coos Bay and North Bend fire departments provide. Jordan Cove conducted many meetings with local emergency response personnel, and it became clear that finding a location that would meet emergency response time requirements could only be achieved by siting the SORSC on the North Spit.
- The North Spit location for the SORSC also needs to be both on the west side of the existing north-south mainline of the CBRL railroad tracks and to the south of the North Spit rail spur that services the Southport Lumber mill. This requirement is necessary to ensure that access between the SORSC and the LNG terminal would not be compromised by a train blocking road crossings. The local agencies pointed out to Jordan Cove that a passing train could block access for ambulance, fire, and law enforcement personnel.
- The SORSC needed to be located so that it did not interfere with the existing Roseburg wood chip facility use of the railroad. Roseburg currently brings a number of trains into their property via a rail spur that comes off the main line, which moves north and south. If the SORSC were located elsewhere, emergency services could be blocked as with the main line.
- The site needed to be able to meet the State of Oregon fire response criteria for having equipment and personnel on scene of an incident in four minutes. The SORSC needed to

be close but not too close to the LNG facility. The criteria were established using NFPA standards for industrial facilities.

- Although local and state of Oregon emergency response personnel identified a need to have the SORSC close to the LNG terminal they deemed it essential that there be a separation of these two facilities; preferably by one of the major sand dunes. The North Spit area is partitioned by a number of north-south oriented sand dunes that are separated by deflation plains. With these tree-covered sand dunes running to an elevation of over 150 feet in many places, having a sand dune provide a buffer between the SORSC and the LNG terminal was considered to be an important characteristic.
- The SORSC site needed to be located where access to the LNG terminal would not be disrupted in the event of a tsunami. The Jordan Cove facilities are being specially prepared to meet the tsunami standards with every major area accessible even in the event of a design earthquake and resultant tsunami. This means that all areas of the SORSC, LNG terminal, and connecting corridors between the two must be at an elevation and of a structural integrity to survive a tsunami and maintain functionality.
- The SORSC building would house the Jordan Cove security system and must be located adjacent to or within the secured perimeter of the LNG terminal. This proximity allows security personnel to properly respond to any potential security breach. The primary security watch is within the SORSC building and having it within the security boundaries is critical to establishing and maintaining successful facility perimeter security.
- The location of SORSC should allow emergency personnel to access both the LNG terminal and the power plant facilities at the elevated level and clear of the tsunami inundation zone. With the site being elevated, having the Jordan Cove emergency resources elsewhere would leave them open to tsunami destruction and therefore unavailable. The selected location places them at approximately the same elevation and directly accessible to the crossroad.
- The lower land elevation in surrounding areas would have made it necessary for filling of these locations to elevate from the tsunami inundation and to allow for emergency vehicles to travel to the elevated Jordan Cove site.
- The need for an elevated site to be above tsunami inundation also enhances the interoperable communications managed from the SORSC. Jordan Cove is required to ensure interoperable communications with local emergency agencies and for communications around the facility. This would require UHF, VHF, and cellular signals. The elevated area provides the radio signals better capability to operate within the facility

Based upon the above criteria, only three potential sites for the SORSC were identified as being potentially suitable. The locations of these three potential sites are shown in figure 3.3-2. An alternatives analysis based on the criteria requested by the FERC is presented in table 3.3.2.4-1.

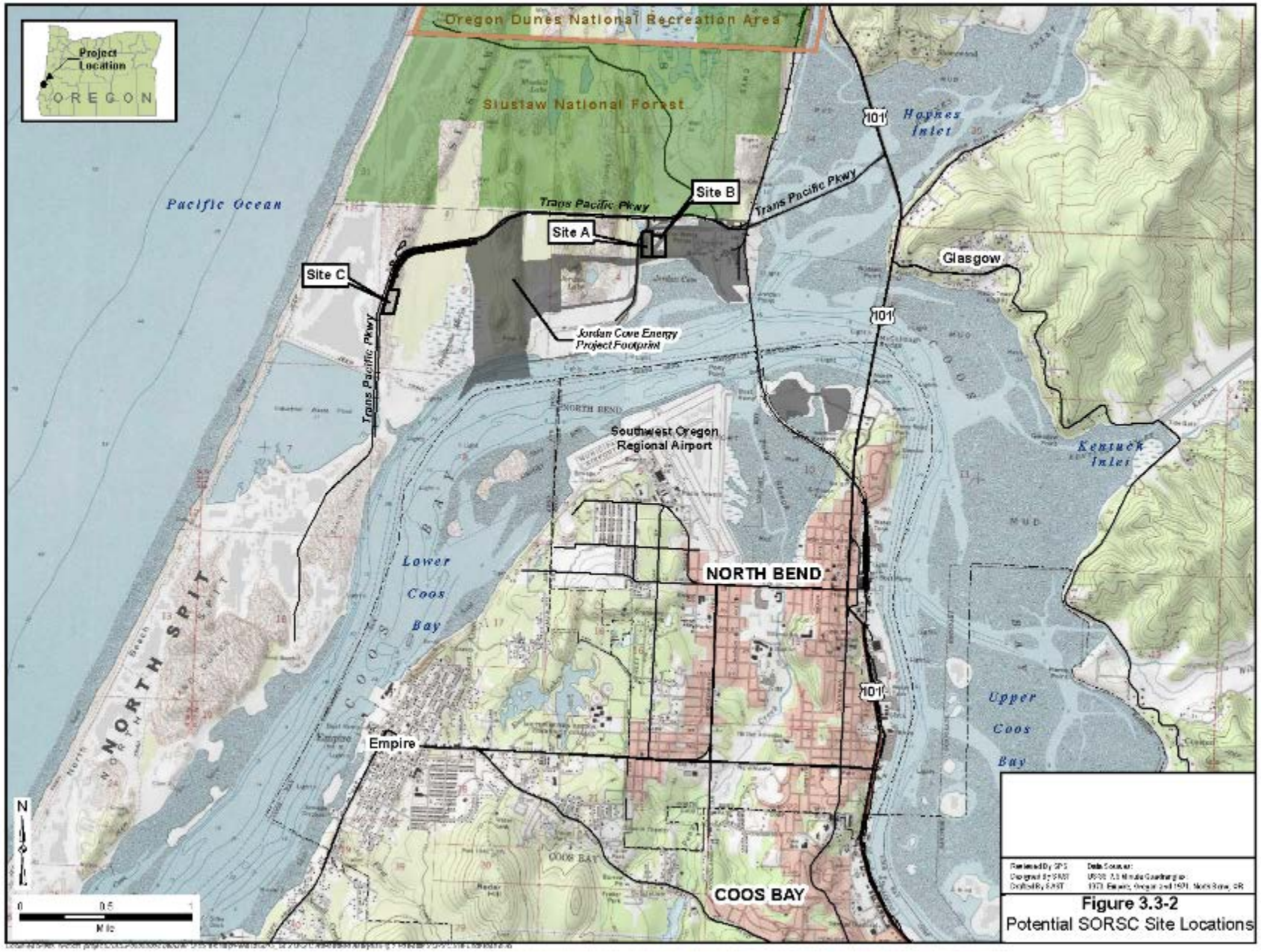


Figure 3.3-2
Potential SORSC Site Locations

TABLE 3.3.2.4-1

SORSC Alternatives Analysis

Site	Acres	# Residences within 0.25 mile	# Waterbodies Affected	Acres of Wetlands and Open Water Affected	Acres of Ag Land Affected	Acres of Forest* Cleared	Acres of Critical Habitat for T&E Species	Acres of Potential Suitable Habitat for T&E Species	# Archy Sites	Current Land Use/ Zoning
A	6.1	0	2	0.6	0	4.6	0	0.6	0	CBEMP: 6-WD, Industrial
B	6.0	0	1	3.1	0	1.8	0	2.8	0	CBEMP: 7-D, Industrial
C	14.8	0	2	2.1	0	7.5	0	2.2	0	CBEMP: 5-WD

* Forest is defined as Coastal Dune Forest (CDF)

Coos County Comprehensive Plan: Coos Bay Estuary Management Plan (CBEMP)

CBEMP: 5-WD, 6-WD:

Water-Dependent Development Shorelands (WD): areas managed for water-dependent uses and some of these areas are suited for water-dependent development. Water-related and other uses are restricted to specific instances prescribed in unit management objectives. Water-Dependent Development Shoreland areas are always located outside of urban growth boundaries, and satisfy needs that cannot be met within urban growth boundaries.

CBEMP: 7-D:

Development Shorelands (D): areas managed to maintain a mix of compatible uses, including non-dependent and non-related uses. Development areas include areas presently suitable for commercial, industrial, or recreational development. Development Shoreland areas are always located outside of urban growth boundaries and satisfy needs that cannot be met within urban growth boundaries.

Source: Attachment 6-4 of Jordan Cove's Third Supplemental Response to Environmental Information Request Dated April 10, 2015, filed May 1, 2015.

Site B is located on the South Dunes site and essentially comprises Wetland E directly to the west of the South Dunes Power Plant and Gas Conditioning unit outside of the secured battery limits of the facility. Because most of this site is wetland, it would need to be filled with excess sand removed from the Jordan Cove terminal marine slip and access channel. While Site B could function as a suitable substitute for the preferred Site A, it would result in a significant increase in the amount of jurisdictional wetlands impacted.

Site C is located on the western flank of the Henderson Marsh, on the south side of the Trans-Pacific Parkway, about 0.5 mile south of the Ingram Yard tract. This location was deemed to be potentially suitable for the SORSC facility because there is a north-south oriented sand dune on the western flank this parcel. Locating Site C any closer to the LNG terminal would create two unsatisfactory conditions. First, the SORSC would be physically located too close to facilities that store LNG and refrigerants. Additionally, siting the SORSC on the eastern portion of Henderson Marsh would violate the objective of having a sand dune provide a buffer between the SORSC and the LNG terminal. Third, placing the SORSC on the eastern portion of Henderson Marsh would require the filling of Henderson Marsh to raise the location of the SORSC out of tsunami inundation.

Site C does have the advantage of being elevated above the tsunami inundation zone without a need for fill. However, a new road would have to be built from Site C that would connect the SORSC complex to the western entrance to the LNG terminal. During a tsunami event both the Trans-Pacific Parkway and the CBRL would most likely be inundated. To ensure connectivity between the SORSC at Site C and the LNG terminal, fill would need to be placed in Henderson Marsh to create the required elevated corridor road. This is a particularly sensitive issue in that the primary direction of tsunami inundation will be from the northwest of the LNG terminal site. This location could place the SORSC directly in the path of a tsunami. Site C is nearly 1.5 miles

closer to the ocean, the source of tsunami waves, than either Sites A or B. An additional concern for this location would be the remoteness from the electric power to be supplied by the South Dune plant, in comparison to both Sites A and B. For these reasons, Site C was rejected as the preferred location for the SORSC.

Site A, the proposed location for the SORSC, is directly to the east of Jordan Cove Road and to the west of Wetland E on the South Dunes site. This site had been previously disturbed by the former owner of the property (Weyerhaeuser) and contains some minor wetlands (Wetlands A and B). Jordan Cove proposes to compensate for impacts on wetlands associated with the construction and operation of the SORSC through a combination of wetland creation and enhancement at the West Bridge Mitigation Site and the West Jordan Cove Mitigation Site. Jordan Cove's most recent wetland mitigation proposal was filed with the FERC on April 17, 2015, and is discussed in more detail in section 4.4.3.1 of this EIS.

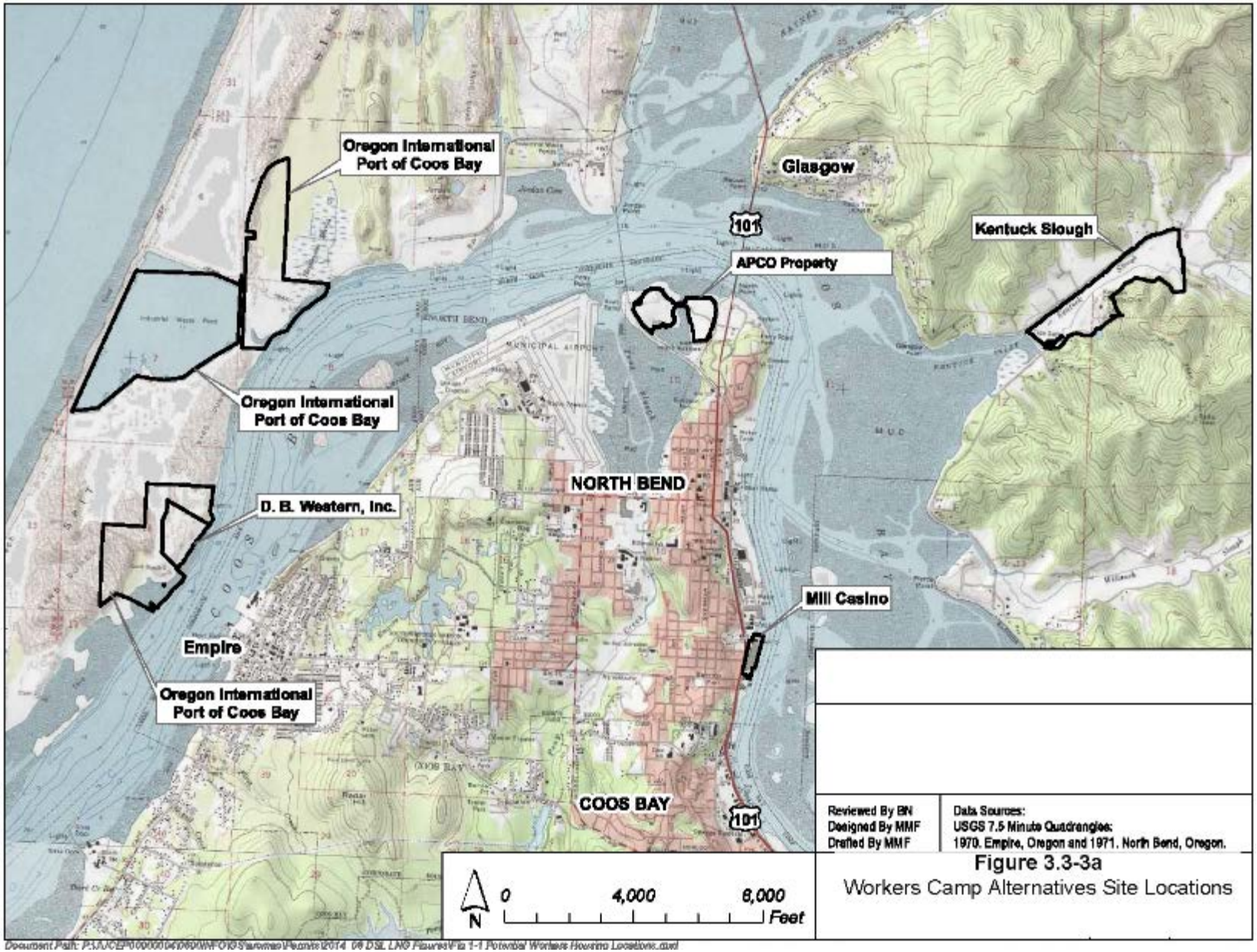
As the table suggests, Site A would result in notably less impact on resources than Sites B or C. Site A is the environmentally preferred and the selected location. None of the other alternative locations have significant environmental advantages over the proposed location for the SORSC.

3.3.2.5 NPWHC Alternatives

In a March 23, 2015, letter to the FERC, the NMFS requested additional information about the NPWHC. In an April 10, 2015, data request, we asked Jordan Cove to explain how it selected the location for the workers camp in North Bend, and to compare that location with other alternative sites considered (see figures 3.3-3a, b, and c). In a filing on April 22, 2015, Jordan Cove explained how it had eliminated alternative sites during its selection process. Port-owned land and the D.B. Western site on the North Spit were eliminated because they may be better suited as potential yard or laydown areas, and the Port land contained wetlands. The Mill Casino Site in Coos Bay and the Myrtlewood RV site along Highway 101 near Hauser were too small for the workers camp, but were selected instead as off-site commuter parking lot locations. The former Kentuck Slough golf course, now owned by Jordan Cove, contained wetlands, and is to be used for wetland mitigation.

Lastly, the former International Paper site near Gardiner was evaluated. This site contains 200 acres which is large enough to accommodate a camp. However, it is 25 miles from the Jordan Cove terminal, resulting in longer commuting time for employees. In addition, the population of Gardiner is 248 people, while the population of Reedsport is 4,000. Jordan Cove believes that a camp of 2,100 workers would have greater socioeconomic impacts on the Gardiner-Reedsport communities, in comparison to the city of North Bend, which has a population of almost 9,600 people.

Jordan Cove selected the Al Pierce tract in North Bend for its NPWHC location because it is relatively close to the LNG terminal on the North Spit. At 50 acres, it is large enough for the camp. It is currently zoned for industrial use, and is near existing utilities. This location contains no agricultural land, no forest, no known archaeological sites, and no habitat for threatened and endangered species. None of the other alternative locations have significant environmental advantages over the proposed location for the NPWHC.

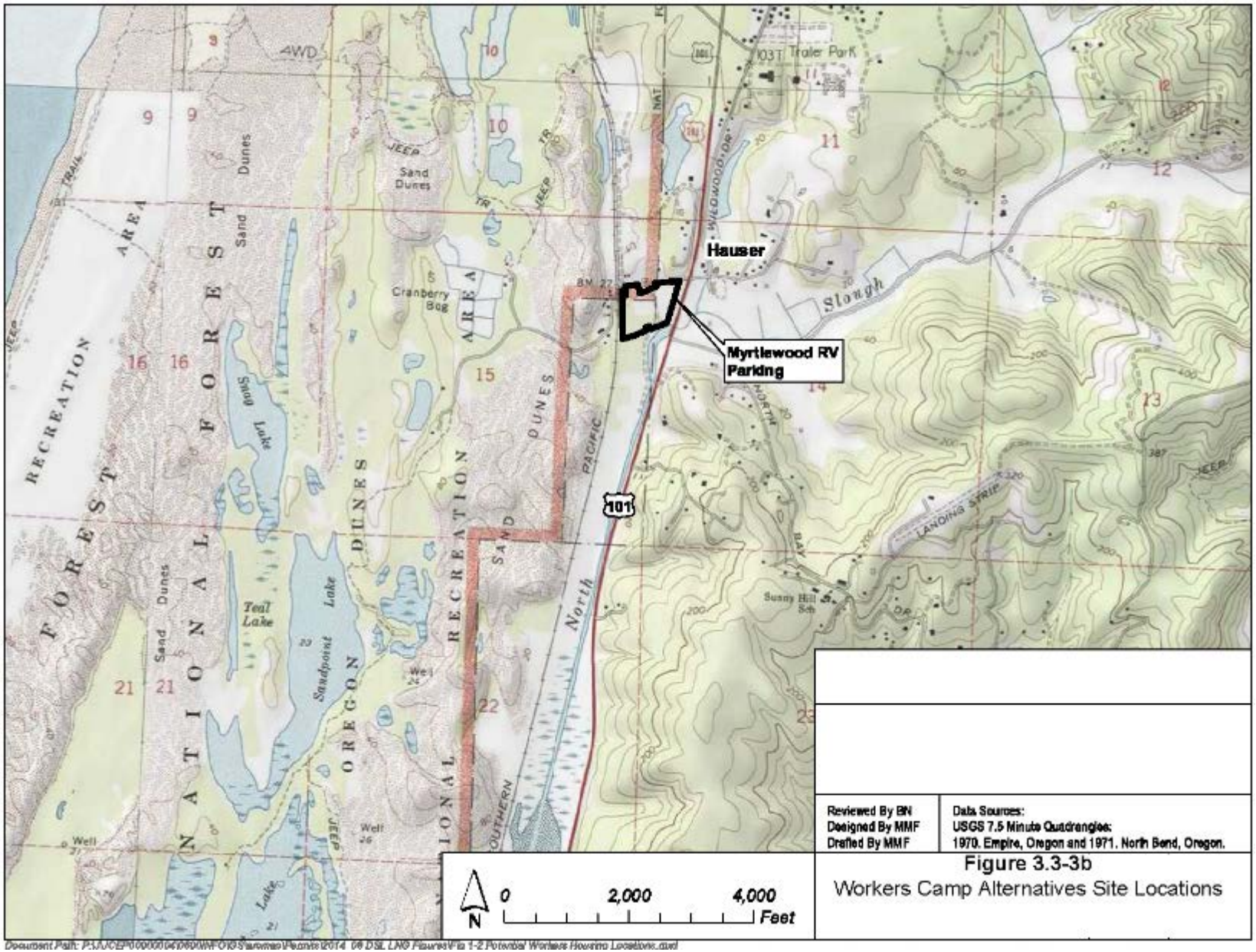


Reviewed By BN
Designed By MMF
Drafted By MMF

Data Sources:
USGS 7.5 Minute Quadrangles:
1970, Empire, Oregon and 1971, North Bend, Oregon.

Figure 3.3-3a
Workers Camp Alternatives Site Locations

Document Path: P:\JUCEP\000000\040600\MFO\Summer\Permit\2014_09 DSL LNG Figures\Fig 1-1 Potential Workers Housing Locations.mxd



Reviewed By BN
Designed By MMF
Drafted By MMF

Data Sources:
USGS 7.5 Minute Quadrangles:
1970, Empire, Oregon and 1971, North Bend, Oregon.

Figure 3.3-3b
Workers Camp Alternatives Site Locations

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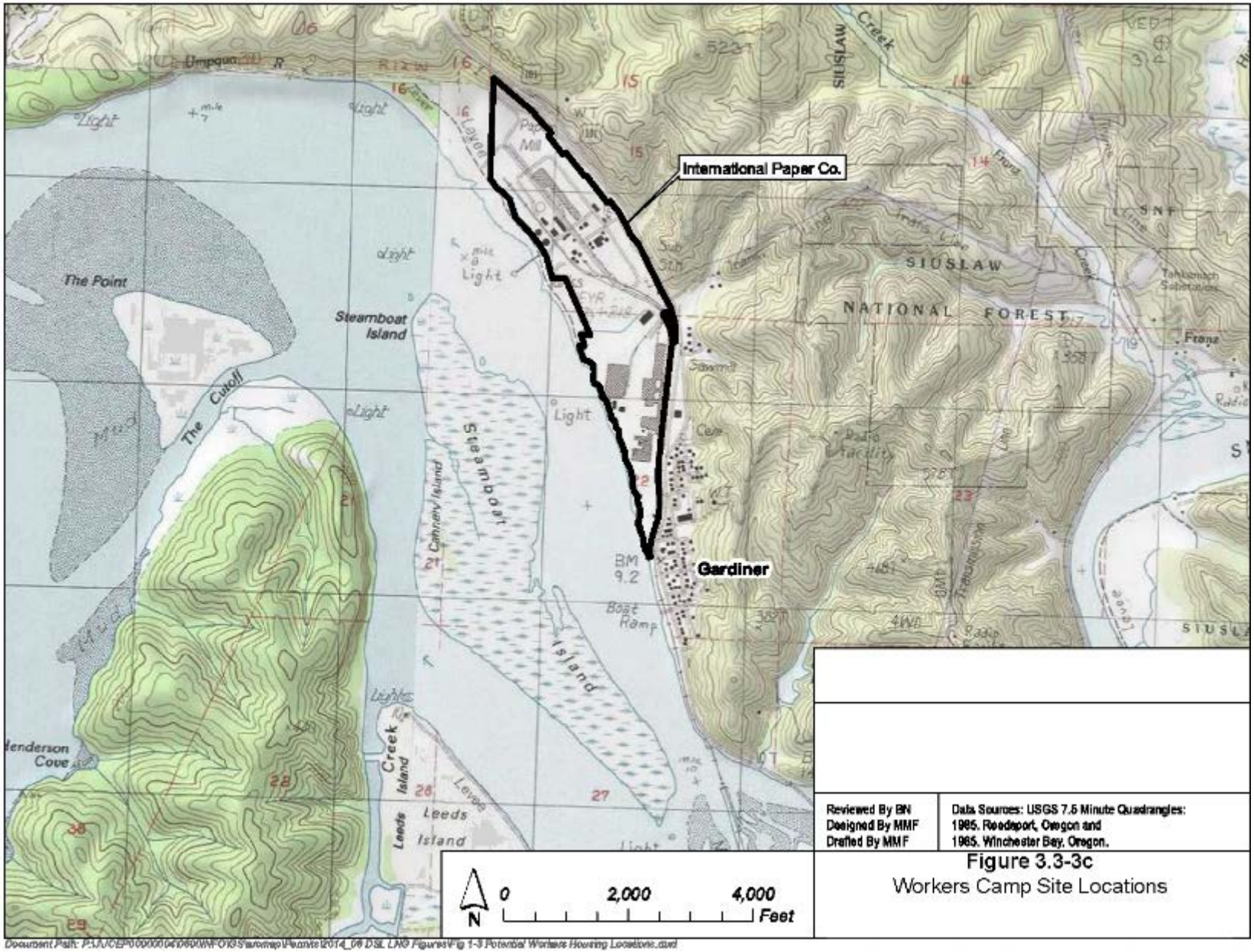

Reviewed By BN
Designed By MMF
Drafted By MMF

Data Sources: USGS 7.5 Minute Quadrangles:
1985, Reedsport, Oregon and
1985, Winchester Bay, Oregon.

Figure 3.3-3c
Workers Camp Site Locations

Document Path: P:\JOB\00000\40000\NFO\GIS\arcmap\Heanie\2014_08 DSL LNG Figures\Fig 1-3 Potential Workers Housing Locations.mxd

3.3.2.6 Electric Power Alternatives

The Jordan Cove LNG terminal would need electricity to power the liquefaction trains and other facilities. Jordan Cove plans to provide for its own power needs by constructing and operating the South Dunes Power Plant. Below, we discuss other alternatives for electric power.

Existing Electric Power Infrastructure

The Bonneville Power Administration (BPA) is the sole source of wholesale power to the region's various electric cooperatives. In a 1999 study, BPA noted uncertainties in terms of providing additional residential and commercial power demands. Jordan Cove's own investigation came to the conclusion that the local public utility system could not meet the power needs for the LNG export terminal if it relied solely on BPA to provide electricity. Therefore, Jordan Cove planned to construct and operate its own source of electricity through the 420-MW South Dunes Power Plant to be located adjacent to the terminal on land owned by Jordan Cove. The LNG terminal would, however, also be connected to the local distribution company, PacifiCorp, to provide power during times when the South Dunes Power Plant may be temporarily shut down. In addition, Jordan Cove could sell excess electricity generated from the South Dunes Power Plant, above what is needed for liquefaction and terminal operations, back to the grid for local consumption.

Wind Power

We considered the possibility of using wind power to replace or augment the electric power needed for the LNG terminal liquefaction process, through the currently planned South Dune Power Plant. As discussed below, we are not certain that wind energy alternatives could replace all the 420 MW needed for the Jordan Cove LNG terminal that would be generated by the planned South Dunes Power Plant. Nor do we find that wind farms would offer significant environmental advantage over Jordan Cove's currently proposed design.

<u>Existing and Proposed Wind Farms</u>

According to the State of Oregon 2013-15 Biennial Energy Plan, by 2012 wind energy production in Oregon made up nearly 6 percent of Oregon's total net generation and over 75 percent of the total non-hydroelectric sources of renewable energy. More than 4,000 MW of large-scale wind farms were in different phases of the ODE-EFSC process at the start of 2013. Most of the state's large-scale wind development takes place in the central and eastern Columbia River Plateau and in northeastern Oregon.

The ODE has stated that: "Wind machines generate, on average, about one third of the maximum output or capacity" (ODE 2005). If this "de-rating" is applied to the entire existing and proposed wind capacity of 4,000 MW from all of the onshore Oregon wind farms combined, they would produce about 1,320 MW of sustained output. It is unrealistic to assume that about one-third of the total electrical output from existing and proposed wind farms in Oregon would be redirected to the Jordan Cove terminal, and not serve other customers.

There are a number of problems that limit the availability of electricity generated by wind farms. First, there is no known technology for storing electric power generated by wind turbines. While the turbines are turning, electricity is generated that must be immediately conveyed to customers via transmission lines. Second, there is the limitation of existing transmission line infrastructure

between where most of the wind power is generated (eastern Oregon) and markets (population centers in western Oregon). Third, there is limited space on existing transmission lines for wind power, and there is competition for access to some lines.[6]

Wind generation suffers from what is referred to as a "clustering effect." This clustering effect means that all the machines within a specific farm tend to generate power at approximately the same time, as the wind blows. This results in spikes in supply or troughs in production that have no relationship with demand. This clustering also means that power transmission lines in the vicinity of a wind farm may experience congestion.

Wind farms are also not without environmental impacts. The turbines are known to adversely affect bird and bat populations. Wind farms have visual impacts as well.

Principal Power Proposed Off-shore Wind Project

Principal Power, under a $4 million grant from the DOE, is proposing to anchor five 6 MW semi-submerged wind turbine modules approximately 3 miles off the coast of Coos Bay, Oregon, in waters of the Pacific Ocean about 1,000 feet deep. If the Principal Power Project is funded and constructed, Jordan Cove has agreed to purchase the 30 MW of electricity produced. That would eliminate the need to have the Principal Power Project connected to the regional electric grid. The electricity produced by the Principal Power turbines would supplement the electricity generated from Jordan Cove's planned South Dunes Power Plant. However, in addition to the 30 MW that may be provided from Principal Power, Jordan Cove would still need at least 390 MW to maintain reliable LNG production. The South Dunes Power Plant would also be necessary to supply power to the Jordan Cove terminal when the wind is not blowing and the Principal Power Project is not operating. Lastly, the Principal Power Project is one of seven DOE grants and may not be selected for full funding and construction.

Solar

The bulk of solar power installations in Oregon are geared to residential or individual building use and not as a commercial base load installation. Commercial solar projects require large land areas. The largest commercial solar farm in Oregon is located in Christmas Valley, in Lake County. Known as the Outback Solar Project, it includes more than 20,000 solar panels arrayed over 40 acres, generating up to 5 MW of electricity.

The constraints related to the production of solar power on a major scale include the siting of solar farms in mostly clear and sunny geographic regions, large tracts needed for the arrays of solar panels, the location of nearby transmission lines, and access to the grid. There may not enough sunlight to generate much solar energy during the cloudy winter months along the southern Oregon Coast when there is peak demand. Data collected for the city of Seattle, which has a similar climate to much of western Oregon, showed the average annual percent sunshine for the area is about 43 percent (NCDC n.d.). Data presented by the George Washington University Solar Institute (2009) estimated that the daily average for Seattle in December is 0.7 kWh per square meter (m^2). At that rate, hundreds of acres of solar collectors would be needed to supply adequate power for the Project.

[6] In a recent case, BPA blocked wind farm generators from gaining access to its power lines, which BPA claimed were committed to carrying electricity generated by hydropower facilities.

Hydropower

Hydropower generates electricity from water stored behind dams and then run through turbines. Conventional hydropower in Oregon generates about 330,542,260 megawatt-hours (MWh), which represents about 58 percent of all the electricity produced in Oregon.

According to the Northwest Power and Conservation Council (2007), most feasible hydroelectric facilities have already been developed. New hydropower projects in the Pacific Northwest are estimated to yield 480 MW in additional electric capacity through 2025, but that new capacity would mainly replace older hydroelectric facilities that are retired.

The ODE recognizes that climate change may alter the runoff regime feeding water to the hydroelectric dams, which could result in less summer power in the future. Legal issues concerning the operation of the dams with regards to fisheries could also diminish hydropower generation (ODE 2008).

It is unlikely that new dams would be constructed in the future because of high development costs and environmental impacts. In fact, efforts are underway to remove some existing dams to restore habitat and fish passage.[7] Further, environmental scrutiny during the relicensing process for existing dams has, in some instances, resulted in increased release of water for fisheries, which has reduced their electric generation capacity. Thus, the development of additional hydropower resources is not considered to offer significant environmental benefits over the power generation portion of the proposed Project.

Tidal

Generation of electricity through conversion of ocean current, swell, wave action, tidal gradients, and thermal gradients is being successfully demonstrated around the world. Wave densities in Oregon are estimated to be capable of producing between 5 and 15 megawatts per mile of coastline. In January 2013, Oregon set the course for future wave energy development in waters of the state by adopting an amendment to the Territorial Sea Plan. This document identified four Renewable Energy Suitability Study areas.

However, the only wave energy project in Oregon state waters to begin the permitting phase was Ocean Power Technologies' (OPT) proposal about 2.5 miles off the coast of Reedsport. On August 13, 2012, OPT received a license from the FERC in P-12713 to develop this project. The proposal was to install 10 buoys in the wave park capable of generating a total of about 1.5 MW of electricity. In April 2014, OPT announced that it was dropping the project.[8] On May 30, 2014, OPT filed an application with the FERC to surrender its license.

There are now no permitted wave or tidal energy projects off the Oregon shore. Therefore, we do not consider tidal or wave energy would meet the electricity generating objectives of the Project.

[7] There are plans to remove four dams along the lower Klamath River as part of the FERC's relicensing review of PacificCorp's Klamath Hydroelectric Project in P-2082. See USDOI and CDFG (2012).
[8] Schwartz, D. 4 April 2014. "Oregon Wave Energy Project Sinks." *EarthFix*. Website: http://earthfix.opb.org/energy/article/oregon-wave-energy-project-sinks/.

3.4 PIPELINE ALTERNATIVES

We assessed whether it might be possible to significantly reduce environmental impacts associated with the construction and operation of the Pacific Connector pipeline by following alternative routes. We evaluated route alternatives raised during scoping by the public, or by federal land-managing agencies, that may avoid or minimize impacts on specific, localized resources such as mature forest habitat, waterbodies, wetlands, sensitive species, cultural resources, or residences. Lastly, we considered if there were alternative locations for aboveground facilities associated with the pipeline, such as the proposed compressor station, that would have lesser environmental impacts.

The "proposed route," discussed below in comparison to alternative routes, is the pipeline route filed by Pacific Connector in its June 2013 application to the FERC, as modified by supplemental filings thereafter up until the publication of this EIS. The proposed route is illustrated on maps contained in appendix C of this EIS.

3.4.1 Pipeline Alternative Routes Eliminated from Detailed Analyses

In the FERC May 2009 FEIS for the original sendout pipeline project in Docket No. CP07-441-000, we explained how Pacific Connector selected its route. Section 3.4.1 of that document discussed the Coos County Pipeline Alternative Route; Highway 42 Alternative Route; Powers Highway Alternative Route; Grants Pass Lateral Alternative Route; Cow Creek Alternative Route; Highway 138 Alternative Route; BPA Powerline Alternative Route; Highway 227 Alternative Route; Grants Pass to Medford Alternative Routes; Butte Falls Highway Alternative Route; Medford East Alternative Routes; and Klamath Falls East Alternative Routes. For the reasons given in the May 2009 FEIS, we eliminated those alternative routes from detailed analysis because they were unreasonable, infeasible, or unbuildable, and offered no significant environmental advantages over the proposed route. As stated in section 3.4.1 of the May 2009 FEIS, Pacific Connector reviewed more than 1,000 miles of alternative route segments, and selected its proposed route based on a number of factors, such as: minimization of the length of the pipeline; utilization of existing rights-of-way; avoidance of population centers; avoidance of known designated sensitive natural resource areas; recommendations from federal land managing agencies; avoidance of geological hazards; use of ridgelines; and construction feasibility and buildability.

Several commenters during scoping for the current Project in Docket No. CP13-492-000 proposed alternative routes that we considered but then eliminated from further analysis, as discussed below.

3.4.1.1 Straight Line Alternative Route

We received comments recommending that the pipeline route follow the shortest, most direct path, a straight line from Malin to Coos Bay.[9] This straight line alternative (figure 3.4-1) would be approximately 175 miles long compared to 232 miles for the proposed route. In theory, the shorter route would disturb approximately 650 acres less than the proposed route. However, this does not account for the additional workspaces required to cross steep terrain with unstable slopes in the Cascades and Coast Range.

[9] Comments during scoping recognized that there could be a straight line alternative that would be the optimum pipeline route for technical and economic reasons if environmental impacts and federal land use were not taken into consideration. See the letter from Ron Sadler dated October 15, 2012 and public testimony starting on page 31 of the transcript from the October 9, 2012 public scoping meeting in North Bend, Oregon.

The straight line route would require Congressional approval because it would cross the Mountain Lakes Wilderness and the Sky Lakes Wilderness. In addition the straight line route would cross directly through population centers at Altamont, Klamath Falls, and several towns, impacting many more homes and businesses than the proposed route. The straight line route would not offer significant environmental advantages over the proposed action and is not considered further in this analysis.

3.4.1.2 All Highway Alternative Route

During scoping, commenters made suggestions about possible route alternatives. One comment suggested the pipeline follow existing highways as much as possible.[10] This all-highway alternative would follow Highway 50 west from Malin, to Highway 39 northwest to Klamath Falls, then along Highway 140 west to Medford, then along I-5 north to Winston, then west along Highway 42, and then north along Highway 101 to Coos Bay (figure 3.4-1). This route would be approximately 281 miles long, which would be about 50 miles longer than the proposed route, resulting in approximately 600 acres of additional disturbance. Because the highways in southern Oregon cross through cities and towns, this route, and other possible routes sited along highways, would impact many more homes and businesses than the proposed route.

An all-highway route would not offer significant environmental advantages over the proposed route and is not considered further in this analysis.

In addition, the Federal Highway Administration (FHWA) historically prohibited the installation of new utility facilities within the rights-of-way of access-controlled freeways except in some extraordinary cases. This prohibition was consistent with the American Association of State Highway Transportation Officials (AASHTO) policies for longitudinal accommodation. However, with a 1988 amendment to the FHWA regulations, the FHWA's policy changed to allow each state to decide whether to permit new utility facilities within these rights-of-way, or continue to adhere to the stricter AASHTO policies (FHWA 2013). Oregon defines its policy for accommodating utilities in highway rights-of-way in Oregon Administrative Rule 734-055-0080. In general, Oregon does not allow utilities to occupy interstate rights-of-way for longitudinal uses (Caswell 2008).

[10] See letter from Bill Gow, dated October 26, 2012, filed under Docket No. PF12-17-000, and his comments during public scoping meetings for the Pacific Connector Pipeline Project.

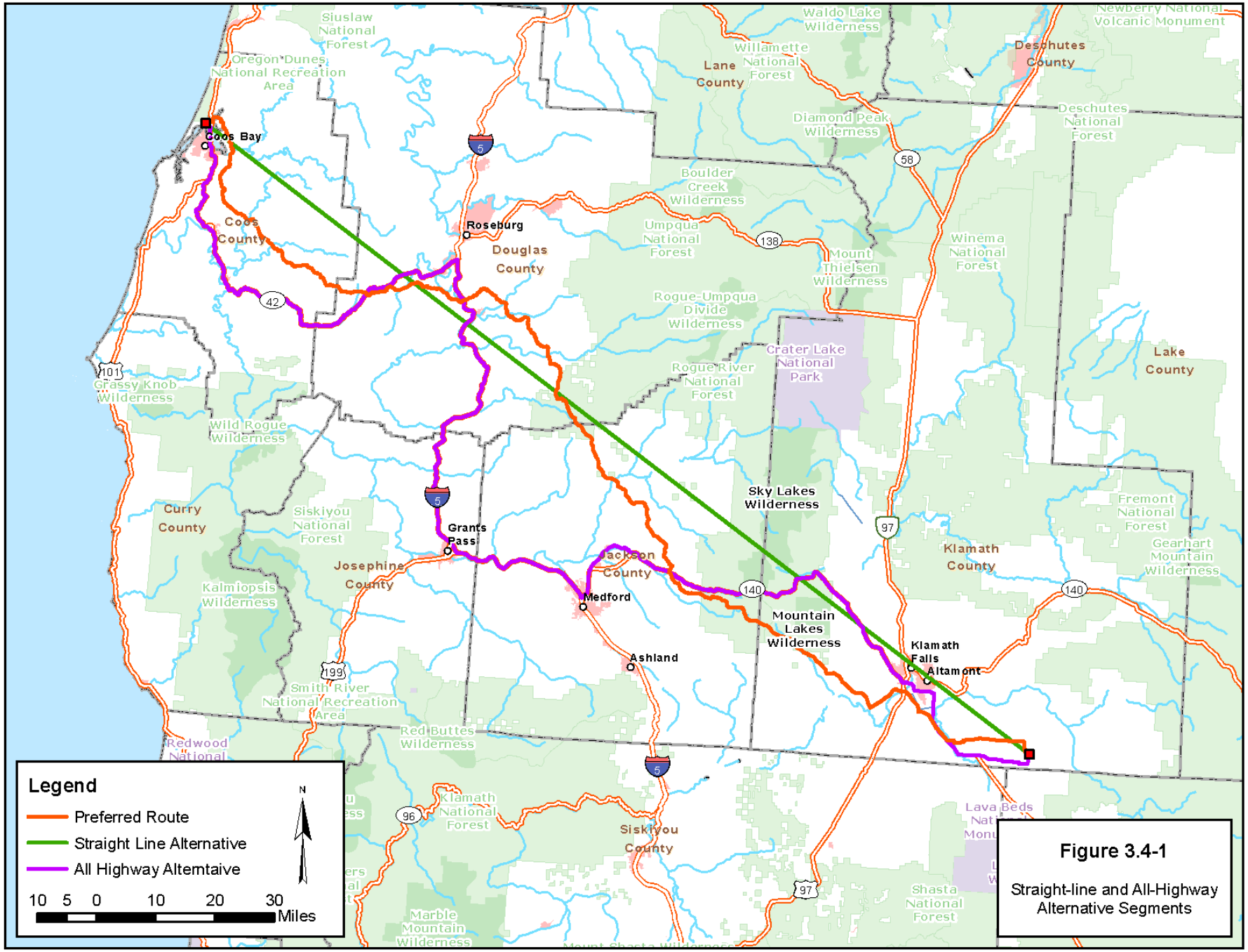

Figure 3.4-1

Straight-line and All-Highway Alternative Segments

3.4.1.3 Federal Land Route Alternative

We received a comment during scoping suggesting that the pipeline should be routed entirely on federal lands to avoid impacts on private property.[11] Given the patchwork nature of federal land holdings in southern Oregon, with federal blocks scattered between private tracts (see figure 3.4-1), we were unable to identify a route between Malin and Coos Bay that would not cross private lands. Therefore, a route that would be entirely on federal land and would avoid private property would be unrealistic and unfeasible, and is not considered further in this EIS.

3.4.1.4 Round Top Butte National Natural Landmark Route Alternative

The NPS requested that we consider an alternative route that would increase the distance between the pipeline and the Round Top Butte NNL boundary (also see the discussion in section 4.8.1.2 of this EIS). The proposed Pacific Connector pipeline route would pass within about one-quarter mile of the eastern boundary for the NNL near MP 135.3. At this location, the proposed pipeline route would be within a saddle or gap between Round Top Butte on the west and Obenchain Mountain on the east. Pacific Connector stated that to move the pipeline eastward away from the NNL boundary would put it on the steep slopes of Obenchain Mountain, which may create constructability issues. Further, the pipeline is currently routed over private lands outside of the NNL boundary that were recently harvested for timber. Relocating the pipeline to the east could affect five additional landowners, and result in the clearing of more forest. The BLM, which administers the land containing the Round Top Butte NNL, is a cooperating agency in the development of this EIS, has taken a role in the siting of the pipeline on its lands, and does not have any concerns about the proposed route in this area. Therefore, we conclude that the proposed route is environmentally preferable, and we did not do any further study of a reroute to increase the distance away from the Round Top Butte NNL.

3.4.1.5 West-wide Energy Corridor Routes (Section 368 Corridors)

Section 368 of the EPAct (42 U.S.C. 15926) directed the Secretaries of Agriculture, Commerce, Defense, and Energy to designate corridors for oil, gas, and hydrogen pipelines and electricity transmission facilities in 11 western states ("Section 368 Corridors"). The agencies prepared the *Final Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE/EIS-0386) (PEIS) to evaluate the impacts of proposed Section 368 Corridors. In January of 2009, the Department of the Interior and the Department of Agriculture each issued a ROD that designated Section 368 Corridors over lands under their respective jurisdiction. The RODs contain Interagency Operating Procedures that are intended to, in part, provide practicable measures to avoid or minimize environmental harm from future development within the corridors.

On July 7, 2009, several non-profit organizations filed a lawsuit in the Northern District of California challenging the designation of the Section 368 energy corridors pursuant to the EPAct, NEPA, ESA, and the Administrative Procedure Act. The parties entered into a settlement agreement, which was approved on July 11, 2012.[12]

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[11] See for example, Dave Picanso comments at the public meeting in Klamath Falls on August 29, 2012, in transcripts filed under Docket No. PF12-17-000.

[12] *Wilderness Society v. United States Department of the Interior*, No. 3:09-cv-03048-JW (D. N.D. Cal). Information about the settlement agreement can be found at the following web address: http://corridoreis.anl.gov/.

The Pacific Connector pipeline would occupy a one-mile segment crossing lands managed by BLM identified as a corridor of concern in the settlement agreement. This corridor of concern was identified as Section 368 Corridor 4-247, approximately located between pipeline MPs 80 and 81. In its role as a cooperating agency, BLM has worked closely with the proponent on route locations. The FERC, the BLM, and the Forest Service hereby meet the notification requirements of the settlement agreement through publication of this EIS, and by having informed the proponent that a small segment of the proposed route is subject to the terms of the settlement agreement.

In this EIS, we considered the proposed use of the Section 368 Corridor segment 4-247 in accordance with BLM Instruction Memorandum 2014-080 "Policy Guidance for Use of Corridors Designated Pursuant to Section 368 of the Energy Policy Act of 2005 as Required by the Settlement Agreement in *Wilderness Society v. United States Department of the Interior*, No. 3:09-cv-03048-JW (D. N.D. Cal)." Specifically, this EIS addresses issues related to critical habitat for fish and wildlife species listed under the ESA, LSRs, and Riparian Reserves and management direction provided in the BLM Roseburg District LMP. The FERC and the BLM would consider the above information in their respective decisions regarding the proposed Project.

3.4.1.6 Klamath Project Avoidance Alternative Routes

During a July 9, 2015, site visit between representatives of Pacific Connector and Reclamation, the Area Manager requested that Pacific Connector consider route alternatives that would avoid in their entirely the irrigation features associated with Reclamation's Klamath Project. In an August 7, 2015, filing with the FERC, Pacific Connector provided the results of its analysis and an explanation why route alternatives that completely avoid the Klamath Project would be impracticable and not environmentally preferable.

The Pacific Connector pipeline must begin at the proposed Klamath Compressor Station at MP 228.2, where the proposed Klamath-Eagle and Klamath-Beaver meter stations would interconnect with the existing GTN and Ruby pipelines, the source of the natural gas to be transported for the Project. The co-located Klamath-Eagle and Klamath-Beaver meter stations and Klamath Compressor Station are all located within the geographic boundaries of Reclamation's Klamath Project; therefore, the Klamath Project cannot be completely avoided. However, Pacific Connector developed two pipeline route alternatives between MPs 189.2 and 228.2 that would avoid most of the irrigation features of the Klamath Project. The Northern Route Alternative would be 9.4 miles longer than the corresponding segment of the proposed route. It would have to cross the outfall of Upper Klamath Lake using trenchless technology, follow an existing powerline, and then go across Hogback Mountain. The Southern Route Alternative would be 47.4 miles longer than the corresponding segment of the proposed route. This route is so long in order to avoid National Wildlife Refuges, the Lava Beds National Monument, and inventoried roadless areas. Trenchless technology would have to be used to cross under the Klamath River. Because of the greater distances and greater amount of disturbance, we conclude that neither route alternative to avoid the Klamath Project features would provide a significant environmental advantage to the corresponding segment of the proposed route.

3.4.2 Pipeline Alternative Routes Analyzed in Detail

We studied a number of alternative pipeline route segments that were suggested by stakeholders, including landowners and agencies, or developed by the FERC staff. Route variations were identified in an effort to avoid or minimize potential impacts on specific localized resources. Each alternative route was compared to the corresponding segment of the proposed route using desktop data (such as maps or file searches). In some cases, Pacific Connector conducted on-the-ground studies of specific alternative routes. Elements we considered during these analyses included pipeline length, use of existing rights-of-way, forest land, agricultural land, waterbody and wetland crossings, residences, known cultural resources, habitat for federally listed threatened or endangered species, and geological hazards and slope stability. After the comparison, we determined if the alternative route had significant environmental advantages over the corresponding segment of proposed route. We also took into consideration if the alternative route was technically feasible or safely buildable. These alternative route segments are discussed below.

3.4.2.1 Brunschmid Wetland Reserve Program Easement Alternative Routes

In an August 30, 2012, letter to the FERC, the NRCS indicated that it had concerns regarding the potential negative impacts the Pacific Connector Pipeline Project may have on the operation and function of the 13.4 acres enrolled in the permanent conservation easement under the Wetland Reserve Program (WRP) on the Brunschmid property. The NRCS stated that its policy is that proposed projects should avoid impacts on WRP easements. Pacific Connector's proposed route in its June 2013 application to the FERC between about MPs 9.4R and 12.4R would avoid the Brunschmid WRP easements. We evaluated Pacific Connector's June 2013 proposed pipeline route to the equivalent portion of the May 2009 FEIS Route and Pacific Connector's Brunschmid-WRP1 Route. Figure 3.4-6 illustrates the proposed route and the alternatives, and environmental elements are compared in table 3.4.2.1-1.

The May 2009 FEIS Alternative Route would directly impact the WRP easements on the Brunschmid property. The Brunschmid-WRP1 Alternative Route would avoid the WRP easements, going to the west of the easements. The Brunschmid-WRP1 Alternative Route would be slightly shorter than the proposed route; however, it would be in close proximity to an occupied bald eagle nest. While both the May 2009 FERC Alternative Route and the Brunschmid-WRP1 could use an HDD to cross under the Coos River, we are concerned about the potential for buried cultural resource deposits in the vicinity of Graveyard Point.[13]

Pacific Connector completed geotechnical borings along the proposed route in this area, which confirmed the feasibility of an HDD of the Coos River. The proposed route would avoid the WRP easements on the Brunschmid property (although it would affect other wetlands). It would also avoid the bald eagle nest along the Brunschmid-WRP-1 Alternative, Graveyard Point, and the community at the west end of Echo Valley. We conclude that the alternative routes would not offer significant environmental advantages over the proposed route.

[13] Site 35CS33 was recorded by Ron Stubbs in 1974 at Graveyard Point. Mark Tveskov (2007) wrote that the Graveyard Point Site "…documented an uninterrupted record of traditional household subsistence practices from over 1,300 years ago into the 20th century."

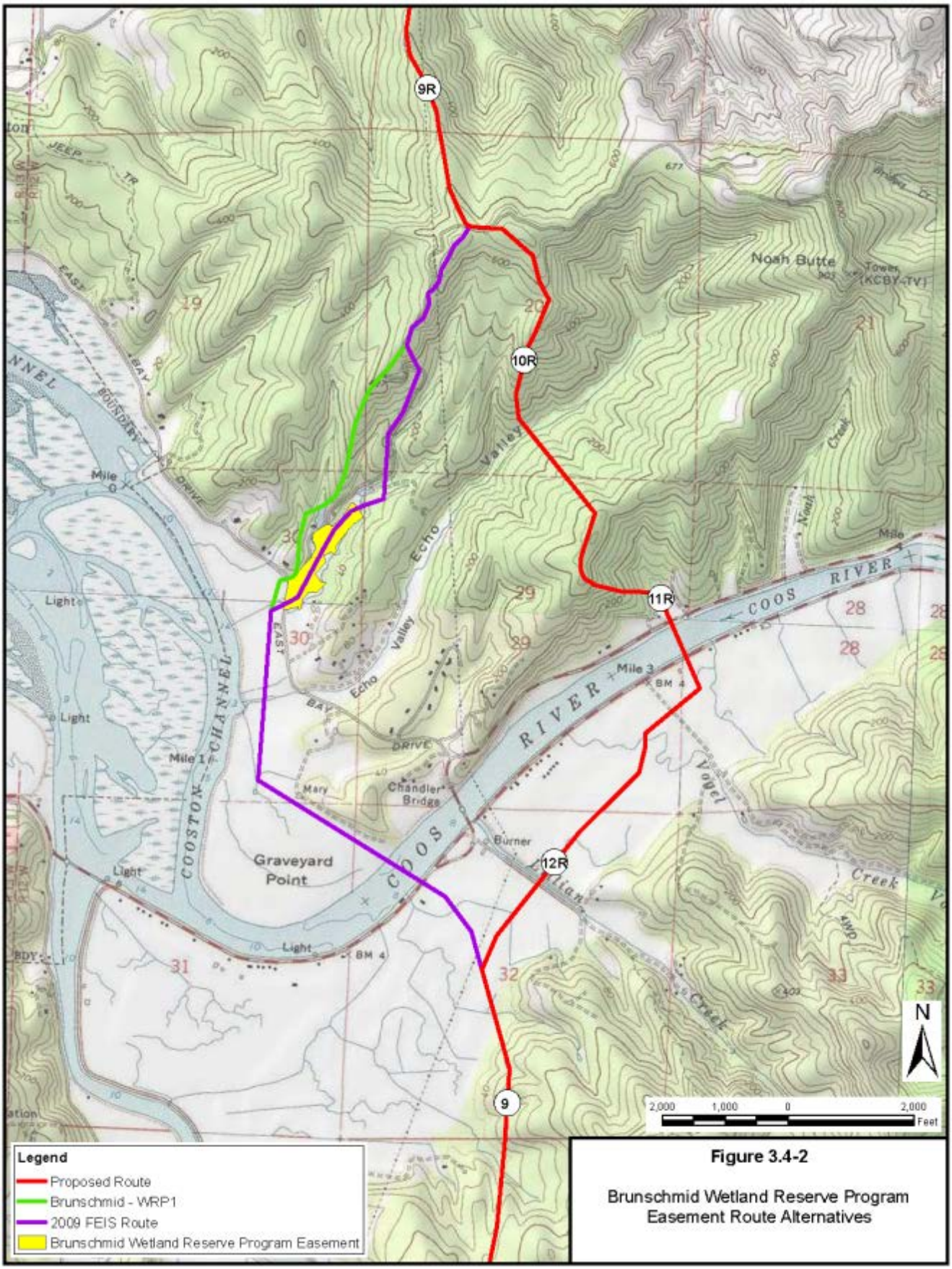

Figure 3.4-2

Brunschmid Wetland Reserve Program
Easement Route Alternatives

TABLE 3.4.2.1-1

Comparison of the Proposed Route with the 2009 FEIS Route and Brunschmid WRP Easement Avoidance Alternative 1

Alternatives Analysis	2009 FEIS Route	WRP Avoidance Alternative 1	Proposed Route
Length (miles) a/	2.9 b/	2.8	3.0
Construction Right-of-Way (acres)	31	31	33
TEWAs (acres)	23	18	19
Operational Easement (acres) c/	18	17	18
Number of Landowner Parcels Crossed (all private)	14	20	18
Number of Residences within 50 feet of Construction Right-of-Way	0	0	0
Number of Waterbodies Crossed	6 d/ Coos River and 1 ditch for HDD	7 d/ Coos River and 1 ditch for HDD	7 d/ Coos River to be HDD'd
Length of wetland crossings (feet)	9,082 e/,f/	4,417 f/	6,687 f/
Agricultural Lands Crossed (miles)	0.33 g/	0.33 g/	1.19 g/
Evergreen Forest (acres construction right-of-way)	4	8	14
Regenerating Forest clearing (acres construction right-of-way) h/	7	7	15
Habitat for threatened or endangered species	Coos River Southern DPS Green Sturgeon River – HDD	Directly affects known bald eagle nest i/ Coos River Southern DPS Green Sturgeon River – HDD	Coos River Southern DPS Green Sturgeon River – HDD
Number of Previously Recorded Cultural Resources	1	1	1
Number of Newly Identified Cultural Resources j/	0	0	0
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of alternative length)	0.8 (29.5 percent)	0.8 (27.1 percent)	0.5 (17.2 percent)
Avoids WRP Easement	No	Yes	Yes

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ Mileage length cannot be calculated by subtracting milepost ranges because of engineering station equations included in route segments between MPs 8.59 to 9.41R.
c/ Acres of permanent easement calculated based on crossing length on private and federal timber lands. Pacific Connector proposes a 50-foot permanent easement on federal lands and a 50-foot permanent easement on private timber lands.
d/ From review of Pacific Northwest Hydrography Framework Clearinghouse data layers (http://hydro.reo.gov/)
e/ Field surveys identified 5,902 feet.
f/ Based on NWI mapping. Waterbodies/ditches not separated out of extensive wetlands.
g/ Agricultural lands are associated with the Coos River Floodplain and included wetland pastures and hayfields.
h/ Includes recent clear-cut forests.
i/ ORBIC (2012). Nest site confirmed during Pacific Connector October 2012 over-flight route investigation.
j/ Surveys incomplete.

3.4.2.2 Blue Ridge Alternative Routes

A group of landowners[14] objected to the pipeline route filed with Pacific Connector's June 2013 application to the FERC between about MPs 11.1R and 21.8, in Coos County, and suggested that the FERC consider an alternative route. Pacific Connector conferred with the landowners and developed the Modified Blue Ridge 2013 Alternative Route (Blue Ridge Alternative) that it believes is buildable. The June 2013 proposed route and the Blue Ridge Alternative are illustrated on figure 3.4-3. Figure 3.4-3 also shows a portion of the May 2009 FEIS route, and a Landowner Amended Route that was mostly incorporated into the Blue Ridge Alternative, and is therefore not analyzed as a separate alternative.

[14] See letters to the Commission filed on July 10, August 15, 16, 20, 22, and 30, September 25, October 29, and November 13, 2013, in Docket No. CP13-492-000.

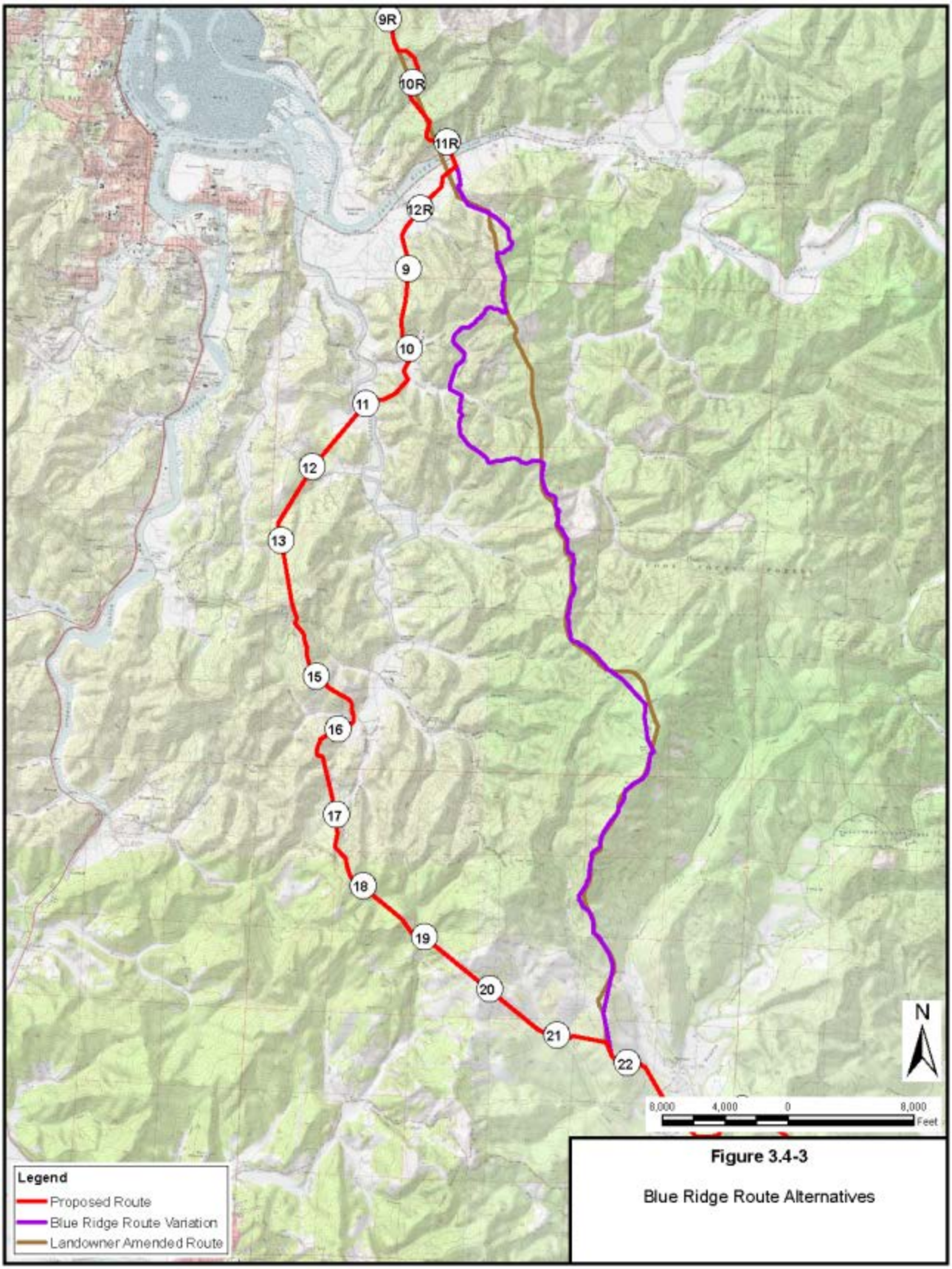

Figure 3.4-3

Blue Ridge Route Alternatives

The June 2013 proposed route would be slightly longer (14.4 miles) than the Blue Ridge Alternative (14.0 miles), and affect a greater number of landowners (table 3.4.2.2-1). Nearly 52 percent of the corresponding segment of the June 2013 proposed route would be co-located with a BPA powerline right-of-way, while 63 percent of the Blue Ridge Alternative would parallel logging roads. The Blue Ridge Alternative would shift portions of the pipeline from land owned by private individuals and timber companies to federal land managed by the Coos Bay District of the BLM. The proposed route would cross 61 privately owned parcels, while the Blue Ridge Alternative would cross 23 private parcels. The alternative route would cross about 6.5 miles of private land and 7.6 miles of federal land, while the proposed route would cross about 12.9 miles of private land and 1.5 miles of federal land. However, some landowners along the Blue Ridge Alternative object to it, believing that the alternative would affect the value of their properties, clear more forest including old growth, and impact wildlife and waterbodies, particularly Daniels Creek.[15]

In order to provide an equal comparison our DEIS used publicly available data for both the alternative and corresponding segment of proposed route, even though field data was available for a portion of the proposed route. Our DEIS found that the alternative did not provide a significant environmental advantage because additional clearing of LSOG forest and NSO and MAMU habitats along the Blue Ridge Alternative could cause long-term impacts and an irretrievable loss of suitable and occupied habitat that could not be easily mitigated. We received a number of comments on the DEIS that requested that we re-evaluate our assessment of the Blue Ridge Alternative.[16]

In response, on April 16 and May 22, 2015, we sent data requests to Pacific Connector asking for more information about the Blue Ridge Alternative in comparison to the proposed route, including data collected from on-site surveys. Pacific Connector was able to collect on-the-ground environmental information along the 7.6 miles of federal lands crossed by the alternative. The FEIS has been updated to include field data where available for the alternative, as well as field data previously collected by Pacific Connector where access was granted along the corresponding segment of proposed route. Environmental characteristics are compared in table 3.4.2.2-1, and additional details regarding the assessment for the Blue Ridge Alternative can be found in appendix Q of this EIS.

[15] See letters from Cary Norman and Karen Dohler filed with the FERC on June 24, 2914, and letters from David Schmidt, Kathi Windsor, Tom Younker, Julie Eldridge, and Christine Keenan filed July 16, 2014, in Docket No. CP13-492-000.

[16] E.g., letters from Mark Sheldon filed with FERC on January 26, 2015, James and Archina Davenport filed with FERC on February 2, 2015, Curtis and Mellissa Pallin filed with FERC on January 19, 2015, and Oregon Small Woodlands Association filed with FERC on February 13, 2015.

TABLE 3.4.2.2-1

Comparison of Pacific Connector's Proposed Route with the Blue Ridge Alternative

Impact/Issue		Proposed Route	Blue Ridge Alternative
Length (miles) a/		14.4	14.0
Construction right-of-way (acres)		166	161
Temporary extra work areas (TEWA) (acres)		62	37
Operational easement (acres) b/		87	85
Land ownership (miles)	Private	12.9	6.5
	BLM	1.4	7.5
	State	>0.1	0.0
Number of landowner parcels crossed	Private	57	24
	BLM	4	11
	State	1	1
Number of residences within 50 feet of the construction right-of-way		1	0
Water supply wells within 50 feet of the construction right-of-way c/		0	0
Number of waterbodies crossed	Field survey data	43 perennial 23 intermittent d/, e/	4 perennial 4 intermittent e/
Length of wetland crossings (miles)		2.2 f/,g/	1.2 g/
Riparian Reserves Impacted (acres)		14	17
Agricultural pastures affected (acres construction right-of-way) h/		8	8
Coniferous forest (acres construction right-of-way) i/	LSOG	9	41
	Mid-seral	50	42
	C – R	117	77
LSRs/Unmapped LSRs crossed (miles/acres)		0 miles / 0 acres	0.4 mile / 7 acres
Northern Spotted Owl (NSO) home range (1.5 mile radii)		1 NSO Home Range crossed (42310)	1 NSO Home Ranges crossed (42310)
High NRF and NRF habitat remover (acres) j/		7	66
Confirmed occupied Marbled Murrelet (MAMU) stands intersected by the alignment (based in NWFP criteria)		0	9 occupied stands (12 based on FWS criteria)
Potentially occupied MAMU stands intersected by the alignment (based in NWFP criteria)		3	1 (12 based on FWS criteria)
Marbled Murrelet suitable habitat removed		3	48
Fish-bearing streams crossed k/	Known	9	4
	Assumed	5	0
Fisheries critical habitat (streams crossed)	Coho l/	8	4
	Green Sturgeon m/	5	0
Geologic hazards (number, feet) n/	Previously mapped: SLIDO, other published	5 slides, 7,137 feet	2 slides, 3,276 feet
	LiDAR identified	2 slide, 3,257 feet	2 slides, 1,088 feet
	Total	7 slides, 10,397 feet	4 slides, 4,364 feet
Number of known cultural resources sites		0	1 o/
Number of newly identified cultural resources		0	0 o/
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of route length) p/		7.4 (52 percent)	8.3 (59 percent)

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ Acres of permanent easement calculated based on a 50-foot permanent easement.
c/ OWRD (2013)
d/ http://hydro.reo.gov/, and field survey data
e/ Includes waterbodies not crossed by the centerline but within the right-of-way.
f/ Field surveys identified 2.0 miles.
g/ Based on NWI mapping.
h/ Only acres associated with the construction right-of-way are provided for comparison, as TEWAs have not been designed for the Modified Blue Ridge Route Variation.
i/ Evergreen Forest: LSOG (late successional/old-growth forest) = 80+ years; Mid-seral = 40 to 80 years; C-R (Clear-cut/regenerating forest) = 0 to 40 years.
j/ Nesting, Roosting, Foraging
k/ ODFW (2012a)
l/ NMFS (2008a)
m/ NMFS (2009)
n/ See GeoEngineers (2013a).
o/ Surveys incomplete.
p/ Approximately 5.6 miles (39 percent) of the proposed route is co-located/adjacent to a BPA Powerline corridor, whereas the Blue Ridge Alternative is adjacent/co-located with logging roads.

Based on field-collected data, the Blue Ridge Alternative would cross four perennial streams and four intermittent streams, all on BLM lands, while the corresponding segment of proposed route would cross 43 perennial streams and 23 intermittent streams. The Blue Ridge Alternative would cross 1.2 miles of wetlands compared to 2.2 miles crossed by the corresponding segment of the proposed route.

The DEIS identified three stands crossed by the proposed route that may be occupied by MAMU and we have no new information regarding these stands, therefore we continue to assume that the proposed route would cross three stands that may be occupied by MAMU and no stands that are confirmed as occupied. Construction of the Blue Ridge Alternative would result in removal of 48 acres of MAMU suitable habitat compared to 3 acres by the corresponding segment of proposed route.

The information that we had at the time of the DEIS indicated that there were three stands crossed by the Blue Ridge Alternative that were known to be occupied by MAMU, and seven additional stands that may be occupied by MAMU. The recently completed surveys along the Blue Ridge Alternative confirmed that six of the seven stands are occupied by MAMU (based on NWFP criteria). One additional stand crossed by the alternative route may be occupied; however, a second-year survey would be needed to confirm occupancy.

Based on our assessment, we conclude that the Blue Ridge Alternative would not offer significant environmental advantages over the proposed route. The additional clearing of LSOG forest, NSO and MAMU habitats, and Riparian Reserves along the Blue Ridge Alternative would cause long-term impacts and loss of suitable and occupied habitat that could not be easily mitigated, while impacts on waterbodies and their associated aquatic resources crossed by the proposed route would primarily be short-term occurring only during construction, and could be reduced or mitigated.

3.4.2.3 Weaver Ridge Alternative Routes

The BLM requested that Pacific Connector consider route alternatives in the vicinity of Weaver Ridge between MPs 42.7 and 49.8 to avoid MAMU and NSO critical habitat. Several alternative routes were identified: Deep Creek Variation Alternative Route, the May 2009 FEIS Alternative Route, Weaver Ridge Alternative 1 Route, Weaver Ridge Alternative 2 Route, Weaver Ridge Alternative 2a Route, Weaver Ridge Alternative 3 Route, Weaver Ridge Alternative 3a Route, and the proposed route. These routes are illustrated on figure 3.4-4 and compared in table 3.4.2.3-1.

The Weaver Ridge Alternative 1 Route would leave the proposed route around MP 46.0 crossing the logging spur road north of a reservoir and head almost due east on the north side of a tributary of Wildcat Creek over ridges, reconnecting with the proposed route at about MP 49.8. This alternative would be slightly shorter than the proposed route. However, the Weaver Ridge Alternative 1 Route would cross more miles of critical habitat for MAMU and NSO, and would cross two MAMU occupied stands (compared to one along the proposed route) and five NSO home ranges (compared to four along the proposed route).

The Weaver Ridge Alternative 2 Route would leave the Alternative 1 Route east of the proposed route at about MP 46, crossing a logging spur road, pass the Signal Tree Quarry, then follow Signal Tree Road for about 3 miles. It would head south over ridges, then join the Alternative 3 along Wildcat Creek. The Weaver Cove Alternative 2a Route would deviate from Alternative 2

just across the Coos County line along Signal Tree Road, cutting diagonally along Wildcat Creek to rejoin the Alternative 2 Route across the Douglas County line.

The Weaver Ridge Alternative 3 Route would leave the proposed route at about MP 42.6. It would follow ridges for about 3.5 miles, crossing Signal Tree Road and Upper Rock Creek. The alternative would then turn east and follow ridges for almost 4 miles, crossing Wildcat Creek before rejoining the proposed route at about MP 48.5. The Weaver Ridge Alternative 3a Route would leave Alternative 3 and follow Wildcat Creek for 1.5 miles to join the proposed route at about MP 49.0.

The Weaver Ridge Alternatives 2, 2a, 3, and 3a Routes are all longer than the proposed route and would cross more miles of MAMU and NSO critical habitat. Alternatives 3 and 3a would cross six NSO home ranges, while Alternatives 2 and 2a would cross five NSO home ranges (compared to four for the corresponding segment of proposed route). Compared to the proposed route, these alternatives would clear more LSOG and affect more acres of LSR on lands managed by the BLM. Therefore, those alternatives were eliminated from further consideration.

The May 2009 FEIS Alternative Route would leave the proposed route at about MP 46.3 and head southeast over ridges on the north side of Deep Creek, crossing the logging spur road south of the reservoir and reconnecting with the proposed route at about MP 48.0. The Deep Creek Variation Alternative Route would leave the proposed route at about MP 46.3 and follow a ridge north of Holmes Creek Spur Road and an unnamed four-wheel drive road back to the proposed route at about MP 47.0 and cross to the north side of the proposed route and parallel that route for about 1 mile before reconnecting with the proposed route near MP 48.0.

The Deep Creek Variation Alternative Route would be about 0.2 mile longer than the May 2009 FEIS Alternative Route, and cross one additional waterbody. Pacific Connector was concerned with the feasibility of this alternative. Based on a geotechnical review, the company indicated there would be a high risk of landslides and surface erosion where the Deep Creek Variation Alternative Route would cross the eastern flank of Weaver Ridge through convergent slopes above a first order stream. Pacific Connector also had concerns about the constructability of the May 2009 FEIS Alternative Route. Where that alternative would cross Weaver Ridge, it would traverse an extremely steep, narrow rock outcrop that would require blasting. So instead, the proposed route would ascend Weaver Ridge westward from a forest plantation near MP 46.5 up the slope to the north of the Deep Creek Variation Alternative Route, avoiding the rock outcrop.

The FERC staff agrees that the proposed route is environmentally preferable, because it would have the least impact on MAMU and NSO habitat, old-growth forest, and BLM LSR land allocations, and cross the fewest waterbodies, while being one of the most buildable alternatives, avoiding geological hazards and bedrock outcrops. We conclude that the alternative routes would not offer significant environmental advantage over the proposed route.

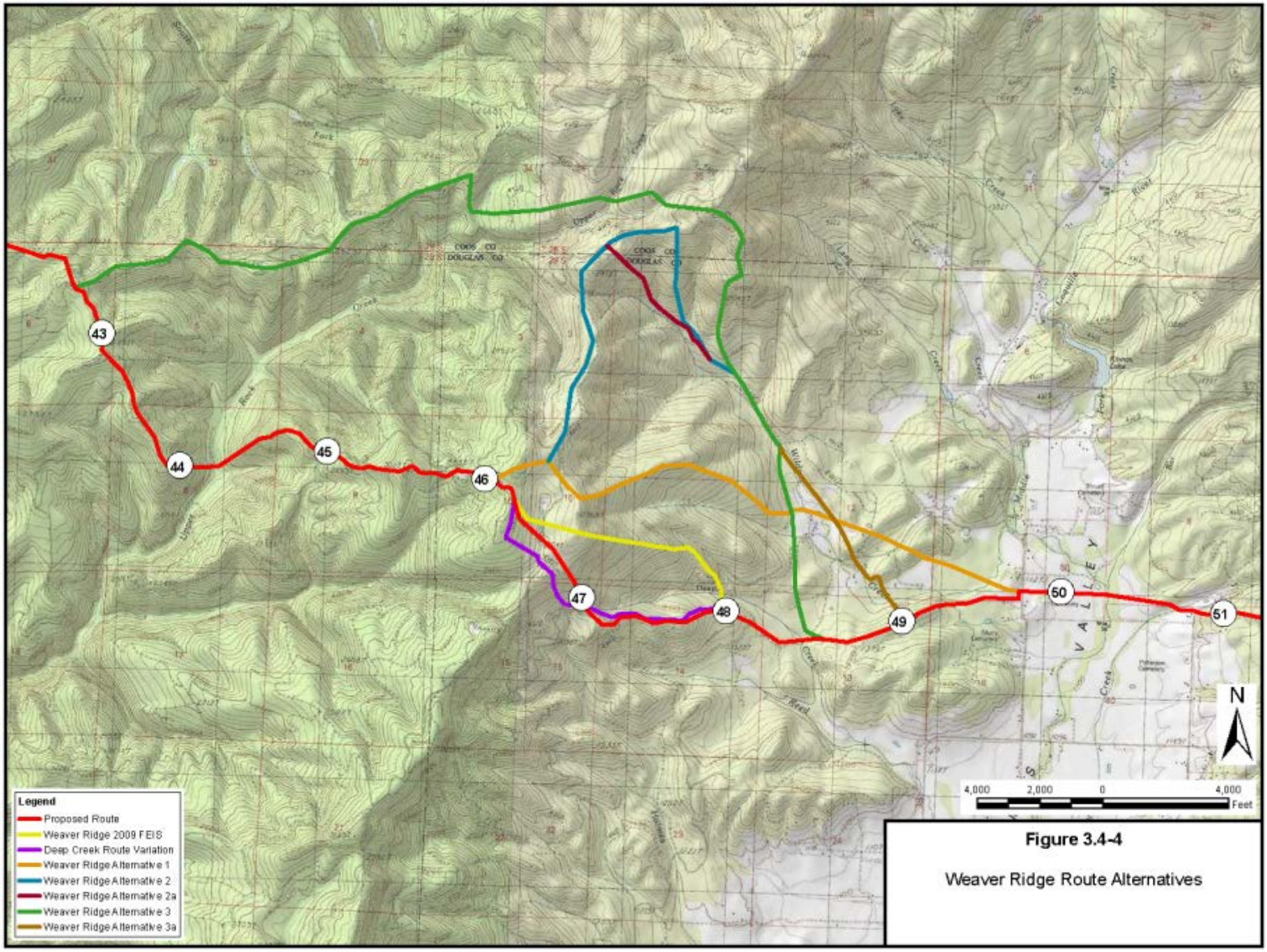

Figure 3.4-4

Weaver Ridge Route Alternatives

TABLE 3.4.2.3-1

Comparison of the Proposed Route with Weaver Ridge Alternative Routes

Alternatives Analysis		Proposed Route	Deep Creek Route Variation	2009 FEIS Route	Weaver Ridge Alternative 1	2	2a	3	3a
General									
Total length (miles) a/		7.3	7.4	7.2	7.0	9.3	9.0	8.6	8.2
Acres of construction right-of-way b/c/		84	85	82	80	107	103	99	94
Acres affected during operations (operational easement) d/		44	45	43	42	56	54	53	50
Number of Parcels Affected	BLM	4	4	4	3	5	4	4	4
	Private	12	12	11	11	15	14	12	13
	State	0	0	0	0	0	0	0	0
Land ownership (miles)	BLM	2.7	2.8	3.3	2.5	3.4	2.8	3.6	3.2
	Private	4.6	4.6	3.9	4.5	6.0	6.2	5.0	5.0
	State	0	0	0	0	0	0	0	0
Waterbodies and Wetlands									
Number of waterbodies crossed e/		5	5	5	2	7	7	11	11
Total wetland crossing length (feet) f/		0	0	0	0	0	0	0	0
Land Use									
Land Allocations (miles)	Matrix	2.1	2.1	2.1	1.1	1.4	1.4	0.7	0.4
	LSR	0.6	0.7	1.2	1.4	1.9	1.4	2.9	2.9
	Riparian Reserves	0.5	0.7	0.5	<0.1	0.5	0.3	0.6	0.5
Evergreen forest, Mixed conifer (late successional/old-growth) (miles)		0.4	0.7	0.4	1.8	2.2	1.7	1.2	1.7
Regenerating/mid-seral forest (miles)		3.7	5.4	3.9	3.4	4.5	4.5	6.3	5.2
Total forest lands affected (miles)		6.0	7.1	5.9	6.3	8.5	8.1	8.0	7.4
Other land use types (miles)		1.3	0.3	1.3	0.7	0.8	0.8	0.7	0.8
Miles of right-of-way that would be parallel or adjacent to existing rights-of-way		3.2	3.8	3.6	2.4	3.6	3.2	2.7	2.3
Number of previously identified cultural resources along the route f/		0	0	0	1	0	0	0	0
Number of newly identified cultural resources along the route f/		0	0	0	0	0	0	0	0
Endangered Species									
Miles of marbled murrelet critical habitat crossed		0.6	0.7	1.2	1.4	2.0	1.4	2.9	2.9
Number of marbled murrelet occupied stands crossed		1	1	2	2	1	1	0	0
Miles of marbled murrelet occupied stands crossed		<0.1	<0.1	0.4	1.0	<0.1	<0.1	0	0
Miles of northern spotted owl critical habitat crossed		0.9	1.0	1.0	1.1	1.7	1.3	2.5	2.5
Number of northern spotted owl home ranges crossed		4	4	4	5	5	5	6	6

TABLE 3.4.2.3-1

Comparison of the Proposed Route with Weaver Ridge Alternative Routes

Alternatives Analysis	Proposed Route	Deep Creek Route Variation	2009 FEIS Route	Weaver Ridge Alternative 1	2	2a	3	3a
Miles of northern spotted owl home ranges crossed	5.9	6.0	5.8	6.0	8.1	7.8	7.3	7.0
Number of northern spotted owl 500-acre core areas crossed	1	1	0	1	2	2	2	2
Miles of northern spotted owl core areas crossed	0.6	0.6	0	1.1	1.4	1.0	1.9	1.9
Number of 30-acre nest patches crossed	0	0	0	1	1	0	0	0
Miles of 30-acre nest patches crossed	0	0	0	0.1	0.4	0	0	0

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ The construction right-of-way estimate for all route variations utilized 95 feet.
c/ TEWAs for all route variations have not been designed and are not included in the total acres of disturbance.
d/ The assumed operational easement is 50 feet; however, Pacific Connector will only maintain vegetation within 15 feet of the pipeline centerline for a total of 30 feet during the long term.
e/ Waterbodies from PNW Hydrography Framework Clearinghouse.
f/ NWI CONUS data.

3.4.2.4 Camas Valley Alternative Routes

The BLM requested Pacific Connector consider route alternatives in the vicinity of the Camas Valley in Douglas County, Oregon to avoid MAMU habitat. Three route variations that cross the Camas Valley were identified: the 2007 Northern Alternative (or Variation) Route, the Camas Valley East Alternative Route, and the proposed route. These routes are illustrated on figure 3.4-5 and compared in table 3.4.2.4-1.

The Northern Alternative Route would leave the proposed route at about MP 50.2 and head northeast across the Camas Valley then turn southeast over forested hills before it rejoins the proposed route near MP 53.0. This alternative route would cross habitat and one occupied stand for MAMU and habitat for NSO, and the BLM found it unacceptable.

The BLM suggested the Camas Valley East Alternative Route, which would follow the Northern Alternative for about 1 mile. It would leave the Northern Alternative Route and head southeast for about 0.4 mile. It would then turn east and follow the section line for about 1.2 miles before reconnecting with the proposed route just west of MP 53.0, east of the Camas Valley. Pacific Connector determined that the Oregon State Highway 42 crossing location along BLM's Camas Valley East Alternative Route was unacceptable for engineering design and safety reasons. The highway crossing along this alternative would be at the midpoint of a mile-long section of highway fill approximately 80 feet deep. The alternative pipeline route would also cross a tributary to Jim Bilieu Creek that flows beneath the highway in a culvert. Between Highway 42 and Quiet Mountain Road there is a rocky outcropping with numerous seeps and springs. The water appears to be collected and utilized by the nearby landowners for various uses. The severe elevation change from one side of the highway to the other, residences, water sources, powerline, and the presence of fill and rock collectively renders the alternative highway crossing virtually non-constructible.

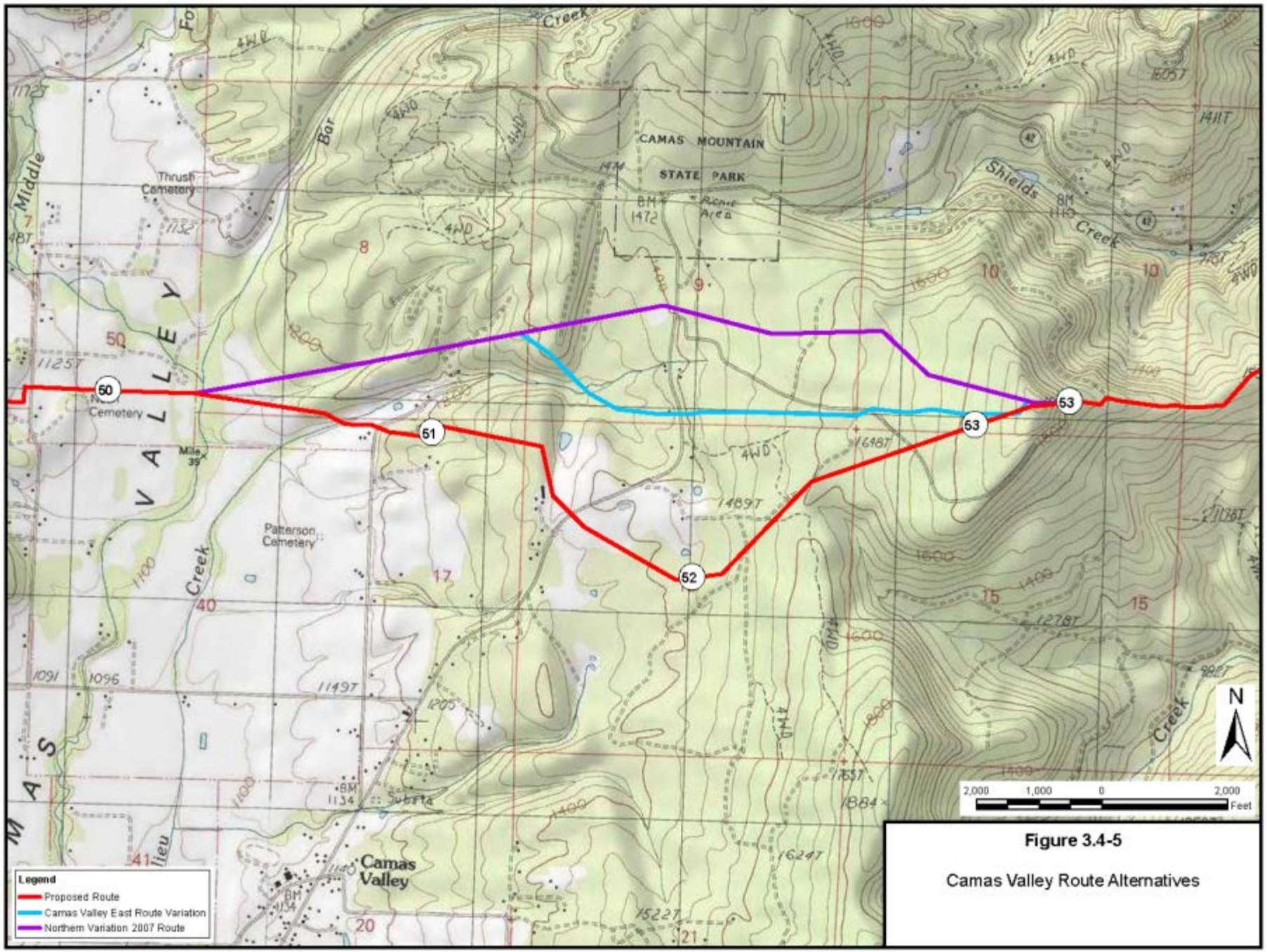

Figure 3.4-5

Camas Valley Route Alternatives

TABLE 3.4.2.4-1

Comparison of Camas Valley Alternatives with the Corresponding Segment of the Proposed Route

Alternatives Analysis		2007 Northern Alternative Route	Camas Valley East Alternative Route	Proposed Route
General				
Length (miles) a/		2.7	2.7	2.9
Construction right-of-way (acres)		31	32	33
Permanent easement (acres) b/		16	Estimated to be similar to Northern Variation	17
Land Use				
Land Ownership (miles)	Private	2.0	Similar to Northern Variation	2.3
	State	0	0	0
	Federal (BLM/NFS lands)	0.8	Similar to Northern Variation	0.6
Number of landowner parcels crossed		8	Unknown	15
Number of residences within 50 feet of construction right-of-way		0	1	0 c/
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of alternative length)		0.1	1.2	0.1
LSR - Federal land use designation (acres)		0	Unknown	5 d/
Riparian Reserves - federal land use designation (acres)		3	Unknown	1
Waterbodies and Wetlands				
Number of waterbodies crossed e/		11	3	4
Length of wetland crossings (feet) f/		0	0	0
Vegetation				
Agricultural lands affected (acres)		2	2	8
Total forest clearing (acres)		39	14	28
Acres Clearcut/Regenerating (0 to 40 years) g/		22	13	14
Acres Mid-Seral Forest (40 to 80 years)		10	Undetermined	8
Acres Late-Successional Forest (80 to 175 years)		2	Undetermined	6
Old-Growth Forest (175 +)		4	Undetermined	0
Biological Resources				
MAMU suitable habitat crossed (feet) h/		18	Unknown	5
MAMU stands	Occupied	Alignment crosses 1,043 feet of Occupied Stand R3027	Unknown	No known stands
	Presumed	Alignment crosses 350 feet of Potential MAMU Stand B12 that is not likely to be occupied based on the 2-year survey protocol.	Unknown	No known stands
MAMU critical habitat (acres)		0	Unknown	5 Pacific Connector made a minor adjusted to the Southern Route Variation to avoid crossing approximately 175 feet of the old-growth forest within this Critical Habitat Unit.)
NSO. suitable habitat crossed (acres) i/		33	Unknown	20
NSO. nest patch/cores		None	Unknown	No known nest patch/cores
NSO critical habitat crossed (feet)		0	Unknown	0
Habitat category(acres) j/	1	5	Unknown	2
	2	5	Unknown	13
	3	15	Unknown	17
	4	18	Unknown	16
	5	2	Unknown	2
	6	2	Unknown	3

TABLE 3.4.2.4-1

Comparison of Camas Valley Alternatives with the Corresponding Segment of the Proposed Route

Alternatives Analysis	2007 Northern Alternative Route	Camas Valley East Alternative Route	Proposed Route
Kincaid's lupine	Approximately 2.2 miles of potential habitat crossed; 0.8 mile surveyed of which 0.3 mile was considered suitable; no plants located in 2007.	Unknown	Approximately 1.1 miles of habitat may be suitable for Kincaid's lupine.
ESA fish species present/habitat k/	1 stream crossing known, 3 stream crossings unknown. 1 stream crossing - Oregon Coast ESU Coho, assumed.	Unknown	1 stream crossing known, 3 stream crossings unknown. 1 stream crossing - Oregon Coast ESU Coho, assumed.
StreamNet – anadromous fish distribution l/	None	None	None
Geotechnical			
Steep or difficult terrain (miles) m/	0.0	Unknown	0.0
Highly erosive soils (miles) n/	0.2	Unknown	0.2
Cultural Resources			
Number of previously recorded cultural resources	3 - Isolated finds; 2- sites	1 site	2 sites
Number of newly identified cultural resources o/	N/A	Unknown	1- isolated find

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ Acres of operational easement calculated based on a 50-foot width.
c/ There are 2 outbuilding structures (barns/sheds) in the vicinity of the Southern Route Alternative**.** that are within 50 feet of the construction right-of-way (MP 51.4 and MP 51.9). Neither of these structures is suspected of being residences; however, during the right-of-way acquisition phase, Pacific Connector would attempt to locate the construction right-of-way 50 feet from any residences, where feasible.
d/ A total of approximately 5 acres of federal LSR would be affected, with 3 acres occurring within clear- cut/regenerating forests (0 to 40 years) and 2 acres occurring within mid-seral forest (40 to 80 years).
e/ Waterbodies from PNW Hydrography Framework Clearinghouse.
f/ NWI CONUS data.
g/ Forest Age Classes: Includes recent clearcut forests and areas of inroad construction where forest clearing would be reduced.
h/ Huff et al. (2006)
i/ Forest Service (2005a)
j/ See Section 3.4.1.4 of Pacific Connector's Resource Report 3 filed with its September 2007 application to the FERC.
k/ FWS, NMFS, and StreamNet (http://www.streamnet.org).
l/ ODFW (2000a, 2006a); StreamNet.
m/ Based on Soil Mapping Units that have slopes of 50-75 percent and have a water erosion rating of high or severe (NRCS 2004).
n/ Based on Soil Mapping Units that have a water erosion rating of high or severe (NRCS 2004).
o/ The new proposed route would avoid one site and three isolated finds on the Northern Alternative. One site would be affected regardless of the route selection. This route was not completely surveyed.

The proposed route includes a highway crossing location that Pacific Connector states is constructible, and avoids an occupied MAMU stand. Pacific Connector proposes to cross under Highway 42 along the proposed route where it is essentially level using conventional boring methods. Both sides of the highway crossing are only lightly vegetated which would minimize visual impact of the pipeline right-of-way from motorists traveling along Highway 42.

The proposed route is approximately 0.2 mile longer than the Northern Alternative Route. Based on evaluation of the Pacific Northwest Hydrography Framework Clearinghouse data layers, the proposed route would cross 4 waterbodies compared to 11 for the Northern Alternative Route, and would require the clearing of less forest. The FERC staff and BLM agree that neither the 2007 Northern Variation nor the Camas Valley East Alternative Route offer significant environmental advantage over the proposed route between MPs 50.2 and 53.0.

3.4.2.5 Interstate 5 and South Umpqua River Crossing Alternative Routes

Pacific Connector investigated various alternative routes to cross I-5 and the South Umpqua River between about MPs 67.4 and 74.8 in Douglas County, south of the city of Roseburg due to

concerns raised during scoping. The various routes are illustrated on figure 3.4-6 and are compared on table 3.4.2.5-1.

The route analyzed in the FERC's May 2009 FEIS in Docket No. CP07-441-000 (May 2009 FEIS Alternative Route) had constructability and environmental issues. Pacific Connector had proposed to use a bore to cross under I-5 along the May 2009 FEIS Alternative Route, but concerns were raised due to uncertain subsurface conditions associated with the extended crossing length (approximately 400 feet) and unknown types of fill material. Additional considerations include removal of approximately 40 feet of overburden material on the west side of I-5 to construct a bore pit, and un-useable workspace conditions due to steep side slopes on both sides of I-5 at the alternative route crossing location. Pacific Connector had originally proposed to use a diverted open cut for the western crossing of the South Umpqua River along the May 2009 FEIS Alternative Route, but concerns were raised about impacts that crossing method may have on federally listed fish species. In addition, a bald eagle nest was found near the crossing location that would have delayed construction during the breeding season, conflicting with the ODFW water crossing window.

Also along the May 2009 FEIS Alternative Route, the pipeline would be near a recently developed subdivision on property owned by Marc and Dea McConnell. Pacific Connector created the MP 69.7 Alternative Route that would go on the north side of the McConnell property from the original location of the proposed Clarks Branch Meter Station eastward to cross I-5. This alternative route would move the bore under I-5 approximately 350 feet to the northwest. However, that alternative would still cross one of the developed lots and one of the undeveloped lots, and would be within 50 feet of five residences. Although this modification would result in a slightly shorter bore under I-5, and eliminate the need to remove excessive amounts of overburden at the bore pit location, the MP 69.7 Alternative Route would involve additional affected landowners and would not address risks associated with highway fill material and steep slopes at the crossing.

The MP 69.5 Alternative Route would go south of the McConnell property to avoid the residential development. This alternative route would still be within 50 feet of one residence. It would cross I-5 in an area where Pacific Connector believed it could put in a bore. This alignment would require a relocation of the proposed Clarks Branch Meter Station. Both the MP 69.7 Alternative Route and the MP 69.5 Alternative Route would use the same diverted open cut crossing of the South Umpqua River at the location along the May 2009 FERC Alternative Route; and therefore would also be within one-quarter mile of the occupied bald eagle nest. The MP 69.5 Alternative Route would be slightly longer than either the May 2009 FERC Alternative Route and the MP 69.7 Alternative Route, and would cross land owned by the Cow Creek Tribe.

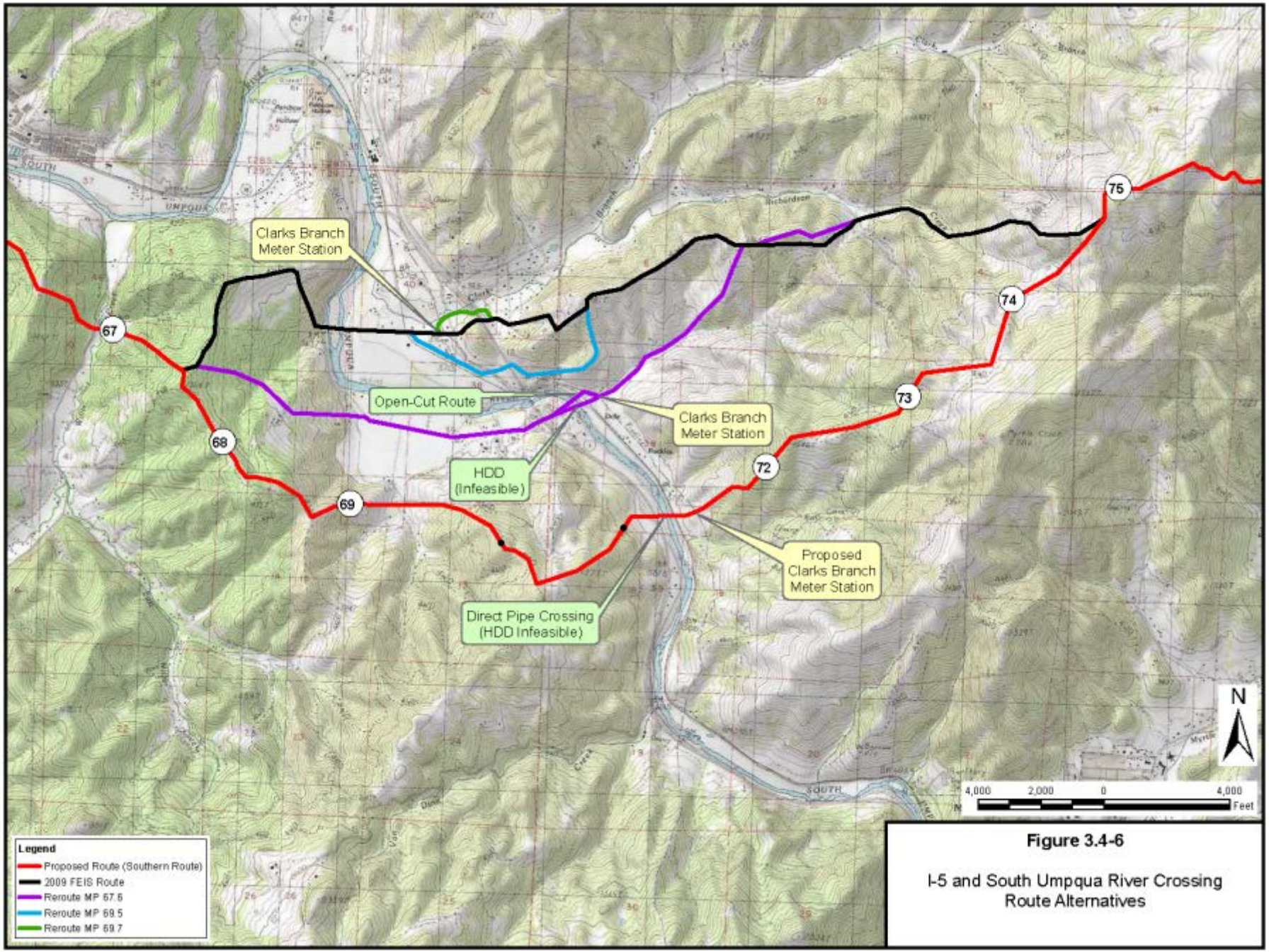

Figure 3.4-6

I-5 and South Umpqua River Crossing Route Alternatives

TABLE 3.4.2.5-1

Comparison of I-5 Alternative Routes to the Proposed Route

Alternatives Analysis		May 2009 FEIS Route Alternative	MP 69.7 Route Alternative	MP 69.5 Route Alternative	MP 67.6 Route Alternative	Proposed Route
General						
Total length (miles) a/		6.6	6.6	6.8	6.2	7.3
Acres of construction right-of-way b/		76	76	79	72	82
Total acres of construction disturbance		148	Not designed c/	Not designed c/	121	106
Acres affected during operations (operational easement) d/		40	40	41	38	44
South Umpqua River Crossing Method		Diverted open cut	Diverted open cut	Diverted open cut	Open cut	DP technology
Landowner parcels crossed e/		39	35	27	28	26
Number of residences within 50 feet of construction right-of-way		7	5	1	0	0
Land ownership (miles)	Private	5.7	5.7	4.9	4.3	7.1
	State	0.3	0.3	0.3	0.4	0.2
	Federal (BLM/NFS Lands)	0.0	0.0	0.0	0.0	0.0
	Tribal	0.6	0.6	1.6	1.5	0.0
Waterbodies and Wetlands f/						
Number of waterbodies crossed		13	13	14	19	18
Total wetland crossing length (feet)		644	0	0	741	959
Land Use						
Agricultural land (including pastures) affected (miles)		0.6	0.5	0.8	1.1	0.1
Forest lands affected (miles) g/		1.5	1.5	1.4	1.6	3.7
Miles of right-of-way that would be parallel or adjacent to existing rights-of-way		3.5	3.4	2.5	3.0	1.6
Number of previously identified cultural resources along route		0	0	0	0	0
Number of newly identified cultural resources along route h/		3	1	1	0	0
Critical Habitat						
The coho salmon – Oregon Coast ESU – including designated CHU.		Present - South Umpqua River	Present - South Umpqua River	Present - South Umpqua River	Present - South Umpqua River	Present - South Umpqua River
Bald eagle nest within 0.25-mile		Present	Present	Unknown	Unknown	Unknown

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ The construction right-of-way for the preferred route and original proposed alignment is 95 feet.
c/ TEWAs for the various potential I-5 reroutes have not been designed and are not included in the total acres of disturbance. Pacific Connector assumes that the need for these TEWAs would be similar to the proposed route.
d/ The permanent easement for the proposed route and potential I-5 reroutes is 50 feet.
e/ Douglas County Assessor's Office (2011)
f/ Waterbodies and wetlands were obtained from the Hydrography Framework Clearinghouse and review of aerial photos. NWI mapping is not available for this area.
g/ Includes all forestland types and age classes; Mixed conifer, Deciduous forest.
h/ Surveys completed along proposed route; survey incomplete on reroutes.

It was Pacific Connector's preference to cross under both I-5 and the South Umpqua River using a single HDD, or cross I-5 with a bore where the slopes were not steep and highway fill would not be so great. Therefore, the applicant examined another crossing location along the MP 67.6 Alternative Route. The MP 67.6 Alternative Route would leave the May 2009 FEIS Alternative Route at about MP 67.6 heading southeast down a hill and then follow Old Highway 99 east for about 1 mile. It would cross I-5, the South Umpqua River, Dole Road, and a railroad before

rejoining the May FEIS Alternative Route along Richardson Ridge at about MP 72.6. Because of the immediate proximity of Dole Road along the steep abrupt east bank of the river, it would be necessary to temporarily close the road to complete the river crossing. Old Highway 99 may also have to be temporarily closed to traffic during installation of the pipeline along the MP 67.6 Alternative Route.

Pacific Connector completed geotechnical investigations along MP 67.6 Alternative Route and determined that an HDD under I-5, the river, and the railroad would not be feasible because of the unfavorable geologic conditions. An open-cut crossing of the South Umpqua River would be required along the MP 67.6 Alternative Route because a diverted open-cut crossing at that location would be problematic for the following reasons:

- narrow gravel bar in the river would limit the diversion channel;
- shallow bedrock in upstream part of the gravel bar may require blasting;
- bar may have subsurface water flows;
- upstream and downstream elevation changes may require greater excavation and larger spoil storage areas; and
- longer in-water work associated with construction of temporary diversion dams and restoration of the diversion channel.

In 2013, Pacific Connector investigated a southern route that would have a less difficult crossing of I-5 and the South Umpqua River using a different technological method, and incorporated this change into the proposed route filed with its application to the FERC in Docket No. CP13-492-000. The proposed route would leave the May 2009 FEIS Alternative Route at about MP 67.6 and head southeast over upland ridgelines, turning due east for about a mile between MPs 69.0 and 70.0, then turn northeast from Edies Land at MP 70.5 to Highway 99 at MP 71.1. Because subsurface conditions would not allow for a HDD along the proposed route, Pacific Connector would use DP technology to cross under I-5, the South Umpqua River, Dole Road, and a railroad to MP 71.4. DP technology can overcome the problematic issues associated with the HDD crossing method because it provides a continuously supported hole during the excavation process, reduces the pressure of drilling mud, and eliminates the bore hole reaming and pull back requirements of an HDD. The Clarks Branch Meter Station would be moved to a pasture on the east side of the railroad where Northwest's Grants Pass Lateral is located near MP 71.5. The proposed route would continue northeast from the meter station following upland ridges to rejoin the May 2009 FEIS Alternative Route at about MP 74.8, along a private road south of the head of Clark Branch.

The proposed route would avoid residential areas as well as the pastures and croplands crossed by the MP 67.6 Alternative Route. It offers the best crossings of I-5 and the South Umpqua River, and avoids the steep side slopes found along the May 2009 FEIS Alternative Route. The relocation of the Clarks Branch Meter Station to MP 71.5 on the proposed route would avoid the need for permanent wetland fill at the meter station location along the May 2009 FEIS Alternative Route. We conclude that none of the alternative routes would offer significant environmental advantages over the proposed route between MPs 67.4 and 74.8.

3.4.2.6 Northern Spotted Owl Nest Patch Alternative Routes

The BLM asked Pacific Connector to revise its 2009 route in order to avoid LSOG and a NSO nest patch. The pipeline route analyzed in the FERC's May 2009 FEIS for Docket No CP07-441-000 crossed an NSO nest patch between about MPs 81.2 and 82.5, east of South Myrtle

Creek in Douglas County. Pacific Connector modified its pipeline alignment to avoid the NSO nest patch in its June 2013 application to the FERC in Docket No. CP13-493-000. These two routes are compared in table 3.4.2.6-1 and illustrated in figure 3.4-7.

The proposed route would be co-located with a recently constructed logging road, and routed through recently harvested forest. The May 2009 FEIS Alternative Route would cross less private land, including agricultural land. However, the proposed route would reduce impacts on LSOG forest and avoid the NSO nest patch. Therefore, we conclude that the May 2009 FEIS Alternative Route would not offer significant environmental advantage over the proposed route between MPs 81.2 and 82.5.

TABLE 3.4.2.6-1

Comparison of the May 2009 FERC FEIS Route Alternative With the Proposed Route Between MPs 81.2 and 82.5

Impact/Issue		May 2009 FEIS Route Alternative	Proposed Route
Total length (miles) a/		1.3	1.3
Acres of construction right-of-way		15	15
Acres of TEWAs		11	9
Permanent easement (acres) b/		8	8
Number of landowner parcels crossed		4	3
Land ownership (miles):	Private	0.6	1.3
	State	0.0	0.0
	Federal (BLM/NFS lands)	0.7	0.0
Number of residences within 50 feet of construction right-of-way		0	0
Geotechnical constraints		0	0
Number of waterbodies crossed c/		1	1
Total waterbody crossing length (feet)		2	2
Number of wetlands crossed		0	0
Total wetland crossing length (feet)		0	0
Agricultural land affected (acres)		<1	<1
Forest lands cleared (miles) d/		1.1	0.7
Forest cleared LSOG (miles)		0.7	0.0
Number of NSO nest patches crossed		1	0
Number of previously identified cultural resources along route		3	0
Number of newly identified cultural resources along route		0	0
Miles of right-of-way that would be parallel or adjacent to existing rights-of-way		1.0	1.0

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).

a/ Mileage length cannot be calculated by subtracting milepost ranges because of engineering station equations included in route segment between MPs 9.41R to 8.59. Route Alternative lengths also cannot be accurately calculated by comparing mileposts due to shifts in the alignment.

b/ Acres of permanent easement calculated based on crossing length on private and federal timber lands. Pacific Connector proposes a 50-foot permanent easement on both federal and private lands.

c/ From Pacific Northwest Hydrography Framework Clearinghouse data layers (http://hydro.reo.gov/) and review of aerial photography and review of NWI mapping.

d/ Includes recent clear-cut forests and areas of inroad construction where forest clearing would be reduced.

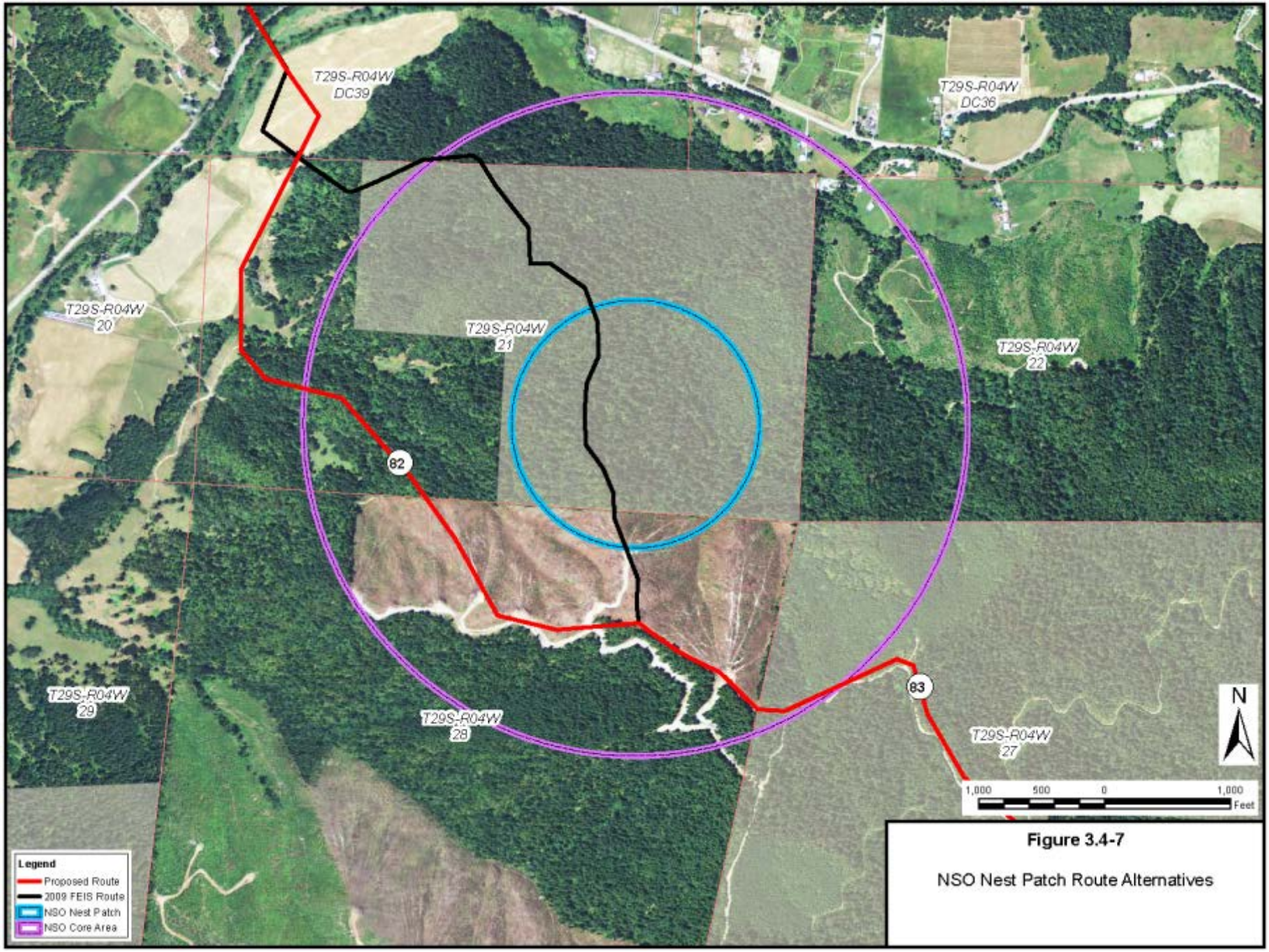

Figure 3.4-7

NSO Nest Patch Route Alternatives

3.4.2.7 Oregon Women's Land Trust Alternative Routes

In response to objections raised by the Oregon Women's Land Trust about the 2007 pipeline route across its property, Pacific Connector adjusted its proposed route between about MPs 85.4 and 87.0. Table 3.4.2.7-1 compares the 2007 Alternative Route to the proposed route; both routes are illustrated on figure 3.4-8.

The 2007 Alternative Route would be approximately 50 feet from a guest house. The proposed route avoids this house and minimizes the overall crossing of Trust-owned lands. Other environmental advantages of the proposed route include following an existing right-of-way for 0.4 mile and avoiding crossing tributaries to Wood Creek. However, the 2007 Alternative Route would be shorter, affect two fewer landowners, clear fewer acres of forest, and avoid an historic NSO activity center.

In an October 27, 2012, letter to the Commission, the Oregon Women's Land Trust stated that it found both routes objectionable. The Trust's Board believes that either route would conflict with the Trust's mission to protect the land in perpetuity. When evaluating alternatives, sometimes tradeoffs between resources have to be considered. In this situation, we are weighting impacts on natural resources against impacts on a residence. While we acknowledge that the 2007 Alternative Route would impact less forest, we conclude that the proposed route would result in the least amount of impact on the Oregon Women's Land Trust property, would avoid impacts on a residence, and would avoid crossing any waterbodies. Therefore, we found that the 2007 Alternative Route would not offer significant environmental advantages over the proposed route between MPs 85.4 and 87.0.

TABLE 3.4.2.7-1

Comparison of Alternative Routes Across the Oregon Women's Land Trust Property

Alternatives Analysis		2007 Route Alternative	Proposed Route
General			
Length (miles) a/		1.4	2.0
Construction right-of-way (acres)		16	22
Number of TEWAs		10	6
Acres of TEWAs		5	2
Operational easement (acres) b/		8	10
Land Use			
Land Ownership (miles)	Private	1.2	1.5
	State	0.0	0.0
	Federal (BLM/NFS Lands)	0.2	0.5
Number of landowner parcels crossed		6	8
Number of residences within 50 feet of construction right-of-way		1	0
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of alternative length)		0.0 (0 percent)	0.4 (21 percent)
Waterbodies and Wetlands			
Number waterbodies crossed d/		3 c/	0
Length of wetland crossings (feet) e/		0	0
Vegetation			
Total forest clearing (acres)		20	25
Acres Clearcut/Regenerating (0 to 40 years)		5	4
Acres Mid-Seral Forest (40 to 80 years)		2	<1
Acres Late-Successional Forest (80 to 175 years)		9	15
Acres Old-Growth Forest (175 +)		4	5
Biological Resources			
Northern spotted owl. suitable habitat crossed (acres) f/		19	24
Northern spotted owl nest patch/cores		1	1
Northern spotted owl critical habitat crossed (feet)		0	0

TABLE 3.4.2.7-1

Comparison of Alternative Routes Across the Oregon Women's Land Trust Property

Alternatives Analysis		2007 Route Alternative	Proposed Route
Habitat category (acres) g/	1	4	7
	2	9	13
	3	7	5
	4	0	0
	5	0	0
	6	<1	<1
ESA fish species present / habitat h/		1 stream Oregon Coast ESU Coho, assumed habitat T, CH	None
StreamNet – anadromous fish distribution i/		1 stream – assumed	None
Geotechnical			
Steep or difficult terrain (miles) j/		0.0	0.0
Highly erosive soils (miles) k/		0.9	1.4

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ Acres of permanent easement calculated based on a 50-foot width.
c/ Field surveys identified 2 streams.
d/ Pacific Northwest Hydrography Framework Clearinghouse data layers (http://hydro.reo.gov/).
e/ From NWI mapping - access was denied on the majority of the parcels crossed by this route.
f/ Forest Service (2005a).
g/ See description in Pacific Connector's Resource Report 3 in its June 2013 application.
h/ FWS, NMFS, and StreamNet (http://www.streamnet.org).
i/ ODFW 2000a, 2006a; StreamNet.
j/ Based on Soil Mapping Units that have slopes of 50 to 75 percent and have a water erosion rating of high or severe (NRCS 2004).
k/ Based on Soil Mapping Units that have a water erosion rating of high or severe (NRCS 2004).

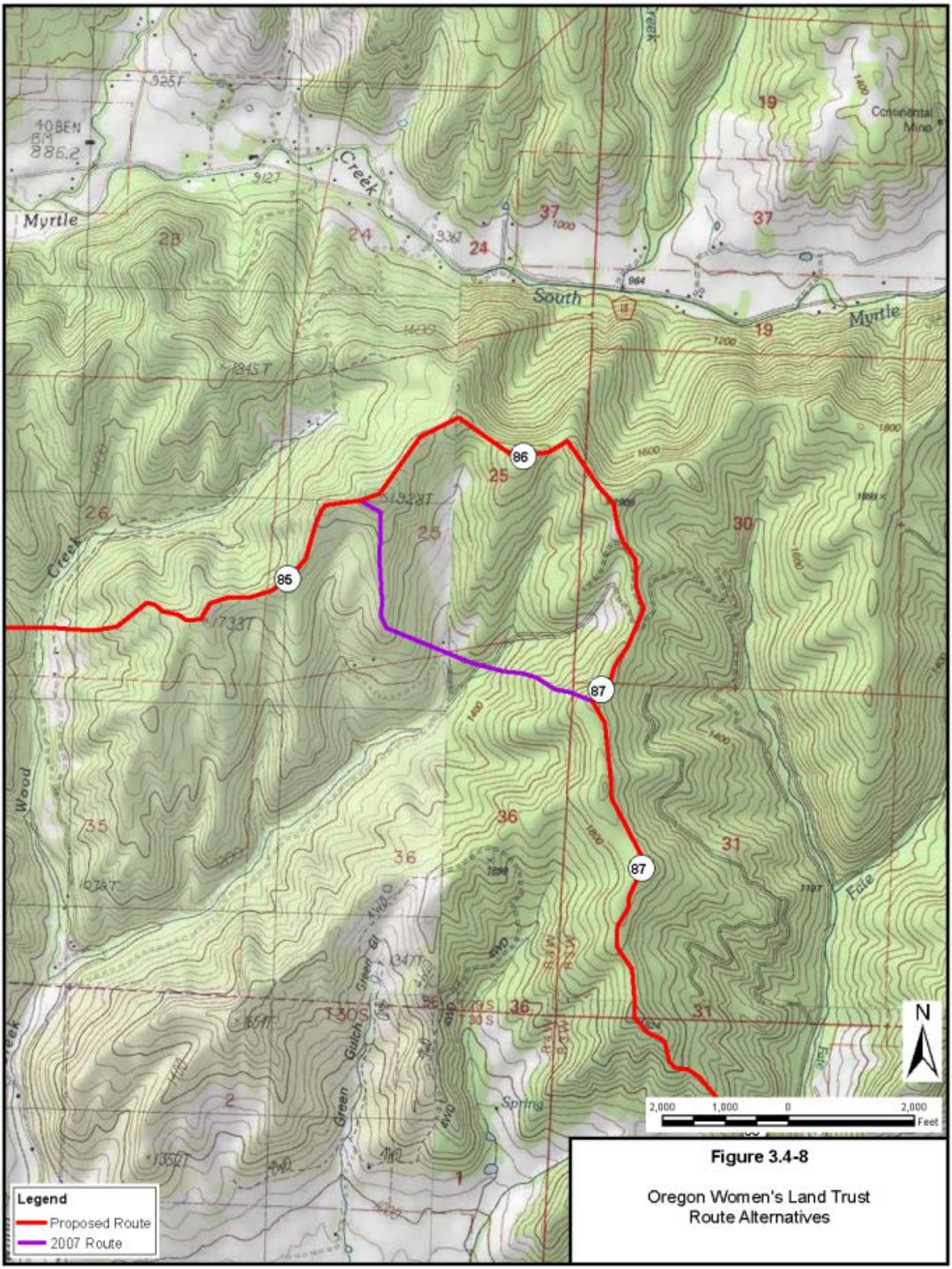

Figure 3.4-8

Oregon Women's Land Trust
Route Alternatives

3.4.2.8 Umpqua National Forest – Neuman Gap to Long Prairie Alternative Routes

The Forest Service requested the consideration of alternative routes within the Umpqua National Forest, along Wildcat Ridge between Neuman Gap near MP 105 and Long Prairie near MP 111. We compared the proposed route to three alternatives routes: the May 2006 Alternative Route (Alternative 1); the Forest Service Road 3200 Alternative Route (Alternative 2); and the Compromise Alternative Route (Alternative 3). The proposed route and alternative routes in this area are shown on figure 3.4-9, and table 3.4.2.8-1 includes a comparison of environmental variables between the alternative routes and the corresponding segment of proposed route.

The Forest Service and the Cow Creek Tribe indicated that a segment of the pipeline route originally proposed by Pacific Connector in May 2006 had the potential to impact an important traditional cultural property. The Forest Service also raised issues related to the crossing of an LSR. Based on these objections, we do not recommend use of the May 2006 Alternative Route (Alternative 1).

The Forest Service suggested a different alternative route that would follow existing Forest Service Road 3200 (Alternative 2). The rationale for this alternative was to utilize the existing cleared road corridor to minimize forest fragmentation and reduce impacts on LSRs. We also do not recommend use of the Forest Road 3200 Alternative Route Variation, because of Pacific Connector's concerns about its constructability, including:

- There is a high risk of landslide occurrence from Forest Service Road #3200, headwall swales and from constructed fill slopes that would be completed during construction;
- Earthwork necessary for a 95-foot construction corridor on side slopes exceeding 70 percent along the route is considered infeasible due to geotechnical considerations;
- Steep side slopes (greater than 50 percent) require significant excavations to construct a 95-foot construction corridor. Based on anticipated range of excavation of between 0.5:1 (horizontal:vertical) and 1:1, the cutslope would be between approximately 100 to 135 feet in height. The excavation would extend at least 50 feet upslope of the existing cutslope; and
- Up to 25,000 cubic yards of excavation material would be generated per station (100 feet) along the steep slopes. The excavated materials would need to be end-hauled to a stable, temporary stockpile site.

Subsequently, Pacific Connector developed its Compromise Alternative Route (Alternative 3). The Forest Service indicated that the Compromise Alternative Route would cross an area planned for expansion of the Peavine rock quarry, and issues were raised about the crossing of the East Fork Cow Creek. The Peavine quarry is the largest and most extensively developed quarry within the upper reaches of the watershed and is of strategic importance to the Umpqua National Forest. The Forest Service also requested that the pipeline avoid a known NSO nest patch. Based on the Forest Service objections, we do not recommend use of the Compromise Alternative Route.

Pacific Connector conducted site visits with the Forest Service and additional field studies. Based on this information, they identified the proposed route.

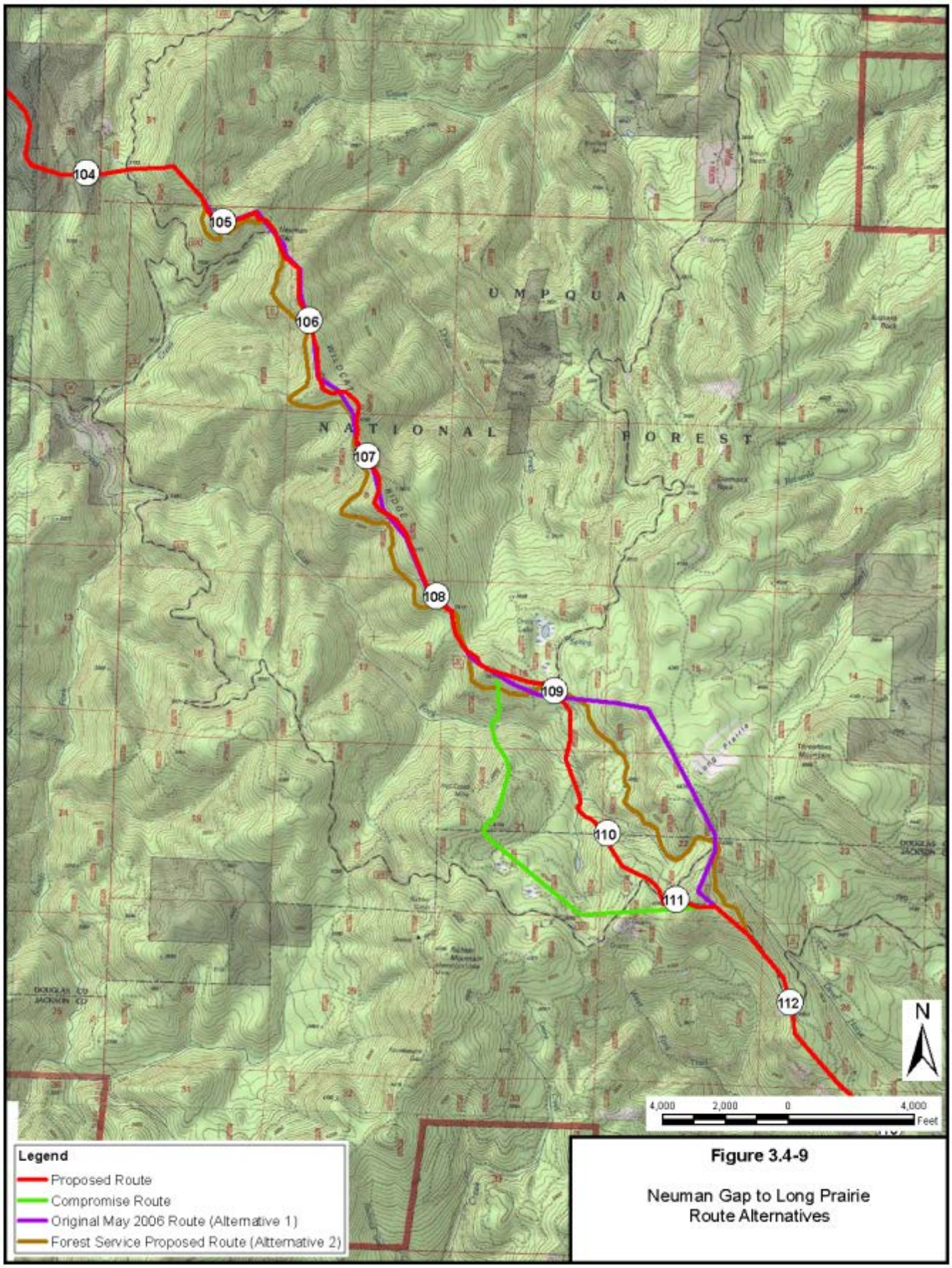

Figure 3.4-9

Neuman Gap to Long Prairie
Route Alternatives

TABLE 3.4.2.8-1

Comparison of Umpqua National Forest Alternative Routes With the Corresponding Segment of the Proposed Route Between Neuman Gap and Long Prairie – MPs 105 to 111

Impact/Issue	Proposed Route	Compromise Alternative Route (Alternative 3)	May 2006 Alternative Route (Alternative 1)	Forest Service Road 3200 Alternative Route (Alternative 2)
General				
Total length (miles) a/	6.4	6.7	6.4	7.5
Acres of construction right-of-way b/	73	77	73	86
Total acres of construction disturbance	110	117	73 c/	Pipeline integrity risks associated with steep side hill construction along the road, geologic hazards due to grading requirements (25,000 cy/100 feet).
Acres affected during operations (operational easement) d/	45	41	39	86
Land Ownership (miles)				
Forest Service	6.4	6.7	6.4	7.5
Geotechnical				
Miles of steep or difficult terrain to be crossed e/	0.2	0.4	0.1	See construction disturbance comment
Waterbodies and Wetlands				
Number of waterbodies and wetlands crossed f/	7	6	0	0
Total waterbody and wetland disturbance during construction (acres)	0.2	0.3	0	0
Land Use				
Land allocations (miles):				
Matrix	2.9	3.3	3.1	3.3
LSR	3.5	3.4	3.3	4.2
Riparian Reserves	0.5	0.2	0.0	0.3
Evergreen Forest, Mixed conifer (miles)	4.2	3.9	3.4	5.6 h/
Regeneration Forest (miles)	1.8	2.3	2.7	1.8 h/
Clearcuts (miles)	0.0	0.0	0.1	0.0 h/
Total forest lands affected (miles)	6.0	6.2	5.9	7.4 h/
Other land use types	0.4	0.5	0.4	0.1 h/
Miles parallel or adjacent to existing rights-of-way	5.6	5.1	5.4	7.3
Cultural Resources				
Number of previously identified cultural resources along route	0	1 – site 2 – isolated finds	3	0
Number of newly identified cultural resources along route	3 – site 1–isol. find	N/A	1	N/A
Critical Habitat g/				
Acres of federally listed critical habitat for NSO	52	33	34	40 (95-foot ROW only)
Miles of federally listed critical habitat for NSO crossed	6.4	6.7	6.3	7.5
NSO core area (0.5 mile buffer of nest site)	3	4	3	3

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).

a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.

b/ The construction right-of-way for the proposed route and alternative route is 95 feet.

c/ TEWAs for the alternative route have not been designed and are not included in the total acres of disturbance. Pacific Connector estimates that the number and acres of these would be less than those required for the proposed route because the alternative route does not cross any streams or have the length of slope crossings as does the proposed route.

d/ The assumed operational easement for both the proposed route and alternative route is 50 feet; however, Pacific Connector will only maintain vegetation within 15 feet of the pipeline centerline for a total of 30 feet in the long term.

e/ Based on slopes that are greater than 50 percent (based on 10-meter digital elevation model). However, Pacific Connector has routed the alignment to ensure constructability, safety, and long-term stability by avoiding side slopes and approaching slopes with the alignment obliquely or perpendicularly to the slope.

f/ PNW Hydrography Framework Clearinghouse. Ditches were excluded.

g/ Includes acres of impact associated with the construction right-of-way and TEWAs. This analysis used the final revised critical habitat designation (2008).

h/ The proposed Forest Service route follows existing Forest Service Road 3200. Construction of the Forest Service proposed route would require extensive side-cuts; therefore, miles crossed considered habitat adjacent to the road.

The proposed route would avoid the Peavine quarry; avoid crossing the known NSO nest patch; provide better crossing locations of the East Fork Cow Creek; and avoid the Peavine Camp, a dispersed recreation site. We conclude that none of the alternative routes within the Umpqua National Forest from near Neuman Gap to near Long Prairie, between MPs 105 to 111, would offer significant environmental advantage over the proposed route

3.4.2.9 East Side of the Rogue River Access Alternatives

During the scoping period, landowners along Old Ferry Road raised concerns about the use of that road for access to the HDD drill site on the east side of the Rogue River during pipeline construction.[17] Therefore, Pacific Connector researched the possibility of finding other alternative access roads to the east side of Rogue River crossing, in the vicinity of MP 123.0.

BLM Road 34-1-23

It may be possible to use existing BLM Road 34-1-23 (Indian Creek Firebreak) as access to the east side of the Rogue River. Use of that road would require driving 2.3 miles on BLM Road 34-1-23 to about MP 125.0, then traveling about 2.2 miles along the new pipeline right-of-way westward to the HDD site. Portions of the pipeline right-of- way would exceed 65 percent grade, which would require that essentially all vehicles receive towing assistance to negotiate the grades. We conclude this may create a safety hazard. Therefore, we have not considered use of this road any further.

New Temporary Access Road

We considered the construction of a new temporary access road to the HDD drill site, on the east side of Old Ferry Road. Figure 3.4-10 shows the potential new road location. Our road design assumptions included:

- the road must be able to handle traffic for the duration of the construction window;
- the road would be reclaimed and revegetated back to its original condition and contours after construction;
- the road would need to be approximately 16 feet wide; and
- the maximum grade for the road could not exceed 12 percent.

[17] See the letter dated October 27, 2012 from Marcella and Alan Laudani and the testimony of Marcella Laudani at the August 30, 2012, public meeting in Medford, and the letter dated October 26, 2012, from Bob Barker and his testimony at the October 10, 2012, public meeting in Canyonville, under Docket No. PF12-17-000.

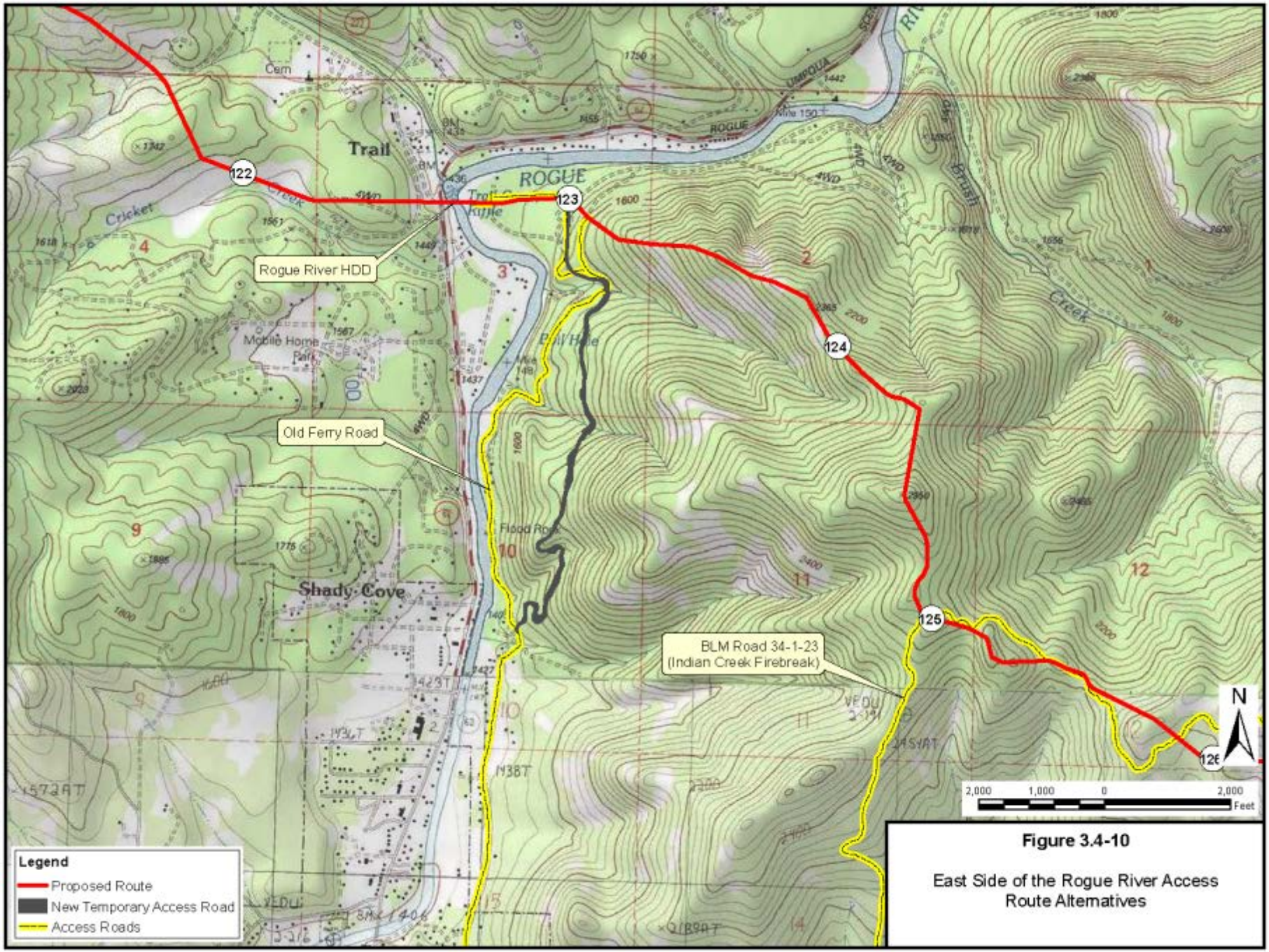

Figure 3.4-10

East Side of the Rogue River Access Route Alternatives

Table 3.4.2.9-1 provides a comparison of the potential new access road with the existing Old Ferry Road. Construction of the new road would result in about 11 acres of disturbance. It is estimated that the combined cut and fill volumes to create a new temporary access road would be 120,000 cy of material, not including the rock to be transported in for the road base. The new TAR would cross approximately 1.4 miles of soils with limiting characteristics that would make disturbed areas difficult to reclaim because they have high erosion potential, steep slopes, large

TABLE 3.4.2.9-1

Comparison of Access Road Alternatives to Reach the East Side of Rogue River

Alternatives Analysis		Existing Old Ferry Road Improvement (Proposed)	New Temporary Access Road Alignment (Alternative)
General			
Road length (miles) a/		1.6	1.4
Road construction right-of-way (acres)		0 b/	11
Number of TEWAs c/		8	0
Acres of TEWAs		<1	0
Land Use			
Land Ownership (miles)	Private	<0.1	2.9
	State	0.0	0.0
	Federal (BLM/NFS Lands)	0.2	7.9
Number of landowner parcels crossed		22	7
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of alternative length)		1.6	0.2
BLM Visual Resource Management II (acres)		<1	8
Waterbodies and Wetlands			
Number waterbodies crossed d/		9	6 e/
Number of wetlands crossed f/		0	0
Vegetation			
Agricultural lands affected (acres)		0	0
Total forest clearing (acres) g/		<1	11
Biological Resources			
Big game winter range (acres)		<1	8
Soils			
Steep or difficult terrain (miles) h/		0.0	0.0
Highly erosive soils (miles) i/		38.0 j/ (TEWAs)	1.2
Reclamation sensitivity (miles) k/		39.0 l/ (TEWAs)	1.4

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).

a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.

b/ The existing road prism of Old Ferry Road is estimated to be an average of approximately 12 feet in width. To utilize the road, minor brushing, grading, and graveling to fill pot holes would be required within the existing road prism.

c/ Temporary extra work areas associated with improvements required on the existing Old Ferry Road for curve widening, and turnouts (the eight TEWAs would be located in 6 areas along Old Ferry Road). No additional temporary extra work areas are associated with the "new road construction" because all necessary construction footprint requirements are included in the road construction right-of-way.

d/ From Pacific Northwest Hydrography Framework Clearinghouse data layers (http://hydro.reo.gov/). No stream widths are provided. Waterbodies are not fish bearing based on StreamNet data (http://www.streamnet.org) and BLM fish presence data (Fsh_aa_a_med_fishbearing).

e/ Four waterbodies crossed on the new road alignment would be new, previously undisturbed waterbody crossings requiring in-water work to install culverts if flowing at the time of construction.

f/ No wetlands are crossed on the proposed Old Ferry Road based on field surveys.

g/ Limited tree clearing required for Old Ferry Road improvements. The new temporary access road would disturb mixed forest typed primarily in the late successional forest age class (80-175 years) based on the BLM's Forest Inventory coverage.

h/ Based on Soil Mapping Units that have slopes of 50-75 percent and have a water erosion rating of high or severe (SCS 1993).

i/ Based on Soil Mapping Units that have a water erosion rating of high or severe (SCS 1993). Approximately 1.2 miles of soil would be crossed in Soil Mapping Unit 122E, which has a Moderate to High Erosion Hazard Potential.

j/ Three TEWAs associated with the Old Ferry Road improvements are located on Soil Mapping Unit 122E which has a Moderate to High Erosion Hazard Potential.

k/ Reclamation Sensitivity – soils having reclamation sensitivity is a combined rating for soils with high or severe erosion potential, steep slopes, large stones, shallow soils, and saline or sodic conditions and clayey soils (greater than 40 percent). This also includes soil map units with dominant amounts of rock outcrop.

l/ Seven TEWAs associated with the Old Ferry Road improvements are located on Soil Mapping Units 144G or 122E, which have a Reclamation Sensitivity Rating.

stones, or are shallow to bedrock. Of the land that would be crossed by the new access road,73 percent is public land managed by the BLM. The remaining 27 percent is owned by six private landowners. If this alternative access were to be required, Pacific Connector would not acquire permanent rights to the road, and the road could not be used for public use.

The new TAR disturbance located on BLM lands (about 8 acres) would be within an area designated as Visual Resource Management Class II (VRM II). The objective of the VRM II class is to retain the existing character of the landscape. The level of change to the landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Pacific Connector expects that the new TAR would not meet the BLM's visual quality objective and the road would be visible to many residences on the west side of the river in the communities of Shady Cove and Trail.

The new TAR would disturb about 8 acres of big game winter range within an Elk Management area on BLM lands. Almost all of the new disturbance associated with the new TAR would not be co-located with rights-of-way or other previous disturbance and would cause additional habitat fragmentation. Based on the data above, we do not recommend use of the new access road to the Rogue River HDD site.

Existing Old Ferry Road-Revised Improvements

Existing Old Ferry Road is a privately owned and maintained access road to houses located on the east side of the Rogue River opposite of the communities of Shady Cove and Trail. That road would need to be improved prior to its use by Pacific Connector for construction access. Improvements could be limited to several turn outs, curve widenings, and one staging area. Pacific Connector would maintain Old Ferry Road during the construction window. Once the HDD crossing under the Rogue River is installed, Pacific Connector would revegetate all disturbed areas and restore Old Ferry Road to its former condition, or better.

As noted in table 3.4.2.9-1, the use of the existing Old Ferry Road to access the Rogue River drill site would require installing eight small TEWAs (less than about 1 acre total) in six locations along the 1.6-mile road to accommodate turn-outs and to widen a sharp curve. These improvements would require only limited tree limb clearing. In comparison, construction of the 1.4-mile-long new temporary access road would require clearing about 11 acres of late successional mixed forest stands (80 to 175 years of age).

Although three of the TEWAs associated with the improvements for Old Ferry Road would be located within VRM II areas on an isolated BLM parcel, they would be immediately adjacent and co-located with the existing road. The largest TEWA within the VRM II area has also been located in an existing log landing area. BLM has reviewed the visual impacts of the Project in this vicinity and has determined that "the project does not meet VRM Class II objectives in the short-term (less than 5 years) at [this location], but plan amendments are not needed because the areas in question are very short, and mitigation developed in the Aesthetics Management Plan will help the areas reach VRM Class II objectives in the long term (5-10 years)" (see appendix R-8 of the EIS). Although about less than one-quarter acre of disturbance associated with the improvements to Old Ferry Road would occur within big game winter range on BLM lands, it would occur immediately adjacent to existing disturbance associated with the road.

Construction-related traffic on Old Ferry Road would be temporary and short term, lasting about 60 days total, which is the time Pacific Connector has estimated for completion of the Rogue River HDD. We conclude that improvement and use of the existing Old Ferry Road is the preferred alternative for access to the east side of the Rogue River, provided that the road would remain open to residents throughout all phases of construction. None of the other access road alternatives would offer significant advantages over the proposed improvement of Old Ferry Road.

3.4.2.10 Rogue River National Forest – Robinson Butte to Cox Butte Alternatives Routes

In response to the Forest Service's concerns over impacts to LSR and Riparian Reserves, Pacific Connector identified two route alternatives within the Rogue River National Forest in the vicinity of Robinson Butte and Cox Butte between about MPs 155.1 and 168.9. Table 3.4.2.10-1 provides a comparison of the May 2006 Alternative Route (Alternative 1), the Forest Service Roads Alternative Route (Alternative 2), and the proposed route (Compromise Route, or Alternative 3). These alternatives and the proposed route are shown on figure 3.4-11.

We refer to the route originally proposed by Pacific Connector in May 2006 as Alternative 1 (or the May 2006 Alternative Route). This alternative would deviate from the currently proposed route at about MP 155, and remain south of it on the south side of Robinson Butte near MP 159. From that point southeastwardly, Alternative 1 would closely follow the proposed route but would be straighter and cross through older forests, which provide NSO habitat. As with the proposed route, Alternative 1 would cross Big Elk Road, cross northeast of Cox Butte, and would cross Daley Prairie. The May 2006 Alternative Route would cross into Klamath County and rejoin the proposed route near MP 169. Alternative 1 would be about a mile shorter than the corresponding segment of proposed route. The route variation would cross more waterbodies and wetlands, and would affect more forest. The corresponding segment of proposed route would be adjacent to existing rights-of-way to a greater extent.

The Forest Service's suggested Roads Alternative Route, labeled Alternative 2, would leave the proposed route within the Rogue River National Forest in Jackson County, Oregon, at about MP 155, north of Grizzly Canyon, and head east along Forest Service Roads 410 and 300, around the south side of Robinson Butte along Forest Service Road 3730, south of Big Elk Guard Station along Forest Service Road 3705, across the South Fork Little Butte Creek, turn east along Forest Service Road 3720, entering Klamath County, to Forest Service Road 700, cross the Pacific Crest Trail (PCT) several miles south of Brown Mountain, then head southeast cross-county into the Winema National Forest, across Dead Indian Memorial Highway, and would rejoin the proposed route along Clover Creek Road north of Burton Butte just east of MP 169. The rationale for the Forest Service Roads Alternative Route was to reduce the amount of forest vegetation clearing by utilizing the existing cleared roadways as part of the construction corridor, thereby reducing some of the forest fragmentation and habitat loss in LSR 227. Also, this alternative would cross the PCT along an existing road, reducing potential impacts to trail users by eliminating a separate crossing. The Forest Service's suggested Roads Alternative Route would be about 3 miles longer than the original route and would require widening the existing roads, which are generally between 20 and 30 feet wide. This would require cutting mature forest in portions of the right-of-way. The Forest Service Roads Alternative Route would result in the largest construction footprint. In concept, acreage of construction impact would be reduced by the fact that most of the route (14.0 miles of the 15.7-mile route) would be along

existing forest roads. However, Pacific Connector determined the pipeline would not be constructible along portions of some roads due to the terrain and the tight radius turns.

TABLE 3.4.2.10-1

Comparison of Rogue River National Forest Alternative Routes with the Proposed Route from Robinson Butte to Cox Butte – MPs 155 to 169

Impact/Issue		May 2006 Alternative	Forest Service Alternative	Proposed Route
General				
Total Length (miles) a/		12.9	15.7	13.8
Acres of construction right-of-way b/		148	180	159
Total acres of construction disturbance		148 d/	180 e/	209
Number of UCSAs		Not designed c/	Not designed c/	45
Acres of UCSAs		Not designed c/	Not designed c/	73
Acres affected during operations (operational easement) f/		78	95	84
Land Ownership (miles)	Forest Service	11.5	14.3	12.5
	Private	0.5	0.6	0.5
	State	0.0	0.0	0.0
Waterbodies and Wetlands				
Number of waterbodies crossed g/		2	14	6
Total wetland crossing length (feet) h/		0	0	0
Land Use				
Land allocations (miles)	Matrix	0.0	0.0	0.0
	LSR	11.5	14.3	12.5
	Riparian Reserves	1.5	1.1	0.4
Evergreen Forest, Mixed Conifer		6.8	6.0	6.1
Regeneration Forest (miles)		5.9	5.4	5.6
Clearcuts (miles)		0.1	0.0	0.3
Total Forest lands affected (miles)		12.8	11.4	12.0
Other land use types (including Transportation)		0.1	4.3	1.8
Miles of right-of-way that would be parallel or adjacent to existing rights-of-way		1.6	14.0	4.4
Visual Resources				
Visual Impacts along existing Forest roads		Minimal except at existing road crossings	Existing road corridors expected to be significantly altered from 95-foot construction footprint along 13.6 miles of Forest roads.	Minimal except where parallel to existing roads (i.e., 4.4 miles)
Cultural Resources				
Number of previously identified cultural resources along route		1	0 k/	1
Habitat for Federally Listed Species				
Acres of federally listed critical habitat for the NSO l/		148	180	159
NSO activity center		2 - ½ mile buffer of site	2 - ½ mile buffer of site	2 - ½ mile buffer of site

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ The construction right-of-way for the preferred route and original proposed alignment is 95 feet.
c/ TEWAs for the Original May 2006 Route have not been designed and are not included in the total acres of disturbance.
d/ Pacific Connector estimates that the Original May 2006 Route would likely require more TEWAs compared to the compromise route because of side slope construction between approximately MPs 149 and 152.9 and because of the increased number of stream crossings along the Original May 2006 Route.
e/ TEWAs have not been designed for this route and are not included in total construction work area requirements.
f/ The assumed operational easement for all routes is 50 feet. However, Pacific Connector will only maintain vegetation within 15 feet of the pipeline centerline for a total of 30 feet in the long term.
g/ Waterbodies from PNW Hydrography Framework Clearinghouse.
h/ Wetlands from NWI CONUS data. Surveys identified 422 feet for the May 2009 Route and 56 feet for the Proposed Route.
i/ Crossing distance based on parallel alignment with waterbody feature (i.e., intermittent stream)
j/ Based on ground survey, NWI coverages and photo interpretation.
k/ Includes acres of impact associated with the construction right-of-way and TEWAs.

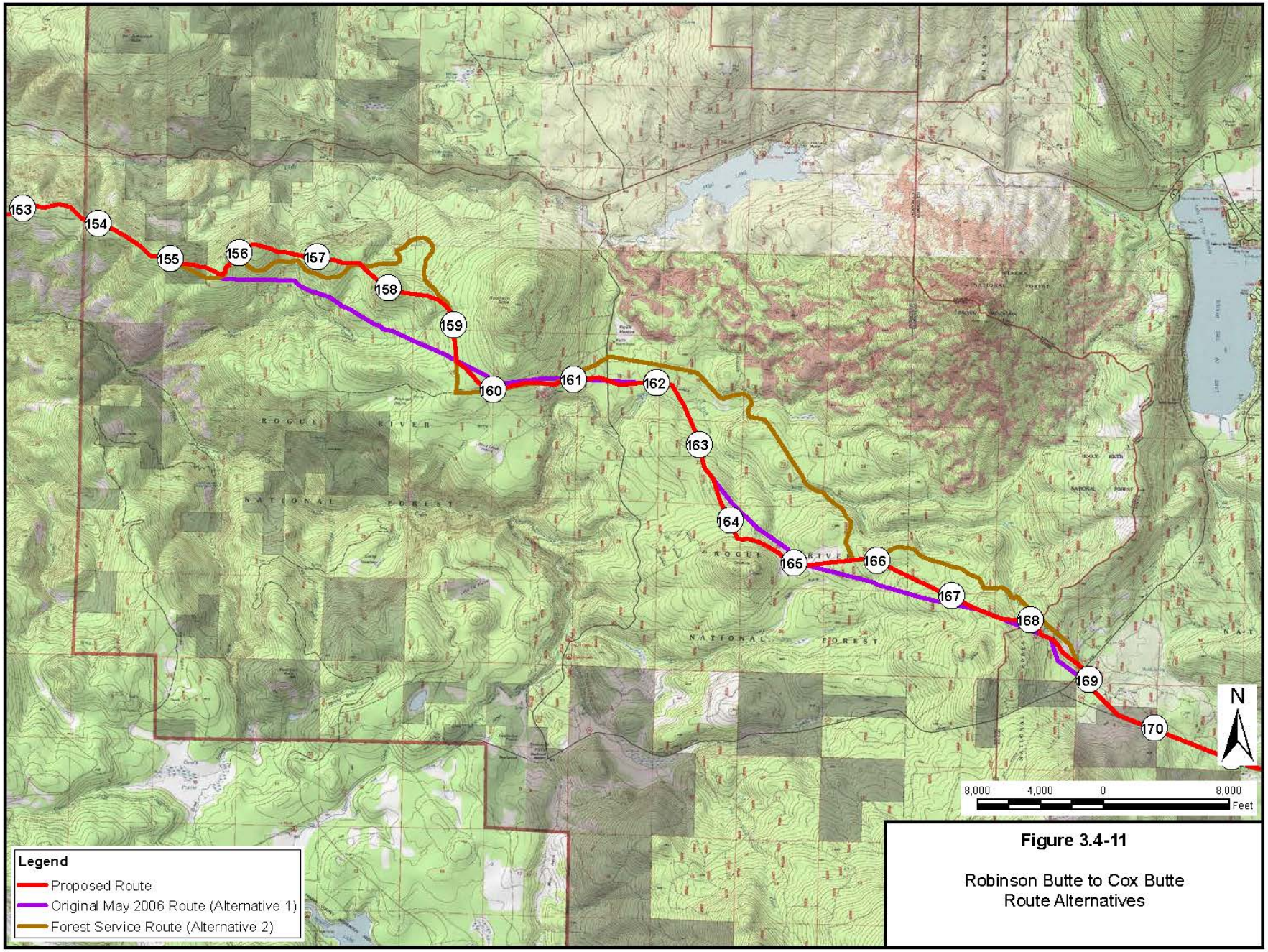

Figure 3.4-11

Robinson Butte to Cox Butte
Route Alternatives

Pacific Connector studied the Forest Service's suggested Roads Alternative Route and determined that the alignment was feasible for the most part, except where it followed tight radius road curves. As a result of consultations with the Forest Service, Pacific Connector developed its proposed route (which we refer to as Alternative 3 or the Compromise Route) and incorporated as much of the Forest Service Roads Alternative Route as was feasible. As a result, the Compromise Route incorporates recommendations of the Forest Service such as co-locating the pipeline within existing forest road corridors and within regeneration harvested areas, to minimize impacts to mature forests in LSR 227. Specifically, Pacific Connector incorporated a Forest Service recommended realignment between MPs 162.3 and 161.38 into the Compromise Route to avoid the Big Elk NSO patch, located in an NSO core area. This realignment would be about 0.5 mile south of Big Elk Meadow and Guard Station. Pacific Connector made further adjustments along the Compromise Route to minimize side slope construction and extra work area requirements, and to avoid a wetland (Riparian Reserve). This adjustment utilized an existing forest road and regenerating clear-cut area to minimize impacts on mature forest. After working with the applicant to create a modified route the Forest Service determined that neither the May 2006 route, nor the Forest Service Roads Alternative Route, would be environmentally preferable to the Compromise Route.

All three routes would cross NFS lands allocated as LSR or Riparian Reserve, with the original route crossing the least distance through LSR. We conclude that the Compromise Route would avoid or minimize environmental impacts, and neither the May 2006 Alternative Route nor the Forest Service Roads Alternative Route would offer a significant environmental advantage over the proposed route.

3.4.2.11 Pacific Crest Trail and Dead Indian Memorial Highway Alternative Routes

Due to concerns raised by the Forest Service and stakeholders who use the PCT, Pacific Connector identified two short alternative crossings of the PCT and Dead Indian Memorial Highway within the Rogue River and Winema National Forests in Klamath County, Oregon, between about MPs 167.5 and 169.1. The western segment crosses the PCT while the eastern segment crosses the Dead Indian Memorial Highway. These two alternative route segments are illustrated with the proposed route on figure 3.4-12. Table 3.4.2.11-1a compares the proposed route with the PCT Alternative Route. Table 3.4.2.11-1b compares the proposed route with the Dead Indian Memorial Highway Alternative Route.

When Pacific Connector first mapped out its pipeline route in 2007, it considered a straight line perpendicular crossing of the PCT at about MP 167.8. Stakeholders including the Forest Service and the Pacific Crest Trail Association requested that Pacific Connector and the FERC consider means of reducing impacts on the PCT and its recreational users. To reduce visual impacts, Pacific Connector's proposed route would use a right-angle 45-degree crossing of the PCT.

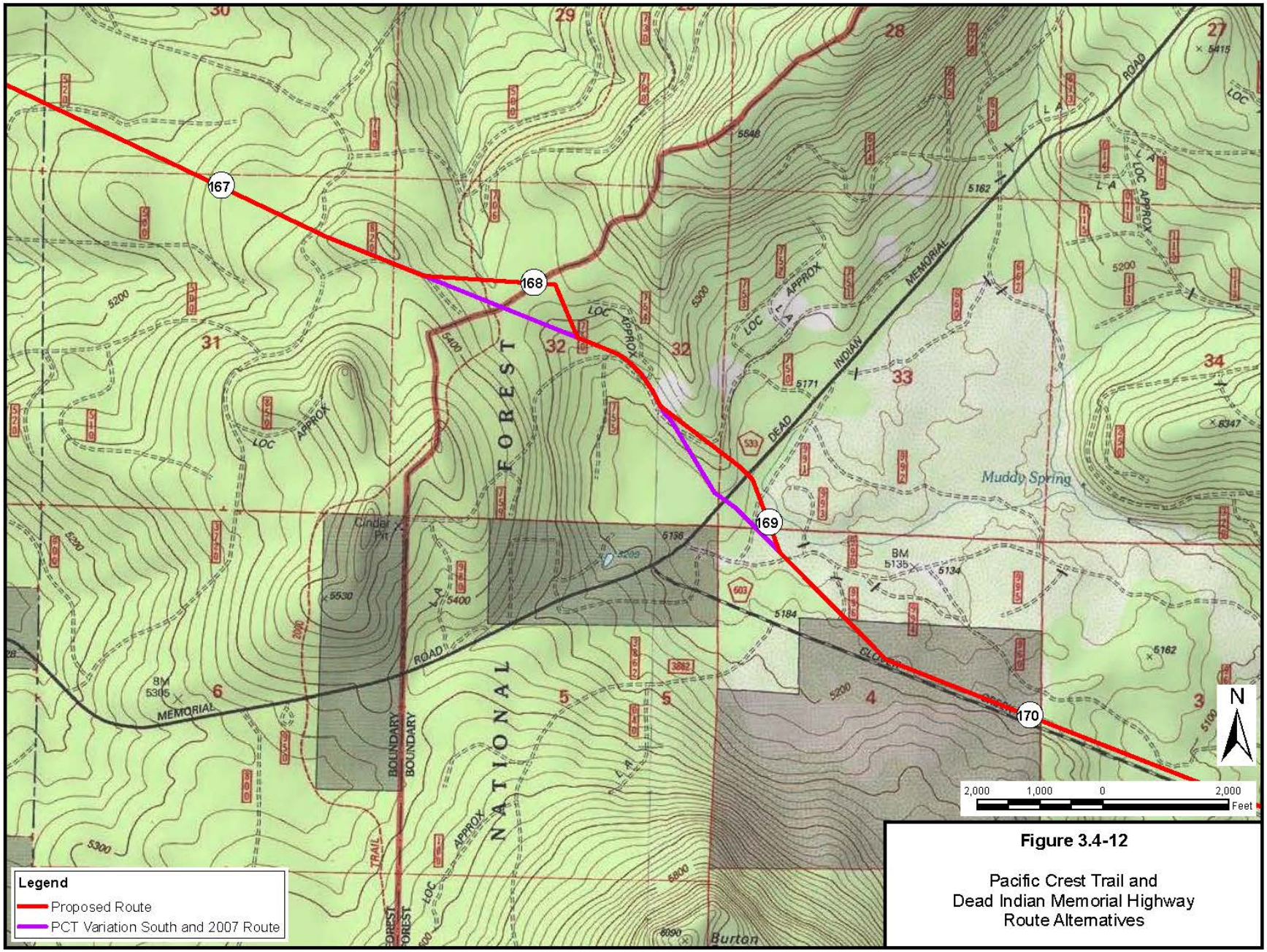

Figure 3.4-12

Pacific Crest Trail and
Dead Indian Memorial Highway
Route Alternatives

TABLE 3.4.2.11-1a

Comparison of the PCT Alternative Route with the Proposed Route

Impact/Issue		PCT Alternative Route	Proposed Route
General			
Length (miles) a/		0.5	0.6
Construction right-of-way (acres)		6	6
Number of TEWAs (acres)		0	2
Acres of TEWAs		0	<1
Operational easement (acres) b/		3	4
Land Use			
Land ownership (miles)	Private	0	0
	State	0	0
	Federal (NFS Lands)	0.5	0.6
Number of landowner parcels crossed		1	1
Number of residences within 50 feet of the construction right-of-way		0	0
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of alternative length)		0	0
LSR – Federal Land Use Designation (acres)		3	4
Riparian Reserves – Federal Land Use Designation (acres)		0	0
Waterbodies and Wetlands			
Number of waterbodies crossed c/		0	0
Length of wetland crossings (feet) c/		0	0
Vegetation			
Agricultural lands affected (acres)		0	0
Total forest clearing (acres)		6	7
Acres clear-cut/regenerating (0-40 years)		2	4
Acres mid-seral forest (40-80 years)		0	<1
Acres Late Successional Forest (80-175 years)		0	0
Old-Growth Forest (175+ years)		4	3
Biological Resources			
NSO. suitable habitat crossed (acres) d/		6	7
NSO nest patches/cores		0	0
NSO. critical habitat crossed (acres)		3	4
Habitat Category (acres)	1	3	3
	2	2	1
	3	0	3
	4	0	0
	5	0	0
	6	0	0
ESA Fish Species Present/Habitat e/		0	0
StreamNet – Anadromous Fish Distribution f/		0	0
Geotechnical			
Steep or difficult terrain (miles) g/		0	0
Highly erosive soils (miles) h/		0	0
Cultural Resources			
Number of previously recorded cultural resources		0	0
Number of newly identified cultural resources		n/a	0

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ Acres of operational easement calculated based on a 50-foot width.
c/ Based on Pacific Connector field surveys.
d/ Forest Service (2005a)
e/ FWS, NMFS, and StreamNet (http://www.streamnet.org).
f/ ODFW (2000a, 2006a); StreamNet.
g/ Based on Soil Mapping Units that have slopes of 50-75 percent and have a water erosion rating of high or severe (Forest Service 1976).
h/ Based on Soil Mapping Units that have a water erosion rating of high or severe (Forest Service 1976).

TABLE 3.4.2.11-1b

Comparison of the Dead Indian Memorial Highway Alternative Route with the Proposed Route

Impacts/Issues		Dead Indian Memorial Highway Alternative Route	Proposed Route
General			
Length (miles)		0.6	0.6
Construction right-of-way (acres)		7	7
Number of temporary extra work areas (TEWAs)		7	7
Acres of TEWAs		3	3
Operational Easement (acres) a/		3	4
Land Use			
Land Ownership (miles)	Private	0	0
	State	0	0
	Federal (NFS Lands)	0.6	0.6
Number of landowner parcels crossed		2	2
Number of residences within 50 feet of construction right-of-way		0	0
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of alternative length)		0	0
LSR – Federal Land Use Designation (acres)		0	0
Riparian Reserves - Federal Land Use Designation (acres)		0	0
Waterbodies and Wetlands			
Number of waterbodies crossed		1	1
Length of waterbody crossings (feet)		1	1
Number of wetlands crossed		0	0
Length of wetland crossings (feet)		0	0
Vegetation			
Agricultural lands affected (acres)		0	0
Total forest clearing (acres)		10	10
Acres clear-cut/regenerating (0-40 years)		6	8
Acres mid-seral forest (40-80 years)		<1	<1
Acres Late Successional Forest (80-175 years)		2	1
Acres Old-Growth Forest (175 + years)		2	1
Biological Resources			
Northern Spotted Owl Suitable Habitat Crossed (acres) b/		4	2
Northern Spotted Owl nest patch/cores (NSO)		0	0
Northern Spotted Critical Habitat Crossed (acres)		10	10
Habitat Category(acres) c/	1	4	2
	2	6	8
	3	0	0
	4	0	0
	5	0	0
	6	0	0
ESA Fish Species Present/ Habitat d/		0	0
StreamNet – Anadromous Fish Distribution e/		0	0
Geotechnical			
Steep or difficult terrain (miles) f/		0	0
Highly erosive soils (miles) g/		0	0
Cultural Resources			
Number of previously recorded cultural resources		0	0
Number of newly identified cultural resources		0	0

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Acres of operational easement calculated based on a 50-foot width.
b/ Forest Service (2005a).
c/ See Section 3.4.1.4 (Special Habitats) in Pacific Connector's Resource Report 3 filed with its September 2007 application to the FERC.
d/ FWS, NMFS, and StreamNet (http://www.streamnet.org).
e/ ODFW 2000a, 2006b; StreamNet.
f/ Based on Soil Mapping Units that have slopes of 50-75 percent and have a water erosion rating of high or severe (Forest Service 1976).
g/ Based on Soil Mapping Units that have a water erosion rating of high or severe (Forest Service 1976).

The original straight line crossing of the PCT, which we refer to as the PCT Alternative Route, would have created an unnatural tunnel-like visual effect through the forest that would not meet Forest Service VQO of Partial Retention for this section of the PCT. We discuss a proposed amendment to the Rogue River National Forest LRMP that would allow for increased time for revegetation to meet Forest Service VQOs for the pipeline crossing of the PCT in sections 4.1.3.4 and 4.8.2.4 of this EIS. It is estimated that about 4,000 feet of cleared right-of-way would be visible from the trail/pipeline intersection along the PCT Alternative Route.

The proposed route would be slightly longer (about 0.1 mile) and construction would affect less than 1 acre more than the PCT Alternative Route. Three more pipeline bends at points-of-intersection would be required for the proposed route, resulting in the clearing of additional land for TEWAs. These TEWAs would be located within regenerating forest. However, the proposed route would impact less LSOG forest and minimize impacts within the Ichabod Quarry South NSO Home Range. Pacific Connector would reduce the width of the construction right-of-way at the PCT crossing, and would implement other measures to minimize impacts on users of this trail, as more fully discussed in section 4.8.1.2 of this EIS. The advantage of the proposed route is that it would reduce the length of permanently cleared right-of-way that would be visible from the trail to about 1,000 feet.

The FERC's May 2009 FEIS for Docket No. CP07-441-000 showed a straight line pipeline crossing of the Dead Indian Memorial Highway at about MP 168.8. Between 2010 and 2012, Pacific Connector conducted environmental surveys that found rare fungi considered to be S&M species by the Forest Service near the crossing of Dead Indian Memorial Highway. S&M species on NFS lands are more fully discussed in section 4.7 of this EIS. To avoid impacts on these sensitive species, Pacific Connector modified its proposed pipeline route between about MPs 168.5 and 169.1 to take a right-angle 45-degree turn to the east when crossing the highway.

The proposed route would reduce visual impacts on the PCT, and avoid rare fungi near the crossing of the Dead Indian Memorial Highway. We conclude that the alternative routes would not offer significant environmental advantages over the proposed route's crossings of the PCT and Dead Indian Memorial Highway between about MPs 167.5 and 169.1.

3.4.2.12 Keno Access Road and Clover Creek Road Alternative Routes

The currently proposed pipeline route follows Clover Creek Road between about MPs 169.5 and 187.4 in Klamath County, Oregon. Pacific Connector developed this proposed route after considering the Keno Access Road Alternative and the 2007 Clover Creek Road Alternative Routes. The proposed route and the alternative routes are shown on figure 3.4-13 and compared in table 3.4.2.12-1.

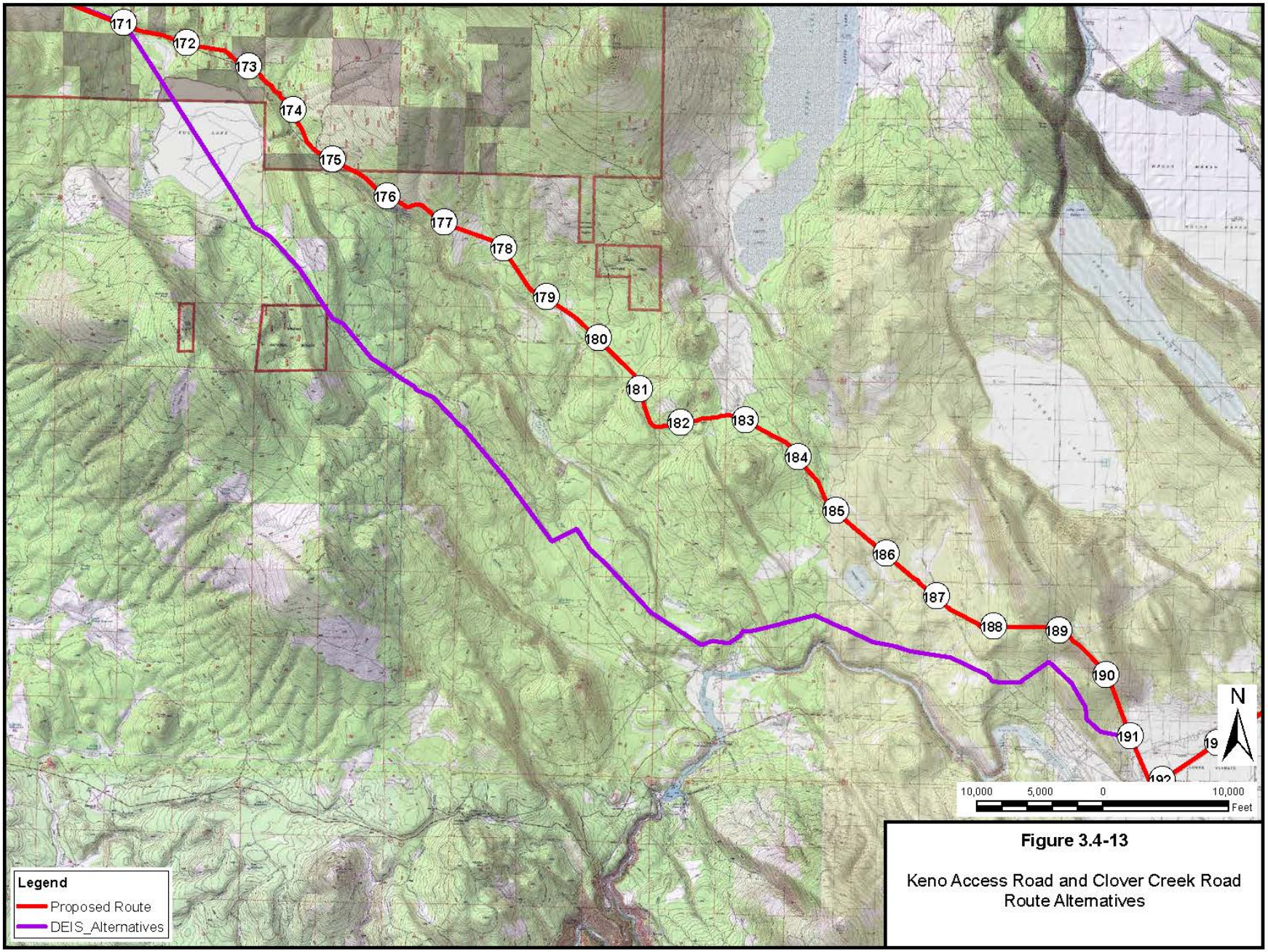

Figure 3.4-13

Keno Access Road and Clover Creek Road Route Alternatives

TABLE 3.4.2.12-1

Comparison of the Keno Access Road and 2007 Clover Creek Road Alternative Routes With the Proposed Route

Impact/Issue		Proposed Route	Keno Access Road Alternative	2007 Clover Creek Road Alternative
General				
Total length (miles) a/		16.3	18.7	16.9
Acres of construction right-of-way b/		187	215	288
Total acres of construction disturbance		204	298	215
Acres affected during operations (operational easement)		99	140	99
Landowner parcels crossed		9	16	11
Number of residences within 50 feet of construction right-of-way		0	0	0
Land ownership (miles):	Private	11.7	15.7	11.6
	State	0.0	0.2	0.0
	Federal (BLM/NFS lands)	4.6	2.8	4.7
Geotechnical				
Miles of steep or difficult terrain to be crossed		0	0	0
Waterbodies and Wetlands				
Number of wetlands and waterbodies crossed		9	23	9
Length of wetlands and waterbodies crossed (miles)		0.2	2.1	0.2
Land Use				
Agricultural land affected (miles)		0.0	9.5	0
Forest lands affected (acres)		161	72	172
Miles of right-of-way that would be parallel or adjacent to existing rights-of-way		16.3	0	16.3
Biological Resources				
Oregon spotted frog habitat crossed c/		Avoided	Yes	Avoided
Klamath redband trout habitat crossed d/		Avoided	Yes	Avoided
NSO	Critical habitat miles crossed e/	0	1.6	0
	Critical habitat acres within 1 mile of route e/	Similar to 2007 Route	4,238	2,514
	Suitable habitat within 1 mile of route f/	Similar to 2007 Route	6,547	5,534
	Number of nest sites	Similar to 2007 Route	3 NSO within 1 mile of route (1 historical)	2 NSO within 1 mile of route (1 historical)
Bald eagle g/		Similar to 2007 Route	2 active nests within 0.3 mile of route	1 active nest within 0.6 mile of route

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).

a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.

b/ The construction right-of-way for the proposed route and the alternative is 95 feet.

c/ Known Habitat of the Oregon spotted frog would be crossed on the proposed route between MPs 171.29 and 191.34 in Wetland AW 182. Pacific Connector would utilize conservation measures to minimize impacts to the spotted frog such as seasonal construction windows to avoid critical breeding periods and life stages. The alternative route would avoid the known Oregon spotted frog habitat.

d/ The proposed route crosses Spencer Creek above River Mile 12 in areas of known red band trout spawning habitat. Pacific Connector would use conservation measures to minimize impacts to the red band trout, including using the “dry” open cut crossing method (flume or dam and pump) within the ODFW-specified crossing window to protect the trout. The Offset Alternative crosses Spencer Creek above River Mile 12 where red band trout is not documented. Pacific Connector would also use the “dry” open cut crossing method within the ODFW-specified crossing windows to minimize impacts to aquatic species.

e/ NSO critical habitat coverage obtained from FWS Critical Habitat Portal [online: http://criticalhabitat.fws.gov/].

f/ NSO suitable habitat determined through GIS analysis using a BioMapper product created by the Forest Service Pacific Northwest Research Station and further refined based on consultation with FWS using aerial photo reconnaissance and GIS Neighborhood Analysis to determine areas with at least 30 percent suitable habitat.

g/ Bald eagle documented sites from bald eagle nest locations and history of use in Oregon and the Washington portion of the Columbia River Recovery Zone, 1971 through 2006 (Isaacs and Anthony 2007).

When Pacific Connector first mapped out its pipeline route, it wanted to follow the existing GTN Medford Lateral as much as possible and parallel a portion of the Keno Access Road between the boundary of the Winema National Forest and town of Keno. However, the Forest Service and other agencies raised concerns that this route, which we refer to as the Keno Access Road Alternative, would cross Buck Lake, an extensive emergent wetland, that provides habitat for the Oregon Spotted Frog (a federally listed candidate species) and would cross Spencer Creek at a location where redband trout are known to spawn.

After consultations with an interagency task force, in 2007 Pacific Connector suggested a new alternative route that would parallel but be offset from Clover Creek Road, to avoid impacting the species associated with the crossing of Buck Lake and Spencer Creek along the previously identified Keno Access Road Alternative Route. The Forest Service then requested that Pacific Connector move the pipeline closer to Clover Creek Road to eliminate the strip of trees left between the road and the Clover Creek Alternative Route.

The route adjacent to Clover Creek Road was filed as the proposed route in Pacific Connector's June 2013 application to the FERC. The proposed route has minor deviations from the road to avoid steep slopes or road cuts (at MPs 172.3-172.5, 173.0-173.7, 182.3, and 184.2-184.9), to avoid waterbodies and wetlands (at MPs 172.5 and 173.5-174.5), and to avoid S&M fungi species (at MPs 171.9-172.8 and 173.2-173.3).

We find the proposed route environmentally preferable to both the Keno Access Road and the 2007 Clover Creek Road Alternative Routes. First, the proposed route is shorter than either alternative resulting in less overall impact. Second, the proposed route would avoid crossing Buck Lake and Spencer Creek at locations that contain habitat for sensitive species. Lastly, moving the pipeline closer to Clover Creek Road would reduce visual impacts from forest clearing in comparison to the off-set location of the pipeline along the 2007 alternative. We conclude that the Keno Access Road Alternative and 2007 Clover Creek Road Alternative Routes would not offer significant environmental advantages over the proposed route between about MPs 169.5 and 187.4.

3.4.2.13 Shasta View Irrigation District Alternative

Reclamation and the Klamath Water Users Association have raised concerns regarding Pacific Connector's plans for crossing water conveyance facilities within the Shasta View Irrigation District (SVID) at five locations between about MPs 223 and 227. In a letter to Pacific Connector dated May 8, 2015, Reclamation, in cooperation with SVID and the Klamath Water Users Association, stated there are "significant operational, engineering, and potential socioeconomic impacts associated with the crossing locations within the SVID" and Reclamation recommends that the pipeline be rerouted to avoid crossing SVID facilities. Pacific Connector responded in a letter dated May 18, 2015, that it is committed to building the pipeline using trenchless boring technology in compliance with Reclamation's Engineering and O&M Guidelines for Crossings. In addition, in accordance with its *Klamath Project Facilities Crossing Plan*, Pacific Connector intends to conduct pipeline construction during the winter in the Klamath Basin, when most of the irrigation canals would be dry and not in use. However, Reclamation states "the Techite brand pipe used throughout the SVID distribution system is extremely fragile and has a long history of failures, many of them catastrophic." Reclamation further states that construction has the potential to disturb bedding materials surrounding these pipes, increasing the potential for failure.

Working with Reclamation and BLM, we identified a route alternative that would avoid crossing the SVID facilities. The SVID Alternative would begin at about MP 217.9 where it would turn slightly northeast from the proposed route and continue adjacent to an overhead electric transmission line for about 5.8 miles, and then turn south and southeast for about 4.9 miles, including one segment where it would share the same location as the proposed route, before rejoining the proposed route at about MP 228.0. The SVID Alternative is slightly longer than the proposed route (10.7 miles compared to 10.1 miles) but would cross fewer landowner parcels (11 compared to 17). The proposed route would parallel or be adjacent to 0.6 mile more existing rights-of-way than the alternative. The alternative would cross fewer waterbodies (9 compared to 11) but would impact slightly more wetland acres based on NWI data. The proposed route would cross 11 waterbodies while the route alternative would cross 9. The SVID Alternative and corresponding segment of proposed route are compared in table 3.4.2.13-1 and illustrated in figure 3.4-14.

Although Pacific Connector claims it could either cross the SVID facilities without damaging them or would rebuild any unstable irrigation pipes, Reclamation is concerned that this may not eliminate the risk of potential failure due to the underlying bedding material and the type of pipe used in the SVID. Therefore, Reclamation has stated that it may not be able to concur in granting a right-of-way across the SVID facilities which are part of the Klamath Project. Because of Reclamation's concerns and the fact that the alternative would avoid crossing SVID facilities and have similar or even reduced environmental impacts compared to the corresponding segment of proposed route, **we recommend that:**

- **<u>Prior to construction</u>, Pacific Connector should incorporate the SVID Alternative into its proposed pipeline route between about MPs 218 and 228, unless its files with the Secretary a mutually agreeable plan for crossing the SVID features that addresses concerns to the satisfaction of Reclamation.**

TABLE 3.4.2.13-1

Comparison of the Shasta View Irrigation District Alternative with the Proposed Route

Alternatives Analysis	Proposed Route	Shasta View Irrigation District Alternative
General		
Length (miles) a/	10.1	10.7
Construction right-of-way (acres)	116	123
Number of TEWAs (acres)	34.4	Not Designed
Operational Easement (acres) b/	61	65
Land Use		
Number of landowner parcels crossed	17	11
Land Ownership		
Land Owner: private (miles)	10.1	10.7
Land Owner: State (miles)	0.0	0.0
Land Owner: Fed/BLM/NFS (miles)	0.0	0.0
Number of Residences within 50 feet of Construction Right-of-Way c/	0	0
Miles of right-of-way parallel or adjacent to existing rights-of-way c/	7.3	6.7
Waterbodies and Wetlands		
Riparian Reserves (acres) d/	0	0
Wetlands Crossed e/	0	2
Wetland Crossings (acres) e/	0.0	0.3
Waterbody crossings f/	11	9
Vegetation		
Number of tree orchards crossed g/	0	3
Agricultural Vegetation impacted (acres) h/	28	14
Forest & Woodland impacted (acres) h/	8	18
Semi-Desert impacted (acres) h/	21	26
Shrubland & Grassland impacted (acres) h/	2	7
Biological Resources		
ESA Fish Species/Habitat Present (streams crossed)	5	3

General: All values are rounded (acres to nearest whole acre, miles to nearest tenth of a mile, feet to nearest whole foot).
a/ Route Alternative lengths cannot be accurately calculated by comparing mileposts due to shifts in the alignment.
b/ The construction right-of-way for the proposed route and the alternative is 95 feet.
c/ Based on aerial imagery.
d/ From Riparian-Reserves_2012
e/ NWI data
f/ NHD Stream data
g/ Based on aerial image, may include tree farms
h/ GAP data

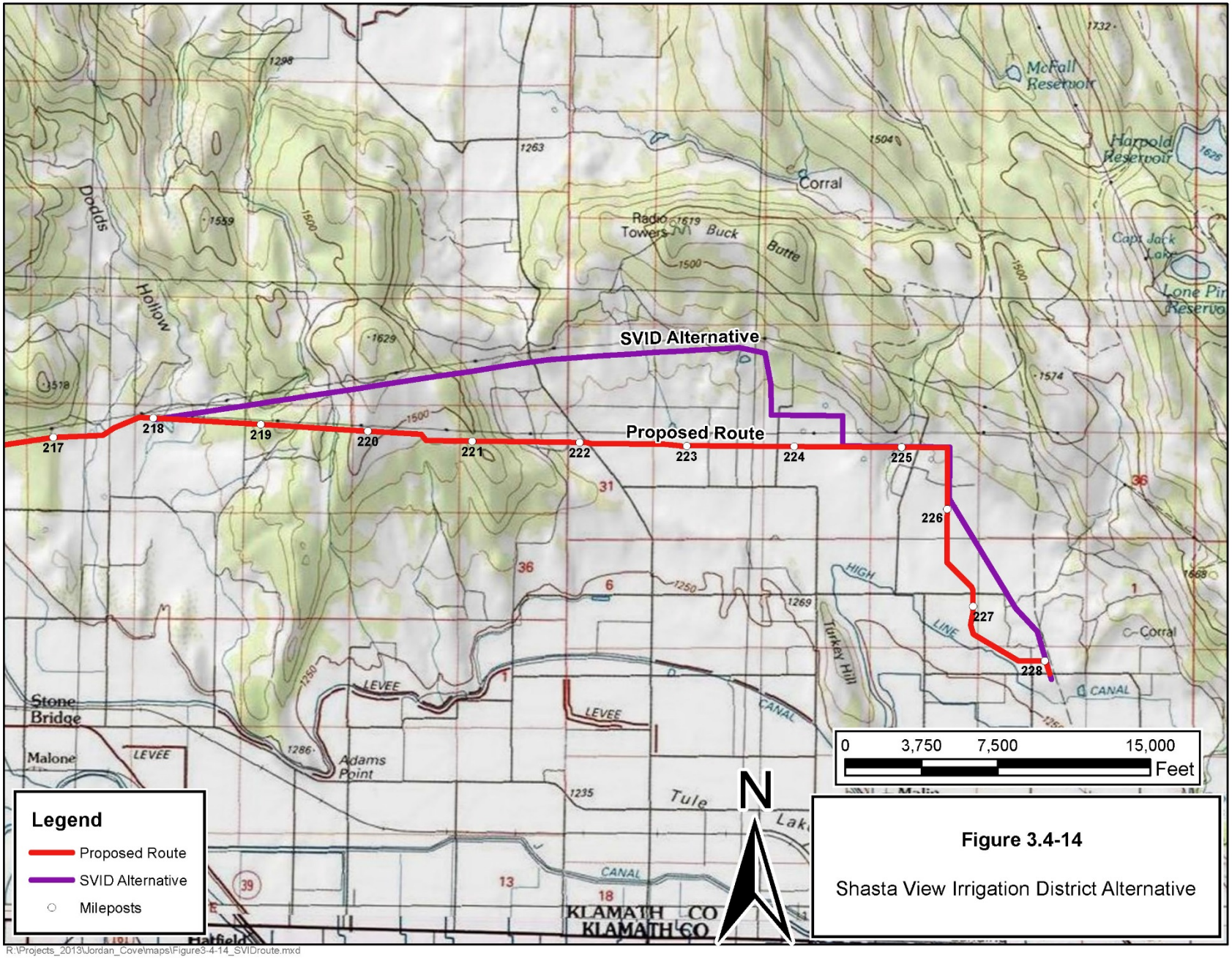

Figure 3.4-14

Shasta View Irrigation District Alternative

R:\Projects_2013\Jordan_Cove\maps\Figure3-4-14_SVIDroute.mxd

3.4.3 Pipeline Alternatives Over Federal Lands

Several of the pipeline alternative routes discussed above cross federal lands. Specifically, the Weaver Ridge Alternatives between MPs 42.7 and 49.8, the Camas Valley Alternatives between MPs 50.2 and 53.0, and the NSO Nest Patch Alternative between MPs 81.2 and 82.5 would cross BLM lands. The Neuman Gap to Long Prairie Alternatives between MPs 104.8 and 111.5, the Robinson Butte to Cox Butte Alternatives between MPs 155.1 and 168.9, the PCT Alternative between MPs 167.7 and 168.4, and the Dead Indian Memorial Highway Alternative Route between MPs 168.6 and 169.1 would be on NFS lands. In these cases, the BLM and the Forest Service conducted an analysis of the alternatives and found the proposed route environmentally preferable. The FERC staff concurs.

However, the Forest Service and BLM also considered if there were alternatives that would avoid or minimize impacts on specific land management allocations, such as LSRs and Riparian Reserves. In 1994, the Secretaries of Agriculture and Interior signed the *Record of Decision for Amendments to the Forest Service and Bureau of Land Management Planning Documents with the Range of the Northern Spotted Owl* (NSO ROD). The NSO ROD amended LRMPs for all BLM Districts and National Forests within the range of the NSO in California, Oregon, and Washington states, and created new land use allocations known as LSRs and Riparian Reserves. The NSO ROD indicated that LSRs are to be managed to protect and enhance old-growth forest conditions.

All of the NFS lands on the Rogue River National Forest lie within the Dead Indian LSR RO227, while about half of the proposed pipeline route across the Umpqua National Forest would be within the South Umpqua River/Galesville LSR RO223. There are no designated LSRs where the pipeline would be located within the Winema National Forest.

The ROD stipulates that non-silvicultural activities in LSR, such as the installation of a pipeline or other utilities, would only be allowed where those activities could be demonstrated to be neutral, or may have benefits for the creation and maintenance of late-successional habitat. New developments, such as a pipeline, may be allowed if it would have a public benefit and if adverse effects on the LSR could be minimized or mitigated. In designing its pipeline project, Pacific Connector followed the principles outlined in the Regional Interagency Executive Committee memorandum dated January 3, 2001, regarding New Developments in LSRs.

The BLM and Forest Service indicated that amendments to their LMPs may be necessary to allow the Pacific Connector pipeline to cross federal lands. These amendments are described as part of the proposed action in sections 2.1.3 and 4.1.3.4 of this EIS.

3.4.3.1 Public Need

The Commission will consider the need and public benefit of this Project when making its decision on whether or not to authorize it, as documented in the Project Order. The cooperating agencies will consider public benefit within the context of each agency's respective authorities. Each cooperating agency will document its decision in the applicable permit, approval, concurrence, or determination.

3.4.3.2 Avoidance of Late Successional Reserves

We did consider an all-highway route that would potentially avoid or only minimally affect LSR, but determined that such an alternative would not provide a significant environmental advantage over the proposed route (see section 3.4.1.2). Because the proposed Pacific Connector pipeline is a linear, large-diameter, high-pressure natural gas pipeline that must be routed to ensure safety, stability, and integrity, it is unreasonable, impractical, and infeasible to entirely avoid all designated LSRs for the following reasons:

- the overall extent of the designated LSR land allocation in the area crossed by the pipeline on BLM and NFS lands makes it unrealistic to completely avoid LSRs;
- long re-routes around LSRs would be impractical because of other determining factors, such as topography, the overall length and direction of the pipeline, and the large size of individual LSRs within contiguous tracts of NFS lands; and
- safety and constructability requirements for installation of the pipeline, in areas with limited geological hazards to ensure the long-term integrity of the pipeline and stability of the right-of-way makes it infeasible and unreasonable to avoid LSRs by aligning the pipeline on steep side slopes or other potentially unstable areas.

3.4.3.3 Project Design Measures to Minimize Adverse Impacts on Late Successional Reserves and Riparian Reserves

To comply with the Principles of the 2001 Regional Interagency Executive Committee memorandum regarding new developments in LSRs and Riparian Reserves, this alternative analysis discusses how the proposed Pacific Connector pipeline and associated facilities have been designed to have the least possible adverse impacts on these resources. In summary, this alternative analysis will discuss: (1) the project design measures that were implemented to avoid LSRs and Riparian Reserves, where feasible; (2) the project design procedures that minimize impacts to LSRs and Riparian Reserves; (3) the measures that would be implemented to rectify project-related impacts to LSRs and riparian reserves; (4) the project design measures that would be applied to reduce impacts over time by maintenance operations during the life of the action; and (5) the compensatory mitigation that Pacific Connector proposes to mitigate for unavoidable impacts to LSRs and Riparian Reserves.

Pacific Connector worked closely with the BLM and Forest Service to minimize impacts to LSRs and Riparian Reserves during the proposed pipeline route selection and construction footprint design process through the following steps.

- Performing routing and geotechnical evaluations to ensure the most stable pipeline alignment for long-term stability. These efforts minimize the potential need to conduct future maintenance activities, which could require additional impacts to suitable NSO habitat, LSRs, and Riparian Reserves.
- Where feasible, the alignment was co-located with existing roads to minimize disturbance impacts.
- Areas of side slopes were avoided to the extent possible to minimize the need for additional TEWAs to accommodate the necessary cuts and fill to safely construct the pipeline.

- The number and size of the TEWAs in LSRs and Riparian Reserves were minimized to those critical for safe pipeline construction.
- Where feasible, TEWAs were located in previously disturbed areas (recently logged) or in young regenerating forest stands.
- Existing roads would be used to access the construction right-of-way during construction and the right-of-way would be used as the primary travel-way to move equipment and materials up and down the right-of-way to remove the need for additional roads within LSRs and riparian reserves. The existing roads would also be used during operations to avoid the need for new access routes.

To help rectify pipeline-related impacts to LSRs, Pacific Connector would replant all disturbed areas of the construction footprint as described in its ECRP. Pacific Connector would replant or allow trees to naturally regenerate to within 15 feet of the pipeline centerline within the operational pipeline easement to minimize potential long-term effects of the pipeline easement. Vegetation within the remaining area of the pipeline easement would be maintained as necessary to allow for DOT-required visual aerial survey requirements, and to prevent the root systems of trees from damaging pipe coatings and pushing on the pipeline.

Additionally, Pacific Connector understands that unavoidable impacts on LSRs would require mitigation measures that in the long run would make the Project impacts neutral or beneficial. Pacific Connector has agreed to fund a suite of Forest Service- and BLM-recommended measures that are described in chapter 2 of this EIS to mitigate Project-related impacts to LSRs and Riparian Reserves in a manner that would ensure that the Project is neutral or beneficial to the creation and maintenance of late-successional habitat (see appendix F). Example mitigation projects would include decommissioning existing disturbance areas within LSRs such as roads that are no longer required, and non-economic thinning or other management projects to accelerate old growth characteristics within young or dense forest stands. Additionally, the Forest Service and BLM would re-allocate Matrix land to LSR, where feasible.

3.4.4 Minor Route Variations Incorporated into the Proposed Pipeline Route

During the course of refining the route alignment for the currently proposed route, Pacific Connector incorporated a number of minor route variations to address agency concerns and landowner requests, constructability issues or constraints, to avoid cultural resources or geological hazards, or reduce impacts on special status, threatened, or endangered species. These minor route variations are listed in table 3.4.4-1. Several variations that were recommended in the DEIS have been incorporated in the table. These included variations recommended by the BLM between MPs 119.5 and 119.8, at MP 126.0, and at MP 131.5, and between MPs 183.9 and 187, and recommended by the Forest Service between MPs 154.7 and 155.1, MPs 157.1 and 158.7, and MPs 171.2 and 173.0. In all the cases listed on the table below, we find the minor route changes to be environmentally preferable and acceptable. These minor route variations were incorporated into the proposed route that is analyzed in section 4 of this EIS. We did not identify any alternative routes that would be environmentally preferable to these minor route variations.

TABLE 3.4.4-1

Minor Deviations Incorporated into the Proposed Pipeline Route

Deviation Name/MPs	County	Rationale for Route Realignment
Powerline Structure MPs 6.0R-6.1R	Coos	Added two PIs to the west to avoid power line structure guy wires and facilitate power line crossing.
Snelgrove MPs 6.1R-6.2R	Coos	Landowner recommended modification to avoid a water source. The alignment modification follows a ridgeline to minimize sidehill construction, grading, and cut/fill grading requirements.
Sweet MPs 7.5R – 8.4R	Coos	Landowner recommended modification to avoid a potential future home site. Realignment follows a stable ridgeline alignment which was evaluated onsite by GeoEngineers. The modification avoids crossing a tributary to Willanch Slough.
Powerline alignment MPs 8.4R-8.8R	Coos	Minor route modification facilitates parallel power line alignment along ridgeline; minimizes cut/fill/grading and TEWA requirements; and avoids wetland/stream GSI-031. Alignment modification also avoids parcel (Edwards - APN 273401).
Stock Slough MPs 9.7–10.3	Coos	The proposed route has been slightly modified between MPs 9.7 and 10.3 from the FERC May 2009 FEIS route. The route modification avoids crossing Stock Slough Road (County Road 54) in a steep road cut as the alignment descends a steep ridge slope. Further, the route modification avoids two crossings of Stock Slough in the tight meandering bends which were crossed immediately below Stock Slough Road and immediately adjacent to a residence.
Muenchrath/Wilson MPs 12.1–12.8	Coos	During an on-site meeting with Mr. Muenchrath, an agreement was reached to route the pipeline farther east, away from the Muenchrath and Wilson residences. Although a potential geological hazard was identified along this route, Pacific Connector determined that the new proposed reroute to the east could be built and maintained over the long term if certain site-specific construction, backfill, and restoration techniques were adhered to.
Boone Creek MPs 15.3–16.0	Coos	The alignment in this area was adjusted based on geological hazard evaluations. The proposed route now minimizes sidehill and steep slope construction requirements.
BPA Adjustments MPs 20.9–22.3	Coos	The alignment between MPs 20.9 and 22.3 was adjusted based on Pacific Connector's meeting with the Bonneville Power Administration (BPA). BPA requested that the pipeline easement more closely abut the powerline corridor in these areas to minimize the strip of trees between the two easements. Abutting the easements would minimize the potential for tree wind throw hazards and subsequent maintenance requirements.
Coos Wagon Road MPs 24.0 – 24.3	Coos	Minor route modification facilitates Coos Wagon Road crossing (removes PI from road prism); minimizes sidehill construction and cut/fill grading requirements. TEWAs have been located based on topographic conditions.
Lone Rock Timberlands Development MPs 29.0–29.5	Coos	The alignment between MPs 29.0 and 29.5 was modified to minimize impacts on Lone Rock Timberland's planned subdivision. The reroute would avoid impacts to a number of lots within the subdivision.
East Fork Coquille River MPs 29.8–39.1	Coos	New proposed route segment between MPs 29.8 and 39.1 avoids marbled murrelet (MAMU) habitat and MAMU Stands G46 and G47.
MAMU Stand G50 MPs 30.3–30.7	Coos	New proposed route segment between MPs 30.3 and 30.7 reduces impacts on MAMU Stand G50.
MAMU Stand C3088 MPs 31.7–32.3	Coos	New proposed route segment between MPs 31.7 and 32.3 reduces impacts on MAMU Stand C3088.
Hardwood Study Plot MPs 31.4–32.2	Coos	The alignment between MPs 31.4 to 32.2 was rerouted to avoid a long-term Hardwood Study Plot on BLM lands that is being studied by Oregon State University. The new proposed route was coordinated with the BLM.
SF Elk Creek MPs 34.4.34.7	Coos	Added PI to the north to avoid stream meander and improve stream crossing alignment at MP 34.46, South Fork Elk Creek (CSP-5).
Elk Creek Road MPs 35.5-35.7	Coos	Removed PI to better align/co-locate with Elk Creek Rd (28-11-29) and to minimize cutslope/grading disturbance and MAMU stand effects.
MAMU Stand B07 MPs 36.0–36.3	Coos	New proposed route segment between MPs 36.1 and 36.3 reduces impacts on MAMU Stand B07.
Road Crossing MPs 36.6-36.8	Coos	Removed PI to better align pipeline with road cutslope to minimize additional cut/fill/grading requirements.
Big Creek MPs 37.1-37.4	Coos	Realignment to fit topography and improve stream crossing at two tributaries of Big Creek (ESI-19 and ESP-20) by minimizing side slope construction, grading, cut/fill requirements.
Tri W Group LP MPs 39.9-41.7	Coos	Landowner recommended modification to move the alignment to a recent clear-cut to minimize timber impacts (Tri W Group – APN 811900 & 8118000). Realignment avoids two road crossings and an in-road lay segment (MPs 40.3 - 40.4) and incorporates other minor alignment refinements to follow topographic conditions to minimize sidehill construction and cut/fill/ grading requirements.
Road Crossing MPs 42.1-42.8	Coos	Adjusted alignment to follow topography; removed PIs to avoid two road crossings which also shortened the alignment length. Realignment also occurs within a recent clear-cut to minimize timber impacts

TABLE 3.4.4-1

Minor Deviations Incorporated into the Proposed Pipeline Route

Deviation Name/MPs	County	Rationale for Route Realignment
Road Crossing MPs 43.3-44.5	Coos	Adjusted route to better align with parallel road alignment, existing log landing, and topography to minimize road crossings/inroad lays, sidehill construction, and cut/fill/grading requirements.
MAMU Stand C3070 MPs 45.2–45.7	Coos	New proposed route segment between MPs 45.2 and 45.7 reduces impacts on MAMU Stand C3070.
Rust Parcel Subdivision MPs 49.3–49.8	Douglas	The alignment between MPs 49.5 and 49.8 was adjusted to minimize impacts on the landowner's planned parcel subdivision. The pipeline route and block valve locations were realigned to the edge of the parcel.
Brian and Darla Standley MPs 51.5–52.5	Douglas	Pacific Connector incorporated a minor route deviation between approximately MPs 51.5 and 52.5, east of Highway 42, to accommodate a landowner request/concern.
Brian and Darla Standley MPs 51.6–52.3	Douglas	Landowner subsequently requested to revert back to Pacific Connector's 2009 FERC Certificated Route. Pacific Connector included a minor modification in the 2009 Certificated Route to avoid a residential parcel owned by the Standleys (APN R123564) near MP 51.6.
Kincaid's lupine MPs 57.8–57.9	Douglas	New proposed route segment between MPs 57.8 and 57.9 avoids population of Kincaid's lupine.
Willis Creek and Road MPs 66.9-67.0	Douglas	Added PIs to provide perpendicular crossing of Trib. to Willis Creek (BSI-169) and Willis Creek Road. Also improves crossing of Willis Creek (BSI-169).
Stream Crossing MPs 77.7-78.0	Douglas	Adjusted PI locations to improve alignment based on topography and stream crossing/offset. Realignment balances grading and cut/fill requirements.
Transmission Tower MPs 79.2–79.7	Douglas	The alignment between MPs 79.2 and 79.7 was modified to avoid a transmission tower. The route of the minor deviation was dictated by topographic conditions and the presence of three transmission line crossings in this area.
St. Johns Creek Reroute MPs 88.1–90.0	Douglas	Pacific Connector's proposed reroute alignment crosses the creek in an area where the creek is not steeply incised and there is a minor floodplain on either side of the stream to facilitate the crossing.
NSO Nest Patch 094-8 MPs 95.1–95.6	Douglas	New proposed route between MPs 95.1 and 95.6 reduces impacts on old-growth forest and northern spotted owl (NSO) Nest Patch 094-8.
Landslide Hazards Nos. 34-35 MPs 108.5–109.0	Douglas	Route realigned to avoid landslide hazards.
Civil Survey Corrections MPs 109.7-109.8	Douglas	Civil survey correction to move alignment to previously surveyed/staked PIs.
Civil Survey Corrections MPs 110.8–111.1	Jackson	The alignment in this area was trued-up with actual civil survey data which ensured that the alignment approached the slope perpendicularly or head-on to the contours to minimize right-of-way grading requirements.
Umpqua National Forest Stream / Road MPs 110.4-111.8	Jackson	Alignment adjustment and construction right-of-way modification to minimize grading and cut/fill requirements based on topography to minimize stream effects (RDI-68 / FS-HF-N). Also facilitates co-location with Forest Service Road FS 3232000 and facilitates crossing and co-location with Forest Service Road FS-3200RD.
Umpqua National Forest MPs 113.6-113.8	Jackson	Relocated Block Valve # 9 moved from MP 112.10 to MP 113.70 based on Forest Service request to be on private land outside the Forest Service's 1.5-mile peregrine falcon buffer zone. To accommodate the aboveground facility, the alignment was slightly realigned to the east based on topographic conditions to minimize grading requirements.
Gagnon MPs 118.7–119.1	Jackson	The alignment in this area (MPs 118.7 to 123.3) was adjusted based on landowner concerns/recommendations to move the alignment to the edge of the parcel/pasture.
Medford BLM – Riparian Reserve MPs 119.5-120.3	Jackson	BLM recommended alignment modification to avoid a crossing and parallel alignment along a 1-2 feet wide unnamed intermittent tributary to Trail Creek and potential effects to the tributary's associated Riparian Reserve. The modified alignment would avoid crossing one landowner parcel Adam (APN 10215722).
Laudani MPs 123.1–123.3	Jackson	The alignment between MPs 123.1 and 123.3 was adjusted based on landowner concerns. In this area the alignment was moved upslope and away from residence as much as possible. Further, the TEWAs in this area were reduced in size and extent to minimize overall disturbance on the slope which was a concern of the landowner.
Medford BLM – Riparian Reserves MPs 126.3 – 126.8	Jackson	BLM recommended alignment modification to avoid a crossing of an unnamed intermittent tributary to Indian Creek (1-2 feet wide) and minimize crossings and potential effects to the tributary's associated Riparian Reserve. The construction right-of-way modifications also incorporated a neckdown to 75 feet across the two remaining intermittent waterbodies to minimize effects to these waterbodies and their associated Riparian Reserves.
Mitchell Ranch Deviations MPs 127.4–127.8	Jackson	Minor reroute to avoid home site development.

TABLE 3.4.4-1

Minor Deviations Incorporated into the Proposed Pipeline Route

Deviation Name/MPs	County	Rationale for Route Realignment
Mucky Flats Reroute MPs 128.4–130.6	Jackson	Reroute to address landowner concerns with shallow groundwater, irrigation pastures. Landowner also proposed to extend private runway airstrip in Mucky Flats, which would have crossed the proposed pipeline route.
Powerline MPs 129.9-130.0	Jackson	Adjusted route to provide a more perpendicular power line crossing.
Gibson MPs 130.0-130.5	Jackson	Minor modification incorporated to avoid a private quarry on Gibson (APN 10536777). The alignment modification avoids two parcels: BLM - APN 10536710 and Gibson - APN 10536777.
Obenchain Mountain MPs 130.0–132.1	Jackson	Reroute to address landowner concern and impacts to spring and seep water sources and developed pasture.
NSO Reroute MPs 127.4–128.6	Jackson	New proposed route segment between MPs 127.4 and 128.6 to avoid impacts on NSOs.
Medford BLM – Riparian Reserves MPs 131.4 – 132.1	Jackson	BLM recommended alignment modification to avoid a parallel alignment along an intermittent drainage to Neil Creek as well as two crossings of unnamed intermittent tributaries to Neil Creek (1-3 feet wide) to minimize potential effects to these tributaries and their associated Riparian Reserves.
Schott MPs 131.9-132.7	Jackson	Landowner recommended modification to minimize impacts to hayfields and relocates Block Valve #11 out of important cattle winter loafing area. Modification minimizes crossing of emergent wetlands (hayfields) and shortens the length of the permanent access road (PAR) to BV#11. Shortening the PAR also avoids the road crossing of the reservoir impoundment dam. The modified route would decrease the wetland crossing length and acres of wetland affected by approximately 1,838.5 feet and 3.2 acres, respectively.
Stream MPs 141.4-141.5	Jackson	Realignment on BLM lands to remove approximately 460 feet of the parallel alignment of the Tributary to Salt Creek (ASI188), an intermittent waterbody, from the construction right-of-way. This minor realignment also adjusts the construction right-of-way to the topography to minimize cut and fill requirements, disturbance, and soil/spoil handling.
C-2 Ranch MPs 143.71–147.54	Jackson	Between MPs 143.71 and 147.54, the alignment crosses the C-2 Ranch, on which there are numerous irregularly-shaped conservation easements held by the Southern Oregon Land Conservancy (Conservancy). Pacific Connector met with the Conservancy and received GIS data showing the locations of the conservation easements. Pacific Connector adjusted the alignment to minimize the impacts on conservation easements, irrigated pastures, and irrigation facilities (canals/ditches). Mainline valve (MLV) #11 was also relocated to MP 145.2 adjacent to Gardner/Salt Creek Road and out of the view of Highway 140.
Heppsie Mountain Quarry MP 150.4–150.7	Jackson	Minor realignment (MPs 150.4 to 150.7) to avoid the Heppsie Mountain Rock Quarry on BLM lands.
Rogue River National Forest – Civil Survey Correction M Ps 151.4-155.5	Jackson	Civil survey coordinate correction.
Rogue River National Forest – S&M Species MPs 154.7–154.9	Jackson	To avoid Survey and Manage (S&M) fungus species *Gymnomyces abietis* (GYAB), identified during surveys on the Rogue River National Forest, a minor route deviation was incorporated into the pipeline alignment to create an adequate S&M protective buffer on this fungi species as directed by the Forest Service.
Rogue River National Forest – S&M Species MPs 158.1-158.2	Jackson	To avoid S&M fungus species *Sedecula pulvinata* (SEPU), identified during surveys on the Rogue River National Forest, a minor route deviation was incorporated into the pipeline alignment to create an adequate S&M protective buffer on this fungi species as directed by the Forest Service.
Rogue River National Forest - Road Crossing 158.7-159.4	Jackson	Alignment adjustment extends co-location with existing road and improves parallel alignment along FS Road 3707500.
Rogue River National Forest – SF Little Butte Creek 162.45	Jackson	Alignment adjustment to provide better stream crossing and right-of-way and TEWA setbacks from South Fork Little Butte Creek (ASP-165).
Rogue River National Forest – S&M Species MPs 162.5–162.8	Jackson	To avoid a cluster of S&M species, including *Albatrellus ellisii*, *Boletus pulcherrimus, Cortinarius olympianus*, *Gomphus kauffmanii*, and *Albatrellus dispansus,* a Forest Service strategic species.
Rogue River National Forest - S&M Species MPs 164.2–164.3	Jackson	To avoid a S&M fungus species *Hygrophorus caeruleus,* identified during surveys in 2009 on the Rogue River National Forest, a minor route deviation was incorporated into the pipeline alignment between MPs 164.2 and 164.3. The deviation moved the alignment and construction right-of-way to the south side of Forest Service Road 37200000.

TABLE 3.4.4-1

Minor Deviations Incorporated into the Proposed Pipeline Route

Deviation Name/MPs	County	Rationale for Route Realignment
Winema National Forest - S&M Species MPs 168.6–169.1	Klamath	To avoid S&M fungus species *Hygrophorus caeruleus* identified during surveys in 2009 on the Winema National Forest, a minor route deviation was incorporated into the pipeline alignment between MPs 168.6 and 169.1. The deviation moved the alignment approximately 500 feet to the north so that the construction right-of-way would avoid the species by approximately 100 feet at the crossing of Dead Indian Memorial Road.
Winema National Forest – S&M Species MPs 171.9–173.0	Klamath	To avoid S&M fungus species *Choiromyces alveolatus* (CHAL), identified during surveys in 2009 on the Winema National Forest, a minor route deviation was incorporated into the pipeline alignment to create an adequate S&M protective buffer on this fungi species as directed by the Forest Service.
Winema National Forest – S&M Species MPs 173.2–173.3	Klamath	To avoid S&M fungus species *Arcangeliella crassa*, identified during surveys in 2009 on the Winema National Forest, a minor route deviation was incorporated into the pipeline alignment between MPs 173.2 and 173.3. The deviation moved the alignment to the north so that the construction right-of-way would avoid the species by 125 feet or more.
Clover Creek Road MPs 175.7-176.4	Klamath	Alignment adjusted to ensure the pipeline's permanent easement does not encroach onto the permanent easement of Clover Creek Road (CR 603).
McLaughlin Lane and Big Buck Lane MPs 187.3–191.8	Klamath	To avoid potential habitat for Applegate's milk-vetch and to avoid the houses in a residential neighborhood along McLaughlin Lane and Big Buck Lane.
Powerline MPs 187.3-187.8	Klamath	Adjusted PIs to avoid power line structure and facilitate power line crossing.
Powerline MPs 189.3-189.4	Klamath	Adjusted alignment to avoid power line structure.
Johnston Subdivision MPs 190.2-192.3	Klamath	Route modification minimizes effects to a planned subdivision (Palomino Pines). The modified alignment skirts around the edge of the planned subdivision along the back lot lines vs. bisecting the middle of the subdivision. The route modification would also avoid crossing two parcels: Johnson - APN R579859 and Lilly - APN R619281.
Applegate's milk-vetch MPs 195.5–196.5	Klamath	New proposed route segment between MPs 195.5 and 196.5 avoids population of Applegate's milk-vetch.
Pipe Rack MPs 198.4-198.5	Klamath	Adjusted alignment to facilitate construction under overhead pipe rack.
Pipeline MPs 199.7-200.0	Klamath	Adjusted alignment to ensure the pipeline's permanent easement avoided encroaching onto the permanent easement of the GTN pipeline.
Canal MPs 200.3-200.7	Klamath	Alignment adjusted to ensure the pipeline's permanent easement avoided encroaching onto the permanent easement of BOR lateral C-4 (ADX-293) and potential construction effects to the canal. Also avoids one parcel (S. Suburban Sanitary District - APN R581016).
Powerline Reroute MPs 202.3– 202.6	Klamath	The alignment in this area was shifted to minimize impacts to hayfields by realigning the pipeline adjacent to the powerline corridor.
Highway 39 Reroute MPs 210.3–211.6	Klamath	The alignment would more closely parallel State Highway 39 to minimize land encumbrances and to minimize pipeline traversing the middle of the fields in this area.
Powerline Reroute MPs 215.3–217.5	Klamath	The alignment was shifted upslope to parallel the powerline corridor more closely in this area, and to avoid a center pivot irrigation feature.
Powerline Reroute MPs 217.5-219.2	Klamath	Alignment modification avoids encroachment of the pipeline's permanent easement onto the permanent easement of the power line. The modification would also avoid one parcel (Alford - APN R103863).
Powerline Reroute MPs 220.5-221.1	Klamath	Alignment modification avoids encroachment of the pipeline's permanent easement onto the permanent easement of the power line. Also avoids four parcels: Johnson - APN R890029 and R104087, Calvin - APN R627851, and Four H Organics - APNR627842.
Lyons Center Pivot MPs 225.5–228.2	Klamath	The alignment in this area was rerouted to avoid impacts to the center pivot irrigated hayfield. Additionally, the reroute avoids an area that is expected to require blasting due to shallow and hard bedrock. The reroute was aligned along property line boundaries where feasible to minimize potential encumbrances.
Topographic modifications MPs - various	Coos, Douglas & Jackson	Fifty (50) minor alignment modifications to ensure that the centerline and construction right-of-way, based on detailed civil survey, maximize ridgeline alignment to minimize sidehill construction, grading and cut/fill requirements, disturbance, and soil/spoil handling. These alignment modifications where described in Pacific Connector's January and March 2015 supplemental information filings to FERC.

TABLE 3.4.4-1

Minor Deviations Incorporated into the Proposed Pipeline Route

Deviation Name/MPs	County	Rationale for Route Realignment
Various Minor MPs – various	Coos, Douglas, Jackson & Klamath	Twenty one (21) minor route modifications were incorporated into the Proposed Route, which have a deviation of less than 20 feet from Pacific Connector's 2013 FERC Certificate Application route; the average deviation is approximately 9.5 feet with a range between 1.4 and 18.5 feet. Generally, these minor alignment modifications were incorporated to avoid encroaching on the permanent easement of Clover Creek Road (CR 603), correcting minor survey errors, ensuring the alignment follows ridgelines to minimize grading requirements, and avoiding existing powerline structures.

3.4.5 Compressor Station Alternatives

Pacific Connector's selection criteria for siting its proposed compressor station were:

- located near the eastern terminus based on pipeline hydraulics and expected fuel usage;
- proximity to interconnecting pipeline facilities;
- need for a relatively flat area, approximately 30 acres in size to accommodate planned facilities and provide a buffer from local development;
- proximity to a paved or all-weather access road, electrical power, and telephone connectivity;
- remote or sparsely populated area to minimize potential noise and visual effects;
- compatibility with existing land uses; and
- minimization of environmental impacts, such as avoidance of wetlands and sensitive habitat.

Besides the proposed location of the Klamath Compressor Station at MP 228.1, Pacific Connector identified two alternative locations: at MP 225.4 about 2 miles north of the proposed Klamath Compressor Station, and at MP 230.9 about 1.7 miles south (figure 3.4-15). In addition, Pacific Connector considered the design alternative of using electric-driven units at the proposed compressor station instead of natural gas burning units. Electric units would produce less noise and less air pollution than gas-burning units.

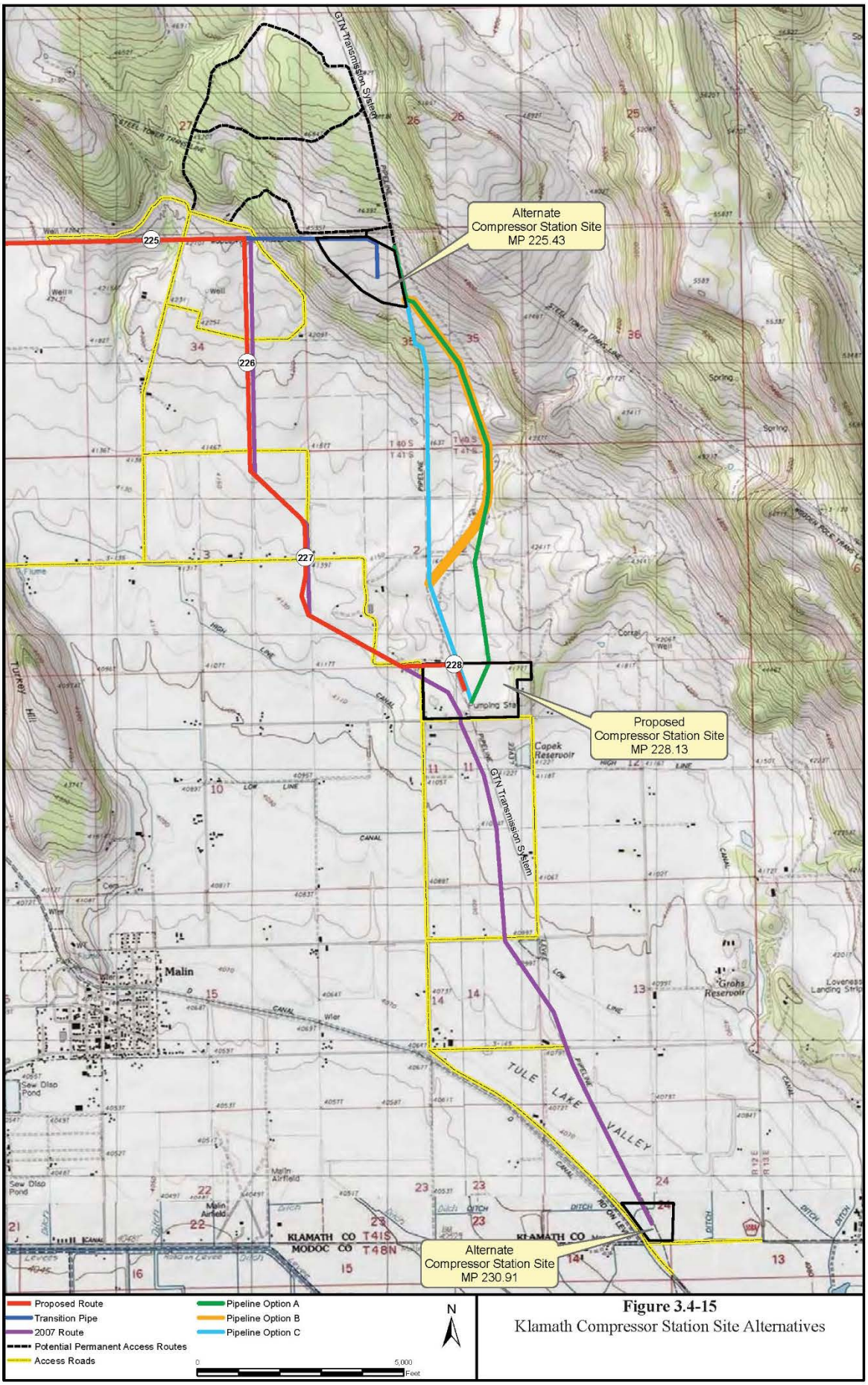

Figure 3.4-15
Klamath Compressor Station Site Alternatives

3.4.5.1 Northern Alternative Compressor Station Location

Pacific Connector evaluated an alternate compressor station site at MP 225.4, about 2.0 miles north of the proposed Klamath Compressor Station, in Section 35, T.40S., R.12E., Klamath County, Oregon, approximately 3.2 miles northeast of Malin. This alternate site is located on a bench adjacent to the GTN natural gas pipeline and a PacifiCorp electric line. The tract is on a hill, east of and topographically about 200 feet above the valley floor. It consists of rangelands with a few scattered juniper trees. Pacific Connector has identified an approximately 48-acre area suitable for siting a compressor station. The closest residence from the center of the site is approximately 0.7 mile to the northwest. This residence is about 150 feet in elevation below the alternative compressor station site, and is topographically screened from view from the site. Noise surveys and modeling have not been completed for this site. However, preliminary evaluations indicate that this alternative site may meet Oregon noise standards.

The additional facilities noted below would be required if this alternate site were selected.

- Upgrading between approximately 1.0 and 1.5 miles of existing dirt road for permanent all-weather access. Pacific Connector is evaluating three potential permanent access routes that are shown on figure 3.4-21 and utilize an existing all-weather road to a Pacific Power substation facility.
- An interconnect with the Ruby pipeline system near MP 228.1. The connection may require installation of pipe larger than 36-inches-in-diameter. Pacific Connector has identified three potential route options for the interconnecting pipeline, that are described below:
    1. Interconnect Pipeline Option-A is approximately 2.0 miles long and proceeds southerly to Ruby Pipeline's existing meter station at MP 228.1. This route deviates from the GTN pipeline to avoid irrigated croplands by crossing primarily rangeland vegetation and land use types.
    2. Interconnect Pipeline Option-B is also approximately 2.0 miles long and is similar to Option-A in that it proceeds southerly avoiding most irrigated cropland. The alignment avoids an irrigated center pivot field then converges with the GTN pipeline for approximately 0.6 mile of the alignment. Approximately 0.2 mile of the southern portion of this route would cross an irrigated field.
    3. Interconnect Pipeline Option-C is approximately 1.9 miles long and proceeds to the south, co-located entirely with the GTN pipeline. This alignment would cross two irrigated fields for approximately 0.8 mile. Pacific Connector has discussed this alignment with the landowner of the center pivot irrigated field, and he is adamantly opposed to this route.

Selection of the alternate compressor station site at MP 225.4 would eliminate the need to construct the proposed Pacific Connector pipeline between MPs 225.4 and 228.1 (2.7 miles), which crosses through primarily irrigated croplands.

3.4.5.2 Southern Alternate Compressor Station Location

Pacific Connector evaluated a potential alternate compressor station site at MP 230.9. The Southern Alternative Compressor Station site would be adjacent to the Oregon/California state line and approximately 2.7 miles southeast of Malin, in Section 24, T.41S., R.12E., in Klamath

County, Oregon. The parcel is an alfalfa field immediately north of County Road 108A. This site is the same as the formerly proposed Tule Lake, Russell Canyon, and Buck Butte meter stations in Klamath County, Oregon previously analyzed in the FERC's May 2009 FEIS for Docket No. CP07-441-000. The Tule Lake, Russell Canyon, and Buck Butte meter stations are not part of the current proposal under Docket No. CP13-492-000, and would be replaced by the Klamath-Beaver and Klamath-Eagle meter stations to be located within the proposed Klamath Compressor station at MP 228.1.

The Southern Alternative Compressor Station site was eliminated from further consideration for the following reasons:

- it was recently encumbered by construction of the Ruby Pipeline aboveground facilities, reducing available space;
- it would require construction of 2.5 more miles of pipeline, affecting 11 additional landowner parcels; and
- it would permanently remove agricultural land on prime farmland soils from crop production.

3.4.5.3 Electric Motor–Driven Compressor Units Alternative

As an alternative to the proposed natural gas driven compressors, Pacific Connector has worked with the local electric distribution company to determine feasibility and cost of power for electric motor–driven (EMD) compressors. Sufficient power is available in the area but transmission line(s) and a substation would have to be constructed to the compressor station. Three motors (13,200 hp each) would be required, one for each compressor. Only two would be in service at any time. For the EMD alternative, dedicated 230-kV transmission lines would have been identified to provide the total load and voltage needs for the Klamath Compressor Station. The total load would be 27.6 MW. The demand would be for two motors with the assumed power demand for the start of the first motor at 15 megavolt ampere (MVA), with a 0.85 power factor followed by a start of the second motor with the first motor operating normally at a total of 30 MVA at a 0.85 power factor.

The provision of the required power for operating EMD compressors would require that an approximately 2-mile-long 230-kV line be constructed to the compressor station from Pacific Power's line 70 that traverses between the Klamath Falls and Malin substations, as well as the installation of an approximately 500-foot by 500-foot (approximately 6-acre) substation. The substation would contain a 230-kV circuit breaker, two 30 MVA transformers, and 12,740-volt metered delivery from each transformer to the compressor station.

Comparatively, for the proposed natural gas–driven turbine, power would be obtained from a multi-customer distribution line, probably in the 25-kV class. Pacific Connector has not made a formal request for service, but Pacific Connector believes (subject of informal discussions with the utility) that the required power could be supplied from existing lines. The power required for the natural gas–driven turbines would be less than 1 MVA, compared to 26 MVA for the EMD option.

3.4.5.4 Conclusions about Compressor Station Alternatives

Oregon has a noise standard (OAR 340-035-0035(1)(f)) for new sources located at previously unused sites. Pacific Connector completed noise surveys and modeling at the proposed Klamath Compressor Station that indicate that the Oregon noise standard would not be achievable at this

location, even after the application of advanced acoustical mitigation measures. However, Pacific Connector stated that the standard only applies to "industrial and commercial noise sources," and should not be applicable to a commodity conveyance utility such as a pipeline. Further, in 1991, the Oregon legislature terminated funding for the ODEQ's administration of the state noise regulation. Since the state can no longer provide site-specific variances or exemption procedures, Pacific Connector believes that the Oregon noise regulation would be unenforceable and would pose an unreasonable impediment to the Project. Therefore, only the FERC noise standards should be applied to the Project.[18] The FERC staff agrees that, in this situation, the FERC noise standards would take precedence over the Oregon regulations. As discussed in section 4.12.2.4 of this EIS, we calculated that noise from the Klamath Compressor Station would average between a day-night sound level (L_{dn}) of 56.1 and 47.5 A-weighted decibels (dBA) at the five closest residences. The FERC standard of an L_{dn} of 55 dBA at noise sensitive areas (NSA) would be met at the proposed Klamath Compressor Station, with the exception of NSA 1. However, Pacific Connector has reached an agreement with the landowners to purchase the property at NSA 1.

We conclude that the use of the EMD alternative may not offer significant environmental advantages over the use of gas-burning compressors at the proposed Klamath Compressor Station. While there are no direct air emissions from EMD compressors, there are indirect emissions associated with generating power at the electric power plant. Depending on its fuel source, the indirect emissions from the power plant may or may not be higher than the direct emissions from the gas-fired compressors at Klamath Compressor Station. The natural gas–driven turbine system would require less electric power and avoid the construction of a new powerline and substation required by the EMD alternative.

The Southern Alternative Compressor Station location would not be environmentally preferable because it would require the additional construction of 2.5 more miles of pipeline; would convert prime farmland to industrial purposes; and the proposed Pacific Connector facilities may conflict with the existing Ruby facilities at the site. While the Northern Compressor Station location could possibly meet the Oregon noise standards, use of that site would require about 2 miles of additional 42-inch-diameter piping, and another new access road. The proposed Klamath Compressor Station would be in compliance with the FERC noise standards. Noise and visual impacts on nearby NSAs would be reduced by measures implemented by Pacific Connector, including slatted fence and vegetative screening, as further discussed in sections 4.8.2.2 and 4.12.2. The proposed Klamath Compressor Station would offer direct access to the GTN and Ruby systems. It would be located on a relatively flat hayfield. We conclude that the alternative compressor station locations do not offer any significant environmental advantages over the proposed site of the Klamath Compressor Station.

[18] Oregon noise standards are discussed in sections 4.12.2.2 and 4.12.2.4 of this EIS; these standards limit increases to 10 dBA above the ambient background L_{10} and L_{50} noise levels at nearby NSAs. Pacific Connector contends that if the Oregon standards were applied to its Project, the company would have to purchase nine residences closest to the Klamath Compressor Station. In Section 10.5.4 of Resource Report 10 in its June 2013 application to the FERC, and in its September 16, 2013, response to the FERC's August 16, 2013, data request, question 84, Pacific Connector explained its position that the Oregon noise regulations should not be applicable to its Project, and that the FERC noise standards should take precedence. This stance was not refuted by ODEQ in its comments on the FERC's November 2014 DEIS for the Project filed on February 12, 2015.

4.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the JCE & PCGP Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. A temporary impact generally occurs during construction with the resource returning to preconstruction condition almost immediately afterward. A short-term impact could continue for up to three years following construction. Impact was considered long term if the resource would require more than three years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the Project. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general and site-specific construction and operational impacts, and proposed measures to avoid, reduce, or mitigate impacts. Our discussion encompasses Project-related impacts associated with the construction and operation of Jordan Cove's LNG export terminal and associated facilities, and Pacific Connector's pipeline and associated aboveground facilities.

Jordan Cove and Pacific Connector, as part of their proposals, agreed to implement certain measures to avoid, minimize, or mitigate impacts on specific resources. We evaluated these proposed measures to determine if they would adequately mitigate impacts. In cases where we felt the proposed measures were less than adequate, where no mitigation measures were proposed, or where final design details requiring Commission review have yet to be developed, and to ensure that appropriate design requirements are implemented, we have added our recommendations to reduce impacts. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific environmental conditions attached as an appendix to any Commission Order authorizing this Project.

This EIS represents our independent analysis of the proposed action and the data submitted by the applicants. It includes the review of the proposal by the federal agencies cooperating in the production of the EIS: the Forest Service, COE, EPA, Coast Guard, BLM, Reclamation, DOT, and FWS. Conclusions in this EIS are based on our analysis of environmental impacts, given the following assumptions:

- Jordan Cove and Pacific Connector would comply with all applicable laws and regulations;
- the proposed facilities would be constructed as described in chapter 2 of this EIS; and
- Jordan Cove and Pacific Connector would implement the mitigation measures included in their respective applications and supplemental filings to the FERC.

To facilitate requirements of the federal cooperating agencies, we have modified the structure of this section of the EIS from the standard format of other documents issued by the Commission. In all cases, the modification has been inclusion of agency-specific needs. In particular, the Land Use section includes analysis of resources as they relate to BLM and Forest Service proposed LMP amendments for the Pacific Connector pipeline.

4.1 LAND USE

4.1.1 Jordan Cove LNG Terminal

4.1.1.1 Land Ownership, Existing Land Use, and Zoning

Virtually all of Jordan Cove's upland elements are on privately owned lands. No federal lands would be utilized for the Jordan Cove Project. However, Jordan Cove proposes to acquire one parcel from the Port as part of its *Habitat Mitigation Plan*. In addition, some components are situated within waters of the State of Oregon. The majority of the waterway for LNG vessel marine traffic, the access channel to the terminal, and the eelgrass mitigation area would be located in Coos Bay. The bay is considered waters of the State, with the bottom of the bay managed by ODSL. Part of the waterway for LNG vessel traffic and the existing dredge disposal Site F are located in the Pacific Ocean offshore of the North Spit.

The Jordan Cove LNG export terminal would be located on the bay side of the North Spit, about 7.5 miles up the existing Coos Bay navigation channel, approximately 1,000 feet north of the city limit of North Bend, in Coos County, Oregon. The various elements of the Jordan Cove Project, except for the waterway for LNG vessel traffic in Coos Bay, are illustrated on figure 4.1-1. The land at the LNG terminal is currently covered by open grasslands (58 acres) and brush (including wetlands) and forested dunes (57 acres, see figure 4.1-2).

The LNG terminal would be within Section 5, Township (T.) 25 South (S.), Range (R.) 13 West (W.), shown on Coos County Assessor's map as tax lots 100/200/300. The LNG terminal, slip, and access channel are located within the aquatic and shoreline segments of the Coos Bay Estuary Management Plan (CBEMP). The access channel and inter-tidal portion of the slip fall within zoning districts 5 and 6 – Development Aquatic (5-DA and 6-DA). The purpose of the 6-DA zone is to provide areas for navigation and other water-dependent uses. The upland portions of the LNG terminal are located within the Coastal Shorelands Boundary and are designated districts 5 and 6 - Water Dependent Development Shorelands (5-WD and 6-WD). The purpose of zoning district 6-DA is to protect the shoreline and provide areas suitable for water-dependent industrial uses. On July 25 and September 17, 2012, the Coos County Planning Department approved Jordan Cove's request for fill within the 6-WD zoning district. The Port obtained a permit from ODSL for dredging the portion of the access channel to the terminal within Coos Bay.

Historically, the LNG terminal tract was once part of the Henderson Ranch, dating back to the 1860s. In the 1880s, the Henderson Ranch was acquired by the Luse family, who later sold it to the Southern Oregon Improvement Company. The Peterson family operated a dairy farm in the area in the early twentieth century, and continued to run cattle on the North Spit until the late 1950s (Byram 2006a). The terminal tract, then referred to as the Ingram Yard, was acquired by the Menasha Wood Ware Corporation, and was sold to Weyerhaeuser in 1981. The Ingram Yard was used for log sorting and disposal of debris from operation of the mill. In the early 1970s, the

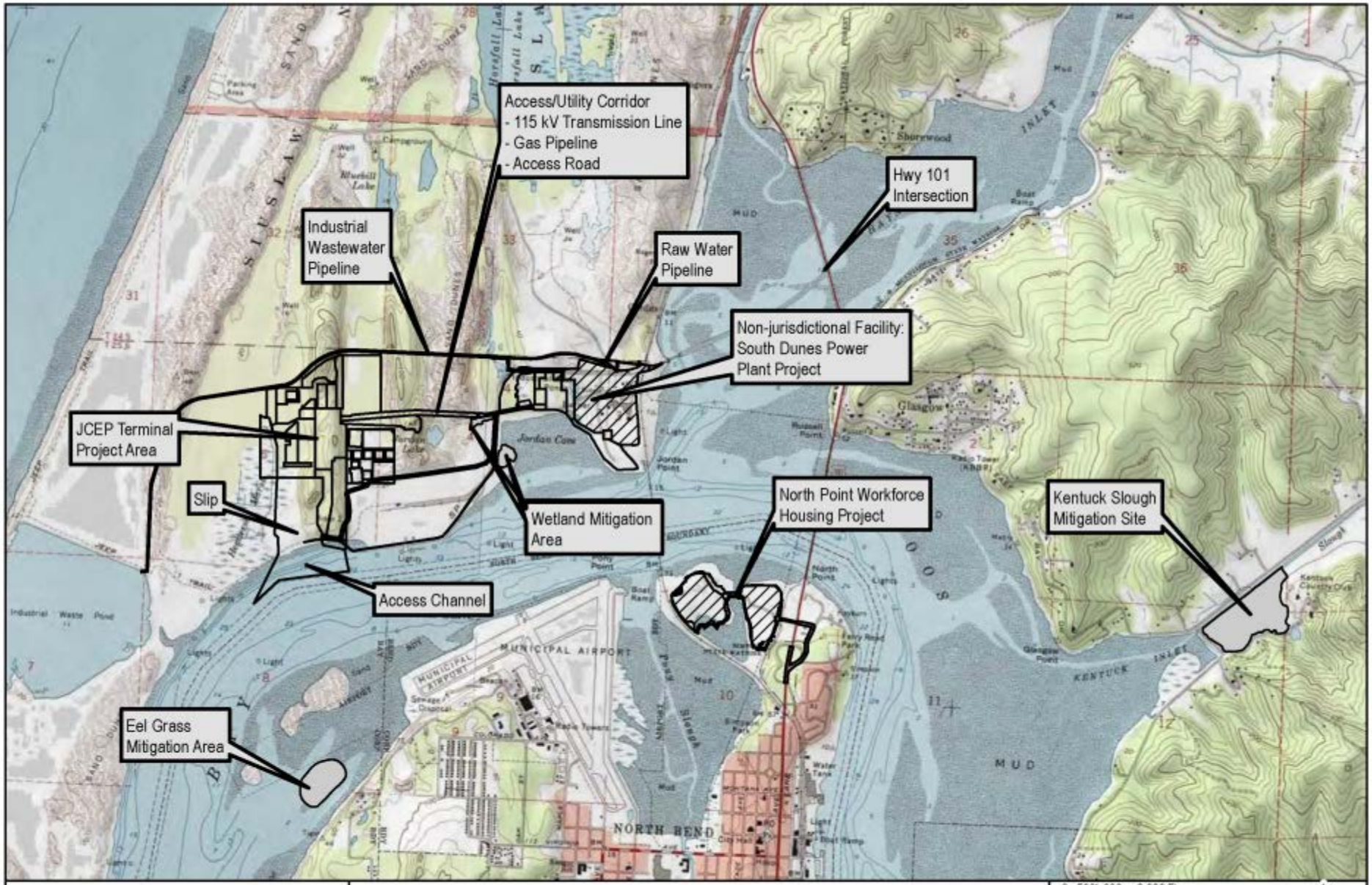

Figure 4.1-1

USGS Topographic Map of the Jordan Cove LNG Terminal Project Site

0 500 1,000 2,000 Ft

1:36,000

Source:
ESRI, Black and Veatch

Created by: TRC

3/28/2014

Figure 4.1-2

Existing Land Use of the Project Area

COE deposited materials dredged during maintenance of the Coos Bay navigation channel at the Ingram Yard.

Jordan Cove proposes to construct and operate a 1.5-mile-long utility and access corridor between the LNG terminal and the South Dunes Power Plant, in the Northeast (NE) Quarter of Section 5, T.25S., R.13W., and Northwest (NW) Quarter of Section 4. This corridor would be north of the existing Roseburg Forest Products property, on land Jordan Cove acquired from Weyerhaeuser. On the south side of the utility-access corridor, adjacent to the eastern boundary of the terminal tract, Jordan Cove would install support buildings, including the terminal control building and the warehouse and maintenance building. Combined, the utility-access corridor and terminal support buildings area encompass about 19 acres. This would include about 10 acres of forest, 5 acres of industrial land, and 4 acres of open shrub/grassland (see table 4.1.1.1-1). Historically, this parcel was once part of the Henry Barrett and Sam Crawford Ranch and the James Jordan Ranch, established in the 1860s, and consolidated by the Luse family in the 1880s.[1]

TABLE 4.1.1.1-1

Types of Land Uses Affected by Construction and Operation of the Jordan Cove Project

	Acres of Impact a/							
	Open Water		Open Land (including shrubs and grasslands)		Forest		Industrial	
Project Element	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Jurisdictional Facilities								
Access Channel and Marine Slip	29	29	20	20	17	17	0	0
Terminal Site Access	0	0	2	2	2	2	0	0
Refrigerant Storage Area	0	0	1	1	1	1	0	0
LNG Loading Berth/Platform and Transfer Line	0	0	0	0	9	9	0	0
Liquefaction Process Area	0	0	0	0	20	20	0	0
LNG Storage Tank Area	0	0	21	21	7	7	0	0
Terminal Fire Water Ponds	0	0	4	4	0	0	0	0
Ground Flare	0	0	<1	<1	1	1	0	0
Barge Berth	2	2	0	0	1	1	<1	<1
Gas Processing Area	0	0	1	1	<1	<1	12	12
Stormwater Pond	0	0	10	10	0	0	1	1
PCGP Meter Station b/	0	0	0	0	0	0	0	0
Utility Corridor and East Access Road	1	1	4	4	6	6	1	1
Terminal Operator Building and Warehouse	0	0	0	0	4	4	4	4
Industrial Wastewater Pipeline Relocation	0	0	0	0	<1	0	12	5
Raw Water Pipeline Extension	0	0	0	0	0	0	3	1
North Point Workforce Housing Complex Bridge	0	0	0	0	0	0	<1	<1
Total Impacts	***32***	***32***	***63***	***63***	***67***	***67***	***33***	***24***
Non-Jurisdictional Facilities								
South Dunes Power Plant	0	0	5	5	1	1	51	51
Southwest Oregon Regional Safety Center (SORSC)	0	0	0	0	7	7	1	1
Total Impacts	***0***	***0***	***5***	***5***	***9***	***9***	***52***	***52***

[1] William Luse was the son of H.H. Luse, who founded the first saw mill at Empire in 1856 (Dodge 1898). William Luse, John Henderson, Henry Barrett, Sam Crawford, and James Jordan were all acquaintances who married native Coos women, sought refuge on the North Spit, and were tangentially involved in the operation of the stage line from Jarvis Landing north along the beach to the Umpqua River.

TABLE 4.1.1.1-1

Types of Land Uses Affected by Construction and Operation of the Jordan Cove Project

	Acres of Impact a/							
	Open Water		Open Land (including shrubs and grasslands)		Forest		Industrial	
Project Element	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Temporary Construction Areas c/								
Construction Offices at Roseburg Forest Products Property	0	0	0	0	0	0	1	0
Parking at Roseburg Property	0	0	0	0	0	0	<1	0
Craft Areas at Roseburg Property	0	0	0	0	0	0	<1	0
Warehouse/Storage at Roseburg Property	0	0	0	0	0	0	1	0
Fabrication Areas at Roseburg Property	0	0	0	0	0	0	4	0
Open Areas	0	0	0	0	0	0	11	0
LNG Vessel Berth Dune	0	0	0	0	14	0	1	0
Northern Terminal Sand Dune Area	0	0	0	0	7	0	0	0
Laydown Area at Roseburg Property	0	0	0	0	0	0	13	0
Laydown Area	0	0	7	0	14	0	0	0
Gas Processing Plant Laydown Area	0	0	0	0	0	0	4	0
Heavy Equipment Haul Road at Roseburg Property	0	0	0	0	0	0	8	0
Slurry and Return Water Pipelines at Roseburg Property	0	0	0	0	0	0	1	0
North Point Workforce Housing Complex d/ e/	0	0	0	0	0	0	48	0
Total Impacts from Temporary Construction Areas	***0***	***0***	***8***	***0***	***35***	***0***	***93***	***0***
TOTAL PROJECT AREA	**32**	**32**	**76**	**68**	**111**	**76**	**178**	**76**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Values may not sum exactly due to rounding of significant digits.

b/ Acres impacted by the Pacific Connector Meter Station are accounted for by the Pacific Connector pipeline and associated aboveground facilities in section 4.1.2.2.

c/ The values reported for Temporary Construction Area impacts exclude areas that overlap with permanent facility impacts.

d/ Jordan Cove indicated that 2 additional acres of construction impact may occur to areas classified as "industrial" for the NPWHC, which would bring the total to 50 acres.

e/ Jordan Cove would also use existing paved or graveled parking areas within the Mill Casino Parking Lot (approximately 15 acres) and former Myrtlewood RV Camp Parking Lot (approximately 6 acres) for off-site worker parking during construction.

The jurisdictional gas processing plant, and non-jurisdictional South Dunes Power Plant and SORSC, would be located east of existing Jordan Cove Road, north of geographic Jordan Cove. This tract, encompassing a total of about 101 acres, was acquired by Jordan Cove from Weyerhaeuser. Now known as the former linerboard mill site, historically, it was once part of the Jordan Ranch, dating back to the 1860s, later acquired by the Luse family, and conveyed to the Southern Oregon Improvement Company. In 1961 Menasha built a sulfate pulp and paper mill on the property, which was sold to Weyerhaeuser in 1981, and converted to a recycled paper mill in 1995. The mill was closed in 2003. Between 1981 and 1992, Weyerhaeuser leased the southern portion of the tract, adjacent to geographic Jordan Cove, to a fish hatchery. The buildings for the mill and fish hatchery have been removed.

The power plant tract includes portions of Sections 3 and 4, T.25S., R.13W., within tax lots 04/100 and 03/200. It is zoned as Industrial (IND) land within the Beach and Dune Area with Limited

Developmental Suitability according to the CBEMP. On October 4, 2012, the Coos County Planning Department granted Weyerhaeuser's request for a fill conditional use permit. The former linerboard mill property, including the Jordan Cove natural gas treatment plant, South Dunes Power Plant, and the SORSC, would cover about 5 acres of open land, 9 acres of forest, and 52 acres of industrial land (see table 4.1.1.1-1).

In addition, Jordan Cove would lease about 40 acres of industrial land within the existing 229-acre Roseburg Forest Products property for temporary construction staging activities. The haul road and dredge slurry and return water lines from the slip, to be used temporarily during construction of the terminal, would also cross Roseburg Forest Products industrial land. The proposed relocations of the CBNBWB industrial wastewater pipeline and the raw water pipeline would be routed along the existing Trans-Pacific Parkway, on the north side of the terminal. The relocations of the water lines would impact about 15 acres of industrial land and less than half an acre of forest land during construction.

Jordan Cove has proposed mitigating the loss of wetlands through three sites in the vicinity of the Project: Kentuck Slough, West Jordan Cove, and West Bridge. Two sites are located on the east side of the Roseburg Forest Products property—3.7 acres of wetlands for the West Jordan Cove Mitigation Area, and 2.0 acres of wetlands at the West Bridge Mitigation Area. Additional information about wetland impact and mitigation is presented in section 4.4.3.

Construction of the LNG terminal, South Dunes Power Plant, SORSC, and associated facilities would affect a total of approximately 397 acres, of which 178 are currently industrial land, 111 acres forest land, 76 acres open land (including shrubs and grasslands), and 32 acres of open water. Permanent operation of the facilities would affect approximately 251 acres, of which 68 acres are open land, 76 acres industrial, 76 acres forest, and 32 acres open water. See table 4.1.1.1-1 for acres affected by construction and operation for each Project element.

Various areas associated with Jordan Cove's proposal are geographically separate from the LNG terminal-power plant complex on the North Spit. At disposal site F, in the Pacific Ocean about 1.8 miles northwest of the mouth of Coos Bay (figure 2.1-1; figure 2.1-12), Jordan Cove proposes to dump materials dredged during maintenance of the access channel and marine slip at the terminal. This is an existing EPA-approved offshore placement site, covering about 3,075 acres, primarily used by the COE's Navigation Branch and the Port. (see chapter 2 for further details).

The waterway for LNG vessel marine traffic would traverse 7.5 miles of the existing navigation channel within Coos Bay. The navigation channel is zoned "Deep-Draft Navigation Channel." in the CBEMP. The navigation channel, which is generally 300-feet-wide and 37-feet-deep, is maintained by the COE on behalf of the Port. It is used by deep draft commercial ships and barges, a commercial fishing fleet, and recreational boats (as described in sections 2.1.1, 4.8.1, 4.9.1, and 4.10.1 of this EIS). The Coos Bay navigation channel does not need to be improved for the Jordan Cove Project. Also within Coos Bay, adjacent to the Southwest Oregon Regional Airport, would be the eelgrass mitigation area, covering approximately 7.5 acres of open water and bay bottom (see section 4.6).

On the north side of the McCullough Bridge, Jordan Cove would make improvements to the intersection of Highway 101 with the Trans-Pacific Parkway, in accordance with its Transportation Impact Analysis (DEA 2012; see also section 4.10.1.2 of this EIS). On the south side of the McCullough Bridge, in North

Bend, Jordan Cove proposes to build the NPWHC and parking lot, covering about 48 acres. This land is owned by Al Pierce Lumber Company, and would be leased by Jordan Cove. It is zoned for heavy industry according to the North Bend Municipal Code and is classified as industrial land. The site was formerly used for log staging. Jordan Cove proposes to use the site for worker housing, and an associated road, transit, utility corridor, bridge crossing, parking area, and staging area (see section 2.4.1.1). In March and April 2014, the City of North Bend Planning Commission issued a Conditional Use Permit to Jordan Cove to allow for the NPWHC.

Jordan Cove proposes to use two temporary off-site parking lots during terminal construction for commuting workers not residing at the NPWHC. One lot, approximately 15 acres, would be at the Mill Casino in the city of Coos Bay. The other lot, approximately 6 acres, would be at the former Myrtlewood RV Camp along Highway 101 near the community of Hauser.

The Kentuck Slough Wetland Mitigation Area would cover about 43.6 acres of uplands on the western shore of Coos Bay at the mouth of Kentuck Slough, to the west of NCM 11 along the Coos Bay navigation channel, including parts of Sections 6 and 7, T.25S,R.12W., tax lots 100/799 and Sections 1 and 12, T.25S.,R.13W. tax lots 400/100. Formerly, this was the Kentuck Golf Course, zoned for Recreation (REC) and Forest (F). However, on September 23, 2009, the Coos County Board of Commissioners, responding to an application from the Port, rezoned this land to Exclusive Farm Use (EFU), and amended the Coos County Comprehensive Plan for this tract from Recreation and Forest use to Agriculture. Also, the County granted the Port's request for conditional use to allow for mitigation and restoration within Segment 15-RS of Rural Shorelands identified in the CBEMP. This property, which is open land including grasslands and wetlands, is currently owned by Jordan Cove.

Lastly, Jordan Cove has identified three parcels it would like to acquire and preserve as part of its Habitat Mitigation Program. Two parcels (P and W) are on the North Spit. The other parcel (S) would be on land owned by Roseburg Forest Products along the Coquille River (see section 4.6.1.1).

Construction and operation of the Jordan Cove LNG terminal, the South Dunes Power Plant, and related facilities should have no significant adverse impacts on existing land use. Jordan Cove's facilities would be consistent and compatible with existing zoning. The LNG terminal tract is zoned for water-dependent industrial use and the adjacent South Dunes Power Plant property as well as the workers camp are zoned for industrial use. Jordan Cove has obtained or is in the process of obtaining local and state permits necessary for use of the Project component areas (see table 1.4.1-1).

4.1.1.2 Coastal Zone Management

The Jordan Cove LNG terminal would be located within the Oregon coastal zone (figure 4.1-3). The coastal zone is formally defined as extending from the Washington border on the north to the California border on the south; seaward to the extent of state jurisdiction as recognized by federal law (i.e., the territorial sea, extending 3 nautical miles offshore); and inland to the crest of the Oregon Coast Range. The Oregon Coastal Management Program of the ODLCD coordinates management of the state's coastal zone and reviews project-specific compliance and consistency with the CZMA. Procedures for ODLCD coastal zone reviews are specified in federal (15 CFR 930) and state regulations (OAR 660-035).

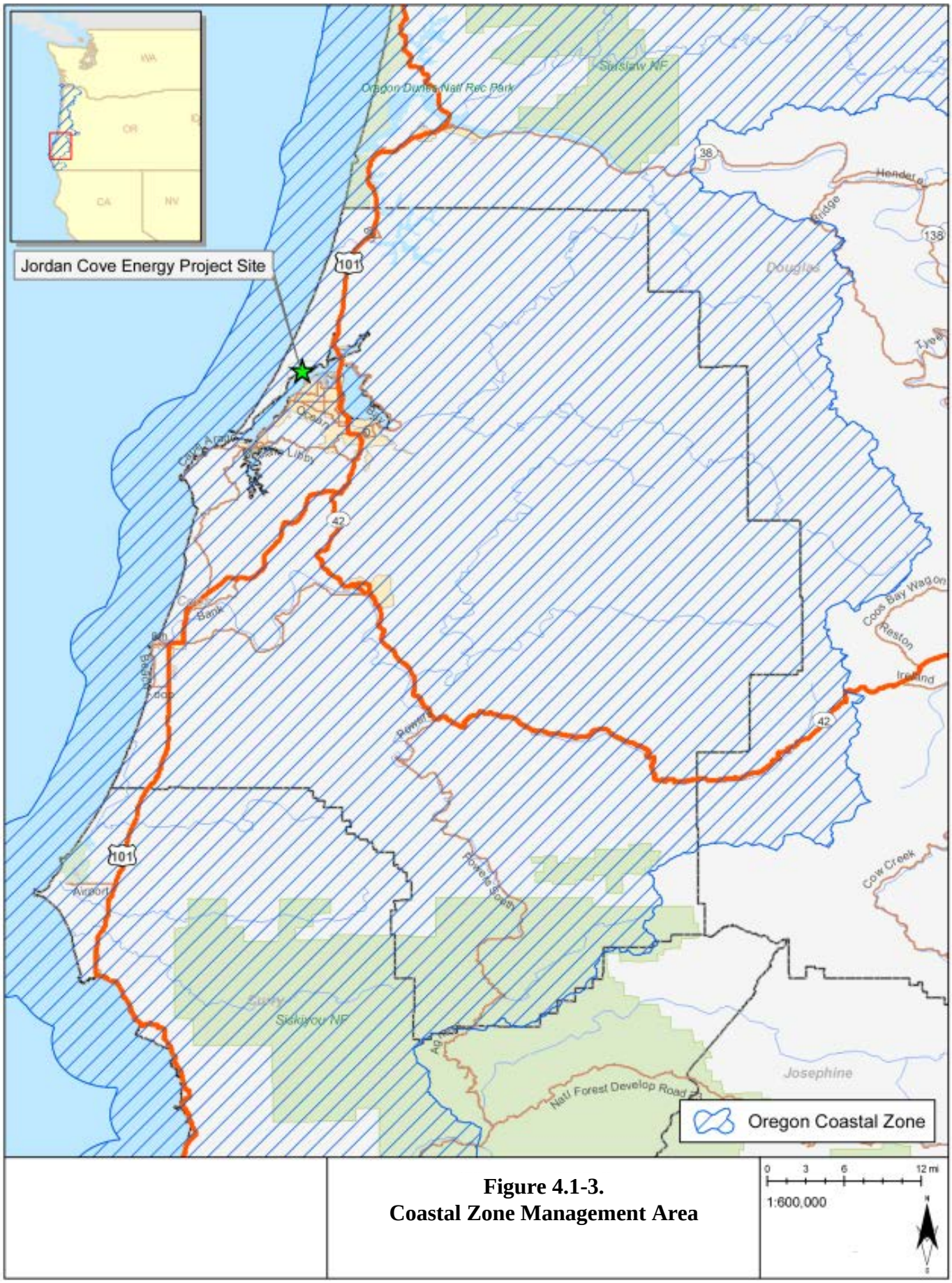

Figure 4.1-3.
Coastal Zone Management Area

On August 1, 2014, Jordan Cove and Pacific Connector submitted their applications to the ODLCD for certification of consistency with the CZMA. The CZMA allows for a six-month review of the applications, with extensions upon agreement. On July 8, 2015, the ODLCD signed a stay agreement that delays their review to January 9, 2016. Therefore, **we recommend that:**

- **Jordan Cove and Pacific Connector <u>should not begin construction of their respective facilities</u> until the companies each file with the Secretary a copy of the ODLCD's determination of consistency with the CZMA.**

4.1.1.3 Existing Residences, Commercial Buildings and Planned Developments

The nearest residential structure to the LNG terminal is about 1.1 miles to the southeast. The closest commercial buildings are part of the existing Roseburg Forest Products industrial operation adjacent to the Jordan Cove LNG terminal. All structures, including businesses, residences, schools, churches, and government buildings, within 2 miles of the LNG terminal site are summarized in table 4.1.1.3-1 below and shown on figure 4.1-4.

TABLE 4.1.1.3-1

Structures Within Two Miles of the Proposed Jordan Cove LNG Terminal

Structure Type	Number of Structures
Businesses	49
Residences	1,438
Schools	2
Churches	6
Government Buildings	70
Total Structures within 2 miles	**1,565**

There are currently no planned residential or commercial developments identified within 1.0 mile of the Project site. However, we are aware that the Coos County Airport District is planning to extend one of the runways at the Southwest Oregon Regional Airport. Ocean Terminals, located at approximately NCM 11 on the Coos Bay waterfront in North Bend is planning to expand its storage yard and extend its pier and wharf on the east side of North Bend. This would be about 3 miles southeast of the Jordan Cove terminal.

Within the City of Coos Bay, a private company, Ocean Grove Development LLC, broke ground in 2013 on a subdivison on 69 acres south of Ocean Boulevard. Eventually, the developer would like to build 676 housing units at the Ocean Grove subdivision.[2] The Coos Tribes are considering construction of a museum and cultural center, and a 30,000-square-foot hotel and convention center at the Hollering Place in Empire, and a new 10,000-square-foot casino on Ocean Boulevard in Coos Bay. The City of Coos Bay is considering the redevelopment of four buildings and the McAuley Hospital as part of its Downtown Revitalization Project. The Hollering Place is about 2 miles south of the proposed Jordan Cove terminal, and the Ocean Grove subdivision and downtown Coos Bay are situated about 3 miles away.

[2] See Thornton, E., 6 August 2013, "Breaking Ground, Ocean Grove Development Group Plans to Build 676 Houses in Coos Bay," *The World*. Although the newspaper article website indicated that the subdivision could supply housing for Jordan Cove construction workers, in fact there is no agreement between Ocean Grove Development and Jordan Cove.

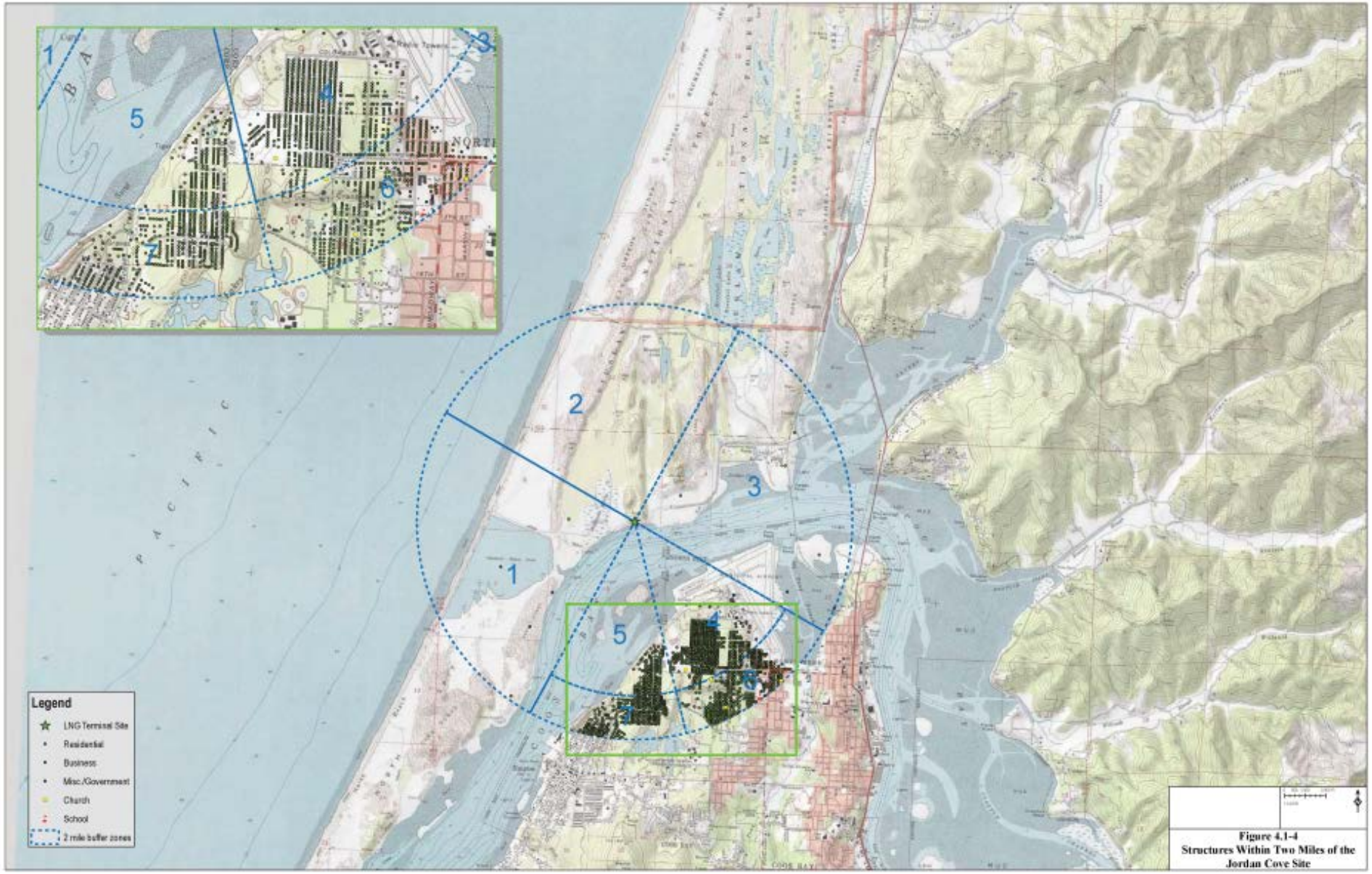

Figure 4.1-4
Structures Within Two Miles of the Jordan Cove Site

4.1.2 Pacific Connector Pipeline and Associated Facilities

4.1.2.1 Land Ownership

A variety of public and private lands would be crossed by the Pacific Connector pipeline, as is summarized in table 4.1.2.1-1. Land ownership along the pipeline route is approximately 31 percent federal, 68 percent private, and 1 percent state lands. No tribal-owned lands or county lands would be crossed. Federal lands are more fully discussed below in section 4.1.3.

TABLE 4.1.2.1-1

Land Ownership Crossed by the Pacific Connector Pipeline a/

	Federal Land		State Land		Private Land		
County	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Total**
Coos	10.8	4.66	2.9	1.25	35.3	15.23	**49.0**
Douglas	21.0	9.06	0.0	0.00	45.1	19.46	**66.1**
Jackson	30.1	12.99	0.2	0.09	25.6	11.04	**55.9**
Klamath b/	9.3	4.01	0.2	0.09	51.3	22.13	**60.8**
Total	**71.2**	**30.72**	**3.3**	**1.42**	**157.3**	**67.86**	**231.8**

Note: Rows and columns may not add correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1").

a/ In the GIS database, 0.24 miles in Klamath County was identified as "unknown" and have been added to the State Land column for the crossings of the Klamath and Lost rivers.

b/ To account for Reclamation facilities on private lands, 0.34 miles was manually added to the federal lands and subtracted from the private lands column in Klamath County.

4.1.2.2 Existing Land Use and Zoning

Pacific Connector is proposing to construct and operate an approximately 232-mile-long, 36-inch diameter interstate natural gas pipeline between Malin and Coos Bay, Oregon. Section 2.1.2 provides a detailed description of the pipeline and aboveground facilities. Approximately 95.3 miles, or 41 percent, of the pipeline route would be constructed within or adjacent to existing utility and transportation corridors (see table D-1 in appendix D of this EIS for a listing of co-locations by MP).

Land Use

Pipeline

Approximately 62 percent of the land that would be crossed by the pipeline is classified as forest, 16 percent is agricultural land, 12 percent is rangelands, and about 8 percent is urban or built-up lands. The other land types combined (water, wetlands, barren lands) comprise about 2 percent of the proposed route. A summary of existing land uses crossed by the pipeline facilities is presented in table 4.1.2.2-1. For tables detailing the location of access roads, hydrostatic discharge sites, topsoil salvage areas, TEWAs, UCSAs, rock source/disposal sites, land ownership by MP, and pipe storage yards see appendix D, tables D-2 through D-9 in this EIS.

The pipeline centerline would cross a combined total of about 145 miles of forest, including deciduous forest, evergreen forest, mixed forest (containing both deciduous and evergreen trees), clearcut forest, and regenerating forest (see section 4.5.1.2 for more details about forested lands). About 37 miles of agricultural lands would be crossed, mainly cropland and pasture. The pipeline would cross about 27 miles of rangeland, including grasslands, shrub, and brush. Urban and built-up lands, crossed by the proposed route for about 18 miles, including about 2 miles of residential areas, commercial areas, and industrial areas combined, and about 16 miles of transportation, communication and utility corridors (including roads, railroads, telephone lines, powerlines, and pipelines). The pipeline would cross about

5 miles of water and wetlands combined.[3] Water includes bays and estuaries, lakes and reservoirs, rivers and streams, and ditches and canals. Wetlands include forested and non-forested wetlands. Less than 0.1 mile of barren lands would be crossed, including beaches, exposed bedrock, strip mines, quarries, and gravel pits, transitional areas, and mixed barren lands.

TABLE 4.1.2.2-1

Land Uses Crossed by the Pacific Connector Pipeline Right-of-Way

U.S. Geological Survey Land Use Classification		Project Total (miles)	Percent of Total
Urban or Built-Up Land	Residential	0.2	0.13
	Industrial	0.3	0.12
	Transportation/Communication	16.4	7.08
	Other Urban or Built-up Land	1.2	0.52
	Subtotal	***18.1***	***7.73***
Agricultural Lands	Cropland and Pasture	37.2	16.18
	Orchards, Groves, Vineyards, etc.	<0.1	0.01
	Subtotal	***37.2***	***16.19***
Rangeland	Herbaceous Rangeland	7.9	3.40
	Shrub and Brush Rangeland	14.9	6.43
	Mixed Rangeland	4.2	1.81
	Subtotal	***27.0***	***11.65***
Forest Land	Deciduous Forest Land	4.9	2.12
	Evergreen Forest Land	50.4	21.57
	Clearcut Forest Land	11.0	4.75
	Regenerating Forest Land	49	21.15
	Mixed Forest Land	29.6	12.77
	Subtotal	***144.8***	***62.35***
Water	Streams	1.0	0.43
	Ditches and Canals	0.3	0.15
	Bays and Estuaries	2.5	1.07
	Subtotal	***3.8***	***1.65***
Wetlands	Forested Wetland	0.2	0.08
	Nonforested Wetland	0.6	0.25
	Subtotal	***0.8***	***0.35***
Barren Land	Beaches	<0.1	<0.01
	Mines, Quarries, Gravel Pits	<0.1	0.01
	Subtotal	***<0.1***	***0.01***
	Project Total	**231.7**	**100**

Note: Rows and columns may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1").

A summary of acres affected by the construction and operation of the Pacific Connector pipeline is presented in table 4.1.2.2-2. Installation of the pipeline would require the clearing of vegetation within the construction right-of-way. The impact of pipeline construction on vegetation is discussed in section 4.5.1.2 of this EIS. Excluding areas along the pipeline route that have been clear cut recently and storage areas where trees would not be cleared (UCSA), about 2,055 acres of upland forest would need to be cleared during pipeline construction activities. Less than one acre of forest would be permanently removed for access roads. During operation of the pipeline, a 30-foot-wide corridor centered on the pipeline would be kept in an herbaceous

[3] This value is limited to the pipeline centerline. Length of wetlands crossed is approximately 9.4 miles total for all Project elements. See section 4.4 for results of wetland delineation and discussion of project impacts to wetlands.

TABLE 4.1.2.2-2

Acres of Land Affected by Construction and Operation of the Pacific Connector Pipeline

	Residential	Commercial	Industrial	Transportation/ Communication	Other Urban/Built-up Land	Cropland/Pasturel and	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Evergreen Forest Land	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest	Streams	Ditches/Canals	Bays and Estuaries a/	Forested Wetlands a/	Nonforested Wetlands a/	Beaches	Strip Mines, Quarries, Gravel Pits	Total
CONSTRUCTION DISTURBANCE b/																							
Construction Right-of-Way	4	<1	4	161	14	424	<1	91	175	47	58	580	346	124	571	7	4	74.2	3.0	5.9	0.2	1	2,694
Hydrostatic Discharge Sites c/	0	0	0	0	0	<1	0	<1	<1	0	0	0	<1	0	<1	0	0	0	0	0	0	0	1
Klamath CS	0	0	0	0	<1	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	32
Temporary Extra Work Areas	4	<1	23	77	31	226	<1	44	52	54	19	118	91	37	214	1	3	2.0	1.0	4.7	6.6	23.0	1,030
Uncleared Storage Areas	<1	0	0	18	0	1	0	3	8	3	7	180	223	63	168	<1	0	0	<0.1	1.5	0	<1	676
Rock Source/Disposal	0	0	0	2	0	3	0	2	7	0	0	3	3	0	6	<1	0	0	0	0	0	61	87
Contractor and Pipe Storage Yards	9	0	315	12	2	325	0	114	0	0	0	0	7	0	33	0	<1	0	0	0	0	206	1,024
Access Roads (TARs/PARs) d/	<1	0	<1	<1	0	5	0	2	2	<1	<1	<1	5	<1	<1	<1	<1	0	0	<0.1	0	0	21
Total	**17**	**1**	**342**	**270**	**48**	**981**	**<1**	**256**	**276**	**104**	**84**	**881**	**676**	**224**	**992**	**10**	**7**	**76.2**	**4.0**	**12.2**	**6.8**	**291**	**5,565**
OPERATION DISTURBANCE																							
Permanent Easement e/	2	0	2	96	7	224	<1	48	90	26	30	305	181	66	299	6	2	14.9	1.8	3.6	<1	<1	1,404
Permanent Access Roads	<1	0	0	<1	0	<1	0	<1	<1	<1	0	0	<1	<1	<1	<1	<1	0	0	<1	0	0	2
Total	**3**	**0**	**2**	**96**	**7**	**224**	<1	**49**	**90**	**26**	**30**	**305**	**181**	**66**	**299**	**6**	**2**	**14.9**	**1.8**	**3.6**	<1	<1	**1,406**
30-Foot Maintenance Corridor	1	0	1	59	4	135	<1	29	54	15	18	183	108	40	179	4	1	8.9	1.1	2.2	<1	<1	843

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown a "<1").

a/ Acreages for estuaries and wetlands are rounded to the nearest tenth of an acre. Values below 0.1 are shown as <0.1. Acres of wetlands affected during construction according to jurisdictional delineation are much greater (approximately 197 acres) than the land use definition used in this table. See section 4.4 for discussion of impacts to wetlands.

b/ Construction disturbance associated with the aboveground facilities is included in the pipeline construction right-of-way impacts. Operation disturbance for aboveground facilities is presented separately in table 4.1.2.2-3. With aboveground facilities, total operation disturbance is 1,438 acres. This includes the 31-acre Klamath CS and the 1-acre communication tower sites.

c/ These are sites located outside the construction right-of-way. Small brush or trees may be cleared by a rubber-tired rotary or flail motor (brush hog) or by hand with machetes/chainsaws. No soil disturbance would occur. A rubber-tired or track hoe would be utilized to lay the discharge line and to remove the saturated hay bales or filter bags upon completion of hydrostatic discharge.

d/ Portions of some of the PARs are located within the construction right-of-way and, therefore, there is some duplication in the acreage calculations. Existing access roads that would be improved (e.g., widening) would affect an additional 14 acres (see table 2.3.2-1). Land use types affected by existing road improvement activity were identified by adjacent land uses, although the majority of the 14 acres is assumed to be road surface or immediate roadside, which would be "Transportation" land use.

e/ The permanent easement is located within the disturbed acreage of the construction right-of-way. It is not an addition to the construction impacts.

state, resulting in a permanent loss of about 528 acres of forest land.[4] Outside of that 30-foot-wide corridor, forest would be restored within the remainder of the construction right-of-way. Pacific Connector would reduce impacts on forest by following its ECRP.[5] However, even with restoration, this would be a long-term impact, as it takes many years for trees to mature.

About 981 acres of agricultural land would be affected by pipeline construction. With the exception of the permanent right-of-way in orchards, these lands can be restored and returned to their original condition and use after the pipeline is installed. Shallow-rooted crops or pasture grasses may be grown across the entire 50-foot-wide permanent easement. The planting of deep-rooted crops, such as orchards and vineyards, would not be permitted directly over the pipeline. Orchards comprise less than 0.1 mile of the pipeline route. Pacific Connector would negotiate with landowners and provide compensation for crop losses or orchards taken out as a result of pipeline construction. Landowners could select seed mixes or crops to be planted over the right-of-way in agricultural crop land or pastures.

To lessen impacts on agricultural lands, Pacific Connector would segregate topsoil and repair any damaged irrigation systems or drain tiles. The segregation of topsoil is discussed in section 4.3. In addition, in agricultural areas the pipeline would have a minimum depth cover of 5 feet over the top of the pipe, where possible, to avoid operational impacts. The largest proportion of agricultural lands crossed by the pipeline, a total of about 30 miles of privately irrigated cropland, would be in Klamath County. Pacific Connector would reduce or mitigate impacts by using a winter construction schedule between MPs 188 and 228, when many of the irrigation canals are dry or unused, and water tables are low. Pacific Connector prepared a *Winter Construction Plan for the Klamath Basin*.[6]

The primary impacts on pasture and rangelands used for grazing livestock would be temporary removal of fences during construction of the pipeline, and temporary removal of livestock from construction areas. To reduce impacts on range, Pacific Connector would erect temporary fences and gates to landowner specifications. Fences cut would be braced and secured to prevent slack wires. If construction activities break or destroy a natural barrier used for livestock control, gaps would be temporarily fenced to prevent passage of livestock. After construction, fences, gates, and cattle guards, including any natural barriers broken, would be restored to their original state as soon as practical. Pacific Connector would consult with landowners and provide them with an opportunity to remove livestock from the construction right-of-way. Hayfields and pastures would not be cleared except in areas directly over the trench or where grading would be required to create a level working surface. Impacts to grazing allotments on federal lands are discussed below in section 4.1.3.2.

We discuss impacts and mitigation for the crossing of residential and commercial lands below in section 4.1.2.3. The crossing of roads by the pipeline is discussed in section 4.10. When crossing

[4] Reported acreage of forest-woodland vegetation impacted in the 30-foot-wide corridor is slightly higher (530 acres) in section 4.5 of this EIS due to differences in habitat calculation versus the land use classifications reported in table 4.1.2.2-2 of this section.

[5] In addition, Pacific Connector would follow the procedures for cutting forest along all lands crossed by its pipeline outlined in the *Right-of-Way Clearing Plan for Federal Lands* included as Attachment 20 of its POD.

[6] Attached as Appendix 1E of Resource Report 1 in the Environmental Report included with Pacific Connector's June 2013 application to the FERC.

other underground utilities, Pacific Connector would follow standard pipeline construction procedures, such as calling the One-Call underground utility number prior to construction in a specific area, and contacting the utility companies to coordinate the crossing (see section 2.4.2.2). The crossing of waterbodies and wetlands is discussed in section 4.4.

Aboveground Facilities

As shown below in table 4.1.2.2-3, the Klamath Compressor Station tract, including the Klamath-Beaver and Klamath-Eagle Meter Stations, would cover about 31 acres of rangeland. The Clarks Branch Meter Station would be located within less than one acre of agricultural land.

TABLE 4.1.2.2-3

Acres Affected by Operation of Pacific Connector Proposed Aboveground Facilities

Facility	Milepost	Land Use	Acres a/
Jordan Cove Meter Station, MLV #1 b/ Receiver c/, d/	1.5R	Industrial	<1
MLV #2 (Boone Creek Road)	15.5	Regenerating Mixed Forest Land	<1
MLV #3 (Myrtle Point Sitkum Road)	29.5	Evergreen Forest	<1
MLV #4 (Deep Creek Spur)	48.4	Regenerating Evergreen Forest	<1
MLV #5 (South of Olalla Creek)	59.6	Cropland/Pasture	<1
Clarks Branch Meter Station, MLV #6, Launcher/Receiver & Communications Tower d/	71.5	Cropland/Pasture	1.0
MLV #7 (Pack Saddle Road)	80.0	Evergreen Forest	<1
MLV #8 (Hwy 227)	94.7	Herbaceous Rangeland	<1
MLV #9 (BLM Road 32-2-12)	113.7	Evergreen Forest	<1
MLV #10 (Shady Cove)	122.2	Transportation, Communications, and Utilities	<1
MLV #11 Launcher/Receiver (Butte Falls)	132. 5	Cropland and Pasture	<1
MLV #12 (Heppsie Mtn Quarry Spur)	150.7	Shrub and Brush Rangeland	<1
MLV #13 (Clover Creek Road)	169.5	Regenerating Evergreen Forest	<1
MLV #14 & Launcher/Receiver Site	187.4	Regenerating Evergreen Forest	<1
MLV #15 (Klamath River)	196.5	Cropland/Pasture	<1
MLV #16 (Hill Road)	214.3	Cropland/Pasture	<1
Klamath Compressor Station, Klamath-Beaver and Klamath-Eagle Meter Stations, MLV #17, Launcher/Receiver & Communications Tower d/	228.1	Shrub and Brush Rangeland	31
		Subtotal	**35**
Communication Sites Not Located at Other Aboveground Facilities			
Blue Ridge e/	~ 20	Transportation, Communications, and Utilities/Commercial	<1
Signal Tree e/	~45.0	Transportation, Communications, and Utilities/Commercial	<1
Flounce Rock e/	~123.0	Transportation, Communications, and Utilities/Commercial	<1
Robinson Butte e/	~159.0	Transportation, Communications, and Utilities/Commercial	<1
Stukel Mountain e/	~209	Transportation, Communications, and Utilities/Commercial	<1
		Subtotal	2
		Total	**36**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Permanent impacts are associated with the fenced and graveled sites required for long-term operational use. These facilities would be located within the construction right-of-way for the pipeline; therefore temporary construction disturbance is included in the disturbance associated with the pipeline.

b/ The 17 mainline block valves would be located within areas disturbed by the construction right-of way or within associated aboveground facility footprints (i.e., meter stations and the compressor station); however, the permanent operation acres provided would remain as permanent disturbance associated with these graded, graveled and fenced facilities.

c/ The Jordan Cove Meter Station would be located entirely within the South Dunes Power Plant site.

d/ Communication facilities are included in the disturbed areas associated with the meter stations and compressor station.

e/ Communication facilities would utilize existing towers and equipment buildings, where space is available for lease, with no associated disturbance. If construction of new facilities is required, Pacific Connector would obtain an approximately 100-foot x 100-foot (0.23-acre) area in the immediate area of the existing communication tower facilities.

The Jordan Cove Meter Station would cover less than one acre of industrial land. The other locations for communications towers would be at existing utility areas. The locations of the MLVs would be mostly within the pipeline construction right-of-way, or within the tracts for other aboveground facilities. The installation of aboveground facilities would result in their permanent conversion to industrial lands.

Zoning

The pipeline would cross 49.0 miles within Coos County, 66.1 miles in Douglas County, 55.9 miles within Jackson County, and 60.8 miles within Klamath County. Current zoning designations crossed by the pipeline are as shown in table 4.1.2.2-4.

TABLE 4.1.2.2-4

County Zones Crossed by the Pacific Connector Pipeline Project

County	Zone	Miles Crossed
Coos County	Forest (F)	40.6
	Exclusive Farm Use (EFU)	4.2
	CBEMP (all zones)	3.8
	Rural Residential (RR-5, RR-2)	0.4
	Total	**49.0**
Douglas County	Timberland Resource (TR)	36.1
	Farm Forest (FF)	16.6
	Exclusive Farm Use, Grazing (FG)	10.8
	Agriculture and Woodlot (AW)	1.6
	Rural Residential (5R)	0.5
	Exclusive Farm Use, Cropland (F2)	0.1
	Unknown a/	0.4
	Total	**66.1**
Jackson County	Forest Resource (FR)	37.7
	Woodland Resource (WR)	6.7
	Exclusive Farm Use (EFU)	10.4
	Open Space Reserve (OSR)	1.1
	Rural Residential (RR-5)	<1
	Total	**55.9**
Klamath County	Forest (F)	19.0
	Exclusive Farm Use (EFU-C)	17.2
	Exclusive Farm Use (EFU-CG)	2.5
	Forestry/Range (FR)	9.3
	Natural Resource (NR)	1.9
	Rural Residential (R5)	1.8
	Heavy Industrial (IH)	3.9
	Suburban Residential (RS)	0.1
	Unknown a/	5.1
	Total	**60.8**

Note: Rows and columns may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1").
a/ "Unknown" refers to gaps in the GIS data (usually associated with roads and waterbodies).

Pacific Connector has not requested that any of the land crossed by the pipeline be rezoned by any of the affected counties. Pacific Connector has received a LUCS from each of the counties that would be crossed by the pipeline route. Coos County and Douglas County determined that the Pacific Connector pipeline would be compatible with their comprehensive plan. The Project was not subject to the land development standards of the Jackson County Land Development Ordinance because it would be authorized by the FERC. Likewise, because the pipeline would be authorized by the FERC, it was not subject to the Klamath County Land Development Code and would not

require county applications and review. Therefore, no conditional use permits would be necessary in either Jackson or Klamath Counties.

Prior to operation, Pacific Connector may be required by the ODSL to obtain a Special Use and/or Waterway Lease for safety exclusion zones (see section 4.13).

Coastal Zone Management

Coos County and a portion of Douglas County, up to the crest of the Coastal Range, are within Oregon's coastal zone. Therefore, Pacific Connector would need to obtain a finding from the ODLCD that the portion of its pipeline within the coastal zone (MPs 1.5 R to 53) is consistent with the CZMA.

Pacific Connector was issued a conditional use permit from Coos County on September 8, 2010. On December 10, 2009, Douglas County issued a conditional use permit to Pacific Connector. On March 20, 2014, the Douglas County Planning Commission approved an amendment to its 2009 decision, affirmed by the Board of Commissioners of Douglas County on April 30, 2014, allowing the pipeline to cross 7.3 miles of coastal zone in Douglas County. Douglas County issued the corresponding LUCS on June 2, 2014.

Pacific Connector, together with Jordan Cove, submitted an application to the ODLCD to obtain a coastal zone consistency determination on August 1, 2014. On July 8, 2015, the ODLCD signed a stay agreement that delays their review to January 9, 2016. Above, we made a recommendation that the Commission not allow construction of the pipeline to proceed until after the ODLCD makes a finding that the Project is consistent with the CZMA.

4.1.2.3 Existing Residences, Commercial Buildings, and Planned Developments

Existing Residences

Pacific Connector did not identify any commercial buildings within 50 feet of the construction right-of-way for its pipeline and ancillary facilities. There are 10 residences identified within 50 feet of the edge of the construction right-of-way, including TEWAs, listed on table 4.1.2.3-1. For the residences within 50 feet of construction work areas, Pacific Connector developed site-specific drawings depicting the temporary and permanent rights-of-way and has noted special construction techniques and mitigation measures (see table 4.1.2.3-1). Appendix I contains the site-specific drawings for these 10 residences.

TABLE 4.1.2.3-1

Residences within 50 Feet of the Construction Right-of-Way or Temporary Extra Work Areas

MP	Distance from Pipeline (feet)	Distance from Edge of Construction Work Area (feet)	Number of Residences
4.2	288	44	1
14.2	45	15	1
49.6	107	42	1
56.9	81	21	1
57.5	57	17	1
65.6	112	47	1
65.9	54	4	1
122.0	455	96	1
199.7	157	30	1
200.3	310	22	1

We have reviewed the site-specific residential construction plans and find them acceptable for reducing impacts; however, we encourage the owners of each of these residences to notify the Commission with comments on the plans for their individual property.

Within 50 feet of residences, the edge of the construction work area would be fenced for a distance of 100 feet on either side to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area. Fencing would be maintained, at a minimum, throughout the open trench phases of pipeline installation. Where possible, the width of the construction right-of-way would be reduced near residences, and TEWAs would be located as far away from residences as practical. Pacific Connector would also limit the period of time the trench remains open prior to backfilling in residential areas.

Pacific Connector has proposed the following general measures to reduce impacts on residential properties:

- Landowners would be notified prior to construction, and Pacific Connector has developed and would implement a Landowner Complaint Resolution Procedure. If a landowner is not satisfied with Pacific Connector's response to a complaint, they would be directed to call or email FERC's Dispute Resolution Division for further assistance.
- Pacific Connector would install orange safety fence between the construction right-of-way and the residence.
- Construction would proceed quickly through residential areas, minimizing exposure to nuisance effects, such as noise and dust, and limiting the hours of operations that high decibel noise levels can be conducted.
- Pacific Connector would attempt to schedule activities during normal working hours. Pacific Connector does not currently plan to work on Sundays; however, certain activities may require a 24-hour work schedule.
- Pacific Connector would comply with all local noise ordinances.
- Access and traffic flows would be maintained during construction activities through residential areas, particularly for emergency vehicles.
- Dust minimization techniques such as watering would be used on-site and all litter and debris would be removed daily from the construction site.
- Mature trees, vegetation screens, and landscaping would be preserved to the extent possible. Landowners would be compensated for the removal of any trees.
- Immediately after backfilling the trench, all lawn areas and landscaping within the construction work area would be restored consistent with the requirements of the FERC's *Plan*.
- Pacific Connector would provide alternative sewer facilities if septic system is disturbed during construction. Pacific Connector would repair and restore septic system affected by construction.
- Pacific Connector would compensate landowners for damage to homes should the home be damaged by pipeline construction.
- Depending on the specific circumstances, Pacific Connector may choose to temporarily relocate residents during construction activities. Arrangements would be determined through

negotiations between the landowner and Pacific Connector's Land Representative prior to construction.

- Pacific Connector would implement the measures outlined in their *Groundwater Supply Monitoring and Mitigation Plan*.

During the scoping process, many landowners commented on the Pacific Connector pipeline. Some have requested that the pipeline be moved off their property. In section 3.4, we evaluate route alternatives to lessen impacts on specific tracts where landowners raised routing concerns. Other concerns included impacts on water wells, utility lines, septic systems, slope erosion, farming operations, loss of future development opportunities, and environmental impacts on resources on their land (e.g., vegetation, wildlife, water quality, etc.). Impacts to agricultural land have been addressed above in section 4.1.2.2. Water resources, including wells, are addressed in section 4.4. Erosion is discussed in section 4.3. All socioeconomic-related impacts are discussed in section 4.9. In many cases, Pacific Connector has been able to make minor adjustments to the pipeline route to lessen impacts to individual landowners and address site-specific infrastructure issues (see section 3.4).

Planned Developments

In correspondence with Pacific Connector, planning agency officials at each of the four counties that would be crossed by the pipeline route did not identify any other privately sponsored large-scale projects that are currently being developed, permitted, or constructed. Our own research identified two newly planned developments in Klamath Falls: 1) a 28-unit memory care center on 1 acre on Jade Terrace adjacent to the Sky Lakes Medical Center and Oregon Institute of Technology; and 2) a FedEx distribution center and office on a 4-acre site on Altamont Drive west of the Klamath Regional Airport. At the closest point, the airport is about 1 mile northeast of the pipeline route near MP 202. In section 4.14 (Cumulative Impacts) of this EIS, we discuss other projects that may occur within the watersheds crossed by the pipeline route.

We received comments from affected landowners and other interested parties during scoping that stated the pipeline would impact the ability to do small-scale development, such as adding a home site, barn, or other structure, or dividing a lot into two parcels to sell the other one. In some cases, Pacific Connector modified the route of the pipeline to avoid improvements on private parcels, as discussed in section 3.4 (Pipeline Alternatives). Most recently, Pacific Connector became aware of the planned "Johnson" subdivision (Palomino Pines). Pacific Connector worked with the subdivision landowner and re-routed (MPs 190.15 to 192.28) to minimize the effect to subdivision lots. This re-route was described in Pacific Connector's filing on January 20, 2015 (see Section 4.0, Table 2, Index Map Sheet 29, Detail Map Sheet 81, and Attachment 5). Impacts on private property are further discussed in section 4.9 (Socioeconomics).

Private Forest Lands

Approximately 1,452 acres of private forestlands (including a small fraction of state land) would be affected by the construction right-of-way, TEWAs, and temporary access roads. To mitigate effects to private forest landowners, Pacific Connector would negotiate an easement, which would account for the value of timber to be cleared within the construction right-of-way and TEWAs, lost timber production within the temporary and permanent easement, as well as potential operational easement effects. During public scoping, concerns were raised that the pipeline could interfere with forest

operations or timber harvest and potential fire suppression efforts. The following discussion addresses these concerns.

Forest operations, including timber production and harvesting, hauling timber, logging road construction and maintenance, application of chemicals, and disposal of slash on forest lands adjacent to the permanent pipeline easement are not expected to be significantly altered, nor would the costs of forestry operations be expected to increase due to the presence of the pipeline. Surrounding forestry operators would be able to cross the pipeline right-of-way with heavy hauling and logging equipment, provided they coordinate those crossings with Pacific Connector and safety precautions are implemented to protect the integrity of the pipeline. For example, it may be necessary to provide additional cover directly over the pipeline in equipment crossing areas and on logging roads. If a landowner demonstrated a need to cross the pipeline in order to conduct forestry operations, Pacific Connector would work with that property owner to develop a pipeline crossing plan that allows the access points to be constructed and used in a safe manner.

While the requirement to coordinate with the pipeline operator would be an inconvenience for some forest operators, it does not constitute a significant change in forestry operations because the operator would be able to continue to cross the pipeline area in order to access or haul timber. Additionally, timber operators generally develop and carefully consider future harvesting and access plans. The need to consult with the pipeline operator if those plans include future crossings of the pipeline right-of- way would not represent a significant imposition or significant change in normal planning activities. The coordination requirement would also not significantly increase the cost of conducting forestry operations. In some situations, however, the presence of a pipeline along a ridge would require a change in log landing locations, which would affect timber operations. See additional discussion of potential impact on timber operations in section 4.5 of this EIS.

4.1.3 Land Use for Pacific Connector Components on Federal Lands

This section addresses land use on federal lands, including detailed analysis of proposed land management plan amendments on BLM and NFS lands.

4.1.3.1 Land Requirements on Federal Lands

The Pacific Connector pipeline would cross approximately 31 miles of NFS lands and 40 miles of BLM lands (table 4.1.3.1-1). Between MPs 200.5 and 227.2, the pipeline would cross 31 irrigation facilities that fall under the jurisdiction of Reclamation.

Temporary impacts of the pipeline on federal lands would include timber and brush clearing, grading, trenching, impacts to visual quality at some locations, and soil compaction as a result of equipment driving and storage of logs, slash, pipe lengths, and other supplies. Long-term impacts include the time it would take trees to grow back within the temporary construction right-of-way. Permanent impacts would include the conversion of forest to herbaceous vegetation within a 30-foot-wide corridor kept clear of trees, and prohibitions of use of the operating pipeline easement. The pipeline and associated facilities would not cross, and therefore no acreage would be removed from, any federally designated wilderness, wildlife refuge areas, or inventoried roadless areas.

TABLE 4.1.3.1-1

Federal Lands Affected by the Pacific Connector Pipeline Project

Pipeline Facility/Component	Jurisdiction		
	BLM	**Forest Service**	**Reclamation**
Miles Crossed by Pipeline	40.3	30.6	0.7
Temporary Construction Acreage Requirements (acres)			
Construction Right-of-Way	460	350	4
Temporary Extra Work Areas	161	103	<1
Uncleared Storage Areas	173	124	0
Off-site Source/Disposal	7	9	0
Existing Roads Needing Improvements in Limited Locations	2	1	0
Temporary Access Roads (TAR)	<1	0	0
Hydrostatic Discharge Locations Outside the right-of-way	<1	0	0
Total Temporary Impacts (acres)	**803**	**587**	**4**
Permanent Construction Acreage Requirements (acres)			
Permanent Easement	244	185	2
Permanent Access Roads (PAR)	<1	0	0
Existing Roads Needing Improvements in Limited Locations a/	2	1	0
Aboveground Facilities	<1	0	0
Total Permanent Impacts (acres)	**244**	**186**	**2**
Right-of-Way (acres)			
30-Foot Maintained Right-of-way (acres)	147	111	1

Note: Columns may not sum correctly due to rounding. Miles rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1"). Acres rounded to the nearest whole acre (values less than 1 shown as "<1").

a/ Road improvements necessary for construction would not be restored; however, no additional maintenance would occur on access roads improved for construction of the Project. Acres are not included in the Permanent Construction acres total.

Pacific Connector would protect its pipeline from corrosion over time through a cathodic protection (CP) system. The CP system would consist of a number of sites where below ground rectifier/anode beds would be installed that input a low voltage electrical charge into the pipeline. These rectifier/anode beds would typically be spaced about 15 to 20 miles apart, usually installed within the previously disturbed pipeline construction right-of-way. The CP system would be installed about one year after the pipeline would be constructed, to allow the trench to stabilize and for collection of post-construction data on electro-conductivity soil potentials, which is required before the system can be designed and installed. Pacific Connector would consult with appropriate federal, state, and local regulatory agencies after pipeline construction to acquire the permits necessary for the CP system. A Corrosion Control Plan was included as Appendix F to Pacific Connector's POD. Based on a preliminary analysis of CP sites that could create a potential for new electrical service, there is no need for new electrical service on federal lands.

Table 4.1.3.1-2 provides acres affected by the pipeline broken out by land use type and ownership for each federal jurisdiction.

TABLE 4.1.3.1-2

Federal Lands Required for Construction and Operation of the Pacific Connector Pipeline by Land Use Type (acres)

Jurisdiction/ Project Element	Residential	Commercial	Industrial	Transportation/ Communication	Other Urban/Built-up Land	Cropland/Pastureland	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Evergreen Forest Land	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest Land	Streams	Ditches	Bays and Estuaries	Forested Wetlands	Nonforested Wetlands	Beaches	Strip Mines, Quarries, Gravel Pits	Transitional Areas	Total
Coos Bay BLM																								
Construction a/	0	0	0	19	0	<1	0	0	0	0	0	100	5	5	43	<1	0	0	<1	<1	0	<1	0	**174**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	9	0	<1	0	0	0	0	0	39	2	2	13	<1	0	0	<1	<1	0	0	0	**65**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	0	6		<1	0	0	0	0	0	24	1	1	8	<1	0	0	<1	0	0	0	0	**39**
Roseburg BLM																								
Construction a/	0	0	0	28	0	0	0	2	0	0	0	73	136	1	94	<1	0	0	0	<1	0	<1	0	**335**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	5	0	0	0	<1	1	1	0	45	0	<1	32	<1	0	0	0	0	0	<0	0	**80**
Permanent Access Roads c/	0	0	0	<1	0	0	0	0	0	0	0	0	<1	0	<1	0	0	0	0	0	0	0	0	**<1**
30-Foot Maintenance Corridor	0	0	0	2	0	0	0	<1	<1	1	0	27	0	<1	19	<1	0	0	0	0	0	0	0	**50**
Medford BLM																								
Construction a/	0	0	0	6	0	0	0	13	56	3	37	65	59	<1	35	<1	<1	0	0	0	0	<1	0	**274**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	2	0	0	0	4	19	1	13	21	19	<1	13	<1	<1	0	0	0	0	0	0	**92**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Foot Maintenance Corridor	0	0	0	1	0	0	0	3	11	<1	8	13	11	<1	8	<1	<1	0	<1	0	0	<1	0	**55**

TABLE 4.1.3.1-2

Federal Lands Required for Construction and Operation of the Pacific Connector Pipeline by Land Use Type (acres)

Jurisdiction/ Project Element	Residential	Commercial	Industrial	Transportation/ Communication	Other Urban/Built-up Land	Cropland/Pastureland	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Evergreen Forest Land	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest Land	Streams	Ditches	Bays and Estuaries	Forested Wetlands	Nonforested Wetlands	Beaches	Strip Mines, Quarries, Gravel Pits	Transitional Areas	Total
Lakeview BLM																								
Construction a/	0	0	0	1	0	0	0	0	<1	<1	0	16	0	0	0	<1	0	0	0	0	0	0	0	**18**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	<1	0	0	0	0	<1	<1	0	7	0	0	0	<1	0	0	0	0	0	0	0	**8**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	0	<1	0	0	0	0	<1	<1	0	4	0	0	0	<1	0	0	0	0	0	0	0	**5**
Umpqua National Forest																								
Construction a/	0	0	0	14	0	0	0	0	0	0	0	162	0	0	23	<1	<1	0	<1	<1	0	12	0	**211**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	4	0	0	0	0	0	0	0	52	0	0	9	<1	<1	0	<1	0	0	0	0	**66**
Permanent Access Roads c/	0	0	0	<1	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	<1
30-Foot Maintenance Corridor	0	0	0	3	0	0	0	0	0	0	0	31	0	0	6	<1	<1	0	<1	0	0	0	0	**39**
Rogue River National Forest																								
Construction a/	0	0	0	15	0	0	0	<1	7	3	0	131	0	<1	109	<1	0	0	0	0	2	16	0	**283**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	5	0	0	0	<1	1	1	0	45	0	<1	32	<1	0	0	0	0	0	0	0	**83**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	0	2	0	0	0	<1	1	1	0	27	0	<1	19	<1	0	0	0	0	0	0	0	**50**

TABLE 4.1.3.1-2

Federal Lands Required for Construction and Operation of the Pacific Connector Pipeline by Land Use Type (acres)

Jurisdiction/ Project Element	Residential	Commercial	Industrial	Transportation/ Communication	Other Urban/Built-up Land	Cropland/Pastureland	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Evergreen Forest Land	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest Land	Streams	Ditches	Bays and Estuaries	Forested Wetlands	Nonforested Wetlands	Beaches	Strip Mines, Quarries, Gravel Pits	Transitional Areas	Total
Winema National Forest																								
Construction a/	0	0	0	3	0	0	0	1	0	0	0	56	0	<1	31	<1	0	0	<1	0	0	0	0	**92**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	1	0	0	0	<1	0	0	0	23	0	<1	12	<1	0	0	<1	0	0	0	0	**37**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	0	<1	0	0	0	<1	0	0	0	14	0	<1	7	<1	0	0	<1	0	0	0	0	**22**
Bureau of Reclamation																								
Construction a/	0	0	0	0	0	<1	0	0	4	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	**4**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Operational Easement b/	0	0	0	0	0	<1	0	0	2	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	**2**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	0	0	0	<1	0	0	1	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	**1**

Note: Rows may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1".

a/ Construction disturbance associated with pipeline facilities including construction right-of-way, TEWAs, UCSAs, TARs, existing roads needing improvements, pipe yards, off-site source and disposal areas, and hydrostatic discharge locations outside the right-of-way.

b/ The operational right-of-way is located within the disturbed acreage of the construction right-of-way. It is not an addition to the construction impacts.

c/ Portions of some of the PARs are located within the construction right-of-way and, therefore, there is some duplication in the acreage calculations.

BLM Lands

The Pacific Connector pipeline would cross approximately 40 miles of BLM lands within the Coos Bay, Roseburg, Medford, and Lakeview Districts. Of the aboveground facilities, three MLVs would be located on BLM lands. Pacific Connector also proposes to construct one new TAR to support construction and three new PARs on BLM lands to support construction and operation.

Acres of BLM lands, by land use classification, that would be affected by pipeline construction and operation are listed above in table 4.1.3.1-2. For all of the BLM land crossed combined, construction of the Pacific Connector pipeline would affect about 669 acres of forest, 60 acres of rangeland, 54 acres of transportation-utility lands, less than 0.1 acre of agricultural land, 0.8 acre of wetlands, 1 acre of water, and about 2 acres of barren lands/quarries. The BLM expressed concerns regarding impact of the pipeline on current and future forest management activities on federally administered lands that might result from prohibited or restricted land management and use activities within or near the pipeline right-of-way. In response, Pacific Connector provided a list of activities that would be prohibited or restricted on the pipeline right-of-way (table 4.1.3.1-3).

TABLE 4.1.3.1-3

Land Management and Land Use Activities That Would be Prohibited or Restricted on the Proposed Pacific Connector Pipeline Construction and Operational Rights-of-Way

Location	Prohibited/ Restricted Activities	Duration
Directly over the pipeline	Obstructions that may endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance and use of the pipeline (i.e. trees, engineered structures, buildings, roads-parallel, other utilities-parallel, logging, blasting, mining)	During the construction, operations, and maintenance of the pipeline facilities.
Within the pipeline right-of-way clearing limits	Obstructions that may endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance and use of the pipeline (i.e. engineered structures, buildings, roads-parallel, limited logging, blasting, mining)	During the construction of the pipeline facilities.
Within the pipeline right-of-way	Obstructions that may endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance and use of the pipeline (i.e. engineered structures, buildings, roads-parallel, limited logging, blasting, mining)	During the construction, operations, and maintenance of the pipeline facilities.
Within one-quarter mile of the pipeline	Some blasting and mining	During operation and maintenance of the pipeline facilities.
On existing federally managed roads and trails	Only when within the right-of-way, obstructions that may, endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance, and use of the pipeline as described above; otherwise none	During the construction, operations, and maintenance of the pipeline facilities.

The BLM also expressed concerns about how prohibited or restricted activities within the pipeline right-of-way may affect parties who hold valid existing rights of federal lands in the project area. In response, Pacific Connector stated that such situations would be handled on a case-by-case basis. In general, Pacific Connector would identify all landowners and interested parties in each of these situations and would work with them, following the guidelines in the Williams Gas Pipeline Developers' Handbook. The BLM also asked Pacific Connector to identify the requirements and timelines for notification to Pacific Connector when activities are planned on the federal lands, either by the agency or a third party. Pacific Connector responded that for any aboveground alterations Pacific Connector would rely on its Operations & Maintenance Manual Public Awareness and Damage Prevention (Policy 10.17.00.09). This policy requires the company to notify in writing at least once per year any landowner or interested party within 660 feet from

either side of the pipeline. The notification would include written information of where the pipeline is and who and how to reach Pacific Connector for any concerns they may have with the pipeline. These notifications would provide the landowner or interested party with the information they need to contact the company to discuss any work around the pipeline or right-of-way.

National Forest System Lands

The pipeline would cross through approximately 30.6 miles of NFS lands within the Umpqua, Rogue River, and Winema National Forests. Acreages of NFS lands, by land use classification, that would be affected by pipeline construction or operation of the Pacific Connector pipeline and associated aboveground facilities are included above in table 4.1.3.1-2. On NFS land, the pipeline would affect about 512 acres of forest, 32 acres of transportation-utility lands, 28 acres of barren lands/quarries, 8 acres of rangelands, 0.5 acre of water, 0.6 acre of wetlands, and 2 acres of beach (i.e., the "beach" category in GIS, in this case banks along the Rogue River).

Reclamation Lands

Between MPs 200.5 and 227.2, Pacific Connector's pipeline route would cross two parcels of withdrawn land totaling 0.7 mile, and 31 irrigation facilities that are managed by Reclamation's Klamath Basin Area Office of the Mid-Pacific Region. Acres of Reclamation land, by land use classification, that would be affected by the Project are included above in table 4.1.3.1-2. Construction of the Pacific Connector pipeline across Reclamation lands and facilities would affect less than half an acre of agricultural land, about 4 acres of rangeland, and less than a tenth of an acre of irrigation ditches.

Construction in the Klamath Basin would occur between October 15 and March 15 to minimize impacts to agricultural activities in the area and to cross the Reclamation irrigation facilities when they are not likely to be used or contain water. Pacific Connector included a *Klamath Facilities Crossing Plan* as Appendix O of its POD, and a *Winter Construction Plan for the* Klamath Basin as Appendix 1E in Resource Report 1 of its June 2013 application to the FERC.

During construction across Reclamation lands and features, their use would be temporarily interrupted. However, after pipeline installation, Pacific Connector would restore those lands and features to their original condition and use.

4.1.3.2 Grazing Allotments on BLM and NFS Lands

The proposed Pacific Connector pipeline route would cross 15 livestock grazing allotments, 5 of which occur on NFS lands managed by the Umpqua, Rogue River, and Winema National Forests, and 10 of which occur on BLM lands managed by the Medford and Lakeview Districts (see table's 4.1.3.2-1 and 4.1.3.2-2). Pacific Connector believes grazing deferments would not be necessary for the Project because grazing is not a dominant land use crossed by the pipeline route. Pacific Connector has consulted with the BLM and the Forest Service regarding grazing resources.

TABLE 4.1.3.2-1

Grazing Allotments on National Forest System Lands Crossed by the Pacific Connector Pipeline Project

Allotment Number	Allotment Name/Pasture	MP	Allotment Acres	Management Category a/	Total AUMs b/	3-Year Average AUMs	Season Used	Livestock Kind	Grazing System	Notes
Umpqua National Forest – Tiller Ranger District										
00R12	Diamond Rock	105.4 - 113.2	21,819	PB: A, F	680	187	5/1-10/31	Cow/Calf	Continuous Season	Managed in conjunction with an adjoining allotment.
Rogue River National Forest – Ashland Ranger District										
00R08	South Butte	153.8 - 167.5	25,570	PB: A, F	230	230	6/1-10-15	Cow/Calf	Continuous	1035 AUs
00R07	Deadwood	167.5 - 167.9	21,174	PB: A, F	382/150 Total of 532	382/150	6/1-10/15 See notes	Cow/Calf	Deferred	Managed with BLM Odd yrs = 6/1–8/15 on FS Even yrs =8/16–10/15 on FS
Winema National Forest – Klamath Ranger District										
OR250	Indian	167.9 - 171.3	10,646	PB: I,A, F	906	665	7/1-10/15	Cow/Calf	Continuous Season	Managed with Buck Allotment as 1 Allotment.
OR220	Buck	171.3 - 172.4	15,932	PB: I,A, F						Same as Indian, managed as 1 Allotment.

a/ 'PB' classification indicates that allotments that have potential to be managed under a quality management strategy. Basic resource damage is not occurring.
P = lack of permittee interest participation;
I = lack of total AMP implementation;
A = lack of reliable range analysis data, and
F = lack of funding to implement quality management.
b/ AUM = animal unit month

TABLE 4.1.3.2-2

Grazing Allotments on BLM Lands Crossed by the Pacific Connector Pipeline Project

Allotment Number	Allotment Name/Pasture	MP	Allotment Acres	Management Category a/	Total AUMs	3-Year Average AUMs	Season Used	Livestock Kind	Grazing System b/	Notes
Medford District										
10004	Longbranch	121.3 - 122.6	11,154	C	93	52	4\16-5\15	Cattle	NX	
10038	Crowfoot	123.5 - 128.4		I			4\15-6\30	"	SS	
10031	Summit Prairie/Carney	131.4 - 131.8	25,693	I	1,158	827	6\1-10\30	"	DF	
10030	Derby Station	133.2 - 133.5	540	C	36	36	N.A.	Closed		Closed to grazing
10024	Big Butte/05-Daisy Mill, 06- Rice Place,04- Lick Creek, 08 Baker Mountain, 07- Baker Flat, 09- Watercress	133.6 - 141.9	21,595	I	1,663	301	4\16-5\31	Cattle	SL	Rice Place pasture now closed to grazing
00126	Heppsie Mountain	148.8 - 153.8	4,076	I	294	277	5/1-10/15	Cattle	SL	
Lakeview District										
0104	Buck Lake	172.4 - 175.7	11,971 e/	C	175 c/	174 c/	6/15 –9/15	Cattle	d/	
0103	Buck Mountain	176.3 - 178.3	7,022 e/	C	204 c/	122 c/	5/15 –9/15	Cattle	d/	
0147	Grubb Spring	178.3 - 189.1	3,524 e/	C	130 c/	130 c/	5/1 – 9/15	Cattle	d/	
0848	Pope	216.5 - 216.8	724 f/	C	48 c/	63 c/	5/1 – 7/31	Cattle	d/	

a/ I = intensive management
C = custodial
M = maintain

b/ NX = Not Allocated: Area is closed to livestock grazing either through a land use plan or by legislation.
SS = Spring/Summer: Use throughout the critical growing season annually.
DF = Deferred: Delay of livestock grazing on an area for an adequate period of time to provide for plant reproduction, establishment of new plants, or restoration of vigor of existing plants.
SL = Season Long: Season long use annually, including during the growing season (spring, summer, fall).

c/ BLM licensed AUMs only.

d/ Grazing is every year for the listed season; no other specific grazing system.

e/ BLM Klamath Falls Resource Area acres only listed

f/ A portion of the allotment was recently sold reducing the acreage.

Potential impacts to grazing allotments may occur from the temporary loss of forage from Project vegetation clearing and grading activities. In addition, construction activities could disturb improvements such as developed springs and fences or other barriers that restrict livestock to the allotment. From current survey activities, Pacific Connector is not aware of any range improvements such as springs that would be impacted. Pacific Connector does not believe it is necessary to remove livestock from the allotments during construction activities because of the significant size of most of the allotments crossed. Prior to construction, Pacific Connector would coordinate with the BLM and Forest Service regarding lease holder notifications.

Pacific Connector would mitigate impacts on grazing allotments during construction by installing temporary fences as needed to control livestock movement. After construction, permanent repairs to fences and natural barriers or other improvements that were disrupted by construction activities would occur to equivalent or better standards to ensure that livestock do not trail outside the allotment. Additional permanent fences may also be required during operation. After the pipeline is installed, the right-of-way would be restored and revegetated, as discussed in section 4.5. Revegetation is expected to return allotment forage quantity and values to preconstruction conditions within one to two growing seasons.

4.1.3.3 BLM and Forest Service Land Use Plans and Land Allocations

Federal lands are managed under a framework of laws passed by Congress, regulations promulgated through the federal rule-making process by the Secretaries of the Interior and Agriculture to implement these laws passed Executive Orders issued by the President, and policies developed by the agencies to govern day-to-day actions. Each administrative unit of the BLM and Forest Service has a land management plan that provides a framework for on-the-ground implementation of these various laws, regulations and agency policies.

Overview of Statutes Applicable to Federal Land Use Planning

Although a number of federal statutes apply to the Pacific Connector pipeline where it crosses federal lands, there are five primary federal land-use laws that provide the framework for federal land use plans:

- NEPA,
- ESA,
- FLPMA,
- NFMA, and
- The Oregon and California Revested Lands Sustained Yield Management Act of 1937 (O&C Act).

Three of these statutes—NEPA, ESA, and FLPMA—apply to both the BLM and the Forest Service. The relevance of the NEPA and ESA to federal land management along the route of the Pacific Connector pipeline is discussed in chapter 1 of this EIS. For the Pacific Connector pipeline, the O&C Act applies only to BLM lands. BLM's LMPs are based on the requirements of FLPMA. The Forest Service's LRMPs are based on the requirements of the NFMA. FLPMA and NFMA were enacted in a manner to complement each other. Reclamation does not have any land use plans or land allocations administered by the Klamath Basin Area Office that would be amended or modified or which need to be addressed in this EIS.

The O&C Act of 1937 applies to lands granted by the federal government to the Oregon and California Railroad Company. These lands were reconveyed to the federal government when the Oregon and California Railroad (O&C) went bankrupt. A similar, but smaller land grant in 1869 to the Southern Oregon Company was associated with the Coos Bay Wagon Road. These lands were also subsequently reconveyed to the federal government. The O&C Act of 1937 requires the Secretary of the Interior to manage Coos Bay Wagon Road lands and O&C lands for permanent forest production in conformity with the principle of sustained yield. These lands must also be managed in accordance with BLM RMPs in addition to applicable environmental laws such as the ESA. The O&C and Coos Bay Wagon Road land grants resulted in a patchwork of alternating federal and non-federal parcels across western Oregon and northern California.[7] Table 4.1.3.3-1 lists the O&C and Coos Bay Wagon Road lands crossed by the Pacific Connector pipeline.

TABLE 4.1.3.3-1

O&C Lands, Coos Bay Wagon Road Lands, and Reserved Public Domain Lands Crossed by the Pacific Connector Pipeline (miles)

Jurisdiction	O&C Lands	Coos Bay Wagon Road Lands	Reserved Public Domain Lands a/	Total
BLM – Coos Bay District	1.2	9.7	0.0	10.8
BLM – Roseburg District	10.6	1.8	0.6	13.0
BLM – Medford District	12.3	0.0	2.9	15.2
BLM – Lakeview District	1.0	0.0	0.3	1.3
Total BLM	**25.1**	**11.5**	**3.7**	**40.3**
Forest Service– Umpqua NF	3.4	0.0	7.4	10.8
Forest Service– Rogue River NF	0.0	0.0	13.7	13.7
Forest Service – Winema NF	0.0	0.0	6.1	6.1
Total NFS	**3.4**	**0.0**	**27.2**	**30.6**
Total	**28.5**	**11.5**	**30.9**	**70.9**

Note: Rows and columns may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1").
a/ Reserved Public Domain Lands are the remaining lands not classified as O&C or Coos Bay Wagon Road lands.

Enacted in 1976, the FLPMA established a unified, comprehensive, and systematic approach to managing and conserving public lands to provide for multiple uses and sustained yield of goods and services from public lands. The act includes provisions for withdrawing or otherwise designating or dedicating federal lands for specified purposes. It also establishes procedures for disposing of public lands, acquiring non-federal lands for public purposes, exchanging lands consistent with the prescribed mission of the department or agency involved and for issuing Right-of-Way Grants across lands administered by multiple federal agencies. The BLM is the authorizing agency for the Pacific Connector pipeline right-of-way grant application.

Under Title II of the FLPMA, the BLM and Forest Service are required to establish a planning process for the management of federal lands under a framework of multiple uses sustained yields goods and services. Although there are distinct differences between the BLM and Forest Service planning regulations, the following elements are common to the two agencies:

- use of a systematic, interdisciplinary approach that utilizes information from the physical, biological, economic, and other sciences;
- considering present and potential uses of public lands;
- giving priority to areas of critical environmental concern;

[7] Appendix H of this EIS provides additional discussion of the O&C Act and associated lands related to this Project.

- considering the relative scarcity of the various values of public lands;
- weighing long-term and short-term public benefits;
- complying with applicable pollution control laws; and
- coordinating land-use planning with other relevant federal and state agencies.

The Forest Service is also subject to the requirements of the NFMA, which was enacted as an amendment to the 1974 Forest and Rangeland Renewable Resources Planning Act. In NFMA, Congress established a comprehensive notice and comment process for adopting, amending, and revising LRMPs for units of the NFS (e.g., National Forests). Planning regulations later promulgated by the Secretary of Agriculture explain that National Forest planning and decision making occurs at four levels: nationwide, region wide, LRMPs, and projects. One of the statutory requirements of the NFMA is to "specify…guidelines for LRMPs developed to achieve the goal of providing for diversity of plant and animal communities based on the suitability and capability of the specific lands area in order to meet multiple use objectives." This biodiversity requirement led to the development of the NWFP, which currently guides the management of NFS and BLM lands in southwest Oregon and meets the NFMA's biodiversity goal.

Northwest Forest Plan

In 1994, the Secretaries of Agriculture and Interior jointly signed a *Record of Decision for Amendments to Forest Service and BLM Planning Documents within the Range of the Northern Spotted Owl* (otherwise known as the Northwest Forest Plan or NWFP; Forest Service and BLM 1994a). This decision established the following common land allocations to be used throughout BLM and NFS lands in the area covered by the NWFP.

- **Congressionally Reserved Areas**—Lands reserved by act of Congress including National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges and Department of Defense lands.
- **Late-Successional Reserves**—LSRs in combination with other land allocations and standards and guidelines are intended to maintain functional, interactive LSOG forest ecosystems for species that are dependent on this type of habitat.[8]
- **Adaptive Management Areas**—Areas designed to develop and test new management approaches to integrate and achieve ecological, economic and other social and community objectives.
- **Administratively Withdrawn Areas**—Areas identified in BLM and Forest Service LMPs not scheduled for timber harvest (e.g., recreation sites, administrative facilities).
- **Key Watersheds**—Large watersheds that are a system of refugia that either provide, or are expected to provide, high-quality habitat that is crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. Key Watersheds are not a designated area or matrix but overlay all land allocations. Tier 1 Key Watersheds contribute directly to conservation of at-risk stocks of anadromous salmonids, bull trout and resident fish. While Tier 2 Key Watersheds may not contain at-risk fish species, they are important sources of high-quality water.

[8] Appendix H of this EIS provides a comprehensive discussion of LSRs as they relate to the Project.

- **Riparian Reserves**—Areas along all streams, wetlands, ponds, lakes and unstable and potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. Riparian Reserves are also intended to serve as connectivity corridors between other reserves and the Matrix lands.[9] Riparian Reserves exist within all land allocations of the NWFP.
- **Matrix**—The lands outside the other designated areas listed above. Matrix lands are the area in which most timber harvest and other silvicultural activities would be conducted.

Attachment A to the NWFP ROD, "Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Species within the Range of the Northern Spotted Owl," provides detailed requirements and instructions for how land managers should treat forest lands subject to the NWFP (Forest Service and BLM 1994b).[10] Some standards and guidelines apply to all BLM and NFS lands, while others are only applicable to certain land allocations or activities. More than one set of standards and guidelines may apply in some areas. Where standards and guidelines overlap, both are applied. Where there are conflicts, the standard and guideline that provides the most protection for LSOG-associated species governs.

Federal Land Allocations Affected by the Pacific Connector Pipeline Project

Table 4.1.3.3-2 presents the miles of NWFP land allocations crossed by the Pacific Connector pipeline route.

TABLE 4.1.3.3-2

NWFP Land Allocations Crossed by the Pacific Connector Pipeline Project (miles)

Jurisdiction	LSRs	Unmapped LSRs	Matrix	Riparian Reserves a/
BLM – Coos Bay District	1.0	2.7	7.2	1.8
BLM – Roseburg District	3.9	1.6	7.6	0.5
BLM – Medford District	0.0	0.0	15.2	1.4
BLM – Lakeview District	0.0	0.0	1.3	<0.1
Forest Service – Umpqua	5.5	0.0	5.3	0.8
Forest Service – Rogue River	13.7	0.0	0.0	0.2
Forest Service – Winema	0.0	0.0	6.1	0.5

Note: Rows and columns may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1").
a/ Riparian Reserves overlay other land use allocations

Effects to different federal land allocations are discussed in relation to each proposed LMP amendment in section 4.1.3.4, and effects to LSRs are discussed in further detail in section 4.1.3.6.

Forest Service Land and Resource Management Plans

Current Forest Service LRMPs for the Rogue River, Umpqua, and Winema National Forests were adopted in the early 1990s (Forest Service 1990a, 1990b, and 1990c). In 1994, the NWFP ROD amended the LRMPs for those portions of National Forests within the range of the NSO to include the NWFP land allocations and standards and guidelines in addition to the existing direction in those plans. Wherever there were conflicts between the NWFP and the underlying land

[9] Appendix J of this EIS provides a comprehensive discussion of Riparian Reserves as they relate to the Project.
[10] Standards and Guidelines: "the rules and limits governing actions, and the principles specifying environmental conditions or level to be achieved or maintained" (Forest Service and BLM 1994b: C-1).

management plan, the direction that provided the most protection for late-successional and old-growth–dependent species was adopted.

BLM Resource Management Plans

The BLM was in the process of revising its RMPs for southwest Oregon when the NWFP was signed in 1994. The BLM was therefore able to incorporate the provisions of the NWFP into its RMPs for areas within the range of the NSO, including the Coos Bay, Medford, and Roseburg Districts and the Klamath Falls Resource Area of the Lakeview District.

Elements Common to BLM and Forest Service Land Management Plans

In addition to the NWFP land allocations described in the previous section, there are three fundamental elements from the NWFP ROD that are common to both the BLM and Forest Service LMPs. These common elements concern standards and guidelines for management of Riparian Reserves, LSRs, and S&M species.[11] In the BLM RMPs, these standards and guidelines are represented as "management direction," but have essentially the same language as that stated in the NWFP ROD.

Common Direction for Implementation of the Aquatic Conservation Strategy

A central objective in the NWFP is the restoration of aquatic habitats. This objective is effected through the ACS of the NWFP (Forest Service and BLM 1994b: B-9). To comply with the ACS objectives, the BLM and Forest Service must manage the riparian-dependent resources needed to maintain existing conditions and implement actions to restore degraded conditions. Improvement relates to restoring biological and physical processes to their ranges of natural variability. This may take from decades to a century or more in some watersheds so it is not expected that any single project would completely accomplish this objective; it is, however, expected that projects be designed so as not to prevent attainment of the ACS objectives and that management actions be should be taken where possible to restore degraded habitats to their historic range of natural variability.

A wide array of standards and guidelines focus on the prohibition or regulation of activities in Riparian Reserves that could prevent attainment of the ACS objectives. Coupled with the goal to "maintain and restore" in each of the ACS objectives, the standards and guidelines provide the context for agency review and implementation of management activities. For both the BLM and the Forest Service, watershed analysis (also called "watershed assessment") provides the baseline from which to assess watershed conditions. Watershed assessments have been developed for all the fifth-field watersheds subject to the NWFP ROD that would be crossed by the pipeline project.

The standards and guidelines for Riparian Reserves restrict activities that would prevent attainment of the ACS objectives and specify stream buffer widths of one site potential tree height on each side of the stream for non-fish-bearing streams and two site potential tree heights on each side of fish-bearing streams. New developments in Riparian Reserves must conform to Standard and Guideline LH 4, which states, "For activities other than surface water developments, issue leases, permits, rights-of-way, and easements to avoid adverse impacts that retard or prevent attainment of ACS objectives."

[11] Appendix K of this EIS provides a detailed discussion of S&M species.

Preliminary assessment of the pipeline project determined that amendment of the standards and guidelines for Riparian Reserves would not be required. Detailed environmental analysis is included in this EIS to support an agency final determination regarding project conformance with Riparian Reserve Standards and Guidelines and ACS. This management direction does not prohibit developments like the Project provided the development can demonstrate compliance with the ACS.

As a whole, the ACS objectives and associated standards and guidelines for Riparian Reserves provide the framework upon which the proposed action, including specific mitigation measures developed by both the BLM and Forest Service (see table 2.1.4-1), has been developed. The ACS is evaluated at multiple scales, from the site or project area to the watershed.

Common Direction for Management of Late-Successional Reserves

The standards and guidelines for LSRs are contained in Attachment A (pages C-9 through C-21) of the NWFP ROD. They are designed to protect and enhance the conditions of LSOG forest ecosystems that serve as habitat for LSOG-dependent species. They are written to apply to specific management actions such as silviculture, range management, mining, and new developments and should be interpreted in that context.

Page C-17 of the NWFP ROD contains specific language applicable to new developments in LSRs:

> *Developments of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects would be reviewed on a case-by-case basis and may be approved when adverse impacts can be minimized and mitigated. These would be planned to have the least possible adverse impacts on Late-Successional Reserves. Developments would be located to avoid degradation of habitat and adverse impacts on identified late-successional species.*

As a whole, the LSR standards and guidelines provide the framework upon which the impacts to LSR, the proposed LSR mitigation actions and the related plan amendments described in section 2 of this EIS are evaluated.

Common Direction for Survey and Manage Species

In 2001, the *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (2001 ROD, or 2001 Survey and Manage ROD; Forest Service and BLM 2001a) was signed. This decision replaced previous direction concerning S&M species, and like the NWFP, amended all of the affected land management plans within the area of the NSO. The amendments in the 2001 Survey and Manage ROD were designed to add clarity, remove duplication, increase or decrease levels of management for specific species based on new information affecting the level of concern for their persistence, and establish a process for making changes to management for individual species in the future originally intended in the 1994 ROD. The 2001 Survey and Manage ROD also retained the direction to manage known sites of protection buffer species but removed their automatic designation as small, species-specific LSRs. For the BLM, the 2001 Survey and Manage ROD

amended the RMPs for the Roseburg, Medford, and Coos Bay Districts, and the Klamath Falls Resource Area of the Lakeview District. For the Forest Service, the 2001 ROD amended the LRMPs for the Rogue River and Umpqua National Forests, as well as portions of the Winema National Forest.

4.1.3.4 Proposed Amendments to BLM and Forest Service Land Management Plans

Both BLM and Forest Service LMPs aim to provide goods and services and achieve desired conditions in a specific planning area.[12] Goals and objectives further describe the desired condition for the administrative unit or for certain land allocations. Land allocations are areas that are managed for specific purposes such as wildlife habitat, stream protection or timber production. Similar to a zoning ordinance, standards and guidelines (Forest Service planning documents), or management direction (BLM planning documents) are specific rules that regulate or prohibit activities such as timber sales or road construction to ensure that goals and objectives (desired conditions) of the plan are achieved.

The FLPMA and NFMA both require that proposed projects, including third-party proposals subject to permits or rights-of-way, be consistent with the LMPs of the administrative unit where the project would occur. When a project would not be consistent with the LMP where the project would occur, the BLM or Forest Service have three options: (1) cancel the project, (2) modify it to make it consistent with the LMP, or (3) amend the LMP to make provision for the project.

Pacific Connector has applied for a Right-of-Way Grant for its pipeline to cross BLM and NFS lands. Pacific Connector crafted its proposal to be consistent with BLM and Forest Service LMPs, where feasible. However, because of the linear nature of the pipeline route, it was not possible to be fully consistent with the agency LMPs in all locations across federal lands. Where the proposal cannot be made consistent with existing BLM and Forest Service LMPs, the BLM and Forest Service propose to amend those plans to make provision for the project.

Proposed amendments of BLM and Forest Service LMPs may affect the goods and services provided by the affected plan in addition to having potential environmental consequences. A description of each of the proposed LMP amendments, an assessment of its impact on the delivery of goods and services from BLM and NFS lands, and an evaluation of the effects of each one on land management plan components (goals, objectives, land allocations, standards and guidelines, management direction, etc.) follows. The NFMA and Forest Service planning regulations (36 CFR 219.10(f) [1982 version]) also require the Forest Service to determine whether a proposed amendment constitutes a "significant" change in the affected Forest Service LRMP. Criteria for determining the significance of plan amendments are found in Forest Service Manual (FSM) 1926 (Forest Service 2006a). Where proposed amendments apply to a Forest Service LRMP, these criteria are applied in the form of questions and answers.

[12] The "Planning Area" in the context of a land management plan is the administrative unit described in the applicable plan. It is generally a BLM district or a national forest. "Goods and services" are the outputs that occur from a BLM District or a National Forest under their respective LMP. These outputs may be tangible, commodity goods such as timber or commercial recreation, or intangible non-market values or benefits such as ecosystem services or wildlife habitat. Neither the BLM planning rule (43 CFR 1600) nor the Forest Service planning rule (36 CFR 219) require decision makers to determine non-market values or quantify non-market benefits. For the purposes of this assessment, environmental impacts are identified but market values are not ascribed to non-market goods and services.

Assessment of Effects of Proposed Amendments on BLM and Forest Service Land Management Plans

In the following sections, the numbering of the proposed LMP amendments corresponds to the designations used in the NOI for the Pacific Connector Pipeline Project published by the BLM and Forest Service in the *Federal Register* on September 21, 2012 (Vol. 77, No. 184).

Proposed RMP Amendments Applicable to the BLM Coos Bay District

This section describes two proposed RMP amendments that would apply only to the BLM Coos Bay District. These two amendments relate to impacts and mitigations associated with the LSR network. The analysis of project impacts and mitigations associated with the LSR network is in sections 4.1.3.6 and 4.1.3.7 of this EIS.

Coos Bay District, BLM-1: Site-Specific Exemption of Requirement to Protect MAMU Habitat on the BLM Coos Bay District

The Coos Bay District RMP would be amended to waive the requirements to protect contiguous existing and recruitment habitat for MAMU within the Pacific Connector right-of-way that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM. This is a site-specific amendment applicable only to the Pacific Connector right-of-way and would not change future management direction at any other location.

In the Coos Bay District, occupied contiguous existing and recruitment MAMU habitat is part of the LSR network. Waiving the requirement to protect contiguous existing and recruitment habitat for MAMU within the Project right-of-way on the Coos Bay District would result in both direct and indirect impacts on mapped and unmapped elements of the LSR network. See section 4.1.3.6 and appendix H of this EIS for an analysis of the Pacific Connector pipeline effects on LSR and mitigation.

Coos Bay District, BLM-4: Reallocation of Matrix Lands to LSR

The Coos Bay District RMP would be amended to change the designation of approximately 387[13] acres from the Matrix land allocation to the LSR land allocation in Sections 19 and 29 of T. 28 S., R. 10 W., W. M., Oregon. This change in land allocation is proposed to mitigate for the potential adverse impact of the Pacific Connector Pipeline Project on LSRs in the Coos Bay District. The proposed amendment would change future management direction for the lands reallocated from Matrix lands to LSR.

Reallocation of O&C or Coos Bay Wagon Road Matrix lands to LSR potentially affects the sustained timber yield objective for the O&C and Coos Bay Wagon Road lands. In order to ensure that this objective is met, the BLM is requiring the applicant to acquire 387 acres of comparable lands to be transferred to the BLM to be managed as Matrix lands that contribute to the sustained timber yield objectives of the O&C and Coos Bay Wagon Road lands.

[13] The NOI published in the *Federal Register* listed 454 acres for BLM-4. The change (67 acres) reflects the discovery of an occupied MAMU stand within the proposed Matrix reallocation area. These 67 acres are now unmapped LSR; therefore, the net matrix area has been reduced to 387 acres.

Proposed RMP Amendments Applicable to the BLM Roseburg District

This section describes three proposed RMP amendments that apply only to the Roseburg District BLM. All three of these proposed amendments relate to mapped and unmapped LSRs. Section 4.1.3.6 describes project impacts and mitigations for the LSR network.

Roseburg District BLM-1: Site-Specific Exemption of Requirement to Protect MAMU Habitat on the BLM Roseburg District

The Roseburg District RMP would be amended to waive the requirements to protect contiguous existing and recruitment habitat for MAMU within the Pacific Connector right-of-way that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM. This is a site-specific amendment applicable only to the Pacific Connector right-of-way and would not change future management direction at any other location or authorize any other project.

Contiguous and existing MAMU habitat is part of the LSR network. By waiving the requirement to protect contiguous existing and recruitment habitat for MAMU on the Roseburg District, there would be both direct and indirect impacts on MAMU habitat that is part of the LSR network (see section 4.1.3.6).

Roseburg District BLM–2: Site-Specific Exemption of Requirement to Retain Habitat in KOAC on the BLM Roseburg District

The RMP for the Roseburg District would be amended to exempt the Pacific Connector Pipeline Project from the requirement to retain habitat in KOAC at three locations. This is a site-specific amendment applicable only to the Pacific Connector right-of-way and would not change future management direction at any other location or authorize any other project.

A KOAC as described in the 1994 NWFP ROD is approximately 100 acres of the best NSO habitat adjacent to a nest site or activity center for all NSO sites known prior to January 1, 1994, on federal Matrix and Adaptive Management Area lands (Forest Service and BLM 1994a). In 2006, BLM provided the applicant with GIS data layers of KOAC within its jurisdictional boundaries. Three KOAC located on Matrix lands (unmapped LSRs) within the Roseburg District occur within the proposed right-of-way for the pipeline project (KOACs P2199, P0361, and P2294) (see figures 4.1-18 and 4.1-19 in section 4.1.3.6).

Roseburg District BLM–3: Reallocation of Matrix Lands to LSR

The Roseburg District RMP would be amended to change the designation of approximately 409 acres from the Matrix land allocations to the LSR land allocation in Sections 32 and 34, T. 29 1/2 S., R. 7 W.; and Section 1, T. 30 S., R. 7 W. W.M, Oregon.

Reallocation of O&C or Coos Bay Wagon Road Matrix lands to LSR potentially affects the sustained timber yield objective for the O&C and Coos Bay Wagon Road lands. In order to ensure that this objective is met, the BLM is requiring the applicant to acquire 409 acres of comparable lands to be transferred to BLM management to be managed as Matrix lands that contribute to the sustained timber yield objectives of the O&C and Coos Bay Wagon Road lands.

Proposed LMP Amendment Applicable to All Administrative Units

BLM/FS-1: Site-Specific Waiver of Management Recommendations for Survey and Manage Species in the BLM Coos Bay District, Roseburg District, Medford District, and Klamath Falls Resource Area of the Lakeview District RMPs, and the Umpqua National Forest, Rogue River National Forest, and Winema National Forest LRMPs

Applicable BLM District RMPs and National Forest LRMPs would be amended to exempt certain known sites within the area of the proposed Pacific Connector Right-of-Way Grant from the management recommendations required by the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines,". For known sites within the proposed right-of-way that cannot be avoided, the management recommendations for protection of known sites of Survey and Manage species would not apply. For known sites located outside the proposed right-of-way but with an overlapping protection buffer, only that part of the buffer within the right-of-way would be exempt from the protection requirements of the management recommendations. Those management recommendations would remain in effect for that part of the protection buffer that is outside of the right-of-way.

Approximately 664 sites of 87 species could be affected by the pipeline project, including approximately 568 sites of 77 species within the clearing limits of the pipeline corridor, 94 of these sites are occupied by *Arborimus longicaudus* (red tree vole)[14]. See section 4.7.4 and appendix K of this EIS for the analysis of species persistence associated with this proposed amendment.

Relationship to LMP Objectives and Significance Assessment for Forest Service Plans

Part 36 CFR 219.10(f) (1982) requires an assessment of the significance of proposed amendments of national forest LRMPs. Criteria for determining the significance of a proposed amendments are found in FSM 1926.51. These criteria are expressed as questions in the following section. If the responsible official elects to implement this proposed amendment, they will use these criteria to determine the significance of the proposed amendment. This section includes the BLM because this proposed amendment applies to the BLM as well as the Forest Service; however, only the Forest Service is required to address whether a proposed amendment is significant in the context of the affected national forest LRMP.

How does this proposed amendment change the BLM and Forest Service LMPs?

S&M species occur along the proposed alignment. The BLM and Forest Service have worked closely with the applicant to refine the alignment to avoid known sites to the extent feasible; in some cases, avoidance of these sites would not be feasible. This proposed amendment waives application of standards and guidelines (described as "management recommendations" in the 2001 Survey and Manage ROD) that generally require protection of known sites of individual survey and manage species. The proposed amendment does not waive the persistence objective for S&M

[14] These values are approximate and based on survey data through Fall 2014 and additional BLM and Forest Service geospatial data as of December 2014. Results from Survey and Manage Species surveys are expected to be updated in 2016 prior to any BLM or Forest Service decision on LMP amendments.

species. This means that for BLM and NFS lands within the project area, individual sites of S&M species may be impacted or lost to construction clearing, but affected species are expected to persist within the range of the NSO despite the loss of these individual sites. See section 4.7.4 and appendix K of this EIS for a detailed analysis of species persistence.

What are the spatial and temporal boundaries of effects?

The spatial boundary of effects is the right-of-way for the Pacific Connector pipeline where it overlaps the protection buffers for affected species (see section 4.7.4 and appendix K of this EIS for detailed analysis). The temporal boundary of the proposed amendment as it relates to land management plans is determined by the duration of the requirements of the 2001 Survey and Manage ROD. This waiver applies to the Pacific Connector pipeline right-of-way as long as the requirements of the Survey and Manage ROD are in force. This proposed amendment does not apply to any other project. The loss of individual sites is presumed to be long-term effect since S&M species are dependent on late-successional forest, which takes 80 years or more to develop.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This proposed amendment would be specific to the Pacific Connector pipeline and would not be related to any other utility corridor or project. It does not prevent attainment of any multiple use goal or objective. The proposed amendment specifically requires that the persistence objective of the Survey and Manage ROD be attained. This is supported by the analysis. Therefore, this proposed amendment would not alter or prevent attainment of long-term goals and objectives in the affected land management plans.

Is this proposed amendment a minor change in standards and guidelines?

This is a minor change in standards and guidelines because:

- The proposed amendment applies only to the Pacific Connector project area and does not affect any other project.
- The geographic area affected by the proposed amendment is a small portion of any single BLM District or National Forest and of the area of the NWFP.
- The amendment is not inconsistent with the species persistence objectives of the Survey and Mange ROD and the NWFP. These objectives must still be met.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

No changes between levels of goods and services associated with the BLM and Forest Service LMPs have been identified as a result of this proposed amendment. Since the proposed amendment does not prevent attainment of goals and objectives in the respective LMPs, it would not alter the long-term relationship between levels of goods and services provided by the LMP.

Does this proposed amendment have an important effect on the LMPs for BLM and/or the Forest Service throughout large portions of the agencies' respective planning areas during the planning period?

As a site-specific waiver of management recommendations for S&M species that is restricted to a single project, this proposed amendment by definition does not have an important effect over a large portion of the respective planning areas. This proposed amendment is not directly related to any other project or location on the BLM Districts or National Forests. Since objectives of the S&M program would still be achieved, and the proposed amendment is site-specific, it does not have an important effect on the entire planning area.

Proposed LRMP Amendments Applicable to the Rogue River National Forest

Six proposed LRMP amendments would apply only to the Rogue River National Forest.[15] As directed by 36 CFR 219.15 and FSM 1926, the decision maker evaluated the proposed Project for consistency with the LRMP (Conroy 2009). That evaluation is the basis for describing the proposed amendments to the Rogue River National Forest LRMP needed to make provision for the Project. This section describes how the proposed amendments would affect the delivery of goods and services and components of the Rogue River National Forest LRMP using the criteria in FSM 1926. These criteria are expressed as questions for each of the proposed LRMP amendments. The Deciding Official for the Forest Service will use this information to determine the significance of these proposed amendments as they relate to the Rogue River National Forest LRMP.

Rogue River National Forest, RRNF-2: Site-Specific Amendment of VOQ on the Big Elk Road

The Rogue River National Forest LRMP would be amended to change the VQO where the Pacific Connector pipeline route crosses the Big Elk Road at about MP 161.4 in Section 16, T.37S., R.4E., W.M., Oregon, from foreground retention (Management Strategy 6, LRMP page 4-72) to foreground partial retention (Management Strategy 7, LRMP page 4-86) and allow 10 to 15 years for amended VQO to be attained. The existing standards and guidelines for VQOs in foreground retention where the Pacific Connector pipeline route crosses the Big Elk Road require that VQOs be met within one year of completion of the project and that management activities not be visually evident.

How does this proposed amendment change the LRMP?

This proposed amendment would change the VQO for Management Area 6 in the vicinity of where the Pacific Connector pipeline would intersect the Big Elk Road from foreground retention to foreground partial retention and allow 10 to 15 years to achieve the modified VQO.

[15] RRNF-1: Amendment to Provide for Energy Transmission was published in the Federal Register as a potential amendment. Subsequent evaluation by the Forest Supervisor determined that this amendment was not necessary. See Forest Plan Consistency Evaluation.

What are the temporal and spatial boundaries of effects?

This proposed amendment would affect about 5 acres in the year of construction which would decrease to approximately 1.72 acres after 10 years. The 1.72 acres represents the seen area associated with the 30-foot-wide operation corridor of the Pacific Connector pipeline. This proposed amendment would change the VQO on approximately 5 acres (the seen area of the corridor) for approximately 10 years. This change would prevent achievement of the VQO of a natural appearing forest at that location during that period. Drivers passing the corridor would be able to see the corridor for approximately 15 to 20 seconds. This change would affect VQOs in the vicinity of the Big Elk–pipeline intersection. No other LRMP goals and objectives would be affected by this change. This proposed amendment is for the Pacific Connector pipeline only and would not change future management direction for other projects subject to authorization by the Rogue River National Forest.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This proposed amendment would change the VQO on approximately 5 acres (the seen area of the corridor) for approximately 10 to 15 years (Mattson 2009). No other goals and objectives would be affected by this change. This proposed amendment is for the Pacific Connector Pipeline Project only and would not change future management direction for other projects.

Is this proposed amendment a minor change in standards and guidelines?

Standards and guidelines for facilities in Management Area 6 state that "Power lines and other facilities shall be constructed, operated and maintained to achieve the visual quality objective as viewed from the highway" (Forest Service 1990a: 4-84, 4-98). This proposed amendment would not change the standards and guidelines; it would instead change only the VQO for this specific project.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- This would be a project-specific amendment that would affect only VQOs in a limited area. It would not change future management of any resource or alter levels of outputs between any other goods and services. The impacts related to scale would be limited to the difference between foreground retention and foreground partial retention at one location after 10 years.
- No other outputs of goods and services that would be affected by the proposed amendment have been identified.
- No other project or plan would be affected by this proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Rogue River National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LMP area, nor would it affect land and resources on NFS lands other than on the specific portion of the project area near the intersection of the Pacific Connector pipeline route with Big Elk Road because:

- Changes that would result from this proposed amendment would be project-specific and would affect only VQOs and related experiences at the location where the Pacific Connector pipeline route crosses Big Elk Road.
- The project area would affect a very small part of the Rogue River National Forest. The construction right-of-way where most impacts would occur occupies approximately 280 acres of the 632,000-acre Rogue River National Forest. This is less than 0.05 percent of the Rogue River National Forest. This proposed amendment would affect approximately 5 acres.

Rogue River National Forest, RRNF-3: Site-Specific Amendment of VQO on the PCT

The Rogue River National Forest LRMP would be amended to change the VQO where the Pacific Connector pipeline route crosses the PCT at about MP 168 in Section 32, T.37S., R.5E., W.M., Oregon, from Foreground Partial Retention (Management Strategy 7, LRMP page 4-86) to Modification (USDA Forest Service Agricultural Handbook 478) and to allow 5 years for amended VQOs to be attained. The existing standards and guidelines for VQOs in Foreground Partial Retention in the area where the Pacific Connector pipeline route crosses the PCT require that visual mitigation measures meet the stated VQO within three years of the completion of the project and that management activities be visually subordinate to the landscape.

How does this proposed amendment change the LRMP?

The language of this proposed amendment has been revised to address new analysis that was developed in response to comments on the DEIS. This analysis indicates that would change the VQO in Management Area 7 in the vicinity of where the Pacific Connector pipeline route crosses the PCT from partial retention to modification and would extend the timeframe for meeting the objective to 5 years.

What are the temporal and spatial boundaries of effects?

This proposed change would affect approximately 5 acres of seen area in the year of construction. Vegetation growth and mitigation measures would reduce the affected seen area to approximately 2 acres after years. This proposed amendment would reduce the VQO on approximately 5 acres (the seen area of the corridor) for approximately 5 years. This change would not achieve the LRMP visual objective of a natural-appearing forest at that location during that period. Hikers and horseback riders passing the corridor would be able to see it for approximately 1 to 3 minutes (Mattson 2009). This change would only affect VQOs in the vicinity of the PCT-pipeline intersection. It would not be visible from any Level I travel route identified in the RRNF LRMP.

This proposed amendment would be for the Pacific Connector pipeline only and would not change future management direction.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This proposed amendment does not affect multiple use goals and objectives for long-term land and resource management. This proposed amendment would reduce the VQO on approximately 5 acres (the seen area of the corridor) for approximately 5 years. This change would not achieve the Forest visual objective of a natural-appearing forest at that location during that period. Hikers and horseback riders passing the corridor would be able to see it for approximately one to three minutes. This change would only affect VQOs in the vicinity of the PCT Pacific Connector pipeline corridor. This proposed amendment would be for the Pacific Connector pipeline only and would not change future management direction.

Is this proposed amendment a minor change in standards and guidelines?

Standards and guidelines for facilities in Management Area 7 state that "Power lines and other facilities shall be constructed, operated and maintained to achieve the VQO as viewed from the highway" (Forest Service 1990a: 4-84, 4-98) This proposed amendment would not change the standards and guidelines to allow the Pacific Connector pipeline corridor; instead, it would change the VQO that is assigned. Note that this area is not actually seen from the highway, which further moderates the intensity of impacts.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- This is a project-specific amendment that would only affect VQO in a limited area. It would not change future management of any resource or alter levels of outputs between any other goods and services so long-term relationships between multiple-use goods and services would not be affected. The impacts related to scale would be limited to the difference between VQOs of partial retention and modification at one location.
- No other outputs of goods and services that would be affected by the proposed amendment have been identified.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Rogue River National Forest during the planning period?

The proposed amendment would not have an important effect on the entire LMP area nor would it affect land and resources throughout a large part of the planning area because:

- Changes resulting from this proposed amendment would be project-specific and would affect only VQO and related experiences at the location where the Pacific Connector pipeline would cross the PCT. At most, this would affect about 5 acres of seen area that would be visible for 1 to 3 minutes (Mattson 2009).

Rogue River National Forest, RRNF-4: Site-Specific Amendment to VQO Adjacent to Highway 140

This proposed amendment does not change VQOs, but instead allows more time to meet the VQO of Middleground Partial Retention as seen from Highway 140. The Rogue River National Forest LRMP would be amended to allow 10 to 15 years to meet the VQO of Middleground Partial Retention between Pacific Connector pipeline MPs 156.3 to 156.8 and 157.2 to 157.5 in Sections 11 and 12, T.37S., R.3E., W.M., Oregon. Standards and guidelines for Middleground Partial Retention (Management Strategy 9, LRMP Page 4-112) require that VQOs for a given location be achieved within three years of completion of the Project. Approximately 0.8 mile or 9 acres of the Pacific Connector right-of-way in the Middleground Partial Retention VQO visible at distances of 0.75 to 5 miles from State Highway 140 would be affected by This proposed amendment.

How would this proposed amendment change the LRMP?

This location has a VQO of Middleground Partial Retention. Standards and guidelines for Middleground Partial Retention (Forest Service 1990a: 4–112) require that VQOs for a given location be achieved within three years of completion of a project. The Project would not meet this standard at that location. This proposed amendment would allow 10 to 15 years to meet the Middleground Partial Retention standard at this location. This location would not be visible from other key observation points or travel routes.

What are the temporal and spatial boundaries of effects?

This proposed change would affect approximately 9 acres or about 0.8 mile of the pipeline corridor as seen from Highway 140 in the year of construction. For the next 10 to 15 years, the pipeline corridor would remain visually dominant over the surrounding landscape but would become less evident each year. Vegetation growth and mitigation measures would allow the area to meet the assigned VQO of Middleground Partial Retention after 10 to 15 years. To the degree that travelers look up as they are headed west on Highway 140, this location would be visible from a distance of 0.75 miles to 5 miles for a few minutes. The duration would depend on travel speed but would likely be less than 10 minutes and would likely not be continuous because of the height of roadside trees and line of sight from the highway (Mattson 2009).

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This proposed amendment would not affect multiple use goals and objectives for long-term land and resource management. This proposed amendment would reduce the VQO on approximately 9 acres (the seen area of the corridor) for approximately 10 years. It would therefore not achieve the LRMP visual objective of a natural-appearing forest at that location during that period. This proposed amendment would be for the Pacific Connector pipeline only and would not change future management direction for other projects subject to authorization by the Rogue River National Forest.

Is this proposed amendment a minor change in standards and guidelines?

Standards and guidelines for facilities in Management Area 7 state that "Landscapes seen from selected travel routes are managed so that, to the casual observer, results of activities are evident but are visually subordinate to the natural landscape." This proposed amendment would not change the standards and guidelines to allow the pipeline project corridor. Instead, it would change the amount of time allowed to reach the objective. This would be a minor change to the standards and guidelines.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- This would be a project-specific amendment that would only affect VQO in a limited area. It would not change future management of any resource or alter levels of outputs between any other goods and services; long-term relationships between multiple-use goods and services would therefore not be affected. The impacts related to scale are limited to the difference between meeting a VQO immediately or allowing a longer period of time to meet the same objective.
- No other projects that would be affected by this proposed amendment have been identified. The limited scale and lack of impacts on other projects make it improbable that the long-term relationship between levels of goods and services would be affected.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Rogue River National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LMP area nor affect land and resources throughout a large part of the planning area because:

- Changes resulting from this proposed amendment would be project-specific and would affect only VQO and related experiences along Highway 140 as seen for a few minutes at a distance of 0.75 mile to 5 miles (Mattson 2009).

Rogue River National Forest, RRNF-5: Site-Specific Amendment to Allow Utility Transmission Corridors in Management Strategy 26, Restricted Riparian Areas

The Rogue River National Forest LRMP would be amended to allow the Pacific Connector pipeline right-of-way to cross the Restricted Riparian land allocation. This would potentially affect approximately 2.5 acres of the Restricted Riparian management strategy at one perennial stream crossing on the South Fork of Little Butte Creek at about MP 162.45 in Section 15, T.37S., R.4E., W.M., Oregon. Standards and guidelines for the Restricted Riparian land allocation prescribe locating transmission corridors outside of this land allocation (Management Strategy 26, LRMP page 4-308).

How would this proposed amendment change the LRMP?

This proposed amendment would allow the Pacific Connector Pipeline Project to cross the Restricted Riparian land allocation at the South Fork of Little Butte Creek.

What are the temporal and spatial boundaries of effects?

The spatial boundary of effects is approximately 3 acres of the 24,000-acre Restricted Riparian land allocation. Temporal boundaries depend on the affected resource. Immediate impacts from construction clearing, such as loss of vegetation cover and soil erosion, can be mitigated in the first year, but reestablishment of mature riparian vegetation may take 50 years or more within the 3-acre construction work area. Low-growing riparian vegetation, such as willows, can be reestablished within 15 feet of the pipeline, but trees with roots that could damage the pipeline cannot be allowed to develop in the maintained 30-foot-wide corridor during the life of the project.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This proposed amendment does not affect multiple use goals and objectives for long-term land and resource management because:

- This proposal would be a project-level amendment that would affect approximately 3 acres of the project area at one stream crossing. No other projects or programs would be affected.
- Only a very small portion (3 acres or 0.01 percent) of the Restricted Riparian land allocation would be affected by this proposed amendment.
- The Forest Service proposed and the applicant adopted an extensive mitigation plan to ensure that LRMP goals and objectives would be achieved. On the Rogue River National Forest, a number of stream crossings associated with roads would be restored as part of the mitigation plan, thus contributing to achieving the LRMP goals and objectives for soils and watersheds as well as the ACS. Riparian planting would also be accomplished as part of the mitigation measures for the Pacific Connector pipeline. See section 4.1.3.5 for a discussion of this proposed amendment as it relates to the ACS.
- An evaluation of stream temperature impacts concluded there would be no discernible water temperature increase at the point of crossing on the South Fork of Little Butte Creek (NSR 2009).

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- It would affect one stream crossing with an estimated 3 acres of 24,000 acres of the Restricted Riparian (about 0.01 percent) land allocation on the Rogue River National Forest.
- An evaluation of the ACS concluded that Pacific Connector Pipeline Project impacts would be within the range of natural variability for the Little Butte Creek watershed. As a result, it is unlikely that the long-term delivery of goods and services would be altered by this proposed amendment.
- The proposed amendment would be project specific.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

Although the Project would have impacts on riparian habitat at the project scale, the proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- This proposed amendment does not affect any proposed projects, so it is unlikely that it would affect the delivery of goods from the Forest.
- The proposed amendment is specific to the pipeline project site. It would not authorize other stream crossings in the Restricted Riparian land allocation. The Pacific Connector pipeline affects about 0.01 percent of the Restricted Riparian land allocation. It is highly improbable that effects at that scale would change long-term relationship between levels of goods and services.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Rogue River National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire land management plan nor would it affect land and resources throughout a large part of the planning area because:

- The proposed amendment would affect about 3 acres of the Restricted Riparian land allocation. There are 24,000 acres of the Restricted Riparian land allocation on the Rogue River National Forest.
- The project area would be a very small part of the Rogue River National Forest. The construction right-of-way where most impacts would occur occupies approximately 280 acres of the 632,000-acre Rogue River National Forest, approximately 0.05 percent. This proposed amendment changes the LRMP for 3 acres, or 0.0004 percent of the Forest.

Rogue River National Forest, RRNF-6: Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas

The Rogue River National Forest LRMP would be amended to waive limitations on areas affected by detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in all affected Management Strategies. Standards and guidelines for detrimental soil impacts in affected Management Strategies require that no more than 10 percent of an activity area should be compacted, puddled or displaced upon completion of a project (not including permanent roads or landings). No more than 20 percent of the area should be displaced or compacted under circumstances resulting from previous management practices including roads and landings. Permanent recreation facilities or other permanent facilities are exempt (Forest Service 1990a: 4-41, 4-83, 4-97, 4-123, 4-177, 4-307).

How this does this proposed amendment change the LRMP?

This proposed amendment would waive the restriction on detrimental soil conditions within the right-of-way of all management areas crossed by the Pacific Connector pipeline. This means that more than 20 percent of the project activity area may be in a degraded soil condition as a result of compaction or displacement when pipeline construction is completed.

What are the temporal and spatial boundaries of effects?

For planning purposes, soil impacts are considered long term. Soil displacement would be confined to the project area, but it is not possible to predict how much of the project area would be affected by soil displacement. If it is assumed that 30 to 70 percent of the project area would remain in a detrimental condition after mitigation and rehabilitation, there would be about 62 to 144 acres of detrimental soil conditions depending on soil conditions spread over about 13.5 miles of right-of-way (see also section 4.3.4 for a complete discussion of pipeline impacts on soils and detrimental soil conditions).

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would have only a minimal effect on the attainment of multiple-use goals and objectives for long-term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan to ensure that long-term goals and objectives would be attained. This mitigation plan includes approximately 50 miles of road decommissioning on the Rogue River National Forest; the road decommissioning would be responsive to Forest-wide management goals for soil and water and wildlife habitat. An ancillary benefit of road decommissioning would be amelioration of existing compaction on the roads being decommissioned. If a 14-foot-wide corridor on decommissioned roads is assumed, approximately 84 acres of existing compacted soils would be repaired by the decommissioning, offsetting the acres of detrimental soil conditions from the Pacific Connector pipeline in the Little Butte Creek fifth-field watershed.
- This is a project-level amendment that applies only to the Pacific Connector pipeline and would not change future management for other projects subject to authorization by the Rogue River National Forest.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- This proposal would be a project-level amendment that would affect only the Pacific Connector pipeline. It would not change any future management direction for other projects subject to authorization by the Rogue River National Forest. Impacts would be restricted to the project area.
- Standards and guidelines for future projects remain unchanged.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services in the LRMP because:

- The proposed amendment would affect only the pipeline project area. No other projects would be affected, and no long-term change in management direction would occur for other projects subject to authorization by the Rogue River National Forest.
- No changes in Forest outputs have been identified as a result of the proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Rogue River National Forest during the planning period?

The proposed amendment would not have an important effect on the entire land management plan nor would it affect land and resources throughout a large part of the planning area because:

- The pipeline project area would affect a very small part of the Rogue River National Forest. If no soil mitigation measures were performed within the right-of-way, the construction impacts would occupy approximately 276 acres (this includes the construction corridor, TEWAs and UCSAs) of the 632,000-acre Rogue River National Forest, approximately 0.04 percent of the Forest. Approximately 30 to 70 percent or 62 to 144 acres of the cleared project area (206 acres) would likely remain in a detrimental soil condition after rehabilitation. Planned mitigation measures that would decompact an additional 84 acres would further reduce potential impacts on the LRMP.

Rogue River National Forest, RRNF-7: Reallocation of Matrix Lands to LSR

The Rogue River National Forest LRMP would be amended to change the designation of approximately 512 acres from the Matrix land allocation to the LSR land allocation in Section 32, T. 36 S., R. 4 E., W. M., Oregon. This change in land allocation is proposed to partially mitigate the potential adverse impact of the Pacific Connector Pipeline Project on LSR 227 on the Rogue River National Forest. This proposed amendment would change future management direction for the lands reallocated from Matrix to LSR.

How does this proposed amendment change the LRMP?

This proposed amendment would reduce the Matrix land allocation on the Rogue River National Forest by 512 acres from 191,839 acres to 191,327 acres, or by approximately 0.27 percent. It would increase the total LSR land allocation on the Rogue River National Forest by 512 acres from 187,745 acres to 188,257 acres, or by approximately 0.27 percent. This proposed amendment would increase LSR 227 by 512 acres from 101,600 acres to 102,112 acres, or by approximately 0.5 percent.

What are the temporal and spatial boundaries of effects?

This proposed amendment would affect 512 acres for the life of the current planning cycle. The spatial boundaries of effects include the area reallocated from Matrix to LSR. Peripheral habitat

connectivity with adjacent habitats would be improved on the perimeter of the additional lands reallocated from the Matrix to LSR 227.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This proposed amendment would minimally alter multiple-use goals and objectives for long-term land and resource management because:

- An extensive mitigation plan was developed by the Forest Service and adopted by the applicant to ensure that the goals and objectives of the LRMP related to late-successional forest habitat would be achieved. Mitigation measures include:
  - Closing and decommissioning up to 53 miles of roads. This would help consolidate interior stand habitat and reduce fragmentation to achieve long-term objectives for LSR. There would be an ancillary benefit to the goals and objectives for soils and watersheds through a reduction in soil compaction on existing roads during decommissioning. This reduction would offset unavoidable detrimental soil conditions within the project area.
  - Approximately 600 acres of precommercial thinning of young stands would accelerate the development of late-successional stand conditions.
  - Coarse woody debris (CWD) would be placed back on approximately 300 acres in existing harvest units that are lacking in CWD to provide the constituent elements of late-successional habitat. These areas overlap with precommercial thinning units.
  - Snags would be created on approximately 600 acres that are currently below desired snag levels for LSR. These areas are in addition to the 300 acres of precommercial thinning and CWD placement described above.
- Approximately 55 acres of LSOG would be removed from LSR 227 by the construction of the PCGP Project and 333 acres of LSOG would be added back to the LSR in the land allocation change. Also within the 512 acres being reallocated to LSR 227 there are approximately 179 acres of younger forest (less than 80 yrs old) that would develop into late successional forest over time, further increasing the amount of LSOG in the LSR. Additionally, several elements of the mitigation plan would accelerate the development of late-successional stand characteristics on several hundred acres.

This proposed amendment would not change existing standards and guidelines in the LRMP, but it would change the standards and guidelines under which this parcel of land would be administered. If amended, these 512 acres would be administered as LSR in the future. Modification of standards and guidelines on 512 acres or 0.08 percent of the 623,000-acre national forest would be a minor change.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

- Moving 512 acres from Matrix to the LSR would minimally change the attainment of the long-term balance of goods and services for the Forest because:
- Acres of LSOG habitat replaced in the LSR by the proposed amendment would exceed the acres of LSOG habitat removed by construction of the Pacific Connector pipeline.

Approximately 55 acres of LSOG would be removed from the LSR by the construction of the Pacific Connector Pipeline Project, and approximately 333 acres of LSOG would be added back to the LSR in the land allocation change. Additionally, several elements of the mitigation plan would accelerate the development of late-successional stand characteristics on several hundred acres within the LSR where the potential loss of habitat would occur.

- The Pacific Connector Pipeline Project would not affect outputs from the LRMP because it would not stop any existing or planned project. If it would not stop or otherwise affect any management activity designed to benefit the LSR or meet other management direction, then it is not likely that the Pacific Connector Pipeline Project would affect the multiple-use balance of the LRMP.
- Probable sale quantity would not be affected before the Rogue River LRMP is revised because the Forest has the capacity to maintain probable sale quantity without the acres of Matrix lands that are being reallocated to LSR. If a linear relationship between acres and outputs is assumed, the potential effect would be less than one-half of one percent of the Forest's probable sale quantity since this proposed amendment would affect less than one-half of one percent of the Forest's Matrix land base. This proposed amendment would not prevent future vegetation management activities such as thinning that would benefit LSR and also contribute to the local forest products industry.

Does this proposed amendment have an important effect on the entire land management plan or would it affect land and resources throughout a large portion of the Rogue River National Forest during the planning period?

The proposed amendment would not have an important effect on the entire LMP area, nor would it affect land and resources throughout a large part of the planning area because:

- Reducing the Matrix land allocation of 191,839 acres by 512 acres or approximately 0.27 percent would not be an important change. This would not alter the outputs of goods and services from the Matrix lands during this planning period.
- The project area would affect only a very small part of the Rogue River National Forest. The construction right-of-way where most impacts would occur occupies approximately 280 acres of the 632,000-acre Rogue River National Forest, or approximately 0.05 percent of the Forest.
- Proposed amendments associated with the Pacific Connector Pipeline Project would be coordinated with the Regional Ecosystem Office (REO) and Regional Interagency Executive Committee as required by the NWFP.

<u>Proposed LRMP Amendments Applicable to the Umpqua National Forest</u>

Four proposed amendments would apply only to the Umpqua National Forest LRMP. As directed by 36 CFR 219.15 and FSM 1926, the decision maker evaluated the proposed Pacific Connector pipeline for consistency with the LRMP (Dills 2009). That evaluation is the basis for describing the proposed amendments to the Umpqua National Forest LRMP needed to make provision for the project. This section describes how the proposed amendments would affect the delivery of goods and services and components of the Umpqua National Forest LRMP using the criteria in FSM 1926. These criteria are expressed as questions for each of the proposed LRMP amendments. The deciding official for the Forest Service will use this information to determine the significance of these proposed amendments as they relate to the Umpqua National Forest LRMP.

Umpqua National Forest, UNF-1: Site-Specific Amendment to Allow Removal of Effective Shade on Perennial Streams

The Umpqua National Forest LRMP would be amended to change the standards and guidelines for Fisheries (Umpqua National Forest LRMP, page IV-33, Forest-Wide) and for Water Quality (Umpqua National Forest LRMP, page IV-60, Forest Wide) to allow the removal of effective shading vegetation where perennial streams are crossed by the Pacific Connector right-of-way. This change would potentially affect an estimated total of three acres of effective shading vegetation at approximately four perennial stream crossings in the East Fork of Cow Creek subwatershed from MPs 109 to 110 in Sections 16 and 21, T.32S., R.2W., W.M., Oregon.

How does this proposed amendment change the LRMP?

This proposed amendment would allow removal of effective shade in the Forest-wide standards and guidelines for fisheries, S&G #1 on page IV-33 (Forest Service 1990b). This would occur on approximately four crossings of perennial streams and would affect approximately 3 acres of effective shade where the Pacific Connector Pipeline Project crosses perennial streams.

What are the temporal and spatial boundaries of effects?

The temporal boundary of effects for the proposed plan amendment is the duration of the present planning cycle or until effective shade is reestablished at the crossings. The spatial boundary of effects is the stream crossings plus the distance downstream that any temperature effect occurs. This proposed amendment would affect approximately 3 acres of effective shade in the first year of construction. Stream temperatures with mitigations to reestablish shade may increase at the crossing site by 0.1 to 0.2°C but are expected to return to background levels within short distances because of groundwater recharge and inflows from other channels. With mitigation measures, temperatures are expected to remain near or at background levels (NSR 2009, 2014) and below the 60.8°F threshold established by the State of Oregon (ORS 340-041-0028).

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would not alter multiple-use goals and objectives for long-term land and resource management because:

- This proposal would be a project-level amendment that would apply only to the Pacific Connector Pipeline Project. No other projects or programs would be affected.
- The Forest Service proposed and the applicant has adopted an extensive mitigation plan to ensure that the LRMP goals and objectives would be achieved. On the Umpqua National Forest, five off-site road crossings of perennial streams would be improved in addition to mitigation measures where the Pacific Connector Pipeline Project crosses perennial streams.
- An evaluation of the ACS concluded that Pacific Connector Pipeline Project impacts would likely be within the range of natural variability for the affected resources.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- It would allow removal of effective shade on an estimated 3 acres of 9,237 acres, or 0.03 percent, of Riparian Reserves in the Upper Cow Creek fifth-field watershed.
- There would be no impacts on stream temperature from this action outside of the project area (NSR 2009, 2014; see also section 4.1.3.5, and appendix J of this EIS).
- Mitigation measures associated with the Pacific Connector Pipeline Project would likely provide effective shade within the first year after construction (NSR 2009, 2014).
- This proposed amendment would be project-specific and would apply only to the Pacific Connector Pipeline Project. It would not change any future management direction for other projects subject to authorization by the Umpqua National Forest.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- Mitigation measures associated with the Pacific Connector Pipeline Project would likely provide effective shade within the first year after construction (NSR 2009, NSR 2014).
- The area affected by the proposed amendment would be very small; less than 3 acres of the watershed would be affected.
- There would be no temperature impacts beyond those anticipated at the site-scale.
- An ACS evaluation did not identify any impacts that are outside the range of natural variability for the Upper Cow Creek watershed.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Umpqua National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire land management plan nor would it affect land and resources throughout a large part of the planning area because:

- It would affect approximately 3 acres of effective shade in the 47,416-acre Upper Cow Creek fifth-field watershed.
- The construction right-of-way where most impacts would occur would occupy approximately 220 acres of the 983,129-acre Umpqua National Forest, or approximately 0.02 percent of the Forest. This proposed amendment would affect approximately 3 acres.

Umpqua National Forest, UNF-2: Site-Specific Amendment to Allow Utility Corridors in Riparian Areas

The Umpqua National Forest LRMP would be amended to change prescriptions C2-II (LRMP IV-173) and C2-IV (LRMP IV-177) to allow the Pacific Connector pipeline route to run parallel to the East Fork of Cow Creek for approximately 0.1 mile between about MPs 109.7 and 109.8 in Section 21,

T.32S., R.2W., W. M., Oregon. This change would potentially affect approximately 1 acre of riparian vegetation along the East Fork of Cow Creek.

How does this proposed amendment change the LRMP?

This proposed amendment would allow the Pacific Connector pipeline to be constructed parallel to approximately 0.1 mile of the East Fork of Cow Creek south of Forest Road 3200-500 from MP 109.7 to MP 109.8.

What are the temporal and spatial boundaries of effects?

The temporal boundary of effects is the duration of the current planning cycle while this requirement remains in effect or until vegetation in the riparian area has recovered. Spatially, this proposed amendment would affect 0.1 mile of Riparian Reserve or less than 1 acre of Riparian Reserve adjacent to a perennial, fish-bearing stream. Approximately 20 to 60 feet of riparian vegetation dominated by LSOG forest would remain between the Pacific Connector Pipeline Project corridor and the East Fork of Cow Creek along this reach. Within the portion of the Project corridor that lies within the Riparian Reserve for the East Fork of Cow Creek (and its tributaries), erosion control and revegetation can be accomplished within the first year following construction consistent with the site-specific restoration plan prepared for the Forest Service; however, the loss of riparian habitat structure and function on less than 1 acre is a longer-term effect. Restoring riparian vegetation that includes larger trees would take at least 50 to 70 years on the less than 1 acre where these trees are removed.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would not affect the attainment of multiple-use goals and objectives for long-term land and resource management because:

- This proposal is a project-level amendment that would apply only to the Pacific Connector Pipeline Project. Although less than 1 acre would be affected within the Pacific Connector Pipeline Project corridor, no other projects or programs would be affected.
- An ACS assessment concluded that any project impacts were within the range of natural variation for the Upper Cow Creek Watershed (see section 4.1.3.5 and appendix J of this document).
- The Forest Service proposed and the applicant has adopted an extensive mitigation plan to ensure that LRMP goals and objectives would be achieved. On the Umpqua National Forest, five off-site road crossings of perennial streams would be improved in addition to on-site mitigation measures that would be implemented where the Pacific Connector Pipeline Project would affect aquatic habitat.
- BMPs adopted by the applicant would limit possible sedimentation in adjacent streams and water bodies.
- Where the pipeline parallels the East Fork of Cow Creek (and its tributaries) effective shade may be lost for the first 20 to 40 feet after the Pacific Connector Pipeline Project crosses Forest Road 3200-500 at MP 109.7. From that point until the corridor turns and crosses the East Fork of Cow Creek at MP 109.8, there would be a 20- to 60-foot distance between the pipeline right-of-way and the creek that would provide buffering vegetation. This

buffer would maintain the existing channel profile and reduce the impacts on aquatic food chains because the overhanging vegetation would not be impaired.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- Less than 1 acre of Riparian Reserve would be affected in the 47,416-acre Upper Cow Creek fifth-field watershed.
- There are no effects of this proposed amendment beyond the project area.
- This proposed amendment would be project-specific and would apply only to the Pacific Connector Pipeline Project. No future management direction would be changed.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- No other projects or programs would be affected by this proposed amendment. It is therefore unlikely that the long-term relationship between goods and services provided by the plan would be altered.
- The area affected by the proposed amendment is less than 1 acre of the 983,129-acre Umpqua National Forest.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Umpqua National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LRMP area nor would it affect land and resources throughout a large part of the planning area because:

- The Pacific Connector Pipeline Project would affect only a very small part of the Umpqua National Forest. The construction right-of-way where most impacts would occur would occupy approximately 220 acres of the 983,129-acre Umpqua National Forest. This proposed amendment affects less than 1 acre or 0.00009 percent of NFS lands managed by the Umpqua National Forest.
- Any stream temperature increase at the project scale would be negligible at the scale of the larger stream network and at the fifth-field watershed scale (NSR 2009, 2013).

Umpqua National Forest, UNF-3: Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas

The Umpqua National Forest LRMP would be amended to waive limitations on the area affected by detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way. The standards and guidelines for soils (LRMP page IV-67) require that not more than 20 percent of the project area have detrimental compaction, displacement, or puddling

> *after completion of a project. This amendment applies only to the right-of-way and associated work areas of the Pacific Connector Gas Pipeline. It does not affect other projects, or change any future management direction.*

How would this proposed amendment change the LRMP?

This proposed amendment would allow the Pacific Connector Pipeline Project to exceed the restriction on the proportion of an activity area that may have detrimental soil conditions. This means that more than 20 percent of the activity area may be in detrimental soil condition, primarily from compaction and displacement associated with right-of-way clearing.

What are the spatial and temporal boundaries of the impacts?

For planning purposes, soil impacts are considered long term. Detrimental conditions would be confined to the project area, but predicting how much would be affected would be speculative. Assuming that 30 to 70 percent of the project area would remain in a detrimental condition after mitigation and rehabilitation about 54 to 127 acres would be affected.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would minimally affect multiple-use goals and objectives for long-term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan to ensure that long-term goals and objectives would be attained. This mitigation plan includes approximately 8 miles of road decommissioning on the Umpqua National Forest that is responsive to Forest-wide management goals for soil and water. Decommissioning includes rehabilitation of compacted soils. Assuming a 14-foot-wide compacted soil area on decommissioned roads, approximately 14 additional acres of compacted soils would be rehabilitated, contributing to goals and objectives for soils and watersheds and partially offsetting the detrimental soil conditions associated with the Pacific Connector Pipeline Project.
- This is a project-level amendment that applies only to the Pacific Connector Pipeline Project and would not change future management direction.
- Even without mitigation measures, the Pacific Connector Pipeline Project would affect no more than 223 acres (0.02 percent) of the 983,129-acre Umpqua National Forest. With on-site mitigation measures, the number of acres that would be affected would be reduced to 54 to 127 acres within the pipeline right-of-way. Off-site mitigation measures would further reduce detrimental soil conditions by an estimated additional 14 acres.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- This proposal would be a project-level amendment that would affect only the Pacific Connector Pipeline Project. It would not change any future management direction, and impacts would be restricted to the project area.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- This proposed amendment would affect only the project area. No other projects would be affected and no long-term change in management would occur.
- No changes in Forest outputs occur as a result of this proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or would it affect land and resources throughout a large part of the Umpqua National Forest during the planning period?

The Pacific Connector Pipeline Project would affect only a very small part of the Umpqua National Forest. The construction right-of-way where most impacts would occur (this includes the construction corridor, TEWAs, and UCSAs) occupies approximately 223 acres of the 983,129-acre Umpqua National Forest. Areas where detrimental soil conditions may exist would affect 54 to 127 acres or 0.006 to 0.013 percent of the forest. This proposed amendment, by its own evidence, would not affect large parts of the planning area or the area of the entire plan.

Umpqua National Forest, UNF-4: Reallocation of Matrix Lands to LSR

The Umpqua National Forest LRMP would be amended to change the designation of approximately 588 acres from the Matrix land allocation to the LSR land allocation in Sections 7, 18, and 19, T.32S., R.2W., W.M., Oregon; and Sections 13 and 24, T.32S., R.3W., W.M., Oregon. This change in land allocation is proposed to partially mitigate for the potential adverse impact of the Pacific Connector Pipeline Project on LSR 223 in the Umpqua National Forest. This proposed amendment would change future management direction for the lands reallocated from Matrix to LSR.

How would this proposed amendment change the LRMP?

This proposed amendment would reduce the Matrix land allocation on the Umpqua National Forest by 588 acres from 412,300 acres to 411,712 acres, or by approximately 0.14 percent. It would increase the total LSR land allocation on the Forest by 588 acres from 375,160 acres to 375,748 acres, or by approximately 0.16 percent. This proposed amendment would increase LSR 223 by 588 acres from 66,900 acres to 67,488 acres, or by approximately 0.9 percent.

What are the spatial and temporal boundaries of effects?

This proposed amendment would affect 588 acres, or 0.06 percent, of the Umpqua National Forest for the life of the current planning cycle.

Does this proposed amendment affect multiple-use goals and objectives for long-term land and resource management?

This change would have only a minimal effect on the attainment of multiple-use goals and objectives for long-term land and resource management because:

- An extensive mitigation plan has been developed by the Forest Service and adopted by the applicant to ensure that the goals and objectives of the LRMP related to late-successional forest habitat would be achieved. Mitigation measures include:
  - Creation of snags on 175 acres of LSRs that are below desired snag densities for LSRs.
  - Placing LWD on 165 upland acres in units that are currently below desired levels for LWD.
  - Closing and decommissioning 7.6 miles of roads in LSRs to reduce fragmentation and develop interior stand habitat over time.
  - Thinning approximately 2,080 acres of overstocked stands and underburning approximately 1,128 acres in LSR to reduce fire risk and accelerate development of LSR characteristics.
- Approximately 23 acres of LSOG would be removed from the LSR 223 allocation by the construction of the Pacific Connector pipeline; approximately 431 acres of LSOG would be added back to the LSR 223 in the land allocation change, increasing the amount of LSOG in the LSR. Also within the 588 acres being reallocated to LSR 223, there are approximately 157 acres of younger forest (less than 80 years old) that would develop into late successional forest over time, further increasing the amount of LSOG in the LSR. Additionally, several elements of the mitigation plan would accelerate the development of late-successional stand characteristics on several hundred acres within the LSR where the potential loss of habitat would occur.

Is this proposed amendment a minor change in standards and guidelines?

This proposed amendment is a change in land allocation. Lands that are transferred from the Matrix land allocation to LSR would be managed under the LSR standards and guidelines in the future. This means that they would be managed for late successional and old-growth habitat conditions instead of multiple-use objectives associated with Matrix lands. This is a minor change in standards and guidelines because it affects 588 acres or 0.06 percent of the 983,129 Umpqua National Forest. This proposed amendment would reduce the Matrix land allocation on the Umpqua National Forest by 588 acres from 412,300 acres to 411,712 acres, or by approximately 0.14 percent. It would increase the total LSR land allocation on the Forest by 588 acres from 375,160 acres to 375,748 acres, or by approximately 0.16 percent.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

Moving 588 acres from the Matrix to the LSR would only minimally affect attainment of the long-term balance of goods and services for the Forest because:

- The Pacific Connector Pipeline Project would not affect outputs from the LRMP because it would not affect any existing or planned project. If it would not stop or affect any

management activity designed to benefit the LSR or meet other management objectives, it is not likely that it would affect the multiple-use balance of the LRMP.

- Probable sale quantity would not be affected before the Umpqua LRMP is revised because the Forest has the capacity to maintain probable sale quantity without the acres of Matrix lands that would be reallocated to LSR. If a linear relationship between acres and outputs is assumed, the potential effect would be less than two-tenths of one percent of the Forest's probable sale quantity since this proposed amendment would affect less than two-tenths of one percent of the Forest's Matrix land base. This proposed amendment would not prevent future vegetation management activities such as thinning that would benefit LSR and that would also contribute to the local forest products industry. As a practical matter, it is highly unlikely that the LSOG forest that is in Matrix lands reallocated to LSR would be harvested even if it remained in the Matrix land base because Recovery Action 32 for NSOs strives to maintain existing LSOG forests.
- Other larger changes in land allocation have been found to be non-significant amendments of the Umpqua LRMP.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large part of the Umpqua National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LMP area nor would it affect land and resources throughout a large part of the planning area because:

- Reducing the Matrix land allocation of 412,300 acres by 588 acres would affect only about 0.14 percent of the Matrix land base.
- The Pacific Connector Pipeline Project would affect a very small part of the Umpqua National Forest. The proposed reallocation of land would affect 588 acres or 0.06 percent of the 983,129-acre Umpqua National Forest. By its own evidence, this proposed amendment affects a very small area compared to the overall area of the Umpqua National Forest.

Proposed LRMP Amendments Applicable to the Winema National Forest

Five proposed site-specific amendments would apply only to the Winema National Forest LRMP. As directed by 36 CFR 219.15 and FSM 1926, the decision maker evaluated the proposed Pacific Connector pipeline for consistency with the LRMP (Shimamoto 2009). That evaluation is the basis for describing the proposed amendments to the Winema National Forest LRMP needed to make provision for the Pacific Connector Pipeline Project. This section describes how the proposed amendments would affect the delivery of goods and services and components of the Winema National Forest LRMP using the criteria in FSM 1926. These criteria are expressed as questions for each of the proposed LRMP amendments. The deciding official for the Forest Service will use this information to determine the significance of these proposed amendments as they relate to the Winema National Forest LRMP.

Winema National Forest, WNF-1: Site-Specific Amendment to Allow Utility Corridors in Management Area 3

The Winema National Forest LRMP would be amended to change the standards and guidelines for Management Area 3 (LRMP page 4-103 and 4-104, Lands)

to allow the Pacific Connector pipeline corridor in Management Area 3 from the Forest Boundary in Section 32, T.37S., R.5E., W.M., Oregon, to the Clover Creek Road corridor in Section 4, T.38S, R.5E., W.M., Oregon. Standards and guidelines for Management Area 3 state that the area is currently an avoidance area for new utility corridors. This proposed new utility corridor is approximately 1.5 miles long and occupies approximately 17 acres.

How would this proposed amendment change the LRMP?

This proposed amendment would allow creation of a pipeline corridor from the Forest boundary to the point where the Pacific Connector pipeline would join the Clover Creek Road.

What are the spatial and temporal boundaries of effects?

This proposed amendment would allow an approximately 1.5-mile-long pipeline corridor in Management Area 3; the pipeline corridor would affect approximately 17 acres of the Management Area. As the corridor becomes revegetated over time, the affected area would decrease to approximately 4 acres. The pipeline corridor would be seen only at the crossing with the Dead Indian Memorial Highway and where the corridor joins the Clover Creek Road. The visual impact at the Dead Indian Memorial Highway crossing is discussed in a separate section below. This would be a long-term effect because the 4 acres would be maintained in a low vegetation state for the life of the project.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would have only a minimal effect on the attainment of multiple-use goals and objectives for long-term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan that includes mitigation measures to minimize the visual impacts of the Pacific Connector Pipeline Project and meet long-term goals and objectives for visual quality.
- Over time, the visual standards for the area would be achieved.

Is this proposed amendment a minor change in standards and guidelines?

This change in management area direction and standards and guidelines would be relatively minor in the context of the LRMP because:

- The proposed amendment is site-specific and only applies to the Pacific Connector Pipeline Project.
- There are 119,000 acres of Management Area 3 on the Forest. The Pacific Connector Pipeline Project corridor would affect 17 acres, or about 0.01 percent of the management area.
- The proposed amendment would allow an impact that extends the seen pipeline corridor adjacent to the Clover Creek road to north-bound travelers for approximately 10 to 15 seconds.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

The proposed amendment would not alter the long-term relationship between levels of multiple-use goods and services because:

- This proposal is a project-specific amendment that would affect a limited area of MA-3. It would not change future management of any other resource or alter levels of outputs between any other goods and services; long-term relationships between multiple-use goods and services would therefore not be affected.
- No other LRMP outputs of goods and services have been identified that would be affected by this proposed amendment.
- Over time, a visual standard of partial retention would be achieved.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Winema National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LRMP area nor would it affect land and resources throughout a large part of the planning area because:

- Changes resulting from this proposed amendment are project-specific and would affect only visual standards and related experiences at the location where the Pacific Connector Pipeline Project corridor is visible along the Clover Creek Road.
- This proposed amendment would affect 17 acres or about 0.002 percent of the 1.04 million–acre Winema National Forest.

Winema National Forest, WNF-2: Site-Specific Amendment of VQO on the Dead Indian Memorial Highway

The Winema National Forest LRMP would be amended to allow 10 to 15 years to achieve the VQO of Foreground Retention where the Pacific Connector right-of-way crosses the Dead Indian Memorial Highway at approximately MP 168.8 in Section 33, T.37S., R.5E., W. M., Oregon. Standards and guidelines for Scenic Management, Foreground Retention (LRMP 4-104, Management Area 3A, Foreground Retention) requires that visual standards for a given location be achieved within 1 year of completion of a project. The Forest Service proposes to allow 10 to 15 years to meet the specified visual standards at this location.

How would this proposed amendment change the LRMP?

This proposed amendment would change the timeframe for which Foreground Retention would be achieved after construction of the Pacific Connector Pipeline Project is completed from one year to 10 to 15 years.

What are the spatial and temporal boundaries of effects?

This proposed amendment would initially affect about 3 acres of Management Area 3A. Over a period of 10 to 15 years, the affected area would decrease to about 0.25 acre.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would have only a minimal effect on the attainment of multiple-use goals and objectives for long-term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan to ensure that long-term goals and objectives would be attained. This mitigation plan includes mitigation measures to minimize the visual impact of the Pacific Connector Pipeline Project and meet long-term goals and objectives.
- Over time, the visual standard for the area would be achieved.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- There are 27,315 acres of Management Area 3A on the Forest. Allowing the Pacific Connector Pipeline Project crossing at the Dead Indian Memorial Highway would create an impact that is visible for about 13 seconds. Less than 3 acres would be affected, which is much less than 1 percent of Management Area 3A. This is also a very small portion of the Forest.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

The proposed amendment would not alter the long-term relationship between levels of multiple-use goods and services because:

- This proposal is a project-specific amendment that would affect only visual standards in a limited area. It would not change future management of any other resource or alter levels of outputs between any other goods and services. Long-term relationships between multiple-use goods and services would therefore not be affected.
- No other Forest outputs of goods and services have been identified that would be affected by this proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Winema National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire land management plan nor would it affect land and resources throughout a large part of the planning area because:

- Changes resulting from this proposed amendment would be project-specific and would affect only visual standards and related experiences at the location where the Pacific Connector Pipeline Project is visible where it crosses the Dead Indian Memorial Highway.
- The Pacific Connector Pipeline Project would affect a very small part of the Winema National Forest. The construction right-of-way where most impacts would occur would occupy approximately 90 acres of the 1.04 million–acre Winema National Forest, which is a tiny fraction of the Forest.

Winema National Forest, WNF-3: Site-Specific Amendment of VQO Adjacent to the Clover Creek Road for Management Area 3B

The Winema National Forest LRMP would be amended to allow 10 to 15 years to meet the VQO for Scenic Management, Foreground Partial Retention, where the Pacific Connector right-of-way would be adjacent to Clover Creek Road from approximately MP 170 to 175 in Sections 2, 3, 4, 11, and 12, T.38S., R.5E., W.M., Oregon, and Sections 7 and 18, T.38S., R.6E., W.M., Oregon. This change would potentially affect approximately 50 acres. Standards and guidelines for Foreground Partial Retention (LRMP, page 4-107, Management Area 3B) require that VQOs be met within 3 years of completion of a project.

How does this proposed amendment change the LRMP?

This proposed amendment would change the timeframe for which Foreground Partial Retention would be achieved after construction of the Pacific Connector Pipeline Project is completed from one year to 10 to 15 years.

What are the spatial and temporal boundaries of effects?

This proposed amendment would initially affect about 50 acres of Management Area 3B. Over a period of 10 to 15 years, the affected area would decrease to about 29 acres.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would only minimally alter multiple-use goals and objectives for long for term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan to ensure that long-term goals and objectives would be attained. This mitigation plan includes measures to minimize the visual impact of the Pacific Connector Pipeline Project along Clover Creek Road and meet long-term goals and objectives.
- Over time, the visual quality standards for the area would be achieved.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- They would be project-specific for the Pacific Connector Pipeline Project. There are 15,703 acres of Management Area 3B on the Forest. Allowing the Pacific Connector Pipeline Project to parallel Clover Creek Road would affect visual integrity for approximately 6 miles and would affect about 50 acres of this management area. The effect would be relatively short term (10 to 15 years) and would affect less than 1 percent of Management Area 3.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

The proposed amendment would not alter the long-term relationship between levels of multiple-use goods and services because:

- This proposal would be a project-specific amendment that would affect only visual standards in a limited area. It would not change future management of any other resource or alter levels of outputs between any other goods and services. Long-term relationships between multiple-use goods and services would there not be affected.
- No other Forest outputs of goods and services have been identified that would be affected by this proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Winema National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LMP area, nor would it affect land and resources throughout a large part of the planning area because:

- Changes resulting from this proposed amendment are project-specific and would affect only visual standards and related experiences at the location where the Pacific Connector Pipeline Project is visible adjacent to the Clover Creek Road.
- The Pacific Connector Pipeline Project would affect only a very small part of the Winema National Forest. The construction right-of-way where most impacts would occur occupies approximately 50 acres of the 1.04 million–acre Winema National Forest, which is a tiny fraction of the Forest.

Winema National Forest, WNF-4: Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas

The Winema National Forest LRMP would be amended to waive restrictions on detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in all affected management areas. Standards and guidelines for detrimental soil impacts in all affected management areas require that no more than 20 percent of the activity area be detrimentally compacted, puddled, or displaced upon completion of a project (LRMP page 4-73, 12-5).

How does this proposed amendment change the LRMP?

This proposed amendment would exempt the Pacific Connector Pipeline Project from the restriction on the proportion of an activity area that may have detrimental soil conditions. Under this proposed amendment, more than 20 percent of the activity area for the Pacific Connector Pipeline Project could have a detrimental soil condition when the project is completed. The detrimental soil condition would primarily result from displacement associated with trenching.

What are the spatial and temporal boundaries of effects?

For planning purposes, soil impacts are considered long term. Soil displacement would be confined to the project area, but it would be speculative to predict how much soil would be affected. If it is assumed that 30 to 70 percent of the project area would remain in a detrimental condition after mitigation and rehabilitation, about 24 to 56 acres spread over about 6 miles of right-of-way, or about 4 to 9 acres per mile, would be affected.

Does this proposed amendment affect multiple-use goals and objectives for long-term land and resource management?

This change would not significantly alter multiple-use goals and objectives for long-term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan to ensure that long-term goals and objectives would be attained. Pacific Connector's ECRP includes substantial mitigation measures to reduce soil impacts and restore productivity.
- This proposal is a project-level amendment that applies only to the Pacific Connector Pipeline Project and would not change future management.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- This proposal would be a project-level amendment that would affect only the Pacific Connector Pipeline Project. It would not change any future management direction, and impacts would be restricted to the project area.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

It would not change the long-term relationship between levels of multiple-use goods and services because:

- It would affect only the project area. No other projects would be affected, and no long-term change in management would occur.
- No changes in Forest outputs would occur as a result of this proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Winema National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LMP area nor would it affect land and resources throughout a large part of the planning area because:

- The project area would affect only a very small part of the Winema National Forest. The construction right-of-way where most impacts would occur occupies approximately 92 acres (this includes the construction corridor, TEWAs, and UCSAs) of the 1.04 million–acre Winema National Forest, which is a tiny fraction of the Forest. If detrimental soil

conditions were to affect 30 to 70 percent of the project area, only about 24 to 56 acres, or about 6 to 9 acres per mile of right-of-way, would be in a detrimental condition.

Winema National Forest, WNF-5: Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within Riparian Areas (Management Area 8)

The Winema National Forest LRMP would be amended to waive restrictions on detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in Management Area 8, Riparian Area (Management Area 8). This change would potentially affect approximately 0.5 mile or an estimated 9.6 acres of Management Area 8. Standards and guidelines for Soil and Water, Management Area 8 require that not more than 10 percent of the total riparian zone in an activity area be in a detrimental soil condition upon the completion of a project (LRMP page 4-137, 2).

How would this proposed amendment change the LRMP?

This proposed amendment would allow the Pacific Connector Pipeline Project to exceed restrictions on detrimental soil impacts in Management Area 8.

What are the spatial and temporal boundaries of effects?

The Pacific Connector Pipeline Project potentially would affect approximately 0.5 mile of the Management Area 8 Riparian Area, totaling an estimated 9.6 acres. For planning purposes, soil impacts are considered long term. Assuming that 30 to 70 percent of the area would remain in a detrimental condition after mitigation and rehabilitation, approximately 3 to 6 acres would potentially be affected.

Does this proposed amendment affect multiple use goals and objectives for long-term land and resource management?

This change would not significantly alter multiple-use goals and objectives for long-term land and resource management because:

- The Forest Service has proposed and the applicant has adopted an extensive mitigation plan to ensure that long-term goals and objectives would be attained. The ECRP has substantial mitigation measures to reduce soil impacts and restore productivity.
- This is a project-level amendment that applies only to the Project and would not change future management.

Is this proposed amendment a minor change in standards and guidelines?

Changes in standards and guidelines associated with this proposed amendment would be minor because:

- This would be a project-level amendment that would affect only the Pacific Connector Pipeline Project. It would not change any future management direction, and impacts would be restricted to the project area.

Does this proposed amendment affect the long-term relationship between levels of goods and services provided by the LRMP?

This proposed amendment would not change the long-term relationship between levels of multiple-use goods and services because:

- This proposed amendment would affect only the project area. No other projects would be affected and no long-term change in management would occur.
- No changes in Forest outputs occur as a result of this proposed amendment.

Does this proposed amendment have an important effect on the entire land management plan or affect land and resources throughout a large portion of the Winema National Forest during the planning period?

The proposed amendment would neither have an important effect on the entire LRMP area nor affect land and resources throughout a large part of the planning area because:

- The project area would affect only a very small part of the Winema National Forest. The construction right-of-way where most impacts would occur occupies approximately 92 acres (this includes the construction corridor, TEWAs, and UCSAs) of the 1.04 million–acre Winema National Forest, which is a tiny fraction of the forest. The proposed amendment would affect less than 10 acres of the Forest.

4.1.3.5 Resource Values and Conditions on Federal Lands: ACS

This section provides information for BLM and Forest Service decision makers to evaluate whether the proposed Pacific Connector Pipeline Project retards or prevents attainment of the objectives of the ACS of the NWFP. This section summarizes EIS appendix J, Aquatic Conservation Strategy Technical Report, which contains the full text of the analysis. Section numbers that refer to sections in appendix J are so noted. Content of this section reflects interagency direction for demonstrating compliance with the ACS (Goodman et al. 2007).

The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on BLM and NFS lands in the area of the NWFP (Forest Service and BLM 1994a, 1994b). The ACS established watershed assessment requirements, management objectives, and Riparian Reserves and Key Watersheds as land allocations on BLM and NFS lands. Standards and guidelines for management and protection of aquatic resources on BLM and NFS lands were also developed as part of the NWFP to ensure that the objectives of the ACS are achieved. BLM and Forest Service line officers must determine whether activities that occur on BLM or NFS lands retard or prevent attainment of the ACS objectives established under the NWFP.

Private lands dominate the landscape in many of the watersheds that would be crossed by the project. The ACS applies only to lands managed by the BLM and the Forest Service within the area covered by the NWFP. On private lands, compliance with the CWA is the best evidence of protection of aquatic values. Issuance of permits for the Pacific Connector Pipeline Project under Section 401 of the CWA from the ODEQ and Section 404 of the CWA from the COE demonstrate compliance with the CWA. Pacific Connector's application to FERC will include the necessary information for the ODEQ and COE permits. The BLM and Forest Service require that the applicant secure those permits prior to making any findings related to the ACS. Section 4.4 of this EIS describes watershed impacts of the Pacific Connector Pipeline Project on private lands.

Summary of Environmental Consequences Related to the ACS

The Pacific Connector pipeline would traverse approximately 40 miles of BLM lands and 31 miles of NFS lands on its 232-mile route from Malin to Coos Bay, Oregon. The pipeline project would cross portions of 19 fifth-field watersheds, 16 of which include BLM or NFS lands where the ACS applies. Tables 4.1.3.5-1a and 4.1.3.5-1b summarize (1) the number and acreage of Riparian Reserves of perennial and intermittent streams and forested wetlands that would be crossed by the pipeline on BLM or NFS lands, and (2) the number and acreage of Riparian Reserves that would be "clipped" where a portion of the Riparian Reserve is impacted without the pipeline trench crossing a waterbody or wetland. In 12 of the 16 watersheds traversed by the pipeline on federal lands, the pipeline project would cross perennial or intermittent streams or clip areas designated as Riparian Reserves; in 4 of the watersheds crossed, the pipeline project would not intersect with Riparian Reserves or stream crossings.

The Pacific Connector pipeline route would follow ridgelines and existing rights-of-way, such as powerlines and roads, wherever possible. This analysis shows that impacts on BLM and NFS Riparian Reserves and aquatic habitats would be temporary or minor in scale in any given fifth-field watershed or sixth-field subwatershed. Possible impacts would be sediment transport to waterbodies where construction at stream crossings causes surface erosion, disturbance of banks and stream bottoms, possible increases in water temperature from removal of effective shade and removal of vegetation at stream crossings. Use of roads, including standards for reconstruction, would be subject to applicable ACS standards and guidelines. In order to minimize potential adverse impacts on fish, timing of instream work would be tied to work windows established by the ODFW. These time periods were established to avoid the vulnerable life stages of potentially affected fish species, including migration, spawning, and rearing.

TABLE 4.1.3.5-1a

Summary of Riparian Reserves, Stream Channels, and Wetlands Crossed by the Pacific Connector Pipeline Project on BLM and NFS Lands by Administrative Unit

	Perennial Streams Crossed a/		Intermittent Streams Crossed		Wetlands Crossed b/		Total Stream Channels or Wetlands Crossed		Riparian Reserves Clipped without Stream or Wetland Crossings c/		Total d/	
Agency	**Stream Channels Crossed e/**	**Riparian Reserves Cleared (Acres)**	**Stream Channels Crossed**	**Riparian Reserves Cleared (Acres)**	**Wetlands Crossed**	**Riparian Reserves Cleared (Acres)**	**Total Crossed**	**Total Riparian Reserves Cleared (Acres)**	**Riparian Reserves Clipped**	**Total Riparian Reserves (Acres)**	**Affected Riparian Reserves**	**Cleared (Acres)**
BLM Coos Bay District	3	8.4	10	9.2	3	0.5	16	18.1	4	22.0	20	40.1
BLM Roseburg District	1	4.1	2	3.9	2	0.3	5	8.31	2	11.4	7	19.7
BLM Medford District	3	7.7	13	17.3	1	1.2	17	29.2	4	7.2	21	36.4
BLM Lakeview District	0	0.0	1	1.32	0	0.0	1	1.3	0	0.0	1	1.3
Total BLM	**7**	**20.2**	**26**	**31.**	**6**	**2.0**	**39**	**53.9**	**10**	**40.1**	**49**	**94.0**
Umpqua National Forest	4	7.3	3	6.3	1	2.0	8	15.6	3	1.4	11	17.0
Rogue River National Forest	1	2.5	1	1.6	0	0.0	2	4.1	2	0.6	4	4.7
Winema National Forest	0	0.0	2	3.3	2	2.5	4	5.8	4	2.6	8	8.3
Total Forest Service	**5**	**9.7**	**6**	**11.2**	**3**	**4.5**	**19**	**25.4**	**9**	**4.6**	**28**	**30.0**
Total BLM and Forest Service	**12**	**29.9**	**32**	**42.9**	**9**	**6.5**	**53**	**79.3**	**19**	**45.3**	**72**	**124.7**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest tenth of an acre (values below 0.1 are shown as "<0.1").

Data Source: Resource Report 3, table 2A-3A and BLM and Forest Service Riparian Reserve Assessment, database.

a/ "Crossed" means that the pipeline trench crosses the stream channel or delineated wetland area.

b/ "Wetlands" refers to delineated wetland areas that are not already counted as streams. Where the Riparian Reserve of a wetland is fully encompassed in the adjacent Riparian Reserve of a stream channel, the acres are counted as part of the stream channel to avoid double counting and are shown as 0 in this table.

c/ "Clipped" means that the Riparian Reserve associated with a stream channel or wetland was cleared as part of the construction corridor or TEWA, but the pipeline trench did not cross the stream channel or delineated wetland area.

d/ This table includes only areas where vegetation is cleared in the construction corridor and temporary extra work areas (TEWAs). An additional 11.05 acres of Riparian Reserves are used as Uncleared Storage Areas (UCSAs) where habitat may be modified but vegetation is not removed.

e/ Irrigation ditches or other man-made water conveyances are crossed by the project, but they do not create Riparian Reserves and are not subject to the requirements of the NWFP.

TABLE 4.1.3.5-1b

Vegetation Age Class Structure of Riparian Reserves Cleared in Construction Corridor and TEWAs by Administrative Unit, BLM and Forest Service

		LSOG (>80 Years) Forest Cleared (Acres)				Mid-Seral (40-80 Years) Cleared (Acres)				Early Seral (0-40 Years) Cleared (Acres)						
Administrative Unit	**Waterbody Type**	**Conifer Forest**	**Hardwood Forest**	**Mixed Conifer and Hardwood Forest**	**Total LSOG Cleared**	**Conifer Forest**	**Hardwood Forest**	**Mixed Conifer and Hard-wood Forest**	**Total Mid-Seral Cleared**	**Conifer Forest**	**Shrub or Brush-field**	**Grasslands and non-forest**	**Total Early Seral Cleared**	**Total All Vegetation Classes (Acres)**	**Stream Channel or Wetland Area within Corridor (Acres)**	**Total within Cleared Area (Acres)**
BLM Coos Bay	Perennial Stream	2		<1	2			2	2	5	<1			6	10	<1
	Intermittent Stream	2		<1	3	9		<1	9	4	3			7	19	<1
	Wetland			<1	<1	3	<1	<1	4	<1	<1			<1	5	<1
	Total	**5**		**1**	**6**	**12**	**<1**	**2**	**15**	**10**	**4**			**14**	**35**	**<1**
BLM Roseburg	Perennial Stream					4			4	2				2	7	<1
	Intermittent Stream	2		1	3			<1	<1	<1			<1	<1	5	<1
	Wetland	<1			<1	4			4				<1	<1	4	<1
	Total	**3**		**1**	**4**	**9**		**<1**	**9**	**2**			**<1**	**3**	**16**	**<1**
BLM Medford	Perennial Stream	2	<1	2	5		<1	1	1			<1	<1	<1	7	<1
	Intermittent Stream	2	5	3	9			1	1			6	2	8	18	<1
	Wetland					1	<1		1		<1			<1	1	
	Total	**3**	**6**	**5**	**14**	**1**	**<1**	**2**	**4**		**<1**	**6**	**2**	**8**	**26**	**<1**
BLM Lakeview	Intermittent Stream			1	1								<1	<1	1	<1
Total BLM	Perennial Stream	4	<1	2	7	4	<1	3	7	7	<1	<1	<1	9	23	<1
	Intermittent Stream	6	5	6	17	9		2	11	5	3	6	2	15	43	<1
	Wetland	<1		<1	<1	9	<1	<1	9	<1	<1		<1	1	11	<1
	Total	**10**	**6**	**9**	**25**	**22**	**<1**	**5**	**27**	**13**	**4**	**6**	**3**	**26**	**78**	**1**
Umpqua NF	Perennial Stream	3			3	<1			<1	3				3	7	<1
	Intermittent Stream					3			3	<1				<1	4	<1
	Wetland					2			2						2	
	Total	**3**			**3**	**5**			**5**	**3**				**3**	**12**	**<1**

TABLE 4.1.3.5-1b

Vegetation Age Class Structure of Riparian Reserves Cleared in Construction Corridor and TEWAs by Administrative Unit, BLM and Forest Service

Administrative Unit	Waterbody Type	LSOG (>80 Years) Forest Cleared (Acres)				Mid-Seral (40-80 Years) Cleared (Acres)				Early Seral (0-40 Years) Cleared (Acres)				Total All Vegetation Classes (Acres)	Stream Channel or Wetland Area within Corridor (Acres)	Total within Cleared Area (Acres)
		Conifer Forest	Hardwood Forest	Mixed Conifer and Hardwood Forest	Total LSOG Cleared	Conifer Forest	Hardwood Forest	Mixed Conifer and Hard-wood Forest	Total Mid-Seral Cleared	Conifer Forest	Shrub or Brush-field	Grasslands and non-forest	Total Early Seral Cleared			
Rogue River NF	Perennial Stream	1			1					1				1	2	<1
	Intermittent Stream					<1			<1	<1			<1	<1	1	<1
	Wetland	<1			<1					<1				<1	<1	
	Total	**1**			**1**	**<1**			**<1**	**2**			**<1**	**2**	**4**	**<1**
Winema NF	Perennial Stream															
	Intermittent Stream	2			2					2				2	4	<1
	Wetland	<1			<1	<1	<1		<1	1			<1	1	3	<1
	Total	**3**			**3**	**<1**	**<1**		**<1**	**3**			**<1**	**3**	**7**	**<1**
Total Forest Service	Perennial Stream	4			4	<1			<1	4				4	9	<1
	Intermittent Stream	2			2	3			3	3			<1	3	9	<1
	Wetland	1			1	2	<1		2.4	1			<1	2	5	<1
	Total	**7**			**7**	**6**	**<1**		**6**	**9**			**<1**	**9**	**23**	**<1**
Total BLM and Forest Service	Perennial Stream	8	<1	2	11	5	<1	3	8	11	<1	<1	<1	13	32	<1
	Intermittent Stream	9	5	6	19	12		2	14	8	3	6	3	19	52	<1
	Wetland	1		<1	2	11	<1	<1	11	2	<1		<1	3	16	<1
	Total	**18**	**6**	**9**	**32**	**28**	**<1**	**5**	**34**	**21**	**4**	**6**	**3**	**34**	**100**	**2**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

Sediment

Corridor construction and stream crossings may create conditions where accelerated soil erosion and sediment transport to streams could occur in the absence of active and aggressive erosion control measures and rapid successful revegetation.

There are three project phases when sediment could be created:

1. **Corridor clearing and construction.** The ECRP for the project describes the erosion control measures that would be implemented during corridor clearing to minimize transport of sediment to adjacent and nearby aquatic habitats. The FERC EI, in cooperation with agency representatives of the BLM and Forest Service, would determine appropriate temporary measures to be used to minimize potential erosion and sediment impacts during and after timber clearing operations. These are proven erosion control techniques. As a result of application of the measures in the ECRP, soil erosion and sediment transport during corridor clearing and construction is expected to be minor and within the range of natural variability of the watersheds where the action occurs. These measures include:
    - Leaving slash generated during timber clearing operations on the corridor to reduce erosion over the following winter. This minimizes raindrop impacts and overland flow.
    - Scarifying compacted surfaces, where appropriate, to promote infiltration and reduce runoff;
    - Use of additional slash/brush piles and coarse woody debris (limbs to large logs) at appropriate locations to minimize offsite runoff and sedimentation. Coarse woody debris placed on contour has been shown to be an effective hillslope measure to reduce erosion (Robichaud et al. 2000).
    - Installation of slope breakers (water bars) at appropriate locations and spacings to shorten slope lengths, prevent concentrated flow, and divert runoff to stabilized areas. Waterbars are a proven and effective method of reducing the erosive energy of overland flow, diverting overland flow and minimizing sediment transport;
    - Installation of silt fences and straw bale sediment barriers to prevent transport of sediment to aquatic habitats. Pacific Connector has committed to install and maintain erosion control structures including silt fences at stream crossings until effective ground cover is reestablished. Silt fences are 90 to 95 percent efficient at trapping sediment (Robichaud et al. 2000).
    - Temporary seeding (using appropriate quick-germinating cover crops such as annual ryegrass or other appropriate cover species), where not precluded by federal restrictions on introduced species; and/or
    - Mulching of corridor areas that do not have sufficient cover. Geotextile fabric erosion control blankets may also be used to provide temporary ground cover. Mulching reduces raindrop impacts, and when in contact with the ground, limits overland flow and sediment transport.
2. **Stream channel crossing.** During stream crossings, Pacific Connector will primarily use dam-and-pump construction methods on flowing streams to isolate the crossing construction site from the flowing stream on both the upstream and downstream sides of the crossing. In some cases, the flume method may also be used. The BLM and Forest

Service have used the dam-and-pump method to install culverts in flowing streams. A literature review of pipeline stream crossing studies showed the dam-and-pump method to be effective at controlling sediment. During construction, the crossing site is isolated from the stream by dams, and water is pumped around the site to maintain downstream flows. When dams and pumps are removed and the stream is allowed to flow across the crossing site, there may be a short-term (typically a few hours) pulse of sediment that will vary by substrate type. When compared to sediment mobilized by natural disturbance events such as fires and high-intensity precipitation, the sediment created is expected minor, short-term and well within the range of natural variation and comparable in scale to a minor bank slough. The flume method is also effective at controlling sediments as discusses in section 4.6.2.3 of this EIS.

Pacific Connector conducted an extensive engineering analysis of stream crossings that included substrate type, channel morphology and other variables (GeoEngineers 2013c; 2013d). The findings of this analysis were consistent with the findings noted above and in appendix J. In this EIS, see also section 4.6.2.3, Sedimentation and Turbidity Resulting from Pipeline Installation Across Inland Freshwater Streams and Impacts on Aquatic Resources.

3. **Post-construction.** The analysis discloses that in the first year or two following construction, a minor pulse of sediment could be observed following the first seasonal rain, but this sediment-laden water is likely to dissipate within a few hundred feet and would be indistinguishable from background levels. With the exceptions noted below at MP 119.7, 125.59 and 131.7, this is expected to be a very minor amount of sediment because of the requirements in the ECRP to establish and maintain erosion control structures, sediment barriers, effective ground cover and accomplish rapid revegetation. Pacific Connector has committed to maintain silt barriers until effective ground cover is reestablished. Silt fences are 90 to 95 percent efficient at trapping sediment (Robichaud et al. 2000). As a result of these measures, the Project corridor is not expected to become a chronic source of fine sediments. For areas with reclamation sensitivity (see section 4.3.4 of this EIS) the Forest Service and BLM will also require soil remediation with biosolids or other appropriate organic materials to ensure successful revegetation. Except as noted at MP 119.7, 126.59 and 131.7, the analysis discloses that with the application of measures in the ECRP and effective soil remediation, projected impacts from sediment would be short term, minor, and within the range of natural variability for the watersheds crossed by the Project (appendix J, section 1.3.1.2; see also section 4.3.4 and section 4.6.2.3, Sedimentation and Turbidity Resulting from Pipeline Installation Across Inland Freshwater Streams and Impacts on Aquatic Resources.)

   At MPs 119.7 (Trail Creek Watershed), 126.59 (Shady Cove - Rogue River Watershed), and 131.7 (Big Butte Creek Watershed), the Project, if constructed, would likely become a chronic source of sediment that may retard attainment of ACS objectives at those locations. At MPs 119.7 and 131.7, the filed alignment lies entirely within the Riparian Reserve, and is closely adjacent and parallel to intermittent stream channels. Clearing limits at these locations would remove most riparian vegetation adjacent to the affected stream channel leaving little or no undisturbed area adjacent to the channel. At MP 126.59, the filed alignment crosses three intermittent stream channels in close proximity in an area that is sparsely vegetated and highly erosive once disturbed. In all three of these locations, soils

inventories and agency experience indicate that revegetation would be difficult once these areas are disturbed. As a result, these three locations would likely become chronic sources of sediment that may retard attainment of ACS objectives.

The BLM Medford District has requested the applicant reroute the alignment at these locations. Preliminary changes in alignment have been developed with the concurrence of the Medford District BLM that would address these issues. At MPs 119.7 and 131.7, a realignment proposal has been developed that would move the corridor out of the adjacent Riparian Reserve. At MP 126.59, an alignment modification has been developed that would eliminate a stream crossing and move the alignment into an area that can be revegetated. Once final engineering of modified alignments on these locations has been completed, the filed alignment will be modified to reflect these changes. This assessment would then be modified to reflect the new alignment.

If implementation or post-project monitoring show evidence as defined by the BLM or Forest Service of unacceptable surface erosion on an area of at least 100 square feet and at least 5 feet wide, or unacceptable sediment transport to aquatic systems, Pacific Connector would be required by the terms of the right-of-way grant to take additional erosion control measures as needed, as directed by the BLM or Forest Service, to reduce sediment transport to background levels. Evidence of "unacceptable" levels of sediment transport would include silt fences or other sediment barriers that are not maintained, lack of effective ground cover, visible turbidity at channel crossings, visible evidence of sheet or gulley erosion where sediment is transported to aquatic systems, or deposition downstream of crossings.

Streambed and Stream Bank Impacts

All stream crossings on BLM and NFS lands (whether intermittent or perennial, wet or dry) would have either: (1) a bridge; (2) a temporary culvert with temporary road fill to be removed after work is completed; or (3) a low water ford with a rock mat. If water is present in streambeds at the time of construction, Pacific Connector will utilize temporary construction bridges during all phases of construction to cross the waterbodies. Where feasible, Pacific Connector's contractors would attempt to lift, span, and set the bridges from the streambanks. Where it is not feasible to install or safely set the temporary bridges from the streambanks, only the equipment necessary to install the bridge or temporary support pier would cross the waterbody. Any equipment required to enter a waterbody to set a bridge would be inspected to ensure it is clean and free of dirt or hydrocarbons (Resource Report 2: 31). Agency representatives would also participate in pre-construction evaluation of crossing methods as necessary.

At stream crossings, the corridor width would be reduced from 95 feet to 75 feet where it is feasible to do so, and TEWAs would be set back at least 50 feet from the stream channel. The area of potential disturbance to stream banks and bottoms from equipment is generally less than 15 feet wide. Measures described above would minimize disturbance of streambanks and channel bottoms. The stream crossing for the pipeline would be accomplished by constructing a trench 4 to 6 feet wide and deep enough to avoid possible channel scouring. Typically, this would be at least 3 to 5 feet below the stream bottom. In some locations, steep streambanks would be "laid back" (excavated) to a 2:1 to 3:1 backslope ratio to stabilize the banks and minimize bank erosion from the stream. These crossings are identified in the individual watershed descriptions. After installation of the pipeline, the trench would be backfilled with material excavated from the trench and capped with gravel as needed. Boulders and

LWD removed from the corridor would be placed as needed within the stream crossing area and Riparian Reserve to reestablish or improve pre-crossing conditions. Streambanks would be revegetated with native species and "armored" as needed and specified by Agency representatives with LWD and boulders to ensure stability. Channel breakers or plugs would be installed on each side of the trench to ensure that subsurface flows are not captured by the pipeline trench. A site-specific crossing evaluation has been completed by Pacific Connector that specifies likely BMPs to be applied at each crossing (GeoEngineers 2013c). Prior to construction, a final evaluation, which would include Agency representatives, would be completed to determine crossing methods based on conditions at the time of construction. Site-specific restoration plans have been developed by the agencies for each of the eight perennial stream crossings that occur on BLM or NFS lands to ensure that the sites are restored to pre-crossing conditions.

Temperature

Vegetation clearing in the pipeline project corridor potentially affects stream temperature where removal of vegetation increases stream exposure to solar radiation. There are five perennial stream crossings on NFS lands and two on BLM lands where corridor construction potentially could remove shading vegetation. To evaluate whether corridor construction would increase water temperatures, a site-specific field evaluation of stream temperature impacts on the five perennial stream crossings on NFS lands was conducted (NSR 2015b). The evaluation showed that with mitigation measures, any temperature increases would be less than 0.2°C and limited to the point of maximum impact. No impacts were predicted at the stream network scale because of the small volume of affected streams, likely groundwater inputs, and the assimilative capacity of the stream network. On-the-ground conditions and water temperature model results suggest that it is unlikely the stream temperature downstream of any of the perennial crossings would be increased above the ODEQ Core Cold-Water Habitat temperature criteria of 16°C (61°F) (NSR 2009:41-42, Table 6.1.1). BLM personnel conducted a field review of perennial stream crossings on BLM lands and determined that increases in stream temperature were unlikely to occur as a result of construction (appendix J, section 1.3.1.3; see also individual watershed discussions in this section).

Pacific Connector used predictive modeling on a representative cross-section of crossings along the Pacific Connector route, spanning the ecoregions, Hydrologic Unit Codes (HUCs), width classes, and aspect classes present from Coos Bay to Malin, Oregon, including stream crossings on BLM and NFS lands. Model results show a maximum predicted increase of 0.16°C over one 75-foot clearing. Thermal recovery analysis shows that temperatures return to ambient within a maximum distance of 25 feet downstream of the pipeline corridor, based on removal of existing riparian vegetation over a cleared right-of-way width of 75 feet. These findings are consistent with NSR (2009). Pacific Connector also assessed the cumulative impact of right-of-way clearing on stream temperatures. Given that mitigation for loss of effective shade would occur, and that predictive modeling using the Stream Segment Temperature Model (SSTEMP) shows that the local impacts would be small in magnitude and spatially limited, the cumulative effects of the pipeline project on the thermal regime in the Coos, Coquille, South Umpqua, Rogue, Klamath, and Lost River Basins are expected to be exceptionally minor and well below detection in the field (GeoEngineers 2013d: 26).

Temporary Construction Corridor

The construction corridor would be 75 to 95 feet wide, excluding TEWAs and UCSAs. Clearing of the construction corridor would remove vegetation; with both short-term and long-term effects. In the short term, disturbed areas within the right-of-way would be revegetated after pipeline installation. Where mid or late-seral vegetation is removed this would result in a long-term change in vegetative condition. The analysis discloses that the scale of this impact would be minor in each single watershed and, given the fire and flood disturbance history of southwest Oregon, well within the range of natural variability for the watersheds crossed. Approximately 125 acres[16] (table 4.1.3.5-1a) or approximately 0.06 percent of an estimated 189,000 acres of Riparian Reserves on BLM and NFS lands in watersheds crossed by the Project (table 4.1.3.5-2a, later in this section) would cleared in the construction corridor, hydrostatic test sites or TEWAs. Approximately 11 acres of UCSAs would be located within Riparian Reserves (table 4.1.3.5-1a). Riparian habitat in these uncleared storage areas may be modified, but existing canopy would not be removed. On all BLM and NFS lands, approximately 32 acres of Riparian Reserves within the construction clearing are LSOG forest. Of these, approximately 18 acres are coniferous forests, 6 acres are deciduous hardwood forests, and 9 acres are mixed hardwood and coniferous forests. The remaining affected Riparian Reserves consist of early seral (34 acres), mid-seral (34 acres), or non-forest vegetation (2 acres) (table 4.3.1.5-1b). There would be seven crossings of perennial fish-bearing streams where a total of 8 acres of LSOG would be within the clearing limits of the pipeline project (appendix J of this EIS).

Permanent Pipeline Easement

Pacific Connector would retain a 50-foot-wide operational permanent easement for the entire length of its pipeline. Within this 50-foot easement, a 30-foot-wide corridor centered on the pipeline would be maintained in an herbaceous state, and trees would be removed within 15 feet from the pipeline centerline. However, the remainder of the permanent easement would be fully restored with native vegetation, according to Pacific Connector's ECRP, including trees in forested areas. No service road would be established or maintained within this inspection corridor. LWD and boulders would be placed as needed within the permanent easement to minimize surface erosion, provide wildlife habitat, and discourage OHV use.

Hydrostatic Testing

Hydrostatic testing is the process used to pressure test the pipeline with water to identify potential leaks. Pacific Connector has prepared a *Draft Hydrostatic Testing Plan* that incorporates requirements from the BLM and Forest Service for discharge of water used in testing, erosion control measures at discharge sites, and prevention of aquatic pathogen transmission (*Draft Hydrostatic Testing Plan*, Appendix M of Pacific Connector's POD). Key points of this plan relative to the ACS include:

- None of the water sources are federally controlled. All water sources are controlled by municipalities, local water districts, Reclamation, or the State of Oregon. Pacific

[16] Acres of affected Riparian Reserves are based on the 2013 filed alignment in the application. Minor realignments noted above and changes in final engineering are expected to reduce to reduce affected Riparian Reserve acres by about 8 to 10 percent.

Connector would secure permits for water sources from the jurisdiction that controls the source site.

- All of the discharge sites have been reviewed in the field and approved by the BLM and Forest Service.
- Erosion control measures at discharge sites have been designed to allow the discharged water to soak into the ground without causing sediment transport to stream channels.
- No water would be discharged to streams or other waterbodies on BLM or NFS lands. Water that has soaked into the round may, however, indirectly reach stream channels as subsurface flows.
- Waters known to include aquatic pathogens would not be used for hydrostatic testing.
- All water from non-domestic sources would be treated with chlorine to prevent the transmission of aquatic pathogens. Chlorinated water would be discharged according to the ODEQ's May 19, 1997, Memorandum for Chlorinated Water Discharges (ODEQ 1997).

Use and Maintenance of Roads

Approximately 330 miles of existing BLM or NFS roads would be used during construction of the pipeline. Post-project monitoring and maintenance would use a much smaller subset of these roads and is expected to be no more than light truck traffic. Pacific Connector prepared a TMP for federal lands as Appendix Y of its POD. Road use standards and guidelines (Forest Service) and management direction (BLM) applicable to the ACS have been incorporated into the TMP (appendix J, section 1.2.2). Any necessary reconstruction such as surfacing, culvert upgrades, running surface widening, or curve widening are also identified, with specifications, in the TMP. The pipeline project is consistent with requirements in BLM and Forest Service LMPs for use of roads.

Compliance with Standards and Guidelines

Standards and guidelines regulate or prohibit activities to ensure that objectives of land management plans would be achieved. Compliance with standards and guidelines for activities in Riparian Reserves is an important part of ensuring that the objectives of the ACS would be achieved. The preliminary analysis discloses that the Pacific Connector pipeline would be consistent with the requirements of the NWFP for activities in Riparian Reserves. As required by the Standard and Guideline for Lands, LH-4, requirements necessary to accomplish the objectives of the ACS would be incorporated into the Right-of-Way Grant if issued by the BLM.

These requirements include:

- seasonal restrictions on operations to the ODFW in-stream work window on all perennial streams;
- use of temporary bridges at stream crossings to prevent bank and bottom disturbance;
- use of dry dam-and-pump methods that isolate the stream from the crossing site to minimize sediment produced at perennial streams;
- installation of water bars as needed to divert water off of slopes;
- maintenance of effective ground cover according to agency standards until revegetation is completed;
- installation and maintenance of sediment barriers until permanent effective ground and revegetation is completed;

- monitoring after storm events to ensure that erosion control measures and sediment barriers are functioning;
- revegetation of Riparian Reserves and upland areas with native vegetation specified by the BLM and Forest Service;
- soil remediation that includes decompacting compacted soils and the use of biosolids or other organic supplements as needed to accelerate revegetation; and
- scattering LWD and slash in amounts specified by the BLM and Forest Service across the right of way to provide ground cover and maintain long-term site productivity.

Standard and Guideline WR-3 in the NWFP (Forest Service and BLM 1994b) stipulates that mitigation measures not be used as substitutes for preventing habitat degradation. Standard and Guideline WR-3 does not mean that mitigation measures cannot be used to offset otherwise unavoidable impacts of a project.[17] The BLM and Forest Service interpret WR-3 to mean that mitigation measures are not to be used as a substitute for appropriate design standards, to allow an inappropriate standard of environmental compliance, or to justify a project. Appropriate design measures and application of BMPs for water quality have been incorporated throughout the ECRP and other PODs. Mitigation measures are not being used as substitutes for preventing habitat degradation, to allow inappropriate environmental standards to be used, or to justify the project.

The Pacific Connector proposal would not be compliant with underlying and more restrictive standards and guidelines in the Umpqua, Rogue River, and Winema National Forests' LRMPs that apply to riparian areas. Although BMPs and appropriate design standards have been applied, these are otherwise unavoidable effects due to the limitations of routing and the linear nature of the pipeline project. These standards and guidelines are not specific to the ACS; however, the analysis must show that implementation of these amendments would not prevent attainment of ACS objectives. Site-specific amendments of these aquatic-related standards and guidelines are proposed to make provision for the Project:

- Rogue River National Forest, RRNF-5: Proposed site-specific amendment to allow utility transmission corridors in Management Strategy 26, Restricted Riparian Areas.
- Umpqua National Forest, UNF-1: Proposed site-specific amendment to allow removal of effective shade on perennial streams.
- Umpqua National Forest, UNF-2: Proposed site-specific amendment to allow utility corridors to parallel riparian areas.
- Winema National Forest, WNF-5: Proposed site-specific amendment to waive limitations on detrimental soil conditions within Riparian Areas (Management Area 8).

These amendments are discussed in the sections of this chapter that are applicable to the watershed where they occur.

Table 4.1.3.5-2a summarizes ownership and land allocations by agency for each of the watersheds where the Pacific Connector pipeline crosses federal lands. This provides the environmental baseline from which to measure how the pipeline project would affect lands within each of the listed land allocations by watershed.

[17] See CEQ Regulation 40 CFR 1508.14(f) which directs agencies to include appropriate mitigation measures, and 1502.16(h) which directs agencies to identify means to mitigate adverse environmental impacts.

TABLE 4.1.3.5-2a

BLM and Forest Service Land Allocations in Watersheds Crossed by the Pacific Connector Pipeline Project

		Land Ownership (acres)				Federal Land Allocation (acres)						
						LSR		Matrix		Riparian Reserves		
Watershed	**Watershed Total (acres)**	**BLM**	**NFS**	**Total BLM and NFS**	**Other**	**BLM**	**NFS**	**BLM**	**NFS**	**BLM**	**NFS**	**Total**
South Coast Basin												
Coos Bay Frontal	151,611	5,408	4,914	10,322	141,289	0	0	5,408	4,914	2,056	2,555	4,611
Coquille	111,644	2,737	0	2,737	108,907	0	0	2,737	0	1,094	0	1,094
NF Coquille River	98,407	36,854	0	36,854	61,553	16,268	0	20,585	0	19,275	0	19,275
EF Coquille River	85,963	45,540	0	45,540	40,424	24,066	0	21,474	0	25,097	0	25,097
MF Coquille River	197,314	59,286	1,545	60,831	136,483	16,386	0	42,901	0	23,715	618	24,333
South Coast Basin Total	**644,940**	**149,825**	**6,459**	**156,284**	**488,656**	**56,720**	**0**	**93,105**	**4,914**	**71,236**	**3,173**	**74,410**
South Umpqua River Sub-Basin												
Olalla - Lookingglass	103,212	27,373	0	27,373	75,839	12,642	0	14,731	0	8,755	0	8,755
Clark Branch S. Ump.	59,577	7,483	0	7,483	52,094	0	0	7,483	0	2,698	0	2,698
Myrtle Creek	76,250	31,111	133	31,244	45,006	0	0	31,111	133	12,748	54	12,803
Days Creek S. Ump.	141,569	57,997	2,807	60,804	80,765	24,193	2,417	33,804	390	21,852	142	21,994
Elk Creek S. Ump.	54,356	370	34,187	34,558	19,798	68	14,271	303	19,916	137	12,641	12,778
Upper Cow Creek	47,499	9,866	24,151	34,017	13,482	8,672	2,350	1,194	21,801	4,831	11,827	16,658
South Umpqua River Sub-Basin Total	**482,464**	**134,201**	**61,279**	**195,479**	**286,984**	**45,575**	**19,039**	**88,626**	**42,240**	**51,021**	**24,665**	**75,686**
Upper Rogue River Sub-Basin												
Trail Creek	35,338	14,701	4,353	19,055	16,283	3	0	14,699	4,353	3,232	957	4,189
Shady Cove Rogue River	74,268	22,439	0	22,439	51,828	5	0	22,434	0	6,941	0	6,941
Big Butte Creek	158,243	29,520	58,181	87,701	70,541	0	1,636	29,520	56,545	4,959	8,334	13,293
Little Butte Creek	238,879	54,843	59,900	114,743	124,135	0	52,813	54,843	7,088	5,155	5,631	10,786
Upper Rogue River Sub-Basin Total	**506,727**	**121,504**	**122,435**	**243,938**	**262,788**	**8**	**54,449**	**121,496**	**67,986**	**20,287**	**14,922**	**35,209**
Upper Klamath Sub-Basin												
Spencer Creek	**54,247**	**8,751**	**22,323**	**31,074**	**23,172**	**0**	**5,319**	**8,751**	**17,004**	**210**	**535**	**745**
Total All Watersheds												
Total All Watersheds	**1,688,377**	**414,281**	**212,495**	**626,775**	**1,061,600**	**102,303**	**78,807**	**311,978**	**132,144**	**142,754**	**43,295**	**186,050**

Note: Acres rounded to nearest whole acre. Rows/columns may not sum correctly.

Mitigation Measures

Off-site mitigation measures that are a part of the proposed action (see table 2.1.4.3-1) would help ensure that watershed function would be maintained or restored during construction and operation of the pipeline project as required by the ACS. These measures are considered in the section of this chapter that describes individual watershed conditions, and in detail in appendix J of this EIS.

Off-site mitigation actions that contribute to the objectives of the ACS include:

- Approximately 85.2 miles of road decommissioning, of which approximately 14 miles are in Riparian Reserves. Decommissioning roads can substantially reduce sediment delivery to streams (Madej 2000; Keppeler et al. 2007). Proposed road decommissioning would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the pipeline project occur. This mitigation is responsive to ACS objectives 2, 3, 4, and 5 and Standards and Guidelines for Key Watersheds (Forest Service and BLM 1994b).
- Approximately 60.9 miles of road resurfacing and drainage improvement. Road surfacing reduces sediment by capping existing fine textured sediments in the running surface of a gravel road with coarser rock or by paving. Paving all but eliminates traffic-generated sediments. Drainage repair reestablishes out-sloping, cross-drains and in some cases ditchlines to ditch-relief culverts. These actions have the effect of getting water off the road before it can enter streamcourses. This mitigation is responsive to ACS objectives 2, 3, 4, and 5 and Standards and Guidelines for Key Watersheds (Forest Service and BLM 1994b).
- Approximately 12.8 miles of road stormproofing to reduce the risk of road failures during storms. Drainage repair reestablishes out-sloping, cross-drains and in some cases ditchlines to ditch-relief culverts. These actions have the effect of getting water off the road before it can enter streamcourses and reducing the risk of road failure. This mitigation is responsive to ACS objectives 2, 3, 4, and 5 and Standards and Guidelines for Key Watersheds (BLM and Forest Service 1994b).
- Approximately 30 miles of instream LWD projects. Placement of LWD in streams adds structural complexity to aquatic systems by creating pools and riffles and trapping fine sediments, and can contribute to reductions in stream temperatures over time (Tippery et al. 2010). This is responsive to ACS objectives 2, 3, 4, and 5 (Forest Service and BLM 1994b).
- Fourteen fish passage culverts. Old culverts may block fish passage either by poor design or by failure over time. Removing these blockages and replacing them with fish-friendly designs can allow fish and other aquatic organisms to access previously unavailable habitat. This is responsive to ACS objectives 1, 2, 3, and 9 (Forest Service and BLM 1994b).
- Approximately 0.5 mile of riparian planting. Riparian planting reestablishes willows and other riparian vegetation in areas where prior land use has removed existing vegetation. Riparian plantings reestablish shade, increase bank stability and, over time, contribute to restored riparian plan plant communities.

- Approximately 6.4 miles of fencing. Fencing restricts cattle grazing in sensitive riparian ecosystems. This allows riparian vegetation to be reestablished and eliminates hoof damage to stream banks.
- Approximately 6,560 acres of fuels reduction and stand density management and 2,000 acres of underburning to reduce fuels. This action may be revised depending on the final scale and follow-up assessment of the 2015 Stouts Fires that began in August 2015. High intensity stand replacement fires may adversely affect riparian values. Reducing fuel loading and stand density can reduce the risk of high intensity fires in areas where the treatments occur, and slow the spread of fires. Stand density reductions in riparian zones have the dual benefit of reducing the risk of stand-replacing fire, while also accelerating the development of late-successional stand conditions by accelerating growth of remaining trees. This is responsive to ACS objectives 8 and 9.
- Reallocation of approximately 1,800 aces from the Matrix land allocation to the LSR land allocation. Managing lands for LSR objectives generally benefits aquatic resources. This measure is responsive to all nine ACS objectives.

Determining Consistency with the ACS at Multiple Scales

The ACS does not prohibit project-level impacts so long as the effects of the action do not retard or prevent attainment of ACS objectives (Forest Service and BLM 1994b: B-9). Project impacts that result in minor and short-term degradation of the aquatic habitat do not necessarily constitute noncompliance with the ACS. Where impacts do occur, the analysis must show they are within the range of natural variability for the watershed where they occur or that the action would move the key processes that influence Riparian Reserves toward the range of natural variability (Reeves 1996). Under the ACS, a project cannot have a long-term negative effect on riparian-dependent resources (Forest Service and BLM 1994c: 3&4 68-69). For example, short-term "pulse" disturbances that result in the deposition of sediment in amounts and texture that mimic natural events may fall within the range of natural variability for a watershed, and would likely not prevent attainment of ACS objectives. Conversely, actions that result in the long-term chronic deposition of fine sediments that do not fall within the range of natural variability in a given watershed probably would not be consistent with the ACS. In all cases, agency decision makers must use the scale, duration, and intensity of impacts and professional judgment to determine whether an action prevents attainment of ACS objectives.

As described in appendix J of this EIS, the ACS assessment prepared for this pipeline project by the BLM and Forest Service defined spatial scales as follows:

- The "site" in the context of this ACS assessment varies in size depending on impacts. It encompasses the Project footprint and areas of potential direct or indirect impacts adjacent to the Project location. The "site" is variable and is intended to reflect the ecological function and variable nature of riparian areas. The "site" may encompass areas outside of Riparian Reserves.
- The "subwatershed" is the sixth-field HUC scale as defined by the U.S. Geological Survey (USGS).
- The "watershed" is the fifth-field HUC scale as defined by the USGS.

- The "basin" is an aggregation of fifth-field watersheds into one logical drainage (i.e., the Umpqua basin), typically at the fourth-field HUC scale. In the Coast Range Province, it may include small drainages that are not part of a larger river system but have common beneficial use and resource concerns.
- The "province" refers to the physiographic (also called aquatic) provinces established in the Report of the Forest Ecosystem Management Assessment Team (FEMAT; Forest Service et al. 1993). These are areas of similar geologic and general climatic conditions.
- "Riparian Reserves" are land allocations in BLM and Forest Service land management plans where special standards and guidelines apply. Riparian Reserves adjacent to fish-bearing streams are two site-potential tree heights wide (on each side of the stream). Riparian Reserves on wetlands and other waterbodies, including intermittent streams, extend one site potential tree height from the edge of the waterbody.
- In this ACS assessment, temporal and spatial scales and the intensity of impacts are defined as follows:
  - Short-term impacts are generally limited to the season(s) of construction.
  - Long-term impacts are those that would persist beyond the season(s) of construction.
  - Minor impacts are defined as impacts that are confined to the general construction site. They either are "short-term" impacts or longer term impacts that are within the range of natural variability at the scale where the impact occurs and that would not prevent attainment of ACS objectives.
- Impacts that are not "minor" are those that that are outside the range of natural variability and would prevent attainment of ACS objectives.

The consistency of the Pacific Connector pipeline with the ACS as defined by the NWPF (Forest Service and BLM 1994b) and subsequent policy interpretations (Goodman et al. 2007) is demonstrated by:

- Using watershed assessments to describe watershed conditions and ranges of natural variability for key physical and biological processes for each fifth-field watershed that would be crossed by the pipeline project.
- Evaluating direct, indirect, and cumulative impacts at the site and watershed scale against the nine ACS objectives for each fifth-field watershed.
- Compliance with applicable agency management direction (i.e., NWFP Standards and Guidelines [appendix J, table 2.2-1]).
- Showing that the environmental consequences of agency decisions regarding proposed land management plan amendments do not prevent attainment of ACS objectives (see appendix J, table 1.2.3-1).
- REO review of any proposed amendments of NWFP standards and guidelines that have been incorporated into land management plans that would reduce protections for aquatic resources. The purpose of this review is to determine if the objectives of standards and guidelines for the ACS would be significantly adversely affected by the proposed amendment(s) (appendix J, table 1.2.3-1).

- A finding by the agency decision makers in the ROD, based on evidence and facts presented in the project EIS and its appendices, that the action taken by the BLM and Forest Service (see appendix J, section 1.2.3.) would not prevent attainment of the ACS objectives at the appropriate scales.

Regional Context of the ACS

The ACS is applied at multiple scales. In order to provide a logical framework for assessment, the report of the FEMAT that underlies the NWFP established physiographic provinces (Forest Service et al. 1993). Physiographic provinces (also referred to as "provinces" or "aquatic provinces") incorporate physical, biological, and environmental factors that shape broad-scale landscapes. Physiographic provinces reflect differences in geology (e.g., uplift rates, recent volcanism, and tectonic disruption) and climate (e.g., precipitation, temperature, and glaciation). These factors result in broad-scale differences in soil development and natural plant communities. Within each province, variable characteristics of rock stability affect the steepness of local slopes, soil texture, soil thickness, drainage patterns, and erosional processes. Thus, physiographic provinces have utility in the description of both terrestrial and aquatic ecosystems (Forest Service et al. 1993).

Within provinces, vegetation types, land-use practices, and responses to disturbance are typically similar. The pipeline project would cross the Coast Range, Klamath-Siskiyou, Western Cascades, and High Cascades provinces (see appendix J, figure 1-1). In the following sections, each of these four provinces is described in terms of climate, geology, soils, vegetation, and the fifth-field watersheds within each of them (appendix J, figure 2.1-1).

Key Watersheds

The NWFP identifies "key" watersheds that have regional significance for the protection of water quality and aquatic habitat. Tier 1 Key Watersheds are intended to benefit at-risk fish species and stocks by providing refugia for maintaining and recovering habitat. Tier 2 Key Watersheds provide high-quality water. Key Watersheds include areas of both high quality and degraded habitat. Key watersheds with high-quality habitat serve as anchors for the potential recovery of depressed stocks. Those of lower quality habitat have a high potential for restoration and would become areas of high-quality habitat if appropriate restoration measures are implemented. The NWFP designates Key Watersheds as the highest priority for restoration. Table 4.1.3.5-2b identifies Key Watersheds that would be crossed by the pipeline project right-of-way.

Specific effects of the Pacific Connector Pipeline Project in Key Watersheds are addressed in the watershed descriptions in this section.

TABLE 4.1.3.5-2b

Miles of Pacific Connector Pipeline Project Right-of-Way in Key Watersheds by Administrative Unit

Watershed	Coos Bay BLM Miles	Roseburg BLM Miles	Medford BLM Miles	Lakeview BLM Miles	Total BLM Miles	Umpqua NF Miles	Rogue River NF Miles	Winema NF Miles	Total NF Miles	Total BLM and NF Miles
Elk Cr.-South Umpqua	—	0.1	—	—	0.1	2.7	—	—	2.7	2.8
Days Cr. South Umpqua (Tier 1) (These fifth-field watersheds are both part of the South Umpqua Key Watershed)		6.7			6.7	1.6			1.6	8.2
North and South Forks Subwatersheds, Little Butte Cr. (Tier 1)	—	—	3.9	—	3.9	—	8.4	—	8.4	12.3
Spencer Cr. (Tier 1)	—	—	—	1.0	1.0	—	—	6.1	6.1	7.1
Clover Cr. Subwatershed, Spencer Cr.(Tier 2)	—	—	—	0.2	0.2	—	—	—	—	0.2
Total	**0.0**	**6.8**	**3.9**	**2**	**9**	**4.2**	**8.4**	**6.1**	**18.7**	**30.6**

Note: Miles rounded to nearest tenth of a mile. Rows/columns may not sum correctly.
Source: Resource Report 2, Table 2.2-4

Historical Disturbance Processes and Patterns in the Pacific Northwest

A critical aspect of the Pacific Northwest riverine and riparian environment is the widespread occurrence of steep, unstable hillslopes that result in active erosional environments. Recent geologic uplift, weathered rocks and soil, and heavy rainfall all contribute to high landslide frequency and to high sediment loads in many of the region's rivers. Hillslope steepness is one of the simplest indicators of areas prone to mass wasting (e.g., rapid mass movements of soil and organic material down hillslopes and stream channels). The response of these steep hillslopes to disturbance processes shaped the evolution of the aquatic environments in the region.

In the Pacific Northwest, fire historically was the dominant watershed disturbance process (Everest and Reeves 2007). Synergy between fire and subsequent intense rainstorms and flood events may be the sequence of disturbances with the greatest effect on riparian ecosystems in the Pacific Northwest (Benda et al. 1998 cited in Everest and Reeves 2007). Wildfires temporarily increase the supply of water and sediment to fluvial systems (Malmon et al. 2007). Runoff-initiated surface erosion events tend to peak during the first year after a forest fire. These effects are highly variable but are typically short-lived (two to four years) due to vegetative recovery (Legleiter et al. 2003). During that period, affected drainages may produce visibly turbid water during each heavy storm or snowmelt event. Landslides, however may occur several years after a severe fire (Wondzell and King 2003). The lag is largely due to the relatively slow decay of roots of fire-killed trees and shrubs. Once these anchors are lost, the soil is more likely to slough from steep slopes when saturated with rainfall or snowmelt.

Mass wasting (i.e., debris torrents, landslides and movement of unstable earthflow terrains) following a fire can transport tremendous amounts of sediment and wood debris to stream channels. Reeves (cited in the Catching-Beaver Watershed Assessment [BLM 2010]) observed that mass wasting following fire can deposit so much material that 2 or 3 meters of accumulated sediment and coarse debris can still remain in the channel 100 years after the deposition event. The accelerated erosion associated with intense fire combined with normal background levels may cause a fivefold increase in sediment yield, and the recovery to pre-fire sediment yields may take

20 to 30 years (Swanson 1981, cited in the Catching Beaver WA [BLM 2010]). Many terrace-like features next to mountain streams in the Pacific Northwest are relic depositions of material transported by debris avalanches that were subsequently cut through by streams. Small, third- to fifth-order forested streams are in close proximity to sediment sources (adjacent hillslopes and channel banks). LWD and boulders form persistent structures that trap significant volumes of sediment in these channels, reducing sediment transport in the short term and substantially increasing channel stability. External sediment inputs such as mass wasting and bank collapse, along with wood accumulation, tend to dominate the channel morphology of smaller streams (e.g., Big Creek on BLM lands or the East Fork Cow Creek on NFS lands), while larger streams are primarily influenced by downstream fluvial sediment transport and bank erosion (e.g., Middle Creek on BLM lands). Bed material transport occurs under relatively high flow conditions for a very short period of time. Since major erosional events are almost always associated with excessive amounts of precipitation, their occurrence depends on these storms occurring during periods of increased susceptibility to surface erosion and mass wasting following intense wildfire (Wondzell and King 2003). Average bankfull discharge recurrence in western Oregon has an interval of 1.1 to 1.2 years, while eastern Oregon has intervals of 1.4 to 1.5 years; thus in any given year, there is a reasonable assurance that a bankfull event could occur (Castro 1997).

The impacts of these disturbance pulses can range from increases in sediment transport in streams to mass wasting events that affect riparian stands at the site to subwatershed scale and deposit large amounts of sediment and LWD in and adjacent to stream channels. Historically, these “pulse” disturbances of sediment occurred infrequently at any given site or subwatershed and affected a relatively small part of the watershed at any one time, though at the watershed or regional scale, disturbance processes were (and are) a constant factor in Pacific Northwest landscapes. Pulse disturbances generally allow aquatic ecosystems to remain within their normal historical range of states and conditions since there is sufficient time between disturbances to enable ecosystems to recover to pre-disturbance conditions (Everest and Reeves 2007).

The large-scale ecological structures, functions, and processes that shaped Pacific Northwest watersheds have been substantially altered by anthropogenic factors. Fire suppression has altered the historical frequency and intensity of fire events in the Pacific Northwest. As result of fire suppression and timber harvest, there has been a general shift in vegetation patterns, structures, and ecological processes from relatively larger patches of late-successional and old-growth forest with frequent low-intensity fires to more fragmented landscapes that are dominated by early and mid-seral plant communities. Large, high-intensity fires do occur (e.g., the Biscuit Fire in 2002), possibly with increasing frequency and intensity. In the past, forest practices (timber harvest) in the Pacific Northwest increased the occurrence of mass wasting events and the magnitude of sediment yield to the aquatic environment. Road-related mass wasting is a major source of sediment (Hassan et al. 2005). Land use patterns and, in particular, forest roads have altered the sediment regimes in many stream networks, replacing episodic pulses of coarse sediments with chronic transport and deposition of fine sediments.

Oregon Coast Range Province, MP 1-47

After leaving Coos Bay, the Pacific Connector pipeline corridor would traverse the southernmost part of the Coast Range Province for approximately 47 miles (appendix J, figure 1-1). This province includes all lands in Oregon from the Coquille River basin north and the Pacific Ocean eastward to the crest of the Coast Range. The province is 30 to 60 miles wide and averages about

1,500 feet above MSL in elevation. The Coos Bay Frontal, Lower Coquille North, and the East and Middle Fork Coquille fifth-field watersheds are included in in the Coast Range Province.

Landform and Erosional Processes

The southern part of the Coast Range Province generally consists of steep slopes with narrow ridges developed on resistant sedimentary rocks. Westward-flowing streams erode headward to mountain passes on the east side of the Coast Range. Many of the higher peaks are composed of resistant igneous rocks. Steep, highly dissected slopes are subject to mass wasting (i.e., debris flows). Tributary channels join at relatively low angles, which allow debris flows to travel for long distances. Unstable landscapes (i.e., earthflows) may constrict or deflect stream channels, creating local low-gradient depositional stream reaches upstream.

The Coast Range is composed primarily of soft marine sedimentary rocks overlying basalt at depth. Combined with the wet climate of the western slopes of the Coast Range and the typically steep terrain, these non-resistant rocks produce an active erosional environment with frequent landslides. Natural disturbance regimes in this province tend to be highly episodic, with large pulses of sediment delivery associated with high-intensity fire, flooding, and wind events, followed by a recovery period with low-level chronic sediment delivery extending over decades (BLM 2010:26). Debris torrents generally begin in first- and second-order streams and come to rest in lower third-order and upper fourth-order draws.

Erosional processes the Coast Range province are dominated by mass wasting associated high-intensity rainfall events. Erosional processes are accelerated where these rainfall events overlap with large, stand-replacing fires. Precipitation gradients decrease from west to east, so landslide frequency decreases with decreased precipitation. Historic land uses such as splash dams for log drives and hydraulic mining during the 19th century dramatically altered landscapes and downstream channels where this activity occurred.

Climate

The mountainous areas on the western slope of the Coast Range receive some of the highest precipitation totals in the continental U.S., with some areas receiving up to 200 inches per year. The Oregon Coast near Coos Bay is typically cool and foggy, with annual precipitation (rainfall equivalent) of about 65 inches. Almost all of the low elevation precipitation falls as rain. As elevation increases, the amount of precipitation that falls as snow increases. Rain typically falls from October to June, though trace amounts as well as coastal fog help keep the vegetation green throughout the summer. Periodic high-intensity storms may drop several inches of rainfall in a few hours causing “peak flow” events that are primary drivers of natural disturbance and watershed conditions, particularly in Riparian Reserves. Summer thunderstorms, though rare, can also result in localized high-intensity rainfall events.

Vegetation

The Coast Range Province is dominated by forests of Douglas-fir, western hemlock, and western red cedar. Vegetative recovery after disturbance is very rapid. Salmonberry and other brush species rapidly occupy disturbed sites. The southern half of the province includes a mixture of private, BLM, and NFS lands. The northern half is largely in private and state ownership. Logging and several extensive wildfires during the last century have changed most of the LSOG forest in the northern end of the province to early and mid-seral forest. Older forests in the southern half

of the province are highly fragmented, especially on BLM lands, which are typically intermixed with private lands in a checkerboard pattern of alternating square-mile sections.

Klamath-Siskiyou Province MP 47–105, 118–153

The Klamath-Siskiyou Province encompasses the Klamath and Siskiyou Mountains and lies between the Coast Range and the Cascades, south of the Willamette Valley. The Project would traverse the northeast corner of the Klamath-Siskiyou Province for approximately 93 miles (appendix J, figure 1-1). It includes parts of the Umpqua and Rogue River National Forests, and the Roseburg and Medford Districts of the BLM. This landscape is typified by deeply dissected valleys and jutting ridges and foothills. Much of this province lies within a rain shadow sheltered from the Pacific maritime influences by the mountains of the Coast Range. The region has a rugged landscape, with high peaks and deep canyons. Elevations range from about 1,000 to 7,000 feet above MSL. Portions of the Middle Fork Coquille River, Olalla-Lookingglass, Myrtle Creek, Clark's Branch-South Umpqua, Elk Creek–South Umpqua, Upper Cow Creek, Trail Creek, Shady Cove Rogue River, Big Butte, and Little Butte Creek fifth-field watersheds are in the Klamath-Siskiyou Province.

Landform and Erosional Processes

The Klamath-Siskiyou Province is rugged and deeply dissected. Tributary streams generally follow the northeast-southwest orientation of rock structure created by accretion of rocks onto the continent. Variable materials juxtapose steep slopes subject to debris flows and gentle slopes subject to earthflows. Scattered granitic rocks are subject to debris flows and severe surface erosion. High rates of uplift have created steep streamside hillslopes known as inner gorges, especially near the coast. The Klamath-Siskiyou Province is known for its highly complex geology. Most of the area is composed of highly deformed volcanic and marine sedimentary rocks with some metamorphic terranes. Also included are deformed pieces of oceanic crust and granitic intrusive bodies. Bedrock is often intensely metamorphosed and fractured. Well-developed floodplains and terraces near major rivers give way to highly dissected mountains with high-gradient streams. Many streams in this province flow only intermittently because of high gradients and low summer precipitation.

Erosional processes in the Klamath-Siskiyou Province are dominated by mass wasting associated high-intensity rainfall events. Erosional processes are accelerated where these rainfall events overlap with large, stand-replacing fires. Precipitation gradients decrease from west to east, so landslide frequency decreases with decreased precipitation. Hydraulic mining during the 19th century dramatically altered landscapes and downstream channels where this activity occurred.

Climate

The valleys and foothills of the Klamath-Siskiyou Province experience a Mediterranean-type climate, while higher elevations demonstrate more montane impacts. Precipitation in the lowlands ranges from 25 to 50 inches a year, while higher elevations may receive up to 130 inches per year. Areas outside the Coast Range rain shadow receive considerably more precipitation. Most precipitation falls as rain and snow during the winter, though summer thunderstorms may produce measureable amounts.

Vegetation

This area is dominated by mixed-conifer and mixed-conifer/hardwood forests. Land ownerships include a mixture of BLM, NFS, private, and state lands. Forests are highly fragmented by natural factors (e.g., poor soils, dry climate, and wildfires) and human-induced factors (e.g., harvest and roads). Much of the historical harvest in this area has been selective cutting rather than clearcutting. As a result, many stands that were logged in the early 1900s include a mixture of old trees left after harvest and younger trees that regenerated after harvest. Much of the area within the Province is characterized by high fire frequencies. Any plan to protect LSOG forests in these areas must include careful consideration of fire management.

Western Cascades Province MP 105-113

Approximately 13 miles of the pipeline corridor cross the north-south trending Western Cascades Province (appendix J, figure 1-1). This province, which drains westward to the Pacific Ocean, reaches elevations of 4,400 feet above MSL in watersheds crossed by the Pacific Connector Pipeline Project. Portions of the Upper Cow Creek and Trail Creek fifth-field watersheds are in the Western Cascades Province.

Landform and Erosional Processes

The landforms in the Western Cascades Province are distinguished from the High Cascades by older volcanic activity and longer glacial history. Ridge crests at generally similar elevations are separated by steep, deeply dissected valleys. Complex volcanoclastic formations juxtapose relatively stable volcanic deposits that weather to thick soils and are subject to earthflows. Unconsolidated alluvial and glacial deposits are subject to streambank erosion and landslides. Tributary channels flow at large angles into wide, glaciated valleys. Stream gradients are typically moderate to high (2 to 30 percent).

Climate

Lowland areas may receive as little as 60 inches of precipitation per year, while higher elevations may receive up to 120 inches annually. Much of the precipitation that falls above 4,000 feet above msl is snow. Average January temperatures range from 26 to 41°F while average July temperatures range from 44 to 78°F.

Vegetation

Forests of this province consist primarily of Douglas-fir and western hemlock at lower to middle elevations. Land ownerships include a mixture of private and state lands, federal lands, and tribal lands. The BLM and Forest Service administer extensive areas of federal lands in this Province. Private and state lands within this area are managed intensively for timber production under the forest practice and water quality laws of the State of Oregon and are primarily early and mid-seral forests whereas federally administered lands still include significant areas (albeit highly fragmented) of LSOG forest. Forests at the southern section of the province are largely replaced by mixed-conifer forests of Douglas-fir, grand fir, and incense-cedar. A large proportion of the known NSO population in Washington and Oregon occurs in the Western Cascades.

High Cascades Province MP 153-180

Approximately 23 miles of the Project corridor would be located in the High Cascades Province (appendix J, figure 1-1). This Province consists of one north-south trending mountain chain that drains both westward to the Pacific Ocean and eastward into Klamath and Columbia Basins (see appendix J, figure 1-1). The High Cascades Province reaches a peak elevation of 9,493 feet MSL at the summit of Mt. McLoughlin. Portions of the Little Butte Creek, Spencer Creek, and Mills Creek–Lost River fifth-field watersheds are in this province.

Landform and Erosional Processes

The province consists of volcanic landforms with varying degrees of historic glaciation. Lava flows form relatively stable plateaus, capped with pumice and ash deposits by the recent Cascade volcanoes. Drainages are generally not yet well developed or otherwise disperse into highly permeable volcanic deposits. Geologically recent volcanic pumice and ash deposits are subject to large debris flows when saturated by snowmelt. This province is composed primarily of approximately 3 million year old volcanic material, primarily andesite and basalt that were subsequently glaciated. Mountains in this province are moderately dissected. Headwater streams have medium to high gradients and are often associated with large meadow-spring complexes. Expansive pumice plateaus associated with the eruption of Mt. Mazama about 5,000 years ago (Dead Indian Plateau, Clover Creek) with droughty soils characterized by high snowmelt infiltration and low summer water retention fill valley floors adjacent to volcanic peaks.

Climate

The High Cascades Province is climatically diverse, with mild valleys, snowy mountains, and alpine conditions at the highest elevations. Precipitation ranges from 45 to 100 inches per year and is largely associated with orographic influences of the mountains in this province. In the lowlands, average January temperatures range from 30 to 45°F while average July temperatures range from 49 to 85°F. At higher elevations, average January temperatures range from 23 to 37°F while average July temperatures range from 44 to 74°F.

Vegetation

This province is dominated by mixed-conifer and ponderosa pine forests at mid- to lower elevations and by true fir forests at higher elevations. The higher elevations of the High Cascades Province support forests of silver fir and mountain hemlock. Some National Parks and wilderness areas within this province include significant areas of mid-elevation LSOG forest. Land ownership patterns include a mixture of NFS, private, state, Indian, and National Park Service lands; Wildlife Refuges managed by the FWS; and BLM land. Forests in this region are highly fragmented due to a variety of natural factors (e.g., poor soils, high fire frequencies, and high elevations) and human-induced factors (i.e., clearcutting and selective harvest). Before the advent of fire suppression in the early 1900s, wildfires played a major role in shaping the forests of this region. Intensive fire suppression efforts in the last 60 years have resulted in significant fuel accumulations in some areas and shifts in tree species composition and may have made forests more susceptible to large high-severity fires and to epidemic attacks of insects and diseases. Any plan to protect LSOG forests in this area must include considerable attention to fire management and to the resilience of forest stands.

Watersheds Crossed by the Pacific Connector Pipeline Project on BLM or NFS Lands Where the ACS Applies

Coos Bay Frontal Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-3 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Coos Bay Frontal watershed. The pipeline project would clip one Riparian Reserve and cross one intermittent stream in the Coos Bay Frontal watershed. Watershed conditions and recommendations are described in the Catching-Beaver Watershed Assessment (BLM 2010) and discussed in detail in appendix J of this EIS.

TABLE 4.1.3.5-3

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Coos Bay Frontal Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features. The pipeline project corridor would clear approximately 2.9 acres or about 0.14 percent of the Riparian Reserves in the Coos Bay Frontal watershed. The pipeline would be located on or near a ridgetop and would affect about 3 acres or about 0.06 percent of the BLM lands in the watershed (appendix J, tables 2.3.3.1-2, 2.3.3.1-3). The pipeline project would be adjacent to an existing powerline corridor or in second-growth timber. Impacts to aquatic systems are expected to be short term, minor, and well within the range of natural variability for the Coast Range because of application of Best Management Practices (BMPs), erosion control measures, and rapid revegetation. Approximately 18 percent of the watershed is currently late successional and old growth (LSOG) (BLM 2010:48). No LSOG would be removed by the Project corridor in the Coos Bay Frontal watershed (appendix J, table 2.3.3.1-4). BLM cannot restore diversity, complexity and landscape-scale features at the fifth-field scale because BLM manages less than 5 percent of the lands within the watershed.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project has one intermittent stream crossing in the Coos Bay Frontal watershed. The crossing would not affect spatial or temporal connectivity because the pipeline would be buried and the actual area of bank and stream bottom disturbance would be small (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site and banks and stream bottoms restored to conditions similar to the pre-construction condition. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project has one intermittent stream crossing in the Coos Bay Frontal watershed. During construction, the actual area of bank and stream bottom disturbance would be small at each crossing (<15 feet wide). Long-term impacts on the bed and banks of these features would be minor and limited to the site of construction because the pipeline would be buried. After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the *Wetland and Waterbody Crossing Plan*. See appendix J, table 2.3.1.1-5 for specific measures. This level of disturbance is well within the historical and current range of natural variability for bank and channel stability in watersheds of the Coast Range Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	It is possible that there may be minor amounts of sediment mobilized during construction (see appendix J, section 1.3.2). No longer term impacts on water quality are expected from the pipeline project in the Catching Slough subwatershed or Coos Bay Frontal watershed because of application of BMPs during construction, implementation of the ECRP, and the ridgetop location of the pipeline.

TABLE 4.1.3.5-3

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Coos Bay Frontal Watershed

ACS Objective	Project Impacts
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Any sediment impacts from the pipeline project are expected to be minor and short-term and well within the range of natural variability for the Coast Range Province. The pipeline location, application of BMPs for water quality, restoration of bed and banks, LWD placement, aggressive erosion control, and the rapid natural revegetation capacity of the Coast-Range Province are expected to limit any potential sediment impacts.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project is not expected to have any effect on instream flows. The single stream crossing in this watershed is a first-order intermittent stream. It is unlikely that flow regimes could be altered because vegetation in the Catching Slough subwatershed is hydrologically recovered, the Project is located on or near a ridgetop, and the scale of the pipeline project in the Coos Bay Frontal subwatershed is limited (0.1 percent of BLM lands in the subwatershed).
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project is not expected to have any impact on floodplain inundation or water table elevation because of its location and lack of connectivity to floodplains and wet meadows.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	The pipeline project impacts on riparian vegetation would be minor and limited to the site of construction. Most of the Riparian Reserve vegetation at this site is second-growth upland forest. Existing herbaceous and brush cover would be maintained to the extent practicable within the clearing limits. Large woody debris (LWD) and boulders would be restored to the disturbed areas after construction. Revegetation would be accomplished using native riparian species.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	The pipeline project impacts on riparian vegetation would be minor and limited to the site of construction. Most of the Riparian Reserve vegetation is upland second-growth forest. Existing herbaceous and brush cover within the clearing limits would be maintained to the extent practicable. LWD and boulders would be restored to the disturbed areas after construction. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

Summary, Coos Bay Frontal Watershed

Given the location of the pipeline right-of-way on or near ridgetops on BLM lands and the relatively small area of the BLM lands in the Coos Bay Frontal watershed that would be affected by the pipeline project (3 acres or 0.06 percent of BLM lands watershed), it is highly improbable that actions related to the pipeline on BLM lands would affect watershed condition in the Coos Bay Frontal watershed or the Catching Slough subwatershed. Although there are possible project-related impacts in the form of sediment at one intermittent stream crossing, those would be minor and short term (see appendix J, table 2.3.1.3-1). Vegetative condition would change in the Riparian Reserve, but this is a minor impact at the project scale. No LSOG vegetation would be removed in Riparian Reserves. No pipeline project impacts relevant to the ACS have been identified that are outside of the range of natural variability for watersheds on BLM lands in the Coast Range Province.

Coquille River Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-4 compares the pipeline project impacts to the objectives of the ACS for the Coquille River watershed. The pipeline corridor would clip one Riparian Reserve near a ridgetop near the watershed boundary in Cunningham Creek, but would not intersect any stream

TABLE 4.1.3.5-4

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are a landscape-scale feature. The pipeline corridor would affect approximately 1 acre or 0.11 percent of Riparian Reserves in the Coquille River watershed (appendix J table 2.3.4.1-3). This is well within the range of natural variability for changes in vegetative condition in the Coast Range Province. No stream channels are crossed in the watershed. The Coquille River watershed on BLM lands is approximately 39% late successional and old growth (LSOG).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project would not intersect any streams and would affect 0.11 percent of Riparian Reserves in the Coquille River watershed; therefore, discernible impacts on aquatic- and riparian-dependent species are unlikely.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project would not affect streambanks or stream bottoms in the Coquille River watershed because the Project would not intersect stream channels.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	The pipeline project would not intersect any streams in the Coquille River watershed; therefore, it would have no impact on aquatic- and riparian-dependent species.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The pipeline project would not affect the sediment regime for aquatic species because of the limited scale of the pipeline project, application of best management practices and the requirements of the ECRP, and the lack of intersections with stream channels.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project would not affect instream flows because there are no stream intersections.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project would not affect floodplains and water table elevations in meadows because there would be no intersections with these features.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	The impacts of the pipeline project on riparian vegetation would be minor and limited to the site of construction. Most of the Riparian Reserve vegetation at this site is second-growth upland forest. Existing herbaceous and brush cover would be maintained to the extent practicable within the clearing limits. Large woody debris (LWD) would be placed back within the cleared area. No stream channels would be intersected.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	The impacts of the pipeline project on riparian vegetation would be minor and limited to the site of construction. Most of the Riparian Reserve vegetation is upland second-growth forest. Existing herbaceous and brush cover within the clearing limits would be maintained to the extent practicable. LWD and boulders would be restored to the disturbed areas after construction. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by Project construction and operation in the watershed (see appendix K of this EIS).

channels in the Coquille River watershed. Approximately 1 acre or 0.11 percent of the Riparian Reserves in the watershed would be cleared. Watershed conditions and recommendations are described in the Middle Main Coquille, North Coquille Mouth, and Catching Creek Watershed Analysis (BLM 1997) and described in detail in appendix J of this EIS.

Summary, Coquille River Watershed

The Pacific Connector Pipeline Project does not cross any stream channels in the Coquille River Watershed on BLM-managed lands. One Riparian Reserve is minimally affected. Given the location of the pipeline corridor on BLM lands and the very small proportion of BLM Riparian Reserves affected by the Project (about 1 acre or 0.11 percent of Riparian Reserves in the watershed) and the relatively small area of BLM lands in the Coquille River watershed that would be affected by the pipeline project (about 1 acre or 0.05 percent BLM lands in the watershed), it is highly improbable that actions related to the pipeline on BLM lands would affect the watershed condition in the Coquille River watershed or the Cunningham Creek subwatershed. No pipeline project impacts relevant to the ACS have been identified that are outside of the range of natural variability for watersheds on BLM lands in the Coast Range Province.

North Fork Coquille River Watershed

Project Impacts by ACS Objectives

Table 4.1.3.5-5 compares the pipeline project impacts to the objectives of the ACS for the North Fork Coquille River watershed. The pipeline corridor crosses three intermittent channels and one perennial stream channel and three forested wetlands. Two corridor-channel intersects of intermittent streams occur in the Hudson Creek subwatershed. The other two corridor-channel intersects are approximately 7 miles away in the Middle Creek subwatershed so the potential for synergistic downstream sediment accumulation from crossings on BLM lands and related impacts to aquatic and riparian resources is very low. The majority of Riparian Reserves clipped are in the Hudson Creek subwatershed and the Middle Creek subwatershed. Approximately 17 acres of Riparian Reserves (0.09 percent of the Riparian Reserves in the watershed) would be cleared in the pipeline project right-of-way. About 9 acres of Riparian Reserve effects are associated with channel crossings; the remaining 7 acres of Riparian Reserve effects are associated with Riparian Reserves that would be clipped, but do not involve a stream crossing (appendix J, tables 2.3.5.1-1 through -4). Watershed conditions and recommendations are described in the North Fork Coquille Watershed Analysis (BLM 2002a) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-5

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, North Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features that would be affected by the pipeline project corridor. The corridor is located primarily in early or mid-seral forests (appendix J, table 2.3.5.1-4) adjacent to an existing utility corridor and road and largely on or near ridgetops to minimize impacts on aquatic habitats. The Project corridor would affect 41 acres of BLM lands or about 0.11 percent of the North Fork Coquille River watershed and about 17 acres or 0.09 percent of the Riparian Reserves within the watershed (appendix J, table 2.3.5.1-3). Most of the habitats crossed by the corridor are already disturbed from past management practices. Impacts to aquatic systems are expected to be short-term and minor because of application of best management practices (BMPs) and erosion control measures and anticipated rapid revegetation of disturbed areas. Impacts of the Project are expected to be within the range of natural variability for natural disturbance processes in the Coast Range Province. BLM lands in the North Fork Coquille watershed are approximately 45 percent late successional and old growth (LSOG).

TABLE 4.1.3.5-5

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, North Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the North Fork Coquille River watershed because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the exhibits specified in the POD (i.e., *Wetland and Waterbody Crossing Plan*). At each crossing, bed and bank disturbances would be small (<15 feet wide). After construction, key habitat components such as large woody debris (LWD) and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project corridor would cross three intermittent streams and one perennial fish-bearing stream in the North Fork Coquille River watershed. During construction, the actual area of bank and stream bottom disturbance at each crossing would be is small (<15 feet wide). Impacts on the bed and banks of these features would be minor and limited to the site of construction because the pipeline would be buried. During construction of the Middle Creek crossing, steep streambanks will be laid back to a stable configuration. After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions where appropriate, consistent with the POD requirements. A site-specific crossing plan is in preparation to ensure accomplishment of these objectives. See appendix J, section 2.3.5 for specific measures. This level of disturbance is well within the historical and current range of natural variability for bank and channel stability in watersheds of the Coast Range Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment would be mobilized during construction, particularly during the crossing of Middle Creek, a perennial stream with silty sand banks and stream bottom. These impacts are expected to be short term and limited to the general area of construction. No long-term impacts on water quality are expected because of application of the ECRP, including maintenance of effective ground cover (see appendix J, section 1.3.1.2) and BMPs during construction. A small amount of shading vegetation would be removed where the corridor crosses Middle Creek, which is already listed under Section 303(d) of the Clean Water Act for temperature due to sparse riparian cover along much of its length (see appendix J, figure 2.3-5). No change in water temperature is expected because shading appears to have much less effect on water temperature on the downstream reaches of perennial streams (Brown 1970, cited in North Fork Coquille River watershed assessment, page. 7-12), possibly due to the higher volume of flow in these lower reaches.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in corridor routing. Dry open-cut methods would be used to cross stream channels (see appendix J, section 1.3.2.1). Any sediment impacts are expected to be minor and short-term (e.g., first wet season) and well within the range of natural variability for the Coast Range Province due to implementation of the ECRP, including BMPs for water quality, restoration of bank and bottom configurations, LWD placement, and erosion control along with the anticipated rapid revegetation characteristic of the Coast Range Province. Road repairs would also help reduce sediment levels in the watershed and move the sediment regime toward the desired condition.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	On streams with flowing water at the time of crossing, the dam-and-pump method (described in section 1.3.1) would be used to maintain flows in the channel downstream of the crossing. No alterations of flows resulting from construction beyond the short-term, site-scale level are anticipated. The pipeline corridor would occupy about 0.10 percent of the North Fork Coquille River watershed. It is highly unlikely that any impacts in this small part of the watershed could affect the timing, magnitude, and duration of peak flows in the watershed, especially in light of other past and ongoing human activities.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project corridor crosses two forested wetlands in the Hudson Creek subwatershed and one forested wetland in the Middle Creek subwatershed, together affecting a total of 4 acre of Riparian Reserve. Trench plugs would be installed on each side of these wetlands to block subsurface flows and maintain water table elevations, as required by FERC's *Wetland and Waterbody Construction and Mitigation Procedures*. Regardless, pipeline project construction may have short-term impacts on water tables in these isolated forest wetlands. These site-specific impacts would be minor (i.e., limited to the general area of construction) and would not be hydrologically connected to larger wetland areas, and may also regulated under Section 404 of the Clean Water Act. By restricting crossings to the dry season (July 1 to September 15), possible impacts on the water tables in these wetland areas are expected to be minor and short term.

TABLE 4.1.3.5-5

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, North Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	Pipeline project impacts on riparian vegetation in the North Fork Coquille River watershed would be minor. In the short term, all vegetation would be removed from the Project corridor. About 1 acre of vegetation within the Riparian Reserve to be cleared along the Project corridor is LSOG forest; 12 acres is mid-seral conifers and hardwoods and 3 acres is early seral forest (see appendix J, table.2.3.5.1-1-4). Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Overall, Project construction would affect approximately 0.09 percent of the Riparian Reserves in the watershed. Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Project impacts on vegetation are expected to be well within the range of natural variability given the disturbance history of the Coast Range.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Pipeline project impacts on riparian vegetation in the North Fork Coquille River watershed would be minor (17 acres or 0.09 percent of the Riparian Reserves in the watershed (appendix J, table 2.3.5.1-1-3). Most of the cleared Riparian Reserve vegetation is upland second-growth conifers and hardwoods. Existing herbaceous and brush cover within the Project clearing limits would be maintained to the extent practicable. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

Summary, North Fork Coquille River Watershed

The routing of the pipeline project through BLM lands, coupled with the relatively small area of BLM land that would be affected by pipeline construction (41 acres or 0.11 percent of the fifth-field watershed; appendix J, table 2.3.5.1-2), make it highly improbable that pipeline project impacts would affect conditions at the subwatershed or watershed scale. Although there are site-level impacts (e.g., short-term sediment and a change in vegetative condition at stream crossings), these would be minor or limited to the boundaries of the project area (appendix J, section 2.3.5.4).

Clearing of vegetation within Riparian Reserves (17 acres or 0.09 percent of Riparian Reserves in the watershed [appendix J, table 2.3.5.1-1-3]) would have long-term but minor impacts on vegetation condition because the areas are widely dispersed and most of the vegetation that would be cleared is early or mid-seral; about 1 acre of LSOG vegetation in Riparian Reserves would be removed by construction of the pipeline project corridor in the North Fork Coquille River watershed (appendix J, table 2.3.5.1-1-4). These impacts are limited to the pipeline corridor and are well within the range of natural variability given the disturbance history within the Coast Range (appendix J, section 2.3.5.4). The watershed would remain well above the 15 percent LSOG minimum threshold established in the NWFP (appendix J, section 2.3.4.5).

Riparian vegetation along Middle Creek, the only perennial stream crossed by the pipeline project within the watershed, is confined to narrow bands due to previous timber harvesting, agriculture, and road construction. Middle Creek is currently on the CWA Section 303(d) list of impaired water bodies for elevated temperatures, which appear to be related to low canopy cover over the stream. The crossing of Middle Creek (MP 27.04) would be unlikely to affect stream temperature (appendix J, section 2.3.5.4, section 2.3.5.8) because it minimally affects the existing solar loading. A site-specific stream temperature assessment of the Middle Creek crossing by the BLM confirmed that stream temperatures are not likely to be affected by this crossing.

Off-site mitigation would further reduce pipeline project impacts. Logs generated in the corridor clearing process or otherwise provided by Pacific Connector would be used as LWD placed at 80 pieces/mile in 3.7 miles of in-stream projects to restore aquatic habitats on the watershed. Road surfacing at the bridge approach on Woodward and Alder Creek Roads would greatly reduce transport of sediments to nearby aquatic habitats. These off-site mitigation measures proposed for BLM lands would supplement on-site minimization, mitigation, and restoration actions. Mitigations associated with the pipeline project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.3.5.6). Table 4.1.3.5-6 describes proposed off-site mitigations in the North Fork Coquille River watershed.

TABLE 4.1.3.5-6

Proposed Off-site Mitigation Projects for North Fork Coquille River Watershed

Project Type	Mitigation Group	Project Name	Qty.	Project Rationale
LWD Instream Placement	Aquatic Habitat	Steinnon Creek Instream Large Wood Placement	1.5 miles	Lack of recruitment of LWD into channels is a consistent factor limiting aquatic habitat quality in watersheds crossed by the PCGP. Implementation of the project would result in the removal of a small amount of LWD from the Riparian Reserves associated with intermittent and perennial channels. The removal of trees within and adjacent to the channel will reduce future recruitment of LWD into the channel and associated Riparian Reserves. Placing LWD at key locations within the channel and Riparian Reserves would offset both the short-term and long-term effects of loss of LWD recruitment to these areas, thereby contributing to attainment of ACS objectives. Collectively, these mitigation measures would result in placement of almost 300 pieces of LWD in 3.7 miles of channels.
LWD Instream Placement	Aquatic Habitat	Upper North Fork Coquille River Instream Large Wood Placement	2.2 miles	
Road Surfacing	Road Sediment Reduction	Bridge Approach Paving – Woodward & Alder Creek Roads	2 sites	Road-related sediment has negatively affected the North Fork Coquille River watershed. While Best Management Practices will be implemented, construction of the PCPG will likely cause some sediment to reach channels and potentially impact the aquatic habitat. Surfacing the approaches to the Woodward Creek and Alder Creek bridges would reduce, if not eliminate, sediment input to aquatic habitat for anadromous and resident salmonids underneath and adjacent to these bridges.

Proposed amendments of the Coos Bay RMP to waive protection measures for S&M species and to cross MAMU habitat in this watershed would not prevent attainment of ACS objectives (section 2.3.4.5) because the project does not threaten the persistence of any riparian-dependent species. All relevant Project impacts are within the range of natural variability for watersheds in the Coast Range Province (Appendix J, section 2.3.5.4). No project impacts have been identified that would prevent attainment of ACS objectives (Appendix J, section 2.3.4.8).

East Fork Coquille River Watershed

Project Impacts by ACS Objectives

Table 4.1.3.5-7 compares the Pacific Connector pipeline impacts to the objectives of the ACS for the East Fork Coquille River watershed. There are two intermittent stream channels in the East Fork Coquille River watershed that would be crossed by the pipeline (appendix J, table 2.3.6.1-4). These crossings are approximately 5 miles apart in separate subwatersheds, so the potential for accumulation of impacts or synergistic effects from these crossings on BLM lands is very low. Six Riparian Reserves not associated with stream channel crossings would be clipped by the proposed right-of-way. Approximately 6 acres of Riparian Reserves, or 0.03 percent of Riparian

Reserves in the watershed, would be cleared; approximately 1 acre of Riparian Reserves would be modified in uncleared storage areas (appendix J, table 2.3.6.1-1-3). Less than 1 acre of LSOG vegetation would be cleared in Riparian Reserves; 3 acres of early seral forest would be cleared (appendix J, table 2.3.6.1-4). Watershed conditions and recommendations are described in the East Fork Coquille Watershed Analysis (BLM 2002b) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-7

Compliance of Pacific Connector Pipeline Project with ACS Objectives, East Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves and aquatic systems are landscape-scale features that would be crossed by pipeline project. The pipeline corridor would intersect two intermittent streams, one of which is at an existing road crossing and is located primarily in early or mid-seral forests where it crosses Riparian Reserves (appendix J, table 2.3.6.1-4). The Project corridor would clear 39 acres (0.09 percent) of the East Fork Coquille River watershed of which about 6 acres are in Riparian Reserves. Impacts of the pipeline project are expected to be within the range of natural variability for natural disturbance processes in the Coast Range Province (see appendix J, Table 2.3.6.4-2). BLM lands in the East Fork Coquille River are approximately 39 percent LSOG.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the East Fork Coquille River watershed because the pipeline would be buried in the two intermittent stream channels that would be crossed. At each crossing, bed and bank disturbances would be small (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized. The residual levels of disturbance are anticipated to be well within the range of natural variability the Coast Range Province.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project corridor would cross two intermittent stream channels in the East Fork Coquille River watershed, one of which is at an existing road crossing. During construction, the actual area of bank and stream bottom disturbance would be small at each crossing (<15 feet wide). Long-term impacts on the bed and banks of these features would be minor and limited to the site of construction because the pipeline would be buried. After construction, key habitat components such as large woody debris (LWD) and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the POD requirements. See appendix J, table 2.3.5.4-1 for specific measures. This level of disturbance is well within the historical and current range of natural variability for bank and channel stability in the watersheds of the Coast Range Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment could be mobilized during the crossing of two intermittent streams. These impacts are expected to be short term and limited to the general area of construction (see appendix J, section 1.3.1.2). No long-term impacts on water quality are expected because of application of the ECRP and best management practices (BMPs) during construction. The two channel intersections in this watershed are in separate subwatersheds approximately 5 miles apart, so the potential for accumulation impacts is very low.

TABLE 4.1.3.5-7

Compliance of Pacific Connector Pipeline Project with ACS Objectives, East Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in corridor routing. Dry open-cut stream crossings would be used to cross stream channels. Any sediment impacts are expected to be minor and short-term and well within the range of natural variability for the Coast Range Province due to application of the POD, including BMPs for water quality, restoration of bank and bottom configurations, LWD placement, and erosion control along with the anticipated rapid revegetation characteristic of the Coast Range Province. See appendix J, table 2.3.5.7-1 for specific measures. As a result, potential sediment impacts are expected to be well within the range of natural variability for historical and current conditions in the Coast Range Province. Road repairs would also help reduce sediment levels in the watershed and move the sediment regime toward the desired condition.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	If either of the intermittent streams is flowing at the time of construction, the dam-and-pump method (described in appendix J, section 1.3.1) would be used to maintain flows in the channel downstream of the crossing. No alterations of flows resulting from construction beyond the short-term, site-scale level are anticipated. The pipeline project corridor would occupy about 0.10 percent of the East Fork Coquille River watershed on BLM lands. It is highly unlikely that any impacts in this small part of the watershed would affect the timing, magnitude, and duration of peak flows in the watershed, especially in light of other past and ongoing human activities (appendix J, section 1.3.1.6).
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	No wetland or meadows would be affected by the pipeline project on BLM lands in the East Fork Coquille River watershed; therefore, the water tables in these features would not be affected.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Pipeline project impacts on riparian vegetation in the East Fork Coquille River watershed would be minor. Vegetation that would be cleared in the Riparian Reserve along the pipeline corridor consists of early and mid-seral conifers and hardwoods (see appendix J, table 2.3.5.1-4). Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Overall, pipeline project construction would affect 0.03 percent of the Riparian Reserves in the watershed. Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Project impacts on riparian vegetation in the East Fork Coquille River watershed would be minor (about 6 acres or 0.03 percent of the Riparian Reserves in the watershed). Most of the Riparian Reserve vegetation that would be cleared is upland second-growth forest. Existing herbaceous and brush cover within the Project clearing limits would be maintained to the extent practicable. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by Project construction and operation in the watershed (see appendix K of this EIS).

Summary, East Fork Coquille River Watershed

The routing of the pipeline project through BLM lands, coupled with the relatively small area of BLM land that would be affected by pipeline construction (about 44 acres or 0.10 percent of the fifth-field watershed), makes it highly improbable that project impacts would affect conditions at the subwatershed or watershed scale. Although there are site-level impacts (e.g., small amounts of sediment and a change in vegetative condition at stream crossings), these would be minor and largely limited to the boundaries of the project area (appendix J, section 2.3.6.3).

Clearing of vegetation within Riparian Reserves (about 6 acres or 0.03 percent of the Riparian Reserves in the watershed) would cause long-term but minor changes in vegetation condition. Less than 1 acre of the Riparian Reserve vegetation that would be cleared in the East Fork of the Coquille is LSOG. The remaining 3 acres that would be cleared is all early seral vegetation.

Off-site mitigation would further offset pipeline project impacts in the watershed. Logs generated in the corridor clearing process or otherwise provided by Pacific Connector would be used as LWD placed at 80 pieces/mile in 2.8 miles of instream projects to restore aquatic habitats. Approximately 5.5 miles of road surfacing projects in the South Fork of Elk Creek and Yankee Run Creek would greatly reduce transport of sediments to nearby aquatic habitats. Reallocation of approximately 180 acres of Matrix lands to LSR would provide additional aquatic protections to streams that are within the reallocation area. These off-site mitigation measures identified by BLM would supplement on-site minimization, mitigation, and restoration actions. Mitigations associated with the pipeline project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.3.6.7). Table 4.1.3.5-8 describes proposed off-site mitigation measures in the East Fork Coquille River Watershed.

TABLE 4.1.3.5-8

Proposed Off-site Mitigation Measures in the East Fork Coquille River Watershed

Project Type	Mitigation Group	Project Name	Qty.	Project Rationale
Road Surfacing	Road Sediment Reduction	Road Surfacing – South Fork Elk Creek	2.6 miles	Road-related sediment has negatively affected the East Fork Coquille. Improvement of existing roads restores hydrologic connectivity and reduces sediment by managing drainage and restoring surfacing where needed.
Road Surfacing	Road Sediment Reduction	Road Surfacing – Yankee Run Mainline	2.0 miles	Surfacing the BLM road that is parallel to the South Fork Elk Creek would reduce if not eliminate sediment input to adjacent Chinook, coho, steelhead, and cutthroat habitat.
Road Surfacing	Road Sediment Reduction	Road Surfacing – Yankee Run Spurs	0.9 miles	Surfacing the BLM road that is parallel to Yankee Run Creek would reduce if not eliminate road-related sediment input to coho, steelhead, and cutthroat habitat.
LWD instream	Aquatic Habitat	Yankee Run In-stream Large Wood Placement	2.75 miles	Lack of large woody debris (LWD) and recruitment of LWD into streams is a consistent factor limiting aquatic habitat quality in all watersheds crossed by the pipeline project. Implementation of the pipeline project would result in the removal of large woody debris from the Riparian Reserves associated with intermittent and perennial streams. The removal of vegetation within and adjacent to the channel will preclude future recruitment of large woody debris into the channel and associated Riparian Reserves. Placing LWD at key locations within the channel and associated Riparian Reserves would offset both the short-term and long-term effects from loss of LWD recruitment to Riparian Reserves and associated aquatic and riparian habitat and contributes to the accomplishment of Aquatic Conservation Strategy (ACS) objectives.
Fire Suppression	Fire Suppression	Heli-Pond Construction	2 sites	High intensity fire has been identified as the single factor most impacting late-successional and old-growth (LSOG) forest habitats on federal lands in the area of the Northwest Forest Plan (NWFP). Construction of the pipeline and associated activities removes both mature and developing stands and will increase fire suppression complexity, however the corridor also provides a fuel break. Within the East/Middle Fork subwatersheds, there is an 18+ mile gap between helicopter accessible waterholes. Quick response time is imperative for successful control in wildfire situations during initial attack. Most water sources in this area are low in the drainage and accessible only by truck. Heli-ponds at these locations would enable a 2-3 mile radius for aerial application. Fire control is necessary to protect LSRs and endangered species habitat should a wildfire occur.

TABLE 4.1.3.5-8

Proposed Off-site Mitigation Measures in the East Fork Coquille River Watershed

Project Type	Mitigation Group	Project Name	Qty.	Project Rationale
Land Re-Allocation from Matrix to LSR Non-Federal Land Acquisition	Acquisition	LSR Reallocation & Land Acquisition	180 acres	This action contributes to the "neutral to beneficial" standard for new developments in mapped and unmapped Late Successional Reserves (LSRs) by adding acres to the LSR land allocation to offset the long-term loss of habitat due to the construction and operation of the pipeline project. The action also compensates for the removal of occupied marbled murrelet habitat and suitable spotted owl habitat. In addition, the selected parcel reduces the potential edge effects caused by management of Matrix lands adjacent to occupied murrelet sites by reallocating the entire parcel to LSR.

The proposed amendment of the Coos Bay RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the Pacific Connector pipeline does not threaten the persistence of any riparian-dependent species. (appendix J, section 2.3.6.6). All relevant pipeline project impacts are within the range of natural variability for watersheds in the Coast Range Province (appendix J, section 2.3.6.3). No project impacts have been identified that would prevent attainment of ACS objectives (appendix J, section 2.3.6.8).

Middle Fork Coquille River Watershed

Project Impacts by ACS Objectives

Table 4.1.3.5-9 compares the Pacific Connector pipeline impacts to the objectives of the ACS for the Middle Fork Coquille River watershed. There are eight stream channel crossings, and seven locations where Riparian Reserves would be clipped by the construction clearing, but the stream channel would not be crossed by the pipeline trench. Approximately 25 acres of Riparian Reserves, or 0.10 percent of the Riparian Reserves in the watershed, would be cleared and 1 acre would be modified in UCSAs (appendix J, table 2.3.7.1-3). Stream channel intersections with the Pacific Connector pipeline corridor would occur in two separate subwatersheds approximately 10 miles apart (appendix J, figure 2.3.7.1-1). In the Big Creek subwatershed, six intermittent streams and one perennial stream would be crossed between MP 35.9 and MP 37.35; three of the intermittent stream crossings are associated with an existing road. Approximately 10 miles away in the Headwaters Middle Fork Coquille subwatershed, one perennial and one intermittent stream would be crossed. Watershed conditions and recommendations are described in the Middle Fork Coquille Watershed Analysis (BLM 1999a) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-9

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Middle Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features that would be affected by the pipeline project. Within the Middle Fork Coquille River watershed, the pipeline would cross two perennial streams (tributary of Big Creek MP 37.35 and Deep Creek MP 48.27). These perennial crossings are in different subwatersheds and are miles apart. Seven intermittent streams would be crossed. Six of these are in the Big Creek subwatershed, of which three are co-located with existing crossings in roads. One intermittent stream crossing is in the Deep Creek subwatershed. The pipeline corridor, hydrostatic test and temporary extra work areas (TEWAs) would clear 96 acres or about 0.18percent (appendix J, table 2.3.7.1-2) of the BLM lands in the watershed, of which 25 acres are Riparian Reserves (appendix J, table 2.3.7.1-4). This amount is about 0.10 percent of the Riparian Reserves in the watershed (appendix J, table 2.3.7.1-3). Applying the estimate from the Upper Middle Fork subwatershed that 29 percent of the Riparian Reserves are late successional and old growth (LSOG), there are approximately 6,800 acres of LSOG in Riparian Reserves (appendix J, table 2.3.7.1-1: 23,703.15*.29=6,873) in the Middle Fork Coquille River watershed on BLM lands. Approximately 3 acres of LSOG vegetation or 0.05 percent of estimated LSOG in Riparian Reserves would be cleared. Over 3 miles of the corridor on BLM lands in the watershed are located on or adjacent to existing roads. Impacts to aquatic systems are expected to be short term and minor because of application of best management practices, erosion control measures, and anticipated rapid revegetation of disturbed areas. Impacts of the pipeline project are expected to be within the range of natural variability for natural disturbance processes in the Coast Range Province (appendix J, table 2.3.7.4-2). Approximately 35 percent of the BLM lands in the Middle Fork Coquille watershed are LSOG (appendix J, Data Summaries, table 3.7-1).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	Wherever possible, the pipeline project is proposed to be on roads and ridgetops to minimize crossings of stream channels and Riparian Reserves. No forested wetlands outside of stream crossings would be affected by the project in the Middle Fork Coquille River watershed. The pipeline project is not expected to affect spatial or temporal connectivity in the watershed because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the exhibits specified in the *Wetland and Waterbody Crossing Plan*. At each crossing, bed and bank disturbances would be small (<15 feet wide). After construction, key habitat components such as large woody debris (LWD) and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized. Proposed mitigation projects would improve aquatic connectivity by repairing culverts that currently preclude passage of aquatic organisms. The residual levels of disturbance are anticipated to be well within the range of natural variability in the Coast Range Province.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project corridor would cross seven intermittent streams and two perennial fish-bearing streams in the Middle Fork Coquille River watershed. Impacts to the bed and banks of these features would be minor and limited to the site of construction because the pipeline would be buried and the actual area of bank and stream bottom disturbance is small at each crossing (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the *Wetland and Waterbody Crossing Plan*. By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained, although during construction, streambanks and bottoms would be disturbed. Given the fire and landslide history of the Coast Range Province, this level of disturbance is well within the range of natural variability for the Middle Fork Coquille River watershed.

TABLE 4.1.3.5-9

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Middle Fork Coquille River Watershed

ACS Objective	Project Impacts
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment would be mobilized during construction, particularly during the dry open-cut crossing (i.e., dam and pump) of tributaries to Big Creek and Deep Creek that are perennial streams. These impacts are expected to be short term and limited to the general area of construction (see appendix J, section 1.3.1). No long-term impacts on water quality are expected because of the rapid regrowth of vegetation typical of the Coast Range Province and application of the ECRP and best management practices during construction. A small amount of shading vegetation would be removed where the corridor would cross perennial tributaries of Deep Creek and Big Creek.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in corridor routing (GeoEngineers 2009a). Dry open-cut stream crossings would be used to cross stream channels (see appendix J, section 1.3.1). Any sediment impacts are expected to be minor and short term and well within the range of natural variability for the Coast Range Province due to application of the POD, including best management practices for water quality, restoration of bank and bottom configurations, LWD placement, and erosion control along with the anticipated rapid revegetation characteristic of the Coast Range Province. Potential for cumulative sediment impacts exists in Big Creek because of the close proximity of channel crossings. If project monitoring detects cumulative sediment impacts, Pacific Connector would be required to take corrective actions to reduce sediment to background levels. Road repairs would also help reduce road-related sediment in the watershed, thereby moving the sediment regime closer to the desired condition.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	On streams with flowing water at the time of crossing, the dam-and-pump method (described in appendix J, section 1.3.1) would be used to maintain flows in the channel downstream of the crossing. No alterations of flows resulting from construction beyond the short-term, site-scale level are anticipated. The pipeline corridor would occupy about 0.14 percent of the Middle Fork Coquille River watershed (appendix J, table 2.3.7.1-2). It is highly unlikely that any impacts in of this scale would affect the timing, magnitude, and duration of peak flows in the watershed, especially in light of other past and ongoing human activities (appendix J, section 1.3.1.6). The pipeline project would not create the kinds of conditions (e.g., large openings with many stream connections) that historically altered peak flows.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	No wet meadows would be crossed in the Middle Fork Coquille River watershed. Floodplain crossings associated with perennial streams are narrow and likely consist of unconsolidated landslide deposits where the water table fluctuates seasonally. Channel breakers (internal plugs) would be installed so that the trench would not lower the water table if wet areas are encountered during floodplain crossings. The pipeline project would not affect water tables in wet meadows and floodplains in the Middle Fork Coquille River watershed. Instream LWD mitigation projects would improve stream channel conditions and help restore floodplain connectivity where these mitigation projects occur.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Project impacts on riparian vegetation in the Middle Fork Coquille River watershed would be minor. In the short term, all vegetation would be removed from the Project corridor, including about 25 acres of Riparian Reserves (appendix J, table 2.3.7.1-3). This is about 0.10 percent of the Riparian Reserves in the watershed (appendix J, table 2.3.7.1-3). Approximately 3 acres of LSOG vegetation or 0.05 percent of estimated LSOG vegetation in Riparian Reserves in the Middle Fork Coquille River watershed would be cleared for the Project corridor and temporary extra work areas (appendix J, table 2.3.7.1-4). Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Stream temperatures and sediment regimes are not expected to change as a result of the Project (see previous discussions). Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. These restoration efforts would help maintain and restore the biological and physical functions of the Riparian Reserves in the watershed.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Project impacts on riparian vegetation in the Middle Fork Coquille River watershed would be minor 25 acres or 0.10 percent of the Riparian Reserves in the watershed). Early-seral (6 acres and mid-seral (5 acres) comprise most of the Riparian Reserve vegetation that would be cleared. Existing herbaceous and brush cover within the Project clearing limits would be maintained to the extent practicable. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline project construction and operation in the watershed (see appendix K of this EIS).

Summary, Middle Fork Coquille River Watershed

The routing of the Pacific Connector pipeline through BLM lands, coupled with the relatively small area of BLM lands that would be affected by pipeline construction (approximately 107 acres or 0.18 percent of the BLM lands in the fifth-field watershed [appendix J, table 2.3.7.1-2]), make it highly improbable that pipeline project impacts would affect conditions at the subwatershed or watershed scale. Although there are site-level impacts (e.g., small amounts of sediment and a change in vegetative condition at stream crossings), these would be minor and largely limited to the project area and well within the range of natural variability for disturbance processes in the Coast Range Province (appendix J, section 2.3.7.4).

Widely separated small changes in vegetative condition in Riparian Reserves (approximately 26 acres or 0.10 percent of Riparian Reserves in the Middle Fork Coquille River watershed) would have long-term but minor impacts. This level of vegetation change is well within the range of natural variability given the fire and landslide history of the Coast Range Province (see appendix J, sections 2.1.1 and 2.3.7.4.). Reforestation and revegetation with appropriate riparian vegetation would restore the terrestrial riparian environment over time. The probability of accumulation of impacts on BLM lands between stream crossings in the Big Creek subwatershed and stream crossings in the Headwaters Middle Fork Coquille River subwatershed is very low because of the wide separation of pipeline project impacts.

Off-site mitigation would further reduce pipeline project impacts. Instream LWD projects would contribute to the restoration of 2.7 miles of perennial fish-bearing streams. Approximately 4.4 miles of road surfacing and repair projects would substantially reduce transport of sediments to nearby aquatic habitats. Paving of selected stretches of road would further reduce potential sediments. These off-site mitigation measures identified by BLM would supplement on-site minimization, mitigation, and restoration actions. Mitigations associated with the pipeline project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.3.7.6). Table 4.1.3.5-10 describes

TABLE 4.1.3.5-10

Proposed Off-site Mitigation Measures in the Middle Fork Coquille River Watershed

Project Type	Mitigation Group	Project Name	Project Rationale	Quantity	Unit
Fire suppression	Fire suppression	Heli-Pond construction	High intensity fire has been identified as the single factor most impacting late-successional and old-growth forest habitats on federal lands in the area of the Northwest Forest Plan (NWFP). Construction of the pipeline and associated activities would remove both mature and developing stands and would increase fire suppression complexity; however, the corridor would also provide a fuel break. Within the East/Middle Fork watersheds, there is an 18+ -mile gap between helicopter accessible waterholes. Quick response time is imperative for successful control in wildfire situations during initial attack. Most water sources in this area are low in the drainage and accessible only by truck. Heli-ponds at these locations would enable a 2-3 mile radius for aerial application. Fire control is necessary to protect Late Successional Reserves (LSRs) and endangered species habitat should a wildfire occur.	1	ea.

TABLE 4.1.3.5-10

Proposed Off-site Mitigation Measures in the Middle Fork Coquille River Watershed

Project Type	Mitigation Group	Project Name	Project Rationale	Quantity	Unit
Land Re-Allocation from Matrix to LSR Non-Federal Land Acquisition	Acquisition	LSR Reallocation& Land Acquisition	This action contributes to the "neutral to beneficial" standard for new developments in mapped and unmapped LSRs by adding acres to the LSR land allocation to offset the long-term loss of LSR habitat due to the construction and operation of the Pacific Connector pipeline. The action also compensates for the removal of occupied marbled murrelet habitat and suitable roosting, nesting, and foraging habitat for northern spotted owls. In addition, the selected parcel reduces the potential edge effects caused by management of Matrix lands adjacent to occupied murrelet sites by reallocating the entire parcel to LSR.	207	acres
LWD instream	Aquatic Habitat	Upper Rock Creek In-stream Large Wood Placement	Lack of large wood and recruitment of large woody debris (LWD) into streams is a consistent factor limiting aquatic habitat quality in all watersheds crossed by the Pacific Connector pipeline. There are approximately 7.3 miles of corridor, 9 stream crossings. Implementation of the pipeline project would result in the removal of LWD from the Riparian Reserves associated with intermittent and perennial streams. The removal of vegetation within and adjacent to the channel will preclude future recruitment of large woody debris into the channel and associated Riparian Reserves. Placing LWD at key locations within the channel and associated Riparian Reserves would offset both the short-term and long-term effects from loss of LWD recruitment to Riparian Reserves and associated aquatic and riparian habitat and contributes to the accomplishment of Aquatic Conservation Strategy (ACS) objectives.	2.1	miles
LWD instream	Aquatic Habitat	Middle Fork Coquille LWD Placement		0.6	miles
Road Drainage and Surface Enhancement	Road Sediment Reduction	Camas Mountain Road Drainage and Surface Enhancement	Road-related sediment and stream network extension from ditchlines have negatively affected the Middle Fork Coquille. There are approximately 7.3 miles of corridor and 9 stream crossings in the Middle Fork Coquille. Roads do not meet current best management practices and are a source of chronic sediment delivery to fish bearing streams. The 9.1 and 9.2 roads currently show signs of water rutting and stream network extension. Stormproofing and blocking the road will reduce the potential for sediment-laden water to be carried off the road surface and into the ditch where it could be transmitted to the stream network. Surfacing the BLM road that is parallel to Fall Creek would reduce if not eliminate sediment input to coho, steelhead, and cutthroat habitat. Surfacing the bridge approach would reduce if not eliminate sediment input to coho, steelhead, and cutthroat habitat from this location.	3.5	miles
		Dice, Boulder, and Twelvemile Creek road systems		11	miles
Road Surfacing	Road Sediment Reduction	Road Surfacing -Fall Creek System		0.9	miles
Road Surfacing	Road Sediment Reduction	Bridge Approach paving -Sandy & Jones Creek Roads		2	ea.

proposed off-site mitigation measures in the Middle Fork Coquille River watershed. Proposed amendments of the Coos Bay RMP and the Roseburg District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the Pacific Connector pipeline does not threaten the persistence of any riparian-dependent species (appendix J, section 2.3.7.5). All relevant pipeline project impacts are within the range of natural variability for watersheds in the Coast Range Province (appendix J, section 2.3.7.4). No project-related impacts that would prevent attainment of ACS objectives have been identified (appendix J, section 2.3.7.8).

Olalla Creek–Lookingglass Creek Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-11compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Olalla Creek–Lookingglass Creek watershed. The pipeline project corridor would not intersect any waterbodies or Riparian Reserves on federal land in this watershed. No direct or indirect impacts on riparian resources in this watershed have been identified. Watershed conditions and recommendations are described in the Olalla-Lookingglass Watershed Analysis (BLM 1998a) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-11

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Olalla Creek–Lookingglass Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	The pipeline project watershed would have minimal impact on landscape-level features in the Olalla-Lookingglass Creek because it would affect 0.09 percent (about 9 acres out of 10,000 acres) of the federal land on the watershed. No Riparian Reserves in the watershed would be affected.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project would have no stream intersections in the Olalla-Lookingglass Creek watershed; therefore, it would have no impact on connectivity in aquatic and riparian species habitats.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project would not affect streambanks or stream bottoms in the Olalla-Lookingglass Creek watershed because the Project would not intersect stream channels.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	The pipeline project has no stream intersections in the Olalla-Lookingglass Creek watershed; therefore, it would have low impact on aquatic- and riparian-dependent species.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The pipeline project would not affect the sediment regime in aquatic habitats on the Olalla-Lookingglass Creek watershed because of the limited scale of the Project, application of Best Management Practices and other requirements of the *Erosion Control and Revegetation Plan*, lack of intersections with stream channels, and absence of riparian impacts.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project would not affect instream flows on the Olalla-Lookingglass Creek watershed because there would be no stream intersections.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project would not affect floodplains and water table elevations in meadows and wetlands in the Olalla-Lookingglass Creek watershed because there would be no intersections with these features.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	The pipeline project would not affect species composition and structural diversity of Riparian Reserves in the Olalla-Lookingglass Creek watershed because no Riparian Reserves would be affected by the project.

TABLE 4.1.3.5-11

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Olalla Creek–Lookingglass Creek Watershed

ACS Objective	Project Impacts
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	The pipeline project would not affect any riparian-dependent species on the Olalla-Lookingglass Creek watershed because no Riparian Reserves would be affected by the project.

Summary, Olalla-Lookingglass Creek Watershed

Given the location of the Pacific Connector pipeline corridor on BLM lands, the lack of intersections with waterbodies, and the absence of Riparian Reserve impacts, it is highly unlikely that pipeline construction and operation would negatively affect watershed conditions on BLM land in the Olalla-Lookingglass Creek watershed. No pipeline project impacts relevant to ACS objectives have been identified that are outside the current range of natural variability for the watershed (appendix J, section 2.4.3.4). Proposed amendments of the Roseburg District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.4.3.5). Mitigations associated with the Project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.4.3.6). Table 4.1.3.5-12 shows proposed off-site mitigations in the Olalla-Lookingglass watershed.

TABLE 4.1.3.5-12

Proposed Off-site Mitigation Projects for the Olalla-Lookingglass Watershed

Project Type	Mitigation Group	Project Name	Project Rationale
Land Re-Allocation from Matrix to LSR Non-Federal Land Acquisition	Acquisition	LSR Reallocation and Land Acquisition	This mitigation contributes to the "neutral to beneficial" standard for new developments in LSRs by adding acres to the Late Successional Reserve (LSR) land allocation to offset the long-term loss of acres and related habitat from the construction and operation of the Pacific Connector pipeline. It also contributes to objectives of the Aquatic Conservation Strategy (ACS) by managing forests for late-successional stand conditions (Forest Service and BLM 1994b: B-12).
Road Stabilization	Road Sediment Reduction	Olalla Tie Road Renovation	Transport of road sediment to stream channels is a primary concern in the Olalla-Lookingglass watershed. Many existing roads do not meet current best management practices and serve as sources of chronic sediment delivery to fish bearing streams. General renovation of the Olalla Tie Road (e.g., resurfacing and drainage channel repair, along with stabilization of several landslides that cross the road) will reduce the delivery of road-related sediments to stream channels.

Clark Branch–South Umpqua River Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-13 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Clark Branch–South Umpqua River watershed. The pipeline project corridor would not intersect any waterbodies or Riparian Reserves on federal land in the Clark Branch–South Umpqua River watershed. Watershed conditions and recommendations are described in the Middle South Umpqua Watershed Analysis (BLM 1999b) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-13

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Clark Branch-South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	The pipeline project would have a low impact on landscape-level features in the Clark Branch–South Umpqua River watershed because it would clear only 0.01 acre of Riparian Reserves (less than 0.01 percent of the watershed) and would affect 0.16 percent of the federal land on the watershed.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project has no stream intersections in the Clark Branch-South Umpqua River watershed; therefore, it would have no impact on connectivity in aquatic and riparian species habitats.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project would not affect streambanks or stream bottoms in the Clark Branch-South Umpqua River watershed because the project would not intersect stream channels.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	The pipeline project would have no stream intersections in the Clark Branch-South Umpqua River watershed; therefore, it would have no impact on aquatic- and riparian-dependent species.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The pipeline project would not affect the sediment regime in aquatic habitats on the Clark Branch-South Umpqua River watershed because of the limited scale of the Project, application of best management practices and other requirements of the *Erosion Control and Revegetation Plan*, lack of intersections with stream channels, and absence of riparian impacts.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project would not affect instream flows on the Clark Branch-South Umpqua River watershed because there would be no stream intersections and clearing in the Transient Snow Zone would be minimal.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project would not affect floodplains and water table elevations in meadows and wetlands in the Clark Branch–South Umpqua River watershed because there would be no intersections with these features.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	The pipeline project would not affect species composition and the structural diversity of Riparian Reserves in the Clark Branch-South Umpqua River watershed because no Riparian Reserves would be affected by the Project.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	The pipeline project would not affect any riparian-dependent species in the Clark Branch–South Umpqua River watershed because no Riparian Reserves would be affected by the project.

Summary, Clark Branch–South Umpqua River Watershed

Given the location of the pipeline project corridor on BLM lands, the lack of intersections with waterbodies, and the absence of impacts on Riparian Reserve, it is highly unlikely that project construction and operation would prevent attainment of the ACS objectives in this watershed (appendix J, section 2.4.4.8). Proposed amendments of the Roseburg District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.4.3.5). No pipeline project impacts relevant to ACS objectives have been identified that are outside the current range of natural variability for the watershed (appendix J, section

2.4.4.4). Mitigations associated with the pipeline project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.4.4.6). Table 4.1.3.5-14 shows proposed off-site mitigations in the Clark Branch–South Umpqua River watershed.

TABLE 4.1.3.5-14

Proposed Off-site Mitigation Projects for Clark Branch-South Umpqua Watershed

Project Type	Mitigation Group	Project Name	Project Rationale
Fish Passage	Fish Passage	Rice Creek Culvert Replacements	Man-made barriers to fish passage, such as culverts not designed for fish passage, malfunctioning and plugged culverts, have restricted access of fish populations to quality upland habitat in the Clark Branch-S. Umpqua watershed. If one of these small, old culverts were to plug up with debris, road fill might enter the stream network. Replacing these faulty culverts with well-designed crossing structures that allow passage of adult and juvenile salmonids through the stream crossing at a range of flows will extend the availability of upstream habitat. This contributes to reestablishing historic connectivity with habitat in the watershed.
Road Drainage	Road Sediment Reduction	East Fork Willis Creek Tributary Culvert Replacement	Sediment is one of the primary water quality problems identified in the Middle South Umpqua watershed assessment on the Clark Branch-S. Umpqua watershed. Analyses clearly indicated that the sediment-turbidity habitat indicator is at risk or more likely not functioning properly. This particular culvert on the East Fork of Willis Creek is old, undersized, shot-gunned, plugged with debris, and eroding the road fill. The culvert also has poor alignment with the stream at the outlet. Replacing the culvert with a properly sized one will reduce the risk of road fill failure.
Road Drainage	Road Sediment Reduction	Judd Creek Culvert Removal	This culvert is undersized and there is a large amount of road fill associated with it. Were the culvert to become plugged, fluxes of sediment to the channel and deposition downstream in fish bearing reaches could occur. Pulling the culvert and fill material and storm proofing the road would prevent such sediment dynamics. In addition, the road is blocked by a landslide just beyond. Access to the stream crossing is gradually being lost due to soil slumping and vegetation growth. Implementing this project also means that access to the crossing will not be lost.

Myrtle Creek Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-15 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Myrtle Creek watershed. The pipeline project corridor would not intersect any waterbodies on federal land in the Myrtle Creek watershed. One Riparian Reserve is clipped by the construction corridor, which would result in approximately one acre of clearing. Approximately three acres would be modified by UCSAs. Watershed conditions and recommendations are described in the Myrtle Creek Watershed Analysis and Water Quality Restoration Plan (BLM 2002c) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-15

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Myrtle Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	The pipeline project is not expected to affect landscape-scale features on BLM lands in the Myrtle Creek watershed because of Project routing and the limited nature of Project impacts. The pipeline corridor would clear approximately 44 acres or 0.14 percent of the federal land on the Myrtle Creek watershed and approximately one acre of Riparian Reserves (appendix J, table 2.4.5.1-1-3). Any impacts on aquatic systems are expected to be localized, short term, and minor because of the lack of intersects with aquatic systems, application of best management practices and erosion control measures, and the anticipated rapid revegetation of disturbed areas. Impacts of the pipeline project are expected to be within the range of natural variability for natural disturbance processes in the Klamath-Siskiyou Province (appendix J, section 2.4.5.4).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the Myrtle Creek watershed because there would be no stream crossings and Riparian Reserve impacts would be minimal. Aquatic system connectivity would be enhanced by repairs to culverts on Slide Creek that currently preclude passage of anadromous fish species and other aquatic organisms. Any residual levels of disturbance are anticipated to be minor, short-term and well within the range of natural variability in the Klamath-Siskiyou Province (appendix J, section 2.4.5.4).
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project would not affect streambanks or stream bottoms in the Myrtle Creek watershed because the project would not intersect stream channels or riparian habitat directly bordering the channels.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment could be mobilized during construction, but the impacts of the sediment are expected to be short term and limited to the immediate area. Since no streams would be crossed, riparian impacts would be minimal. With application of the *Erosion Control and Revegetation Plan* and best management practices during construction, there should be no long-term impacts associated with sediment transport or elevated temperatures due to reduced shading. Minor amounts of riparian vegetation adjacent to the two intermittent tributaries would be affected; however, the tributaries would likely be dry at the time of construction and would not contribute to the temperature balance of downstream reaches during the critical summer season. Road stabilization, drainage enhancement, and surface upgrade mitigation projects are expected to contribute to improvements in overall watershed condition.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in corridor routing. The landslide on South Myrtle Hill would be cleaned up and the hill stabilized as part of off-site mitigation. No streams would be crossed and only a very minor amount of riparian vegetation would be affected. Any sediment impacts are expected to be minor and short term (e.g., first wet season) and well within the range of natural variability for the Klamath-Siskiyou Province due to application of POD best management practices and the anticipated rapid revegetation that is characteristic of the province. As a result, potential sediment impacts would be kept to negligible levels. Road repairs and drainage enhancements would help reduce sediment impacts on the watershed, thereby moving the sediment regime closer to the desired condition.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project would not affect instream flows because there would be no stream intersections and very minor riparian zone impacts. All of the drainages in the watershed are more than 75 percent hydrologically recovered (BLM 2002c:114). The pipeline project would affect less than 1 percent of the watershed; therefore, clearing associated with the project is unlikely to affect peak flows. The pipeline project is unlikely to affect flow regimes because of the extent of hydrologic recovery in the watershed, corridor routing along ridgetops, the limited acreage of the project, and lack of stream connectivity.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project would not affect floodplains and water table elevations in meadows because there would be no intersections with these features and no change to stream morphology or functioning that would cause abandonment of floodplains (e.g., by down cutting).

TABLE 4.1.3.5-15

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Myrtle Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Pipeline project impacts on riparian vegetation in the Myrtle Creek watershed would be minor. Overall, pipeline construction would affect less than half an acre of the Riparian Reserves in the watershed. Following construction, replanting with native species would facilitate reestablishment of riparian communities.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Pipeline project impacts on riparian vegetation in the Myrtle Creek watershed would be minor (less than half an acre) and would occur in early to mid-seral stages of forest growth in upland areas adjacent to intermittent creeks. Large woody debris from corridor clearing would be placed in riparian zones to increase habitat diversity. Revegetation of conifer forest communities would be encouraged by planting of native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline project construction and operation in the watershed (see appendix K of this EIS).

Summary, Myrtle Creek Watershed

Given the location of the Pacific Connector pipeline corridor on BLM lands, the lack of intersections with waterbodies, and the small area of Riparian Reserves affected, it is highly unlikely that pipeline project construction and operation would adversely affect watershed conditions on BLM land in the Myrtle Creek watershed. No pipeline project impacts relevant to the ACS objectives have been identified that are outside the current range of natural variability for the watershed (appendix J, section 2.4.5.4). Mitigations associated with the pipeline project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.4.5.6). Table 4.1.3.5-16 shows proposed off-site mitigations in the Myrtle Creek watershed.

TABLE 4.1.3.5-16

Proposed Off-site Mitigation Projects for Myrtle Creek Watershed

Project Type	Mitigation Group	Project Name	Project Rationale
Fish Passage	Fish Passage	Slide Creek Culvert Replacement	Man-made barriers to fish passage have negatively affected access to habitat in the Myrtle Creek watershed. The existing culvert on Slide Creek is perched, undersized, and a barrier to anadromous and resident fish passage. Replacing this culvert with one that will pass adult and juvenile salmonids at a range of flows will extend the availability of upstream habitat, mitigating unavoidable effects to habitat quality on stream reaches crossed by the pipeline corridor. In addition, old, undersized culverts like this one are at risk of failure. Culvert plugging could cause bank topping and the transport of road fill to the stream network.
Road Stabilization	Road Sediment Reduction	South Myrtle Hill Slide Repair	Sediment in streams resulting from road-related landslides is a limiting factor in the Myrtle Creek watershed. The South Myrtle Hill Road has been affected by upslope failure and landslides. Stabilizing these upslope areas will help reduce the potential for catastrophic slope failure and related sediment delivery to downslope and nearby aquatic habitats.
Road Drainage and Surface Enhancement	Road Sediment Reduction	Slide Creek Road Drainage and Surface Enhancement	Sediment in streams is a major concern in the Myrtle Creek watershed. Many roads on the watershed do not meet current best management practices and, as such, are sources of chronic sediment delivery to fish bearing streams. Surfacing and drainage repair to about 1.0 miles of Ben Branch Road would help reduce sediment delivery to a fish bearing stream.

Proposed amendment of the Roseburg District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian dependent species (appendix J, section 2.4.5.8). All relevant pipeline project impacts are within the range of natural variability for watersheds in the Coast Range Province (appendix J, section 2.4.5.4). No project effects have been identified that would prevent attainment of ACS objectives (appendix J, section 2.5.4.8).

Days Creek–South Umpqua River Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-17 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Days Creek–South Umpqua River watershed. The pipeline project would cross two ridgetop wetland swales affecting approximately one-quarter of an acre of forested wetlands and clear approximately 8.4 acres of Riparian Reserves, but would not cross any stream channels. The Riparian Reserves of five intermittent streams would be clipped, clearing approximately 0.5 acres in the Days Creek-South Umpqua River watershed. All affected Riparian Reserves are near ridgetops. The intermittent streams associated with them would likely be dry during construction. The two wetlands are ridgetop swales that have no apparent surface connection to stream channels. Watershed conditions and recommendations are described in the South Umpqua Watershed Analysis and Water Quality Restoration Plan (BLM 2001) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-17

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Days Creek–South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features that would be affected by the pipeline project. The pipeline corridor would impact 0.31 percent of the BLM land and 1.89 percent of the NFS land on the Days Creek–South Umpqua River watershed. Approximately 8.4 acres of Riparian Reserves would be cleared (0.04 percent of Riparian Reserves on federal lands). Nearly all of the vegetation cleared is mid-seral. While the cutting of trees where the corridor intersects Riparian Reserves would result in a long-term change in vegetation condition, it would be minor in scale and well within the range of natural variability for vegetative change given the fire history of the Days Creek–South Umpqua River watershed. The application of Best Management Practices (BMPs) and erosion control measures, use of native vegetation, and the anticipated rapid revegetation of disturbed areas would likely further reduce Project impacts. The level of impacts is well within the range of natural variability for disturbance processes described by Everest and Reeves (2007) and Agee (1993) and as documented in the South Umpqua River watershed assessment (BLM 2001). The Days Creek South Umpqua watershed is approximately 32 percent late successional and old growth (LSOG) forest (appendix J, Data Summary, table 3.7-1).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the Days Creek–South Umpqua River watershed. No streams would be crossed, and impacts on Riparian Reserve impacts would be minimal. Aquatic system connectivity would be enhanced by replacement of culverts on Beal Creek that currently preclude passage of anadromous fish species and other aquatic organisms. Any residual levels of disturbance are anticipated to be well within the range of natural variability.

TABLE 4.1.3.5-17

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Days Creek–South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project would have no discernible impact on streambanks or bottoms in the Days Creek–South Umpqua River watershed because no stream channels would be crossed. The few impacts on Riparian Reserve are associated with near ridge top intermittent streams or ridgetop (wetland) swales that have no apparent surface connectivity to the drainage system and, therefore, little influence on the physical integrity of the aquatic system. Off-site mitigation measures involving large woody debris (LWD) and boulder placement in several miles of stream channel would help restore physical integrity and complexity.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Sediment impacts are expected to be as described in appendix J, section 1.3.1. Minor amounts of sediment would be mobilized during construction, but these impacts are expected to be short term and limited to the immediate project area. Connectivity to aquatic systems is limited since no stream channels would be crossed. With application of the *Erosion Control and Revegetation Plan* (ECRP)and BMPs, no long-term impacts associated with sediment transport are anticipated. No impacts on water temperature are expected because no channels would be crossed and no effective shade would be removed. Any sediment transport to aquatic systems that may occur would be offset by mitigation projects involving off-site road drainage enhancement, surface upgrade, and storm proofing. The intermittent tributaries located adjacent to the Riparian Reserve vegetation that would be affected would likely be dry at the time of construction and would not contribute to the temperature balance of downstream reaches during the critical summer season.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in corridor routing. There would be no stream channels crossed in the watershed; because the route lies on a ridgetop, connections to aquatic systems that would transport sediment are limited. All waterbodies adjacent to affected Riparian Reserves are expected to be dry during construction. Sediment fluxes are expected to be minor, short term, and well within the range of natural variability for the Klamath-Siskiyou Province with implementation of the erosion control measures in ECRP and BMPs as well as the anticipated rapid revegetation that is characteristic of the Province. Erosional impacts are therefore expected to be consistent with those described in appendix J, section 1.3.1. Road repairs and storm proofing would help reduce sediment impacts in the watershed and move the sediment regime closer to the desired condition.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	It is highly unlikely that the pipeline project would affect flows because of limited connectivity to aquatic systems. The pipeline routing is on a ridgetop in the watershed and would not cross any stream channels. The watershed is hydrologically recovered (BLM 2001:143) and the corridor would affect 0.46 percent of the watershed (appendix J, table 2.4.6.1-2) so changes in peak flows as a result of construction are highly unlikely.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	Two small forested wetlands would be crossed in or near a ridgetop swale in the Stouts Creek subwatershed at MP 102.1 and 102.2. Trench plugs would be installed on each side of these wetlands to block subsurface flows and maintain water table elevations, as required by the FERC's *Wetland and Waterbody Construction and Mitigation Procedures*. By restricting crossings to the dry season (July 1 to Sept. 15), possible impacts on water tables of these wetland areas are expected to be minor and short-term. These features appear to have no surface connectivity with the Stouts Creek drainage network.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Approximately 8.43 acres or approximately 0.04 percent of Riparian Reserves in the watershed would be cleared by the pipeline project. All affected Riparian Reserves are located at or near ridgetops and contribute little to the thermal regulation, nutrient filtering, bank erosion and channel stability of the drainage networks on the watershed. Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Replanting with native species would facilitate recovery of vegetation communities. LWD and boulder placement in and adjacent to 1.2 miles of stream channel as part of off-site mitigation would help to enhance physical complexity of the aquatic habitats. These restoration efforts, along with the limited impacts on which they are directed, would maintain and restore biological and physical functions of the Riparian Reserves on the watershed.

TABLE 4.1.3.5-17

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Days Creek–South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Pipeline project impacts on riparian vegetation on BLM land in the Days Creek–South Umpqua River watershed would be minor (approximately 8.4 acres cleared) and occur largely in early to mid-seral stages forests along ridgetops. Impacts to ridgetop swale wetlands total less than one acre. Existing herbaceous and brush cover would be maintained to the extent practicable. To maintain riparian habitat, construction Best Management Practices would be implemented. LWD and boulders would be placed in channels and adjacent riparian areas and along 1.2 miles of watershed streams to restore and stabilize channel crossings. Revegetation would be encouraged by planting of native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

Summary, Days Creek–South Umpqua River Watershed

Given the location of the Pacific Connector Pipeline Project corridor on BLM lands, the relative lack of intersections with waterbodies and the small acreage of Riparian Reserve affected, it is highly unlikely that pipeline construction and operation would prevent attainment of ACS objectives on BLM land in the Days Creek–South Umpqua River watershed. No pipeline project impacts relevant to the ACS have been identified that are outside of the range of natural variability for disturbance processes in the watershed (appendix J, section 2.4.6.4). Proposed amendments of the Roseburg District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.4.6.5). Mitigations associated with the pipeline project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.4.6.6). Table 4.1.3.5-18 shows proposed off-site mitigation measures for the Days Creek–South Umpqua Watershed.

TABLE 4.1.3.5-18

Proposed Off-site Mitigation Projects for Days Creek–South Umpqua Watershed

Administrative Unit	Mitigation Group	Project Type	Project Name	Project Rationale	Quantity	Unit
Roseburg BLM	Stand Density Fuel Break	Fuels Reduction	Days Creek South Umpqua Hazardous Fuel Reduction	High intensity wildfire has been identified as the single natural factor most impacting late successional and old-growth forest habitats on the Days Creek-South Umpqua watershed. Like a road, the corridor serves a fuel break. Fuels reduction on 1,000 acres adjacent to the corridor will increase the effectiveness of the corridor as a fuel break. The mitigated area is part of the Days Creek to Shady Cove fuel break and ties in with similar projects on the Umpqua National Forest.	1,000	acres
Roseburg BLM	Road Sediment Reduction	Road Drainage and Surface Enhancement	South Umpqua Road Drainage and Surface Enhancement	The Days Creek-South Umpqua watershed is a Tier 1 Key watershed. Sediment is likely the most limiting factor to aquatic functioning in streams of the watershed. Roads do not meet current best management practices and are a source of chronic sediment delivery to fish bearing streams. Surfacing and drainage repair along 10 miles of roads on the watershed would reduce sediment delivery to fish bearing streams, thereby contributing to the attainment of Aquatic Conservation Strategy (ACS) objectives.	10	miles
Roseburg BLM	Road Sediment Reduction	Road stormproofing	31-4-3.2 Road Stormproofing	The Days Creek-South Umpqua watershed is a Tier 1 Key watershed. Sediment is likely the most limiting factor to aquatic function in the South Umpqua basin. There is concern that the Shively Creek culverts may fail, resulting in substantial sediment transport to Shively Creek. Removing these faulty culverts will prevent possible deposition of fine road sediments in stream channels. This mitigation project should occur before road becomes too narrow for heavy equipment access.	1	project
Roseburg BLM	Fire suppression	Suppression Capacity	Dry Hydrants	By installing six dry hydrants, fire vehicles will have an easier time filling up with water, and additional water sources will be available. In this way, areas that have had restoration work for fish populations could still be safely accessed for fire suppression. Over all, better water sources will improve fire suppression success and therefore help protect natural resources..	6	sites
Roseburg BLM	Aquatic and Riparian Habitat	Large Woody Debris (LWD) instream	West Fork Canyon Creek Instream LWD	Lack of LWD and sources of recruitment of this LWD in many streams are major factors limiting aquatic habitat quality in the watershed. There are approximately 8.16 miles of corridor in the watershed. Implementation of the Pacific Connector Pipeline Project would result in the removal of LWD and clearing of woody vegetation from about 6 acres.	0.8	miles

TABLE 4.1.3.5-18

Proposed Off-site Mitigation Projects for Days Creek–South Umpqua Watershed

Administrative Unit	Mitigation Group	Project Type	Project Name	Project Rationale	Quantity	Unit
Roseburg BLM	Aquatic and Riparian Habitat	Fish Passage	Beal Creek Culvert Replacement	Man-made barriers to fish passage have restricted access to quality habitat in the watershed. Both culverts targeted for replacement are undersized and obstructing anadromous and resident fish passage. Replacing these two culverts with ones properly sized for the stream (can handle peak flows) will allow fish passage and reduce the risk of them plugging up and causing road fill failures.	2	sites
Umpqua National Forest (UNF)	Terrestrial Habitat Improvement	Snag Creation	Days Cr.–South Umpqua Snag Creation	Mitigate immediate and future impacts to snag habitat from the clearing of the pipeline right-of-way. The project prevents development of large snags during the life of the project and for decades after. Data rely on the Cow Creek Watershed Analysis which suggests the watershed is far below historic levels of snag habitat due of past management actions. This project will add to those cumulative impacts. As snags are a critical component of LSR spotted owl habitat, replacement is needed. Snag requirements are specifically outlined in the Forest's Land and Resource Management Plan and the Northwest Forest Pan (NWFP). Forests require analysis and mitigation under most management activities. Replacement would be immediate though there would be a 10-year delay as snag decay develops. Snag management levels are based on the Forest's Plant Association Guidelines. Snags are also discussed in the South Cascades LSR Assessment (Chap. 3).	16	Acres
UNF	Terrestrial Habitat Improvement	Snag Creation	Days Cr.–South Umpqua Late Successional Reserve (LSR) Snag Creation		32	Acres
UNF	Stand Density Fuel Break	Underburn	Days Cr.–South Umpqua Matrix Underburn	Both mature stands and developing stands will be removed during pipeline construction. Impacts to mature and developing stands will exceed the life of this project by many decades. Density management will increase longevity of existing mature stands by reducing losses from disease, insects and fire. Density management in younger stands will accelerate development of late-successional and old-growth (LSOG) forest. Associated fuel reductions reduce risk of loss to fire and reduce potential fire size and intensity	102	Acres
UNF	Stand Density Fuel Break	Underburn	Days Cr.–South Umpqua LSR Underburn		125	Acres
UNF	Stand Density Fuel Break	Precommercial Thinning	Days Cr.–South Umpqua. LSR Precommercial Thinning	The Pacific Connector pipeline would cause direct impacts to existing interior, developing interior habitat. The project would result in additional fragmentation and preclude the recovery of fragmented habitat for those stands adjacent to the pipeline corridor. Thinning of young stands is a recognized treatment within LRSs if designed to accelerate development of late-successional habitat characteristics (NWFP ROD C-12; ROD Pages B-11; ACS Objectives, C-11 and C-17).	53	Acres

TABLE 4.1.3.5-18

Proposed Off-site Mitigation Projects for Days Creek–South Umpqua Watershed

Administrative Unit	Mitigation Group	Project Type	Project Name	Project Rationale	Quantity	Unit
UNF	Stand Density Fuel Break	Fuels Reduction	Days Cr. South Umpqua LSR Integrated Fuels Reduction	High intensity fire has been identified as the single factor most impacting LSOG forest habitats on federal lands in the area of the NWFP. Construction of the pipeline and associated activities removes both mature and developing stands and will increase fire suppression complexity, however the corridor also provides a fuel break. Fuels reduction adjacent to the corridor will increase the effectiveness of the corridor as a fuel break. Fuels reduction will lower the risk of loss of developing and existing mature stands and other valuable habitats to high-intensity fire. This segment is part of the Milo to Shady Cove fuel break and ties in with similar projects on the BLM.	232	Acres
UNF	Stand Density Fuel Break	Fuels Reduction	Days Cr. South Umpqua Matrix Integrated Fuels Reduction		150	Acres
UNF	Road sediment reduction	Road Closure	Days Cr. South Umpqua Road Closure	Mowing and maintenance of pipeline corridor, temporary road construction, and road use are direct disturbance impacts to wildlife. Road closure would mitigate some of those impacts, improve interior stand connectivity, and benefit aquatic habitats over time.	0.5	Miles

Note: Acres and mile rounded to nearest whole acre and tenth of a mile, respectively.

Elk Creek–South Umpqua River Watershed

Project Impacts by ACS Objective

Table 4.1.3.5-19 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Elk Creek–South Umpqua River watershed. The Pacific Connector Pipeline Project is on or near ridgetops along the Elk Creek hydrologic divide. The pipeline project crosses one small forested wetland located along the ridge that is too small to register. No stream channel intersects occur in the Elk Creek Watershed. Watershed conditions and recommendations are described in the Elk Creek Watershed Analysis (Forest Service 1996) and described in detail in appendix J of this EIS.

TABLE 4.1.3.5-19

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Elk Creek–South Umpqua Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features that are affected by the Pacific Connector Pipeline Project. The pipeline corridor would affect (cleared and modified) 0.61 percent of the BLM land and 0.09 percent of the NFS land on the Elk Creek–South Umpqua watershed (appendix J, table 2.4.7.1-2), and 3 acres or 0.02 percent Riparian Reserves would be cleared on BLM and NFS lands in the Elk Creek–South Umpqua watershed. The application of best management practices (BMPs) and erosion control measures, use of native vegetation, and the anticipated rapid revegetation of disturbed areas would likely further reduce Project effects. The level of impact is well within the natural range of variability for disturbance processes described by Everest and Reeves (2007), Agee (1993), and as documented in the South Umpqua watershed assessment (Forest Service 1996).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to impact spatial or temporal connectivity in the Elk Creek–South Umpqua watershed. No streams are crossed, and no Riparian Reserve are impacted. Aquatic system connectivity would be enhanced by replacement of three culverts within the watershed. Any residual levels of disturbance are anticipated to be well within the range of natural variability (appendix J, section 2.4.7.4).
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The pipeline project would have no discernible impact on stream banks or bottoms in the Elk Creek–South Umpqua watershed because no stream channels are crossed. Off-site mitigations involving large woody debris (LWD) within riparian reserves would help restore this physical integrity and complexity (appendix J, section 2.4.7.6).
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment would be mobilized during construction, but these effects are expected to be short-term and limited to the immediate project area. Connectivity to aquatic systems is limited since no stream channels are crossed. With application of the *Erosion Control and Revegetation Plan* (ECRP) and BMPs, there should be no long-term effects associated with sediment transport. No impacts to water temperature are expected because no channels are crossed and no effective shade is removed. Any sediment transport to aquatic systems that may occur would be offset by off-site road drainage enhancement, surface upgrade, and storm-proofing mitigation projects.

TABLE 4.1.3.5-19

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Elk Creek–South Umpqua Watershed

ACS Objective	Project Impacts
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in corridor routing. There are no stream channels crossed in the watershed and the route lies on a ridge top so connections to aquatic systems that would transport sediment are limited. All waterbodies adjacent to affected Riparian Reserves are expected to be dry during construction. As a result, sediment fluxes are expected to be minor and short-term and well within the range of variability for the Klamath–Siskiyou Province due to implementation of the erosion control measures in ECRP, BMPs, and the anticipated rapid revegetation that is characteristic of the Province. As a result, erosional effects are expected to consistent with those described in appendix J, section 1.3.1. Road repairs and storm proofing would help reduce sediment effects in the watershed and move the sediment regime closer to the desired condition (appendix J, section 2.4.7.6).
Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	It is highly unlikely that the pipeline project would impact flows because of limited connectivity to aquatic systems. The pipeline routing is on a ridge top in the watershed and does not cross any stream channels. The watershed is hydrologically recovered, and the corridor affects 0.09 percent of the watershed on NFS and BLM lands (appendix J, table 2.4.7.1-2) so changes in peak flows as a result of construction are highly unlikely.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project would not affect floodplains and water table elevations in meadows because these features are not crossed by the project in the Elk Creek Watershed.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Pipeline project effects to Riparian Reserves in the Elk Creek–S. Umpqua Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Replanting with native species would facilitate recovery of vegetation communities. LWD placement within 17 acres of riparian reserves and would help to enhance physical complexity of the aquatic habitats (appendix J, section 2.4.7.6). These restoration efforts, along with the limited effects to which they are directed, would maintain and restore biological and physical functions of the Riparian Reserves in the watershed.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Existing herbaceous and brush cover would be maintained to the extent practicable. To maintain riparian habitat, construction BMPs would be implemented. LWD placement within 17 acres of riparian reserves would help to enhance physical complexity of the aquatic habitats (appendix J, section 2.4.7. Revegetation would be encouraged by planting of native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

Summary, Elk Creek–South Umpqua Watershed

Given the ridgetop location of the pipeline corridor on BLM and NFS lands and the lack of intersects with waterbodies and Riparian Reserves, it is highly unlikely that Pacific Connector Pipeline Project construction and operation would prevent attainment of ACS objectives on BLM and NFS land in the Elk Creek–South Umpqua watershed. Amendments of the Roseburg District BLM and Umpqua National Forest LMPs to waive protection measures for S&M species would not prevent attainment of ACS objectives (appendix J, section 2.4.7.5). No pipeline project effects relevant to the ACS have been identified that are outside of the range of variability for disturbance processes in the watershed (appendix J, section 2.4.7.4).

Mitigations associated with the Pacific Connector Pipeline Project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.4.7.6). The project mitigation plan includes the following activities in the Elk Creek Watershed that are consistent with recommendations in the Elk Creek Watershed

Analysis. Table 4.1.3.5-20 shows proposed off-site mitigations in the Elk-Creek–South Umpqua watershed.

TABLE 4.1.3.5-20

Proposed Off-site Mitigation Projects for Elk Creek–South Umpqua Watershed

Project Type	Mitigation Group	Project Name	Project Rationale
Fuels Reduction	Stand Density Fuel Break	Hazardous Fuel Reduction	This project is 1,183 acres of shaded fuel breaks primarily along the ridgetop between Elk Creek and Cow Creek. High intensity wildfire has been identified as the single natural factor most impacting late successional and old growth forest habitats on the Elk Creek–South Umpqua watershed. Fuel breaks help reduce the potential for large-scale stand-replacement fire. At the landscape scale, this contributes to the maintenance of canopy and reduces the risk of loss of riparian vegetation. The mitigated area is part of the Days Creek to Shady Cove fuel break and ties in with similar projects on the Umpqua National Forest.
			This project is 95 acres of commercial thinning. This has the effect of regulating stand density, accelerating the development of larger trees, and reducing the risk of stand-replacing fire by regulating stand density and ladder fuels.
Habitat Improvement	Upland Terrestrial	Terrestrial LWD Placement	This project is 290 acres of log placement in upland units. To the degree large logs are placed in Riparian Reserves, they would benefit riparian habitats This restores coarse woody debris (CWD) in old harvest units that are currently devoid of this habitat element. CWD also contributes to long-term soil productivity.
Habitat Improvement	Upland Terrestrial	Meadow Restoration	This project is 101 acres of meadow restoration at Callahan Meadows. This has the effect of restoring native plant communities and controlling invasive weeds.
Habitat Improvement	Stand Density	Precommercial Thinning	This project is 363 acres of pre-commercial thinning of young stands in LSR. This has the effect of regulating stand density and accelerating the development of interior stand conditions by accelerating growth
Habitat Improvement	Upland Terrestrial	Off-site Pine Removal	This project is 338 acres of off-site pine removal. This removes trees that are not genetically adapted to the site where they are located and provides a mechanism to restore ponderosa pine and sugar pines that are adapted to the site.

Upper Cow Creek Watershed

Project Impacts by ACS Objectives

Table 4.1.3.5-21 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Upper Cow Creek watershed. BLM and NFS lands where the ACS applies comprise about 49 percent of the Upper Cow Creek watershed (appendix J, table 2.4.8.1-1; Forest Service 1995a). Watershed conditions and recommendations are described in the Cow Creek Watershed Analysis (Forest Service 1995a) and in detail in appendix J of this EIS. In the Cow Creek Watershed:

- timber harvest and removal of LWD from creek channels has reduced structural complexity of the aquatic habitat and its ability to retain sediments;
- chronic, fine-grained sediment, primarily related to roads have negatively affected aquatic habitats; and
- the presence of roads has segregated some stream reaches from upslope habitats that are needed for replenishment of LWD (Forest Service 1995a).

In the Upper Cow Creek Watershed, the Pacific Connector Pipeline Project crosses four perennial streams, two intermittent streams, and one small forested wetland. The pipeline project also clips one perennial stream Riparian Reserve and six wetland Riparian Reserves. Approximately 20 acres of Riparian Reserves would be cleared. This area is about 0.41 percent of the Riparian Reserves in the South Fork of Cow Creek and 0.12 percent of all Riparian Reserves in the Upper Cow Creek watershed (appendix J, table 2.4.8.1-3).

TABLE 4.1.3.5-21

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed-scale features that would be affected by the Pacific Connector Pipeline Project. There would be four perennial and two intermittent stream crossings in the South Fork Cow Creek subwatershed. (Note that Hydrofeature N at MP 111.01 is a perennial stream but because of an upstream diversion, it is dry in the summer. It is counted here has an intermittent stream.) One small shrub dominated wetland is also crossed. Riparian Reserves associated with1 perennial stream and 6 forested wetlands are clipped. The Project corridor is located primarily in early or mid-seral forests (appendix J, table 2.4.8.1-4) and largely on or near ridgetops to minimize impacts on aquatic habitats. The Project corridor would affect 78 acres or about 0.32 percent of BLM and NFS lands in the Upper Cow Creek watershed and about 20 acres or 0.12 percent of the Riparian Reserves within the watershed. Impacts to aquatic systems are expected to be short-term and minor and limited to the project scale because of application of Best Management Practices and erosion control measures. Large woody debris (LWD) cleared in construction of the corridor would be used to stabilize and restore stream crossings. Off-site mitigation measures including road stormproofing and decommissioning and installation of fish-friendly culverts are expected to improve watershed conditions in the Upper Cow Creek watershed (appendix J, section 2.4.8.6). While there are long-term changes in vegetation in Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variation given the fire history of Upper Cow Creek (appendix J, section 2.4.8.4).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the Upper Cow Creek watershed other than during the construction period because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the *Wetland and Waterbody Crossing Plan*. In the short-term during construction connectivity would be disrupted. At each crossing, the corridor would be necked down to 75 feet wide. Bed and bank disturbances associated with equipment and trenching are small (<15 feet wide). After construction all disturbed areas would be returned to their approximate original contours to restore preconstruction contours and drainage patterns. The temporary construction right-of-way would be restored and revegetated with native grasses, forbs, conifers, and shrubs, as outlined in the *Erosion Control and Revegetation Plan* (ECRP). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized. Connectivity would be improved by installation of fish-friendly culverts at four sites currently preclude passage of aquatic organisms (appendix J, section 2.4.8.6). The residual levels of disturbance are anticipated to be well within the range of natural variability in the Klamath–Siskiyou Province.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	Impacts to the bed and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance associated with equipment crossing and trenching is small at each crossing (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the POD requirements. By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained, although in the short-term

TABLE 4.1.3.5-21

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	Project Impacts
	(during construction) elements of the aquatic system could be disturbed. This level of disturbance is well within the range of natural variability that for watersheds of the Klamath-Siskiyou Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Mercury from abandoned mercury mines in the East Fork of Cow Creek is a known issue. Broeker (2010a) and GeoEngineers (2013b) assessed potential risk of release of mercury from disturbance of affected sediments. Mercury concentration of 0.29 part per million (PPM), which is in exceedance of ODEQ threshold of 0.1 PPM, was detected in soil and stream sediment samples at one site. Special measures including maintenance of 100% effective ground cover have been adopted as recommended by ODEQ. As a result, the presence of inorganic mercury is not anticipated to cause any health risk. Minor amounts of sediment would be mobilized during construction, particularly during the dry open-cut crossing dam and pump crossing of the East Fork of Cow Creek and its perennial tributaries (GeoEngineers 2013b). Water quality impacts from sediment are expected to be short-term and limited to the general area of construction (appendix J, section 1.3.1). No long-term impacts on water quality are expected because of application of the ECRP including maintenance of effective ground cover (appendix J, section 1.3.1 and previous discussion) and Best Management Practices during construction. Approximately 3 total acres of effective shading vegetation would be removed at 4 perennial stream crossings. A site-specific shade analysis conducted by Pacific Connector (NSR 2009) showed minor temperature increases were possible at the project scale but no impacts would occur beyond the immediate area of construction, and there were no temperature impacts at the stream network scale. Water quality is expected to remain within the range that supports aquatic biota.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The Upper Cow Creek watershed sediment regime was historically characterized by pulse-type disturbances (Forest Service 1995; Everest and Reeves 2007). The East Fork of Cow Creek, a drainage in the South Fork Cow Creek Subwatershed is characterized by the Cow Creek watershed Assessment as being “in balance” for sediment transport and deposition. The Pacific Connector Pipeline Project is not likely to alter these conditions. Eighty percent (3.73 of 4.73 miles) of the pipeline project in the Upper Cow Creek watershed is on ridgetops with little or no aquatic connectivity. Site-specific field reviews by geologists show the project is unlikely to cause landslides or activate currently stable earth-flow terrains because unstable areas have been avoided (GeoEngineers 2009a; Hanek 2011; Koler 2013). Surface erosion and sediment transport to streams would be minimized because Project would maintain 100 percent effective ground cover, effective sediment barriers and other erosion control measures as needed (See the sediment discussion at the beginning of this section). Sediment generated during construction is expected be minor, and limited to the general area of construction by the use of dry, dam-and-pump measures that isolate the crossing from flowing water during construction (appendix J, section 1.3.1). The pipeline project is not expected to alter the balance of sediment transport and storage in the East Fork of Cow Creek. The pipeline project is not expected to alter either the pulse-type disturbance or surface erosion sediment regimes of the Cow Creek drainage (appendix J, section 2.4.8.4). A pulse of sediment could be observed following the first seasonal rain, but this sediment-laden water is likely to dissipate within a few hundred feet and would be indistinguishable from background levels.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	Instream flows would be interrupted for a short period of time during installation of dams during dam and pump crossings. The area of construction that is between upstream and downstream dams would be dewatered for during the actual crossing construction. During construction, water would be pumped around the construction site to maintain downstream flows. It is possible that there may be local increases in runoff from canopy removal but at the watershed scale flow regimes would not be altered by the Pacific Connector pipeline because of the small scale of the project relative to the watershed, the relatively high proportion (85 percent) of the watershed that is hydrologically recovered and the lack of connectivity of most of the route to any stream network. See the discussion of peak flow processes in appendix J, section 2.4.8.4 for additional information.

TABLE 4.1.3.5-21

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project corridor clips the Riparian Reserve of six forested wetlands and crosses one delineated wetland. Trench plugs would be installed on each side of these wetlands as needed to block subsurface flows and maintain water table elevations, as required by FERC's *Wetland and Waterbody Construction and Mitigation Procedures*. Regardless, pipeline project construction may have short-term impacts on water tables in these isolated forest wetlands. These site-specific impacts would be minor (i.e., limited to the general area of construction) and are not connected to larger wetland areas, and may also regulated under Section 404 of the Clean Water Act. By restricting crossings to the dry season (July 1 to September 15), possible impacts on water tables of these wetland areas are expected to be minor and short term.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Project impacts on riparian vegetation in the Upper Cow Creek watershed would be minor. In the short term, all vegetation would be removed from the pipeline corridor. About 8 acres of vegetation within the Riparian Reserve to be cleared in the pipeline corridor is early or mid-seral vegetation (appendix J, table 2.4.8.1-4). Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Overall, pipeline project construction would affect approximately 0.12 percent of the Riparian Reserves in the watershed (appendix J, table 2.4.8.1-3). Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. These restoration efforts, along with the limited impacts on which they are directed, would maintain and restore biological and physical functions of the Riparian Reserves in the watershed.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Project impacts on riparian vegetation in the Upper Cow Creek watershed would be minor (20 acres or 0.12 percent of the Riparian Reserves in the watershed) (appendix J, table 2.4.8.1-3). Most of the cleared Riparian Reserve vegetation is upland second-growth forest (appendix J, table 2.4.8.1-4). Existing herbaceous and brush cover within the Project clearing limits would be maintained to the extent practicable. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

Summary, Upper Cow Creek Watershed

The South Fork Cow Creek subwatershed has four perennial stream crossings within 1 mile. This is the highest number of perennial stream crossings in one subwatershed on BLM and NFS lands. Construction of the Pacific Connector Pipeline Project in the Upper Cow Creek watershed has high potential for impacts that could prevent attainment of ACS objectives particularly as related to sediment and water temperature (appendix J, sections 2.4.8.4 and 2.4.8.5). The pipeline project has addressed these issues as follows:

- **Project Routing**—Approximately 80 percent of the route in the Upper Cow Creek watershed is on a ridgetop with little or no connectivity to aquatic habitats or Riparian Reserves. Between MPs 109 and 110 in the South Fork Cow Creek subwatershed, the route has been modified to avoid potentially unstable areas. The Forest Service has participated extensively in routing of the Pacific Connector pipeline and concurs that the location is unlikely to trigger mass wasting or excessive surface erosion (appendix J, sections 2.4.8.4 and 2.4.8.5).
- **Implementation of Water Quality Best Management Practices**—A site-specific BMP implementation plan based on construction impact and site-response risk has been prepared that is expected to maintain water quality (GeoEngineers 2013c). Within Riparian

Reserves for all hydrologic features crossed by the pipeline between MPs 109 and 110, the pipeline project would provide 100 percent post-construction ground cover on all disturbed areas. Wood fiber is the preferred material supplemented as needed by biosolids. In addition, the Pacific Connector pipeline would construct water bars at 50-foot intervals. Other erosion control measures would be used as needed to prevent surface erosion associated with stream crossings or to prevent sediment transport that may affect riparian systems (appendix J, section 2.4.8.4).

- **Mitigation of Potential Impacts on Stream Temperature**—A temperature analysis on perennial stream crossings showed the Project may have minor temperature impacts (approximately 0.1°C) at the project scale (NSR 2009). Although the analysis showed there would be no impact at the next downstream reach below the crossings because of groundwater infiltration, flow volumes and existing shade, the pipeline project would transplant larger conifers to riparian areas at perennial crossings in the East Fork Cow Creek to mitigate for temperature impacts at the project scale. Temperatures are expected to remain below those specified by the State of Oregon for streams in the Umpqua basin (appendix J, section 2.4.6.4).
- **Mercury**—The Forest Service contracted with a geologist consultant to collect soil and stream sediment samples for analytical testing and reporting of mercury and other naturally-occurring minerals along a 2,000-foot section of the pipeline route between MP 109 and the East Fork Cow Creek (Broeker 2010b; GeoEngineers 2013b). Geochemical analysis of the soil and stream sediment samples have determined very low to nominal concentrations of naturally occurring mercury mineralization. The mercury level at one of the stream sediment sites was 0.29 part per million, which was above the Level II screening level value of 0.1 part per million for invertebrates (ODEQ 1998a, cited in GeoEngineers 2013b). In order to prevent this naturally occurring mercury from mobilizing during and after construction, additional erosion control measures and monitoring would be conducted at these sites. The proposed pipeline construction activities by Pacific Connector within the upper East Fork Cow Creek watershed are not anticipated to disturb and expose soils and bedrock strata that contain more than low amounts of naturally occurring mercury mineralization; and any sediment that is generated is not likely to reach the aquatic environment due to implementation of short-term and permanent mitigation measures outlined in Pacific Connector's ECRP and as listed in GeoEngineers (2013b).

There are approximately 4,559 acres of Riparian Reserves (NFS lands only) in the Upper Cow Creek Watershed of which approximately 1,595 acres are LSOG (Forest Service 1995a: 94, 95). Approximately 20 acres of Riparian Reserves or 0.12 percent of the Riparian Reserves on NFS lands in the watershed would be cleared (appendix J, table 2.4.8.1-3). Of this, approximately 3 acres are LSOG (appendix J, table 2.4.8.1-4). This is about 0.17 percent of the LSOG in Riparian Reserves on NFS lands in the Upper Cow Creek watershed. Early and mid-seral forest vegetation constitutes the remaining 8 acres of the affected Riparian Reserve vegetation. LSOG and mid-seral vegetation (approximately 5 acres) cleared in the right-of-way would be a long-term, but minor in scale, change in vegetation that is within the range of natural variability for the Upper Cow Creek watershed considering its history of disturbance from stand replacement fire and subsequent landslides (appendix J, section 2.4.8.4.). NFS and BLM lands are currently 36 percent LSOG and exceed minimum watershed thresholds for LSOG forest after consideration of Pacific Connector Pipeline Project impacts (appendix J, section 2.4.8.5).

Off-site mitigation measures, identified by the Forest Service, would supplement on-site minimization, mitigation, and restoration actions. These proposed off-site mitigation measures are responsive to recommendations in the Cow Creek watershed assessment. Mitigations associated with the Project are responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.4.8.6). Table 4.1.3.5-22 shows proposed off-site mitigation projects in the Upper Cow Creek watershed.

TABLE 4.1.3.5-22

Off-site Mitigations in the Upper Cow Creek Watershed

Project Type	Mitigation Group	Project Name	Qty.	Unit	Project Rationale	Land Allocation
Fish Passage Culverts	Aquatic	Fish Friendly Culvert Replacement at Applegate Creek, Beaver Creek, Beaver Creek Trib., and East Fork Cow Creek	4	Ea.	Poor culvert design, erosion at outlets and lack of maintenance of resulted in several road-stream crossings that block access to upstream aquatic habitats. Culvert replacements with fish-friendly designs will benefit fish and other aquatic biota by reconnecting habitats and reducing sediment contributions from these locations. This is responsive to Aquatic Conservation Strategy (ACS) objectives 1, 2, 3, and 5.	Riparian Reserve
Road Closure	Road Sediment Reduction	Road Barricades and Stormproofing	2.6	Miles	Road density and lack of road maintenance were identified as major sources of sediment in the Cow Creek watershed assessment. Decommissioning, barricading, and stormproofing roads reduce road related sediment contributions. This is responsive to ACS objectives 4 and 5.	LSR and Matrix
Road Decommissioning	Road Sediment Reduction	Road Decommissioning	4.3	Miles		
Integrated Stand Density and Fuels Reduction	Stand Density and Fuels Reductions	Upper Cow Creek Matrix Integrated Fuels Reduction	606	Acres	Forest stands in Upper Cow Creek are often overstocked with unnaturally high fuel loads that make them susceptible to high intensity fire. Stand density and underburn fuel reduction projects are designed to reduce fuel loading and stand density in overstocked, fire-prone stands to historic ranges to reduce the risk of high intensity stand replacement fire. Since these types of fires can be a major cause of surface erosion and mass wasting in granite and schist soils, this contributes to reestablishing a natural sediment regime over time by reducing the probability of a large, high intensity fire in this area. This is responsive to ACS objectives 1, 2, and 5.	Matrix
Integrated Stand Density and Fuels Reduction	Stand Density and Fuels Reductions	Upper Cow Creek LSR Integrated Fuels Reduction	972	Acres		LSR
Integrated Stand Density and Fuels Reduction	Underburning	Upper Cow Creek Matrix Underburn	410	Acres		Matrix
Integrated Stand Density and Fuels Reduction	Underburning	Upper Cow Creek LSR Underburn	531	Acres		LSR
Habitat Enhancement	Terrestrial Habitats	Terrestrial LWD Placement	62	Acres	Logging, fire suppression, and fuels treatments have reduced the number of snags and pieces of LWD in Upper Cow Creek. Portions of snag creation and terrestrial LWD projects in Matrix and LSR would occur within Riparian Reserves. This would contribute to ACS objectives for restoring snag levels and down wood to historic ranges in treated areas and is responsive to ACS objectives 1 and 8.	LSR, Matrix, and Riparian Reserves
Habitat Enhancement	Terrestrial Habitats	LSR Snag Creation	91	Acres		
Habitat Enhancement	Terrestrial Habitats	Matrix Snag Creation	14	Acres		
Forest Plan Amendment		Cow Creek Matrix to LSR Land Reallocation	588	Acres	The Pacific Connector project crosses LSR acres in Upper Cow Creek and adjacent watersheds. Matrix to LSR Reallocation provides aquatic protections by managing upland areas for LSOG conditions. This is responsive to all nine ACS objectives.	Matrix / LSR

Several site-specific proposed amendments of the Umpqua National Forest LRMP are required to make provision for the Pacific Connector Pipeline Project. These proposed amendments are not expected to prevent attainment of the ACS in the Upper Cow Creek watershed (appendix J, section 2.4.8.5).

- Proposed amendment UNF-1 would allow removal of effective shade on perennial streams. This amendment would not prevent attainment of ACS objectives because a site-specific temperature assessment (NSR 2009) showed that any temperature increase resulting from removal of effective shade would be minor, and limited to the point of maximum impact at the site of construction.
- Proposed amendment UNF-2 would allow the Pacific Connector corridor to run parallel to an existing stream within the riparian zone. The amendment would not prevent attainment of ACS objectives because an uncut buffer 30 to 60 feet wide would remain between the corridor and the East Fork of Cow Creek. An estimated 94 percent of the effective shade would be maintained adjacent to the East Fork of Cow Creek, erosion control measures specified in the ECRP are expected to be effective at controlling surface erosion, and LWD would not be removed from the stream. Sources of LWD would remain on both sides of the channel.
- Proposed amendment UNF-3 would allow the Pacific Connector Pipeline Project to exceed detrimental soil conditions within the construction corridor. This would not prevent attainment of ACS objectives because soil decompaction and remediation required in Riparian Reserves is expected to effectively moderate detrimental soil conditions. Implementation of measures in the ECRP is expected to effectively control surface erosion and restore native vegetation (see section 4.3.4).
- Proposed amendment UNF-4 would reallocate approximately 588 acres from the Matrix land allocation to the LSR allocation. This would benefit aquatic habitats because this area would be managed for late-successional stand conditions that provide additional aquatic protections.
- Proposed amendment of the Umpqua National Forest LRMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the Pacific Connector Pipeline Project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.4.8.5).

The routing of the pipeline project through NFS lands, coupled with the relatively small area of BLM and NFS land affected by pipeline construction (79 acres or 0.32 percent of the BLM and NFS lands in the fifth-field watershed; appendix J, table 2.4.8.1-2), makes it highly improbable that Project impacts could affect watershed conditions. Although there are project-level impacts (e.g., short-term sediment and a long-term change in vegetative condition at stream crossings), these would be minor in scale and largely limited to the boundaries of the project area (appendix J, section 2.4.8.4).

No project-related impacts that would prevent attainment of ACS objectives have been identified (appendix J, section 2.4.8.8). All relevant Pacific Connector Pipeline Project impacts are within the range of natural variability for watersheds in the Oregon Cascades and Klamath Provinces,

although some of these processes have been altered from their natural condition (appendix J, section 2.4.8.4).

Trail Creek

Project Impacts by ACS Objective

Table 4.1.3.5-23 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Trail Creek watershed. BLM and NFS lands where the ACS applies comprise about 50 percent of the Trail Creek watershed (appendix J, table 2.5.3.1-1). Watershed conditions and recommendations are found in the Trail Creek Watershed Analysis (BLM 1999c) and described in detail in appendix J of this EIS. In the Trail Creek watershed, timber harvest and removal of LWD from creek channels have reduced structural complexity of the aquatic habitat and its ability to retain sediments. Chronic, fine-grained sediment, primarily related to roads, has negatively affected aquatic habitats. The presence of roads has segregated some stream reaches from upslope habitats that are needed for replenishment of LWD. The pipeline project crosses one intermittent stream and clips five Riparian Reserves on BLM lands (appendix J, table 2.5.3.1-1-4)..

TABLE 4.1.3.5-23

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Trail Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed landscape-scale features that would be affected by the Pacific Connector Pipeline Project. There is one Riparian Reserves that is clipped by the project corridor on NFS lands in the Trail Creek watershed (appendix J, table 2.5.3.1-4). Three Riparian Reserves are clipped and two Riparian Reserves are crossed on BLM lands. One intermittent stream channel is crossed on BLM lands at MP 119.7. There are also stream crossings on adjacent private lands. On BLM and NFS lands subject to the ACS, the pipeline corridor is primarily in early or mid-seral forests (appendix J, table 2.5.3.1-4) and largely on or near ridgetops to minimize impacts on aquatic habitats. Approximately 5.32 acres or 0.13 percent of the Riparian Reserves in the Trail Creek watershed are cleared by the pipeline project (appendix J, table 2.5.3.1-3). Approximately 3 acre of late successional and old-growth (LSOG) forest would be removed by the Project from a clipped Riparian Reserve in Lower Trail Creek (appendix J, table 2.5.3.1-4). Impacts to aquatic systems are consistent with those described in appendix J, section 1.3.1. LWD cleared in construction of the corridor would be used to stabilize and restore stream crossings. Off-site mitigation measures including road stormproofing and decommissioning and instream large woody debris (LWD) projects are expected to improve watershed conditions in the Trail Creek watershed (appendix J, section 2.5.3.6). At MP 119.7, the pipeline project has been rerouted to lessen the impact of a small intermittent stream that would have run parallel to the pipeline trench. While there would be long-term effects on vegetation in Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variability for the watershed.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the Trail Creek watershed because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the exhibits specified in the POD (i.e., *Wetland and Waterbody Crossing Plan*). Impacts to the bed and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance associated with equipment crossing and trenching is small at each crossing (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site, and the bed and banks would be returned to pre-construction conditions, consistent with the POD requirements. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized. The residual levels of disturbance are anticipated to be well within the range of natural variability in the Western Oregon Cascade Province.

TABLE 4.1.3.5-23

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Trail Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	No stream channels are crossed on BLM or NFS lands where the ACS applies so physical integrity of banks and stream bottoms would not be affected. There are crossings on private lands immediately adjacent to BLM property boundaries. The impacts of crossing construction would be the same as if those crossings were on BLM lands and are disclosed here because of the close proximity. Impacts to the bed and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance is small at each crossing (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the POD requirements (i.e., *Wetland and Waterbody Crossing Plan*). By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained, although in the short term (during construction) elements of the aquatic system could be disturbed. This level of disturbance is well within the range of natural variability that for watersheds of the Western Oregon Cascade Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	No long-term impacts on water quality are expected because of application of the *Erosion Control and Revegetation Plan* (ECRP) including maintenance of effective ground cover and best management practices during construction (see appendix J, section 1.3.1 and previous discussion).
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The Trail Creek watershed sediment regime was historically characterized by pulse-type depositions of coarser sediments from landslides and surface erosion following major disturbances such as fires and high-intensity winter storms (BLM 1999c; Everest and Reeves 2007). More chronic erosion and deposition of fine sediments primarily from roads, and to a lesser degree from land use has replaced these pulse-type disturbances in the current sediment regime in the watershed. In their 2013 filing, Pacific Connector proposed a route that would have paralleled, and largely encompassed the Riparian Reserve of a small intermittent channel at MP 119.7. Field review by the BLM indicated that this area was moderately to severely erosive and may be difficult to revegetate if disturbed. This area was also flashy (runoff comes up rapidly with storms) because of relatively shallow soils. A route variation was filed in 2015 that removed this crossing from BLM lands. the pipeline project construction and operation are not likely to alter sediment patterns in the watershed, nor are they likely to exacerbate these conditions. Proposed mitigation projects would contribute significantly to reduction of sediments and restoration of aquatic functions (appendix J, section 2.5.3.6).
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project is not likely to affect peak flows in the Trail Creek watershed because of its predominately ridgetop location, the relatively small area of the watershed affected (less than 1 percent) and relative lack of connectivity to aquatic systems. The Trail Creek Watershed Assessment noted that increases in peak flows were a low risk in all of the subwatersheds and in the watershed as a whole (BLM 1999c).
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project would not cross any meadows or wetlands in the Trail Creek watershed on BLM or NFS lands, so there would be no impact from the project on water tables or seasonal inundation of these areas
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Project impacts on riparian vegetation in the Trail Creek watershed would be minor. The pipeline project would clear approximately 5.32 acres of vegetation in Riparian Reserves or 0.13 percent of the Riparian Reserves on BLM and NFS lands in the Trail Creek watershed (appendix J, table 2.5.3.1-3). Approximately one acre affected are mid-seral plant communities; roughly 3 acre is LSOG (appendix J, table 2.5.3.1-4). Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Planned mitigation measures include 2.6 miles of instream LWD that would contribute to restoration of aquatic function (appendix J, section 2.5.3.6).

TABLE 4.1.3.5-23

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Trail Creek Watershed

ACS Objective	Project Impacts
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Project impacts on riparian vegetation in the Trail Creek watershed would be minor. The pipeline project would clear approximately 5.32 acres of vegetation in Riparian Reserves or 0.13 percent of the Riparian Reserves on BLM and NFS lands in the Trail Creek watershed. Less than 1 acre affected are early seral plant communities and approximately 3 acres are LSGO. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

In their 2013 filing, Pacific Connector proposed a route that would have paralleled, and largely encompassed, the Riparian Reserve of a small intermittent channel at MP 119.7. Field review by the BLM indicated that this area was moderately to severely erosive and may be difficult to revegetate if disturbed. This area was also flashy (runoff comes up rapidly with storms) because of relatively shallow soils. At the request of the BLM, Pacific Connector filed a route variation to avoid this channel that was reviewed and approved by the BLM. This route variation reduced the acres of affected Riparian Reserve and provided a location that avoided soils with revegetation sensitivity.

Pacific Connector has modified their route in the Trail Creek watershed to better address the ACS objectives and has incorporated measures consistent with the Riparian Reserve standards and guidelines. While this assessment demonstrates that short-term impacts associated with the project would occur at the site scale related to the removal of riparian vegetation, and impacts on streambanks, and substrates, when considering the design measures and BMPs that have been incorporated into the pipeline project, the impacts on Riparian Reserves would be minor and short term at the watershed or landscape scale.

Summary, Trail Creek Watershed

There would be no intersections with Riparian Reserves or stream crossings on NFS lands in the Trail Creek watershed. The pipeline route clips five Riparian Reserves on BLM lands. Two of these are associated with stream crossings that occur on adjacent private lands. At MP 119.7, at the request of the BLM, Pacific Connector filed a route variation to avoid this crossing; this was subsequently reviewed and approved by the BLM. This route variation reduced the acres of affected Riparian Reserve and provided a location that avoided soils with revegetation sensitivity. As a result of this proposed realignment, one intermittent channel would be crossed on BLM lands.

Clearing associated with the pipeline project corridor would remove approximately 3 acres of LSOG vegetation in Riparian Reserves (appendix J, table 2.5.3.1-4). While this is a long-term change in vegetative condition, it is minor in scale and well within the range of natural variability for changes in vegetative condition given the fire history of the watershed (appendix J, section 2.5.3.4).

The high clay-content soils in the watershed (BLM 1999c:1-4) present a potential issues with possible compaction, sediment produced at stream crossings, and sediment that could be mobilized by overland flow. Subsoil ripping (including the use of hydraulic excavators) is a proven method to reduce soil compaction. Measures in the ECRP including soil remediation with biosolids or other organic materials, rapid revegetation, and maintenance of effective ground cover are likely to control surface erosion. Erosion control measures described in appendix J, section 1.3 for stream crossings are likely to be

successful at minimizing sediment associated with clearing in Riparian Reserves in the Trail Creek watershed. The BLM and Forest Service may require additional erosion control measures if needed.

Stream crossings adjacent to the BLM property boundary on private lands are addressed in section 4.4 of this EIS.

Off-site mitigation measures, identified by the BLM and Forest Service, would supplement on-site minimization, mitigation, and restoration actions. These proposed off-site mitigation measures are responsive to recommendations in the Trail Creek watershed assessment and would contribute to improving terrestrial and aquatic conditions within the watershed (appendix J, section 2.5.3.6). Table 4.1.3.5-24 describes proposed off-site mitigation measures in the Trail Creek watershed.

TABLE 4.1.3.5-24

Off-site Mitigations on BLM and NFS Lands in the Trail Creek Watershed

Agency	Project Type	Mitigation Group	Project Name	Project Rationale
Forest Service	Fuels Reduction	Stand Density Fuel Break	Upper Trail Creek Shaded Fuel Break (414 Acres)	High intensity fire has been identified as the single factor most impacting late successional and old growth forest habitats on federal lands in the area of the Northwest Forest Plan (NWFP). Construction of the pipeline and associated activities removes both mature and developing stands and will increase fire suppression complexity; however, the corridor also provides a fuel break. Fuels reduction adjacent to the corridor will increase the effectiveness of the corridor as a fuel break. Fuels reduction will lower the risk of loss of developing and existing mature stands and other valuable habitats to high-intensity fire. These segments tie together as part of the Milo to Shady Cove fuel break on both BLM and NFS lands.
BLM	Fuels Reduction	Stand Density Fuel Break	Trail Creek Fuel Hazard Reduction (687 Acres)	
BLM	Fire Suppression	Fire suppression	Trail Creek Pump Chance (3 Sites)	Construction of the pipeline and associated activities would increase fire suppression complexity. Pump chances increase capacity for agency response and help reduce potential fire losses to valuable habitats by providing readily available water sources.
Forest Service	Road Decommissioning	Road Sediment Reduction	Upper Trail Creek Road Decommissioning (1.1 Miles)	Sediment has been identified by the Upper Rogue Watershed Council as a limiting factor for aquatic habitat in Trail Creek. Road decommissioning reduces habitat fragmentation, reduces road-related sediment and improves hydrologic connectivity and by reducing road density.
Forest Service	Road storm-proofing	Road Sediment Reduction	Trail Creek Road Stormproofing (0.5 Mile)	Sediment has been identified by the Upper Rogue Watershed Council as a limiting factor for aquatic habitat in Trail Creek. Stormproofing improvement of existing roads restores hydrologic connectivity and reduces sediment by managing drainage and restoring surfacing where needed.
BLM	Road Storm Proofing	Road Sediment Reduction	Trail Creek Road Stormproofing (4.3 Miles)	
BLM	Road Surfacing	Road Sediment Reduction	Trail Creek Road Resurface (16.3 Miles)	Sediment has been identified by the Upper Rogue Watershed Council as a limiting factor for aquatic habitat in Trail Creek. Road surfacing helps reduce road related sediment by providing a wear-resistant running surface and capping erodible fine sediments.
Forest Service	Snag Creation in Matrix Lands	Upland Terrestrial	Snag Creation (109 Acres)	The Pacific Connector Pipeline Project would remove current and future sources of snags, which provide a key wildlife habitat element. Snag creation replaces the existing and potential snags lost in the corridor.

TABLE 4.1.3.5-24

Off-site Mitigations on BLM and NFS Lands in the Trail Creek Watershed

Agency	Project Type	Mitigation Group	Project Name	Project Rationale
BLM	LWD instream	Aquatic Habitat	Trail Creek LWD (2.6 Miles)	Lack of large wood and recruitment of large woody debris (LWD) into streams is a consistent factor limiting aquatic habitat quality in all watersheds crossed by the Pacific Connector pipeline. Implementation of the pipeline project would result in the removal of LWD from the Riparian Reserves associated with intermittent and perennial streams. The removal of vegetation within and adjacent to the channel will preclude future recruitment of large woody debris into the channel and associated Riparian Reserves. Placing LWD at key locations within the channel and associated Riparian Reserves would offset both the short-term and long-term effects from loss of LWD recruitment to Riparian Reserves and associated aquatic and riparian habitat and contributes to the accomplishment of ACS objectives.

A site-specific amendment of the Umpqua National Forest LRMP to waive limitation on detrimental soil compaction is proposed to make provision for the Pacific Connector Pipeline Project. This proposed amendment is minor in scope and is not expected to prevent attainment of ACS objectives because of implementation of the ECRP and the fact that there are no stream intersects on NFS lands in the Trail Creek watershed (appendix J, section 2.5.3.5). Proposed amendment of the Umpqua National Forest LRMP and the Medford District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian dependent species (appendix J, section 2.5.3.5).

The routing of the pipeline through BLM and NFS lands, coupled with the relatively small area of BLM and NFS land cleared by pipeline project construction (112 acres, impacting 0.73 percent of federal lands), make it highly improbable that Project impacts could affect watershed conditions beyond the site scale. Although there are project-level impacts such as short-term sediment and a change in vegetative condition one stream crossing these would be minor and largely limited to the boundaries of the project area (appendix J, section 2.5.3.4).

No project-related impacts that would retard or prevent attainment of ACS objectives have been identified (appendix J, section 2.5.3.8). Impacts, as they relate to relevant ecological processes, are within the range of natural variability for watersheds in the Cascades and Klamath-Siskiyou Provinces, although some of these processes have been altered from their natural condition (appendix J, section 2.5.3.4).

Shady Cove–Rogue River

Project Impact by ACS Objective

Table 4.1.3.5-25 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Shady Cove–Rogue River watershed. The pipeline project would include 4.4 miles of corridor, three intermittent stream channel crossings, and one small forested wetland on BLM lands within the Shady Cove-Rogue River Watershed (appendix J, table 2.5.4.1-1-4). BLM lands where the ACS applies comprise approximately 22,448 acres, or approximately 30 percent of the

74,284-acre watershed. Watershed conditions and recommendations are found in the Shady-Cove Rogue River Watershed Analysis (BLM 2012) and described in detail in appendix J.

In their 2013 filing, Pacific Connector proposed a route that crossed three intermittent streams at MPs 126.5, 126.52, and 126.59 on BLM lands. Field review by the BLM indicated that these areas are moderately to severely erosive and may be difficult to revegetate if disturbed. These areas are flashy (runoff comes up rapidly with storms) because of relatively shallow soils. Based on these concerns, Pacific Connector worked closely with BLM to provide a route variation that avoided these three crossing and shifted downslope where two crossings were in a better location. This route variation was filed in January 2015. This proposed realignment reduced the acres of affected Riparian Reserves, eliminated one stream crossing, and place the corridor in an area not subject to erosion and revegetation sensitivity.

Although Pacific Connector has modified the pipeline project to respond to the ACS objectives and has incorporated measures consistent with the Riparian Reserve standards and guidelines, the assessment demonstrates that short-term impacts associated with the Project would occur at the site scale related to the removal of riparian vegetation, and impacts on streambanks, and substrates. With the elimination of one crossing and relocating the other two at less sensitive locations, when considering the design measures and BMPs that have been incorporated into the project, the impacts on aquatic habitat would be minor and short term at the watershed or landscape scale. This is apparent when considering the total amount of Riparian Reserves that are located within the Shady Cove–Rogue River watershed (10,930 acres) and the amount of clearing (9 acres) in Riparian Reserves within the watershed (0.13 percent) (appendix J, table 2.5.4.1-3). Further, because of the linear characteristic of the pipeline, the Riparian Reserve crossings would be spread out across the landscape and would be discontinuous. In addition, the pipeline project's Riparian Reserve crossings are associated with small intermittent streams that are not fish bearing (BLM 2012).

TABLE 4.1.3.5-25

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Shady Cove–Rogue River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed landscape scale features that would be affected by the Project. There are 8 Riparian Reserves that are affected by the Project corridor on BLM-managed lands in the Shady Cove–Rogue River watershed. No riparian reserves are affected on NFS lands. Three intermittent stream channels and one small forested wetland are crossed on BLM-managed lands. On BLM-managed lands subject to the ACS, the Project corridor is located primarily on or near ridgetops to minimize impacts on aquatic habitats. Approximately 8.5 acres or 0.12 percent of the Riparian Reserves in the Shady Cove–Rogue River watershed are potentially affected by the Project (table 2.5.4.1-3). Approximately 2.43 acres of LSOG would be removed by the Project (table 2.5.4.1-4). Impacts to aquatic systems are consistent with those described in section 1.3.1. LWD cleared in construction of the corridor or otherwise provided by Pacific Connector would be used to stabilize and restore stream crossings. Off-site mitigation measures including road improvements and resurfacing and instream LWD projects are expected to improve watershed conditions in the watershed (section 2.5.4.6). While there are long-term impacts on Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variability given the disturbance history of the watershed (section 2.5).

TABLE 4.1.3.5-25

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Shady Cove–Rogue River Watershed

ACS Objective	Project Impacts
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The Pacific Connector Pipeline Project would remove approximately 6.9 acres of riparian vegetation within the Big Butte Creek Watershed, all within the McNeil Creek subwatershed where the project parallels an intermittent stream between MP 131.4 and 131.79. Although the stream is intermittent, it is likely this amount of canopy loss would affect stream channel complexity and connectivity by removing sources of large wood adjacent to the stream channel and creating chronic sources of fine sediments immediately adjacent to the stream channel. This impacts would likely retard attainment of ACS objectives. The BLM has requested a realignment at this location to move the corridor completely out of the Riparian Reserve. This would completely eliminate any possible impact on aquatic habitat connectivity. When Pacific Connector files final engineering on this realignment this evaluation will be modified to reflect that change.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	There are three intermittent stream channel crossings on BLM lands in the Shady Cove – Rogue River watershed. Impacts to the bed and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance is small at each crossing (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the Wetland and Waterbody Crossing Plan. By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained, although in the short term (during construction) elements of the aquatic system could be disturbed. This level of disturbance is well within the range of natural variability that for watersheds of the Western Oregon Cascade Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Three intermittent stream channels are crossed on BLM-managed lands. Approximately 8.5 acres or 0.12 percent of the riparian reserves on BLM-managed lands in the Shady Cove–Rogue River watershed are potentially affected by the Project (table 2.5.4.1-3) No long-term impacts on water quality are expected because of application of the ECRP including maintenance of effective ground cover (section 1.3.1) and Best Management Practices during construction.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The Shady Cove–Rogue River Watershed sediment regime was historically characterized by pulse-type depositions of coarser sediments from landslides and surface erosion following major disturbances such as fires and high-intensity winter storms (BLM 2012). More chronic erosion and deposition of fine sediments primarily from roads, and to a lesser degree from land use has replaced these pulse-type disturbances in the current sediment regime in the watershed. Riparian Reserve intersects occur at right angles to the Reserve, or minimally clip the boundary. With the elimination of one stream crossing and relocation of two others to less sensitive areas, the Project construction and operation is not likely to alter this sediment pattern nor is it likely to exacerbate these conditions. Proposed mitigation projects would contribute to reduction of sediments and restoration of aquatic functions (section 2.5.4.6.).
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The Project is unlikely to affect peak flows in the Big Butte Creek watershed because of its predominately ridgetop location, the relatively small area of the watershed affected (less than 0.05 percent of the total acres in Riparian Reserves on BLM and NFS lands), and relative lack of connectivity to aquatic systems.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The Project would not affect wetlands in the Big Butte Creek watershed on BLM lands, so there would be no measurable impact from the Project on water tables or seasonal inundation of these areas.

TABLE 4.1.3.5-25

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Shady Cove–Rogue River Watershed

ACS Objective	Project Impacts
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Project impacts on riparian vegetation in the Shady Cove–Rogue River Watershed would be minor. The Project would potentially affect approximately 8.5 acres of vegetation in Riparian Reserves or 0.12 percent of the riparian reserves on BLM-managed lands in the Shady Cove–Rogue River watershed (table 2.5.4.1-3. Approximately 2.4 acres of LSOG forest would be removed (table 2.5.4.1-4) Riparian Reserve intersects occur at right angles to the Reserve, or minimally clip the boundary. Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Planned mitigation measures include 2.5 miles of instream LWD which would contribute to restoration of aquatic function (section 2.5.4.6).
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Project impacts on riparian vegetation in the Shady Cove–Rogue River watershed would be minor. The Project would potentially affect approximately 8.5 acres of vegetation in Riparian Reserves or 0.12 percent of the riparian reserves on BLM-managed lands in the Shady Cove–Rogue River Watershed (table 2.5.4.1-3). Approximately 2.4 acres of LSOG forest would be removed (table 2.5.4.1-4. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by Project construction and operation in the watershed (see appendix M).

Summary, Shady Cove–Rogue River Watershed

The pipeline route would cross three intermittent streams and one small wetland on BLM lands. The project would also clip Riparian Reserves associated with five intermittent streams and one perennial stream but would not cross the streams. The pipeline project would remove approximately 8.5 acres of vegetation within Riparian Reserves, or approximately 0.12 percent of vegetation within Riparian Reserves on BLM lands within the watershed (appendix J, table 2.5.4.1-3). Approximately 2 acres of the riparian vegetation removed would be LSOG forest habitat (appendix J, table 2.5.4.1-4).

Stream crossings proposed in the 2013 application at MP 126.5, 126.52 and 126.59 were subject to a route variation filed with FERC in 2015 to better able to of ACS objectives. Measures in the ECRP including revegetation and maintenance of effective ground cover are likely to control surface erosion. Erosion control measures described in appendix J, section 1.3.1 for stream crossings would likely be successful at minimizing sediment associated with relocated stream crossings in the watershed. The BLM may require additional erosion control measures if needed. Since all of the streams crossed are intermittent, they are likely to be dry by late summer when water temperatures are an issue, and it is unlikely there would be any impact on water temperature.

Off-site mitigation measures, identified by the BLM, would supplement on-site minimization, mitigation, and restoration actions (appendix J, section 2.5.4.6). These proposed off-site mitigation actions are responsive to recommendations in the Shady Cove–Rogue River Watershed Analysis (BLM 2012) and would contribute to improving terrestrial and aquatic conditions within the watershed. Table 4.1.3.5-26 describes proposed off-site mitigations in the Shady Cove–Rogue River watershed.

TABLE 4.1.3.5-26

Proposed Off-site Mitigations on BLM Lands in the Shady Cove–Rogue River Watershed

Project Type	Mitigation Group	Project Name	Project Rationale
Fuels Reduction	Stand Density Fuel Break	Shady Cove Fuel Hazard Reduction 866 acres	High intensity fire has been identified as the single factor most impacting late successional and old-growth (LSOG) forest habitats on federal lands in the area of the Northwest Forest Plan (NWFP). Construction of the Pacific Connector pipeline and associated activities would remove both mature and developing stands and would increase fire suppression complexity; however, the corridor would also provide a fuel break. Fuels reduction adjacent to the corridor would increase the effectiveness of the corridor as a fuel break. Fuels reduction would lower the risk of loss of developing and existing mature stands and other valuable habitats to high-intensity fire. This segment is part of the Milo to Shady Cove fuel break and would tie in with similar projects on the Umpqua National Forest.
Fuels Reduction	Stand Density Fuel Break	Shady Cove Fuel Hazard Maintenance 866 acres	This would provide a mechanism for maintenance of fuel breaks over time for the life of the pipeline project.
Large Woody Debris (LWD) Instream	Aquatic Habitat	Shady Cove LWD 2.5 miles (Estimated 15 acres of aquatic habitat)	Lack of large wood and recruitment of LWD into streams is a consistent factor limiting aquatic habitat quality in all watersheds crossed by the Pacific Connector pipeline. Implementation of the pipeline project would result in the removal of LWD from the Riparian Reserves associated with intermittent and perennial streams. The removal of vegetation within and adjacent to the channel would preclude future recruitment of LWD into the channel and associated Riparian Reserves. Placing LWD at key locations within the channel and associated Riparian Reserves would offset both the short-term and long-term impacts from loss of LWD recruitment to Riparian Reserves and associated aquatic and riparian habitat and would contribute to the accomplishment of Aquatic Conservation Strategy (ACS) objectives.
Road Drainage and Surface Enhancement	Road Sediment Reduction	Shady Cove Road Improvement 1.0 mile	Sediment has been identified by the Upper Rogue Watershed Council as a limiting factor for aquatic habitat in Upper Rogue. The effects of the pipeline project would be similar to those of a road, including habitat fragmentation and potential impacts to flow and sediment regimes. Improvement of existing roads would restore hydrologic connectivity and reduce sediment by managing drainage and restoring surfacing where needed.
Road Surfacing	Road Sediment Reduction	Shady Cove Road Resurface 1.5 miles	Sediment has been identified by the Upper Rogue Watershed Council as a limiting factor for aquatic habitat in the Upper Rogue. The effects of the pipeline project would be similar to those of a road, including the potential for sediment mobilization and transport. Road surfacing helps reduce road related sediment by providing a wear-resistant running surface and capping erodible fine sediments.

The routing of the pipeline through the relatively small area of BLM land that would be affected by pipeline project construction (74 acres or 0.33 percent of BLM lands and 0.19 percent of the all ownerships in the watershed) makes it highly improbable that project impacts would affect watershed conditions beyond the site scale considering the route variation. Although there are project-level impacts (e.g., short-term sediment and a change in vegetative condition at stream crossings), these would be minor and largely limited to the boundaries of the project area (appendix J, section 2.5.4.4).

Considering the route variations that eliminated one crossing and relocated two others, no project-related impacts that would retard or prevent attainment of ACS objectives have been identified (appendix J, section 2.5.4.8). Impacts, except as noted, would be within the range of natural variability for watersheds in the Western Cascades and Klamath Mountain Provinces although some of these processes have been altered from their natural condition (appendix J, section 2.5.4.4). Proposed amendment of the Medford District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.5.4.5).

Big Butte Creek

Project Impacts by ACS Objective

Table 4.1.3.5-27 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Big Butte Creek watershed. The pipeline project would include 0.82 miles of corridor and two intermittent stream crossings on BLM lands within the Big Butte Creek watershed where the ACS applies. Approximately 7 acres, or 0.05 percent of the Riparian Reserves on BLM and NFS lands in the watershed, are affected. BLM lands in the McNeil Creek subwatershed, where all of the pipeline would occur, comprise approximately 3,426 acres (21 percent) of the 16,292-acre subwatershed. From MP 131.4 to 131.78, the filed Project alignment lies parallel to an adjacent intermittent stream and largely overlays the associated Riparian Reserve. Because of the close proximity to the adjacent stream, construction of the project in this location would cause substantial impacts on riparian vegetation on the east side of the channel, and likely cause this reach to become a chronic source of sediment. These impacts would likely retard attainment of ACS objectives at this location. The BLM has requested Pacific Connector realign this section to reduce potential sediment and impacts on Riparian Reserves. The applicant has developed a proposed realignment that would move the corridor to an adjacent ridgetop that is entirely outside of the Riparian Reserve. This proposed realignment would eliminate Riparian Reserve and sediment impacts at this location. When engineering has been completed and the applicant has filed this realignment with FERC, this assessment will be modified to reflect that change. Watershed conditions and recommendations are found in the Upper Big Butte Watershed Analysis (BLM 1995a), Central Big Butte Creek, Big Butte Watershed Analysis (BLM 1995b) and the Big Butte Creek Water Quality Restoration Plan (BLM 2008a) and described in detail in appendix J.

TABLE 4.1.3.5-27

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Big Butte Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed landscape scale features that would be affected by the Project. There are three riparian reserves that are affected by the Project corridor on BLM lands in the watershed. No riparian reserves are affected on NFS lands. Two intermittent stream channels are crossed on BLM lands. On BLM lands subject to the ACS, the Project corridor is located primarily on or near ridgetops to minimize impacts on aquatic habitats. From MP 131.4 to 131.78, the Project would closely parallel an intermittent stream and would clear most of the riparian vegetation on the east side of the stream. This is a disproportionate impact when compared to crossings at right angles to streams that are typical of the project. At the request of the BLM, the applicant has developed an alternative alignment that would move the corridor to an adjacent ridge and completely avoid impacts to the Riparian Reserve. When engineering is completed on this realignment and it has been filed with FERC, this assessment will be modified to reflect that change. Approximately 7 acres or 0.05 percent of the riparian reserves in the watershed would be affected by the Project. Most of those acres are affected by the reach described above. The proposed realignment would eliminate most impacts on Riparian Reserves in the Big Butte Creek watershed. Off-site mitigation measures including resurfacing would improve conditions in the watershed (see appendix J, section 2.5.5.5). Except as noted above, while there are long-term impacts on Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variability given the disturbance history of the watershed.

TABLE 4.1.3.5-27

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Big Butte Creek Watershed

ACS Objective	Project Impacts
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The Pacific Connector Pipeline Project would remove approximately 7 acres of riparian vegetation within the Big Butte Creek Watershed, all within the McNeil Creek subwatershed where the project parallels an intermittent stream between MP 131.4 and 131.79. Although the stream is intermittent, it is likely this amount of canopy loss would affect stream channel complexity and connectivity by removing sources of large wood adjacent to the stream channel and creating chronic sources of fine sediments immediately adjacent to the stream channel. This impacts would likely retard attainment of ACS objectives. The BLM has requested a realignment at this location to move the corridor completely out of the Riparian Reserve. This would completely eliminate any possible impact on aquatic habitat connectivity. When Pacific Connector files final engineering on this realignment this evaluation will be modified to reflect that change.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	From MP 131.4 to 131.78, the project would closely parallel an intermittent stream and would clear most of the riparian vegetation on the east side of the stream. This is a disproportionate impact when compared to crossings at right angles to streams that are typical of the project. Construction at this location would likely not maintain the integrity of the aquatic system. At the request of the BLM, the applicant has developed an alternative alignment that would move the corridor to an adjacent ridge and completely avoid impacts to the Riparian Reserve. When engineering is completed on this realignment and it has been filed with FERC, this assessment will be modified to reflect that change. Although the stream is intermittent, it is likely this amount of canopy loss would affect stream channel complexity by removing sources of large wood adjacent to the stream channel and creating chronic sources of fine sediments immediately adjacent to the stream channel. This impacts would likely retard attainment of ACS objectives. The BLM has requested a realignment at this location to move the corridor completely out of the Riparian Reserve. This would completely eliminate any possible impact on aquatic habitat and channel complexity. When Pacific Connector files final engineering on this realignment this evaluation will be modified to reflect that change
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Two intermittent stream channels are crossed on BLM-managed lands. Approximately 7 acres or 0.05 percent of the riparian reserves in the Big Butte Creek Watershed are potentially affected by the Project all within the McNeil Creek subwatershed where the project parallels an intermittent stream between MP 131.4 and 131.79. Although the stream is intermittent, it is likely this amount of canopy loss would affect water temperature early in the summer. This impacts would likely retard attainment of ACS objectives. The BLM has requested a realignment at this location to move the corridor completely out of the Riparian Reserve. This would completely eliminate any possible impact on aquatic habitat and channel complexity. When Pacific Connector files final engineering on this realignment this evaluation will be modified to reflect that change.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	From MP 131.4 to 131.78, the project would closely parallel an intermittent stream and would clear most of the riparian vegetation on the east side of the stream channel. If constructed as proposed, this site would likely become a chronic source of sediment because of the adjacency of the stream channel to the project corridor. It is likely these impacts would retard attainment of ACS objectives. At the request of the BLM, the applicant has developed an alternative alignment that would move the corridor to an adjacent ridge completely out of the Riparian Reserve. When engineering is complete and the realignment has been filed with FERC, this assessment will be modified to address the change. The Big Butte Creek watershed sediment regime was historically characterized by pulse-type depositions of coarser sediments from landslides and surface erosion following major disturbances such as fires and high-intensity winter storms (BLM 1999d). More chronic erosion and deposition of fine sediments primarily from roads, and to a lesser degree from land use has replaced these pulse-type disturbances in the current sediment regime in the watershed. With the exception noted above, the Project construction and operation is not likely to alter this sediment pattern nor is it likely to exacerbate these conditions. Proposed mitigation projects including road resurfacing would contribute to reduction of sediments and restoration of aquatic functions (Appendix J, section 2.5.5.6).

Summary, Big Butte Creek Watershed

Forests on BLM lands within the Medford District in the Big Butte Creek watershed would be affected over the long term by construction and operation of the Pacific Connector Pipeline Project.

The pipeline project would not affect any NFS lands in the watershed. Approximately 7 acres of vegetation would be cleared on BLM lands within the watershed. This represents approximately 0.05 percent of BLM lands within the watershed (appendix J, table 2.5.5.1-3). While this is a long-term change in vegetative condition, it is limited to the site scale and is within the range of natural variability for changes in vegetative condition given the fire history of the watershed.

From MPs 131.4 to 131.78, the pipeline project would closely parallel an intermittent stream and would clear most of the riparian vegetation on the east side of the stream. This is a disproportionate impact when compared to crossings at right angles to streams that are typical of the project. Construction at this location would likely become a chronic source of sediment and would not maintain the integrity of the aquatic system. These impacts would likely retard attainment of ACS objectives at this location. At the request of the BLM, the applicant has developed an alternative alignment that would move the corridor to an adjacent ridge and completely avoid impacts to the Riparian Reserve. When engineering is completed on this realignment and it has been filed with FERC, this assessment will be modified to reflect that change.

The pipeline would cross two intermittent streams within the Big Butte Creek Watershed on BLM land on the filed alignment. The proposed realignment discussed above would eliminate these crossings. Except as noted above, measures in the ECRP including re-vegetation and maintenance of effective ground cover are likely to control surface erosion. Erosion control measures described in appendix J, section 1.3.1 for stream crossings would likely be successful at minimizing sediment associated with stream channel crossings in the watershed. The BLM may require additional erosion control measures if needed Impacts on stream temperature are unlikely because the affected channels are intermittent streams.

Off-site mitigation measures, identified by the BLM, would supplement on-site minimization, mitigation, and restoration actions. These proposed off-site mitigation actions are responsive to recommendations in the Big Butte Creek Water Quality Restoration Plan (BLM 2008a) and would contribute to improving terrestrial and aquatic conditions within the watershed (appendix J, section 2.5.5.6). Table 4.1.3.5-28 describes proposed off-site mitigations in the Big Butte Creek watershed.

TABLE 4.1.3.5-28

Proposed Off-site Mitigations on BLM Lands in the Big Butte Creek Watershed

Project Type	Mitigation Group	Project Name	Project Rationale
Fire Suppression	Fire suppression	Big Butte Creek Pump Chance 1 site	Construction of the pipeline and associated activities would increase fire suppression complexity. Pump chances increase capacity for agency response and help reduce potential fire losses to valuable habitats by providing readily available water sources.
Road Surfacing	Road Sediment Reduction	Big Butte Creek Road storm-proofing 6.4 miles	Sediment was identified by the Upper Rogue Watershed Council as a factor that limited aquatic habitat in Big Butte Creek. The effects of the Pacific Connector Pipeline Project are similar to those of a road, including possible impacts to flow and sediment regimes. Improvement of existing roads restores hydrologic connectivity and reduces sediment by managing drainage and restoring surfacing where needed.

Except as noted above, the routing of the pipeline through the relatively small area of BLM land that would be affected by pipeline project construction (approximately 14 acres) makes it highly improbable that project impacts would affect watershed conditions beyond minor, short-term

impacts at the site scale on two isolated intermittent streams. Impacts on Riparian Reserves could be further reduced by realignment to get the corridor out of the Riparian Reserves at MP 131.4 to 131.78. Although there are project-level impacts (e.g., short-term sediment and a change in vegetative condition at stream crossings), these would be minor and would be largely limited to the boundaries of the project area except as noted above. Proposed amendment of the Medford District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the pipeline project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.5.5.5).

Except as noted above, no project-related impacts that would prevent attainment of ACS objectives have been identified (appendix J, section 2.5.5.8). Impacts, as they relate to relevant ecological processes, would be within the range of natural variability for watersheds in the Western Oregon and High Cascade Provinces although some of these processes have been altered from their natural condition (appendix J, section 2.5.5.4).

Little Butte Creek

Project Impacts by ACS Objective

Table 4.1.3.5-29 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Little Butte Creek watershed. BLM and NFS lands where the ACS applies comprise approximately 114,658 acres or 48 percent of the Little Butte Creek watershed (appendix J, table 2.5.6.1-1). Riparian Reserves comprise approximately 10,785 acres (about 9.4 percent of the watershed) on BLM and NFS lands. Watershed conditions and recommendations are found in the Little Butte Creek Watershed Analysis (BLM and Forest Service 1997) and described in detail in appendix J of this EIS. The pipeline project would include 6 miles on BLM lands and 14 miles on NFS lands. A total of about 18 acres or 0.17 percent of the Riparian Reserves would be cleared in the watershed on federal lands:

- One perennial stream channel crossing,
- Seven intermittent stream channel crossings, and
- Two intermittent stream and one wetland where Riparian Reserves are clipped, but the associated waterbodies are not crossed by the pipeline project.

TABLE 4.1.3.5-29

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Little Butte Creek

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed-scale features. The Pacific Connector Pipeline Project would clear about 18 acres or about 0.17 percent of Riparian Reserves on BLM and NFS lands in Little Butte Creek (appendix J, table 2.5.4.1-2, 4). There are seven intermittent and one perennial stream channels crossed in the Little Butte Creek watershed. Impacts to aquatic systems are expected to be short-term and minor and limited to the project scale because of application of best management practices and erosion control measures (appendix J, sections 2.5.6.4 and 1.3.1). Large woody debris (LWD) cleared in construction of the corridor would be used to stabilize and restore stream crossings. Off-site mitigation measures including road stormproofing and over 65 miles of road decommissioning, over 9 miles of instream projects, snag creation, and coarse woody debris placement are expected to improve watershed conditions in the Little Butte Creek watershed (appendix J, section 2.5.6.6). While there would be long-term changes in vegetation in Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variability given the disturbance history of the watershed (appendix J, section 2.5.6.4).
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	Impacts to the bed and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance is small at each crossing (<15 feet wide). This level of disturbance is comparable to a bank slough (appendix J, section 1.3.1.) and well within the range of natural variability that for watersheds of the Klamath–Siskiyou Province and High Cascades Province (appendix J, section 2.5.6.4). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the POD requirements. By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the Little Butte Creek watershed because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the exhibits specified in the *Wetland and Waterbody Crossing Plan*. At each crossing, bed and bank disturbances from equipment crossing and trenching are small (<15 feet wide). After construction all disturbed areas would be returned to their approximate preconstruction contours and drainage patterns. The temporary construction right-of-way would be restored and revegetated with native grasses, forbs, conifers, and shrubs, as outlined in the *Erosion Control and Revegetation Plan* (ECRP). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossings, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the Oregon Department of Fish and Wildlife in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized. Road decommissioning that occurs within Riparian Reserves (approximately 18 acres) would contribute to restoration of aquatic connectivity. The residual levels of disturbance are anticipated to be well within the range of natural variability in the Klamath–Siskiyou Province and High Cascades Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment would be mobilized during construction. These impacts are expected to be short-term and limited to the general area of construction (see appendix J, section 1.3.1). No long-term impacts on water quality are expected because of application of the ECRP including maintenance of effective ground cover (see appendix J, section 1.3.1) and Best Management Practices during construction (appendix J, section 1.3.1.1). Effective shade would be removed at the crossing of the South Fork Little Butte Creek at MP 162.45. A site-specific shade analysis (NSR 2009) found no temperature impacts at the site or at the stream network scale at this crossing.

TABLE 4.1.3.5-29

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Little Butte Creek

ACS Objective	Project Impacts
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The Little Butte Creek watershed sediment regime was historically characterized by pulse-type depositions of coarser sediments from landslides and surface erosion following major disturbances such as fires and high-intensity winter storms (BLM and Forest Service 1997). The current sediment regime in the watershed has replaced these pulse-type disturbances with more chronic erosion and deposition of fine sediments primarily from urban and agricultural land use, timber harvest and roads. The pipeline project construction and operation are not likely to alter this sediment pattern nor are they likely to exacerbate these conditions because of implementation of measures in the ECRP (appendix J, section 1.3.1) including maintenance of effective ground cover, water bars to dissipate overland flows and maintenance of sediment barriers until revegetation is successful. Sediment impacts from construction are expected to be similar to those described in appendix J, section 1.3.1.2. Proposed mitigation projects including road resurfacing and decommissioning would contribute to reduction of sediments and restoration of aquatic functions at the watershed scale (appendix J, section 2.5.6.6). Any sediment impacts are expected to be well within the range of natural variability given the disturbance history of the Little Butte Creek Watershed (appendix J, section 2.6.5.4). A pulse of sediment could be observed following the first seasonal rain, but that this sediment-laden water is likely to dissipate within a few hundred feet and would be indistinguishable from background levels.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project is unlikely to affect peak flows in the Little Butte Creek watershed because of the dispersed nature of impacts, the current hydrologically recovered conditions in the watershed, the relatively small proportion of the watershed affected and the relative lack of connectivity to aquatic systems (appendix J, section 2.5.6.4). Decommissioning roads (66.2 miles) as part of the off-site mitigation plan would contribute substantively the restoration of flow patterns by restoring hydrologic connectivity at stream crossings that are decommissioned (appendix J, section 2.5.6.6).
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The Pacific Connector Pipeline Project crosses one small (<0.1 acre) wetland in the Little Butte Creek Watershed. Trench plugs would be used at the edge of the wetland area if any are encountered to minimize drainage by the pipeline trench. Decommissioning 66.3 miles of roads, 18 acres of which are in Riparian Reserves (appendix J, section 2.5.6.6) would contribute substantially to restoring floodplain functions where these projects occur.
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Project impacts on riparian vegetation in the Little Butte Creek watershed would be minor. Approximately 20 acres or 0.18 percent of the Riparian Reserves in the watershed on federal lands are potentially affected by the pipeline project (appendix J, table 2.5.6.1-4). Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Coarse wood placement and snag creation on 126 acres in Riparian Reserves, along with revegetation on 18 acres of Riparian Reserves in roads that would be decommissioned would help to reestablish species composition and structural diversity of plant communities in Riparian Reserves (appendix J, section 2.5.6.6).
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Pipeline project impacts on riparian vegetation in the Little Butte Creek watershed would be minor. Approximately 20 acres or 0.18 percent of the Riparian Reserves in the watershed on federal lands are potentially affected by the project. Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Coarse wood placement and snag creation on 126 acres in Riparian Reserves, along with revegetation on 18 acres of Riparian Reserves in roads that would be decommissioned would help to reestablish species composition and structural diversity of plant communities in Riparian Reserves (appendix J, Section 2.5.6.4). No riparian-dependent Survey and Manage species have been identified whose persistence would be threatened by the pipeline project (appendix J, section 2.5.6.5)

Summary, Little Butte Creek Watershed

Little Butte Creek is the largest, and in some ways, the most complex, watershed crossed by the Pacific Connector Pipeline Project. With 19.7 miles of corridor and 327 acres of clearing on BLM and NFS

lands, this watershed has the most federal land area affected of the 19 watersheds crossed by the pipeline project. Little Butte Creek is geologically complex with both Klamath-Siskiyou Province and High Cascade Province landscapes. It is ecologically diverse and important, providing some of the most productive coho salmon streams in the Upper Rogue Basin. Little Butte Creek is a Tier One Key Watershed above the confluence of the North and South Forks, and all of the NFS lands in the watershed are managed as LSR (appendix J, section 2.5.6.1). Against this backdrop, compliance with the ACS is an important measure of pipeline project impacts.

Pacific Connector has modified their pipeline project to respond to the ACS objectives and has incorporated measures consistent with the Riparian Reserve standards and guidelines. The assessment demonstrates that short-term impacts associated with the pipeline project would occur to streambanks, and substrates at the site scale. Change in vegetative condition from clearing of forest within the pipeline construction corridor is a long-term impact. These impacts, however, are well within the range of natural variability given the disturbance processes that function in the watershed (appendix J, section 2.5.4.4; table 2.5.4.2-1). This is especially apparent when considering the total amount of Riparian Reserves that are located within the Little Butte Creek watershed (10,791 acres) and the amount of clearing (18 acres) in Riparian Reserves (0.17 percent of the Riparian Reserves in the watershed) (appendix J, table 2.5.6.1-3). Also, because of the linear characteristic of the pipeline, the Riparian Reserve crossings would be spread out across the landscape and would be discontinuous.

Off-site mitigation measures including over 66 miles of road decommissioning (53 miles are within the Key Watershed), 9.6 miles of LWD instream projects, 21.8 miles of road resurfacing, identified by the BLM and Forest Service, would supplement on-site minimization, mitigation, and restoration actions. These proposed off-site mitigation measures are responsive to recommendations in the Little Butte Creek Watershed Assessment (BLM and Forest Service 1997) and the South Cascades Late-Successional Reserve Assessment (Forest Service et al. 1998). Mitigation associated with the pipeline project is responsive to watershed analysis recommendations and would improve watershed conditions where they are applied (appendix J, section 2.5.6.4). Table 4.1.3.5-30 describes proposed mitigation measures in the Little Butte Creek watershed.

Three site-specific amendments of the Rogue River National Forest LRMP and one amendment of the Medford District RMP related to the ACS are proposed to make provision for the pipeline project (appendix J, section 2.5.6.5):

- Proposed amendment RRNF-5 would allow the Pacific Connector Pipeline Project to cross the MA-26 Restricted Riparian land allocation at one location on the South Fork of Little Butte Creek. This amendment would not prevent attainment of ACS objectives because a site-specific temperature assessment (NSR 2009) showed there would be no temperature increase from shade removal at this location, effective ground cover and sediment barriers would be maintained and implementation of the ECRP is expected to control surface erosion and reestablish native vegetation.
- Proposed amendment RRNF-6 would allow the Pacific Connector Pipeline Project to exceed detrimental soil conditions within the construction corridor. This would not prevent attainment of ACS objectives because soil decompaction and remediation required in Riparian Reserves is expected to effectively moderate detrimental soil conditions. Implementation of measures in the ECRP is expected to effectively control surface erosion and restore native vegetation (see section 4.3.4).

- Proposed amendment of the Rogue River National Forest LRMP and the Medford District RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the Pacific Connector Pipeline Project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.4.8.5).

The Pacific Connector Pipeline Project is otherwise consistent with standards and guidelines for activities in Riparian Reserves for the Rogue River National Forest and the Medford District, BLM.

The routing of the pipeline through BLM and NFS lands, coupled with the relatively small area of BLM and NFS land affected by pipeline project construction (0.20 percent of BLM lands and 0.49 percent of NFS lands of the fifth-field watershed), makes it highly improbable that project impacts could affect watershed conditions. The relative lack of intersections with aquatic systems serves to further minimize possible impacts (appendix J, section 2.5.6.1). Although there are project-level impacts from short-term sediment and long-term change in vegetative condition at stream crossings), these would be minor in scale (appendix J, section 2.5.6.4).

No project-related impacts that would prevent attainment of ACS objectives have been identified (appendix J, section 2.5.6.8). All relevant pipeline project impacts are within the range of natural variability for watersheds in the Klamath-Siskiyou and High Cascades Provinces, although some of these processes have been altered from their natural condition (appendix J, section 2.5.6.4).

TABLE 4.1.3.5-30

Proposed Mitigation Measures on BLM and NFS Lands in the Little Butte Creek Watershed

Admin Unit	Mitigation Group	Project Name	Quantity	Unit	Project Rationale	Land Allocation
Medford BLM	Aquatic and Riparian Habitat	Little Butte Cr. Fish Screen	1	site	Irrigation diversions have negatively impacted fisheries in Little Butte Creek by causing entrapment. There is a private irrigation ditch with an unscreened diversion and associated push up dam on BLM land in the lower 1.5 miles of Lost Creek. The unscreened ditch is currently accessible to juvenile and adult fish, creating a stranding hazard with limited return access to the main channel. The pus- up dam is constructed at the beginning of the irrigation season and removed at the end of the season. This stream is considered coho critical habitat and building a push up dam in the creek each season disturbs gravels, generates sediment and creates an unnecessary disturbance during steelhead spawning season. Creating a permanent diversion structure, possibly in the form of a boulder weir, would divert water without yearly maintenance and would provide for both upstream and downstream fish passage.	Riparian Reserve
Medford BLM	Aquatic and Riparian Habitat	Lost Cr. Instream LWD	8.6	miles	Lost Cr. provides habitat for Coho Salmon. Lack of large wood and recruitment of LWD into streams is a consistent factor limiting aquatic habitat quality in all watersheds crossed by the Pacific Connector pipeline. Implementation of the Pacific Connector Pipeline Project would result in the removal of large woody debris from the Riparian Reserves associated with intermittent and perennial streams. The removal of vegetation within and adjacent to the channel would preclude future recruitment of large woody debris into the channel and associated Riparian Reserves. Placing large woody debris at key locations within the channel and associated Riparian Reserves would offset both the short-term and long-term impacts from loss of LWD recruitment to Riparian Reserves and associated aquatic and riparian habitat and contributes to the accomplishment of ACS objectives.	Riparian Reserve
Medford BLM	Fire suppression	Little Butte Cr. Pump Chance	8	sites	Construction of the pipeline and associated activities would increase fire suppression complexity. Pump chances increase capacity for agency response and help reduce potential fire losses to valuable habitats by providing readily available water sources.	All
Medford BLM	Road Sediment Reduction	Little Butte Cr. Road Improvement	3.5	miles	Sediment has been identified by the LBC Watershed Council as a limiting factor for aquatic habitat in Little Butte Creek. The Pacific Connector pipeline has approximately 6 miles of corridor and 7 stream crossings on BLM lands in the LBC fifth-field watershed. The effects of the Pacific Connector pipeline are similar to a road, including possible impacts to flow and sediment regimes. Improvement of existing roads restores hydrologic connectivity and reduces sediment by managing drainage and restoring surfacing where needed.	Riparian Reserve, Matrix
Medford BLM	Road Sediment Reduction	Little Butte Cr. Road Decommissioning Butte Falls RA	2.4	miles	Sediment has been identified by the LBC Watershed Council as a limiting factor for aquatic habitat in Little Butte Creek. There are approximately 6 miles of the Pacific Connector pipeline corridor and 7 stream crossings on BLM lands in LBC. The effects of the Pacific Connector pipeline include habitat fragmentation and potential impacts to flow and sediment regimes. Road decommissioning reduces habitat fragmentation, reduces road-related sediment and improves hydrologic connectivity by reducing road density.	

TABLE 4.1.3.5-30

Proposed Mitigation Measures on BLM and NFS Lands in the Little Butte Creek Watershed

Admin Unit	Mitigation Group	Project Name	Quantity	Unit	Project Rationale	Land Allocation
Medford BLM	Road Sediment Reduction	Little Butte Cr. Road Resurfacing Ashland Resource Area	9.0	miles	Sediment has been identified by the LBC Watershed Council as a limiting factor for aquatic habitat in Little Butte Creek. The Pacific Connector pipeline has approximately 6 miles of corridor and 7 stream crossings on BLM lands in the LBC fifth-field watershed. The effects of the pipeline include the potential for sediment mobilization and transport. Road improvement efforts (resurfacing) help restore hydrologic and reduce road-related sediment that could be delivered to stream channels.	Riparian Reserve, Matrix
RRNF	Aquatic and Riparian Habitat	SF Little Butte Cr. LWD	1.5	Mile	Over the last century, many streams with high aquatic habitat potential have become simplified, and therefore, have a reduced capacity to provide quality habitat. Riparian stands have decreased health and vigor, resulting in increased time to develop large tree structure for wildlife, stream shade, and future instream wood. Placement of LWD in streams adds structural complexity to aquatic systems, traps fine sediments and can contribute to reductions in stream temperatures over time. The BLM completed placement last year on 3 miles of Spencer Creek below this reach. Addition of this segment would complete the stream rehabilitation on the reach of Spencer Creek where the project occurs. Logs from the Project right-of-way would be used for the project. An estimated 75 pieces are needed. A helicopter would be used to place the logs.	Riparian Reserve, LSR
RRNF	Aquatic and Riparian Habitat	Little Butte Cr. Stream Crossing Decommissioning	32	Sites	Restoring stream crossings reconnects aquatic habitats by allowing the passage of aquatic biota and restoring riparian vegetation. Over time, these actions reduce sediment and restore shade. Restoration of these crossings includes riparian planting as a mitigation which would help offset the impact of shade removal at pipeline right-of-way crossings.	Riparian Reserve
RRNF	Road sediment reduction	Little Butte Cr. Road Decommissioning	53.2	Miles	A construction corridor 75 to 95 feet wide with additional work areas would be cleared. Of this, a 30-foot-wide route along the pipeline route would be maintained in early successional habitat. This strip of land, in a forested ecosystem, provides a barrier for movement of small animals between the remaining forest blocks and degrades neighboring habitat through edge effects and fragmentation. This is of special concern in riparian ecosystems where movement of wildlife species is concentrated. Decommissioning and planting selected roads in conjunction with precommercial thinning treatments (see other mitigations) would block up forested habitat and reduce edge effects and fragmentation in a period of about 40 years. Removal of culverts and roadbeds in riparian reduces sedimentation to the waters. This mitigation meets ACS objectives 2, 4, 5, 8 & 9. Little Butte Creek is a key watershed and road reduction is a major objective (NWFP ROD C-7). Note that this would be most effective if done in conjunction with the thinning proposed. This mitigation also offsets the impacts of soil compaction and displacement within the construction right-of-way.	Riparian Reserve, LSR

TABLE 4.1.3.5-30

Proposed Mitigation Measures on BLM and NFS Lands in the Little Butte Creek Watershed

Admin Unit	Mitigation Group	Project Name	Quantity	Unit	Project Rationale	Land Allocation
RRNF	Stand Density Fuel Break	Little Butte Cr LSR Precommercial Thin	617	Acres	There would be direct impacts to existing interior, developing interior habitat. The Pacific Connector project would result in additional fragmentation and preclude the recovery of fragmented habitat for those stands adjacent to the pipeline corridor. Maintenance of pipeline corridor would provide a continued vector for predators, early-seral species and non-native species. Also the Project would result in a direct loss in biological services provided by mature forest characteristics for many decades past the life of this Project. Both mature stands and developing stands would be removed during pipeline construction. Density management of forested stands would assist in the recovery of late-seral habitat, impact from fragmentation, reduction in edge effects and enhance resilience of mature stands. Accelerating development of mature forest characteristics would shorten the impacts of those biological services loss due to pipeline construction. Thinning of young stands is a recognized treatment within LRSs if designed to accelerate development of late-successional habitat characteristics (NWFP ROD C-12; ROD Pages B-11 ACS Objectives, C-11 and C-17).	LSR
RRNF	Terrestrial Habitat Improvement	Little Butte Cr. Mardon Skipper Butterfly	20	Acres	The Dead Indian Plateau region is one of three known sites for Mardon skipper butterflies in the world. It is also adjacent to a known site for short-horned grasshoppers. Both species are on the Forest's Sensitive Species list. The pipeline requirement of a permanent open corridor provides a unique opportunity to develop habitat for these skippers and grasshoppers. Planting the corridor with plants preferred by these Sensitive Species has the potential to increase the habitat and local range for these two species. Rehabilitation of disturbed sites is required under various BMP guidelines. Use of specific plant species has no additional problems. Results would be immediate in stabilizing the local habitat and location would be in the pipeline.	LSR
RRNF	Terrestrial Habitat Improvement	Little Butte Cr. LSR LWD Placement	306	Acres	Mitigate for the loss of recruitment of large down wood to adjacent stands and within the construction clearing zone. The project would forgo the development of large down wood for the life of the Project and for decades after. Downed wood is a critical component of Mature Forest ecosystems. Large wood replacement would partially mitigate for the barrier effect of the corridor by creating structure across the corridor for use by small wildlife species. Placement in wood deficient areas adjacent to the corridor allows for scattering of stockpiled wood, reducing localized fuel loads while improving habitat in deficient stands. Larger logs maintain moisture longer and are less likely to be fully consumed by fire. Managing for the proposed levels provide for a greater assurance of species abundance (DecAID; ROD C-11). Acres that can be treated are necessarily limited by material available from the corridor.	LSR

TABLE 4.1.3.5-30

Proposed Mitigation Measures on BLM and NFS Lands in the Little Butte Creek Watershed

Admin Unit	Mitigation Group	Project Name	Quantity	Unit	Project Rationale	Land Allocation
RRNF	Terrestrial Habitat Improvement	Little Butte Cr. LSR Snag Creation	622	Acres	Mitigate immediate and future impacts to snag habitat from the clearing of the pipeline right-of-way. The project prevents development of large snags during the life of the project and for decades after. Corridor construction would result in loss of snag habitat on approximately 775 acres of corridor construction (includes safety zone buffer). This project would add to those cumulative impacts. As snags are a critical component of LSR spotted owl habitat, replacement is needed. Snag requirements are specifically outlined in the Forests' LMPs and NWFP. Forests require analysis and mitigation under most management activities. There would be a 10-year delay as snag decay develops. Snag management is required in the Rogue River National Forest LMP (4-20), with levels set under the various management directions. Snag Management is discussed in the NWFP for LSRs on C-14 and 15 of the ROD (items 4 and 7). Snag management levels are based on the Forest's Plant Association Guidelines. Snags are also discussed in the South Cascades LSR Assessment (Chap. 3).	LSR
RRNF	Reallocation of Matrix Lands to LSR	LSR 227 Addition	12	Acres	This is the Little Butte Creek portion of amendment RRNF 7 which would reallocate 512 acres from the Matrix land allocation to the LSR land allocation. This action contributes to the "neutral to beneficial" standard for new developments in LSRs by adding acres to the LSR land allocation to offset the long-term loss of acres of acres and habitat from the construction and operation of the Pacific Connector Pipeline Project.	LSR

Spencer Creek

Project Impacts by ACS Objective

Table 4.1.3.5-31 compares the Pacific Connector Pipeline Project impacts to the objectives of the ACS for the Spencer Creek watershed. BLM and NFS lands where the ACS applies comprise approximately 57 percent of the Spencer Creek watershed (appendix J, table 2.6.3.1-1). Watershed conditions and recommendations are found in the Spencer Creek Watershed Analysis (BLM et al. 1995) and described in detail in appendix J. The pipeline project would include 1.0 miles of right-of-way on BLM lands and 6 miles on NFS lands. A total of 9 acres of Riparian Reserves or 1.19 percent of the Riparian Reserves in the watershed (appendix J, table 2.6.3.1-4) would be affected on:

- Five intermittent stream channels and two wetlands crossed by the Pacific Connector Pipeline Project.
- Four intermittent streams and two wetlands where Riparian Reserves are clipped but the associated stream channel or wetland is not crossed.

TABLE 4.1.3.5-31

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Spencer Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed-scale features. The Pacific Connector Pipeline Project would affect about 9 acres or about 1.19 percent of Riparian Reserves on BLM and NFS lands in the Spencer Creek watershed (appendix J, table 2.6.3.1-3). There are five intermittent stream channels crossed in the Spencer Creek watershed. No perennial streams are crossed. Riparian Reserves associated with two forested wetlands and four intermittent streams are clipped. Impacts to aquatic systems are expected to be short-term or minor and limited to the project scale because of application of best management practices and erosion control measures (appendix J, sections 2.6.3.4 and 1.3.1.). Clearing of 5.41 acres of late successional and old-growth (LSOG) vegetation in Riparian Reserves is a long-term change in condition, but is minor in scale, and within the range of natural variability given the disturbance processes in Spencer Creek (appendix J, section 2.6.3.4). Spencer Creek watershed remains above the 15 percent threshold for LSOG vegetation established in the Northwest Forest Plan (NWFP) (appendix J, section 2.6.3.5). Large woody debris (LWD) cleared in construction of the corridor would be used to stabilize and restore stream crossings. Off-site mitigation measures including road stormproofing and over 21 miles of road decommissioning, 1.5 miles of instream projects, fencing and riparian planting projects are expected to improve watershed conditions in the Spencer Creek watershed. While there are long-term changes in vegetation in Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variability given the disturbance history of the watershed (appendix J, section 2.6.2.6).
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	Impacts to the bed and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance is small at each crossing (<15 feet wide). This level of disturbance is comparable to a bank slough (appendix J, section 1.3.1.2) and well within the range of natural variability for watersheds of the High Cascades Province (appendix J, section 2.6.3.4). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions, consistent with the *Wetland and Waterbody Crossing Plan*. By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained. Off-site mitigation measures (appendix J, section 2.6.3.6) would substantively improve watershed conditions by decommissioning 21.5 miles of roads (36 acres total of which 13 acres are in riparian reserves), replanting willows along 0.5 mile of perennial streams and restoring LWD in 1.5 miles of Spencer Creek.

TABLE 4.1.3.5-31

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Spencer Creek Watershed

ACS Objective	Project Impacts
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The pipeline project is not expected to affect spatial or temporal connectivity in the Spencer Creek watershed because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the exhibits specified in the POD (i.e., *Wetland and Waterbody Crossing Plan*). Additionally, all of the channel crossed in Spencer Creek are intermittent and are likely to be dry at the time of crossing. In the short-term during construction connectivity could be disrupted for 1 to 5 days. At each crossing, bed and bank disturbances are small (<15 feet wide). After construction all disturbed areas would be returned to their approximate preconstruction contours and drainage patterns. The temporary construction right-of-way would be restored and revegetated with native grasses, forbs, conifers, and shrubs, as outlined in the *Erosion Control and Revegetation Plan* (ECRP). After construction, key habitat components such as LWD and boulders would be restored on-site and the bed and banks would be returned to pre-construction conditions. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. With the exception of a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic and riparian dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts to sensitive life stages of aquatic biota would be minimized. Road decommissioning that occurs within Riparian Reserves (approximately 13 acres) would contribute to restoration of aquatic connectivity (appendix J, section 2.6.3.6). The residual levels of disturbance are anticipated to be well within the range of natural variability in the High Cascades Province (appendix J, section 2.6.3.4).
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Pipeline stream crossings in Spencer Creek are expected to occur when intermittent stream channels are dry. Minor amounts of sediment would be generated during construction that may be mobilized during the onset of seasonal precipitation in the fall. These impacts are expected to be short term and limited to the general area of construction (see appendix J, section 1.3.1). No long-term impacts on water quality are expected because of application of the ECRP including maintenance of effective ground cover (see appendix J, section 1.3.1) and best management practices during construction (appendix J, sections 1.3.1.1 and 2.6..3.4) Off-site mitigation measures (appendix J, section 2.6.3.6) address key issues identified in the watershed assessment and are expected to substantially improve watershed conditions.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The Spencer Creek Watershed sediment regime was historically characterized by pulse-type depositions of coarser sediments from streambank erosion following major disturbances such as fires and high-intensity winter storms. More chronic erosion and deposition of fine sediments primarily from roads, and to a lesser degree from land use has replaced these pulse-type disturbances in the current sediment regime in the watershed. The Pacific Connector Pipeline Project construction and operation are not likely to alter this sediment pattern nor are they likely to exacerbate these conditions. Sediment impacts from construction are expected to be similar to those described in appendix J, section 1.3.1.2. Proposed mitigation projects including 21.5 miles of road decommissioning would contribute to reduction of sediments and restoration of aquatic functions at the watershed scale. Any sediment impacts are expected to be well within the range of natural variability given the disturbance history of the Spencer Creek watershed (appendix J, section 2.6.3.4).
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	The pipeline project is unlikely to affect flow patterns in the Spencer Creek watershed because of the dispersed nature of impacts, high infiltration rates and the relatively small proportion of the watershed affected (appendix J, section 2.6.3.4). Decommissioning roads (21.5 miles) as part of the off-site mitigation plan would contribute substantively the restoration of flow patterns by restoring hydrologic connectivity at stream crossings that are decommissioned (appendix J, section 2.6.3.6).
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The pipeline project corridor crosses two small wetland areas and clips the Riparian Reserve of another two forested wetlands. Trench plugs would be installed on each side of these wetlands as needed to block subsurface flows and maintain water table elevations, as required by FERC's *Wetland and Waterbody Construction and Mitigation Procedures*. Regardless, pipeline project construction may have short-term impacts on water tables in these isolated forest wetlands. These crossings may also regulated under Section 404 of the Clean Water Act. By restricting crossings to the dry season (July 1 to Sept. 15), possible impacts on water tables of these wetland areas are expected to be minor and short term.

TABLE 4.1.3.5-31

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Spencer Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation; nutrient filtering; and appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse, woody debris sufficient to sustain physical complexity and stability.	Pipeline project impacts on riparian vegetation in the Spencer Creek Watershed would be minor. Approximately 9 acres or 1.19 percent of the Riparian Reserves in the watershed are potentially affected by the project (appendix J, table 2.6.3.1-3). Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Revegetation of 13 acres of Riparian Reserves in roads that would be decommissioned would help to reestablish species composition and structural diversity of plant communities in Riparian Reserves (appendix J, section 2.6.3.6).
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Pipeline project impacts on riparian vegetation in the Spencer Creek Watershed would be minor. Approximately 9 acres or 1.19 percent of the Riparian Reserves in the watershed are potentially affected by the project. Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. Revegetation on 13 acres of Riparian Reserves in roads that would be decommissioned would help to reestablish species composition and structural diversity of plant communities in Riparian Reserves. The persistence of riparian-dependent Survey and Manage species would not be threatened by pipeline construction and operation in the watershed (see appendix K of this EIS).

Summary, Spencer Creek Watershed

Spencer Creek is the easternmost and driest watershed that is crossed by the Pacific Connector Pipeline Project in the High Cascades Province where the ACS applies.[18] It is also a Tier One Key Watershed in the NWFP. Stream densities are much lower than watersheds west of the Cascade crest. Spencer Creek would have 9 acres of Riparian Reserves cleared or 1.16 percent of Riparian Reserves in the watershed . Precipitation patterns show a strong declining gradient from 40 inches a year on the crest of the Cascades to less than 12 inches where Spencer Creek flows into the Klamath River. The pumice soils in the watershed have high infiltration rates and rarely exhibit overland flows and mass wasting seen in other watersheds crossed by the pipeline project. By locating the pipeline project adjacent to the Clover Creek Road for much of its length, project impacts on wetlands and stream channels have been minimized when compared to the impacts of creating a new corridor with the Project.

Pacific Connector has modified their pipeline project to respond to the ACS objectives and has incorporated measures consistent with the Riparian Reserve standards and guidelines. The assessment demonstrates that short-term impacts associated with the Pacific Connector pipeline would occur to streambanks and substrates at the site scale. Change in vegetative condition from clearing the corridor is a long-term impact that would occur on 9 acres of Riparian Reserves. These impacts, however, are well within the range of natural variability given the disturbance processes that function in the watershed (appendix J, section 2.6.3.4). Also, because of the linear characteristic of the pipeline project, the Riparian Reserve crossings would be spread out across the landscape and would be discontinuous.

[18] Mill Creek, Lake Ewauna, and JC Boyle watersheds are also crossed by the pipeline project, but they are outside the area of the NWFP. Of these, only Lake Ewauna watershed has a small piece of BLM lands that are crossed. The ACS does not apply in that location.

TABLE 4.1.3.5-32

Proposed Off-Site Mitigation Projects on BLM and NFS Lands in the Spencer Creek Watershed

Agency	Project Type	Project Name	Quantity	Unit	Project Rationale	Land Allocation
BLM	Riparian Vegetation Riparian Stand Density	Upper Spencer Creek LSR/ Riparian Treatment	3.0	miles	Spencer Creek is a Tier One, Key Watershed. Implementation of the Pacific Connector Pipeline Project would require removal of riparian vegetation, thereby influencing the form and function of Riparian Reserves. This project would thin, pile and burn dense white fir understory vegetation and fall occasional trees into the stream channel for large woody debris (LWD). This would enhance forest health and diversity with the LSR/Riparian Reserve by restoring stand density to more natural and sustainable levels. This contributes to forest health and sustainability of riparian reserves by increasing resistance to insect and disease losses and reducing the risk of stand replacing fire. LWD in stream channels contributes to meeting water quality and total maximum daily load (TMDL) targets and provides habitat for sensitive fish and invertebrate species.	Riparian Reserves and LSR
BLM	Riparian Vegetation Riparian Stand Density	Miners Creek LSR, Riparian Treatment	3.0	miles		Riparian Reserves
BLM	Road Closure Road Sediment Reduction	Spencer Creek Repair Existing Road Closure	12	sites	Roads negatively impact wildlife. Implementation of the Pacific Connector Pipeline Project would require use of a large number of permanent and temporary roads and other access routes. Road closures (barricades) were established in the watershed to reduce road density to meet Resource Management Plan objectives for both the aquatic conservation strategy and reduce impacts to wildlife. This project repairs the existing closure structures to ensure that road closures remain effective. Spencer Creek is a Tier One, Key Watershed. Maintaining road closures also reduces sediment by keeping closed roads revegetated.	Riparian Reserves
BLM	Road Sediment Reduction	Spencer Creek Drainage Improvements and Sediment Trap Removal	15	sites	Spencer Creek is a Tier One, Key Watershed. The pipeline project uses a number of roads for access and construction. Drainage improvements and removing non-functioning cross drains and sediment traps at selected locations would benefit aquatic habitat/connectivity by restoring drainage and reducing sediment transport.	Riparian Reserves
BLM	Road Sediment Reduction	Keno Access Road Repair and Culvert Replacement	1	site	Spencer Creek is a Tier One, Key Watershed. The existing stream crossing (culvert) is undersized in both length and diameter, therefore it ability to meet ACS objectives is minimized. The culvert underlying the existing road bed periodically causes erosion of the road prism and adjacent upland and riparian areas. Replacement of the culvert would allow stabilization of the road shoulder and reduce sediment input to Miner's creek and its contribution of sediment to Spencer creek. If this work is not completed, the condition would eventually lead to increased sedimentation. Replacement of this drainage structure would decrease road-related erosion, increase the hydrologic capacity of the crossing and enhance aquatic connectivity for fish and other aquatic organisms.	Riparian Reserves
FS	Aquatic	Riparian Planting	0.5	miles	This is a meadow site along a 0.5-mile reach of Spencer Creek just upstream of Buck Lake (T38S R5E sec 11) that has lost streamside vegetation and has compacted soils. There is an overall need to restore health and vigor to riparian stands by maintaining and improving riparian reserve habitat. Shade provided by the plantings would contribute to moderating water temperatures in Spencer Creek. Root strength provided by new vegetation will increase bank stability, decrease erosion and sediment depositions to Spencer Creek and provide habitat for species that use riparian habitats. This is responsive to Aquatic Conservation Strategy (ACS) objectives 3, 4, 5, 8, and 9.	Riparian Reserves

TABLE 4.1.3.5-32

Proposed Off-Site Mitigation Projects on BLM and NFS Lands in the Spencer Creek Watershed

Agency	Project Type	Project Name	Quantity	Unit	Project Rationale	Land Allocation
FS	Aquatic	Spencer Creek LWD	1.0	miles	Over the last century, a 1-mile reach of Spencer Creek (T38S R6E sec 18) with high aquatic habitat potential has become simplified, and therefore, has a reduced capacity to provide quality habitat. Riparian stands have decreased health and vigor, resulting in increased time to develop large tree structure for wildlife, stream shade, and future instream wood. Placement of LWD in streams adds structural complexity to aquatic systems, traps fine sediments and can contribute to reductions in stream temperatures over time (Tippery et al. 2010). The BLM completed placement last year on 3 miles of Spencer Creek below this reach. Addition of this segment would complete the stream rehabilitation on the reach of Spencer Creek where the project occurs. Logs from the pipeline project right-of-way would be used for the project. An estimated 75 pieces are needed. A helicopter would be used to place the logs. This is responsive to Aquatic Conservation Strategy objectives 2, 3, 4 and 5.	Riparian Reserves
FS	Aquatic	Interpretive Sign	1	project	Continued recreational dam building occurs at this location resulting in negative impacts to stream morphology and riparian habitat impacting fish and the only known Upper Klamath Basin population of Giant Pacific Salamander. There is a need to educate the public as to the detrimental effects of this dam building action and this would best be served by installation of an informational sign to reach those parties utilizing the site.	Riparian Reserves
FS	Aquatic / Terrestrial	Road Decommissioning	21.4	miles	Reduction in road density is a central recommendation of the Spencer Creek Watershed Analysis. The objective of road decommissioning for this project is to reduce road density and accelerate the revegetation of the decommissioned roads with trees to reduce negative impacts of roads on wildlife habitat and aquatic environments. Some natural-surface roads have poor drainage that can lead to erosion and increased sediment in nearby streams (Trombulak and Frissell 2000). Road obliteration can improve drainage and to reduce chronic sediment input to the stream systems (Madej 2000; Switalski et al. 2004; Tippery et al. 2010). This mitigation also offsets the impacts of soil compaction and displacement within the construction right-of-way by reducing compaction in the decommissioned roadbeds. Table 2.6.2.6-2 and figure 2.6-4 in appendix J compare miles of roads decommissioned with impacts of the Pacific Connector project corridor on riparian reserves, acres in degraded soil condition and number of stream crossings. Likely benefits of road decommissioning include increased infiltration of precipitation, reduced surface runoff, and reduced sediment production from surface erosion (Switalski et al. 2004). Where roads are decommissioned within riparian areas, riparian vegetation may be reestablished. Approximately 5.2 miles or 13 acres of proposed decommissioning occur within Riparian Reserves. Approximately 21.4 miles of roads are currently open that can be decommissioned. Road densities decrease at all scales with this mitigation. The greatest reductions in road density occur within 0.3 mile of the pipeline project corridor, showing that mitigations are associated with the impact of the project where the impacts from the pipeline project would occur. Overall, this accomplishes a reduction in road density of 24 percent (appendix J, table 2.6.2.6-3). Assuming a 14-foot average road width, 21.4 miles of proposed road decommissioning would revegetate approximately 36 acres (21.4*5280*14/43560=36 acres) that are currently native road surfaces in the Spencer Creek watershed. This mitigation is responsive to ACS objectives 2, 3, 4, and 5 and Standards and Guidelines for Key Watersheds (Forest Service and BLM 1994b: B-11, C-7).	Riparian Reserves

TABLE 4.1.3.5-32

Proposed Off-Site Mitigation Projects on BLM and NFS Lands in the Spencer Creek Watershed

Agency	Project Type	Project Name	Quantity	Unit	Project Rationale	Land Allocation
FS	Aquatic / Terrestrial	Allotment Fencing	6.4	miles	Construct allotment fencing along the south side of the ROW through National Forest System lands (approximately 6.4 miles). This fence would serve to divide the Buck Indian Allotment into pastures north and south at Clover Creek Road. This fence would keep cattle from grazing newly revegetated areas in the right-of-way corridor, including areas where the corridor crosses Spencer Creek, thus helping to ensure that erosion control and revegetation objectives are met.	Riparian Reserves
FS	Aquatic / Terrestrial	Harden Ford	1	project	Stream crossing improvements would improve aquatic habitat/connectivity and reduce sedimentation. The road accessing this location has been closed on the BLM and Forest Service. The private landowner and cattle cross the ford to access pasture from private land. The raw, unstable banks at this crossing allow fine sediments to enter the stream. This ford needs to be hardened and the banks re-vegetated and protected from grazing. The Forest Service side from the upper Spencer Creek dispersed campground needs more boulders or a method of blocking four-wheel-drive vehicles.	Riparian Reserves

Off-site mitigation measures, identified by the BLM and Forest Service, would supplement on-site minimization, mitigation, and restoration actions. These proposed off-site mitigation measures are responsive to recommendations in the Spencer Creek Watershed Analysis (BLM et al. 1995) and would improve watershed conditions where they are applied (appendix J, section 2.6.3.6). Table 4.1.3.5-32 describes proposed off-site mitigation measures in the Spencer Creek watershed.

Three site-specific amendments of the Winema National Forest LRMP and one amendment of the Lakeview Resource Area RMP that have a nexus with the ACS are proposed to make provision for the Pacific Connector Pipeline Project (appendix J, section 2.6.3.5):

- Proposed amendments WNF-4 and WNF-5 would allow the Project to exceed detrimental soil conditions within the construction corridor. This would not prevent attainment of ACS objectives because soil decompaction and remediation required in Riparian Reserves is expected to effectively moderate detrimental soil conditions. Implementation of measures in the ECRP is expected to effectively control surface erosion and restore native vegetation (see section 4.3.4 of this EIS).
- Proposed amendment of the Winema National Forest LRMP and the Lakeview Resource Area RMP to waive protection measures for S&M species would not prevent attainment of ACS objectives because the Project does not threaten the persistence of any riparian-dependent species (appendix J, section 2.4.8.5).

The Pacific Connector Pipeline Project is otherwise consistent with standards and guidelines for activities in Riparian Reserves for the Winema National Forest and the Klamath Falls Resource Area of the Lakeview District, BLM.

The routing of the pipeline through BLM and NFS lands, coupled with the relatively small area of BLM and NFS land affected by pipeline project construction (0.17 percent of BLM lands and 0.41 percent of NFS in the fifth-field watershed), makes it highly improbable that pipeline project impacts could affect watershed conditions. Although there are project-level impacts (e.g., short-term sediment and long-term a change in vegetative condition at stream crossings), these would be minor in scale (appendix J, section 2.6.3.4).

No project-related impacts that would prevent attainment of ACS objectives have been identified. All relevant pipeline project impacts are within the range of natural variability given the disturbance patterns and fire history of watersheds in the High Cascades Province (appendix J, section 2.6.3.4).

4.1.3.6 Resource Values and Conditions on Federal Lands: LSRs

This section of the EIS summarizes appendix H, LSR Technical Report, which contains the full text of the analysis.

The LSR Network

The NWFP allocated a network of LSRs to conserve species of concern within the existing configuration of land ownership and the location of remaining LSOG forests within the range of the NSO (see section 4.1.3.3 above). The reserve network is embedded in a matrix of “working” forests and was designed to maintain LSOG forests in a well-distributed pattern across these federal lands (Moeur et al. 2011).

The LSR network is composed primarily of areas of large (mapped) reserves, but also includes smaller areas of "unmapped" reserves that are composed of sites occupied by MAMUs or are KOACs. The LSR standards and guidelines are designed to guide management activities occurring within these LSRs to protect and enhance the conditions of the LSOG forest ecosystems contained therein (Forest Service and BLM 1994b). The proposed Pacific Connector pipeline route would cross three mapped LSRs (223, 227, and 261). The proposed mitigation associated with reallocation of Matrix lands to LSR would also affect LSR 259.

LSR Elements

In 1994, the standards and guidelines for the NWFP described five elements that were used to designate LSRs: (1) areas mapped as part of an interacting reserve system; (2) LS/OG 1 and 2 areas within MAMU Zone 1, and certain owl additions, mapped by the Scientific Panel on Late-Successional Forest Ecosystems (1991); (3) sites occupied by MAMUs; (4) KOACs; and (5) Protection Buffers for specific endemic species identified by the Scientific Analysis Team (1993) (Forest Service and BLM 1994b).

Today, elements (1) and (2) are commonly referred to as "mapped" LSRs, and elements (3) and (4) are commonly referred to as "unmapped" LSRs. Although element (5), protection buffers, was originally part of the LSR network, it was later removed by the 2001 Survey and Manage ROD (Forest Service and BLM 2001a). The 2001 Survey and Manage ROD retained the direction to manage known sites of protection buffer species but removed their designation as small, species-specific LSRs.

Mapped LSRs

Most LSR areas are mapped.[19] The LSR network includes approximately 7.4 million acres or about 30 percent of the area covered by the NWFP. Several factors were considered in designating these reserves, including key watersheds and significant areas of old-growth forest that had previously been identified (Forest Service and BLM 1994b). These included LS/OG 1 and 2 areas (most ecologically significant, and ecologically significant LSOG forests, respectively) identified by the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991).

Unmapped LSRs

Unmapped LSRs include sites occupied by MAMUs and KOACs. For MAMUs, surveys are required for projects that occur within MAMU habitat to determine if there is occupation within the project area. If occupation is documented, all contiguous existing and recruitment habitat within a 0.5-mile radius is to be protected and managed by the standards and guidelines for LSRs. The standards and guidelines for LSRs also apply to known NSO activity centers (as of January 1, 1994) located in Matrix or Adaptive Management Areas of the NWFP. Activity centers are defined as an area of concentrated activity of either a pair of NSOs or a territorial single owl. Each KOAC has a 100-acre area identified around or near the activity center, where the standards and guidelines for LSRs apply (Forest Service and BLM 1994b).

[19] Maps of the LSR network are available at the following website: http://www.reo.gov/gis/data/gisdata/index.htm.

LSR Standards and Guidelines

The standards and guidelines for LSRs are contained in Attachment A (pages C-9 through C-21) of the NWFP ROD. They are designed to protect and enhance conditions of LSOG forest ecosystems that serve as habitat for LSOG species. They are written to apply to specific management actions such as silviculture, range management, mining, new developments, etc., and should be interpreted in that context.

The standards and guidelines that apply to new developments such as pipelines are addressed on page C-17 of the NWFP standards and guidelines.

> *Developments of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects would be reviewed on a case-by-case basis and may be approved when adverse impacts can be minimized and mitigated. These would be planned to have the least possible adverse impacts on Late-Successional Reserves. Developments would be located to avoid degradation of habitat and adverse impacts on identified late-successional species.*

The LSR standards and guidelines provide the framework upon which the proposed LSR mitigation actions and related plan amendments for the Pacific Connector pipeline are evaluated.

Project Impacts on LSRs on BLM and NFS Lands

The Pacific Connector pipeline would cross about 71 miles of land managed by the BLM or Forest Service. The pipeline would cross four BLM districts (Coos Bay, Roseburg, Medford, and the Klamath Falls Resource Area of the Lakeview District) for a total of approximately 40 miles. The pipeline would also cross three national forests (Rogue River, Umpqua, and Winema) for a total of approximately 31 miles.

The mapped LSRs that would be crossed are depicted on figure 4.1-5. The proposed Pacific Connector pipeline would affect mapped LSRs on four of the seven BLM and Forest Service units: the Coos Bay and Roseburg Districts for the BLM, and the Rogue River and Umpqua National Forests for the Forest Service. Several unmapped LSR areas would also be affected in the Coos Bay and Roseburg Districts of the BLM. These unmapped LSRs are depicted in figures 4.1-6 and 4.1-7. Direct impacts would occur in the areas that would be cleared (i.e., forest vegetation would be removed) for the pipeline right-of-way and the TEWAs. Direct impacts would also occur in acres that would be “modified” by the Pacific Connector pipeline. These acres include UCSAs that would not be cleared of trees during construction. These areas would be used to store forest slash, stumps, and dead and downed log materials that would be scattered across the right-of-way after construction, which would be considered temporary habitat modifications.

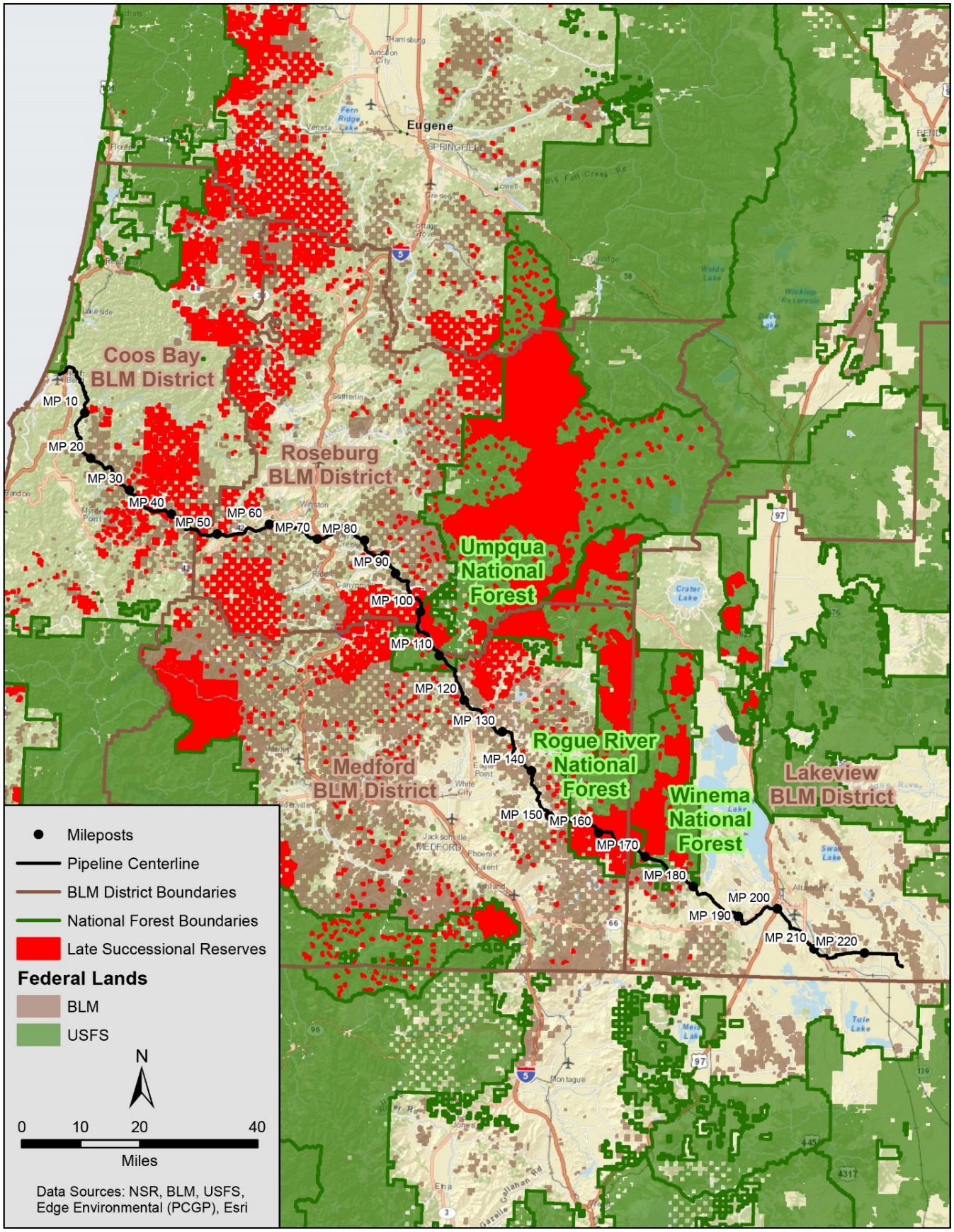

Figure 4.1-5. Overview Map of the Pacific Connector Pipeline Project and LSRs on BLM and NFS Lands

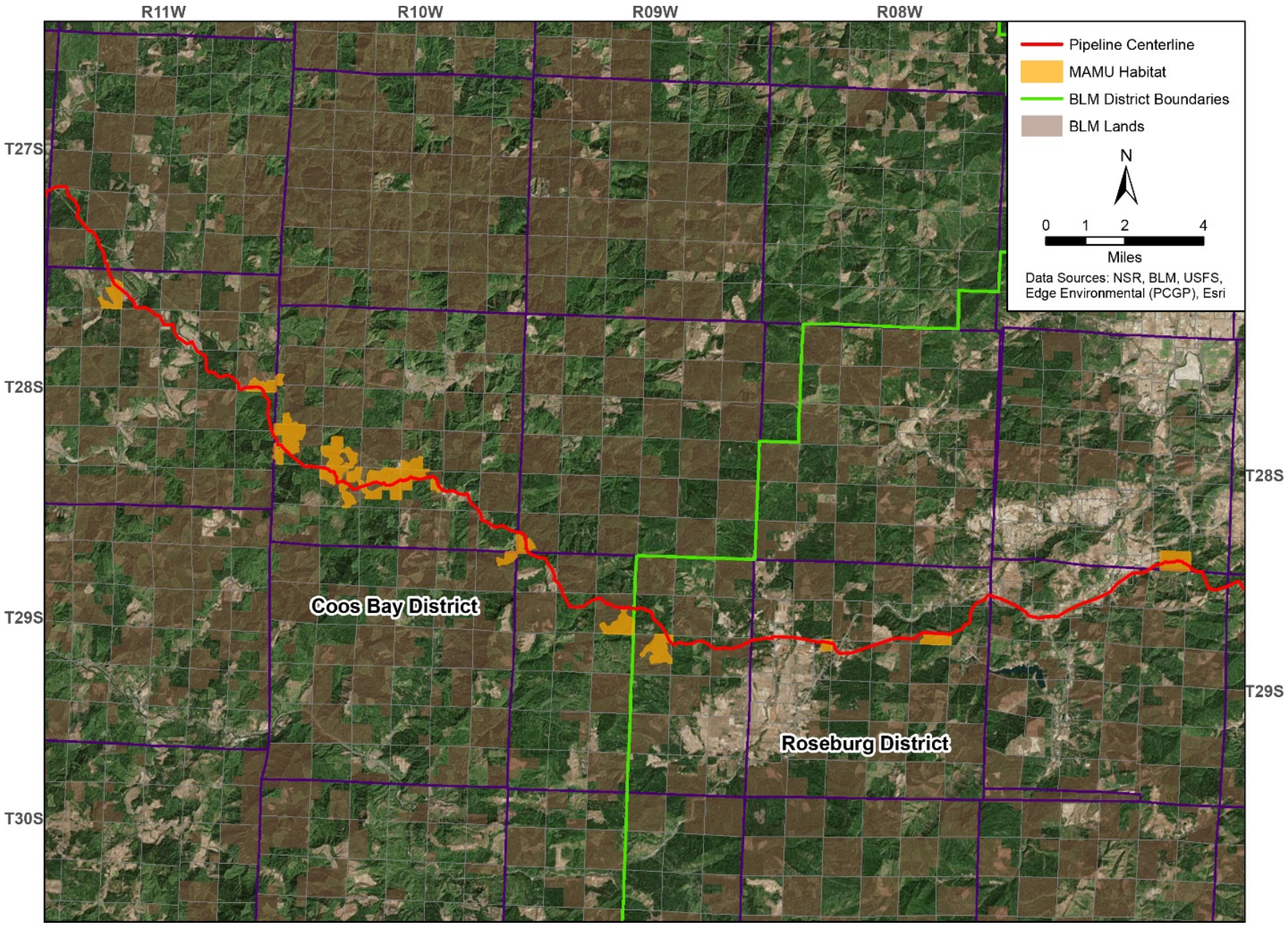

Figure 4.1-6. Occupied MAMU Stands Within the BLM Coos Bay and Roseburg Districts Crossed by the Pacific Connector Pipeline Route

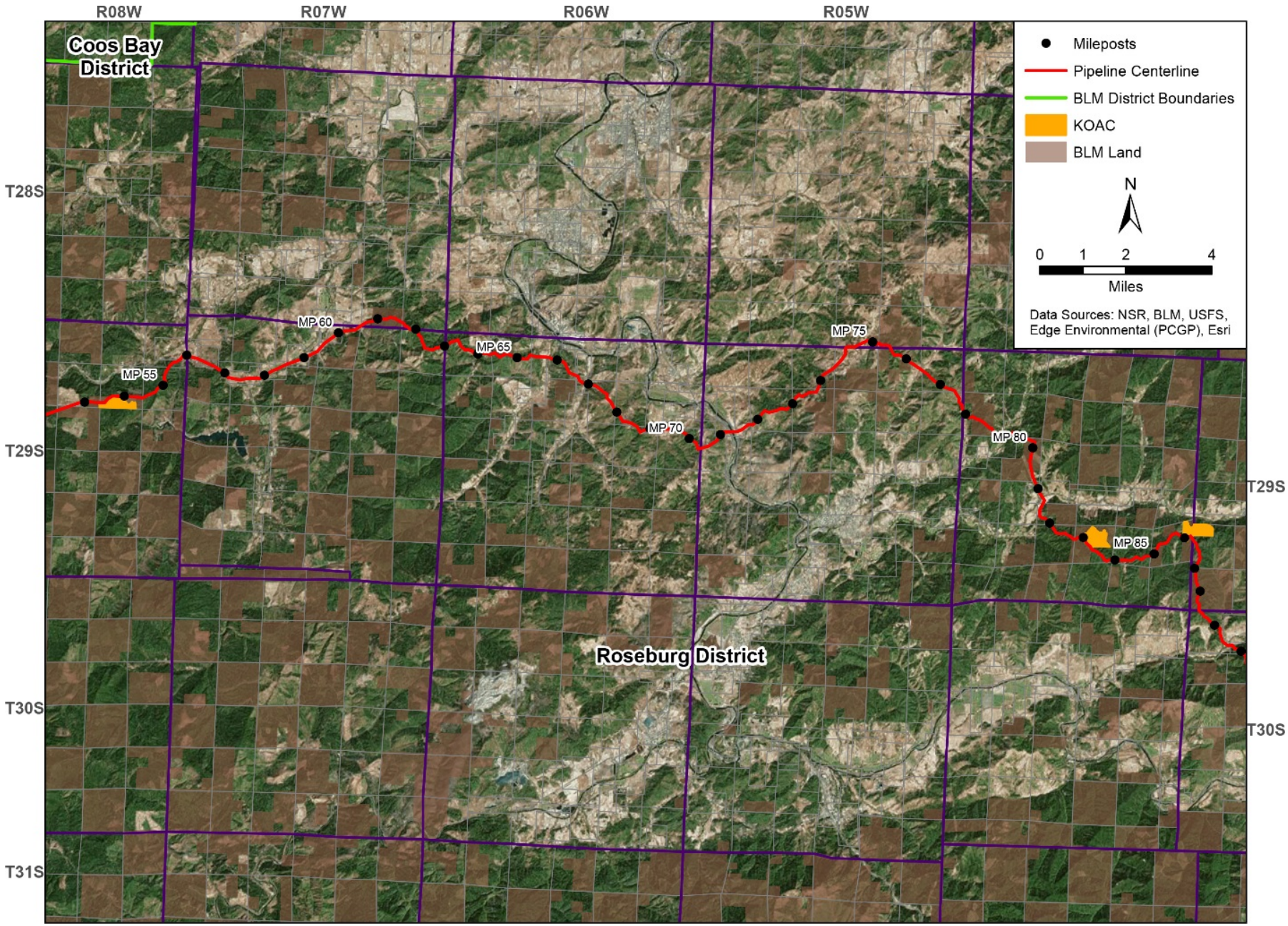

Figure 4.1-7. KOACs Within the BLM Roseburg District Crossed by the Pacific Connector Pipeline Route

Indirect impacts from construction of the pipeline are also expected within LSRs that have interior forest that the MAMU and NSO rely on for nesting habitat. The conversion of large tracts of LSOG forest to small, isolated forest patches with large edge areas can create changes in microclimate, vegetation species, and predator-prey dynamics. Such edge impacts—magnitude of changes over distance from the edge to forest interior—would depend on the general orientation to the sun. Two main physical factors affecting and creating an edge microclimate are sun and wind (Forman 1995; Chen et al. 1995; Harper et al. 2005). Together, sun and wind: (1) desiccate leaves by increasing evapotranspiration; (2) influence which plant species survive and thrive along the edge, usually favoring shade intolerant species; and (3) affect the soil, insects, and other animals along the edge. Compared to the forest interior, areas near edges receive more direct solar radiation during the day, lose more long-wave radiation at night, have lower humidity, and receive less short-wave radiation. However, effects are dependent on local conditions, such as orientation of an edge. The magnitudes of change in humidity with distance from an edge are most extreme with south-facing edges, compared to east- and west-facing edges (Chen et al. 1995). These effects would vary along the pipeline route as a function of route orientation and the facing direction of each edge. Because the Pacific Connector pipeline generally trends from northwest to southeast, edge effects would be most pronounced on the southwest-facing edges and weakest along the northeast-facing edges. Fundamental changes in the microclimate (moisture, temperature, solar radiation) of a stand have been recorded greater than 700 feet from the forest edge (Chen et al. 1995).

Using recommendations from the ESA Sub-Task Group and Habitat Quality Subtask Group,[20] indirect effects are considered to extend for 100 meters from the created edge in LSOG forest. In making their recommendation, the sub-task groups considered the study done by Karen A. Harper et al. (2005), which looked at edge influence on forest structure in fragmented landscapes. The study reviewed the effects caused by forest edges on multiple response variables including: (1) forest processes of tree mortality/damage, recruitment, growth rate, canopy foliage, understory foliage, and seedling mortality, (2) forest structure by canopy trees, canopy cover, snags and logs, understory tree density, herbaceous cover, and shrub cover, and (3) stand composition by species, exotics, individual species and species diversity. The study found that the mean distance of edge influence on any single response variable did not exceed 100 meters. Therefore, indirect impacts for the Project are estimated to extend for 100 meters beyond the cleared area on each side of the corridor in LSOG forest habitat. There is no corresponding research for edge impacts in younger forest stands (less than 80 years old). There is, however, research that indicates the effect extends out approximately two times the average tree height (Morrison et al. 2002). Based on this, an estimate of 30 meters is used in non-LSOG forest habitat. In non-forested areas, no indirect impacts are estimated since no new edge would be created. Table 4.1.3.6-1 and figure 4.1-8 provide a summary of the total number of LSR acres that would be directly and indirectly affected on BLM and NFS lands by the Pacific Connector pipeline.

[20] These sub-task groups were part of an Interagency Task Force, which included representatives of the FWS and NMFS, as well as the Forest Service, BLM, ODLCD, ODE, ODSL, COE, ODFW, EPA, and ODEQ, to obtain specific input, guidance, and technical approach reviews. Agencies participating in the Interagency Task Force reviewed information provided by Jordan Cove and Pacific Connector.

TABLE 4.1.3.6-1

Summary of Total LSR Acres Directly and Indirectly (a/) Affected by the Pacific Connector Pipeline

District/National Forest	Mapped LSR			Unmapped LSR			Total LSR		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
BLM District									
Coos Bay	35 b/	56	91	40	181	220	75 b/	237	312
Roseburg	80	177	257	37	87	124	116	265	381
Total BLM	***115***	***234***	***348***	***76***	***268***	***344***	***191***	***502***	***692***
Forest Service National Forest									
Umpqua	85	241	325	0	0	0	85	241	325
Rogue River	276	534	810	0	0	0	276	534	810
Total Forest Service	***361***	***775***	***1,135***	***0***	***0***	***0***	***361***	***775***	***1,135***
Total Overall	**475**	**1,008**	**1,483**	**76**	**268**	**344**	**552**	**1,276**	**1,828**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
Data source: BLM, Forest Service GIS data layers
a/ Total impacts include cleared acres (corridor and TEWAs), modified acres (UCSAs), and indirect effect acres (100 meters on each side of the cleared corridor edge in LSOG and 30 meters on each side of the cleared corridor edge in non-LSOG).
b/ The acres include the direct and indirect impacts in the Matrix acres that would be reallocated to LSR on the Coos Bay District.

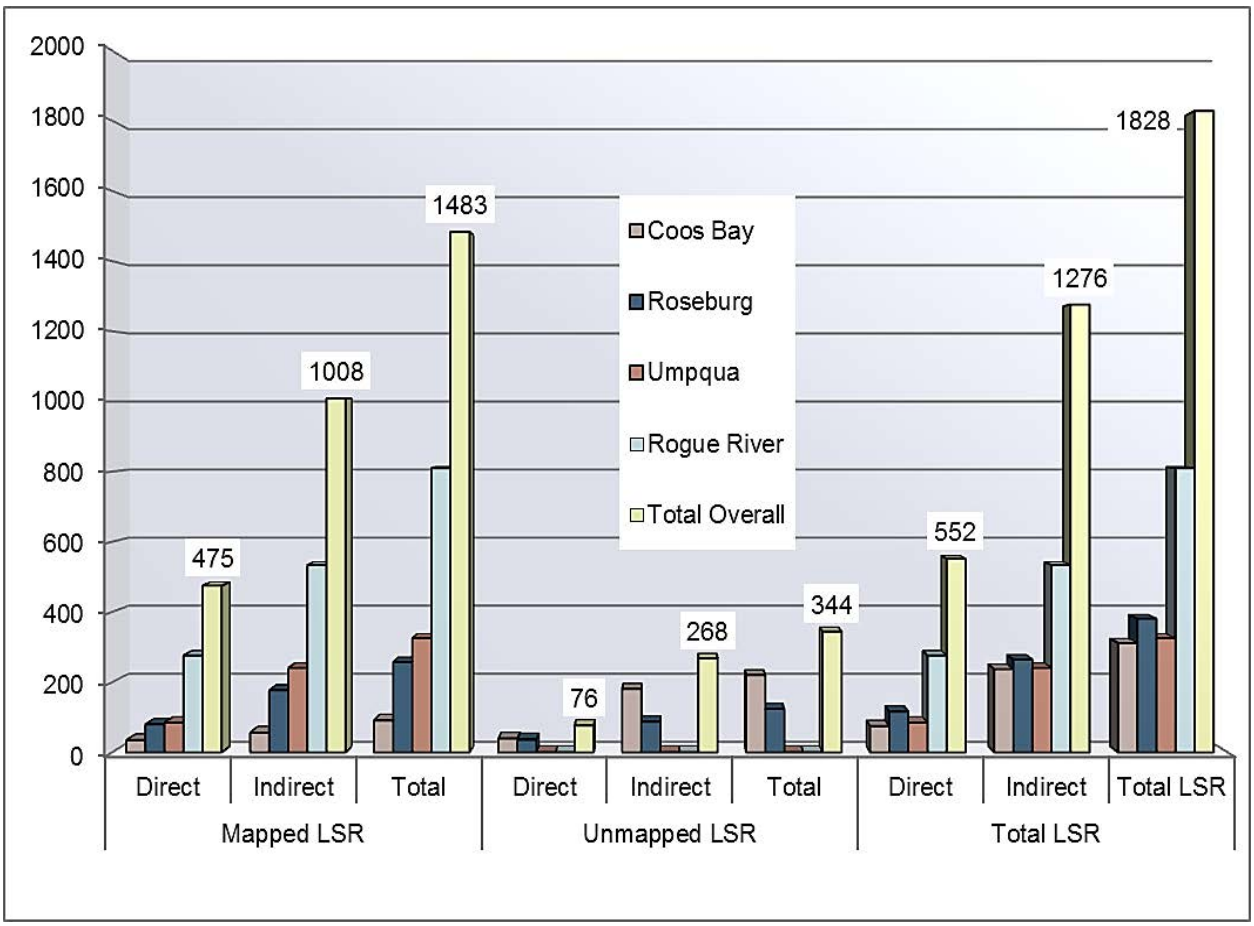

Figure 4.1-8. Summary of Total LSR Acres Directly and Indirectly Affected by the Pacific Connector Pipeline Project

The construction, operation, and maintenance of the Pacific Connector Pipeline Project would affect LSRs on federal lands in several ways. It would remove and fragment LSOG forest habitat that some vertebrate and invertebrate species are dependent on. It would directly affect individuals of species listed as threatened under the ESA (NSO and MAMU) through removal of suitable nesting, roosting, and foraging habitat for NSO, and through the removal of suitable or potential nesting habitat for MAMU. The indirect impacts discussed above would result in the loss of interior LSOG forest habitat and increased predation. These impacts and others from the proposed construction, operation, and maintenance of the Pacific Connector pipeline on LSOG forests are discussed in sections 4.3.2, 4.4.2, 4.5.2, 4.6.2, and 4.7.3 of this EIS. In addition to the direct and indirect impacts of the Project, cumulative impacts are addressed in section 4.14. This analysis would include other actions proposed on federal lands as well as the off-site mitigation actions. The analysis in this section focuses on how the proposed LMP amendments and mitigation actions would affect the LSR land allocation in terms of the distribution, quantity, and quality of LSOG habitat.

Land Management Plan Amendments Related to LSRs on BLM and Forest Service Lands.

The Need for Plan Amendments and Off-Site Mitigation in LSRs

Under the FLPMA and the NFMA, the Pacific Connector pipeline would have to conform to BLM and Forest Service land use plans. Those plans incorporate the NWFP standards and guidelines. The standard and guideline in the NWFP for new developments in LSRs states:

> *Developments of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects be reviewed on a case-by-case basis and may be approved when adverse impacts can be minimized and mitigated. These will be planned to have the least possible adverse impacts on Late-Successional Reserves. Developments will be located to avoid degradation of habitat and adverse impacts on identified late-successional species.* (Forest Service and BLM 1994b: C-17).

In order to be consistent with the standard above, the proposed development (with mitigation) should result in impacts that are either neutral or beneficial to the creation and maintenance of late-successional habitat in LSRs (Forsgren et al. 2001).

Avoidance

Alternative routes that would avoid all LSRs were investigated by the applicant, BLM, Forest Service, and the FERC. Some required lengthy rerouting both in terms of the overall length of the pipeline and in the amount of private land affected. These alternatives and the reasons why they were not selected are discussed in section 3.4 of the EIS. The steps taken to avoid LSRs and how they were incorporated into the proposed route where feasible are also discussed in section 3.4, and in Resource Report 10 attached to Pacific Connector's application to the FERC.

In summary, because the Pacific Connector pipeline is a linear, large-diameter, high-pressure natural gas pipeline that must be routed to ensure safety, stability, and integrity, it is unreasonable,

impractical, and infeasible to entirely avoid all designated LSRs within the project area for the following reasons:

- The overall extent of the designated LSR land allocation in the project area makes it impractical to completely avoid LSRs;
- The length of the pipeline, extending approximately 232 miles from Malin to Coos Bay across portions of Klamath, Jackson, Douglas, and Coos Counties, and traversing federal lands managed by four BLM districts as well as three national forests, makes it impractical to avoid all designated LSRs;
- The checkerboard landownership pattern of BLM lands within the project area makes it unreasonable to avoid LSRs;
- Large contiguous areas of federal lands (see figure 4.1-5) in the project area make it impractical and infeasible to entirely route around these lands to avoid LSRs; and
- Where LSRs are encountered along the alignment, the routing requirements of the pipeline to ensure a safe, stable, and constructible alignment to ensure long-term integrity make it infeasible/unreasonable to avoid LSRs by aligning the pipeline on steep side slopes or other potentially unstable areas.

Address Public Need

The Commission will consider the need and public benefit of this Project when making its decision on whether or not to authorize it, as documented in the Project Order. The cooperating agencies will consider public benefit within the context of each agency's respective authorities. Each cooperating agency will document its decision in the applicable permit, approval, concurrence, or determination.

Minimize Impacts

During the Pacific Connector pipeline route selection process, interdisciplinary teams from the BLM and Forest Service worked with the FERC and the applicant to develop steps that would minimize impacts on LSRs where avoidance was not feasible. In some cases, Forest Service–suggested realignments were incorporated into the proposed route, as in the situation between MPs 104.8 and 111.5 (see discussion in section 3.4.2.8 of this EIS).

To minimize impacts on LSRs, Pacific Connector took the following elements into consideration in route selection and construction design:

- Performed routing and geotechnical evaluations to ensure the most stable pipeline alignment for long-term stability. These efforts would minimize the potential need to conduct future maintenance activities, which could require additional impacts on LSRs.
- Where feasible, the proposed alignment was co-located with existing roads and early seral, conifer plantations to reduce impacts on LSOG habitat and to minimize disturbance impacts.
- Areas of side slopes were avoided to minimize the need for additional TEWAs to accommodate the necessary cuts and fill to safely construct the pipeline.
- The number and size of the planned TEWAs in LSRs were minimized to those critical for safe pipeline construction.

- Additional TEWAs were located in previously disturbed areas (i.e., areas that were recently logged) or in young regenerating forest stands.
- Existing roads would be used to access the construction right-of-way during construction and the right-of-way would be used as the primary travel-way to move equipment and materials up and down the right-of-way to remove the need for additional roads within LSRs. The existing roads would also be used during operations and maintenance to avoid the need for new access routes.
- Pacific Connector would replant or allow trees to naturally regenerate to within 15 feet of the pipeline centerline within the permanent pipeline easement to minimize potential long-term impacts of the pipeline easement.

Detailed descriptions of all the conservation measures proposed by the Pacific Connector are included in Table 1 of Resource Report 3 in its application to the FERC.

Mitigate for Impacts that Cannot Be Avoided

In addition to avoidance and minimization, off-site mitigation would also be necessary to ensure that unavoidable adverse impacts are mitigated to meet the direction that overall the impact would be either neutral or beneficial to the creation and maintenance of late-successional habitat in LSRs. Pacific Connector drafted a *Compensatory Mitigation Plan* (CMP) to avoid, reduce, or mitigate impacts on ESA listed threatened and endangered species and their habitats. [21] A portion of the CMP was developed specifically to compensate for the unavoidable adverse impacts of the Pacific Connector Pipeline Project on LSRs with a goal to achieve a neutral or beneficial condition within affected LSRs, and to maintain the long-term integrity of the BLM and Forest Service land use plans for LSRs. Under the CMP, unavoidable impacts on LSOG forest habitats within LSRs on BLM and NFS lands would be compensated for by a combination of reallocation of Matrix lands to LSR and implementing off-site mitigation projects. The off-site mitigation actions of stand treatments and fuel breaks are consistent with the management recommendations for LSR 223, 227, and 261. Stand treatments would enhance or accelerate the development of LSOG habitat elements to further offset the impacts of the Project on LSRs in the long term (greater than 50 years). Fuel breaks would help reduce the risk of loss of LSOG forest to catastrophic wildfires. The off-site mitigation actions of road decommissioning, snag creation, and large wood placement would improve the quality of the LSOG forest habitat in LSRs. On BLM lands, the proposed mitigation actions also include having the applicant acquire approximately 796 acres of non-federal forest lands to replace the Matrix lands that are being reallocated to LSR.

The primary mitigation action for the impacts of the pipeline on LSRs would add acres to the LSRs. The BLM and Forest Service are proposing to accomplish this through reallocation of Matrix lands to LSR. Reallocating these acres would require amendments to the BLM Coos Bay and Roseburg District, and the Forest Service Umpqua and Rogue River National Forest, LMPs. The analysis in the following sections looks at the acres of habitat (by habitat type of LSOG, non-LSOG and non-forest) that would be removed (cleared) by the Pacific Connector pipeline with the amount of habitat that would be reallocated since this would be the most direct comparison of acres affected in the LSR system. Table 4.1.3.6-2 and figure 4.1-9 display a summary comparison between the LSR acres that would be cleared by the construction of the Pacific Connector pipeline

[21] The mitigation actions are described in section 2.1.4 and appendix F of this DEIS. The CMP is attached to our BA as Appendix O.

and the proposed reallocation of Matrix lands to LSR. Amendments concerning LSRs associated with the Pacific Connector pipeline would be coordinated with the REO as required by the NWFP. Analysis of the aggregated amendments for LSR across all administrative units for the Pacific Connector pipeline and the total proposed off-site mitigations is included in section 4.1.3.7 below.

TABLE 4.1.3.6-2

Comparison of Total LSR Acres Cleared by the Pacific Connector Pipeline and the Acres of Matrix Reallocated to LSR a/

District/National Forest	LSR Components (b/) Affected by the Pacific Connector Pipeline Project Right-of-Way Clearing				LSR Mitigation: Matrix to LSR Reallocations
	Mapped LSRs	Marbled Murrelet Stands	Known Owl Activity Centers	Total LSR Clearing	
BLM District					
Coos Bay	32 c/	33	0	64	387
Roseburg	57	16	7	81	409
National Forest					
Umpqua	67	0	0	67	588
Rogue River	206	0	0	206	512
BLM and Forest Service Combined					
Total	363	49	7	418	1,896

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
Data source: BLM, Forest Service GIS data layers
a/ Clearing includes acres in the pipeline corridor and the TEWAs.
b/ Marbled murrelet stands and known owl activity centers outside of mapped LSRs.
c/ Includes the acres cleared in the Matrix that would be reallocated to LSR on the Coos Bay District.

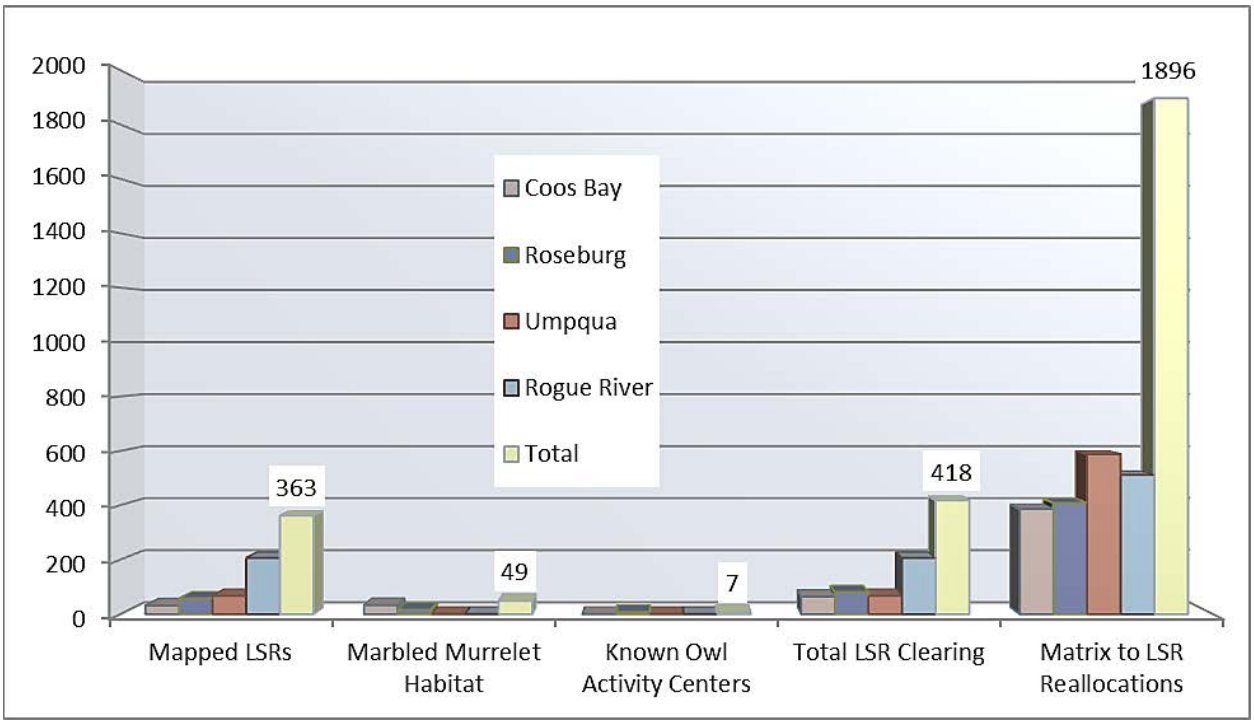

Figure 4.1-9. Comparison of Total LSR Acres Cleared by the Pacific Connector Pipeline Project and Total Acres of Matrix Reallocated to LSR

RMP Amendments Related to LSRs on BLM Coos Bay District

BLM–1, Site-Specific Exemption from Requirement to Protect Marbled Murrelet Habitat in the BLM Coos Bay District

The Coos Bay District RMP would be amended to waive the requirements to protect contiguous existing and recruitment habitat for MAMUs within parts of the Project right-of-way that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM. This is a site-specific amendment applicable only to the Project right-of-way and would not change future management direction at any other location.

Existing known MAMU occupied sites were inventoried using BLM GIS layer data in 2006, and three occupied sites were identified that were in the pipeline corridor. Additional MAMU surveys were conducted in 2007, 2008, 2012 - 2014 within the project area. Nine additional occupied sites were identified from these surveys for a total of 12 occupied MAMU stands within the project area on the Coos Bay District. BLM delineated the extent of the occupied stands identified during the surveys and incorporated the newly identified stands into the GIS layer. All but one of the occupied stands within the project area on the Coos Bay District occur outside of mapped LSRs in lands currently allocated as Matrix in the NWFP. Stand C3070 lies entirely within mapped LSR 261. Approximately 34 acres of occupied MAMU stands would be cleared by the Pacific Connector pipeline on the Coos Bay District. Table 4.1.3.6-3 summarizes the known MAMU occupied stands that occur in the project area in the Coos Bay District. The map in figure 4.1-10 displays the known MAMU occupied stands in relation to the pipeline project.

TABLE 4.1.3.6-3

Known Occupied MAMU Stands within the Pacific Connector Pipeline Project Area in the Coos Bay District

MAMU Occupied Stand	Milepost Location	Acres Cleared a/, b/
C1080	MP 27.14-27.48	4
C3098	MP 32.04-32.48	5
C3075	MP 33.77-33.99	2
C3042	MP 33.84-33.90	1
C3093	MP 35.12-35.79	4
C3165	MP 35.89-36.11	<1
C3073	MP 36.49-37.15	5
C3090	MP 37.15-38.09	9
C3094	MP 38.09-38.18	1
C3095	MP 38.83-38.90	<1
C3070 c/	MP 41.89-41.97	1
C3092	MP 45.40-45.47	1
	Total	**34**

a/ Column may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as “<1”).
b/ Cleared acres include the Pacific Connector pipeline construction corridor and temporary extra work areas.
c/ Occupied Stand C3070 lies entirely within LSR 261.
Data Source: BLM GIS data layers

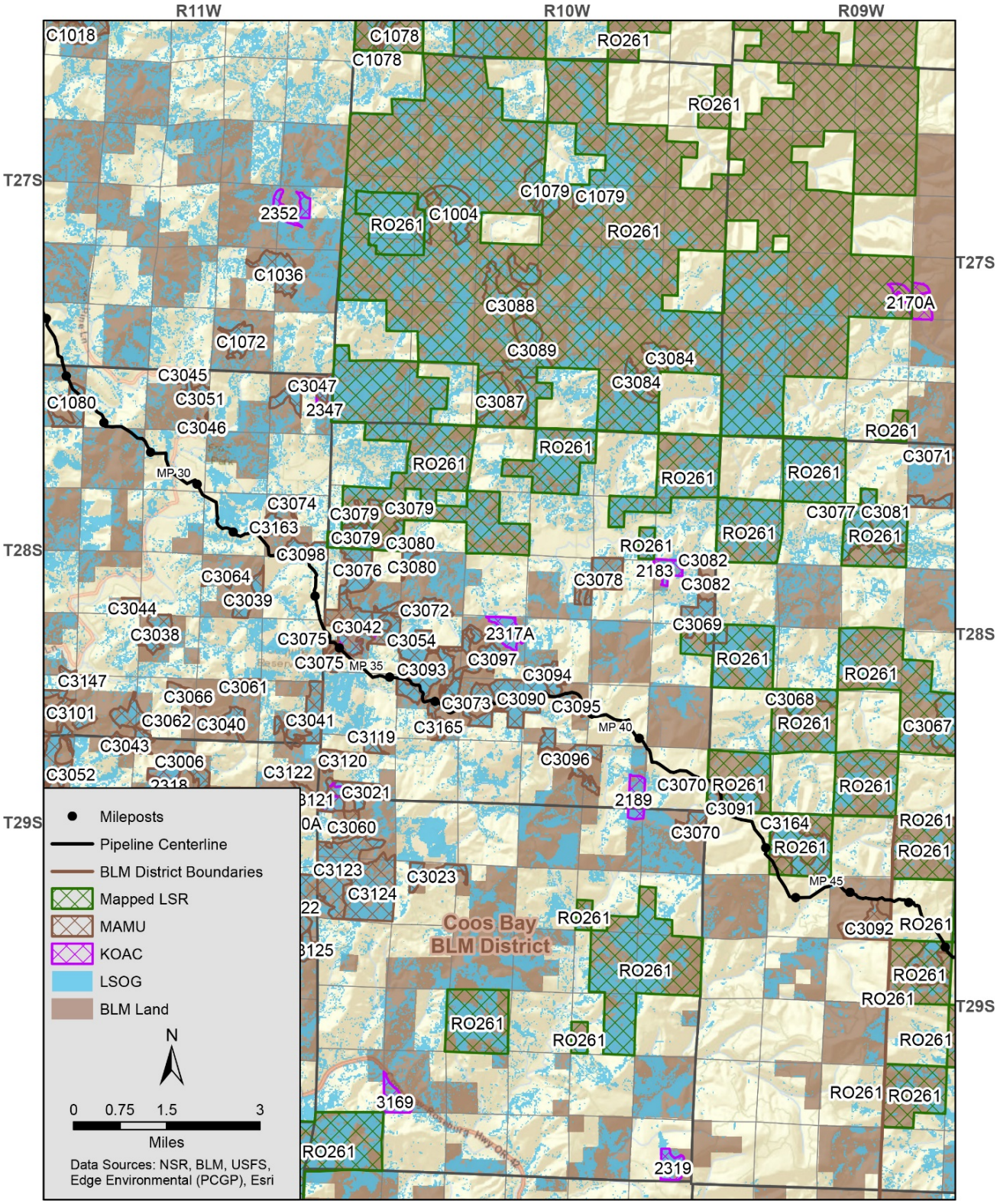

Figure 4.1-10. Map of Occupied MAMU Stands Within the BLM Coos Bay District Crossed by the Pacific Connector Pipeline Route

Amount and Quality of MAMU Habitat Affected by the Construction and Operation of the Pacific Connector Pipeline Project

Currently, based on the latest BLM GIS data layers there are approximately 1,225 acres of LSOG forest habitat within the 12 occupied MAMU stands affected by the Pacific Connector pipeline on the Coos Bay District. The Pacific Connector pipeline would require removing approximately 34 acres of forest vegetation in occupied MAMU stands from both the pipeline corridor and the TEWAs. Approximately 15 of these acres would be LSOG forest habitat. This would result in an approximate 1 percent reduction of the existing LSOG within these twelve occupied MAMU stands.

The area proposed to be added to LSR 261 is approximately 998 acres and is in the immediate vicinity of the occupied MAMU stands that would be affected (see figure 4.1-10). A large part of this area (approximately 611 acres) contains occupied MAMU habitat and is therefore unmapped LSR. The net reallocation of Matrix to LSR is 387 acres (see discussion for RMP Amendment BLM-4 below). Although this MAMU habitat is currently protected by the management direction in the Coos Bay RMP, including it as part of a designated LSR would provide additional protections and benefits for MAMU habitat. The additional protection would result from the area being protected not just because of the existing habitat condition but as a land allocation dedicated to the management of late-successional habitat. The additional benefits would result from the surrounding non-habitat areas being managed in the future to become LSOG forest, thereby creating larger contiguous blocks of habitat. The future management of these LSRs should not only protect habitat currently suitable to MAMUs, but also promote the development of additional MAMU habitat on the landscape. This would help to minimize the loss of unoccupied but suitable MAMU habitat. A summary of the acres that would be affected both directly and indirectly from the construction of the Pacific Connector pipeline is displayed in table 4.1.3.6-4 and figure 4.1-11.

TABLE 4.1.3.6-4

Comparison of Total Pacific Connector Pipeline Project Impacts (a/) on MAMU Stands and Matrix Reallocated to LSR (acres) in Coos Bay District

Coos Bay District	Cleared (Direct Impacts)	Modified (Direct Impacts)	Indirect Impacts	Total Impacts	Matrix to LSR Reallocation
LSOG	15	3	155	173	101
Non- LSOG	19	5	33	57	284
Non-Forest	0	0	0	0	2
Total	**34**	**8**	**188**	**229**	**387**

Note: Columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
Data source: BLM, Forest Service GIS Data Layers
a/ Project total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

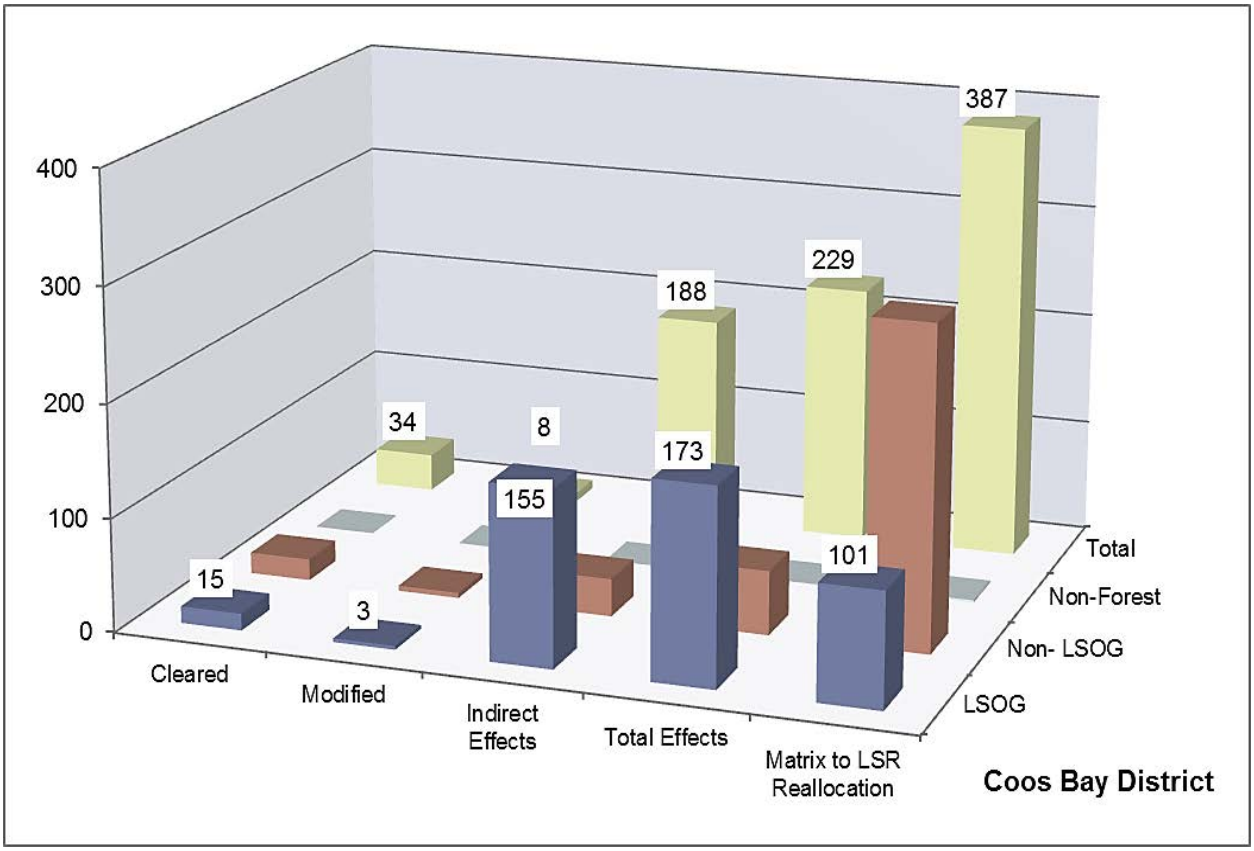

Figure 4.1-11. Comparison of Total Pacific Connector Pipeline Project Impacts on MAMU Stands and Matrix Reallocated to LSR (acres) in Coos Bay District

BLM-4, Reallocation of Matrix Lands to Late-Successional Reserves

The BLM Coos Bay District RMP would be amended to change the designation of approximately 387 acres from the matrix land allocation to the LSR land allocation in Sections 19 and 29, of T.28S., R.10W., W.M., Oregon.

This change in land allocation is proposed to provide partial mitigation for the potential adverse impact of the Pacific Connector pipeline on LSRs in the BLM Coos Bay District. This proposed amendment would change future management direction for the lands reallocated from Matrix to LSR. A map of the proposed reallocation is displayed as figure 4.1-12.

The primary management objective of the LSR land allocation is to protect and enhance conditions of late-successional and old-growth forest ecosystems that serve as habitat for LSOG–related species. Currently, based on the most recent BLM GIS data there are approximately 31,793 acres of LSOG forest, which comprises approximately 45 percent of LSR 261. If constructed, the part of the Pacific Connector pipeline in the Coos Bay District would remove approximately 32 acres of forest vegetation in LSR 261. This would include the removal of forest vegetation from both the pipeline corridor and the TEWAs. Approximately 2 of the 32 acres would be LSOG forest habitat.

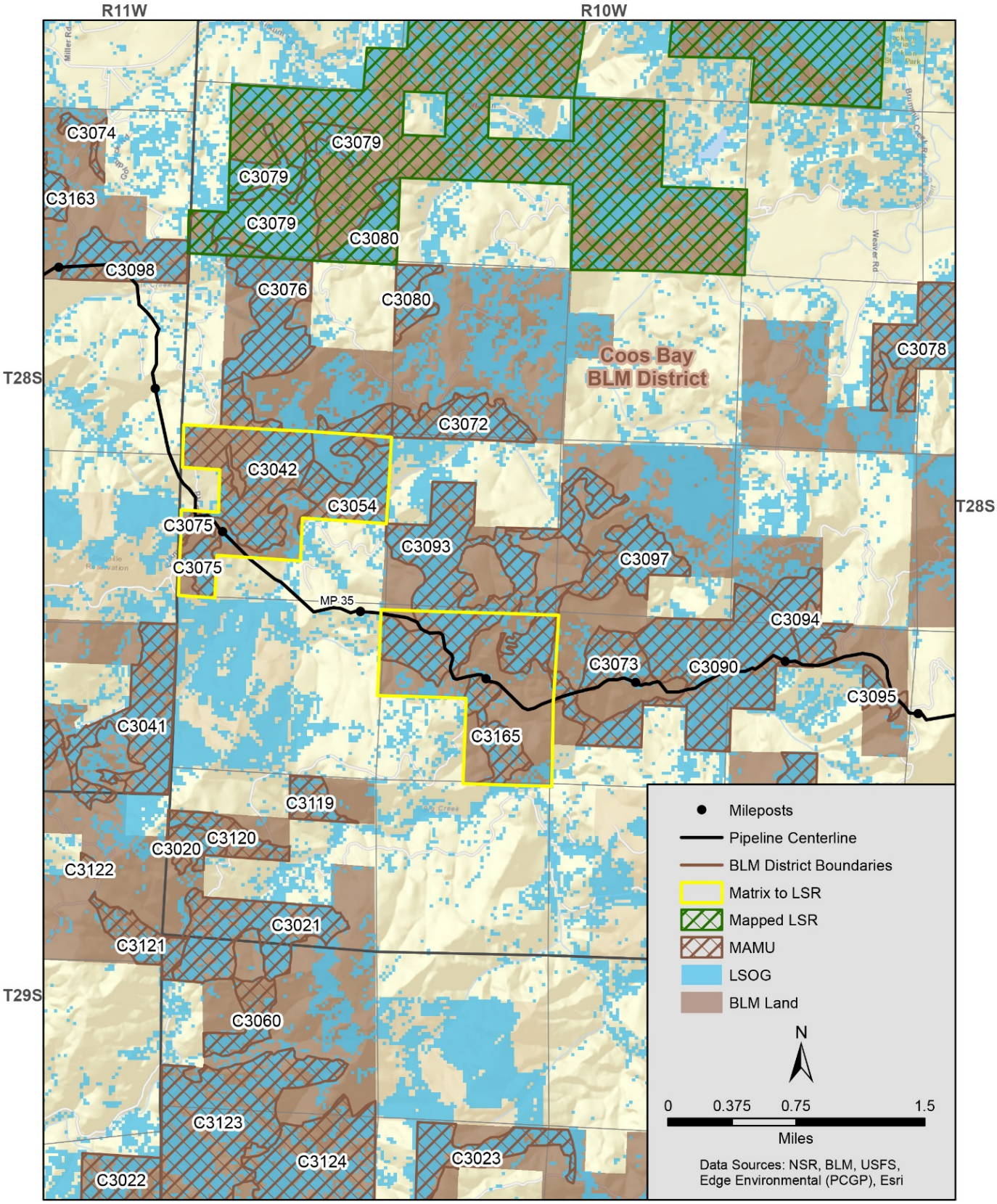

Figure 4.1-12. Map of Reallocation from Matrix to LSR and MAMU Stands Within the BLM Coos Bay District

The area proposed to be allocated to LSR 261 is approximately 998 acres. There are, however, approximately 611 acres of occupied MAMU stands within this proposed area. The occupied MAMU stands are managed by the standards and guidelines for LSRs as unmapped LSRs. Therefore, the net reallocation of Matrix lands to LSR equals approximately 387 acres (998 minus 611), of which approximately 101 acres are LSOG forest. The approximately 32 acres of clearing in LSR 261 described above includes the clearing that would occur within the reallocated acres (see figure 4.1-12 for a depiction of the acres proposed for reallocation and the area of occupied MAMU stands).

This change in land allocation is proposed to partially mitigate for the potential adverse impact of the Pacific Connector pipeline on LSR 261 in the BLM Coos Bay District. When acres reallocated from Matrix to LSR are compared to the acres of LSR that would be cleared by construction, the proposed amendment reallocates approximately 12 times more acres to LSR than would be cleared by the Pacific Connector pipeline. In addition to the impacts from the removal of forest vegetation in LSR 261, there would be additional impacts from the acres modified by UCSAs and from the acres indirectly affected through the creation of new edges and fragmentation of older forest. A comparison of the total acres affected in LSR 261 and the acres of reallocation are displayed in table 4.1.3.6-5 and figure 4.1-13.

TABLE 4.1.3.6-5

Comparison of Total Pacific Connector Pipeline Project LSR Impacts (a/) and Acres of Matrix Reallocated to LSR, Within BLM Coos Bay District LSR 261

Coos Bay District LSR 261	Cleared	Modified			Matrix to LSR Reallocation
	Direct Impacts		Indirect Impacts	Total Impacts	
LSOG	2	0	14	16	101
Non- LSOG	30	3	42	75	284
Non-Forest	0	0	0	0	2
Total	**32**	**3**	**56**	**91**	**387**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
Data source: BLM, Forest Service GIS data layers
a/ Project total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

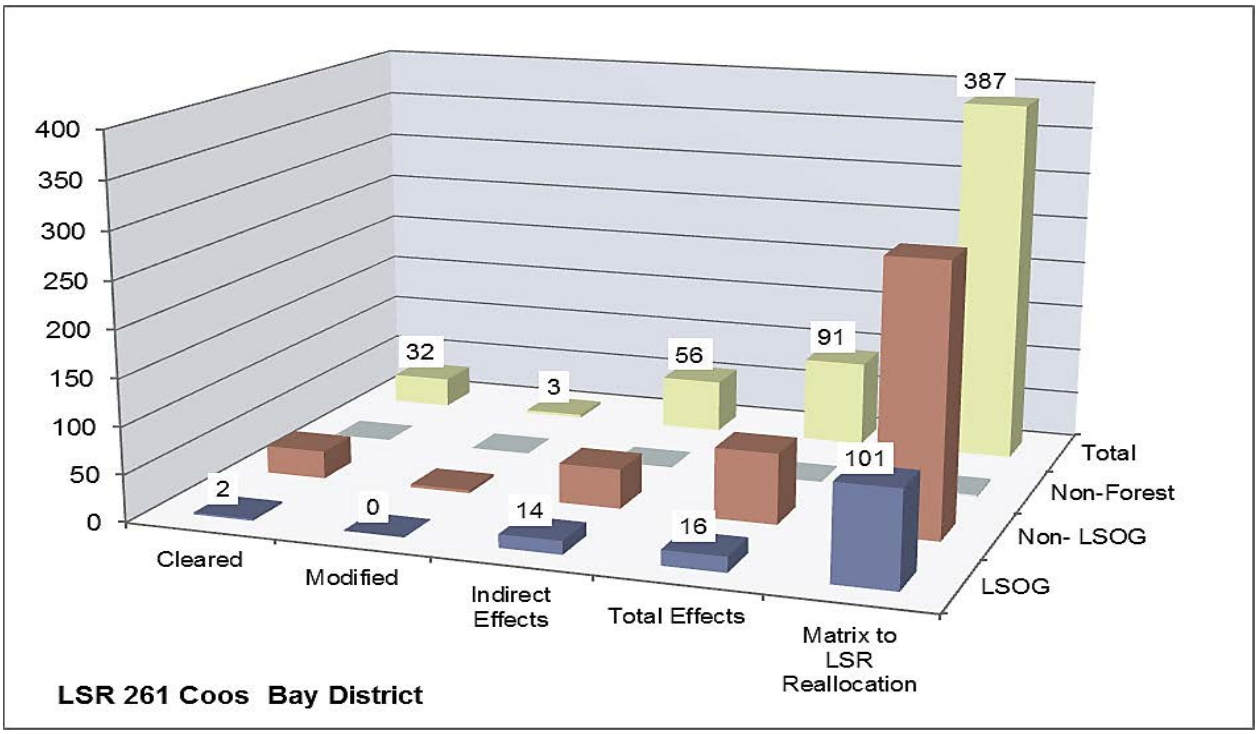

Figure 4.1-13. Comparison of Total Pacific Connector Pipeline Project LSR Impacts and Matrix Reallocated to LSR (acres) Within BLM Coos Bay District LSR 261

Impact on the Functionality of LSR 261 on the BLM Coos Bay District

The functionality of LSR 261 relates directly to the goals and objectives for LSRs and can be measured by the quantity, quality, and distribution of LSOG forest habitat in the LSR and how the Pacific Connector pipeline would affect these characteristics.

- **Quantity** — The overall quantity of LSOG habitat within LSR 261 on the Coos Bay District would increase with the proposed RMP amendment. There are approximately 998 acres that would be designated as LSR 261, approximately 611 of those acres are currently unmapped LSR MAMU stands and the other 387 acres are Matrix. The Pacific Connector pipeline would remove approximately 2 acres of LSOG habitat but the reallocation from Matrix lands would add 101 acres of LSOG habitat for a net increase of 99 acres of LSOG habitat in LSR. There is also approximately 364 acres of LSOG within the 611 acres of unmapped LSR that would be included within mapped LSR 261. The management direction for these 611 acres would not change. Overall, this would increase the current level of LSOG habitat within mapped LSR 261 from 31,793 acres to 32,256 acres or by about 1 percent.
- **Quality** — The area of LSR 261 that would be affected by the Pacific Connector pipeline is highly fragmented due to both the land ownership pattern and past management activities. Like most LSRs on BLM lands, LSR 261 comprises checkerboard sections or even smaller parcels of land. The area proposed for reallocation to LSR 261 contains some large blocks of LSOG habitat as well as occupied MAMU stands (see figure 4.1-12). This reallocation would consolidate habitat in an area that is highly fragmented. Consolidating habitat is one of the management objectives for LSR 261(see appendix H, section 2.2.1.1).

The connectivity within LSR 261 would increase by decreasing distances between individual LSR parcels and reduce the amount of "edge" adjacent to existing occupied MAMU stands over time. With the reallocation of Matrix to LSR and the consolidation of larger blocks of LSOG habitat the quality of the LSOG habitat within LSR 261 would be improved.

- **Distribution** — The distribution of LSOG habitat within LSR 261 would remain largely unchanged with the proposed reallocation of Matrix to LSR RMP amendment. To the extent there are minor changes they would be beneficial due to the location of the proposed reallocation. The reallocation would occur within a current gap between the northern and southeastern portions of LSR 261 and would provide some additional connectivity within LSR 261 in this area.
- The off-site mitigation action would provide added protection to the quantity, quality, and distribution of LSOG habitat by improving the potential to decrease initial fire suppression response times and thereby increase the potential to control fires before they become high-intensity fires that threaten LSOG forests. Protecting LSOG forest from loss due to high-intensity fire is also one of the management objectives for this area.

The RMP amendment and off-site mitigation actions for LSR 261 in the BLM Coos Bay District have been designed with the goal that the overall impact would be either neutral or beneficial to the creation and maintenance of late-successional habitat.

Aggregated Impact of the Pacific Connector Pipeline Project on Mapped and Unmapped LSRs in the BLM Coos Bay District

Approximately 101 acres of the 387 acres of Matrix lands being reallocated contain LSOG forest habitat. A comparison of the total LSR acres that would be affected by the proposed Pacific Connector pipeline in the BLM Coos Bay District (in both mapped and unmapped LSRs) and the Matrix acres reallocated to LSR is in table 4.1.3.6-6 and figure 4.1-14.

TABLE 4.1.3.6-6

Comparison of the Pacific Connector Pipeline Project Total Impacts (a/) on LSRs and Matrix Reallocated to LSR (acres), Within BLM Coos Bay District

Coos Bay District	Cleared	Modified	Indirect Impacts	Total Impacts	Matrix to LSR Reallocation
	Direct Impacts				
LSOG	17	3	164	184	101
Non- LSOG	47	7	73	127	284
Non-Forest	0	0	0	0	2
Total	**64**	**10**	**237**	**311**	**387**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG) in both mapped and unmapped LSR.

Data source: BLM, Forest Service GIS Data Layers

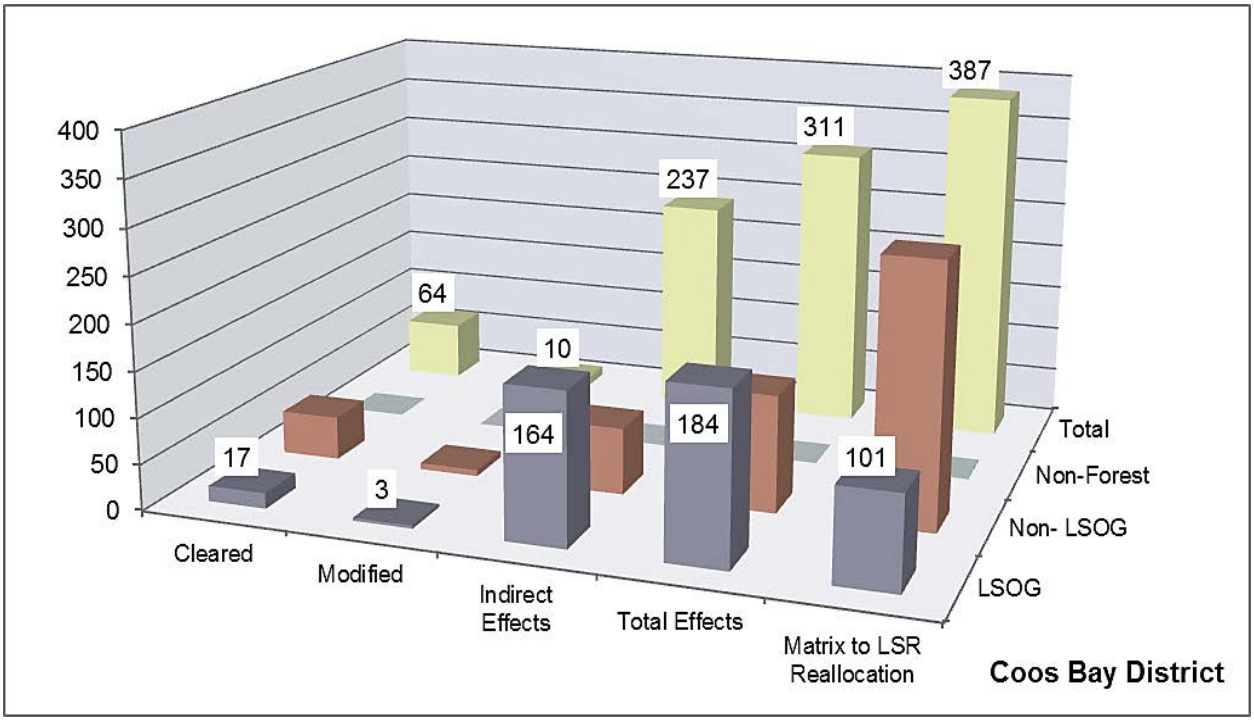

Figure 4.1-14. Comparison of Total LSR Acres Affected by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, Within BLM Coos Bay District

Approximately 64 acres of LSR lands would be cleared by the construction of the Pacific Connector pipeline in the Coos Bay District. Approximately 17 of these acres would be LSOG forest habitat. The proposed amendment would reallocate more than six times the amount of LSOG forest that would be cleared for the construction of the Pacific Connector pipeline.

Mitigation Actions

Off-site mitigation actions would provide added protection to the quantity, quality, and distribution of LSOG habitat. The BLM Coos Bay District is proposing to construct three heli-ponds to help with fire suppression efforts in LSR 261. Protecting LSOG forest from loss due to high-intensity fire is also one of the management objectives for LSR 261. Two of the heli-ponds would be in the East Fork Coquille River watershed and the other in the Middle Fork Coquille River watershed (see figure 4.1-15). High-intensity fire has been identified as the factor most affecting LSOG forest habitats on federal lands in the area of the NWFP (Moeur et al. 2011). Construction of the pipeline and associated activities would remove both mature and developing stands and could increase fire suppression complexity; however, the corridor would also provide a fuel break that could aid in suppression efforts. Within the East/Middle Fork watersheds, there is an over 18-mile gap between helicopter accessible waterholes. Quick response time is imperative for successful control of wildfires. Most water sources in this area are low in the drainage and accessible only by truck. Heli-ponds at these locations would reduce the 18-mile gap to approximately 6 miles and would enable a 2- to 3-mile radius for aerial application. Fire control is necessary to protect LSRs and endangered species habitat should a wildfire occur. These heli-ponds would reduce initial attack response times in both the mapped and unmapped LSRs that would be affected by the Pacific Connector pipeline and increase the potential to control fires before they become high-intensity fires that threaten LSOG forests.

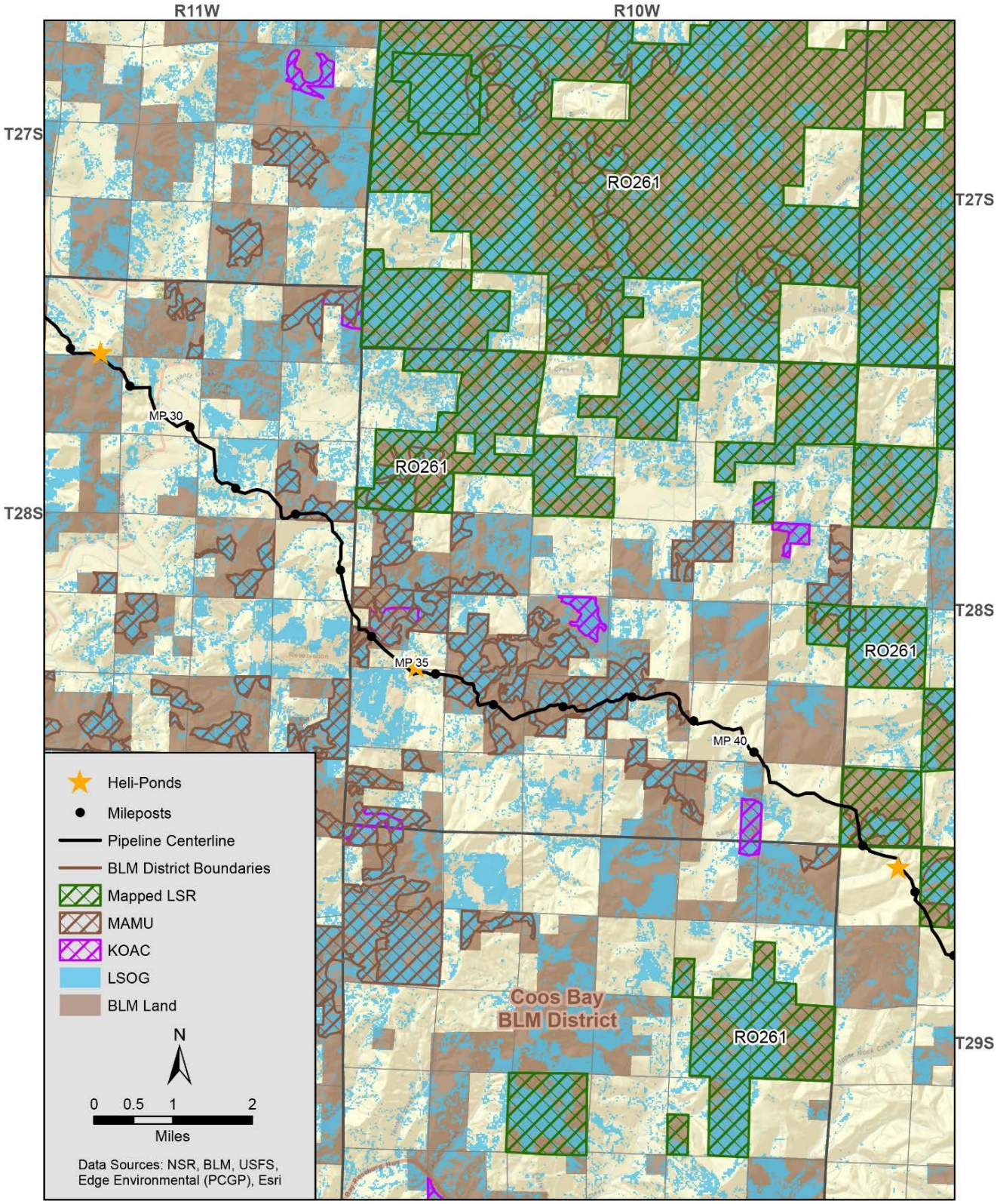

Figure 4.1-15. Map of Off-site LSR Mitigation Proposals in the BLM Coos Bay District

Together with the reallocation action, these off-site mitigation measures have been designed with the goal that the overall impact of the Pacific Connector pipeline would be either neutral or beneficial to the creation and maintenance of LSOG habitat in LSR 261.

RMP Amendments Related to LSRs on BLM Roseburg District

BLM–1, Site-Specific Exemption for Requirement to Protect MAMU Habitat in the BLM Roseburg District

The BLM Roseburg District RMP would be amended to waive the requirements to protect contiguous existing and recruitment habitat for MAMUs within the Project right-of-way that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM. This is a site-specific amendment applicable only to the Project right-of-way and would not change future management direction at any other location.

Existing known MAMU occupied sites were inventoried using BLM GIS layer data in 2006, and one occupied site was in the pipeline corridor on the Roseburg District. Additional MAMU surveys were conducted in 2007-2008 and 2012-2014 within the pipeline project area, and three additional occupied sites were identified on the Roseburg District. Two of these occupied sites (R3051 and R3052) were identified and delineated after the preparation of the 2014 PCGP DEIS. Both of these sites are located in MAMU Zone 2. BLM delineated the extent of the stands identified during the surveys and incorporated the newly identified stands into the GIS layer. Three of the four occupied stands within the project area on the Roseburg District occur outside of mapped LSRs on lands that are currently allocated as Matrix. The other stand lies within mapped LSR 261. Approximately 19 acres of occupied MAMU stands would be cleared by the Pacific Connector pipeline (see table 4.1.3.6-7). The map in figure 4.1-16 displays the known MAMU occupied stands in relation to the Pacific Connector Pipeline Project.

TABLE 4.1.3.6-7

Known Occupied Marbled Murrelet Stands in the Roseburg District within the Pacific Connector Pipeline Project Area

Marbled Murrelet Occupied Stand	Milepost Location	Acres Cleared a/
R3035 b/	MP 46.90-47.10	3
R3036	MP 51.04-51.29	3
R3051	MP 54.18-54.44	12
R3052	MP 60.85-61.66	1
		Total 19

Note: Columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
a/ Acres cleared equals the clearing in the Pacific Connector pipeline corridor and the temporary extra work areas.
b/ Occupied Stand R3035 lies entirely within LSR 261.

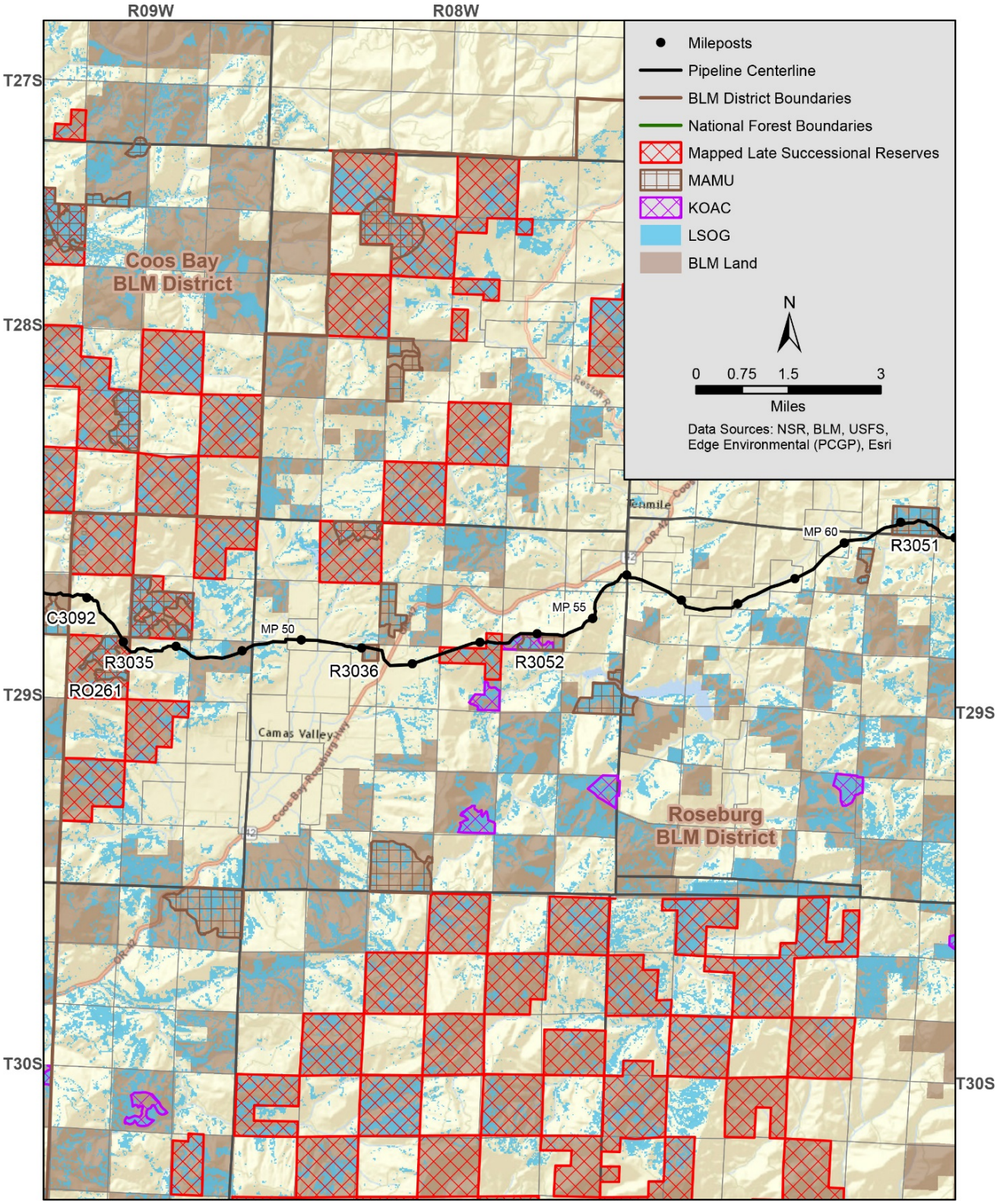

Figure 4.1-16. Map of Occupied MAMU Stands in the Pacific Connector Pipeline Corridor on the Roseburg District

Amount and Quality of MAMU Habitat Affected by the Construction and Operation of the Pipeline Project

The amount of MAMU habitat that would be affected both directly and indirectly is displayed in table 4.1.3.6-8 and figure 4.1-17.

TABLE 4.1.3.6-8

Comparison of Total Acres of Occupied Marbled Stands Impacted (a/) by the Pacific Connector Pipeline and Acres of Matrix to LSR Reallocation

Roseburg District	Cleared	Modified	Indirect Effects	Total Effects	Matrix to LSR Reallocation
	Direct Effects				
LSOG	4	2	42	48	286
Non- LSOG	14	3	25	43	123
Non-Forest	0	0	0	0	0
Total	**19**	**5**	**67**	**91**	**409**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Pacific Connector pipeline total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

Data Source: BLM, Forest Service GIS Data Layers

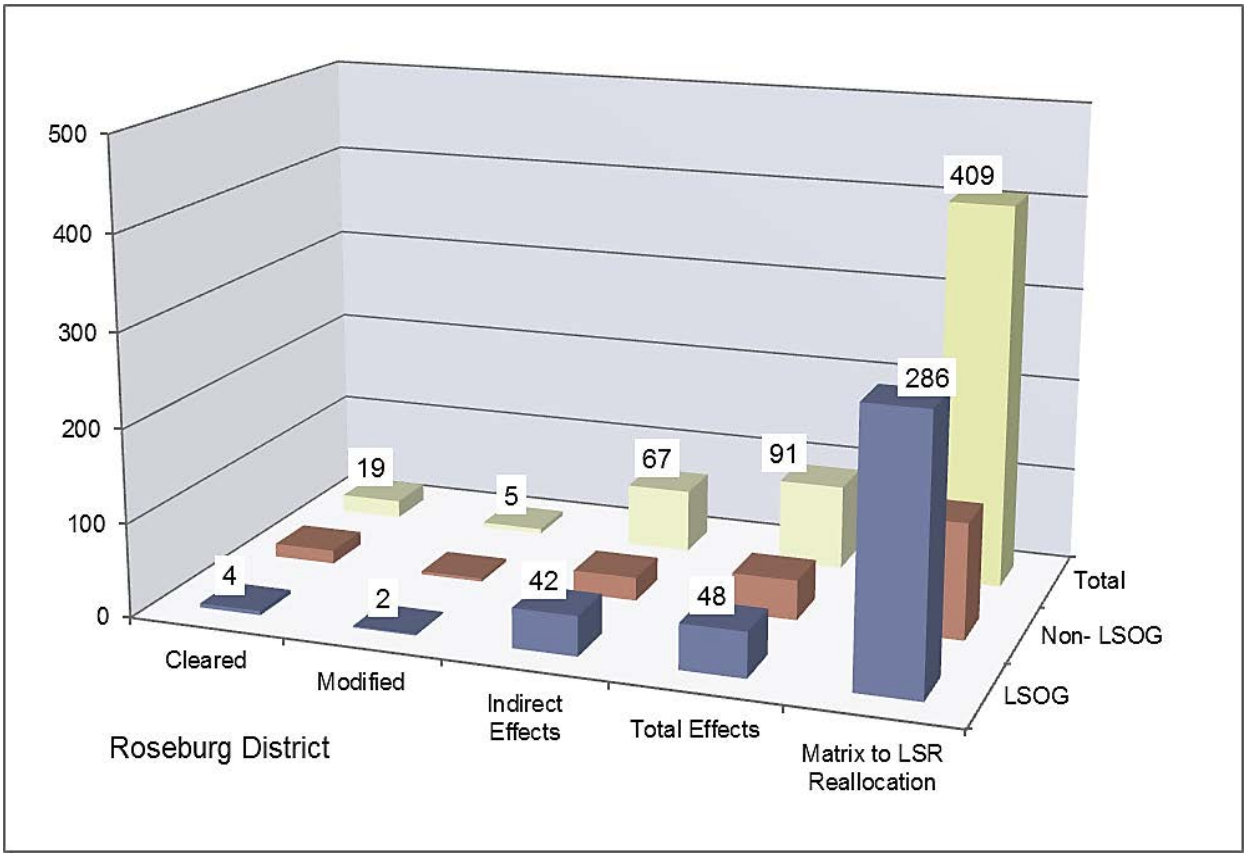

Figure 4.1-17. Total Acres of Occupied MAMU Stands Affected by the Pacific Connector Pipeline Project in the BLM Roseburg District

The Pacific Connector Pipeline Project would remove approximately 19 acres of occupied MAMU stands in the BLM Roseburg District. Approximately 6 of these acres would be located in MAMU Zone One and the remaining 13 acres in MAMU Zone Two. The proposed Matrix to LSR reallocation for LSRs in the BLM Roseburg District is outside of MAMU Zone 1 but is within MAMU Zone 2 and contains suitable habitat for MAMUs. Two of the affected MAMU stands on the Roseburg District are adjacent to affected MAMU occupied stands in the BLM Coos Bay District. The proposed Matrix to LSR reallocation in the BLM Coos Bay District also contains suitable MAMU habitat and is in MAMU Zone 1. The proposed Matrix to LSR reallocation on the Coos Bay District is near the area where MAMU are affected by the project on both the BLM Coos Bay and Roseburg Districts (see figures 4.1-12 and 4.1-22, see also appendix H, section 2.4.4 for additional discussion). The future management of these LSRs should not only protect habitat currently suitable to MAMUs, but also promote the development of additional MAMU habitat on the landscape. These reallocations would help to minimize the loss of unoccupied but suitable habitat. The total proposed amendments for MAMU on the BLM Coos Bay and Roseburg Districts are discussed in section 4.1.3.7 of this EIS.

BLM-2, Site-Specific Exemption from Requirement to Retain Habitat in KOACs in the BLM Roseburg District

The BLM Roseburg District RMP would be amended to waive the requirements to retain habitat in KOACs at three locations (see figures 4.1-18 to 4.1-20). This is a site-specific amendment applicable only to the Project right-of-way and would not change future management direction at any other location. The RMP for the Roseburg District requires retaining habitat within KOACs. By definition, KOACs are within Matrix lands and therefore would be addressed as unmapped LSRs.

Amount and Quality of KOACs Affected by the Construction and Operation of the Pipeline Project

Currently, based on the latest BLM GIS data layers, there are approximately 197 acres of LSOG forest habitat within the three KOACs that would be affected by the Pacific Connector pipeline on the BLM Roseburg District. Even though measures were taken to minimize impacts, habitat would still be affected by the pipeline project. While removal of LSOG forest habitat would be kept to 2 acres, there would also be impacts from the UCSAs and the indirect impacts of new edge and fragmentation of forest habitat. The total impacts from the pipeline on KOACs are displayed below in table 4.1.3.6-9 and figure 4.1-21.[22]

[22] A portion of KOAC P2199 overlaps Occupied MAMU site R3052. While there would be no overlap in the acres directly impacted by construction of the pipeline, there is approximately 6 acres of overlap in indirect effects. Therefore in tables displaying the indirect effects to all unmapped LSR (MAMU + KOAC) there is approximately 6 acres that are double counted.

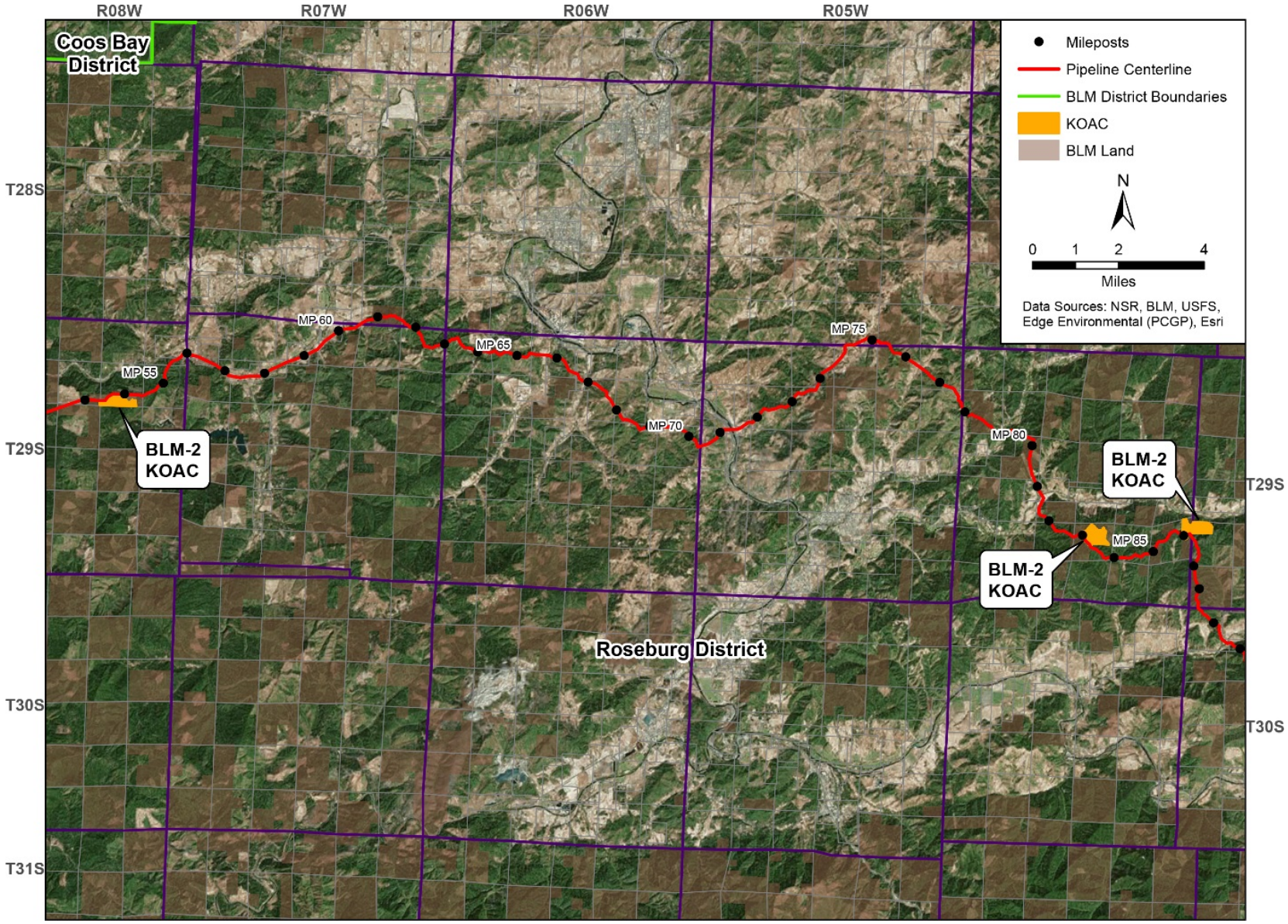

Figure 4.1-18. Map of KOAC Sites Crossed by the Pacific Connector Pipeline Project in the BLM Roseburg District

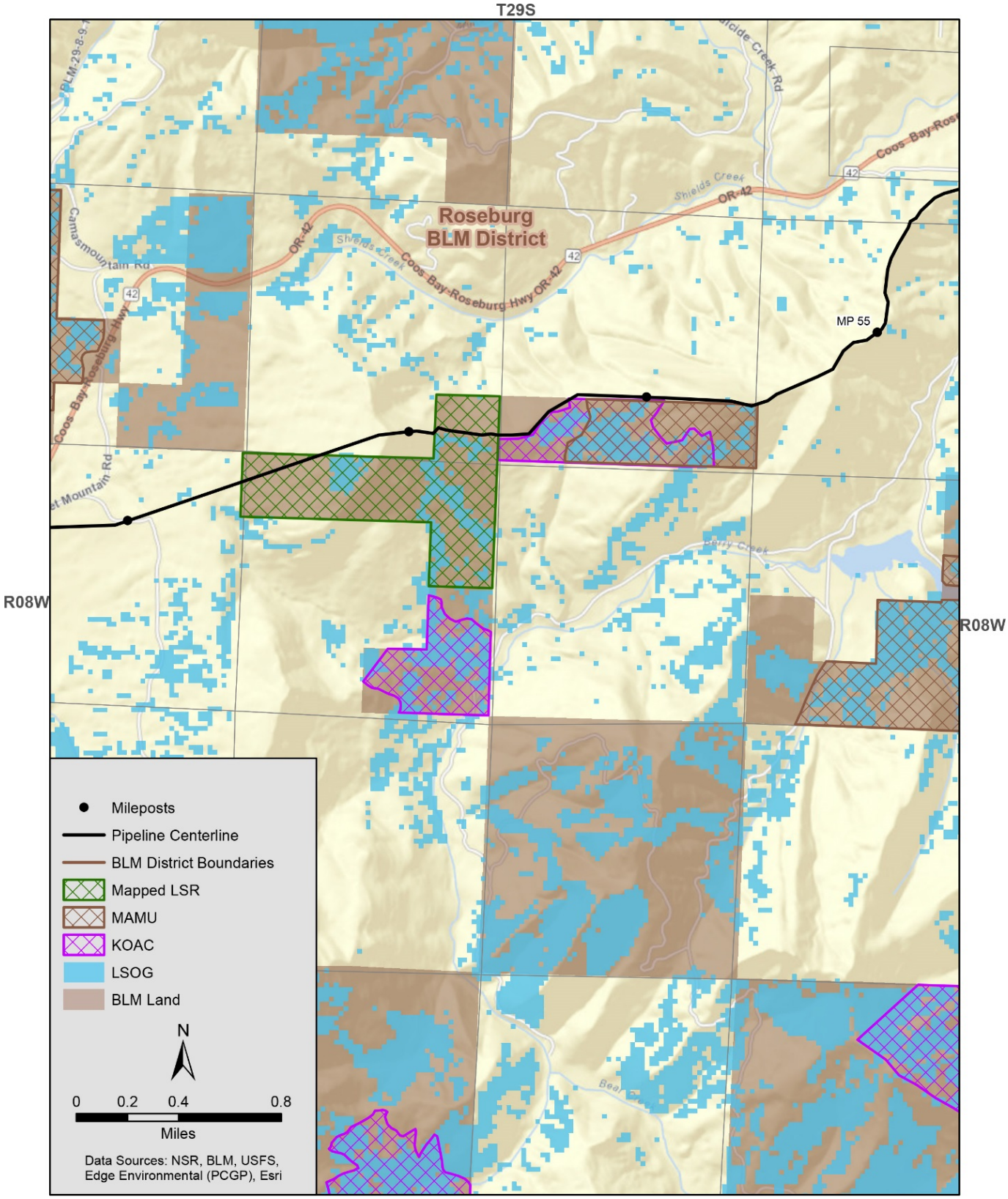

Figure 4.1-19. Map of KOAC P2199 and the Pacific Connector Pipeline, BLM Roseburg District

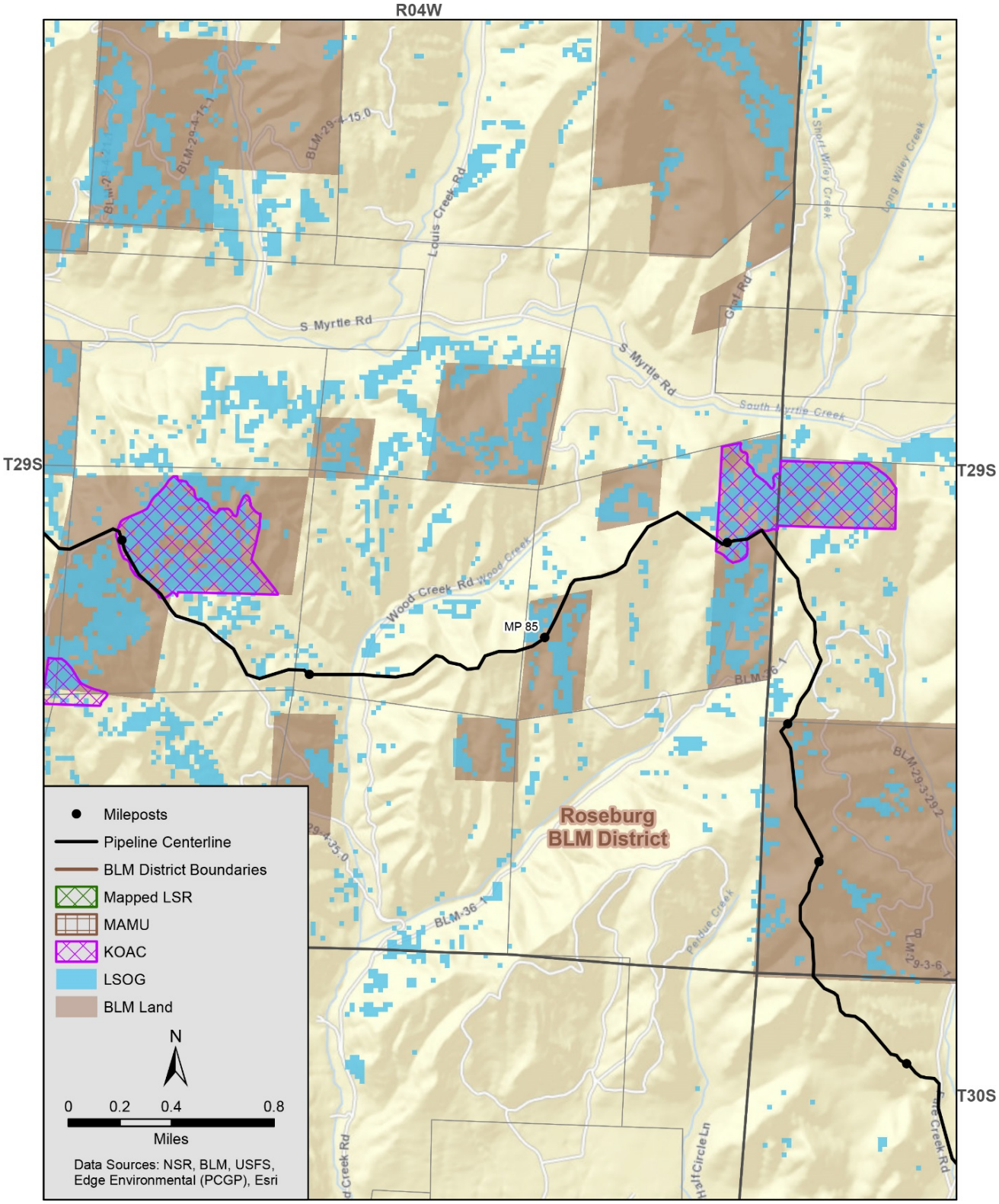

Figure 4.1-20. Map of KOACs P0361 and P2294 and the Pacific Connector Pipeline, BLM Roseburg District

TABLE 4.1.3.6-9

Summary of Total KOAC Acres Affected (a/) by the Pacific Connector Pipeline Project in the BLM Roseburg District

Roseburg Dist. KOACs	Cleared (Direct Impacts)	Modified (Direct Impacts)	Project Indirect Impacts	Project Total Impacts
LSOG	2	5	24	31
Non- LSOG	5	3	6	15
Non-Forest	0	0	0	0
Total	**7**	**9**	**30**	**46**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Total project impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

Data source: BLM, Forest Service GIS Data Layers

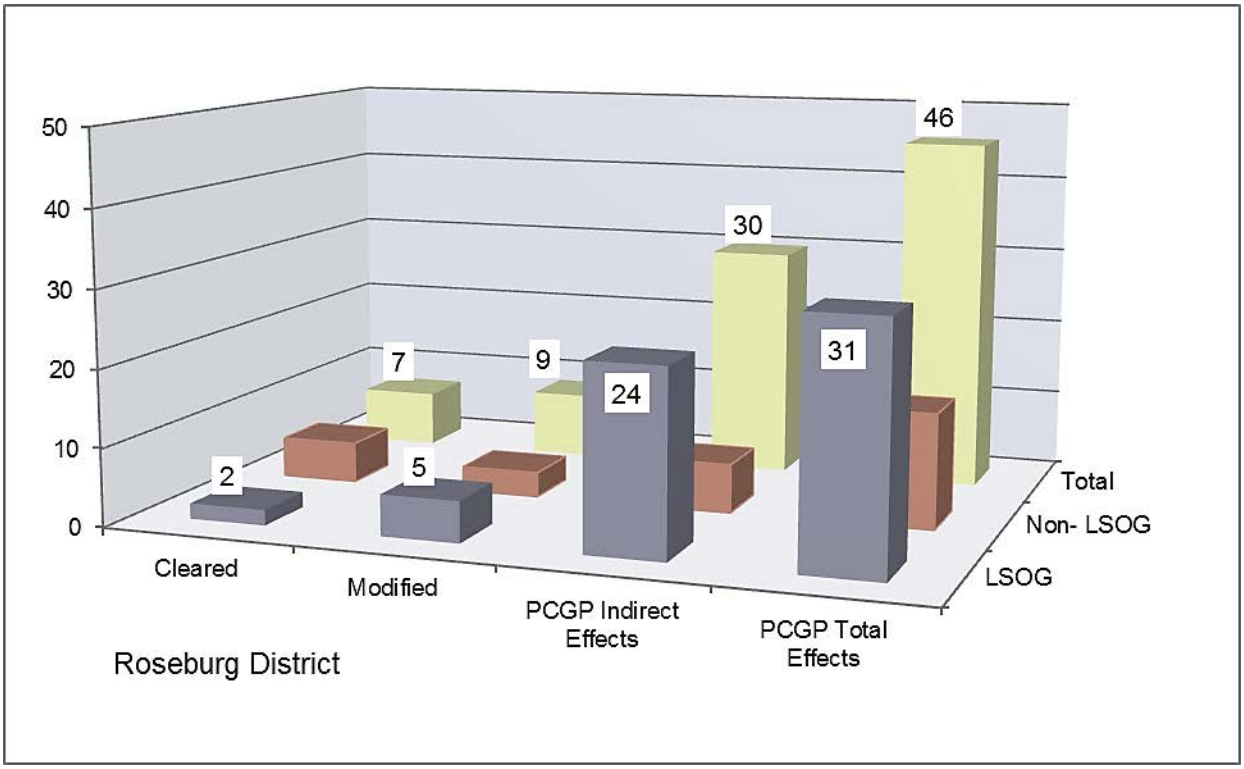

Figure 4.1-21. Summary of Total KOAC Acres Affected by the Pacific Connector Pipeline Project in the BLM Roseburg District

BLM-3, Reallocation of Matrix Lands to Late-Successional Reserves

The BLM Roseburg District RMP would be amended to change the designation of approximately 409 acres from the Matrix land allocation to the LSR land allocation in Sections 32 and 34, of T.291/2 S., R.7W., and section 1 T.30S. R.7W., W.M., Oregon.

This change in land allocation is proposed to partially mitigate for the potential adverse impact of the Pacific Connector pipeline on LSRs in the Roseburg District. This proposed amendment would

change future management direction for the lands reallocated from Matrix to LSR. A map of the proposed reallocation is displayed in figure 4.1-22.

The primary management objective of the LSR land allocation is to protect and enhance conditions of LSOG forest ecosystems that serve as habitat for late-successional and old-growth related species. Currently, based on the latest BLM GIS data there are approximately 31,793 acres of LSOG forest habitat in LSR 261. If constructed, the part of the Pacific Connector pipeline in the BLM Roseburg District would remove approximately 11 acres of forest vegetation in LSR 261. This includes the removal of forest from both the pipeline corridor and the TEWAs. Approximately 1 of these acres is LSOG forest habitat. The area proposed for reallocation to LSR is approximately 409 acres of Matrix lands, of which approximately 286 acres are LSOG forest. In addition to the impacts from the removal of forest vegetation in LSR 261, there would be impacts from the acres modified by UCSAs and the acres indirectly affected through the creation of new edges and fragmentation of older forest. A comparison of the total acres affected in LSR 261 and the acres of reallocation are displayed in table 4.1.3.6-10 and figure 4.1-23 below.

The acres that would be reallocated would become part of mapped LSR 259. This LSR is adjacent to LSR 261 and is also near the area of the Pacific Connector pipeline (see appendix H, section 2.2.2.4). LSR 259 has similar priorities and recommendations as LSR 261 (see appendix H, section 2.2.1.1). One of the key objectives for LSRs 261 and 259 is to increase the stand sizes of contiguous LSOG habitat. A key recommendation for these LSRs is risk management activities to reduce the probability that a major stand-replacing event or events that degrade habitat quality would occur. The primary purpose of risk reduction activities in these LSRs is to reduce the probability of large-scale loss of late-successional habitat. Another purpose of risk reduction activities is to reduce the probability of late-successional habitat loss in stands with important features such as nest stands for NSOs, stands containing other key species, or stands containing larger blocks of interior habitat or providing meaningful localized connectivity.

In addition, the area around LSR 259 provides a better opportunity to consolidate LSOG habitat as evidenced by the high percentage of LSOG forest in the acres proposed for reallocation. The reallocation would increase the quantity of LSOG habitat in LSR 259 by 286 acres. It would also improve the quality of LSOG habitat within the LSR due to the larger LSOG patch size and the consolidation of habitat in this area. Reallocation in this area would also improve the distribution of LSOG habitat between LSR 259 and LSR 261, which is important in this area due to the highly fragmented land ownership patterns (see appendix H, section 2.2.2.4). For these reasons, reallocating acres to LSR 259 is being considered for mitigation for the impacts in LSR 261.

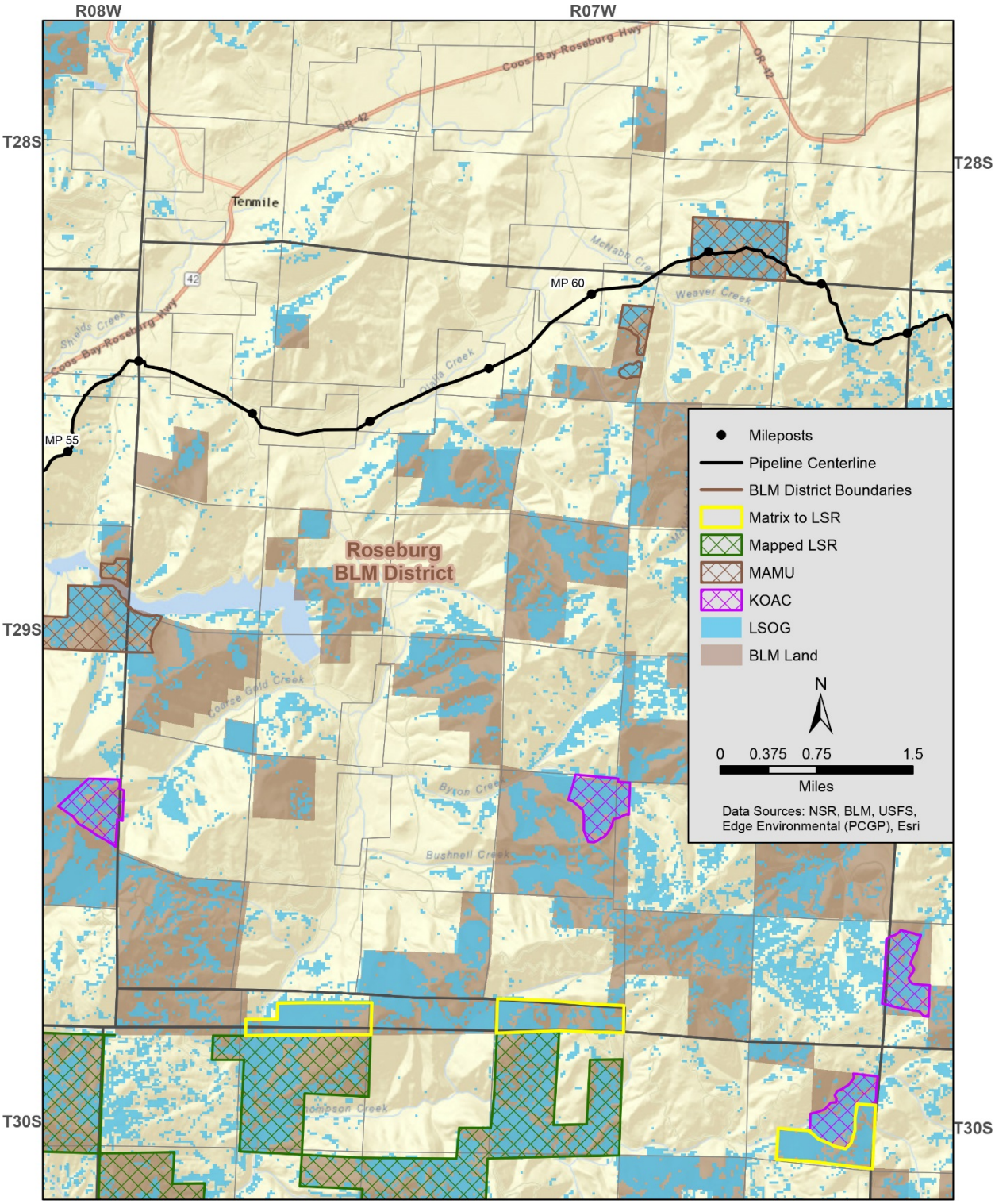

Figure 4.1-22. Map of Proposed Matrix to LSR Reallocation and LSOG Habitat in the BLM Roseburg District

TABLE 4.1.3.6-10

Comparison of the Total LSR Acres Affected (a/) by the Pacific Connector Pipeline Project and Matrix Reallocated to LSR, Roseburg District LSR 261

Roseburg District LSR 261	Cleared	Modified	Project Indirect Impacts	Project Total Impacts	Matrix to LSR Reallocation
	Direct Impacts				
LSOG	1	<1	16	17	286
Non- LSOG	10	1	17	28	123
Non-Forest	0	0	0	0	0
Total	**11**	**1**	**33**	**45**	**409**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Total project impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

Data source: BLM, Forest Service GIS Data Layers

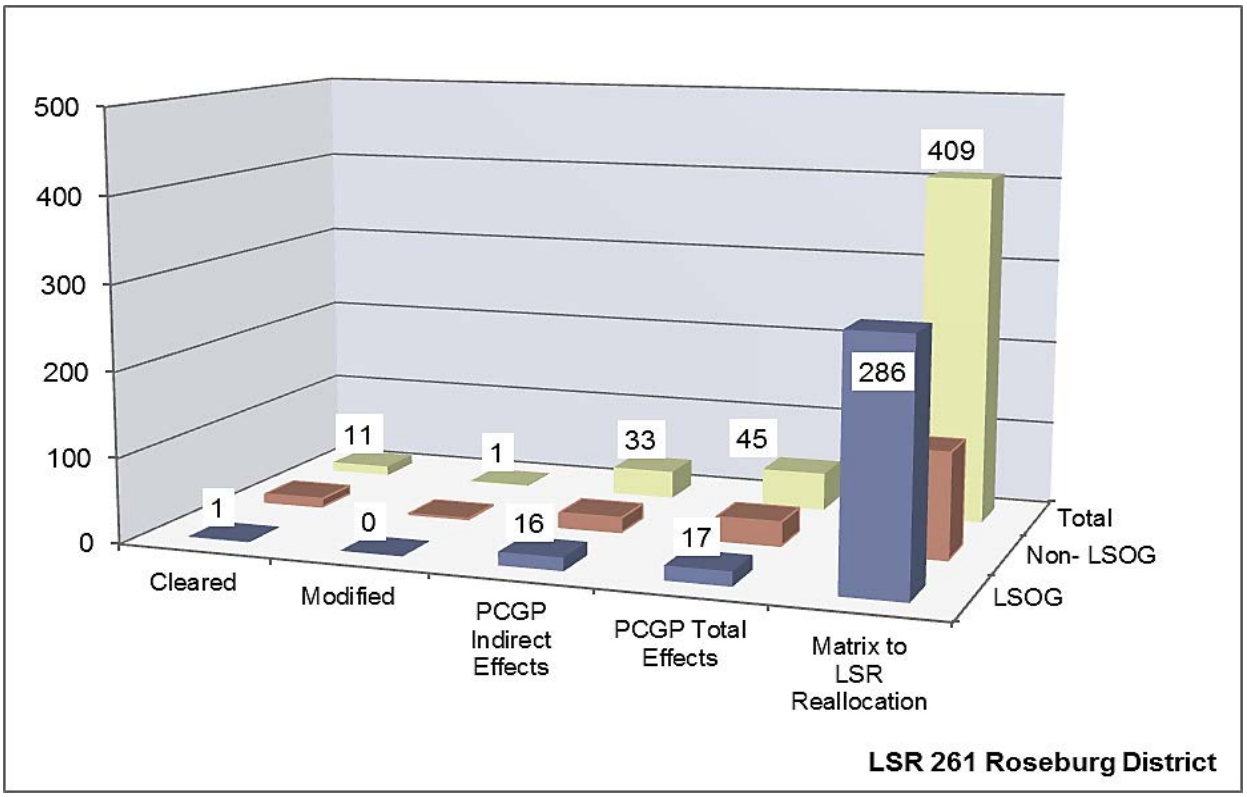

Figure 4.1-23. Comparison of Total LSR Acres Affected by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, BLM Roseburg District LSR 261

Impact on the Functionality of LSR 261 on the BLM Roseburg District

The functionality of LSR 261 relates directly to the goals and objectives for LSRs and can be measured by the quantity, quality, and distribution of LSOG forest habitat in the LSR and how the Pacific Connector Pipeline Project would affect these characteristics.

- **Quantity**: The overall quantity of LSOG habitat in LSRs on the BLM Roseburg District would increase slightly with the construction of the Pacific Connector pipeline and RMP amendment. The Pacific Connector pipeline would remove approximately 1 acre of LSOG

habitat, but would reallocate approximately 286 acres of LSOG habitat with the RMP amendment. This would represent a net increase of 285 acres of LSOG habitat.[23]

- **Quality:** The area of LSR 261 that would be affected by the Pacific Connector pipeline is highly fragmented due to both the land ownership pattern and past management activities. The area contains a high degree of edge with little or no interior forest habitat (see figure 4.1-15). The area proposed for reallocation contains some large blocks of LSOG habitat as well as an adjacent KOAC (see figure 4.1-22). This reallocation would consolidate habitat in an area that is highly fragmented. LSRs on BLM land comprise checkerboard sections or even smaller parcels of land. The intent of the reallocations is to better connect these pieces by decreasing distances between individual LSR parcels and reduce the amount of "edge" adjacent to existing occupied MAMU stands. Consolidating habitat is one of the management objectives for this area. With the reallocation of Matrix to LSR and the consolidating of larger blocks of LSOG habitat, the quality of the LSR LSOG habitat would be improved.
- **Distribution**: The distribution of LSOG habitat within LSR 261 would remain largely unchanged with the Pacific Connector pipeline and the reallocation of Matrix to LSR RMP amendment. To the extent there are minor changes they would be beneficial due to the location of the proposed reallocation. The reallocation would occur between the southern edge of LSR 261 and the northern edge of LSR 259 and would provide some additional connectivity within LSR 259 in this area.
- The off-site mitigation action would provide added protection to the quantity, quality, and distribution of LSOG habitat by improving the potential to decrease initial fire suppression response times and thereby increase the potential to control fires before they become high-intensity fires that threaten LSOG forests. Protecting LSOG forest from loss due to high-intensity fire is also one of the objectives for this area.

The RMP amendments and off-site mitigation actions for LSR 261 in the BLM Roseburg District have been designed with the goal that the overall impact would be either neutral or beneficial to the creation and maintenance of late-successional habitat. A discussion on the total amendments to LSR 261 on the BLM Coos Bay and Roseburg Districts is in section 4.1.3.7 of this EIS. Additional information can also be found in section 2.2.2.5 of appendix H.

Aggregated Impact of the Pacific Connector Pipeline Project on Mapped and Unmapped LSRs in the BLM Roseburg District

The construction of the Pacific Connector pipeline in the BLM Roseburg District would also affect LSR 223 (see figure 4.1-24). Currently, based on the latest BLM and Forest Service GIS data there are approximately 20,557 acres of LSOG forest habitat, which comprise approximately 31 percent of LSR 223. The pipeline would remove approximately 46 acres of forest from LSR 223, of which approximately 13 acres would be LSOG forest. In addition to the acres cleared, there would be impacts from acres modified by UCSAs and indirect impacts from the creation of new edge and the fragmentation of forest habitat. The total impacts on LSR 223 in the BLM Roseburg District are displayed in table 4.1.3.6-11 and figure 4.1-25.

[23] The acres would be reallocated to LSR 259, which is next to LSR 261; see discussion in Amendment BLM-3, Reallocation of Matrix Lands to Late-Successional Reserves above for the reasons reallocation in LSR 259 is being considered as mitigation for LSR 261.

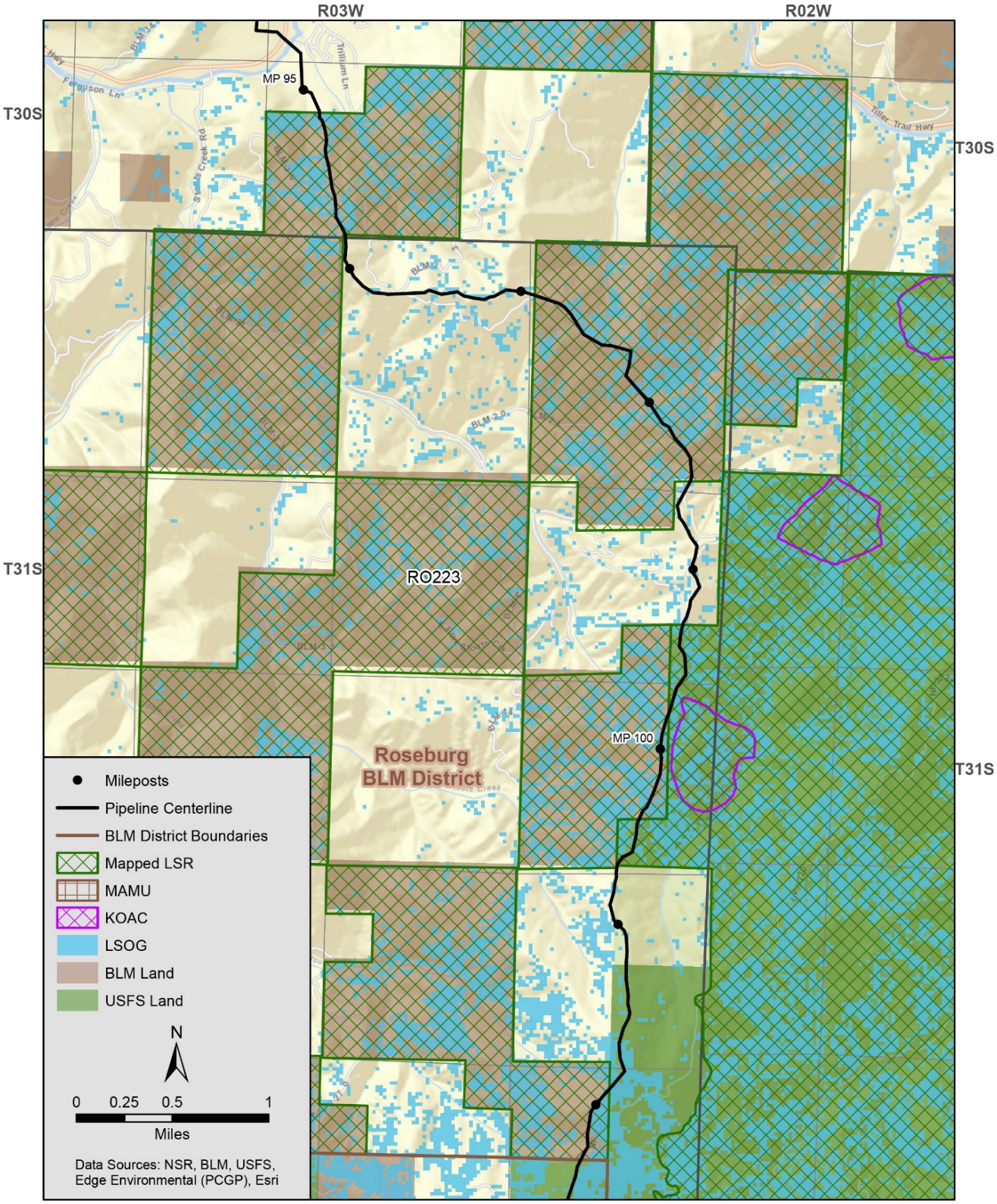

Figure 4.1-24. Map of LSR 223 Crossed by the Pacific Connector Pipeline Project in the BLM Roseburg District

TABLE 4.1.3.6-11

Summary of Total LSR 223 Acres Affected (a/) by the Pacific Connector Pipeline Project in the BLM Roseburg District and Acres of Matrix Reallocated to LSR

Roseburg District LSR 223	Cleared	Modified	Project Indirect Impacts	Project Total Impacts
	Direct Impacts			
LSOG	13	8	103	124
Non-LSOG	34	13	42	88
Non-Forest	0	0	0	0
Total	**46**	**22**	**145**	**212**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Total project impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

Data source: BLM, Forest Service GIS Data Layers

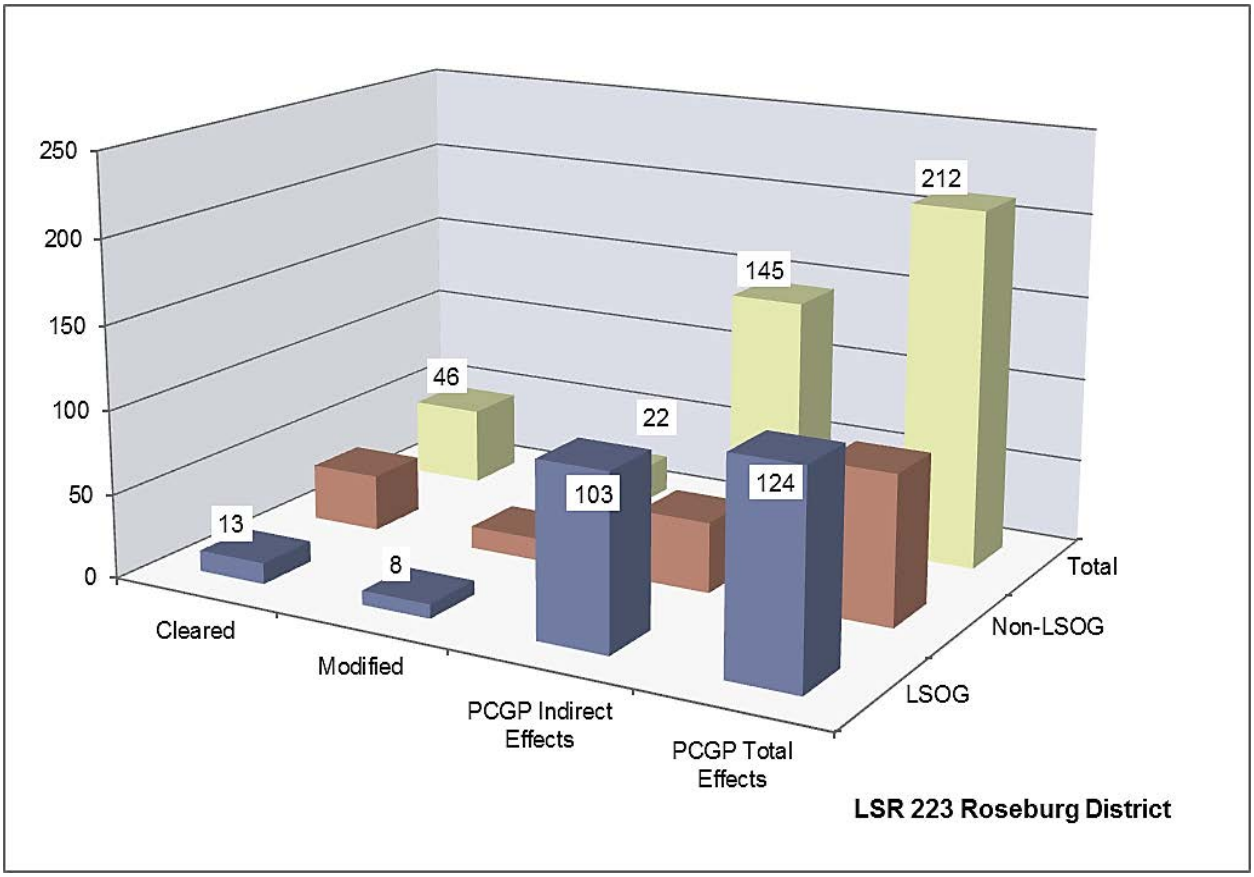

Figure 4.1-25. Summary of Total LSR 223 Acres Affected by the Pacific Connector Pipeline Project on the BLM Roseburg District

In addition to the impacts of the Project corridor on LSR 223 in the BLM Roseburg District, there are also potential off-site impacts on LSR 223 from road reconstruction that would be necessary to accommodate the trucks that would be hauling the sections of pipe. These trucks are longer than typical trucks that use forest roads and some road widening and curve realignment may be necessary to safely allow for this truck traffic. In LSR 223 on the BLM Roseburg District it is

estimated that approximately 2 acres of road widening would occur within LSR. Although this road widening would occur to the extent possible within the existing clearing limits, it is probable that some additional clearing of forest vegetation would be necessary to accommodate the road reconstruction. It is estimated that this would be a maximum of two acres and would occur along an existing road opening.

There are no proposed amendments to reallocate Matrix lands to LSR 223 in the BLM Roseburg District. This is due primarily to the lack of suitable LSOG forest habitat in the Matrix near the LSR and the pipeline. There is, however, a proposed amendment to reallocate Matrix lands to LSR 223 in the Umpqua National Forest, which borders the east side of the BLM Roseburg District and is discussed below. The Pacific Connector pipeline would also affect LSR 223 on the Umpqua National Forest. The combined effects on LSR 223 in the BLM Roseburg District and Umpqua National Forest, the Matrix to LSR reallocation, and the proposed mitigation actions are evaluated in section 4..1.3.7 of this EIS (see also section 2.3.1.4 of appendix H).

Approximately 286 acres of the 409 acres of Matrix lands that would be reallocated in the BLM Roseburg District contain LSOG forest habitat. A comparison of the total LSR acres that would be affected by the Pacific Connector pipeline in the BLM Roseburg District in both mapped LSRs (261 and 223) and unmapped LSRs (MAMU and KOACs), with the Matrix acres reallocated to LSR is in table 4.1.3.6-12 and figure 4.1-26.[24] A total of approximately 81 acres of LSR lands would be cleared by the construction of the pipeline project in the BLM Roseburg District. Approximately 19 of these acres would be LSOG forest habitat. The proposed amendment would reallocate approximately 15 times the amount of LSOG forest that would be cleared with the construction of the Pacific Connector pipeline.

TABLE 4.1.3.6-12

Comparison of Total LSR Acres Affected (**a/**) by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, BLM Roseburg District

Roseburg District	Cleared	Modified	Indirect Impacts	Total Impacts	Matrix to LSR Reallocation
	Direct Impacts				
LSOG	19	15	177	193	286
Non- LSOG	61	21	87	169	123
Non-Forest	0	0	0	0	0
Total	**81**	**36**	**265**	**362**	**409**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG) in both mapped and unmapped LSRs.

Data source: BLM, Forest Service GIS data layers

[24] A portion of KOAC P2199 overlaps Occupied MAMU site R3052. While there would be no overlap in the acres directly impacted by construction of the pipeline, there is approximately 6 acres of overlap in indirect effects. Therefore in tables displaying the indirect effects to all unmapped LSR (MAMU + KOAC) there is approximately 6 acres that are double counted.

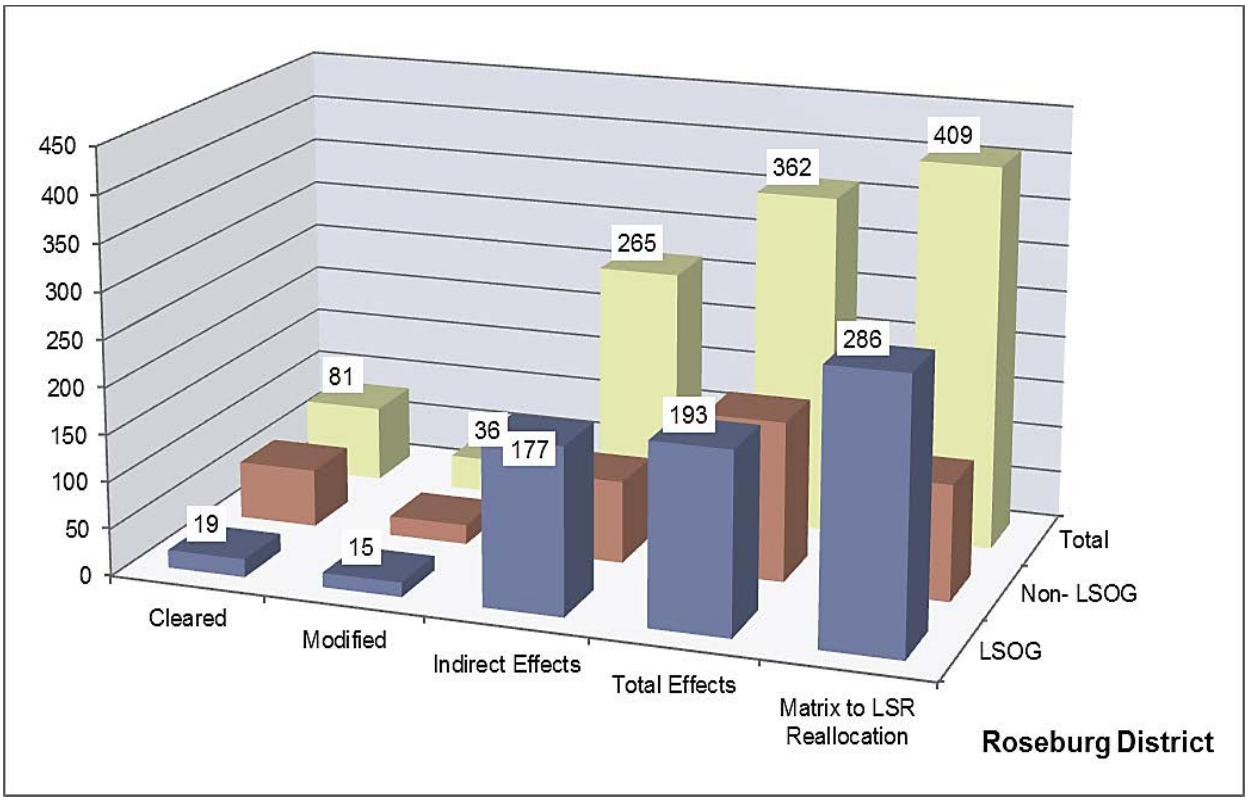

Figure 4.1-26. Comparison of Total LSR Acres Affected by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, BLM Roseburg District

Mitigation Actions

In addition to the reallocation of Matrix lands to LSR, the off-site mitigation actions include hazardous fuels reduction through creating a 1,000-acre fuel break adjacent to the Pacific Connector Pipeline Project corridor in the South Umpqua River watershed and aiding fire suppression efforts through the creation of six dry hydrants in the South Umpqua River, Myrtle Creek, and Middle South Umpqua River watersheds (see figure 4.1-27). These mitigation actions have been designed to complement the mitigation actions being considered in the Umpqua National Forest to benefit LSR 223.

On July 30, 2015 the Stouts Fire started near Milo Oregon and had grown to over 26,000 acres by September 1, 2015. The fire burned into portions of LSR 223 and the proposed pipeline corridor between MP 96 and 105 (see figure 4.1-28 for MP locations). In addition, fire suppression activities occurred along the proposed pipeline route from approximately MP 104.5 to MP 109. At the time this FEIS was being prepared the fire was still burning and the full extent of impacts to LSR 223 were unknown. Once the fire has been controlled the BLM and Forest Service will assess the impacts and develop post-fire strategies and recommendations. We know from fire incident reports some of the LSOG forest in LSR 223 in the vicinity of the proposed pipeline has been impacted by the fire. Therefore the impacts of the proposed pipeline project on LSOG habitat in LSR 223 displayed in figure 4.1-29 above may change. Changes to the proposed 1,000 acre fuel break described below can be expected since portions of that proposed fuel break occur within the fire perimeter and fire suppression activities. There may be changes to other proposed mitigation actions in this area as well once post fire assessments have been completed.

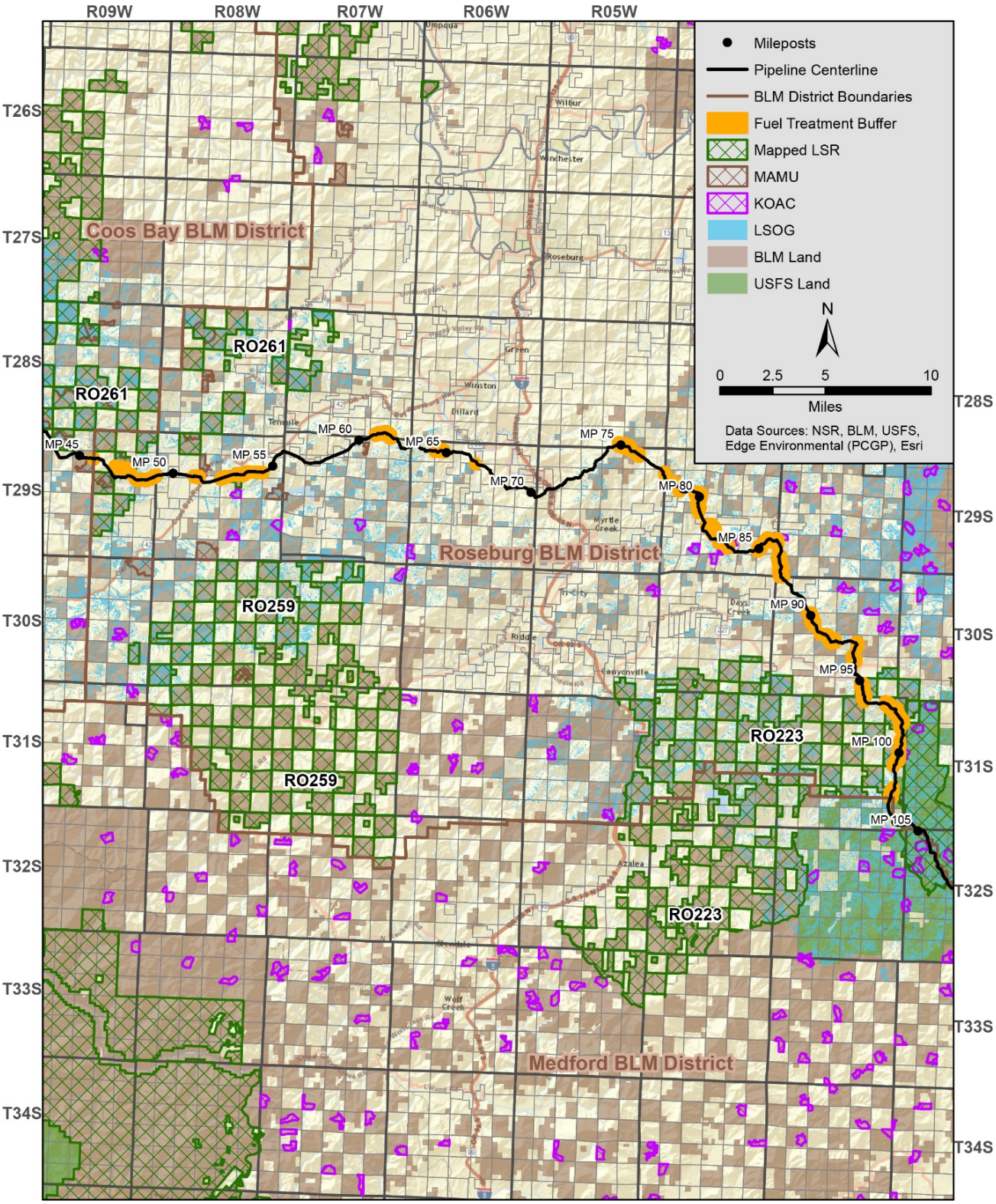

Figure 4.1-27. Map of Proposed Off-site LSR Mitigation Actions in the BLM Roseburg District

1,000-Acre Fuel Break

High-intensity fire has been identified as the single factor most affecting late-successional and old growth forest habitats on federal lands in the area of the NWFP (Moeur et al. 2011). Construction of the pipeline and associated activities would remove both mature and developing stands and increase fire suppression complexity; however, the corridor also provides a fuel break. Fuels reduction adjacent to the corridor would increase the effectiveness of the corridor as a fuel break. Fuels reduction would lower the risk of loss of developing and existing mature stands and other valuable habitats to high-intensity fire. This segment is part of the Days Creek to Shady Cove fuel break and ties in with similar projects in the Umpqua National Forest.

Six Dry Hydrants

By installing dry hydrants, the water source is disturbed only once, and there are several other advantages. Fire vehicles would not need to be really close to the water to fill up, decreasing the risk of contamination, and they can fill from some water sources that would otherwise need to be modified for use. Areas that have had restoration work for fish populations could still be safely accessed for fire suppression. Overall, better water sources would improve suppression success and therefore help protect natural resources.

LRMP Amendments Related to LSRs on the Umpqua National Forest.

UNF-4, Reallocation of Matrix Lands to Late-Successional Reserves

The Umpqua National Forest LRMP would be amended to change the designation of approximately 588 acres from the Matrix land allocation to the LSR land allocation in Sections 7, 18, and 19, T.32S., R.2W., Oregon; and Sections 13 and 24, T.32S., R.3W., W.M., Oregon.

This change in land allocation is proposed to partially mitigate for the potential adverse impact of the Pacific Connector pipeline on LSR 223 in the Umpqua National Forest. This proposed amendment would change future management direction for the lands reallocated from Matrix to LSR. A map of the proposed reallocation is displayed in figure 4.1-28.

The primary management objective of the LSR land allocation is to protect and enhance conditions of LSOG forest ecosystems that serve as habitat for LSOG–related species. Currently, based on latest BLM and Forest Service GIS data, there are approximately 20,557 acres of LSOG forest habitat, which comprises approximately 31 percent of LSR 223.

If constructed, the part of the Pacific Connector pipeline in the Umpqua National Forest would be about 11 miles long, of which about 5 miles would traverse through LSR 223. The Pacific Connector pipeline would clear approximately 67 acres, of which approximately 23 acres are LSOG forest. The area proposed for reallocation to LSR 223 is approximately 588 acres of Matrix lands, of which approximately 431 acres are LSOG forest. When acres reallocated from Matrix lands to LSR are compared to the acres of LSR that would be cleared by the Pacific Connector pipeline, the proposed amendment would reallocate nearly nine times more acres to LSR than would be cleared for the Pacific Connector pipeline corridor. In terms of LSOG habitat, the proposed amendment would reallocate almost 19 times more acres to LSR than would be cleared for the Pacific Connector pipeline corridor.

In addition to the impacts from the removal of forest vegetation in LSR 223, there would be additional impacts from the acres modified by UCSAs and the acres indirectly affected through the creation of new edges and fragmentation of older forest. A comparison of the total acres affected in LSR 223 and the acres of reallocation are displayed in table 4.1.3.6-13 and figure 4.1-29 below.

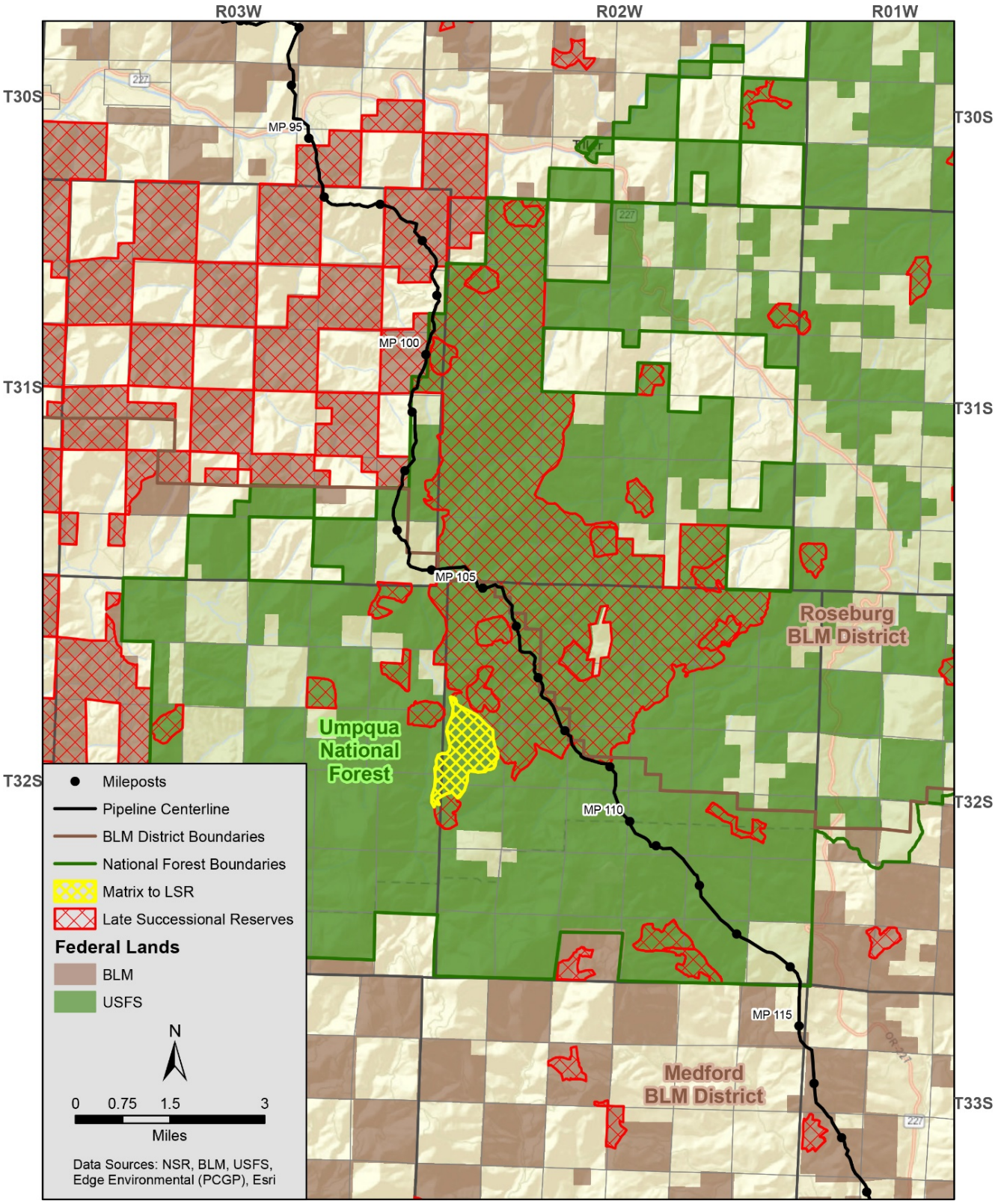

Figure 4.1-28. Proposed Matrix to LSR Reallocation, Umpqua National Forest

TABLE 4.1.3.6-13

Comparison of LSR 223 Acres Affected (a/) by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, Umpqua National Forest

Umpqua National Forest LSR 223	Cleared	Modified	Indirect Impacts	Total Impacts	Matrix to LSR Reallocation
	Direct Impacts				
LSOG	23	6	168	**197**	431
Non- LSOG	45	11	73	**129**	157
Non-Forest	0	0	0	**0**	0
Total	**67**	**17**	**241**	**325**	**588**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

Data source: BLM, Forest Service GIS Data Layers; Cox 2010

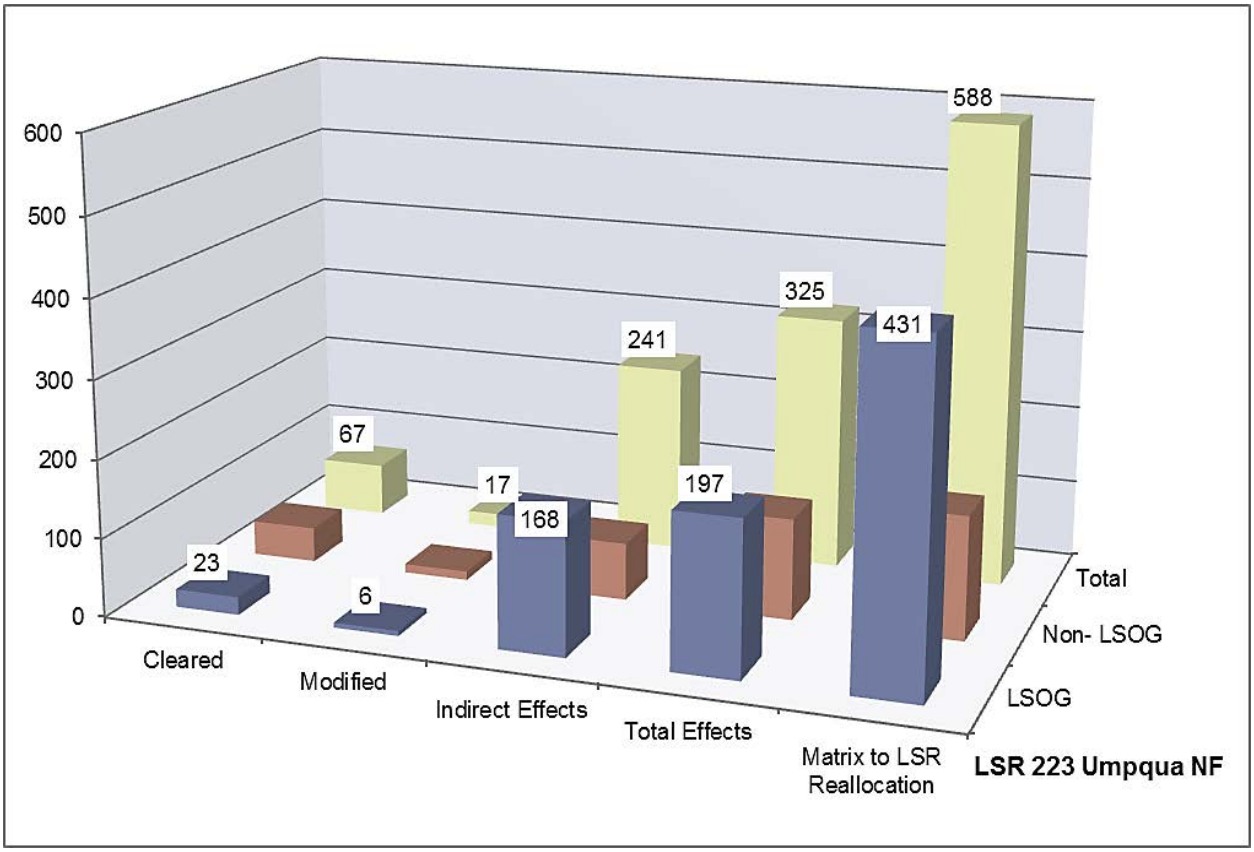

Figure 4.1-29. Comparison of Total LSR 223 Acres Affected by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, Umpqua National Forest

In addition to the impacts of the Pacific Connector pipeline corridor on LSR 223 in the Umpqua National Forest, there are also potential off-site impacts on LSR 223 from road reconstruction that would be necessary to accommodate the trucks that would be hauling the sections of pipe. These trucks are longer than typical trucks that use forest roads and some road widening and curve realignment may be necessary to safely allow for this truck traffic. In LSR 223 on the Umpqua

National Forest, it is estimated that approximately 2.5 acres of road widening would occur. Although this road widening would occur to the extent possible within the existing clearing limits, it is probable that some additional clearing of forest vegetation would be necessary to accommodate the road reconstruction. It is estimated that this would be a maximum of 2.5 acres and would occur along an existing road opening.

Impact on the Functionality of LSR 223 on the Umpqua National Forest

The functionality of LSR 223 relates directly to the goals and objectives for LSRs and can be measured by the quantity, quality and distribution of LSOG forest habitat in the LSR and how the Pacific Connector pipeline would affect these characteristics.

- **Quantity**: The overall quantity of LSOG habitat in LSR 223 on the Umpqua National Forest would increase with the proposed LRMP amendment. The Pacific Connector pipeline would remove approximately 23 acres of LSOG habitat but the reallocation would add 431 acres of LSOG habitat for a net increase of 408 acres. This would increase the current level of LSOG habitat in LSR 223 from 20,557 acres to 20,965 acres or by approximately two percent.
- **Quality**: The area proposed for reallocation to LSR 223 contains some large blocks of LSOG habitat and would also be located immediately adjacent to two KOACs, providing further consolidation of LSOG habitat and increased protection of NSO habitat within LSR 223 (see figure 4.1-27). With the reallocation of Matrix to LSR and the consolidating of larger blocks of LSOG habitat the quality of the LSOG habitat within LSR 223 would be improved.
- **Distribution**: The distribution of LSOG habitat within LSR 223 would remain largely unchanged with the Pacific Connector pipeline and the reallocation of Matrix to LSR LRMP amendment. To the extent there are minor changes they would be beneficial due to the location of the proposed reallocation. The reallocation would occur on the southwest edge of the LSR providing for some additional connectivity within LSR 233 and the nearest LSRs to the south and west.
- The off-site mitigation would improve the quantity, quality, and distribution of LSOG habitat in LSR 223 over time by accelerating the development of constituent elements of late-successional habitat, reducing the risk of stand-replacement fire and reducing fragmentation through road decommissioning and stand-density management.

The mitigation actions for LSR 223 in the Umpqua National Forest have been designed with the goal that the overall impact would be either neutral or beneficial to the creation and maintenance of late-successional habitat. These actions combined would maintain or improve the functionality of LSR 223.

Umpqua National Forest Mitigation Actions

To compensate for the direct and indirect impacts associated with the Pacific Connector pipeline in the LSR land allocation, off-site mitigation actions have also been developed by the Forest Service (see figure 4.1-30). For the purposes of this discussion, indirect impacts of the corridor are modeled by age class of vegetation and an associated estimate of edge impacts. Indirect impacts on LSOG forest are estimated to extend 100 meters on each side of the corridor. Indirect impacts for non-LSOG forest are estimated to extend 30 meters on each side of the corridor. No

indirect impacts are estimated to non-forested areas. These proposed off-site mitigation actions include:

- accelerating development of larger trees by pre-commercial thinning young stands;
- replacing constituent elements of habitat by placing LWD in units, creating snags, controlling noxious weeds, and restoring meadows;
- reducing the risk of stand-replacing fire by stand-density management, commercial thinning, and fuels reduction treatments; and
- reducing habitat fragmentation by decommissioning roads and accelerating the development of interior stand conditions by stand-density management.

The additional off-site mitigation actions would increase the effectiveness of the LSOG forest habitat added to LSR 223 by improving the quantity, quality, and distribution of LSOG forest habitat over time. These off-site mitigation actions are consistent with the management recommendations for LSR 223 (see appendix H, section 2.2.2.2).

On July 30, 2015 the Stouts Fire started near Milo, Oregon, and had grown to over 26,500 acres by September 1, 2015. The fire burned into portions of LSR 223 and the proposed pipeline corridor between MP 96 and 105 (see figure 4.1-28 for MP locations). In addition, fire suppression activities occurred along the proposed pipeline route from approximately MP 104.5 to MP 109. At the time this FEIS was being prepared, the fire was still burning and the full extent of impacts to LSR 223 was unknown. Once the fire has been controlled, the BLM and Forest Service will assess the impacts and develop post-fire strategies and recommendations. We know from fire incident reports that some of the LSOG forest in LSR 223 in the vicinity of the proposed pipeline has been impacted by the fire. Therefore, the impacts of the proposed pipeline project on LSOG habitat in LSR 223 displayed in figure 4.1-29 above may change. Changes to the proposed 2,285-acre fuel break described below can be expected since portions of that proposed fuel break occur within the fire perimeter and fire suppression activities. There may be changes to other proposed mitigation actions in this area as well once post-fire assessments have been completed.

Road Decommissioning (7.6 miles)

Although the Pacific Connector pipeline has been routed to avoid LSOG habitat as much as possible, the pipeline would create edge impacts that would affect interior stand microclimates and cause habitat fragmentation within LSR 223 that cannot be avoided. Edge is the effect of an opening on microclimate in adjacent stands (Chen et al. 1993). Edge impacts introduced by roads (or corridors) are highly variable and depend on aspect, road width, vegetation crossed, and other variables. Edge impacts are greatest when there is a high contrast in structure and composition between a newly created opening and the adjacent landscape (Harper et al. 2005). Thus, edge impacts are greatest when they affect interior stand habitats of older forests and lowest when the new opening is similar to the surrounding landscape, such as adjacent to an existing road or in a recent clearcut.

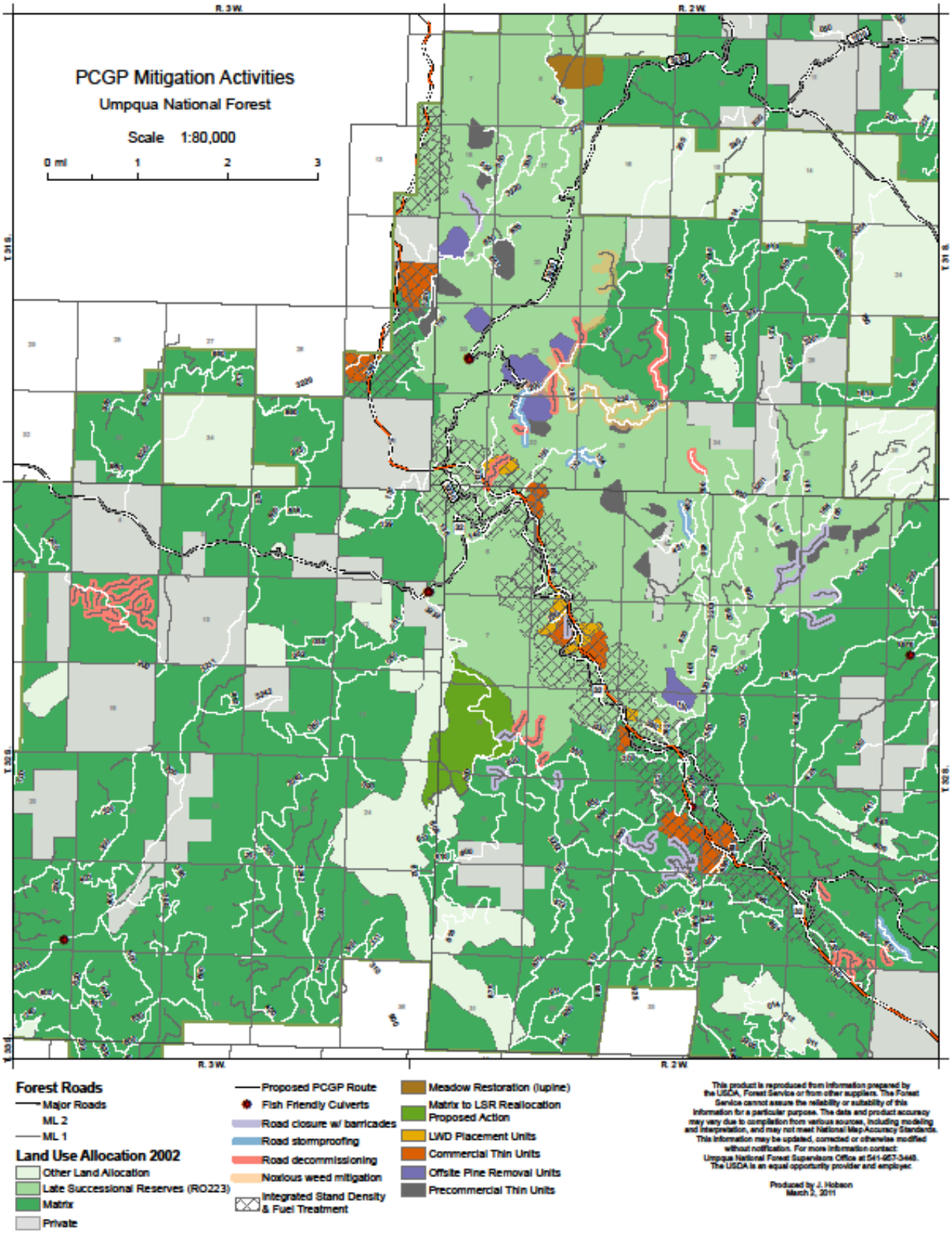

Figure 4.1-30. Proposed Off-site Mitigation Actions in the Umpqua National Forest

Decommissioning roads with appropriate restoration measures would presumably reverse edge impacts and habitat fragmentation caused by existing roads and create habitat for a variety of animals (Switalski et al. 2004). The effect of edge reduction by road decommissioning is highly variable for the same reasons described for the edge impacts created by constructing a road. Agency field experience has shown that road decommissioning reduces the edge impacts over time by revegetating road surfaces and eliminating road corridors. Revegetating selected roads in conjunction with the density management proposed for adjacent plantations would block up forested habitat and reduce edge impacts and fragmentation in a period of about 40 years as planted trees became pole sized (5 to 9 inches diameter at breast height [dbh] and 20 to 40 feet tall).

Published data on rate and pattern of edge reduction associated with decommissioning roads are not available (Baker 2011), but a comparison of the predicted beneficial effect of road decommissioning to edge impacts that would be associated with the Pacific Connector pipeline is useful, even if based on assumptions.[25] Using an assumed edge reduction over time of 50 feet on each side of the road, decommissioning 7.6 miles of road would reduce existing road-related edge impacts on an estimated 92 acres (7.6*5280*100/43560).

Linear edge provides another measurement of the edge effect. Approximately 5.9 miles of the Pacific Connector pipeline would be located within LSR 223, creating 11.8 miles of new edge within LSR 223. Proposed road decommissioning would revegetate 7.6 miles of roads, removing approximately 15.2 miles of existing edge over time.

Stand-Density Management

Stand-density management is proposed in early and mid-seral Douglas-fir or ponderosa pine plantations that were planted. The purpose of this mitigation action is to restore stand density, species diversity, and structural diversity to those considered characteristic under a natural disturbance regime by enhancing and accelerating the physical and biological services for associated flora and fauna within LSR 223. Table 4.1.3.6-14 below displays the acres of density management activities occurring in LSR 223 and Matrix.

TABLE 4.1.3.6-14

Stand-Density Management Activities in LSR 223 and Matrix

Treatment Type	LSR 223 Acres	Matrix Acres	Riparian Reserve Acres
Pre-commercial Thinning	377	40	42
Off-Site Pine Restoration	398		15
Commercial Thinning	138	406	35
Total	**913**	**446**	**92**

Source: Forest Service GIS; Hobson 2010

Pre-commercial thinning is proposed for overstocked plantations to accelerate the development of late-successional and old-growth forest characteristics in LSR 223. Managing stand density would increase growth rates, decrease susceptibility to stand-replacing fire, and diversify stand structure in otherwise relatively homogenous stands. This accelerated development would also reduce fragmentation and edge impacts and would help maintain the ability of these stands to respond to changed environmental conditions from either natural or human-caused disturbances. A majority of the pre-commercial thinning acres are within 1 mile of the pipeline right-of-way. Placing the

[25] This approach is consistent with CEQ Regulations for NEPA, 40 CFR 1508.22.

off-site mitigation activities close to the actual pipeline corridor increases their effectiveness by affecting lands within, or near, the home ranges of individual species affected by the pipeline habitat changes. Because the mitigation actions address ecological processes like the edge effect, placing the mitigation action near the edge impacts would increase the effectiveness of the mitigation action by restoring ecosystem structures near the acres that would be affected by the pipeline. The stand-density management activities in Matrix lands would improve timber productivity by increasing growth rates, which would partially offset some of the lost timber management potential in the Matrix acres reallocated to LSR.

Integrated Stand Density and Fuel Break Treatments (2,285 acres LSR 223)

This prescription is intended accomplish two outcomes. First, it is intended to enhance LSOG habitat by increasing the growth, health, and vigor of the trees remaining in the stands; restoring stand density, species diversity, and structural diversity to those considered characteristic under a natural disturbance regime. Secondly, it is intended to reduce the probability of large-scale loss of LSOG from wildfires as part of a 10-mile-long and 0.5-mile-wide shaded fuel break extending from Stouts Creek on the Roseburg District to Trail Creek on the Medford District that represents a landscape-scale action to reduce the risk of damage to LSR from catastrophic wildfire. Fuels treatments are decided on a case-by-case basis and rely on fuel loading information as well as proximity to roads and other factors. Slash treatments may be as simple as lop and scatter to get the fuels in contact with the ground for more rapid decomposition, or they may involve piling, burning, or removal of fuel from the site for biomass energy or other uses.

Stand-density management over time would reduce existing edge impacts. There is no precise way to estimate the reduction in edge impacts with available data since stands have many different age classes, perimeters, and canopy closures. The estimated perimeter of the units proposed for integrated stand-density management and fuels treatment adjacent to the pipeline in LSR 223 is approximately 10 miles. Assuming some edge effect reduction within 100 feet of the perimeter of these units, density management would reduce edge impacts over time by an estimated 121 acres (10*5280*100/43560).

Snag Creation (175 acres LSR 223)

Snag creation is proposed as a mitigation action to replace snags lost in the pipeline right-of-way for habitat for cavity-nesting birds and denning sites for mammals (bats, bears, fishers, etc.). Snags would be lost from the pipeline corridor to facilitate pipeline construction and mitigate safety hazards for construction workers and from the removal of live trees that would have contributed to future snag habitat.

Approximately 4,200 snags within LSR 223 would be created by blasting tops from live trees (preferably trees with existing decay that makes them more suitable for cavity-nesting birds and/or as denning sites) or by inoculating living trees with heart rot decay fungi or other methods. Sites selected for snag creation would be within 0.5 mile of the pipeline right-of-way to develop snag habitat within (or near) the home ranges of cavity excavators being displaced by the pipeline corridor. Sites would be in mid and late seral stands.

The current direction is to manage CWD levels on a landscape perspective and to use land allocation as a consideration for where levels of CWD may occur overtime. DecAID (a tool for managing snags, partially dead trees, and downed wood for biodiversity in forests in Washington

and Oregon) is a summary of the best available data on dead wood in Pacific Northwest ecosystems (Marcot et al. 2002). To use DecAID, planning areas should be large enough to encompass the range of natural variability in wildlife habitat types and structural conditions; it is suggested that planning areas be at least 20 square miles in size (12,800 acres). A reasonable objective is to manage for a range of conditions within the area, balancing areas with high densities of dead wood with moderate- and low-density areas (Marcot et al. 2002).

Wildlife and inventory data summarized in the DecAID Advisor can be applied to management and planning decisions at a range of spatial scales and geographic extents. The calculated tolerance levels (80, 50, and 30 percent) for wildlife data can be applied to stand-level management. However, it is not advised that a particular tolerance level be applied to all stands across a landscape. Analysis of snag levels in LSR 223 indicates that snags are below historic conditions (see appendix H, section 2.2.2.2). The objectives of the LSR land allocation and the location and size of the Pacific Connector pipeline make it appropriate to manage for high and moderate snag densities for this project. Snags should be managed at the 80 percent tolerance level in LSRs. However, most of the pipeline would be located along ridgetops that are prone to fire disturbance. Considering fuels, it would be appropriate to manage at a lower density of small snags and downed wood in both tolerance levels. The management recommendations for this area include a desired future condition of at least 4 snags per acre less than 20 inches dbh and 15 feet tall (Forest Service and BLM 1999: table 8). The target within the LSR treatment areas would be to manage snags densities at 16 per acre less than 10 inches dbh, of which 8 per acre are less than 20 inches dbh.

Large Woody Debris Placement (165 acres LSR 223)

One of the components of CWD is LWD, which consists of trees or portions of trees lying on the forest floor. LWD placement is proposed to accelerate the development of LSOG forest characteristics by restoring this habitat component to areas where LWD is lacking.

Large wood would be placed in or near areas that are also receiving stand-density management treatment. The large wood would be from trees cut from the pipeline corridor. Sites selected for LWD placement are within 0.5 mile of the pipeline right-of-way. As with the other off-site mitigation actions, placement of the mitigation activities close to the pipeline corridor can benefit species that would be affected by the vegetation changes within the corridor and would make these mitigation actions more effective. Sites for placement of LWD would be in early successional stands that are currently deficient in downed wood. The LWD placement is expected to vary to account for some of the range in variability found across the landscape. For 11- to 20-inch-diameter logs, densities would vary from 8 to 33 logs/acre. For logs greater than 20 inches diameter, densities would vary from 3 to 12 logs per acre. Logs would be approximately 40 feet in length, and the specified diameter (11 to 20 inches, and 20 inches plus) refers to the stem diameter at the midpoint of the 40-foot log.

Noxious Weed Treatment (6.7 miles)

Soils disturbed during pipeline construction and proposed mitigation activities would have the potential to disperse and generate potential seedbeds for noxious weeds. The proposed noxious weed treatment along 6.7 miles roads within LSR 223 would assist in mitigating potential adverse habitat impacts.

Meadow Restoration (80 acres)

There would be a loss of forest habitat buffering unique habitats and disruption to soil horizons within those habitats from the construction of the Pacific Connector pipeline. These actions would result in adverse impacts on native flora and fauna and increase the opportunities for invasion by non-native plant species. These impacts cannot be fully mitigated on site; therefore, restoration activities such burning, removal of encroaching conifers, and noxious weed control would be applied to an 80-acre meadow located in LSR 223.

Comparison of Total Adverse Direct and Indirect Impacts of the Pacific Connector Pipeline Project on Edge Impacts and Total Beneficial Direct and Indirect Impacts of Mitigation Actions on Edge Impacts in LSR 223

The acres of direct and indirect impacts of the Pacific Connector pipeline and the acres of direct and indirect impacts of various mitigation actions as related to the edge effect are shown in table 4.1.3.6-15 and figure 4.1-31. For the purposes of this comparison, indirect impacts of the corridor are modeled by the age class of vegetation and an associated estimate of edge impacts. Since there is no precise method for predicting indirect impacts, the following assumptions were used.

- Adverse indirect impacts of the Pacific Connector pipeline on LSOG habitat are estimated to extend 100 meters from the cleared edge on each side of the corridor.
- Adverse indirect impacts of the Pacific Connector pipeline for non-LSOG habitat are estimated to extend 30 meters from the cleared edge on each side of the corridor.
- No indirect impacts are estimated for non-forested areas since there would be no new edge created.
- Direct impacts of road decommissioning are estimated from the revegetation of an average road prism of 20 feet.
- The beneficial indirect impacts of road decommissioning are estimated to extend 50 feet on each side of the decommissioned road in all vegetation classes.
- The beneficial indirect effect of integrated stand-density fuels management treatments is estimated to extend 100 feet from the perimeter of the unit in all vegetation classes.
- Indirect impacts of other mitigation actions are not considered to reduce edge in this comparison.

TABLE 4.1.3.6-15

Comparison of Total Pacific Connector Pipeline Project Impacts (a/) on LSR 223 and Estimated Edge Reduction Effect (b/) of Proposed Off-site Mitigation Actions (Acres)

Umpqua National Forest (LSR 223)	Direct Effect	Indirect Effect	Total
Total Project Impacts on LSR 223			
Project Impacts	85	241	326
Proposed Off-site Mitigation			
Road Decommissioning	18	92	111
Stand-Density Management.	0	121	121
Total Mitigation	**18**	**213**	**232**

a/ Project direct impacts include corridor clearing, temporary extra work areas, and uncleared storage areas. Indirect impacts include 100 meters on each side of corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of corridor edge in non-LSOG.

b/ Direct edge reduction impacts include acres of decommissioned road revegetated (7.6*5280*20/43560) and indirect impacts include 50 feet on each side of decommissioned road and 100 feet along perimeter of stand-density treatments.

Data source: BLM, Forest Service GIS data layers; Hobson 2010

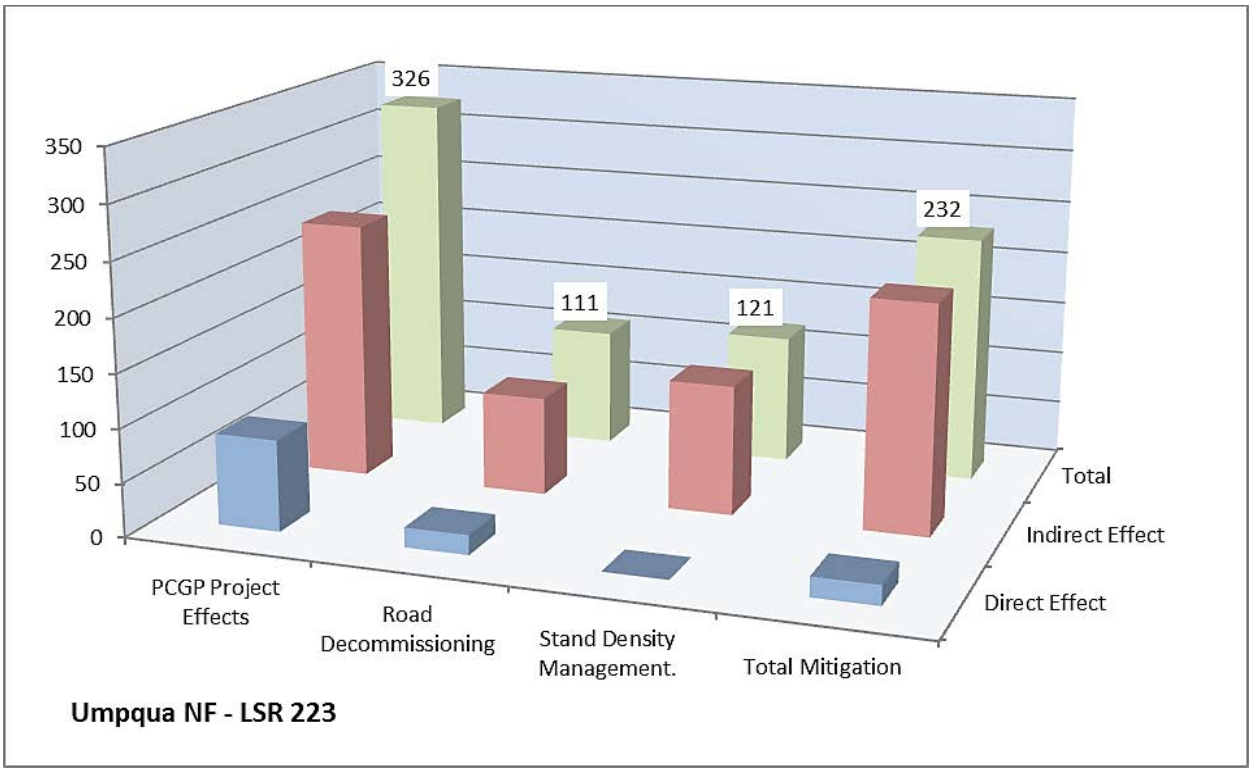

Figure 4.1-31. Comparison of Total Pacific Connector Pipeline Project Impacts on LSR 223 and Estimated Edge Reduction Effect of Proposed Off-site Mitigation Measures (acres)

The comparisons displayed are not one-to-one correlations, because the adverse impacts on edge would occur immediately with the construction of the pipeline and the reduction of edge effect from the off-site mitigation would occur over time. The comparison also does not take into consideration that the edge created by the construction of the pipeline would also reduce over time as the majority of the corridor (about 70 percent) would be re-forested. The comparison does display that some of the mitigation actions proposed would help reduce the amount of fragmentation in LSR 223 by reducing the amount of existing edge. Over time, this would allow for the formation of larger blocks of interior forest habitat.

LRMP Amendments Related to LSRs on the Rogue River National Forest

RRNF-7, Reallocation of Matrix Lands to Late-Successional Reserves

The Rogue River National Forest LRMP would be amended to change the designation of approximately 512 acres from the Matrix land allocation to the LSR land allocation in Section 32, T.36S., R.4E., W.M., Oregon.

This change in land allocation is proposed to partially mitigate for the potential adverse impact of the Pacific Connector pipeline on LSR 227 in the Rogue River National Forest. The proposed amendment would change future management direction for the lands reallocated from Matrix to LSR. A map of the proposed reallocation is displayed in figure 4.1-32.

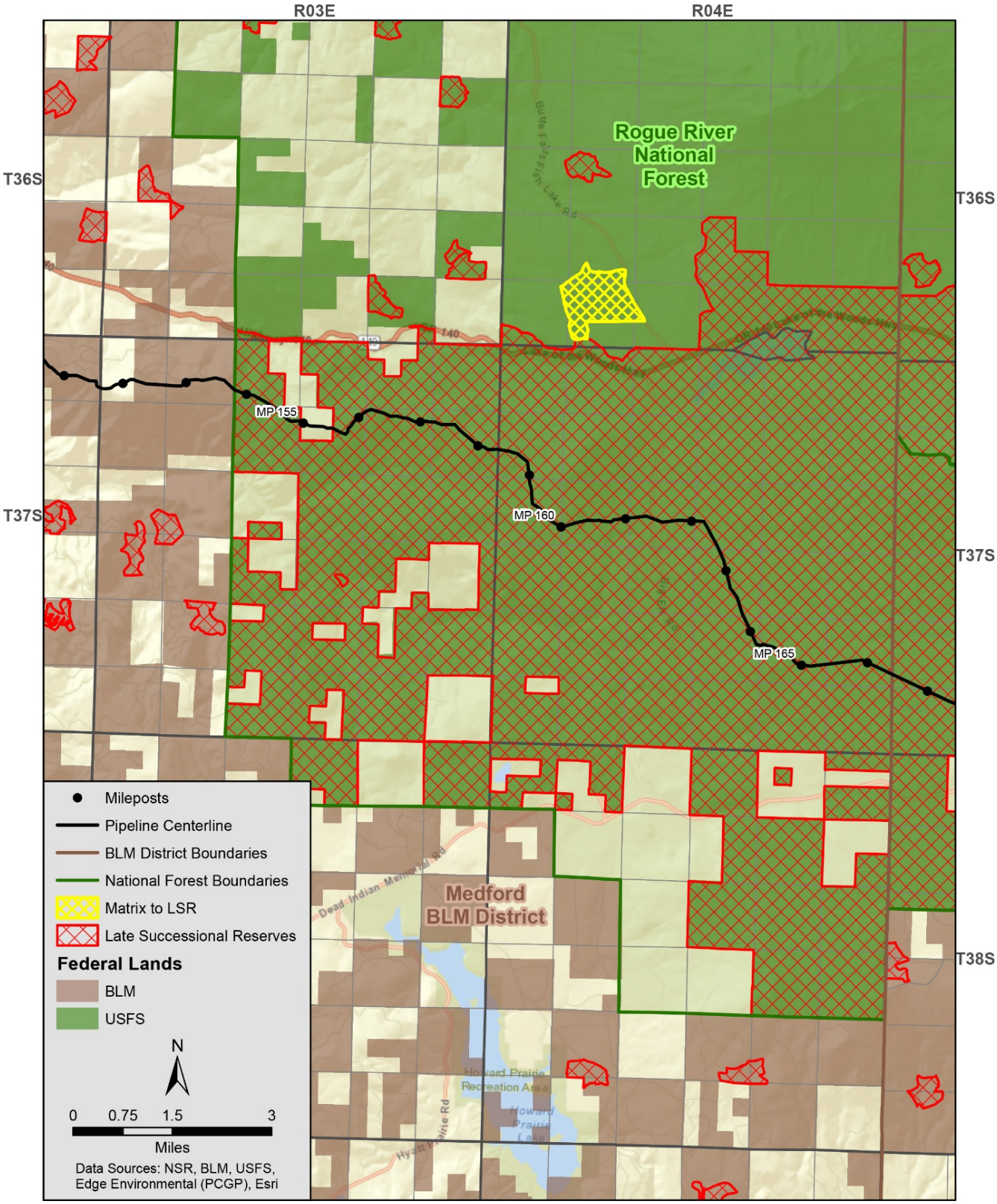

Figure 4.1-32. Map of Proposed Matrix Reallocated to LSR in the Rogue River National Forest

In the Rogue River National Forest, the Pacific Connector pipeline would lie entirely within LSR 227. Currently, based on the latest Forest Service GIS data, there are approximately 30,404 acres of LSOG forest habitat, which comprises approximately 30 percent of LSR 227. If constructed, the part of the Project on the Rogue River National Forest would be about 13.7 miles long and would clear approximately 206 acres of forest vegetation in LSR 227, of which approximately 55 acres are LSOG forest. The Matrix area proposed for reallocation to LSR is approximately 512 acres, of which approximately 333 acres are LSOG forest. When acres reallocated from Matrix to LSR are compared to the acres of LSR that would be cleared by the Pacific Connector pipeline, the proposed amendment would reallocate about 2.5 times more acres to LSR than would be cleared in the pipeline corridor. When comparing acres of LSOG habitat, the proposed amendment would reallocate about 6 times more acres of LSOG habitat than would be cleared by the Pacific Connector pipeline.

In addition to the impacts from the removal of forest vegetation in LSR 227, there would be additional impacts from the acres modified by UCSAs and the acres indirectly affected through the creation of new edges and fragmentation of older forest. A comparison of the total acres affected in LSR 227 and the acres that would be reallocated are displayed in table 4.1.3.5-16 and figure 4.1-33 below.

TABLE 4.1.3.6-16

Comparison of Total LSR Acres Affected (a/) by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, Rogue River National Forest LSR 227

Rogue River National Forest LSR 227	Cleared	Modified			Matrix to LSR Reallocation
	Direct Impacts		Indirect Impacts	Total Impacts	
LSOG	55	21	350	426	333
Non- LSOG	143	48	184	375	179
Non-Forest	9	0	0	9	0
Total	**206**	**70**	**534**	**810**	**512**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project total impacts include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG).

Data source: BLM, Forest Service GIS Data Layers, Cox 2010

In addition to the impacts of the Pacific Connector pipeline corridor there are also potential off-site impacts on LSR 227 from road reconstruction that would be necessary to accommodate the trucks that would be hauling the sections of pipe. These trucks are longer than typical trucks that use forest roads so some road widening and curve realignment may be necessary to safely allow for this truck traffic. It is estimated that approximately 4 acres of road widening would occur within LSR 227. Although this road widening would occur to the extent possible within the existing clearing limits, it is probable that some additional clearing of forest vegetation would be necessary to accommodate the road reconstruction. It is estimated that this would be a maximum of 4 acres and would occur along an existing road opening.

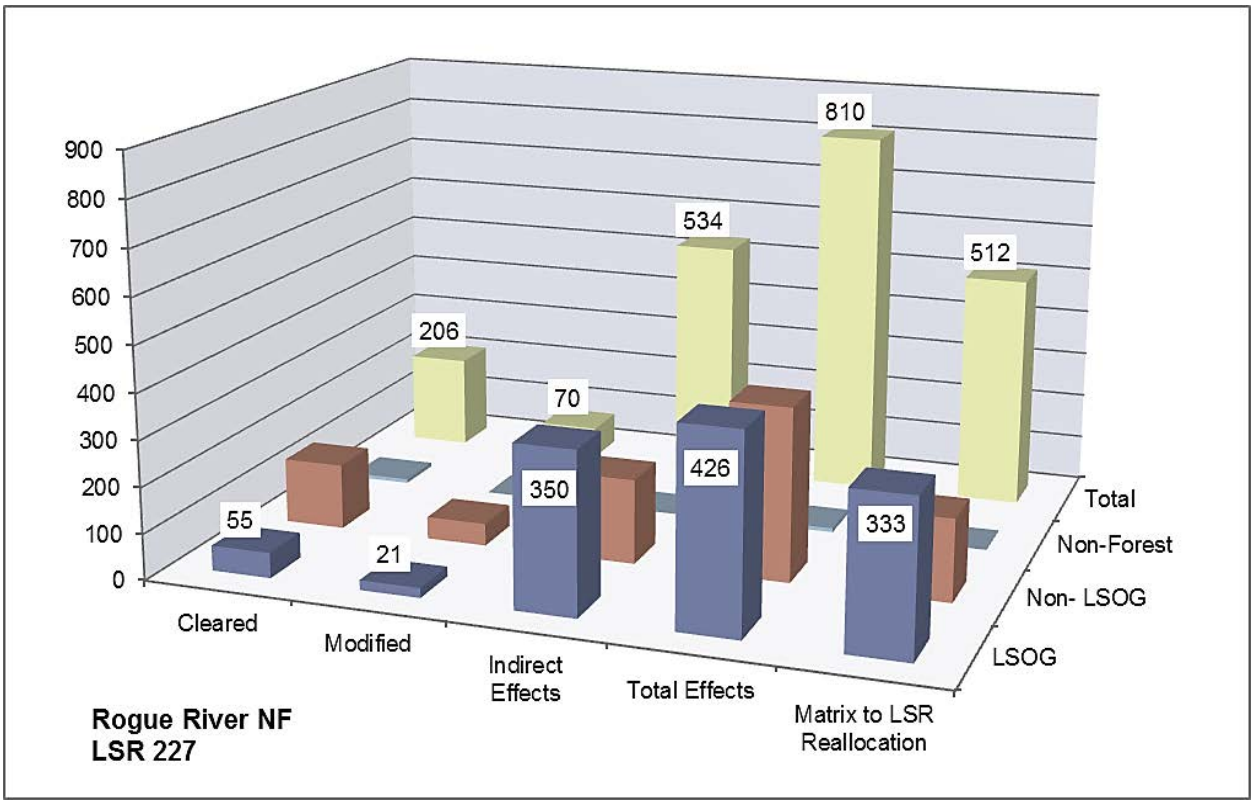

Figure 4.1-33. Comparison of Total LSR Acres Affected by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR, Rogue River National Forest LSR 227

Impact on the Functionality of LSR 227 on the Rogue River National Forest

The functionality of LSR 227 relates directly to the goals and objectives for LSRs and can be measured by the quantity, quality, and distribution of LSOG forest habitat in the LSR and how the Pacific Connector Pipeline Project would affect these characteristics.

- **Quantity**: The overall quantity of LSOG habitat in LSR 227 on the Rogue River National Forest would increase with the proposed LRMP amendment. The Pacific Connector pipeline would remove approximately 55 acres of LSOG habitat but the reallocation would add 333 acres of LSOG habitat for a net increase of 278 acres. This would increase the current level of LSOG habitat within LSR 227 from 30,404 acres to 30,682 acres or by approximately 0.9 percent.
- **Quality**: The area proposed for reallocation to LSR 227 contains some large blocks of LSOG habitat. With the reallocation of Matrix to LSR and the consolidating of larger blocks of LSOG habitat, the quality of the LSOG habitat within LSR 227 would be improved.
- **Distribution**: The distribution of LSOG habitat within LSR 227 would remain largely unchanged with the Pacific Connector pipeline and the reallocation of Matrix to LSR LRMP amendment. To the extent there are minor changes they would be beneficial due to the location of the proposed reallocation. The reallocation would occur on the north end of the LSR providing for some additional connectivity within LSR 227 and the nearest LSRs to the north.

- The off-site mitigation would improve the quantity, quality, and distribution of LSOG habitat in LSR 227 over time by accelerating the development of constituent elements of late-successional habitat, reducing the risk of stand-replacing fire, and reducing fragmentation through road decommissioning and stand-density management.

The mitigation actions for LSR 227 in the Rogue River National Forest have been designed with the goal that the overall impact would be either neutral or beneficial to the creation and maintenance of late-successional habitat. These actions combined would maintain or improve the functionality of LSR 227.

Rogue River National Forest Mitigation Actions

The lands in the Rogue River National Forest that would be affected by the Pacific Connector pipeline are all within LSR 227. The primary objectives for the off-site mitigation actions are to accelerate the development of LSOG forest habitat in LSR 227 through snag creation, woody debris placement, and density management, and to reduce LSOG forest habitat fragmentation through road decommissioning. These off-site mitigation actions would accelerate the development of LSOG forest habitat elements to further offset the effects of the Pacific Connector pipeline on LSR 227 in the long run. The additional off-site mitigation actions would also increase the effectiveness of the additional LSOG forest habitat added to LSR 227 by improving the quantity, quality, and distribution of high-quality habitat. Figure 4.1-34 displays where the proposed off-site mitigation actions would occur.

Road Decommissioning (53.2 miles)

Although the Pacific Connector pipeline has been routed to avoid LSOG forest as much as possible, it would create edge impacts that may affect interior stand microclimates and cause habitat fragmentation within LSR 227 that cannot be avoided. Edge is the effect of an opening on microclimate in adjacent stands (Chen et al. 1993). Edge impacts introduced by roads are highly variable and depend on aspect, road width, vegetation crossed, and other variables. Edge impacts are greatest when there is a high contrast in structure and composition between a newly created opening and the adjacent landscape (Harper et al. 2005:768). Thus, edge impacts are greatest when they affect interior stand habitats of older trees and least when the new opening is similar to the surrounding landscape, such as when it is adjacent to an existing road or in a recent clearcut.

Decommissioning roads with appropriate restoration measures would presumably reverse edge impacts and habitat fragmentation caused by existing roads and create habitat for a variety of animals (Switalski et al. 2004). By discouraging vehicular access, road decommissioning also eliminates disturbance (noise, presence, etc.) caused by human intrusion. This potentially benefits nesting behavior in particular for the NSO. The effect of edge reduction by road decommissioning is highly variable for the same reasons described for the edge impacts created by constructing a road. Agency field experience has shown that road decommissioning reduces edge impacts over time by revegetating road surfaces and eliminating road corridors. Revegetating selected roads in conjunction with the density management proposed for adjacent plantations would block up forested habitat and reduce edge impacts and fragmentation in a period of about 40 years as planted trees became pole sized (5 to 9 inches dbh and 20 to 40 feet tall). Published data on the rate and pattern of edge reduction associated with decommissioning roads are not available (Baker 2011), but a comparison of the predicted beneficial effect of road

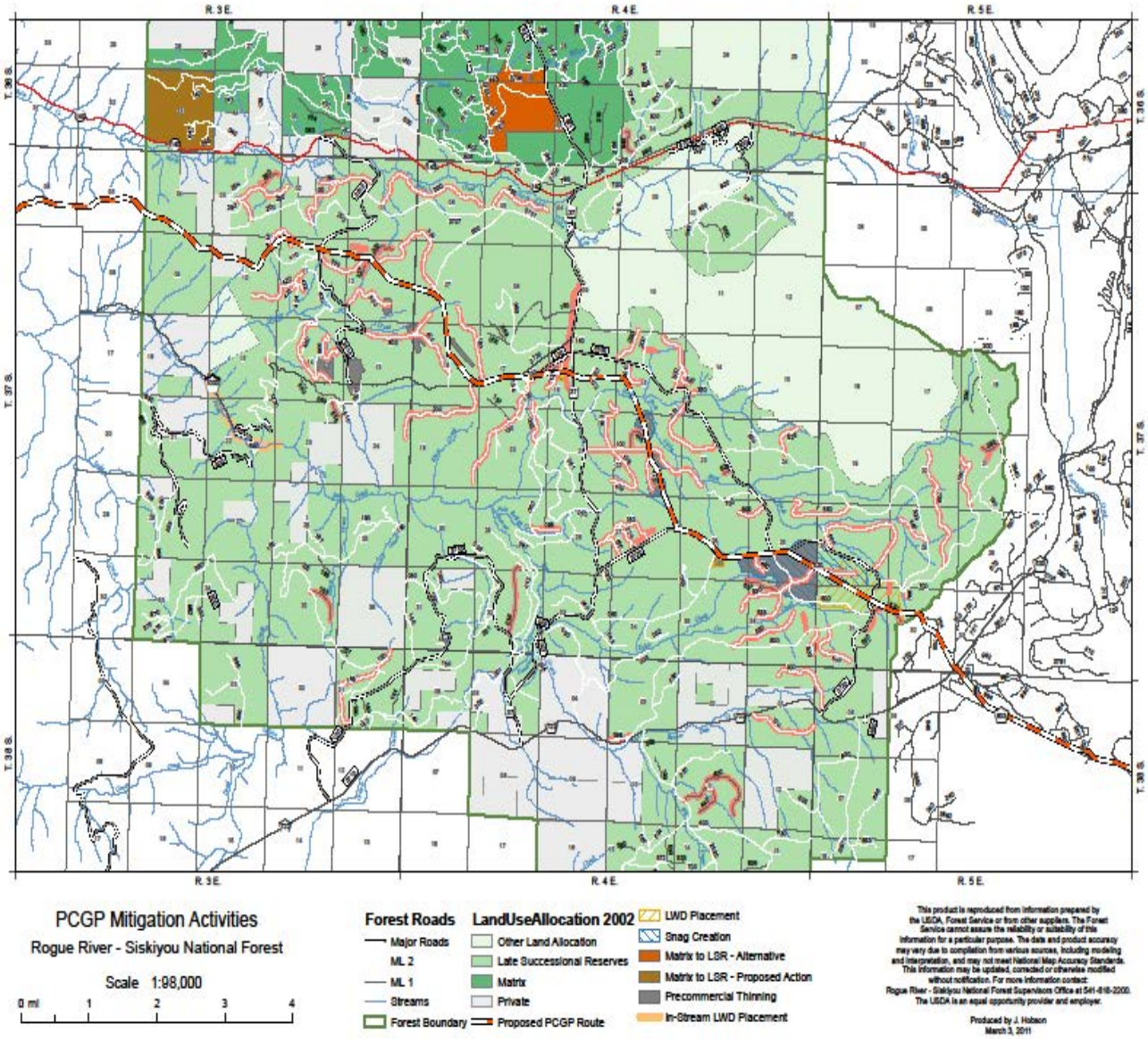

Figure 4.1-34. Proposed Off-site Mitigation Actions in the Rogue River National Forest

decommissioning on edge impacts associated with the Pacific Connector pipeline is useful, even if it is based on assumptions.[26] Using an assumed edge reduction over time of 50 feet on each side of the road, decommissioning 53.2 miles of roads would reduce existing road-related edge impacts on an estimated 645 acres.[27]

Linear edge provides another measurement of edge effect. Approximately 13.6 miles of the Pacific Connector pipeline would be located within LSR 227, creating 27.2 miles of new edge within LSR

[26] This approach is consistent with CEQ Regulations for NEPA, 40 CFR 1508.22.

[27] This value is reached by converting the square footage of the edge reduction of 50 feet on either side of 53.2 miles of road to be decommissioned to acres. Using 5,280 feet as the standard length of a mile, and 43,560 square feet as the conversion factor for feet to acres, the equation is as follows: (length x width)/square feet per acre, which is ((53.2*5280 ft) *100 ft)/43,560 = 644.8 (or 645 when rounded to the nearest whole acre).

227. Proposed road decommissioning would revegetate 53.2 miles of roads, removing approximately 106.4 miles of existing edge over time. Fragmentation in the context of impacts on the LSR land allocation is the process of reducing the size and connectivity of stands that compose a forest. The conversion of large tracts of old-growth forest to small, isolated forest patches with large edge areas can create changes in microclimate, vegetation species, and predator-prey dynamics.

To provide an indication of the impacts of the proposed Pacific Connector pipeline corridor and proposed road decommissioning on fragmentation, the Forest Service conducted a stand-level analysis, considering stands that fall within 100 meters of the pipeline corridor (Forest Service 2010). All stands that overlapped the 100-meter buffer were included in the analysis out to the stand edges beyond the buffer. The only changes examined in this analysis were natural growth and development of trees and the off-site mitigation activities. Natural events, such as wildfire and storms, were not modeled because of their stochastic nature and the relatively limited size of the analysis area. Within the modeled stands, it was assumed that there would be no forest management harvest activities during the 60 years modeled beyond activities already planned. Future management activities would need to be consistent with the LRMP in effect at the time the Project is implemented.

Construction of the pipeline would result in the fragmentation of LSOG forest in LSR 227 and would increase the fragmentation index (ratio of edge to acres) in modeled stands (those within 100 meters of the pipeline) by about 1 percent.[28] After 60 years, normal stand growth would reduce this ratio by about 3 percent. With implementation of proposed road decommissioning, the ratio of edge acres would decrease by about 34 percent. A decrease in the ratio of edge to opening means that patch sizes of forested areas have increased. LSR 227 currently has 1,445 patches of mature forest greater than 1 acre in size that lie within 100 meters of the edge of the pipeline corridor. Pacific Connector pipeline construction would increase fragmentation by passing through and dividing some of these patches, with a net increase of five patches. The current average patch size throughout the LSR is about 7 acres, which is not projected to change within the next 60 years. With the proposed road decommissioning and road closures, the size of patches within 100 meters of the pipeline would increase to an average of 14.5 acres within 60 years. This would be consistent with a reduction in the edge to opening ratio discussed above.

In terms of interior patches (LSOG areas that are at least 1 acre in size and at least 100 meters from a hard edge), there are currently 779 interior patches in LSR 227. Eight of these (about 1 percent of the interior patches) would be fragmented by the pipeline corridor. In 60 years, interior patches are projected to increase to 856 interior patches, a 9 percent increase from the current condition. With the proposed road decommissioning, the number of interior patches would increase by about 16 percent to 927, and the average size of the patches would increase from about 6.5 acres to 13.9 acres, an increase in size of over 100 percent.

There are approximately 233 miles of road in LSR 227. The proposed road decommissioning would create a 23 percent reduction in road mileage in this LSR. Current road density in LSR 227 is about 3.3 miles per square mile. With the proposed road decommissioning, it would be reduced

[28] Changes in edge:area ratios are more meaningful as relative numbers rather than absolute values, so percentages are used to express changes in values.

to about 2.5 miles per square mile. Reductions in road density that would occur within 0.25, 0.5, and 1 mile of the pipeline corridor are shown in the table 4.1.3.6-17 below.

TABLE 4.1.3.6-17

Reductions in Road Density Within 0.25, 0.5, and 1 mile of the Pacific Connector Pipeline Corridor

Road Density	Existing Road Density (miles/square mile)	With Road Decommissioning (miles/square mile)
LSR 227	3.3	2.5
Within 0.25 mile of pipeline	3.9	1.7
Within 0.5 mile of pipeline	4.1	1.7
Within 1 mile of pipeline	4.2	2.5

Stand-Density Management (600 Acres)

Pre-commercial thinning is proposed for overstocked plantations to accelerate the development of LSOG forest characteristics in LSR 227. Managing stand density would increase growth rates, decrease susceptibility to stand-replacing fire, and diversify stand structure in otherwise relatively homogenous stands. This accelerated development would also reduce fragmentation and edge impacts and would help maintain the ability of these stands to respond to changed environmental conditions from either natural or human-caused disturbances. All 600 acres are within 0.5 mile of the pipeline right-of-way. Placing the off-site mitigation activities close to the actual pipeline corridor would increase their effectiveness by affecting lands within, or near, the home ranges of individual animals and species affected by the pipeline habitat changes. As the mitigation actions address ecological processes like edge impacts, placing the mitigation within or near the edge impacts increases the effectiveness of the mitigation by restoring ecosystem structures and processes on some of the acres also affected by the pipeline. Thinning young stands would, over time, reduce existing edge impacts. There is no precise way to estimate the edge effect reduction with available data because stands have many different age classes, perimeters, and canopy closures. The estimated perimeter of the units proposed for thinning is approximately 3.0 miles. Assuming some edge reduction within 100 feet of the edge of these units, density management would reduce edge impacts over time by an estimated 36 acres ((3*5280)*100/43,560).

Fuels treatments for the slash generated by stand-density management are decided on a case-by-case basis and rely on slash loading information as well as proximity to roads and other factors. Slash treatments may be as simple as “lop and scatter” (cutting slash into smaller pieces and scattering) to get the fuels in contact with the ground for more rapid decomposition, or they may involve piling and burning, jackpot or under-burning, or removal of slash from the site for biomass energy or other uses.

Snag Creation (600 acres)

Snag creation is proposed as a mitigation action to replace snags lost in the pipeline right-of-way for habitat for cavity-nesting birds and denning sites for mammals (bats, bears, fishers, etc.). Snags would be lost from the pipeline corridor to facilitate pipeline construction or to mitigate safety hazards for construction workers.

Approximately 1,200 snags would be created by blasting tops from live trees (preferably trees with existing decay, which makes them more suitable for cavity-nesting birds and/or as denning sites),by inoculating living trees with heart rot decay fungi, or by other methods. Sites selected for snag creation would be within 0.5 mile of the pipeline right-of-way to develop snag habitat

within (or near) the home ranges of cavity excavators being displaced by the pipeline corridor. Sites would be in mid-successional stands or around the edges of early successional stands that are currently deficient in snags (see appendix H, section 2.3.2.1). Stand data for the plant associations in this area (which is an indication of undisturbed forest snag levels) show these stands have an average of about four snags per acre in the 11- to 20-inch-diameter range, and an additional four snags per acre greater than 20 inches in diameter.

If the tree diameters in the stands prevent snag creation in the greater than 20-inch-diameter size class, additional snags in the smaller size class (11- to 20-inch-diameter) would be created to make up for the deficit. For sites bordering early successional stands, snags would be created within 100 yards of the stand boundary at the same trees per acre levels described above.

Large Woody Debris Placement in Plantations

Large wood placement in plantations is proposed to accelerate the development of LSOG forest characteristics by restoring this habitat component to plantations where LWD is lacking. Any wood used in this mitigation would come from the project corridor. No additional trees outside the corridor would be harvested to provide LWD, so this mitigation is necessarily limited by the amount of LWD that can be provided from the corridor. LWD used in this mitigation would be staged at appropriate locations and placed with a helicopter.

The first priority in restoration with respect to LWD would be to ensure that that the Pacific Connector pipeline itself meets LRMP standards after construction is completed. After LWD standards within the corridor have been met, any additional LWD would be available for placement in the adjacent units identified below.

Large wood would be placed in plantations that are also receiving stand-density management treatment. The large wood would be from trees cut from the pipeline corridor. Sites selected for downed woody material placement would be within 0.5 mile of the pipeline right-of-way. As with the other off-site mitigation actions, placement of the mitigation activities close to the pipeline corridor can benefit species that would be affected by the vegetation changes within the corridor and would make these mitigation actions more effective. Sites would be in early successional stands that are currently deficient in downed wood.

The large wood placement piece count per acre is expected to vary to account for some of the range in variability found across the landscape. For 11- to 20-inch-diameter logs, treatments would average about 10 pieces on each treated acre but densities would vary from 8 to 33 logs per acre. For 20-inch-plus-diameter logs, an average of 5 pieces would be placed on each treated acre, but densities would vary from 3 to 12 logs per acre. Logs would be approximately 40 feet in length, and the specified diameter (11- to 20-inch and 20-inch plus) refers to the stem diameter at the midpoint of a 40-foot log.

Comparison of Total Direct and Indirect Impacts of the Pacific Connector Pipeline Project and the Beneficial Impacts of Off-site Mitigation Actions on Edge Effect

Acres of direct and indirect impacts of the Pacific Connector pipeline and the acres of direct and indirect impacts of various mitigation actions as related to a reduction in edge impacts are shown in table 4.1.3.6-18. For the purposes of this comparison, indirect impacts of the Pacific Connector pipeline are modeled by the age class of vegetation and an associated estimate of edge impacts.

Since there is no precise method for predicting indirect impacts, the following assumptions were used.

- Indirect impacts for LSOG habitat are estimated to extend 100 meters from the cleared edge on each side of the corridor.
- Indirect impacts for non-LSOG habitat are estimated to extend 30 meters from the cleared edge on each side of the corridor.
- No indirect impacts are estimated for non-forested areas since there would be no new edge created.
- Direct impacts of road decommissioning are estimated from the revegetation of an average road prism of 20 feet.
- Indirect impacts of road decommissioning are estimated to extend 50 feet on each side of the decommissioned road in all vegetation classes.
- The indirect effect of stand-density management is estimated to extend 100 feet from the perimeter of the unit in all vegetation classes.
- Indirect impacts of other mitigation actions are not considered to reduce edge in this comparison.

Using these assumptions, combined direct and indirect impacts of the Pacific Connector pipeline and proposed mitigation actions are shown in table 4.1.3.6-18 and figure 4.1-35.

TABLE 4.1.3.6-18

Comparison of Total Pacific Connector Pipeline Project Impacts (a/) on LSR 227 and Estimated Edge Reduction Effect (b/) of Proposed Off-site Mitigation Actions (acres)

Rogue River National Forest (LSR 227)	Direct Effect	Indirect Effect	Total
		Total Project Impacts on LSR 227	
Project Impacts	276	534	810
		Proposed Off-site Mitigation	
Road Decommissioning	129	645	774
Stand-Density Management.	0	36	36
Total Mitigation	**129**	**681**	**810**

a/ Project direct impacts include corridor clearing, temporary extra work areas, and uncleared storage areas. Indirect impacts include 100 meters on each side of corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of corridor edge in non-LSOG

b/ Direct edge reduction impacts include acres of decommissioned road revegetated (53.2*5280*20/43560) and indirect impacts include 50 feet on each side of decommissioned roads and 100 feet along the perimeter of stand-density treatments.

Data source: BLM, Forest Service GIS data layers; Hobson 2010

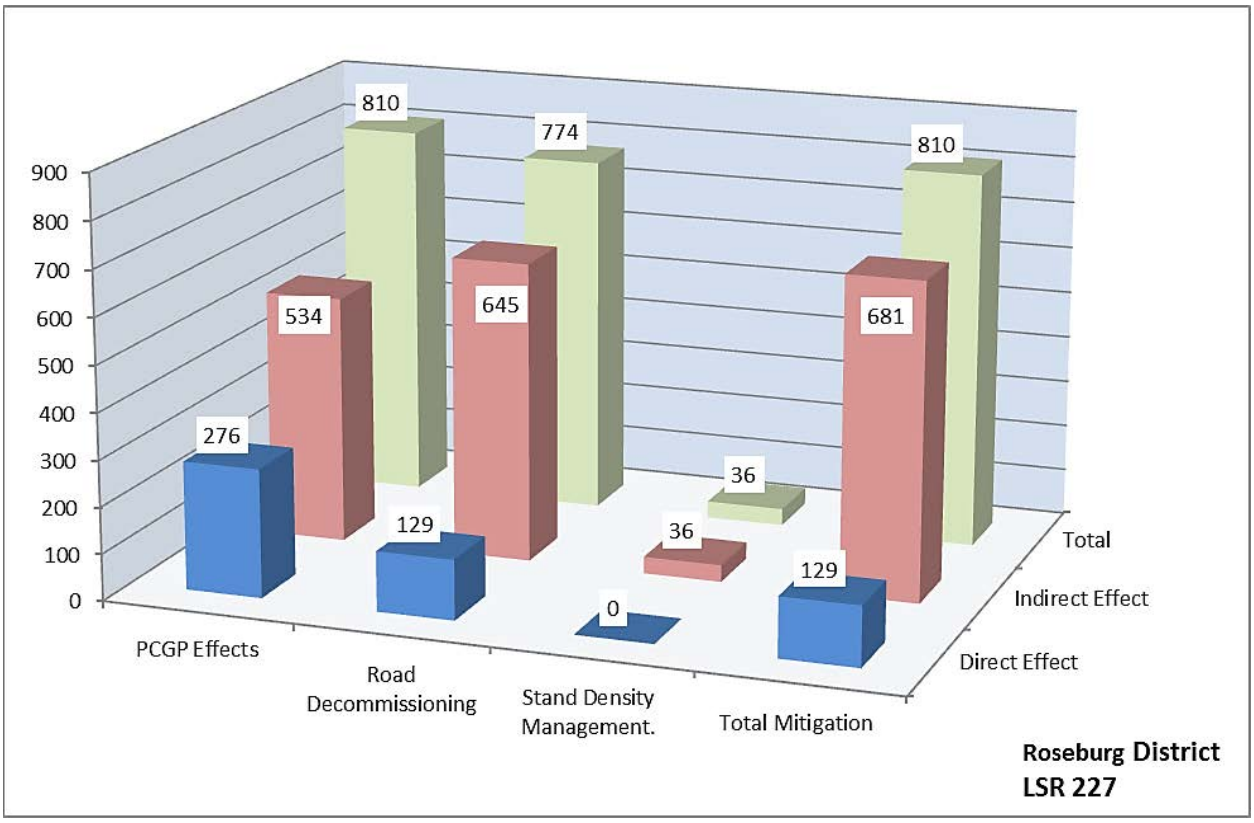

Figure 4.1-35. Comparison of Total Pacific Connector Pipeline Project Impacts on LSR 227 and Estimated Edge Reduction Effect of Proposed Off-site Mitigation Actions (acres)

4.1.3.7 Aggregated Federal Land Management Plan Amendments

This section of the EIS considers the aggregate impacts of BLM and Forest Service proposed LMP amendments for the Pacific Connector pipeline as they relate to LMP objectives. This analysis is focused on the aggregate impact the amendments for the Pacific Connector pipeline, along with any other past, present, or foreseeable future LMP amendments, may have on meeting the objectives in the LMPs of the BLM and Forest Service. For the Forest Service, this analysis will contribute to the evaluation of the significance of the Forest Service LMP amendments as related to the forest planning process defined at 36 CFR 219.10(f) (see section 4.1.3.4).

There are two types of LMP amendments proposed for the Pacific Connector pipeline. The first type is site-specific, project-specific amendments. These amendments would apply only to the Pacific Connector pipeline and those lands within the boundaries of the proposed Right-of-Way Grant. These site-specific amendments are administrative actions that would make provision for the Pacific Connector pipeline by waiving certain management directions or standards and guidelines in order for the project to be in conformance with LMPs (see table 4.1.3.7-1 for a summary of these amendments). The second type is land allocation amendments. These amendments would reallocate Matrix lands to LSR. These land allocation amendments are mitigation actions that would apply to federal lands outside the Pacific Connector project area; applicable standards and guidelines would apply to future management actions within these areas (see table 4.1.3.7-2 for a summary of these amendments).

In addition to considering the aggregate impact of the LMP amendments at the planning level, this section of the EIS also addresses the effects of the proposed off-site mitigation actions in the CMP on both BLM and Forest Service lands. The off-site mitigation actions are related to a number of LMP amendments because they have been designed with the goal that the management objectives in the LMPs would still be met if the Pacific Connector pipeline was built. The off-site mitigation actions have been specifically designed to address two broad strategies that were part of the NWFP: the strategy for managing LSOG forest habitat and the ACS.

These off-site mitigation actions would be implemented concurrently with, or subsequently to, construction of the Pacific Connector pipeline. Some mitigation actions may require additional site-specific analysis before they could be implemented. Therefore, to varying degrees, these mitigation actions are being considered at a programmatic level in this EIS. Any future analysis for these mitigation actions would tier to this EIS (see appendix F of this EIS for further discussion and a description of the proposed mitigation actions).

TABLE 4.1.3.7-1

Summary of Proposed Site-Specific Amendments of BLM and Forest Service LMPs for the Pacific Connector Pipeline Project

Amendment	Unit	Amendment Description
BLM/Forest Service-1	All BLM and Forest Service jurisdictions	Applicable BLM District RMPs and National Forest LRMPs would be amended to exempt certain known sites within the area of the proposed Pacific Connector right-of-way grant from the management recommendations required by the 2001 "Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines."
BLM-1	Coos Bay and Roseburg Districts	The Coos Bay and Roseburg District RMPs would be amended to waive the requirements to protect contiguous existing and recruitment habitat for MAMU within the Pacific Connector right-of-way that is within 0.5 mile of occupied MAMU sites, as mapped by the BLM.
BLM-2	Roseburg District	The RMP for the Roseburg District would be amended to exempt the Pacific Connector Pipeline Project from the requirement to retain habitat in KOACs at three locations.
RRNF-2	Rogue River National Forest	The Rogue River National Forest LRMP would be amended to change the VQO where the Pacific Connector pipeline route crosses the Big Elk Road at about MP 161.4 in Section 16, T.37S., R.4E., W.M., Oregon, from foreground retention (Management Strategy 6, LRMP page 4-72) to foreground partial retention (Management Strategy 7, LRMP page 4-86) and allow 10 to 15 years for amended VQO to be attained.
RRNF-3	Rogue River National Forest	The Rogue River National Forest LRMP would be amended to change the VQO where the Pacific Connector pipeline route crosses the PCT I at about MP 168 in Section 32, T.37S., R.5E., W.M., Oregon, from Foreground Partial Retention (Management Strategy 7, LRMP page 4-86) to Modification (USDA Forest Service Agricultural Handbook 478) and to allow 5 years for amended VQOs to be attained.
RRNF-4	Rogue River National Forest	This proposed amendment does not change VQOs, but instead allows more time to meet the VQO of Middleground Partial Retention as seen from Highway 140. The Rogue River National Forest LRMP would be amended to allow 10 to 15 years to meet the VQO of Middleground Partial Retention between Pacific Connector pipeline MPs 156.3 to 156.8 and 157.2 to 157.5 in Sections 11 and 12, T.37S., R.3E., W.M., Oregon.
RRNF-5	Rogue River National Forest	The Rogue River National Forest LRMP would be amended to allow the Pacific Connector pipeline right-of-way to cross the Restricted Riparian land allocation. This would potentially affect approximately 2.5 acres of the Restricted Riparian management strategy at one perennial stream crossing on the South Fork of Little Butte Creek at about MP 162.45 in Section 15, T.37S., R.4E., W.M., Oregon.
RRNF-6	Rogue River National Forest	The Rogue River National Forest LRMP would be amended to waive limitations on areas affected by detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in all affected Management Strategies.
UNF-1	Umpqua National Forest	The Umpqua National Forest LRMP would be amended to change the standards and guidelines for Fisheries (Umpqua National Forest LRMP, page IV-33, Forest-Wide) to allow the removal of effective shading vegetation where perennial streams are crossed by the Pacific Connector right-of-way.

TABLE 4.1.3.7-1

Summary of Proposed Site-Specific Amendments of BLM and Forest Service LMPs for the Pacific Connector Pipeline Project

Amendment	Unit	Amendment Description
UNF-2	Umpqua National Forest	The Umpqua National Forest LRMP would be amended to change prescriptions C2-II (LRMP IV-173) and C2-IV (LRMP IV-177) to allow the Pacific Connector pipeline route to run parallel to the East Fork of Cow Creek for approximately 0.1 mile between about MPs 109.68 and 109.78 in Section 21, T.32S., R.2W., W. M., Oregon.
UNF-3	Umpqua National Forest	The Umpqua National Forest LRMP would be amended to waive limitations on the area affected by detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way. The standards and guidelines for soils (LRMP page IV-67) require that not more than 20 percent of the project area have detrimental compaction, displacement, or puddling after completion of a project.
WNF-1	Winema National Forest	The Winema National Forest LRMP would be amended to change the standards and guidelines for Management Area 3 (LRMP page 4-103-4, Lands) to allow the Pacific Connector pipeline corridor in Management Area 3 from the Forest Boundary in Section 32, T.37S., R.5E., W.M., Oregon, to the Clover Creek Road corridor in Section 4, T.38S, R.5. E., W.M., Oregon.
WNF-2	Winema National Forest	The Winema National Forest LRMP would be amended to allow 10 to 15 years to achieve the visual standard of Foreground Retention where the Pacific Connector right-of-way crosses the Dead Indian Memorial Highway at approximately MP 168.8 in Section 33, T.37S., R.5E., W. M., Oregon.
WNF-3	Winema National Forest	The Winema National Forest LRMP would be amended to allow 10 to 15 years to meet the visual standards for Scenic Management, Foreground Partial Retention, where the Pacific Connector right-of-way would be adjacent to Clover Creek Road from approximately MP 170 to 175 in Sections 2, 3, 4, 11, and 12, T.38S., R.5E., W.M., Oregon, and Sections 7 and 18, T.38S., R.6E., W.M., Oregon.
WNF-4	Winema National Forest	The Winema National Forest LRMP would be amended to waive restrictions on detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in all affected management areas.
WNF-5	Winema National Forest	The Winema National Forest LRMP would be amended to waive restrictions on detrimental soil conditions from displacement and compaction within the Pacific Connector right-of-way in Management Area 8, Riparian Area (Management Area 8).

TABLE 4.1.3.7-2

Summary of Proposed Land Allocation Amendments of BLM and Forest Service LMPs for the Pacific Connector Pipeline Project

Amendment	Unit	Amendment Description
BLM-3	Roseburg District	The Roseburg District RMP would be amended to change the designation of approximately 409 acres from the Matrix land allocations to the Late-Successional Reserves (LSR) land allocation in Sections 32 and 34, T. 29 1/2S., R. 7W.; and Section 1, T.30S., R.7W., Willamette Meridian (W.M.), Oregon.
BLM-4	Coos Bay District	The Coos Bay District RMP would be amended to change the designation of approximately 387 acres from the Matrix land allocation to the LSR land allocation in Sections 19 and 29 of T.28S., R.10W., W.M., Oregon.
RRNF-7	Rogue River National Forest	The Rogue River National Forest LRMP would be amended to change the designation of approximately 512 acres from the Matrix land allocation to the LSR land allocation in Section 32, T.36S., R.4E., W.M., Oregon.
UNF-4	Umpqua National Forest	The Umpqua National Forest LRMP would be amended to change the designation of approximately 588 acres from the Matrix land allocation to the LSR land allocation in Sections 7, 18, and 19, T.32S., R.2W., W.M., Oregon; and Sections 13 and 24, T.32S., R.3W., W.M., Oregon.

LMP Amendments

This section will consider the aggregate effect of the amendments on meeting LMP objectives for each unit of the BLM and Forest Service. All of the BLM Districts that would be affected by the Pacific Connector Pipeline Project are currently undergoing LMP revisions. On March 9, 2012, the BLM issued an NOI (77[47] FR 14414-14416) initiating the revision process for the Western

Oregon Planning Area. On April 24, 2015, the BLM released the Draft Resource Management Plan/Draft Environmental Impact Statement and the public comment period ended on July 23, 2015. A decision on the plan revisions is not expected until spring 2016. The revisions will not amend existing BLM LMPs; they will replace them and as such are not amendments to the current plans. The revision process will consider the Pacific Connector pipeline in the analysis of the management situation[29] as a pending right-of-way action being considered by FERC. At this time, it is not known how the LMPs may change but all future projects will have to conform to the new plans once they are in place. Prior to the implementation of new LMPs, all project proposals are evaluated for consistency with existing plans. For these reasons, the BLM LMP revisions for the Western Oregon Planning Area are not evaluated in this analysis.

Proposed amendment BLM/Forest Service-1 applies to all of the BLM Districts and National Forests affected by the Pacific Connector Pipeline Project. This amendment would exempt certain known sites of survey and manage species within the area of the pipeline corridor from the Management Recommendations required by the 2001 Survey and Manage ROD (Forest Service and BLM 2001a). The analysis of this proposed amendment is included in sections 4.1.3.4 and 4.7.3 of this EIS and in appendix K of this EIS. The analysis includes an evaluation of the reasonable assurance of species persistence for all of the survey and manage species impacted by the Pacific Connector pipeline. The analysis considers the persistence of the affected species at multiple scales; project, management unit and federal lands subject to the NWFP. The analyses indicated that with the proposed project design features, monitoring, and pipeline re-routes, species persistence would be reasonably assured for all of the affected survey and manage species. For these reasons, the analysis in sections 4.1.3.4 and 4.7.3 and appendix K of this EIS is not repeated in this section.

Aggregate Impact of Proposed Amendments to the BLM Coos Bay LMP

There are three proposed amendments to the Coos Bay District LMP (see tables 4.1.3.7-1 and 4.1.3.7-2 above). Each proposed amendment is discussed in more detail in sections 4.1.3.4 and 4.1.3.6. Collectively, the proposed amendments would affect management objectives on approximately 421 acres of the 329,700-acre Coos Bay District (see table 4.1.3.7-3). There are no other proposed or foreseeable LMP amendments at this time, and there have been no past amendments to this LMP related to LSRs or survey and manage species except for the 2001 ROD amending standards and guidelines for survey and manage.

TABLE 4.1.3.7-3

Summary of Proposed Amendments to the Coos Bay District LMP

BLM/FS-1	**BLM-1**	**BLM-4**
32 survey and manage sites potentially impacted	34 acres of occupied MAMU habitat removed	387 acres of Matrix reallocated to LSR

Proposed amendment BLM-4 affects the most acres of land managed by the Coos Bay District; it would affect future management on approximately 387 acres. The outcome of this amendment would be a management change from the objective of providing commercial timber products to an objective where the primary emphasis would be the creation and maintenance of late-successional forest habitat. The Pacific Connector pipeline would remove approximately 17 acres of LSOG

[29] Refer to federal regulations at 43 CFR 1600 for a description of the BLM resource management planning process.

habitat in LSR compared with the 101 acres of LSOG that would be reallocated to LSR for a net increase of 84 acres. There are currently about 136,000 acres[30] of LSR on the Coos Bay District, and the addition of 387 acres to LSR 261 would represent an increase of approximately 0.28 percent. While beneficial to species dependent on LSOG forest, the change would represent a very small percentage of the overall acres dedicated to LSR on the Coos Bay District. Similarly the change in potential timber harvest from reallocating Matrix lands to LSR would also be small (less than 1 percent) and is not expected to change the objective for timber management since it would not prevent attainment of the probable sale quantity on the Coos Bay District during the present planning cycle. In addition, BLM's mitigation action requiring that the applicant acquire approximately 387 acres of private timberlands to backfill the Matrix acres reallocated to LSR would maintain the potential for future timber supply. All of the proposed amendments on the Coos Bay District are related to the management direction for maintaining habitat for late-successional species. Collectively, the amendments would affect management direction on approximately 421 acres or about 0.13 percent of the Coos Bay District. With the reallocation of 387 acres of Matrix to LSR, the acquisition of 387 acres of timber lands to backfill the Matrix acres, and ensuring that the persistence of survey and manage species is not affected, no measurable changes in the overall objectives and management direction in the Coos Bay District LMP have been identified.

Aggregate Impact of Proposed Amendments to the BLM Roseburg District LMP

There are four proposed amendments to the Roseburg District LMP (see tables 4.1.3.7-1 and 4.1.3.7-2 above). Each proposed amendment is discussed in more detail in sections 4.1.3.4 and 4.1.3.6. Combined the proposed amendments would affect management objectives on approximately 435 acres of the 425,588-acre Roseburg District (see table 4.1.3.7-4). There are no other proposed or foreseeable LMP amendments at this time and there have been no past amendments to this LMP related to LSRs or survey and manage species except for the 2001 ROD amending standards and guidelines for survey and manage. Proposed amendment BLM-3 affects the most acres of land managed by the Roseburg District; it would affect future management on approximately 409 acres.

TABLE 4.1.3.7-4

Summary of Proposed Amendments to the Roseburg District LMP

BLM/FS-1	**BLM-1**	**BLM-2**	**BLM-3**
108 survey and manage sites potentially impacted	19 acres of occupied MAMU habitat removed	7 acres of KOAC habitat removed	409 acres of Matrix reallocated to LSR

The outcome of this amendment would be a management change from the objective of providing commercial timber products to an objective where the primary emphasis would be the creation and maintenance of late-successional forest habitat. The Pacific Connector pipeline would remove approximately 19 acres of LSOG habitat in LSR compared with the 286 acres of LSOG that would be reallocated to LSR, for a net increase of 267 acres. There are currently about 186,423 acres[31] of LSR on the Roseburg District, and the addition of 409 acres to LSR 259 would represent an increase of approximately 0.22 percent. While beneficial to species dependent on LSOG forest, the change would represent a very small percentage of the overall acres allocated to LSR on the

[30] This number does not include acres of unmapped LSR consisting of occupied MAMU stands and KOACs.
[31] This number does not include acres of unmapped LSR consisting of occupied MAMU stands and KOACs.

Roseburg District. Similarly, the change in potential timber harvest from reallocating Matrix lands to LSR would also be small (less than 1 percent) and is not expected to change the objective for timber management because it would not prevent attainment of the probable sale quantity on the Roseburg District during the present planning cycle. In addition the mitigation proposed by the BLM to have the applicant acquire approximately 409 acres of private timberlands to backfill the Matrix acres reallocated to LSR would maintain the potential for future timber supply. All of the proposed amendments on the Roseburg District are related to the management direction for maintaining habitat for late-successional species. Collectively, the amendments would affect management direction on approximately 435 acres or about 0.10 percent of the Roseburg District. With the reallocation of 409 acres of Matrix to LSR, the acquisition of 409 acres of timber lands to backfill the Matrix acres, and ensuring the persistence of survey and manage species is not affected, no measurable changes in the overall objectives and management direction in the Roseburg District LMP have been identified.

Aggregate Impact of Proposed Amendments to the BLM Medford District and the Klamath Fall Resource Area of the Lakeview District LMPs

There is only one amendment proposed to the LMPs for these BLM Districts: BLM/FS-1, waiver of survey and manage protection requirements for the Pacific Connector Pipeline Project. This amendment is addressed in sections 4.1.3.4 and 4.7.4 of this EIS and appendix K. There are no other present or foreseeable future amendments and there have been no past amendments to these LMPs related to survey and manage species except for the 2001 ROD amending standards and guidelines for survey and manage. Therefore, there are no other amendments to consider for either BLM management unit.

Aggregated Impact of Proposed Amendments to the Umpqua National Forest LRMP

There are five proposed amendments to the Umpqua National Forest LMP for the PCGP project (see tables 4.1.3.7-1 and 4.1.3.7-2 above). Each proposed amendment is discussed in more detail in sections 4.1.3.4 and 4.1.3.6. Combined, the proposed amendments would affect management objectives on approximately 659 acres of the 963,129-acre Umpqua National Forest (see table 4.1.3.7-5). There is a previously proposed programmatic forest plan amendment for unique and mosaic habitats on the Umpqua National Forest. The proposed amendment would allow commercial harvest of timber and firewood within 150 feet of inventoried openings when the purpose is to maintain or restore the diverse vegetative species composition, stand structure and ecological functions of these unique habitats. The Pacific Connector Gas Pipeline Project does not impact any of the “unique and mosaic habitat” areas on the Umpqua National Forest and therefore there is no aggregated impacts related to this previously proposed amendment and the proposed amendments for the Pacific Connector Pipeline Project There have been no past amendments to this LMP related to LSRs or Survey and Manage species except for the 2001 ROD amending standards and guidelines for Survey and Manage.

TABLE 4.1.3.7-5

Summary of Proposed Amendments to the Umpqua National Forest LRMP

UNF-4	**UNF-1**	**UNF-6**	**UNF-2**	**BLM/FS-1**
588 acres Matrix reallocated to LSR	3 acres of effective shade removed	<154 acres detrimental soil conditions	1 acre parallel perennial stream	107 survey and manage sites potentially impacted

Proposed amendment UNF-4 affects the most acres of land managed by the Umpqua National Forest; it would affect future management on approximately 588 acres. The outcome of this amendment would be a management change from the objective of providing commercial timber products along with other multiple uses to an objective where the primary emphasis would be the creation and maintenance of late-successional forest habitat. The Pacific Connector pipeline would remove approximately 23 acres of LSOG habitat in LSR compared with the 431 acres of LSOG habitat that would be reallocated to LSR for a net increase of 408 acres. There are currently about 375,160 acres[32] of LSR on the Umpqua National Forest, and the 588 acres added to LSR 223 would represent an increase of 0.16 percent. While beneficial to species dependent on LSOG forest, the change would represent a very small percentage of the overall acres allocated to LSR on the Umpqua National Forest. Similarly, the change in potential timber harvest would also be small (less than 0.14 percent) and is not expected to change the objective for timber management since it would not prevent attainment of the probable sale quantity on the Umpqua National Forest during the present planning cycle. The other proposed amendments are site-specific and would apply only to the Pacific Connector pipeline. Collectively, the proposed amendments affect a very small percentage of the Umpqua National Forest (about 0.06 percent) and with the reasonable assurance that persistence of the affected survey and manage species would not be affected, no measurable changes in management objectives or expected outputs of goods and services have been identified.

Aggregate Impact of Amendments to the Rogue River National Forest LMP

There are seven proposed LMP amendments to the Rogue River National Forest LMP (see tables 4.1.3.7-1 and 4.1.3.7-2 above). Each proposed amendment is discussed in more detail in sections 4.1.3.4 and 4.1.3.6. Collectively, the proposed amendments would affect management objectives on approximately 674 acres of the 632,000-acre Rogue River National Forest (see table 4.1.3.7-6). There are no other proposed or foreseeable LMP amendments at this time and there have been no past amendments to this LMP related to LSRs or survey and manage species except for the 2001 ROD amending standards and guidelines for survey and manage.

TABLE 4.1.3.7-6

Summary of Proposed Amendments for the Rogue River National Forest LRMP

RRNF-7	**RRNF-2**	**RRNF-3**	**RRNF-4**	**RRNF-6**	**RRNF-5**	**BLM/FS-1**
512 acres Matrix added to LSR	5 acres visual impact at Big Elk Road	5 acres visual impact at Pacific Crest Trail	9 acres of visual impact on Hwy 140	<196 acres detrimental soil conditions	<3 acre of Restricted Riparian crossed	36 survey and manage sites potentially impacted

Proposed amendment RRNF-7 would affect the most acres of land managed by the Rogue River National Forest; it would affect future management on approximately 512 acres. The primary difference would be a management change from the objective of providing commercial timber products along with other multiple uses to an objective where the primary emphasis would be the creation and maintenance of late-successional forest habitat. The Pacific Connector pipeline would remove approximately 55 acres of LSOG habitat in LSR compared with the 333 acres of LSOG that would be reallocated to LSR, for a net increase of 278 acres to LSR 227. There are

[32] This number does not include acres of unmapped LSR consisting of KOACs.

presently about 187,745 acres[33] of LSR on the Rogue River National Forest and the 512 acres would represent an increase of 0.27 percent. While beneficial to species dependent on LSOG forest, the change would represent a very small percentage of the overall acres allocated to LSR on the Rogue River National Forest. Similarly, the change in potential timber harvest would also be small (less than 0.27 percent) and is not expected to change the objective for timber management since it would not prevent attainment of the probable sale quantity on the Rogue River National Forest during the present planning cycle. The other proposed amendments are site-specific and would apply only to the Pacific Connector pipeline. All of the proposed amendments combined affect a very small percentage of the Rogue River National Forest (about 0.11 percent) and, with the reasonable assurance that persistence of the affected survey and manage species would not be affected, no measurable changes in management objectives or expected outputs of goods and services have been identified.

Aggregate Impact of Proposed Amendments to the Winema National Forest LMP

There are six proposed amendments to the Winema National Forest LMP (see tables 4.1.3.7-1 above). Each proposed amendment is discussed in more detail in section 4.1.3.4. Collectively, the proposed amendments would affect management objectives on approximately 128 acres of the one million plus acre Winema National Forest (see table 4.1.3.7-7). There are no other proposed or foreseeable LMP amendments on the Winema National Forest at this time.

TABLE 4.1.3.7-7

Summary of Proposed Amendments to the Winema National Forest LRMP

WNF-1	**WNF-2**	**WNF-3**	**WNF-4**	**WNF-5**	**BLM/FS-1**
17 acres of impact in MA 3	3 acres visual impact at Dead Indian Road	50 acres visual impact on Clover Creek Road	<63 acres detrimental soil condition	4 acres in MA 8 in a detrimental soil condition	45 survey and manage sites potentially impacted

There are no proposed land reallocation amendments to the Winema National Forest LMP that would affect future management. All of the proposed amendments are site-specific and would apply only to the Pacific Connector pipeline. Collectively, the proposed amendments affect a very small percentage of the Winema National Forest (about 0.01 percent) and, with the reasonable assurance that persistence of the affected survey and manage species would not be affected, no measurable changes in management objectives or expected outputs of goods and services have been identified.

Land Allocation LMP Amendments in Relation to Mapped LSR

All of the proposed LMP amendments reallocating Matrix lands to LSR in the Coos Bay and Roseburg Districts and in the Umpqua and Rogue River National Forests are listed in table 4.1.3.7-2. The amendments for each unit are evaluated in section 4.1.3.6 of this EIS. This section considers the aggregate effects of these amendments in relation to mapped LSR. Mapped LSRs are large areas that were designated at the NWFP level and often overlap the boundaries of BLM and Forest Service management units. Two of the mapped LSRs that would be affected by the Pacific Connector Pipeline Project overlap district and/or forest boundaries. LSR 261 would be

[33] This number does not include acres of unmapped LSR consisting of KOACs

affected in both the BLM Coos Bay and Roseburg Districts, and LSR 223 would be affected in both the BLM Roseburg District and the Umpqua National Forest.

LSR 261

The following discussion relates to the overall impacts of the Pacific Connector pipeline on LSR 261 and the overall acres being reallocated to LSR in the vicinity of LSR 261.

The total impacts to LSR 261 from the proposed Pacific Connector pipeline on both the BLM Coos Bay and Roseburg Districts are displayed in table 4.1.3.7-8 and figure 4.1-36. The impacts include the direct impacts that would occur from construction (the acres cleared plus the acres

TABLE 4.1.3.7-8

Comparison of Total LSR 261 Acres Affected (a/) by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR

LSR 261	Cleared	Modified	Project Indirect Effects	Project Total Effects	Matrix to LSR Reallocation
	Direct Effects				
LSOG	3	0	30	33	387
Non- LSOG	40	4	59	103	407
Non-Forest	0	0	0	0	2
Total	**43**	**4**	**89**	**136**	**796**

Note: Rows/columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project total effects include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late-successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG) on Coos Bay and Roseburg Districts.

Data source: BLM, Forest Service GIS Data Layers

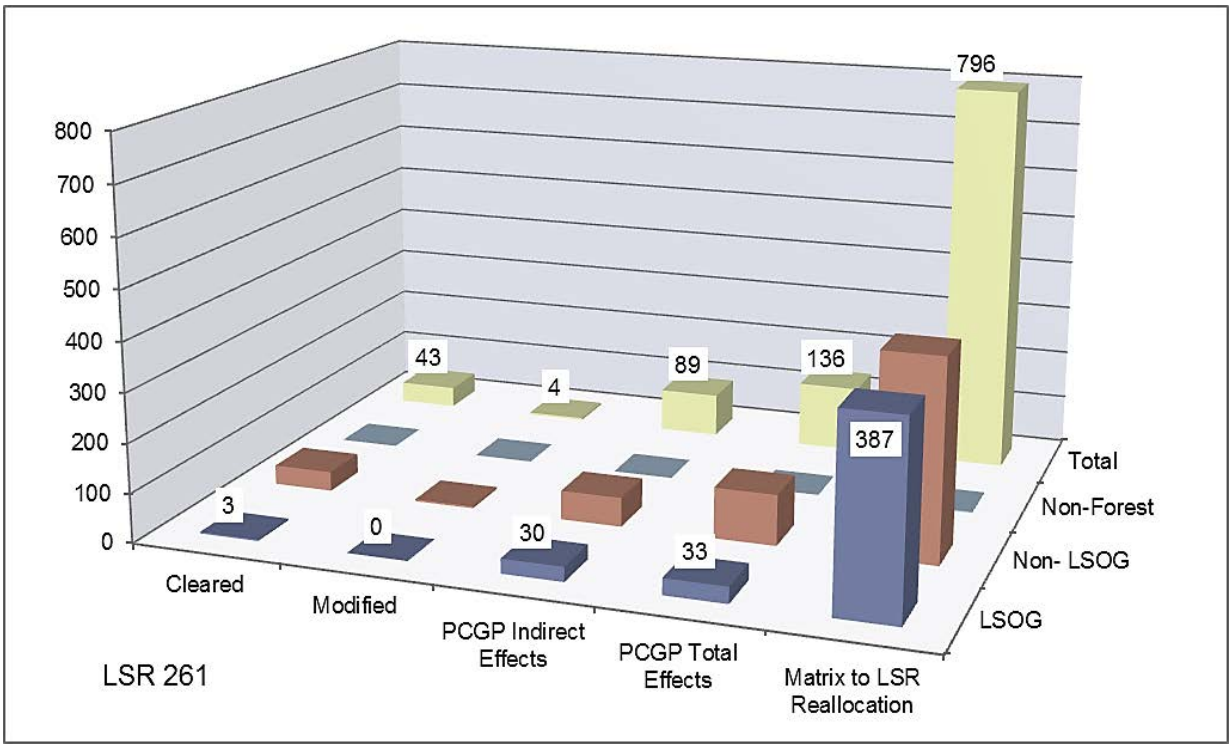

Figure 4.1-36. Comparison of Total LSR 261 Acres Affected by the Pacific Connector Pipeline Project and the Acres of Matrix Reallocated to LSR

modified by UCSAs) as well as the indirect impacts that would occur from the creation of new edge and the fragmentation of existing LSOG forest habitat. The indirect effects are measured as extending for 100 meters from the cleared edge on each side of the corridor in LSOG forest and 30 meters on each side of non-LSOG forest.

In considering the total impacts to LSOG forest habitat in LSR 261, there would be approximately 33 acres affected (including both direct and indirect impacts) compared to the approximately 387 acres of LSOG forest habitat being reallocated. The amendments would reallocate slightly more than 13 times the amount of LSOG forest habitat than would be affected. In considering the total impacts to forest habitat in LSR 261, there would be approximately 136 acres affected (including both direct and indirect impacts) compared to the 796 acres of Matrix lands being reallocated. The amendments would reallocate almost 6 times more forest habitat than would be affected.

Proposed Off-site Mitigation Actions

In addition to the reallocation of Matrix lands to LSR, the off-site mitigation actions on the Roseburg District include hazardous fuels reduction through creating a 1,000-acre fuel break adjacent to the Pacific Connector pipeline corridor in the South Umpqua River watershed and aiding fire suppression efforts through the creation of six dry hydrants in the South Umpqua River, Myrtle Creek, and Middle South Umpqua River fifth-field watersheds. The Coos Bay District is proposing to construct three heli-ponds. Two of them would be in the East Fork Coquille watershed and the other in the Middle Fork Coquille watershed.

- 1,000-Acre Fuel Break: High-intensity fire has been identified as the single factor most affecting LSOG forest habitats on federal lands in the area of the NWFP (Moeur et al. 2011). Construction of the pipeline and associated activities would remove both mature and developing stands and increase fire suppression complexity. However, the pipeline corridor would also provide a fuel break. Actions to reduce fuels adjacent to the corridor would increase the effectiveness of the corridor as a fuel break. This type of mitigation would lower the risk of loss of developing and existing mature stands and other valuable habitats to high-intensity fire. This segment is part of the Days Creek to Shady Cove fuel break and ties in with similar projects in the Umpqua National Forest.
- Six Dry Hydrants: By installing dry hydrants, the water source is disturbed only once, and there are several other advantages. Fire vehicles would not need to be very close to the water to fill up, decreasing the risk of contamination, and they can fill from some water sources that would otherwise need to be modified for use. Site-specific riparian and aquatic restoration efforts would be maintained, and/or enhanced by the installation of dry hydrants that offer safe and effective access for fire suppression equipment. Overall, better water sources would improve suppression success and therefore help protect natural resources.
- Three heli-ponds: Within the East Fork/Middle Fork Coquille fifth-field watersheds, there is an 18-plus-mile gap between water sources accessible to helicopters. Quick response time is imperative for successful control in wildfire situations during the initial attack. Most water sources in this area are low in the drainage and accessible only by truck. Heli-ponds at these locations would reduce the 18 mile gap to approximately 6 miles and would enable a 2- to 3-mile radius for aerial application. Fire control is necessary to protect LSRs and endangered species habitat should a wildfire occur. Development of these heli-ponds would reduce initial attack response times in both the mapped and unmapped LSRs that

would be affected by the Pacific Connector pipeline and increase the potential to control fires before they become high-intensity fires that threaten LSOG forests.

Impact on the Functionality of LSR 261 on the Roseburg and Coos Bay Districts

The functionality of LSR 261 relates directly to the goals and objectives for LSRs (see section 4.1.3.6) and can be measured by the quantity, quality, and distribution of LSOG forest habitat in the LSR and how the Pacific Connector Pipeline Project would impact these characteristics.

- **Quantity:** The overall quantity of LSOG habitat within LSR 261 on the Coos Bay and Roseburg Districts would increase with the proposed LMP amendments. The Project would remove approximately 3 acres of LSOG habitat in LSR 261 but the reallocation would add 387 acres of LSOG habitat for a net increase of 384 acres[34]. This would increase the current level of LSOG habitat in LSR 261 from 31,793 acres to 32,177 acres or by approximately 1.2 percent.
- **Quality:** The area of LSR 261 that would be affected by the Pacific Connector pipeline on both the Coos Bay and Roseburg Districts is highly fragmented due to both the land ownership pattern and past management activities. The area proposed for reallocation to LSR 261 contains some large blocks of LSOG habitat as well as occupied MAMU stands and an adjacent KOAC. This reallocation would consolidate habitat in an area that is highly fragmented. LSR 261, like most LSRs on BLM land, is comprised of checkerboard sections or even smaller parcels of land. The intent of the reallocations is to better connect these pieces by decreasing distances between individual LSR parcels and reduce the amount of "edge" adjacent to existing occupied MAMU stands and KOACs. With the reallocation of Matrix to LSR and the consolidating of larger blocks of LSOG habitat the quality of the LSOG habitat within LSR 261 would be improved.
- **Distribution:** The distribution of LSOG habitat within LSR 261 would remain largely unchanged with the proposed Pacific Connector pipeline and the reallocation of Matrix to LSR RMP amendments. To the extent there are minor changes they would be beneficial due to the location of the proposed reallocation. The reallocation would occur within a current gap between the northern and southeastern portions of LSR 261 and between LSR 261 and LSR 259 which would provide some additional connectivity within LSR in these areas.
- The off-site mitigation actions on the Coos Bay and Roseburg Districts would provide added protection to the quantity, quality, and distribution of LSOG habitat by improving the potential to decrease initial fire suppression response times and thereby increase the potential to control fires before they become high-intensity fires that threaten LSOG forests. Protecting LSOG forest from loss due to high-intensity fire is also one of the objectives in the LSRA for this LSR.

The Matrix to LSR reallocations and the off-site mitigation actions on both the Coos Bay and Roseburg Districts have been designed with the goal that, overall, the impact of the Pacific Connector pipeline on LSR 261 would be either neutral or beneficial to the creation and maintenance of late-successional habitat. With the increase in the acres of protected LSOG habitat

[34] 286 of these acres would be reallocated to LSR 259 which is next to LSR 261, see discussion in section 4.1.3.6 BLM-3, Reallocation of Matrix Lands to Late Successional Reserves for the reasons reallocation in LSR 259 is being considered as mitigation for LSR 261.

and the formation of larger habitat blocks in areas where fragmentation was a major concern in the LSRA, the overall functionality of LSR 261 would be maintained or improved.

LSR 223

The following discussion relates to the overall impacts of the Pacific Connector pipeline on LSR 223 and the overall acres being reallocated to LSR in the vicinity of LSR 223.

The total impacts to LSR 223 from the proposed Pacific Connector pipeline on both the Umpqua National Forest and BLM Roseburg District are displayed in table 4.1.3.7-9 and figure 4.1-37. The impacts include the direct impacts that would occur from the construction of the pipeline project (the acres cleared plus the acres modified by UCSAs) as well as the indirect impacts that would occur from the creation of new edge and the fragmentation of existing LSOG forest habitat. The indirect effects are measured as extending for 100 meters from the cleared edge on each side of the corridor in LSOG forest and 30 meters on each side of non-LSOG forest.

TABLE 4.1.3.7-9

Comparison of Total LSR 223 Acres Affected (a/) by the Pacific Connector Pipeline Project and Acres of Matrix Reallocated to LSR

LSR 223	Cleared (Direct Effects)	Modified (Direct Effects)	Project Indirect Effects	Project Total Effects	Matrix to LSR Reallocation
LSOG	35	15	271	321	431
Non- LSOG	78	24	115	217	157
Non-Forest	0	0	0	0	0
Total	**113**	**39**	**385**	**538**	**588**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project total effects include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of the cleared corridor edge in non-LSOG) in the BLM Roseburg District and Umpqua National Forest.

Data source: BLM, Forest Service GIS Data Layers, Cox 2010

In considering the total impacts to LSOG forest habitat in LSR 223, there would be approximately 321 acres affected (including both direct and indirect impacts) compared to the approximately 431 acres of LSOG forest habitat being reallocated. The amendments would reallocate slightly more than 1.3 times the amount of LSOG forest habitat that would be affected. The off-site mitigation proposed in the Roseburg District would add another 1,000 acres of fuel treatment in addition to the 2,284 acres proposed in the Umpqua National Forest. Collectively, these actions would provide for increased prevention of LSOG forest habitat loss due to intensive fire.

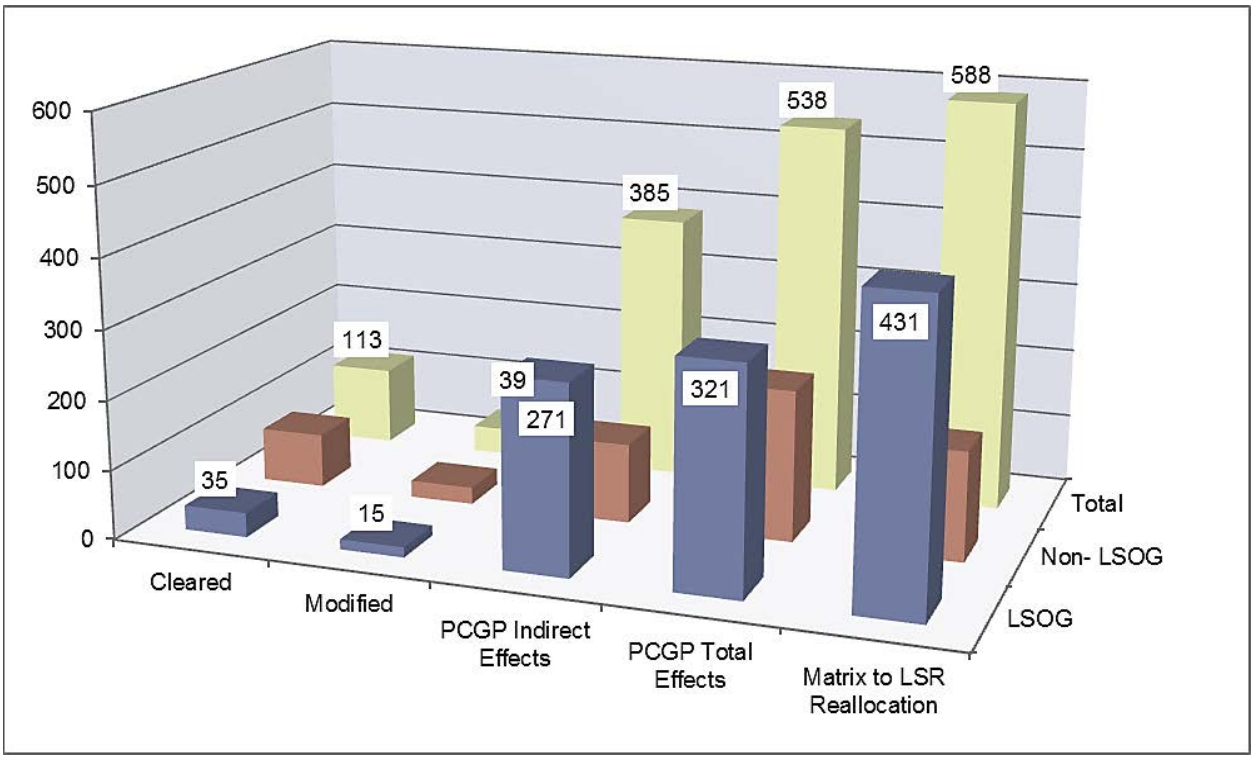

Figure 4.1-37. Comparison of Total LSR 223 Acres Affected by the Pacific Connector Pipeline Project and the Acres of Matrix Reallocated to LSR

Proposed Off-site Mitigation Actions

A Mitigation Plan was developed to ensure that the goals and objectives of the LMPs related to LSR would be achieved. Mitigation actions include:

- Creation of snags on 175 acres that are below desired snag densities for LSRs.
- Placing CWD on 165 acres in units that are currently below desired levels for CWD.
- Closing and decommissioning 7.6 miles of roads to reduce fragmentation and develop interior stand habitat over time.
- Thinning approximately 2,081 acres of overstocked stands, and underburning approximately 1,128 acres in LSRs to reduce fire risk and accelerate development of LSR characteristics.
- Integrated stand density and fuel break treatments on 2,285 acres in LSR 233 to restore stand density, species diversity, structural diversity, and control the spread and intensity of wildfire within forested stands prone to fire activity.

While the primary mitigation action for the effects of the pipeline on LSR 223 would be to replace affected acres with additional acres of LSOG forest habitat that are currently outside of the LSR, the additional off-site mitigation actions proposed are consistent with the recommendations in the LSRA for LSR 223. These off-site mitigation actions would accelerate the development of LSOG forest habitat elements to further offset the effects of the Pacific Connector pipeline on LSR 223 in the long term. The additional off-site mitigation actions would also increase the effectiveness of the additional LSOG forest habitat added to LSR 223 by improving the quantity, quality, and distribution of high-quality habitat. The fuels treatment is part of a long fuel break extending from

Stouts Creek on the Roseburg District to Trail Creek on the Medford District, a landscape-scale mitigation action designed to reduce the risk of damage to LSR from catastrophic wildfire.

Impact on the Functionality of LSR 223 on the BLM Roseburg District and the Umpqua National Forest

The functionality of LSR 223 relates directly to the goals and objectives for LSRs and can be measured by the quantity, quality, and distribution of LSOG forest habitat in the LSR and how the proposed Pacific Connector pipeline would impact these characteristics.

- **Quantity:** The overall quantity of LSOG habitat within LSR 223 on the Umpqua National Forest and Roseburg District would increase with the proposed LRMP amendment. The Project would remove approximately 35 acres of LSOG habitat but the reallocation would add 431 acres of LSOG habitat for a net increase of 396 acres. This would increase the current level of LSOG habitat in LSR 223 from 20,953 acres to 20,953 acres or by approximately 1.9 percent.
- **Quality:** The area proposed for reallocation to LSR 223 contains some large blocks of LSOG habitat and would also be located immediately adjacent to two KOACs, providing further consolidation of LSOG habitat and increased protection of NSO habitat within LSR 223. With the reallocation of Matrix to LSR and the consolidating of larger blocks of LSOG habitat, the quality of the LSOG habitat in LSR 223 would be slightly improved.
- **Distribution:** The distribution of LSOG habitat within LSR 223 would remain largely unchanged with the proposed Project and the reallocation of Matrix to LSR LRMP amendment. To the extent there are minor changes, they would be beneficial due to the location of the proposed reallocation. The reallocation would occur on the southwest edge of the LSR providing for some additional connectivity with the nearest LSRs to the south and west.
- The off-site mitigation actions would improve the quantity, quality, and distribution of LSOG habitat in LSR 223 by accelerating the development of constituent elements of late-successional habitat, reducing the risk of stand-replacement fire and reducing fragmentation through road decommissioning and stand-density management.

The Matrix to LSR reallocation and the off-site mitigation actions on both the Roseburg District and the Umpqua National Forest have been designed with the goal that the overall impact of the Project on LSR 223 would be either neutral or beneficial to the creation and maintenance of late-successional habitat. With the increase in the acres of protected LSOG habitat and the inclusion of large LSOG habitat blocks, the overall functionality of LSR 223 would be maintained or improved.

Aggregate LMP Amendments and Off-site Mitigation Actions Related to LSR

Collectively, there are a total of seven proposed LMP amendments that would affect LSR in order to accommodate construction of the Project. Table 4.1.3.7-10 summarizes the proposed amendments.

TABLE 4.1.3.7-10

Summary of Proposed BLM and Forest Service LMP Amendments for LSR

BLM/Forest Service Management Unit	Reallocate Matrix Land to LSR a/	Exemption from Requirement to Protect MAMU Habitat b/	Exemption from Requirement to Retain Habitat in KOACs c/
BLM Coos Bay District	BLM-4 Proposal to reallocate 387 acres of Matrix Land to LSR 261	BLM-1 Proposal to waive requirement on twelve occupied MAMU stands	None
BLM Roseburg District	BLM-3 Proposal to reallocate 409 acres of Matrix Land to LSR 259	BLM-1 Proposal to waive requirement on four occupied MAMU stands	BLM-2 Proposal to waive requirement on three KOACs
Forest Service Umpqua National Forest	UNF-4 Proposal to reallocate 588 acres of Matrix land to LSR 223	None	None
Forest Service Rogue River National Forest	RRNF-7 Proposal to reallocate 512 acres of Matrix land to LSR 227	None	None

a/ Reallocated acres would become part of mapped LSRs.
b/ Occupied MAMU stands outside of mapped LSRs are designated as un-mapped LSRs.
c/ All KOACs are outside of mapped LSRs and are designated as un-mapped LSRs.

The total amount of LSR acres affected by the Pacific Connector pipeline directly and indirectly across all BLM and Forest Service lands and the total amount of Matrix proposed for reallocation to LSR are displayed in table 4.1.3.7-11 and figure 4.1-38.

TABLE 4.1.3.7-11

Summary of the Total LSR Acres Affected Directly and Indirectly (a/) by the Pacific Connector Pipeline Project and Total Acres of Matrix Reallocated to LSR

	Mapped LSR			Unmapped LSR			Total LSR			Total
Unit	Direct Effect	Indirect Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect	Direct Effect	Indirect Effect	Overall Effect	Matrix to LSR
BLM Districts										
Coos Bay	35	56	91	40	181	220	75	237	312	387
Roseburg	80	177	257	37	87	124	116	265	381	409
Total BLM	115	234	348	76	268	344	191	502	692	**796**
Forest Service National Forests										
Umpqua	85	241	325	0	0	0	85	241	325	588
Rogue River	276	534	810	0	0	0	276	534	810	512
Total Forest Service	361	775	1,135	0	0	0	361	775	1,135	**1,100**
Total Overall	**475**	**1,008**	**1,483**	**76**	**268**	**344**	**552**	**1,276**	**1,828**	**1,896**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
a/ Project total effects include cleared acres (corridor and TEWAs), modified acres (UCSAs), and indirect effect acres (100 meters on each side of the cleared corridor edge in LSOG and 30 meters on each side of the cleared corridor edge in non-LSOG).
Data source: BLM, Forest Service GIS data layers, Cox 2010

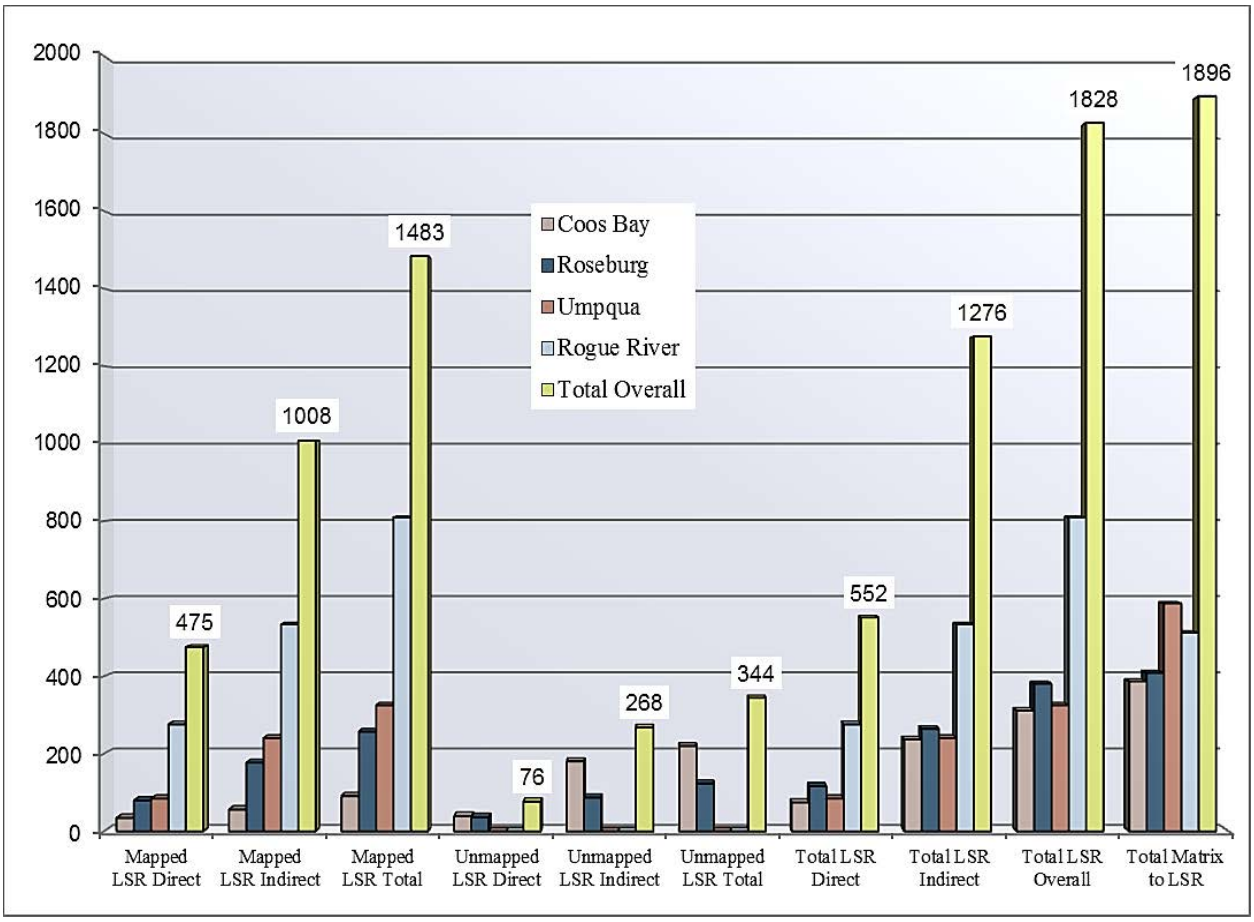

Figure 4.1-38. Comparison of Total LSR Acres Affected by the Pacific Connector Pipeline Project and Total Acres of Matrix Reallocated to LSR

Unmapped LSRs for the most part were avoided with the routing of the Pacific Connector pipeline due to their smaller size and greater dispersal, except for BLM Coos Bay District, where numerous occupied MAMU stands are concentrated in the area of the proposed route (see figure 4.1-10). Mapped LSRs would be affected the most on NFS lands where the proposed route is in the general vicinity of large LSR areas, especially in the Rogue River National Forest (see figures 4.1-28 and 4.1-32).

Comparing the Matrix acres proposed for reallocation to LSR with the total LSR acres that would be directly and indirectly affected by the Pacific Connector pipeline, the ratio is slightly more than one to one. It should be noted, however, that a high percentage of the overall impact (slightly more than two-thirds) would be from the indirect effects of the pipeline project that would result from the creation of new edge and fragmentation of forested habitat. There is no precise way to measure the indirect impacts or compare them to the impacts of removing forest vegetation for the project. In considering the objectives of LSRs, a more important comparison is the overall impact the project would have on LSOG habitat with the amount of LSOG habitat that would be reallocated to LSRs (see table 4.1.3.7-12 and figure 4.1-39).

TABLE 4.1.3.7-12

Comparison of Total LSR Acres by Habitat Type Affected (a/) by the Pacific Connector Pipeline Project and Total Acres of Matrix Reallocated to LSR

Habitat Type	Total Cleared	Total Modified	Total Indirect Effects	Total Effects	Total LSR Reallocation
LSOG	114	46	859	1,018	1,151
Non-LSOG	296	87	417	800	743
Non-Forest	19	0	0	9	2
Totals	**418**	**133**	**1,278**	**1,828**	**1,896**

a/ Project impacts include (direct effects) cleared acres (corridor and TEWAs) and modified acres (UCSAs), and (indirect effects) 100 meters on each side of the cleared corridor edge in LSOG and 30 meters on each side of the cleared corridor edge in non-LSOG.

Data source: BLM, Forest Service, GIS Layers; Cox 2010

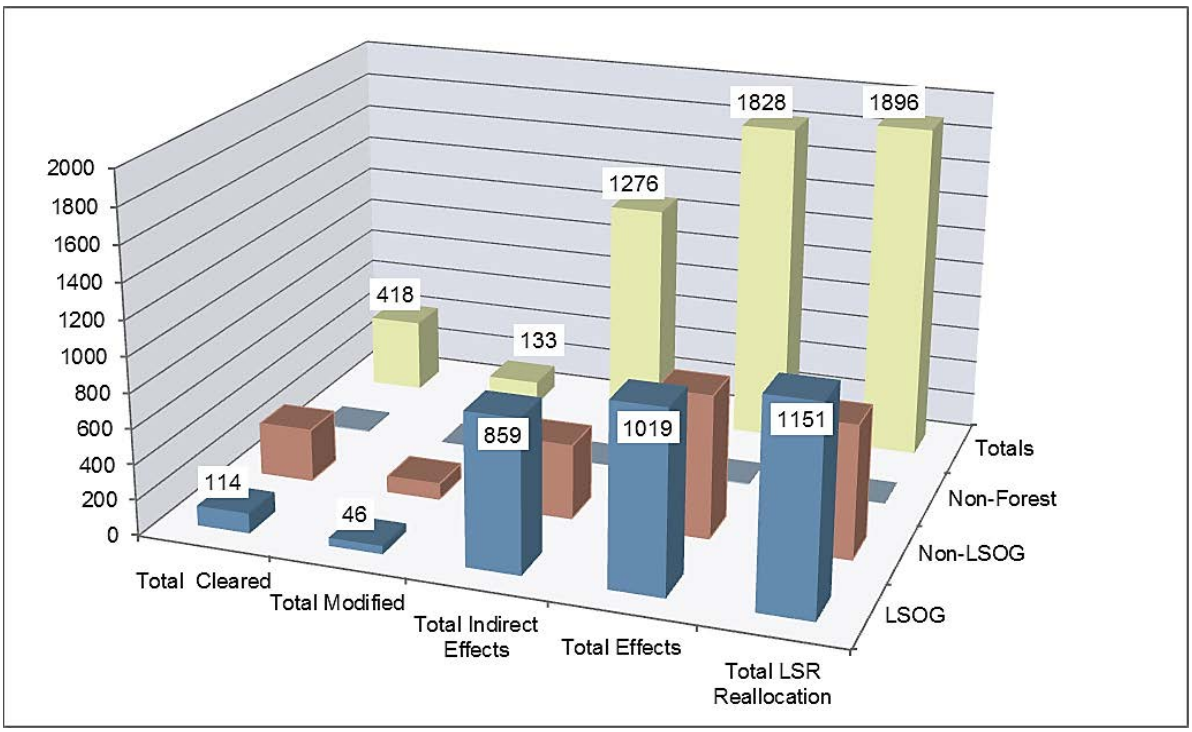

Figure 4.1-39. Comparison of Total LSR Acres Affected by Pacific Connector Pipeline Project and Total Acres of Matrix Reallocated to LSR

In comparing the acres of LSOG habitat that would be reallocated to LSR with the total acres of LSOG habitat in LSRs that would be cleared by the Pacific Connector pipeline, the ratio would be approximately 10 to 1. This is due in part to the efforts both to avoid LSOG habitat in the routing of the Pacific Connector pipeline and to identify larger blocks of LSOG habitat in the Matrix areas proposed for reallocation. Comparing the acres of LSOG habitat proposed for reallocation to LSR with the total LSR acres of LSOG habitat that would be directly and indirectly affected by the Project results in a ratio of approximately 1.1 to 1.

Total Off-site Mitigation Actions Related to LSR

A summary of the proposed off-site mitigation actions for LSRs on BLM and NFS lands is described in table 4.13.7-13. The mitigation actions are designed to accomplish two main

objectives. The first objective is to enhance the development of LSOG habitat and its constituent elements. The second objective is to reduce the risk of losing LSOG habitat to intensive fires.

For the BLM lands, the focus of the mitigation actions would be to reduce the risk of LSOG habitat loss from intensive fire. This focus is due primarily to the highly fragmented ownership pattern in the area of the proposed Pacific Connector pipeline and the few remaining large blocks of LSOG habitat. Because of these factors, protecting the remaining LSOG habitat in the LSRs is the highest priority. The proposed development of the three heli-ponds, the six dry hydrants, and the 1,000 acres of fuel hazard reduction are spread across the Coos Bay and Roseburg Districts in the area of the Pacific Connector pipeline and would provide added protection and reduced fire response times for both the mapped and un-mapped LSRs in this area (see figures 4.1-15 and 4.1-27).

TABLE 4.1.3.7-13

Summary of Proposed Off-site Mitigation Actions for LSR Impacts on BLM and NFS Lands

BLM/Forest Service Management Unit	Fire Hazard Reduction	Road Decommissioning	Stand-Density Management	Coarse Woody Debris Enhancement	Other Treatments
BLM Coos Bay District	Development of three heli-ponds	–	–	–	–
BLM Roseburg District	Development of six dry hydrants	–	Fuel hazard reduction on 1,000 acres	–	–
Forest Service Umpqua National Forest	–	7.6 miles of road decommissioning	913 acres of stand-density management Fuel break treatments on 2,285 acres	Snag creation on 175 acres and LWD placement on 165 acres	80 acres of meadow restoration and 81 acres (a/) of invasive plant treatment
Rogue River National Forest	–	53.2 miles of road decommissioning	Pre-commercial thinning of 600 acres	Snag creation and LWD placement on 600 acres	–
Totals	**9 Sites**	**60.8 Miles**	**4,798 Acres**	**940 Acres**	**161 Acres**

a/ Estimated acres based on 50 feet of treatment on each side of 6.7 miles of road (6.7*5280*100/43560).
Data source: BLM, Forest Service GIS Layers

For the NFS lands, the focus of the off-site mitigation actions would be on (1) reducing the risk of LSOG habitat loss from intensive fire and (2) enhancing the development of LSOG habitat in LSRs. The NFS lands in the vicinity of the Pacific Connector pipeline provide greater opportunities for LSOG habitat enhancement due to the large LSR areas and the larger blocks of LSOG habitat. The proposed treatments include more than 60 miles of road decommissioning, more than 1,500 acres of stand-density management, approximately 2,285 acres of integrated fuel hazard reduction/stand-density management, and approximately 940 acres of CWD enhancement. The integrated fuel hazard reduction treatments in the Umpqua National Forest are designed to tie into the treatments in the Roseburg District to provide for continuous fuel hazard reduction along the corridor on both BLM and Forest Service lands in this area.

A portion of the Forest Service off-site mitigation actions have been designed to partially compensate for the fragmentation of LSOG habitat that would occur with the construction of the Pacific Connector pipeline in LSRs 223 and 227. These off-site mitigation actions include road decommissioning and stand-density management activities. Table 4.1.3.7-14 and figure 4.1-40 compare the impacts that would occur from the construction of the project and the estimated amount of edge effect reduction that would occur over time with the off-site mitigation actions.

TABLE 4.1.3.7-14

Comparison of Total Pacific Connector Pipeline Project Impacts (a/) on LSRs 223 and 227 and Estimated Edge Reduction Effect (a/) of Proposed Off-site Mitigation Actions on Forest Service Lands (Acres)

LSR 223 and 227	Direct Effect	Indirect Effect	Total
	Total LSR Acres Affected on Forest Service Lands		
Pacific Connector Pipeline Project Impacts	361	774	1,135
	Proposed Off-site Mitigation Actions on Forest Service Lands		
Road Decommissioning	147	737	884
Stand-Density Management.	0	157	157
Total	**147**	**894**	**1,041**

a/ Project direct effects include corridor clearing, temporary extra work areas, and uncleared storage areas. Indirect effects include 100 meters on each side of the corridor edge in late successional and old-growth (LSOG) forest and 30 meters on each side of corridor edge in non-LSOG.
b/ Direct edge reduction effects include acres of decommissioned roads revegetated (60.8*5280*20/43560) and indirect effects include 50 feet on each side of decommissioned roads and 100 feet along perimeter of stand-density treatments.
Data source: BLM, Forest Service GIS data layers, Hobson 2010

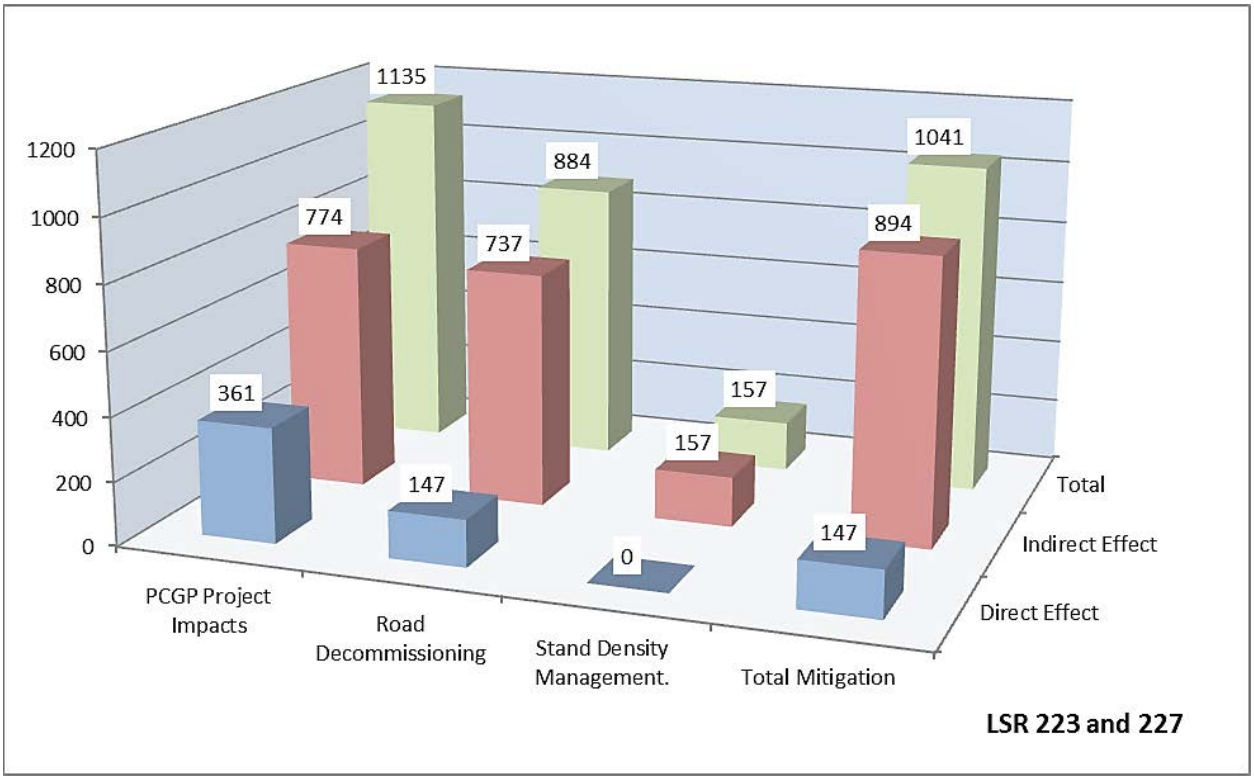

Figure 4.1-40. Comparison of Total Pacific Connector Pipeline Project Impacts on LSRs 223 and 227 and Estimated Edge Reduction Effect of Proposed Off-site Mitigations on NFS Lands (acres)

A more detailed discussion of these off-site mitigation actions and the assumptions used in estimating edge reduction effects is included in section 4.1.3.6. The purpose of the comparison here is to show the total amount of off-site mitigation on Forest Service lands that has been designed to compensate for the indirect effects of edge fragmentation. In comparing the indirect beneficial effects of the off-site mitigation with the indirect effects of the Pacific Connector pipeline on LSRs (which is an estimate of the edge and fragmentation impacts), the ratio is slightly

more than one to one. This is not a one to one comparison, however, because the adverse impacts would occur at the time of construction whereas the beneficial effects of edge reduction would occur over several decades. This comparison, however, does not consider the beneficial effects of the on-site mitigation in edge reduction that would also occur over time from the reforestation of the project corridor except for a 30-foot area over the center of the pipeline.

Summary of Aggregate LMP Amendments and Off-site Mitigation Actions Related to LSR at the Province Level

The NWFP included a comprehensive monitoring program to evaluate progress toward meeting the respective LMP's desired outcomes (Forest Service and BLM 1994a: E-1 to E-12). In 1995, a scientifically based interagency monitoring program was developed (Mulder et al. 1999). The monitoring program is composed of six modules designed to answer key questions. The modules include tracking the status and trends of watershed conditions, LSOG forests, social and economic conditions, tribal relationships, and the populations and habitats of MAMU and NSO. The module for LSOG habitat monitoring characterizes the status and trend of older forests to answer the key question: "Is the NWFP maintaining or restoring late-successional and old-growth forest ecosystems to desired conditions on federal lands in the NWFP area?" Monitoring results are evaluated and reported in one-year and five-year intervals.[35] The 15-year LSOG forest monitoring report was completed in 2011 (Moeur et al. 2011).

The monitoring program for LSOG habitat is based on physiographic provinces. The use of provinces allows differentiation between areas of common biological and physical processes. The provinces are useful for stratifying monitoring findings according to the climatic, topographic, and social gradients across the NWFP area that create significant differences in potential natural vegetation, current vegetation, natural disturbance regime, historical land use, and land ownership (Moeur et al. 2005). The 12 provinces used in the NWFP are shown on figure 4.1-41. The Pacific Connector Pipeline Project would affect LSRs in 3 of the 12 provinces: the Oregon Coast Range, Oregon Klamath, and Oregon Western Cascades provinces. Figure 4.1-42 illustrates the provinces crossed by the Pacific Connector pipeline route.

[35] Monitoring results for the first 10 and 15 years are documented in a series of general technical reports that are available online at http://www.fs.fed.us/pnw/publications/gtrs.shtml.

The Northwest Forest Plan Area

An image of the area covered by the Northwest Forest Plan, provided by NASA's Moderate Resolution Imaging Spectroradiometer (MODIS), from over 400 mi above the Earth onboard the Terra satellite.

This image comes from a composite of images, from June through September 2001, combined to produce one single cloud-free portrait of the Earth, known as the NASA Blue Marble image.

Interstate highways
Urban areas

Physiographic provinces

1. Washington Olympic Peninsula
2. Washington Western Lowlands
3. Washington Western Cascades
4. Washington Eastern Cascades
5. Oregon Western Cascades
6. Oregon Eastern Cascades
7. Oregon Coast Range
8. Oregon Willamette Valley
9. Oregon Klamath
10. California Klamath
11. California Coast Range
12. California Cascades

N

0 50 100 150 200 Miles
0 80 160 240 320 Kilometers

Figure 4.1-41. Physiographic Provinces of the Northwest Forest Plan

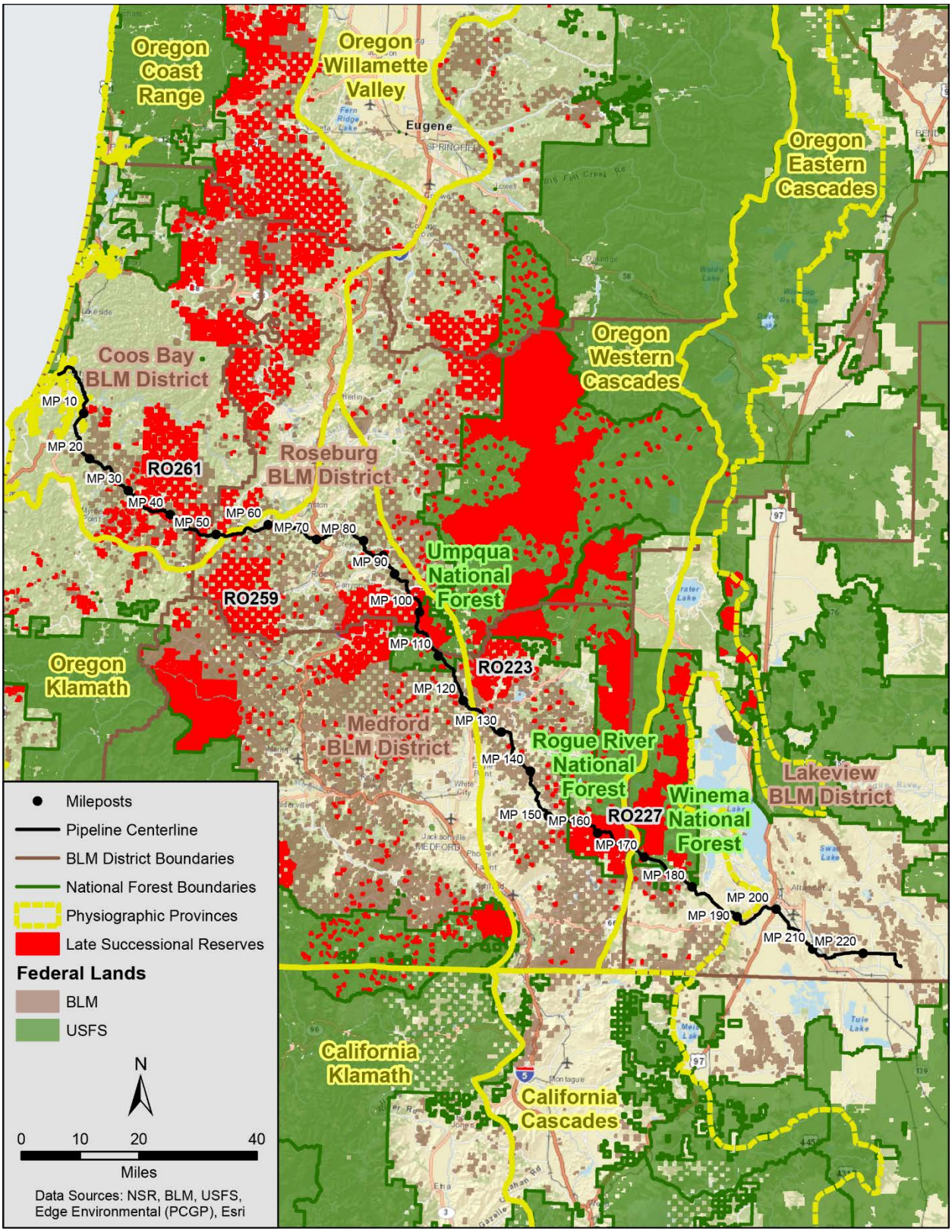

Figure 4.1-42. Map of Physiographic Provinces Crossed by the Pacific Connector Pipeline Project

Table 4.1.3.7-15 and figure 4.1-43 provide a summary of the total LSOG acres in LSRs that would be affected directly and indirectly by the Pacific Connector pipeline and the total acres of LSOG habitat reallocated to LSR by province.

TABLE 4.1.3.7-15

Comparison of Total Pacific Connector Pipeline Project Effects (a/) on LSOG Habitat in LSRs and LSOG Habitat in Matrix Reallocated to LSR by Province (Acres)

Province	Direct Effects: Cleared	Direct Effects: Modified	Indirect Effects	Total Effects	Matrix to LSR Reallocation
Oregon Coast Range	21	5	207	**233**	101
Oregon Klamath	37	20	303	**361**	717
Oregon Western Cascades	55	21	350	**426**	333
Total	**114**	**46**	**860**	**1,020**	**1,151**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

a/ Project effects include cleared acres (corridor and temporary extra work areas), modified acres (uncleared storage areas), and indirect effect acres (100 meters on each side of the cleared corridor edge in late successional and old-growth [LSOG] forest).

Data source: BLM, Forest Service GIS data layers

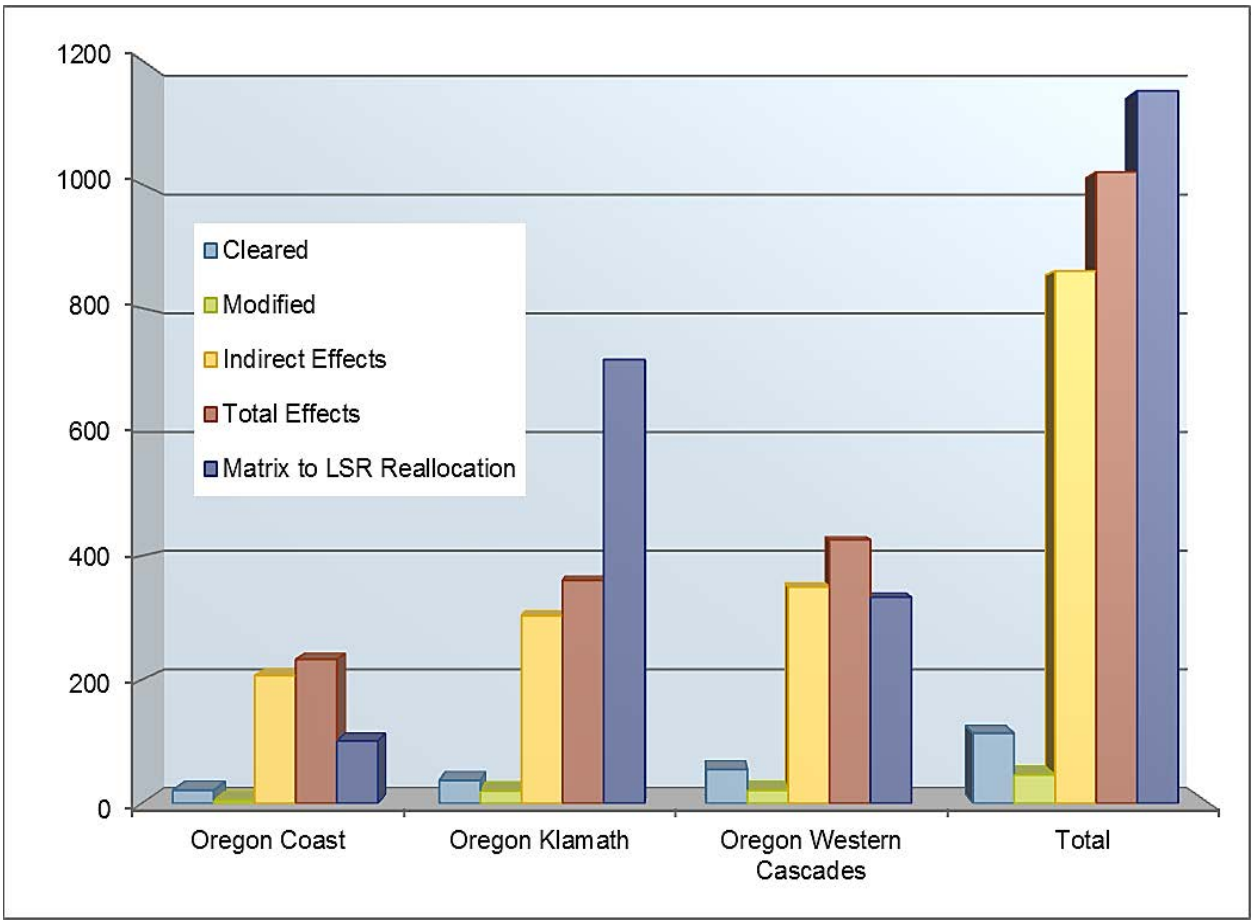

Figure 4.1-43. Comparison of Total Pacific Connector Pipeline Project Impacts on LSOG Habitat in LSRs and LSOG Habitat in Matrix Reallocated to LSR by Province (acres)

As illustrated by table 4.1.3.7-15 and figure 4.1-43, the impacts on LSOG habitat in LSRs from the Pacific Connector pipeline would be spread across three provinces, with the majority of the impacts occurring in the Oregon Klamath and Oregon Western Cascade Provinces, including the majority of the LSOG forest acres reallocated to LSR. Although a small portion of the pipeline would also cross the Oregon Eastern Cascades Province in the Winema National Forest, it would not affect any LSRs in that province.

Table 4.1.3.7-16 summarizes the proposed off-site mitigation actions for LSRs on BLM and Forest Service lands by province. Maps of the proposed off-site mitigation actions are displayed in figures 4.1-15, 4.1-27, 4.1-30 and 4.1-34.

TABLE 4.1.3.7-16

Summary of Proposed Off-site Mitigation Actions for LSR Impacts on BLM and Forest Service Lands by Province

Physiographic Province	Fire Hazard Reduction	Road Decommissioning	Stand-Density Management	Coarse Woody Debris Enhancement	Other Treatments
Oregon Coast Range	Development of three heli-ponds	–	–	–	–
Oregon Klamath	Development of six dry hydrants	7.6 miles of road decommissioning	Fuel hazard reduction on 1000 acres a/ 913 acres of stand-density management Fuel break treatments on 2,285 acres	Snag creation on 175 acres and LWD placement on 165 acres	80 acres of meadow restoration and 81 acres (b/) of invasive plant treatment
Oregon Western Cascades	–	53.2 miles of road decommissioning	Pre-commercial thinning of 600 acres	Snag creation and LWD placement on 600 acres	–
Totals	**9 Sites**	**60.8 Miles**	**4,798 Acres**	**940 Acres**	**161 Acres**

a/ A small portion of these acres would be within the Oregon Coast Province.
b/ Estimated acres based on 50 feet of treatment on each side of 6.7 miles of road (6.7*5280*100/43560)
Data source: BLM, Forest Service GIS Layers

The monitoring data from the 2011 LSOG forest monitoring report suggest a slight net loss of LSOG forest over the NWFP area, from 33.2 percent of federal forest in 1994–1996 to 32.6 percent in 2006–2007. This estimate includes loss from natural disturbances and timber harvesting, as well as the estimated gains from LSOG forest recruitment. The net change was positive in some provinces and negative in others. For the Oregon Coast, Oregon Klamath, and Oregon Western Cascades Provinces, the estimated net loss was 3.0, 1.1, and 7.9 percent, respectively (Moeur et al. 2011).

Similar to the findings of previous monitoring reports, wildfire was the most significant cause of LSOG habitat loss over the NWFP area. Most of the LSOG forest losses on federal lands (approximately 184,000 acres) were associated with wildfire, including several large fire events in the Oregon Klamath and Oregon Western Cascades Provinces. Most of the LSOG forest loss on federal land was from reserves and almost 90 percent of those losses were associated with wildfire. Less than 0.5 percent of the LSOG habitat loss on federal lands was associated with timber harvesting. The 2011 monitoring report concluded that the risk of loss of LSOG habitat to wildfire will continue to be a critical consideration for policies affecting LSOG forests (Moeur et al. 2011).

The proposed LMP amendments and off-site mitigation actions incorporated into the Proposed Action (see section 2.1.4 of this EIS) are consistent with the findings in the 2011 LSOG forest monitoring report. The LMP amendments have been designed to increase the overall acres of LSOG habitat within LSRs in each of the provinces affected (see table 4.1.3.7-15 and figure 4.1-43). The off-site mitigation measures (see table 4.1.3.7-16) have been designed to both reduce the risk of loss of LSOG forest to wildfire and enhance the creation and maintenance of LSOG habitat in LSRs. The proposed LMP amendments and off-site mitigation actions have been designed with the goal that the overall impact of the Pacific Connector pipeline would be neutral or beneficial to the creation and maintenance of LSOG habitat within LSRs.

Summary of LMP Amendments Related to MAMU and Off-site Mitigation Actions at the Province Level

In addition to the NWFP monitoring module for LSOG forests, the monitoring program also includes a module that assesses status and trends in MAMU populations and nesting habitat to answer the key questions: "Are the MAMU populations associated with the NWFP Plan area stable, increasing, or decreasing?" and "Is the NWFP maintaining and restoring MAMU nesting habitat?" (Mulder et al. 1999).

The monitoring for MAMU is also based on the same provinces as the LSOG forest monitoring as well as MAMU zones. There are two zones based on distance from the coast. In Oregon, Zone 1 extends approximately 35 miles inland. Zone 2, which extends approximately 12 miles farther, is defined for survey purposes and was not included in the monitoring report for Oregon and California (Raphael et al. 2011). Figure 4.1-44 is a map of the provinces and zones for MAMUs.

All of the occupied MAMU stands that would be affected by the Pacific Connector pipeline are located on BLM lands (12 stands in the Coos Bay District and 4 stands in the Roseburg District). Most of the stands (14 of the 16) are within Zone 1 and the Oregon Coast Range Province. Two of the stands in the Roseburg District fall within MAMU Zone 2 and the Oregon Klamath Province. Table 4.1.3.7-17 and figure 4.1-45 summarize the total amount of LSOG habitat that would be affected by the Pacific Connector Pipeline Project in occupied MAMU stands and the amount of LSOG habitat that would be reallocated to LSRs in the nearby vicinity by Province.

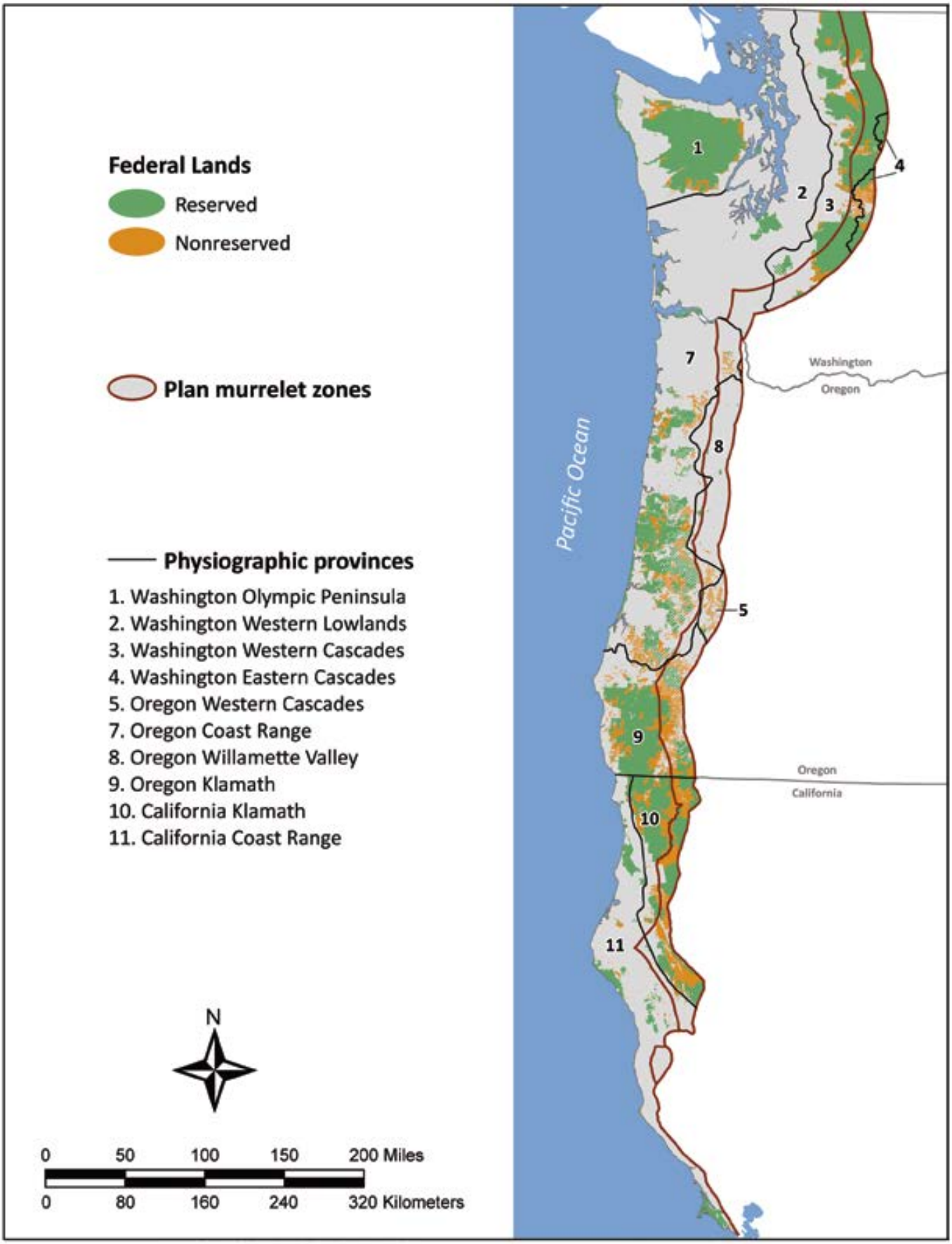

Figure 4.1-44. Map of Physiographic Provinces and MAMU Zones

TABLE 4.1.3.7-17

Comparison of Total LSOG Habitat Acres in Occupied Marbled Murrelet Stands Impacted a/ by the Pacific Connector Gas Pipeline Project and Acres of LSOG Habitat in the Matrix to LSR Reallocation by Province

Province	Acres Cleared	Acres Modified	Acres Indirect Effects	Total Effects	Matrix to LSR Reallocation
Oregon Coast	16	3	163	182	101
Oregon Klamath	3	2	34	39	286
Total	**19**	**5**	**197**	**221**	**387**

a/ Pacific Connector Pipeline Project impacts include (direct effects) cleared acres (corridor and TEWAs) and modified acres (UCSAs), and (indirect effects) 100 meters on each side of the cleared corridor edge in LSOG.
Data Source: BLM, FS, GIS Layers

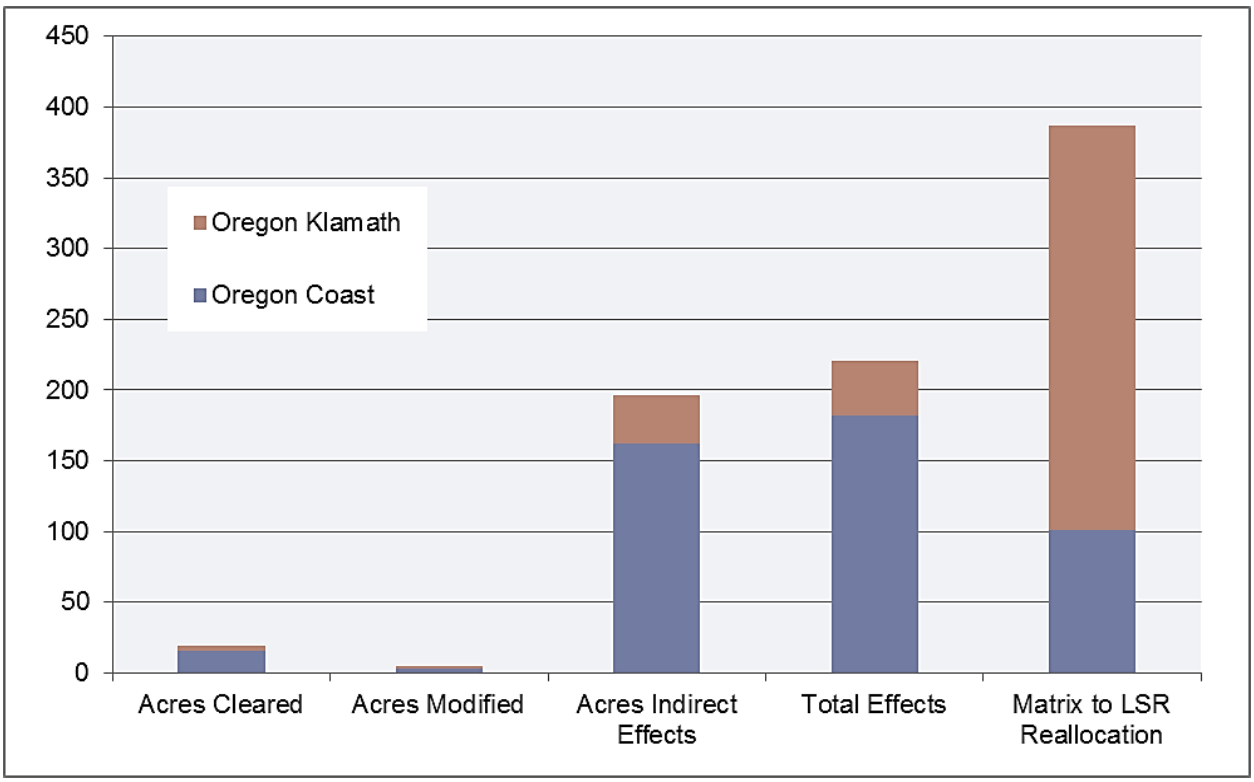

Figure 4.1-45. Comparison of Total LSOG Habitat Acres in Occupied MAMU Stands Affected by the Pacific Connector Pipeline Project and Acres of LSOG Habitat in the Matrix to LSR Reallocation by Province

Approximately two-thirds of the higher suitability nesting habitat for MAMU within the NWFP area occurs on federal lands. Almost 90 percent of that habitat on federal land is protected under various reserve allocations. Based on monitoring data, the rate of loss of higher suitability habitat on reserved lands has been about 3.0 percent over the 10-year period from 1996 to 2006, with most of the loss due to wildfire, especially in Oregon. In the Oregon Coast Range Province, the loss of higher suitability habitat in federal reserves over the same period was approximately 2.4 percent (Raphael et al. 2011). The 2011 MAMU monitoring report found that fire was the major cause of loss of nesting habitat on federal lands since the LMP was implemented and that MAMU population size is strongly and positively correlated with the amount of nesting habitat, suggesting

that conservation of remaining nesting habitat and restoration of currently unsuitable habitat is key to MAMU recovery (Raphael et al. 2011).

The proposed LMP amendments and off-site mitigation actions proposed by the BLM are consistent with the findings in the 2011 MAMU monitoring report. The LMP amendments have been designed to increase the overall acres of LSOG habitat within LSRs and a portion of the Matrix to LSR reallocation is in an area that contains a high concentration of occupied MAMU stands. The 387 acres of Matrix proposed for reallocation to LSR 261 on the Coos Bay District is all within MAMU Zone 1 and in the immediate vicinity of the occupied MAMU stands that would be affected by the Pacific Connector pipeline (see figure 4.1-12 above). The total amount of acres proposed for designation to mapped LSR 261 on the Coos Bay District is about 998 acres, with a large portion of this area (approximately 611 acres) containing occupied MAMU stands. Although this MAMU habitat is currently protected by the management direction in the Coos Bay RMP, designating it as part of LSR 261 would provide additional protections and benefits for MAMU. The additional protection would result from the area being protected, not just because of the existing MAMU occupation but as a land allocation dedicated to the management of late-successional habitat. The additional benefits would result from the surrounding non-habitat areas being managed in the future to become LSOG habitat, thereby consolidating larger contiguous blocks of nesting habitat over time. This is consistent with the findings in the 2011 MAMU monitoring report of the need to protect existing nesting habitat and restore currently non-suitable habitat. The off-site mitigation actions (see section 2.1.4 of this EIS) have been designed to reduce the risk of loss of LSOG forest in occupied MAMU stands from wildfires. This is also consistent with the findings in the 2011 monitoring report that wildfire has been the major cause of the loss of nesting habitat since the NWFP was implemented.

Off-site Mitigation Actions and the Aquatic Conservation Strategy

The Pacific Connector Pipeline Project would cross 19 fifth-field watersheds on BLM and NFS lands. Sixteen of these watersheds are within the NWFP area and have federal lands that are subject to the ACS. A detailed analysis of consistency with the ACS for the Pacific Connector pipeline in each watershed is addressed in section 4.1.3.5 and in appendix J. Off-site mitigation measures that are a part of the proposed action (see table 2.1.4.3-1 for a complete list of actions) would help ensure that watershed function would be maintained or restored during construction and operation of the Pacific Connector pipeline as required by the ACS. These measures and how they address the nine ACS objectives are also considered in detail in section 4.1.3.5 and in appendix J. A number of these off-site mitigation actions have been designed to restore or improve aquatic conditions within Riparian Reserves. Proposed off-site mitigation actions that would occur within Riparian Reserves include:

- Approximately 85 miles of road decommissioning, of which approximately 14 miles are within Riparian Reserves. Decommissioning roads can substantially reduce sediment delivery to streams (Madej 2000; Keppeler et al. 2007). Proposed road decommissioning would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Pacific Connector pipeline would occur.
- Approximately 57 miles of road resurfacing, of which approximately 21 miles are within Riparian Reserves. Road surfacing reduces sediment by capping existing fine textured sediments in the running surface of a gravel road with coarser rock or by paving. Paving

all but eliminates traffic-generated sediments. Drainage repair reestablishes out-sloping, cross-drains and in some cases ditchlines to ditch-relief culverts. These actions have the effect of getting water off the road before it can enter streamcourses.

- Approximately 28 miles of instream LWD projects. Placement of LWD in streams adds structural complexity to aquatic systems by creating pools and riffles, trapping fine sediments, and can contribute to reductions in stream temperatures over time (Tippery et al. 2010).
- Thirteen fish passage culverts. Old culverts may block fish passage either by poor design or by failure over time. Removing these blockages and replacing them with fish-friendly designs can allow fish to access previously unavailable habitat.

The Pacific Connector Pipeline Project would impact approximately 5.2 miles of Riparian Reserve. A comparison of the miles of Riparian Reserves that would be impacted by the Pacific Connector pipeline and the miles of off-site mitigation actions within Riparian Reserves is displayed in table 4.1.3.7-18 and figure 4.1-46.

TABLE 4.1.3.7-18

Summary of Miles of Riparian Reserves Impacted by the Pacific Connector Pipeline Project and Proposed Off-site Mitigation Actions in Riparian Reserves on BLM and Forest Service Lands

BLM/Forest Service Management Unit	Riparian Reserves Impacted (miles)	LWD Placement in Streams (miles)	Road Decommissioning (miles)	Road Surfacing (miles) a/	Fish Passage Improvements (sites)	Other Treatments
Coos Bay District	1.6	8.6	0	3.6	0	
Roseburg District	0.4	5.0	0	3.5	5	Culvert replacement (2 sites)
Medford District	1.6	12.1	1.4	14.0	1	Road Storm-proofing
Lakeview District	0.1	0	0.2 b/	0	0	Riparian Vegetation (6 miles), Culvert Replacement (1 site)
Umpqua National Forest	0.8	0	0.5	0	7	Road Storm-proofing
Rogue River National Forest	0.2	1.5	6.7	0	0	Stream Crossing Repair (32 sites),
Winema National Forest	0.5	1.0	5.2	0	0	Riparian Planting (0.5 miles), Stream Crossing Repair (26 sites)
Totals	**5.2**	**28.2**	**14.0**	**21.1**	**14**	

a/ Estimate of miles based on number of stream intersects and a 600 ft. Riparian Reserve width.
b/ This is a road closure project.
Data source: BLM, Forest Service GIS Layers

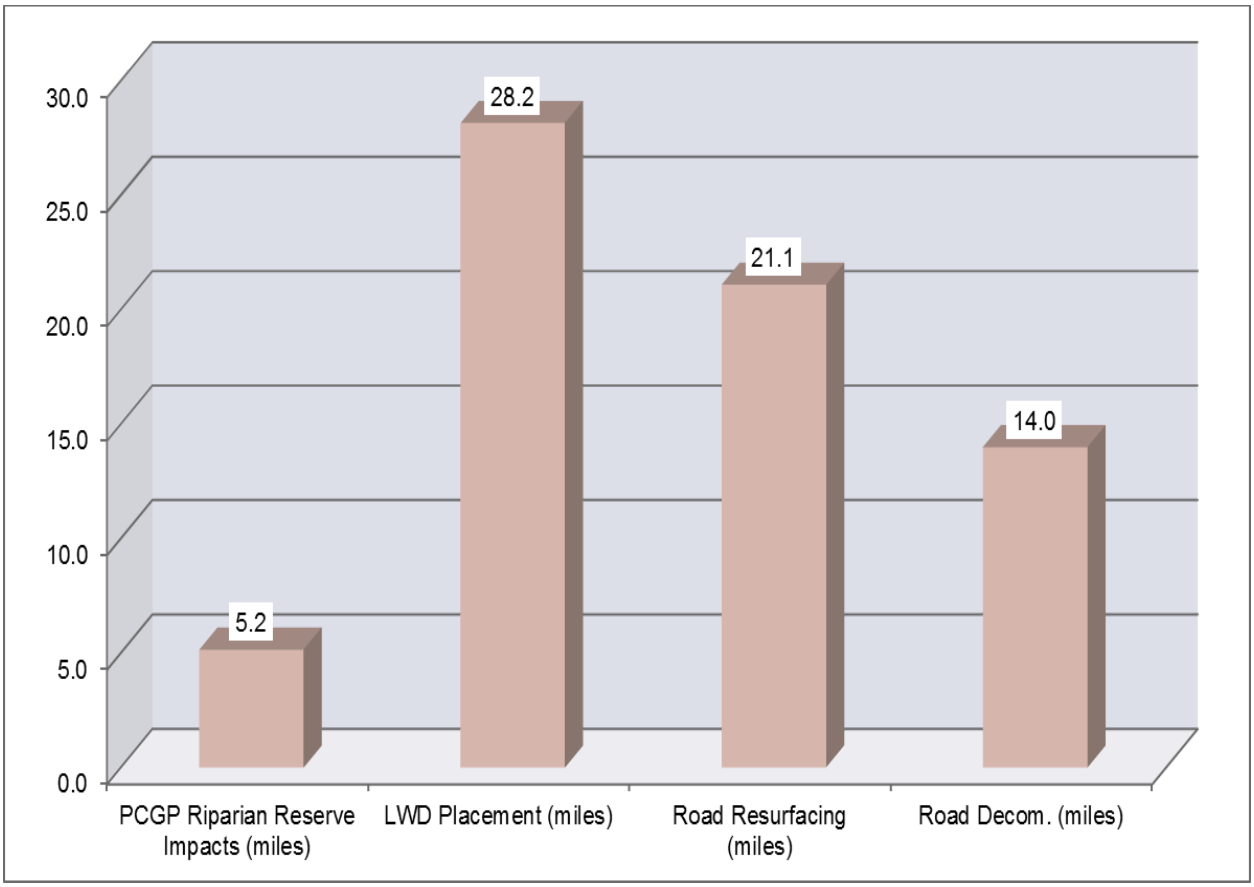

Figure 4.1-46. Comparison of Miles of Riparian Reserve Impacted by the Pacific Connector Pipeline Project and the Miles of Proposed Off-site Mitigation Actions within Riparian Reserves

The proposed mitigation actions would restore or improve approximately 12 miles of Riparian Reserves for every mile of Riparian Reserve that would be impacted by the Pacific Connector pipeline. With the proposed off-site mitigation actions and the on-site mitigation designed to minimize impacts to aquatic systems, watershed conditions on the affected BLM and Forest Service lands would be maintained or improved.

4.1.3.8 Connectivity/Diversity Blocks on BLM Lands

Within the Coos Bay District and Roseburg District BLM, Matrix lands are further segregated into General Forest Management Areas and Connectivity/Diversity Blocks. General Forest Management Areas are managed for multiple uses including commodity production. Connectivity/Diversity Blocks are managed to provide for habitat connectivity for old-growth dependent and associated species within the General Forest Management Area. Connectivity/Diversity Blocks are managed to maintain a minimum of 25 percent of each block in late successional condition both long term and short term. Late-successional stands within Riparian Reserves and other allocations contribute toward this percentage (BLM 1995b: 22; BLM 1995d: 152). Table 4.1.3.8-1 shows Connectivity/Diversity Blocks crossed by the Pacific Connector Pipeline Project on the Coos Bay and Roseburg Districts, BLM. Although the Pacific Connector pipeline would remove LSOG forest in all but one of the Connectivity/Diversity Blocks, table 4.1.3.8-1 shows that none of the blocks fall below the 25 percent LSOG threshold established

in the RMPs. There are no Connectivity/Diversity Blocks crossed on the Medford District or in the Klamath Falls Resource Area of the Lakeview District.

TABLE 4.1.3.8-1

Connectivity/Diversity Blocks Crossed by the Pacific Connector Pipeline Project, Coos Bay and Roseburg Districts, BLM

Milepost a/	BLM District	BLM Block No.	Acres b/	Acres > 80 Years of Age	Acres > 80 Years of Age Removed by ROW	Resulting Acres > 80 Years of Age	Resulting % Acres > 80 Years of Age
33.7-39.15	Coos Bay	CB-1	2,975	1,759	3	1,756	59.0
53.12-54.41	Roseburg	1	621	489	1	488	78.6
60.89-61.63	Roseburg	3	219	219	3	216	98.6
82.7-83.3	Roseburg	11	1,146	807	4	803	70.0
79.7-80.7	Roseburg	12	883	383	4	379	42.9
87.0-87.5	Roseburg	38	639	224	1	223	35.0
93.6-93.9	Roseburg	39	319	224	0	224	70.0

a/ Mileposts are approximate, may include private lands, and may not be continuous.
b/ Acres of late successional and old-growth (LSOG) forest in Coos Bay Block 1 are from the Big Creek Watershed Assessment (BLM 1995b: 97). Acres of LSOG in Roseburg Blocks are from GIS analysis in appendix R of this EIS.

4.2 GEOLOGICAL RESOURCES

The following section describes geological resources and potential impacts related to the various aspects of the Project, including the Jordan Cove LNG terminal and the Pacific Connector pipeline and associated facilities.

4.2.1 Jordan Cove LNG Terminal

4.2.1.1 Geologic Setting

The Jordan Cove LNG terminal would be within a parcel of currently vacant industrial zoned land that historically was part of the Henderson Ranch, but was known as the Ingram Yard when owned by the Menasha and Weyerhaeuser companies. The South Dunes Power Plant would be within a parcel that was historically part of the Jordan Ranch, and later was the site of a mill operated by the Menasha and Weyerhaeuser companies between 1961 and 2003. The mill complex has been dismantled. The geological settings for the LNG terminal, connecting utility corridor, and power plant are generally the same; on the bay side of the North Spit of Coos Bay.

The Jordan Cove LNG terminal is situated within the Pacific Border geomorphic province. The terminal would be located at the western edge of the coastal headlands of the central Coast Range, on the North Spit of Coos Bay, which marks the southern edge of the Coos Dune Sheet. A dune sheet is a dune field that is partially anchored by vegetation.

The terminal site is at the eastern edge of the CSZ, the active convergent plate boundary between the subducting Explorer, Juan de Fuca, and Gorda Plates and the overriding North America Plate. The tectonic regime has dominated the geologic evolution of the landscape in the Jordan Cove project area. The converging tectonic plates have resulted in the accretion of marine deltaic sediments and volcanic seamounts, referred to as the Siletzia terrane, to the western edge of the North American Plate (Heller and Ryberg 1983). Sediments derived from the ancestral Klamath Mountains became lithified into the bedrock units at the site (Beaulieu and Hughes 1975).

The LNG terminal site is underlain by loose to dense fill and a relatively clean fine grained sand which is in turn underlain by a weathered sandstone. Fill depths are typically 10 to 15 feet at the Ingram Yard and up to 25 feet at the mill site. The clean fine grained sand is a dune sand of Holocene and Pleistocene age (Peterson et al. 2005) with thicknesses of over 100 feet.

Bedrock underlies these sands and includes Eocene marine interbedded siltstones and sandstones of the Coaledo Formation (Baldwin et al. 1973). The upper member of the Coaledo Formation is composed of gray, coarse to fine-grained weathered, very dense, weakly cemented sandstone with silt and minor amounts of coal. Weathered sandstone is generally encountered beneath the dune sands to a depth of about 125 feet (GRI Geotechnical and Environmental Consultants [GRI] 2007a). The upper Coaledo Formation also underlies alluvial deposits in the Kentuck Slough.

Jordan Cove completed 11 deep borings GRI (2007a) at the location of the LNG storage tanks. These subsurface explorations identified sand extending to depths of 124 to 133 feet. Organic debris, shell fragments, and scattered wood were encountered at some of the borings at various depths within the sand. A 4-foot-thick layer of wood debris interpreted as a buried log was encountered at 35.5 feet in one of the borings. When encountered, the sandstone extended to maximum depths explored (ranging from 146.5 to 200.3 feet). Scattered wood debris was

encountered at a depth of 129 feet in one boring. Scattered low-grade coal was encountered below a depth of 155 feet in one boring (GRI 2007a). Organic mill waste was encountered in the fill at the ground surface at the Ingram Yard and also in several landfills in the vicinity of the mill site. A Black & Veatch report dated May 2, 2014, summarizes additional geotechnical subsurface investigations performed in 2012 and 2013 at the Jordan Cove site.

Jordan Cove conducted an overwater geophysical seismic reflection survey between the LNG terminal site and the Southwest Oregon Regional Airport located on the east side of Coos Bay navigation channel. The subsurface profile is shallow bedrock, which becomes progressively deeper toward Pony Slough (southeast of the airport), to a depth of approximately 150 feet below the bay floor (GRI 2007a).

Impacts to surface geology would be limited primarily to the construction phase of the LNG terminal, when the topographic features at specific locations on the site would be altered. Construction site preparation would require clearing and grading of the site to an approximate elevation of +30 feet in the LNG storage tank area and approximately +46 feet in the process areas. Individual excavations would be made for equipment foundations. Following completion of foundations, the site would be filled, compacted, and brought up to final grade. Final grading and landscaping would consist of gravel surfaced areas, asphalt surfaced areas, concrete paved surfaces, grass areas, and construction of the storm surge barrier.

Grading of the areas to be occupied by the terminal facilities would entail approximately 2.5 mcy of cut and fill. Any material remaining from that work, including final grading and landscaping, would be used to raise the elevation of the South Dunes Power Plant site and the access/utility corridor. No blasting would be required during any phase of construction of the LNG terminal because the entire site consists of unconsolidated material. Any shoreline areas disturbed by construction would be armored to protect against erosion or shifting beyond the Jordan Cove Project design limits. Construction of the slip and access channel would change the surface geology of the site as a result of excavation and dredging. See sections 2.1.1.3 and 2.1.1.12 of this EIS for additional discussion of dredging and dredged material disposal.

4.2.1.2 Mineral Resources

In 2008, the principal mineral production of Oregon in order of value was crushed stone, construction sand and gravel, Portland cement, diatomite, and crude perlite (USGS 2008). Crushed stone and construction sand and gravel continued to account for 73 percent of Oregon's total non-fuel mineral production value of $398 million.

Mineral resources available in Coos County, Oregon, include chromium, gold, clay, manganese, sand and gravel, silica, stone, and titanium. There are 11 producing mines within 5 miles of the LNG terminal. The closest mines are 1.3 miles to the southeast (a sand and gravel pit at the airport), and 1.5 miles to the northeast (Coos-Sand Corp.; silica, sand and gravel) (USGS 2004a, 2004b).

Coal was mined historically in Coos Bay, starting in 1855 until the early decades of the twentieth century. There were probably 40 coal mines in the field, with total production estimated at about 3 million tons by 1944 (Mason and Erwin 1955). Henry Haines was said to have discovered a coal mine at Glasgow in the late 1850s, but soon abandoned it (Dodge 1898). The closest major productive coal mine was known as the Libby, which operated until about 1920, located south of city of Coos Bay at the head of Coalbank Slough.

Based on studies of coal and natural gas resources in the Coos Bay area completed in the 1970s and 1980s (Newton 1980; Mason and Hughes 1975), coal may occur at depths within or below sandstone at the site. Natural gas may also occur at depth within the underlying sandstone. Initial exploratory tests (Sproule Associates, Inc. 2004, 2005, 2006) indicate a promising but unproven coal gas resource in the Coaledo coals of the basin. This prospect carries risk commensurate with an exploration play and could require several years to reach commerciality. Gas in place in Coos Bay is estimated to be 1,166 Bcf. The majority of the gas (93 percent) is held in the Lower Coaledo coals. There are no coal mines within 150 feet of the LNG terminal, and there are no operating oil and gas wells in proximity to the LNG terminal.

Construction and operation of the LNG terminal would not affect any known mineral resources or the recovery of any mineral resources. Nor would development of the site have any impacts on future oil and gas exploration or production elsewhere in the county.

4.2.1.3 Seismic-Related Hazards

Commenters expressed concerns over faults, ground shaking, and tsunamis associated with the CSZ. These issues are discussed in detail in the following paragraphs. Jordan Cove would be required to design the LNG terminal facilities to resist stringent natural hazard design conditions including earthquakes and tsunamis.

The primary geologic hazard for the LNG terminal is the CSZ, which can generate strong horizontal and vertical ground motions and tsunami waves. At its nearest point, the CSZ is located 13 kilometers (km) (8.0 miles) from the site. Over the past 170 years, the Coos Bay area has experienced moderate to low seismic activity within the active CSZ (Wong 2005). There have been no recent earthquakes of magnitudes greater than 3.0 on the Richter scale within a 50-km (31-mile) radius of the site. However, numerous earthquakes of magnitude 4.0 or greater have been historically recorded in or near western Oregon. An earthquake off the coast of Crescent City, California (275 km or 170 miles away) in 2005 with an estimated magnitude 7.0 and one off the coast of Newport, Oregon (105 km or 65 miles away) in 2004 with an magnitude of 4.9 were felt near the site (GRI 2013a). Geological evidence suggests that large megathrust earthquakes have also occurred along the CSZ during the Holocene epoch, prior to the written historical record.

Commenters have asked that the USGS paper 1661, which evaluates the repeatability of large earthquakes along the CSZ, be taken into consideration. This information has been incorporated into the 2014 USGS National Seismic Hazard maps that were released July 15, 2014. These maps indicate the probabilistic ground motion accelerations predicted at the Jordan Cove site have not increased significantly (less than 5 percent) compared to those provided in the 2008 USGS National Seismic Hazard maps.

Infrequent, but potentially large, earthquakes occur when the offshore boundary (the CSZ) between the Juan de Fuca and North American plates ruptures suddenly. Researchers believe that the last major earthquake occurred on January 26, 1700, and produced a tsunami that was recorded in Japan (Clague et al. 2000; Satake et al. 1996). This offshore earthquake is estimated to have been a magnitude 9.0 event. In addition to intense, long-duration ground shaking, these earthquakes resulted in up to about 3 feet of vertical ground subsidence locally along Oregon

coastal areas near the offshore fault rupture zone (Peterson et al. 1997; Leonard et al. 2004). They can also result in coastal subsidence and tsunamis that can impact low-lying coastal areas.

Geological studies indicate that megathrust earthquakes have occurred numerous times in pre-history (Nelson et al. 2006). The recurrence interval between megathrust events has been irregular and ranges from about 100 to 1,000 years (Atwater and Hemphill-Haley 1997). Typical recurrence intervals are thought to be on the order of 400 to 600 years (Clague et al. 2000). Recent work by Goldfinger et al. (2012) suggests that while the average recurrence interval for full-margin Cascadia events is 520 years, the southern Cascadia margin has a repeat time of 220 years.

Another seismic source significant to the Jordan Cove site is the Blanco Transform Fault Zone. The Blanco Transform Fault Zone is an ocean transform fault related to the movement of tectonic plates that begins about 100 miles off of Cape Blanco (approximately 25 miles south of Coos Bay) and extends in a northwest direction to about 300 miles off of Newport, Oregon. During the past 40 years, approximately 1,500 earthquakes of magnitude 4.0 or greater and many thousands of smaller earthquakes have occurred along this fault zone. Only the largest of these earthquakes are detectable by land-based seismographs along the Oregon coast. The risk of a major tsunami from an earthquake in the Blanco Transform Fault Zone is low because the tectonic plates slip laterally with little vertical displacement of the ocean floor (Zhang 2008).

Through consultation with DOGAMI, 11 faults located within 150 km (93 miles) of the LNG terminal were treated as individual seismic sources in the seismic hazard model in the Site-Specific Seismic Hazard Study (GRI 2014). The 3 closest faults are the CSZ (13 km or 8 miles), the South Slough (16 km or 10 miles), and the Coquille Anticline (30 km or 18.6 miles). There are 3 faults within 67 km (41.6 miles) of the site, and 5 within 133 km (82.6 miles) of the site. The CSZ, a megathrust fault, has the greatest potential maximum moment magnitude (Mw) of 8.3 to 9.0. The estimated maximum potential Mw of the other faults range from 6.3 to 7.7 (GRI 2014).

Briggs (1994) indicated the possibility of a Holocene-active fault located in Pony Slough, immediately southeast of the LNG terminal site. However, the seismic reflection profile obtained specifically for the Jordan Cove terminal did not indicate the presence of a fault either at Pony Slough or across the bay from the Jordan Cove terminal (GRI 2013b; Madin 2006).

As further discussed below, Jordan Cove would design and construct its facilities in a manner that takes geological conditions into consideration. This includes implementing site-specific measures during site preparation and construction of structural foundations that are capable of resisting severe earthquake ground motions and associated ground deformations.

Soil Liquefaction and Lateral Spreading

Loose to medium dense sands and some softer, low-plasticity, fine-grained soils (such as sandy silts) can experience increased pore water pressure during an earthquake if saturated and subject to cyclic shear stresses of a sufficient magnitude and duration. Under certain conditions, the material would lose most of its shear strength and deform as a viscous fluid (complete liquefaction). Lateral spreading involves lateral displacement of large, surficial blocks of soil as a result of liquefaction of a saturated surface layer and can develop in gentle slopes and move toward a free face, such as a river channel. Displacement occurs in response to the combination of gravitational forces and inertial forces generated by an earthquake. Where a free face exists,

the loose saturated fill soils encountered at depths of about 10 to 25 feet may be susceptible to lateral spreading.

The majority of the sandy soils encountered below the fill at the LNG terminal site are dense enough to resist liquefaction during design-level earthquakes. Analyses indicate the potential for liquefaction in a relatively consistent zone below the water table in the upper 15 feet of the soil profile corresponding to historical fill. Liquefaction is also predicted at depths ranging from 25 to 45 feet in zones that do not appear to be continuous across the site. Of these liquefiable zones, the majority of the predicted liquefaction would occur at depths of 30 to 40 feet (Black & Veatch 2014). Based on the liquefaction analysis performed by B&V, the existing soils at the Jordan Cove site have the potential to experience liquefaction settlements for a Safe Shutdown Earthquake event range between 0.4 and 7.4 inches depending on location, with the largest settlements occurring at the shoreline. Lateral spreading displacements for existing soils at LNG terminal site range between 0 and 39 inches depending on location again with large settlements occurring at the shoreline. Lateral spreading displacements for existing soils at the South Dunes Power Plant site range between 0.8 and 19 inches depending on location if subjected Safe Shutdown Earthquake level ground motions (Black & Veatch 2014) with the largest settlements occurring at the shoreline.

We received comments on the DEIS on soil liquefaction at the LNG terminal and South Dunes site. Liquefaction/lateral spread mitigation would consist of ground improvement by vibro-compaction using on-site sand. The goal of vibro-compaction is to densify the in-place sand by imparting vibrations to the ground using a downhole vibrator (vibroflot). The vibroflot is jetted to the depth of interest using water and/or air and then clean sand flows from shallow to greater depths, and the sand is compacted. As the vibroflot is withdrawn further compaction is performed, and sand is typically placed at the ground surface to supply material to flow down around the vibroflot.

Vibro-compaction would be implemented using regular 7-foot by 7-foot and 9-foot by 9-foot patterns. The 7-foot by 7-foot pattern is planned for areas where Seismic Category I structures are located at the LNG terminal site, while for areas where Seismic Category II and III structures are located a 9-foot by 9-foot pattern is planned. Vibro-compaction is planned to the bottom of the liquefiable soils, which is at approximately elevation -30 feet at the LNG terminal site, and elevation -20 feet at the South Dunes Power Plant site and along the utility corridor.

Following ground improvement, testing consisting of cone penetrometer soundings would be performed to confirm the required soil consistency was achieved. To provide adequate structure support, ground improvement for liquefaction mitigation would extend a distance of approximately 30 feet from the outside edge of foundations. Similar to the other facilities on the North Spit, the risk of liquefaction at the Highway 101–Trans-Pacific Parkway interchange site is most significant to depths of about 25 feet, and denser materials were encountered below this depth. In addition, the existing Highway 101–Trans-Pacific Parkway intersection embankments are susceptible to lateral spreading displacements during a design-level earthquake. The proposed improvements at the Highway 101–Trans-Pacific Parkway intersection would be constructed to meet the Oregon Department of Transportation (ODOT) seismic design requirements considering liquefaction and lateral spreading.

The explorations completed at the Kentuck Slough wetland mitigation site encountered soft and loose alluvial soils to depths of about 100 feet in some areas. The loose sand and low plasticity silts encountered are susceptible to liquefaction. The higher plasticity silts and clays encountered are not liquefiable. As no permanent facilities are proposed at the mitigation site, there would be no appreciable impacts from liquefaction at that site.

Subsidence

Modeling of megathrust earthquake ruptures on the CSZ indicates sequences of interseismic uplift and coseismic coastal subsidence. The predictions for coastal subsidence are locally constrained by features such as submerged trees and buried intertidal marshes interpreted to be associated with the 1700 CSZ earthquake. This repeated coastal subsidence pattern has been documented along the length of the CSZ (Atwater et al. 1995; Clague 1997; Goldfinger 2003). Leonard et al. (2004) presents profiles of coastal deformations from Northern California to Southern Canada based on this geologic information. The subsidence information indicates the largest coastal subsidence of 3 to 6 feet occurred in Northern Oregon and Southern Washington with subsidence ranging from 0 to 3 feet elsewhere. Leonard et al. (2004) estimated an average of 2 feet of coseismic subsidence occurred in this area during the 1700 earthquake. Leonard et al. (2004) also estimated the coseismic subsidence in the Coos Bay areas would range from 0 to about 5 feet during a future 8 to 9 magnitude megathrust earthquake located along this portion of the CSZ.

Subsidence estimates for the area have been updated as part of the recent tsunami modeling completed for the southern Oregon coast (Witter et al. 2011) and site-specific modeling completed for the Jordan Cove Project (CHE 2013a). These studies indicate the maximum subsidence at the LNG terminal project site for the specified Design Tsunami Earthquake event occurring on the CSZ is on the order of 7.6 feet.[36]

Tsunami Hazards

The west coast of the United States has historically been subject to minor inundation from tsunamis generated by distant earthquakes in South America, Alaska, and Japan. Kelsey et al. (2005) noted that tsunamis generated from these distant subduction zone earthquakes have minor inundation effects because of the long diagonal approach of tsunami waves to the west coast from these sources. Based on this explanation, observations made around the Indian Ocean following the 2004 megathrust Sumatran earthquake, and recent modeling (DOGAMI 2012a) indicate a tsunami generated by a megathrust earthquake on the CSZ would present the greatest tsunami inundation risk at the LNG terminal site.

The impacts and hazards of tsunamis to an industrialized area were well illustrated during the 2011 Tohoku, Japan, earthquake. This tsunami was generated by an offshore subduction zone earthquake; subsidence occurred and increased the tsunami impacts significantly in some areas. Because similar earthquake and subsidence are of concern off of the Oregon coast, the lessons learned from this earthquake regarding subsidence, runup, scour, and foundation performance, provide a useful case history for evaluating hazards at the LNG terminal site.

[36] Provided in Jordan Cove's 2nd Supplemental Response to the FERC staff's Environmental Information Request dated August 9, 2013, filed with the FERC on October 1, 2013.

DOGAMI produced tsunami hazard maps for a tsunami generated by a megathrust earthquake on the CSZ for most of the Oregon coast in 1995 (Priest 1995), 2002 (Priest et al. 2002), and in 2012 (DOGAMI 2012a). All studies include runup scenarios that vary wave height and coseismic subsidence. The 1995 and 2012 maps are included in the site-specific seismic hazard study conducted by GRI (Zhang 2012; CHE 2013a).

Witter et al. (2011) recommend utilizing the most likely tsunami scenario (M1) or the large splay fault scenario (L1), which encompasses 80 to 95 percent of the hazard, for land use planning and future revisions to the building code along the Oregon coast. For the Jordan Cove Project, a tsunami modeling study was performed (CHE 2013a) for the same seismic source event as was used to determine the Safe Shutdown Earthquake hazard (which has a 2,475-year return period). Predictions concerning the amount of sea level change along the Oregon coast vary; sea level is predicted to decrease in some areas on the coast, primarily due to tectonic rise along the coast (CHE 2014). A National Research Council report (2012) concluded that "for the Washington, Oregon, and California coasts north of Cape Mendocino, sea level is projected to rise 24 inches over the next century." This sea level rise is countered by an estimated tectonic uplift of from about 6 to 20 inches along the coast over the next 100 years. Therefore, sea level change was not used as a factor in the tsunami modeling study. The results of the study, provided below, indicate that the LNG terminal facilities, including protective tsunami berms, are at elevations that exceed the design-level tsunami run-up levels.

The Kentuck Slough wetland mitigation site is frequently underwater during wet portions of the year, and the 2012 DOGAMI mapping confirms it is located within the estimated tsunami inundation zone. As no permanent facilities are proposed at the mitigation site, there would be no appreciable impacts from tsunami inundation at the Kentuck Slough wetland mitigation site. The existing Highway 101–Trans-Pacific Parkway interchange is also located in the tsunami inundation zone.

Given the uncertainty associated with tsunami hazards at the LNG terminal site, Jordan Cove has included in its design barriers surrounding the LNG storage tanks. The LNG storage tanks would be located within an area enclosed by a tsunami barrier with a peak crest elevation of +60 feet and base elevation of the LNG storage tanks would be at elevation +30 feet. The barrier is proposed to be constructed of compacted, dense sand. In the event that it is determined through consultation with DOGAMI, that a more robust interior barrier core is required, cement treated sands would be considered for barrier construction. The design-level tsunami is based on a 2,475-year return period event (including tidal effects, subsidence, and a 1.3 increase factor to account for modeling uncertainties), which has a peak run-up elevation of +32.6 feet (this effective elevation value includes +7.6 feet of co-seismic subsidence). A 2,475-year return period event is same event that is used to determine the Safe Shutdown Earthquake motion used for the design of the most critical LNG facilities. The tsunami barrier also serves as a containment basin that has sufficient volume to contain the contents of one 160,000 m^3 LNG storage tank. The barrier and the elevation of the LNG storage tanks, as well as the minimum +46 feet elevation for all LNG terminal process facilities, including the South Dunes Power Plant, have been designed to meet the recently revised state guidelines for protection from anticipated storm surges and tsunami inundation. The elevation of the access corridor and the South Dunes Power Plant would be raised to about +46 feet, which is above the design-level tsunami run-up elevation. The extent of potential wave action from a tsunami on the western

tsunami berm is considered minimal due to the relative elevations of the maximum wave heights in relation to the berm protection height.

For the berm slopes subject to the design-level tsunami, erosion control measures and wave runup protection would be used. Slopes would be protected against tsunami runup using cement treatment, concrete cellular mattresses, grout-injected geotextile fabric mattresses (fabriform), or other suitable means as determined during detailed design. The erosion control measures would be designed in accordance with the ODOT Erosion Control Manual, where applicable.

Jordan Cove's tsunami model assumes that structures (e.g., jetties, barriers, dunes) would remain immobile throughout the tsunami event. Design of the barrier wall considers the effects of tsunami waves, including scour and deposition in the path of the scenario tsunamis, flow velocities, any highly probable impact loads from potential floating objects including adrift vessels and barges, breaking waves, prolonged inundation, and the effects of tectonic subsidence (prolonged changes in tidal elevation inherent in the earthquake source scenarios used for tsunami generation).

Based upon the Jordan Cove tsunami study performed for the Project, the first tsunami wave would arrive at the beach approximately 20 minutes after the a major CSZ earthquake occurs. It would reach the Jordan Cove LNG terminal location about 5 minutes later. Maximum inundation near the site would occur about 40 minutes after the earthquake, and the second tsunami wave would arrive about 55 minutes after the earthquake, and would compound on the retreating water from the first wave in some places. The third wave would arrive about 72 minutes after the earthquake, but would be substantially smaller than the first two. The model predicts that modifying the landscape for the LNG terminal would result in slightly smaller waves and less water spilling into the Henderson Marsh. Construction of the slip would result in some localized wave patterns. According to geologists researching tsunami hazards in southern Oregon (including Dr. George Priest), the most critical work to ensure public safety related to tsunamis is to provide accurate maps of the tsunami danger zone and educate the public on what to do when they feel a big earthquake (The Oregonian 2008). The major shaking from the earthquake would be the clearest warning of an approaching tsunami.

We received comments regarding concerns over potential tsunami impacts on LNG vessels at the terminal. There are two tsunami scenarios to address. The first scenario would be a distant earthquake event in Alaska or Japan that would result in a tsunami with a relatively long lead time (12 to 24 hours) before reaching the Oregon Coast. Coast Guard policies would prohibit ships from entering Coos Bay until after the tsunami arrival period. All ships in Coos Bay, including the LNG vessel, would be directed to depart the harbor. LNG vessels at the terminal would face the bay and would be manned with the power on when berthed. Therefore, the LNG vessels could depart quickly from the Jordan Cove terminal in the event of a distant tsunami and in response to notice and instructions from the Coast Guard.

The second scenario involves a large earthquake capable of generating a tsunami from the nearby CSZ. It is calculated that it would take approximately 20 to 25 minutes for a large tsunami generated from the CSZ to reach Coos Bay after the earthquake event occurs, which would provide time for LNG vessels to disconnect from the berth and to reconnect with the tug boats. The tethered LNG vessel and the three tug boats would hold their position under power to offset the advancing wave and currents. The tsunami wave is predicted to impact the bow of the ship

head on. If the LNG vessel is traversing the channel during the tsunami, the tugs would also provide assistance as described above. The Emergency Planning and Response Team for Jordan Cove, which comprises numerous agencies, including the Coast Guard, ODE, Oregon Fire Marshall, Oregon Marine Board, police and sheriff departments, fire departments, and Jordan Cove experts, has reviewed and approved the LNG vessel procedures for dealing with a potential tsunami.

Another commenter stated that the area west of the terminal is low lying and could be swamped by a potential tsunami wave. The area west by northwest of the Jordan Cove terminal and parallel to the shoreline is a high dune that provides considerable protection from a direct tsunami wave inundation. A commenter indicated concerns that the predicted tsunami wave height may not be accurate, and therefore the LNG terminal would be at risk from inundation by a potential tsunami wave. State-of-the-art hydrodynamic modeling studies have been performed for an earthquake on the CSZ with a return period of 2,475 years. As indicated above, this is the same return period criteria used to define the Safe Shutdown Earthquake, which is used for the design of critical LNG facilities. These studies predict that the maximum elevation of a potential tsunami wave at the location of Jordan Cove's LNG terminal would be +32.6 feet (this elevation includes +7.6 feet for co-seismic subsidence) and includes a 1.3 factor to account for modeling uncertainties. The crest elevation of the berm surrounding the LNG storage tanks at the terminal would be +60 feet, and the grade elevation of the liquefaction processing area at the terminal would be +46 feet. Therefore, Jordan Cove's LNG terminal would be protected and should be able to safely handle the design tsunami event.

A comparison was made by a commenter to the 2011 Tohoku earthquake in Japan. The most likely cause of tsunamis at the Jordan Cove site would be earthquakes caused by vertical offsets along the CSZ, which are of the same type of offsets that triggered the tsunamis from the 2011 Tohoku earthquake. The offsets selected for determining the design tsunami are consistent with the maximum considered earthquake magnitudes predicted for the CSZ by the USGS and the associated vertical offsets predicted by DOGAMI. The tsunami generated by 2011 Tokohu earthquake did cause damage to one LNG terminal in Japan (the Minato Gas Plant). The low-lying LNG terminal is located in Sendai and was not well protected from tsunami inundation. Even though it was subjected to inundation depths of 4 meters, there was no damage to the LNG tanks, no release of LNG or any safety hazard was reported as result of the tsunami. However, there was operational damage to piping, buildings, pipe supports, and electrical systems and it took a year to bring the plant back into service. Based on observations, the Japanese recommend the LNG plants be either be elevated above tsunami elevation levels or be protected adequately by berms. The Jordan Cove LNG terminal would be both elevated and well protected by tsunami berms. We therefore conclude that the site-specific tsunami studies, coupled with Jordan Cove's proposed mitigation measures, indicate that the site is not unsuitable because of tsunami hazards.

Volcanic Hazards

The terminal site is over 100 miles west of the nearest volcanic hazard area. Although a future eruption of the Mt. Mazama volcano is possible, the terminal site would not be directly affected by the various types of volcanic eruption hazards at this distance (USGS 1997). It is noted that volcanic ash clouds can affect the atmosphere over much larger areas, but such clouds would not impact the terminal infrastructure.

4.2.1.4 Site-Specific Geotechnical Investigation and Seismic Hazard Analysis

Geotechnical Site Characterization

The LNG terminal site is relatively flat and ranges in elevation from +20 feet to +50 feet. Groundwater levels range between 9 and 13 feet below the ground surface. A number of geotechnical investigations were performed at the site between 2005 and 2014 and are summarized in table 4.2.1.4-1. The results of a previous investigation at the site performed in 1997 were also used.

TABLE 4.2.1.4-1

Summary of Geotechnical Investigations for the Jordan Cove Project

Year Borings Performed	Company	Appendix	Borings (number)	CPTs (number)	Notes
1997	GRI	D	B-1 through B-6 (6)	None	GRI Report (2007a,b, 2013a,b)
2005	GRI	A	B-7 through B-17 (11)	C-7, C-8, and C-13 (3)	GRI Report (2007a,b, 2013a,b)
2005	GRI	B	B-4, B-5, B-6 (3)	C-2, C-20, C-24, C-25, C-26 (5)	GRI Report (2007a,b, 2013a,b)
2005	GRI	C	B-1 through B-8 (8)	None	Data Only
2006	Insitu-Tech.	E	Five Borings for Pressuremeter Testing (5)	None	GRI Report (2007a,b, 2013a,b)
2012	GRI	J.2	B-1 through B-12 (12)	None	Power Plant Area, Data Report Only (Nov. 2012)
2013	GRI / Black & Veatch	6.16-1	BVV-101 through BVB-162 (71)	BVS-101 through BVS 156 (55)	GRI Report (2014), Data Only
		Total:	**116**	**63**	

CPT – cone penetration test

A total of 116 borings were drilled at the site to depths ranging from 30 feet to 296.5 feet. In addition, the investigations included 63 cone penetration tests to depths ranging from 24 feet to 78.6 feet, pressure-meter tests, 17 test pits to depths of 12.5 feet, shear wave velocity measurements to depths of 296 feet, piezometers, infiltration tests, and a pump test.

Based on subsurface investigations performed by GRI (2013b, 2014), the subsurface of the Jordan Cove LNG terminal site is typically mantled with relatively clean, fine-grained sand to the maximum depth of 296 ft explored. Boring data indicate that the upper 10 to 15 feet of the sand deposit is loose to medium dense fill with standard penetration blow counts ranging from less than 5 to 20. In some areas, the thickness of the fill soils is as much as 25 feet. However, the transition to the underlying dune sand was indiscernible based on visual observation. The sand typically contains a trace of silt and is brown near the ground surface and transitions to gray below depths of 27 to 50 feet. Below the fill, the sand ranges from medium dense to very dense with standard penetrometer test blow counts ranging from 20 to 50+ or refusal. Some logs characterize the very dense sand below a depth of 125 feet as weathered sandstone, while other logs characterize the same material as very dense sand, weakly cemented. Isolated zones of shells, organic material, coal seams are present within the profile. Below a depth of about 15 feet, the cone tip resistance ranges from about 100 tons per square foot to more than 300 tons per square foot.

Liquefaction analyses performed by GRI have identified two potential zones where limited liquefaction may occur at the site: (1) saturated sand between the depths of 10 and 15 feet below

ground surface (bgs) corresponding to historical fill and (2) discontinuous sand lenses between depths of 25 feet and 45 feet. Estimated liquefaction settlements of the existing unimproved LNG terminal site ranged between 0.4 and 7.6 inches depending on location, with the largest settlement occurring at the shoreline.

The measured shear velocity (V_s), in feet per second (fps), of the soil profile was as follows:

- 0 to 35 feet bgs V_s = 650 fps
- 35 to 75 feet bgs V_s = 750 fps
- 75 to 115 feet bgs V_s = 1050 fps
- 115-180 feet bgs V_s = 1500 fps
- 180-250 feet bgs V_s = 2000 fps
- Below 250 bgs V_s = 2900 fps

The average shear wave velocity in the upper 100 feet of the soil profile is about 750 fps. This shear wave velocity along with the observation that the soil profile is very dense sand characterizes the area as Site Classification D in accordance with the provisions of the 2009 IBC (2010 Oregon Structural Specialty Code) and ASCE 7-05.

Controlling Seismic Events

Based on deaggregation of seismic sources from the GRI Probabilistic Seismic Hazard Analysis (PSHA), the controlling seismic source is a megathrust earthquake occurring on the CSZ. The Jordan Cove LNG terminal is located 13 km (8.0 miles) from the CSZ at its nearest point. In its PSHA, GRI has considered two different scenario events for the CSZ megathrust earthquake. These are a megathrust earthquake with a moment magnitude of 8.3 and a megathrust earthquake with a moment magnitude of 9.0. Both scenario events are given an equal weighting in the PSHA. The CSZ also is the controlling seismic source for tsunamis, which is a significant hazard for the site.

Design Ground Motions

Design ground motions for the terminal site were determined based on site-specific seismic hazard analysis prepared for the LNG terminal by GRI in accordance with requirements of NFPA 59A-2006 and the 2010 Oregon Structural Specialty Code (2009 IBC). The design ground motions for the LNG terminal recommended by GRI are as follows:

- The site-specific Maximum Considered Earthquake (MCE) ground motion parameters based on site response analysis are S_{MS} = 1.50g and S_{M1} = 1.50g. The site-specific MCE peak horizontal ground acceleration based on site response analysis is 0.48g.
- The site-specific Design Earthquake (DE) ground motion parameters adjusted for site effects (which are two-thirds of the MCE value adjusted for site effects) are S_{DS} = 1.00g and S_{D1} = 1.00g. The site-specific DE peak horizontal ground acceleration is 0.32g.
- The Operating Basis Earthquake (OBE) was taken as the earthquake ground motion having a probability of exceedance of 10 percent in 50 years (Return Period = 475 years). The GRI-recommended site-specific OBE design ground motion response spectra at the ground's surface has a peak horizontal ground acceleration (i.e., zero period acceleration) based on site response analysis of 0.27g. The peak site-specific vertical OBE design surface acceleration is 0.30g.

- The Safe Shutdown Earthquake (SSE) was taken by GRI as equal to an earthquake motion that has a probability of exceedance of 2 percent in 50 years (Return Period = 2,475 years), in accordance with NFPA-59A-2006. The GRI-recommended site-specific SSE design ground motion response spectra has an SSE peak horizontal ground acceleration at the ground surface of 0.48g. The vertical SSE design ground motion has a peak vertical ground surface acceleration of 0.53g. The GRI site-specific hazard analysis satisfied the ground motion criteria provided in NFPA 59A-2006.

Proposed/Necessary Site Improvements

The LNG terminal site would undergo extensive earthwork. Some commenters expressed concern that the facility would not be founded on stable ground. This concern is addressed below in the following paragraphs.

The cut and fill for the LNG terminal is largely balanced for the movements of the materials from the LNG slip, the leveling of the LNG terminal site, and placement on the South Dunes Power Plant site (see table 4.2.1.4-2). However, approximately 60,000 cy of sand materials would be transported via trucks from the LNG terminal site to the Kentuck Slough wetland mitigation site for creation of the estuarine wetland. This fill is necessary to establish the appropriate vertical profile to establish tidelands influenced habitat once the dike protecting the existing Kentuck golf course is breached. For additional information regarding the Kentuck Slough wetland mitigation site, see discussion in sections 2.1.1.12 and 4.4.3 of this EIS.

TABLE 4.2.1.4-2

Cut/Fill Quantities

Area	Cut (CY)	Fill (CY)
LNG Storage Tank and Storm Barrier area	None	1,500,000
Liquefaction Process Area	1,100,000	440,000
Marine Slip – Land-based excavation	2,300,000	520,000
Marine Slip – Dredging	1,500,000	1,500,000
Access Channel – Dredging	1,300,000	0
Removal of Earthen Berm Between Slip and Channel – Dredging	500,000	0
Access Road /Utility Corridor	5,000	90,000
Kentuck Slough Filling	0	60,000
Southwest Oregon Regional Safety Center Filling	0	245,000
South Dunes Power Plant Filling – from Slip via Trucks and Slurry Line	0	3,500,000
TOTAL	**6,755,000**	**6,755,000**

The LNG storage tanks would be supported on mat foundations. Buildings, process equipment, and pipe rack foundations would be supported with drilled pier foundations, spread footings, or mats. GRI has recommended that where mat foundations are used, the shallow upper zone of the site soils be improved to mitigate the potential for seismic soil liquefaction. Where necessary, Jordan Cove is currently proposing to utilize dynamic compaction and/or roller recompaction to improve the shallow zones and compaction grouting for the deeper zones. Final design decisions for foundation improvements would be done during detailed engineering and submitted to the FERC for review prior to permitting construction to proceed.

Proposed Foundation Design

The grade elevation in the LNG storage tank area is currently proposed to be +30 feet. The existing grade in this area is about elevation 20 feet; therefore, about 10 feet of compacted fill would be placed to achieve the finished grade in the tank area. Significant cuts of up to 15 to 20 feet would be required in the liquefaction process area. The tsunami barrier would be designed to contain the contents of one 160,000 m^3 LNG storage tank. The barrier and the elevation of the LNG storage tanks, as well as the minimum +46 feet elevation for all LNG terminal process facilities, including the South Dunes Power Plant, have been designed to meet the recently revised state guidelines for protection from anticipated storm surges and tsunami inundation. The elevation of the access corridor and the South Dunes Power Plant would also be raised to about +46 feet. The new slip would be created from an existing upland area. The inside dimensions at the toe of the slope of the slip measure approximately 800 feet along the north boundary and approximately 1,500 feet and 1,200 feet along the western and eastern boundaries, respectively. The minimum water depth within the slip is -45 feet NAVD88. The northern side slope is anticipated to be initially constructed at 3H:1V, and the top of the slope is proposed at elevation +25 feet NAVD88. The eastern side of the slip would be used for an LNG berth, and the northern end would be used for a tractor tug dock (figure 1.1-1).

The LNG tank structures would be supported on a mat foundation, which would be base isolated with a Friction Pendulum bearing system. The base isolators would be located between concrete slabs with a thickness of about 2.6 feet each. The top of the lower concrete slab would be founded at about elevation +30 feet. Buildings, process equipment, and pipe rack foundations would be supported with drilled pier foundations, spread footings or mats founded on improved subgrade. Conditions are provided and included as part of this FEIS that assure that final foundation designs would satisfy both the FERC Seismic Guidelines and the 2010 Oregon Structural Safety Specialty Code.

The design of the facility is currently at the FEED level of completion. Jordan Cove has proposed a feasible design and it has committed to conducting a significant amount of detailed design work for the terminal if the Project is authorized by the Commission. Information regarding the development of the final design, as detailed below, would need to be reviewed by FERC staff in order to ensure that the final design addresses the requirements identified in the FEED. Further, the timing of the production of this information should occur as indicated below. Therefore, **we recommend that:**

- **<u>Prior to commencing final design of the LNG terminal</u>, Jordan Cove should file with the Secretary, stamped and sealed by the professional engineer-of-record registered in Oregon, the following:**
    - **a. final geotechnical investigations necessary to support all final foundation designs in satisfying the criteria stated in the application and subsequent data request responses. These investigations would include how the identified potential zones of liquefaction at the terminal site would be mitigated and the details of the liquefaction mitigation method(s), procedures, plan extent, and verification methods proposed to verify mitigation of liquefaction potential;**

b. **detailed calculations of seismic slope stability and lateral movements anticipated after the liquefaction mitigation is implemented to verify the stability of critical structures for the LNG terminal design earthquake motions;**

c. **final foundation design recommendations, including foundation design and/or liquefaction mitigation measures for all structures including the LNG storage tanks;**

d. **final Seismic Design Criteria for all Seismic Design Category I and II structures, systems, and components that satisfy the criteria stated in the application and subsequent data request responses;**

e. **a final list of Seismic Category assignments for all structures, systems, and components; and**

f. **final Quality Control and Quality Assurance procedures to be used for design.**

- **<u>Prior to commencing with procurement, fabrication, or construction of the LNG terminal</u>, Jordan Cove should file with the Secretary, stamped and sealed by the professional engineer-of-record registered in Oregon, the following information:**

  a. **final seismic specifications to be used in conjunction with the procuring Seismic Design Category I and II equipment;**

  b. **site preparation drawings and specifications;**

  c. **final and construction documents (drawings, calculations, specifications, etc.) for Seismic Category I and II structures, systems and components including the LNG tanks and Seismic Isolation Design Review Report; and**

  d. **final Quality Control and Quality Assurance procedures to be used for procurement, fabrication and construction.**

The Seismic Isolation system for the LNG storage tanks should comply with the design, analysis, and testing requirements of Chapter 17 of ASCE 7-05 and the additional requirements below. Peer Review of the design should be performed as required by Chapter 17. Calculations, testing and design documents that demonstrate that the requirements of Chapter 17 were satisfied have not yet been filed by Jordan Cove. Therefore, **we recommend that:**

- **<u>Prior to commencing final design of the LNG storage tanks</u>, Jordan Cove should file with the Secretary, stamped and sealed by the professional engineer-of-record registered in Oregon, the following information:**

  a. **non-linear response history analysis of the LNG tank and isolation system. The analysis would simultaneously include all three components of ground motion. The response spectra of the time history vertical component of motion envelope the site-specific vertical design response spectra developed for the Project facilities. The horizontal components should be rotated so that one of the components for each set of motions is the maximum component of response at the isolated period of the tank and isolation system;**

  b. **non-linear analyses for both maximum and minimum design liquid levels of the LNG tanks;**

c. **separate non-linear analysis to account for variations of design stiffness, minimum values of friction, and other properties as required by Sections 17.5 and 17.2.4.1 of ASCE 7-05; and**

d. **documentation that the lateral displacement capacity of the seismic isolation bearings is not less than 24 inches.**

Because we recognize the project area is located in an area of high seismicity, our regulations in 18 CFR 380.12(h)(5)[37] recommend that a special inspector be contracted by Jordan Cove to observe the work performed to ensure the quality and performance of the seismic resisting systems. Jordan Cove did not indicate in their submittals that a special inspector would be employed by them to observe construction of the facilities. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Jordan Cove should file with the Secretary documentation that it would employ a special inspector during construction to perform duties described in Section 6 of NBSIR84-2833, Data Requirements for the Seismic Review of LNG Facilities.**

4.2.2 Pacific Connector Pipeline

The pipeline would be constructed by conventional cross-country techniques as described in section 2.4.2.1. Typical pipeline trench depth would range from 6 to 10 feet, although it would be deeper at stream crossings with scour concerns or areas with geological hazards. In Class 1 areas with normal soils, the pipeline would have 36 inches of cover, and 24 inches of cover in Class 1 areas with consolidated rock. Excavation of the trench would encounter a range of soil and rock materials. Special construction methods for crossing rugged terrain were also previously discussed in section 2.4.2.2.

The proposed route would cross a wide variety of terrain and geological conditions. The proposed route was evaluated for seismic, landslide, erosion and scour, mine, and volcanic hazards that may potentially occur across or near the alignment and that could adversely affect the pipeline. In addition, an evaluation was made of the potential impact that pipeline construction and operation could have on the natural geological environment and geological processes in the pipeline vicinity. During route planning, Pacific Connector identified and attempted to avoid geological resource areas and hazards.

Pacific Connector selected the proposed route with input from agencies, stakeholders, and land managers/owners to avoid areas with high risk of geological hazards. The initial proposed route was changed in numerous locations to avoid high hazard areas as more detailed data were collected. During construction, Pacific Connector would implement site-specific construction techniques and BMPs to mitigate local geological hazards that could not be completely avoided. The following sections discuss these hazards and how they would be mitigated.

4.2.2.1 Surface and Bedrock Geology

The proposed route crosses four main physiographic provinces west to east: the Coast Range, Klamath Mountains, Cascade Range, and Basin and Range. The proposed route begins within the Klamath Basin, which is part of the larger Basin and Range physiographic province of the

[37] NBSIR84-2833, Data Requirements for the Seismic Review of LNG Facilities

Great Basin; an area characterized by ridges and valleys that are separated by faulting (Burns 1998). The route would then head westward over the High Cascades sub-province, a chain of geologically active volcanoes with high andesitic peaks, and the Western Cascades sub-province, an ancestral range of deeply eroded (extinct) volcanoes. The proposed route then passes through the Klamath Mountains physiographic province, which consists of several complex geological terrains composed of metamorphosed and fractured volcanic and marine sedimentary rocks. The proposed route would proceed over the Coast Range physiographic province, an area underlain by estuarine and alluvial deposits in lowland areas and sedimentary rocks in the uplands, and terminate at the Oregon Coast. Between the mountain ranges are several valleys, predominantly filled with recent alluvial materials. Some of the major river valleys and their tributaries crossed by the proposed route heading west to east include the Coquille River Valley, Umpqua River Valley, Rogue River Valley, and Klamath River Valley (see section 4.4 of this EIS for more information about waterbodies).

The pipeline alignment is located within varying soil and lithologic units ranging from soft sediments to hard granite and basaltic rock. Unconsolidated silt, sand, and cobbles occur locally in streambeds, alluvial fans, and valley floodplains in all four physiographic provinces. Detailed descriptions of geology along the proposed route are included in Table B-1 in Appendix B of the *Geologic Hazards and Mineral Resources Report* (GeoEngineers 2013e) filed with Resource Report 6 of Pacific Connector's application to the FERC. Below is a west to east description of the physiographic provinces crossed by the pipeline.

Coast Range

The proposed route passes through the southernmost part of the Coast Range province for approximately 71 miles (approximately MP 0 to MP 71). The Coast Range is 30 to 60 miles wide and averages 1,500 feet in elevation, although the highest point (Mary's Peak) reaches an altitude of 4,097 feet (Orr and Orr 2000).

The Coast Range is composed of relatively soft marine sedimentary rock units that overlie basalt at depth. The wet conditions of the western slopes of the Coast Range, along with steep terrain composed of relatively weak rock, contribute to an active erosional environment with frequent landslides.

Uplift of the Coast Range deposits has deformed the bedrock units with folds and faults. Coastal uplift of the present Coast Range over the past 10 to 15 million years has been simultaneous with stream incision and coastal erosion and depositional processes. Ocean-cut terraces exist near the shoreline, some of which have been elevated to altitudes of up to 1,600 feet (Orr and Orr 2000). Low-lying areas near the coast are underlain by modern beach deposits, sand dunes, estuarine mud and alluvial sediments.

Klamath Mountains

The proposed route passes through the northeast corner of the Klamath Mountain physiographic province for approximately 49 miles (approximately MP 71 to MP 120). The province has a rugged landscape of high peaks and deep canyons, with a total local relief of 2,000 to 5,000 feet (Baldwin 1964). The highest peak of the Klamath Mountains is Mt. Ashland, at 7,530 feet (Burns 1998). Most of the Klamath Mountain physiographic province is composed of highly deformed volcanic and marine sedimentary rocks, as well as metamorphic terranes. The

physiographic province also contains deformed pieces of the oceanic crust and granitic intrusive bodies (Walker and MacLeod 1991). Bedrock is often intensely metamorphosed and fractured.

The proposed route passes through three tectonic geological terranes in the Klamath Mountain segment of the alignment. West to east and youngest to oldest, these terranes are: (1) the Franciscan and Dothan belt; (2) the Western Jurassic terrane; and (3) the Western Paleozoic and Triassic terrane. The alignment crosses through the northernmost part of the Franciscan and Dothan belt, an area composed of turbidite sandstone, mudstone, and chert formed on the continental slope and subsequently scraped off the ocean floor during accretion. East of the Franciscan and Dothan belt, the alignment passes through the northern section of the Western Jurassic terrane, an area composed of volcanic flows and ash altered to greenstone, ophiolite, and metamorphosed ocean sediments, including conglomerate, siltstone, and sandstone. Between the Western Jurassic terrane and the Western Paleozoic and Triassic terrane, the alignment crosses the White Rock pluton (a large body of intrusive igneous rock that solidified within the crust). The Western Paleozoic and Triassic terrane is composed of metamorphosed pieces of ocean crust (ophiolites) and metamorphosed ocean-island basalt (Orr and Orr 2000).

Cascade Range

Approximately 60 miles (approximately MP 120 to MP 190) of the route crosses Oregon's southern Cascade Range. The Cascades consist of two north-south trending mountain chains: (1) the older, more weathered Western Cascades; and (2) the younger, higher-elevation High Cascades. The Western Cascades drain westward and reach altitudes of 5,800 feet. The southern High Cascades drain toward the east and the west and reach altitudes of up to 9,493 feet at the summit of Mt. McLoughlin (USGS 2006).

Precipitation of 60 to 100 inches annually on the western side of the Cascades results in extreme weathering of bedrock and soil deposits and larger rivers (Orr and Orr 2000). Both the Western Cascades and the High Cascades consist primarily of volcanoes formed as a result of the subduction of the Juan de Fuca oceanic plate beneath the North American continental plate. The Western Cascades terrain consists of deeply dissected volcanoes that formed between about 42 and 8 to 10 million years ago (USGS 2006). The volcanoes of the High Cascades began erupting about 5 million years ago. As the High Cascades volcanoes erupted, their magma chambers emptied and collapsed, creating calderas (large craters). Crater Lake, north of the pipeline alignment in Klamath County, is one of these calderas. During the Quaternary, andesitic cones formed the range's notable high peaks.

After the formation of the high-altitude andesitic peaks, volcanic activity in the High Cascades has continued intermittently to the present. Minor volcanic vents manifest near the pipeline alignment. These include Brown Mountain, which is a Quaternary-aged volcano situated about 3 miles north of the proposed route near MP 167.

Repeated glaciation of the High Cascades during the Pleistocene Epoch produced glacial U-shaped valleys, cirques, and jagged mountain ridges. No active glaciers exist along or near the pipeline alignment.

Basin and Range

Approximately 35 miles (approximately MP 190 to MP 225) of the easternmost portion of the proposed route passes through the southwestern corner of the Basin and Range province in Oregon, a geographic area named the Klamath Basin. The Basin and Range province contains the Upper Klamath Lake and Lower Klamath Lake National Wildlife Refuge, which, unlike the rest of the province, drain to the Pacific Ocean via the Klamath River.

The Basin and Range is a complex series of alternating uplifted mountain blocks (horsts) and down-dropped basins (grabens). These mountain ranges and valleys are separated by generally north-south trending normal (extensional) faults. The altitude of the Basin and Range province is generally over 4,000 feet, and the summit of Steens Mountain in southeast Oregon reaches 9,670 feet.

Crustal extension is responsible for development of the Basin and Range physiographic province. The extension occurred in two phases, the first of which happened between 20 and 10 million years ago and produced widespread volcanic activity resulting in thousands of feet of basaltic flows and tuffs. The second phase of extension occurred in the last 10 million years and produced the distinct horst and graben block faulted topography.

The low precipitation and runoff rates east of the Cascades restrict the amount of erosional debris that can be transported from watersheds. As a result, sediment has accumulated in the basins, in thicknesses greater than 1,000 feet in some places. Eroded material is deposited in alluvial fans and channels around the margins of the basins and as marsh and lake deposits in the lower elevations. During the wetter and cooler periods of the ice ages, the basins were occupied by much larger lakes; at maximum extent, Pluvial Lake Modoc extended over the pipeline alignment from Klamath Marsh, north of Upper Klamath Lake, to the Tule Lake basin in northern California (Orr and Orr 2000).

4.2.2.2 Seismic Setting and Hazards

The proposed route crosses a complex geological area that has developed through extensive crustal deformation and volcanic activity. However, most of the pipeline construction area has experienced very few earthquakes during the period of historical record. Two primary mechanisms for generating earthquakes of design significance exist along the pipeline alignment: (1) a major, regional earthquake associated with the CSZ; and (2) local earthquakes associated with a seismic hot spot near Klamath Falls.

Geological maps of the pipeline area show many faults that cross the pipeline alignment or are located near the pipeline corridor (Walker and MacLeod 1991). With the exception of the Klamath Falls area, these mapped surface faults are not considered active and are not believed to be capable of renewed movement or earthquake generation (USGS 2002).

With the exception of the Klamath Falls area, historical earthquake activity has been generally quiet in the areas crossed by the pipeline. A total of 492 earthquakes have been recorded within 100 miles of the proposed route (Pacific Northwest Seismograph Network 2006). The majority of these were low magnitude; specifically, 52 percent were less than magnitude 4.0 and 94 percent were less than magnitude 5.0 (table 4.2.2.2-1).

TABLE 4.2.2.2-1

Historical Earthquakes within 100 Miles of the Proposed Pacific Connector Pipeline a/

Magnitude Range b/	Number of Earthquakes	Epicenter Distance From Alignment (miles)
3.0 to 3.99	306	5 to 100
4.0 to 4.99	163	3 to 99
5.0 to 5.99	19	8 to 100
6.0 to 6.99	4	9 to 74
7.0 to 7.99	1	82

a/ Earthquake catalog data from the USGS Earthquake (Comcat) Search (January 1, 2006, to August 28, 2013), Pacific Northwest Seismograph Network (2006) and the Earthquake Database for Oregon, 1833 to 1993 (Johnson et. al. 1994).
b/ Earthquakes with less than magnitude 3.0 are termed micro-earthquakes and are not usually felt (Reiter 1990). Earthquakes of magnitude 5.0 and greater are generally considered to have engineering significance.

Major historical earthquakes near the proposed route include two events in 1873: (1) an estimated magnitude 7.0 earthquake at the southwestern tip of Oregon; and (2) a magnitude 6.3 earthquake near Coos Bay. In addition, a magnitude 6.0 event occurred in 1938 approximately 75 miles south of Coos Bay. On September 21, 1993, two earthquakes occurred within about 2 hours with epicenters located about 15 miles northwest of Klamath Falls: a magnitude 5.9 event followed by a magnitude 6.0 earthquake (Yelin et al. 1994).

Many earthquakes of magnitude 2.0 and larger have occurred during historical times in the Klamath Falls area. Most earthquake epicenters are clustered northwest of Klamath Falls, near the southwest shoreline of Upper Klamath Lake. Epicenters of these earthquakes are typically at depths of about 3 to 5 miles. These events seem to be associated geographically with the boundary between the Basin and Range province and the Cascade Range province. The earthquake clusters also may be associated with volcanic activity (Cole and Bugni 1993).

The primary seismic hazards to pipelines include potential strong ground shaking, surface fault rupture, soil liquefaction (and related lateral spreading), earthquake-induced landslides, and regional ground subsidence. The degree of risk from these hazards varies and depends on several factors, including the magnitude (or size) of the earthquake, the distance of the earthquake origin from the pipeline facilities (lateral and vertical), soil/rock conditions, and slope angle of the ground.

Empirical reviews of historical earthquakes demonstrate that welded steel pipelines are not prone to failure due to earthquakes. A 1996 study of earthquake performance data for steel transmission lines and distribution supply lines operated by Southern California Gas over a 61-year period found that post-1945 arc-welded transmission pipelines in good repair have never experienced a break or leak during a southern California earthquake and are the most resistant type of piping, vulnerable only to very large and abrupt ground displacement (e.g., severe landslides), and are generally highly resistant to traveling ground wave effects and moderate amounts of permanent deformation (O'Rourke and Palmer 1994).

In addition to ground shaking, subsidence and ground rupture from seismic activity, tsunamis can be generated by strong ground motions associated with offshore earthquakes or submarine landslides. Coastal areas of Oregon, including Coos Bay, could experience the effects of tsunamis. The portion of the pipeline near the LNG terminal occurs in the relatively sheltered areas of Coos Bay, where the effects of a tsunami on the pipeline would be expected to be relatively minor (GeoEngineers 2013e).

Seismic hazards for the pipeline were evaluated by reviewing available historical data, by researching geological evidence of prehistoric earthquakes for the Pacific Northwest, and by qualitatively evaluating the potential risk to the pipeline along the overland sections of the alignment. Quantitative evaluation of the potential for liquefaction, lateral spreading, and tsunami inundation was accomplished for the Coos Bay crossing, where liquefaction and lateral spreading hazard were identified during the initial assessment.

Regional Seismicity

Recent research indicates that a major Cascadia earthquake affected coastal areas of the Pacific Northwest on January 26, 1700 (Satake 1996; Clague et al. 2000). This offshore earthquake is estimated to have been a magnitude 9.0 event. In addition to strong ground motion and long shaking duration, large Cascadia-type earthquakes can also result in coastal subsidence and tsunamis that can impact low-lying coastal areas. Geologic studies indicate that Cascadia-type earthquakes have occurred numerous times in pre-history (Nelson et al. 1996). The recurrence interval between Cascadia events has been irregular and ranges from about 100 to 1,000 years (Atwater and Hemphill-Haley 1997). Typical recurrence intervals are thought to be on the order of 400 to 600 years (Clague et al. 2000).

If a Cascadia-type earthquake occurred during the operating life of the pipeline, the ground shaking and possible ground subsidence would be strongest in the Coast Range province and in low-lying areas near Coos Bay. Although ground shaking would likely be felt throughout the length of the pipeline from a Cascadia event, hazards would diminish in the eastward direction, with increasing distance from the offshore epicenter. Regional ground subsidence would likely not pose a risk to the pipeline. Documented subsidence zones associated with the 1960 subduction zone earthquake in Chile (Plafker and Savage 1970) indicate subsidence on the order of 3 to 6 feet vertically distributed over a wide trough of approximately 60 miles. The resultant strain accrual on a welded steel pipeline distributed over that length of pipe is not considered significant.

Ground Shaking and Peak Horizontal Ground Acceleration

Using the historical seismicity record and the available data on Quaternary faults in the United States, the USGS (2009a) has produced probabilistic seismic hazard mapping for the United States in general, and for the region that would be crossed by the pipeline in particular. This mapping has generally been used to address two risk levels: (1) a 10 percent probability of exceedance in 50 years (475-year return period); and (2) a 2 percent probability of exceedance in 50 years (2,475-year return period). The output from the seismic hazard mapping includes estimates of the peak ground acceleration (PGA) and spectral accelerations for 0.2 and 1.0 second structural periods. The PGA values are given in percentages, or decimal fractions, of the acceleration of gravity (g). The acceleration resulting from gravitational forces (g) is defined as 32 feet/second^2. PGAs for the Pacific Connector Pipeline Project were calculated for the specific 475-year and 2,475-year return periods for each corresponding milepost interval of the pipeline alignment (GeoEngineers 2013e).

The 10 percent probability of exceedance in 50 years (475-year return period) is defined by the ASCE Technical Council on Lifeline Earthquake Engineering as the contingency design earthquake for pipeline design (ASCE 1984). The highest 475-year return period PGAs expected along the pipeline alignment are about 25 percent (MP 1.5 to 4.12R) of gravity. The University

of Washington (2001) noted that these intensities are moderate and relate Instrumental Intensity VIII and a "Moderate to Heavy" potential damage to aboveground structures as described by the Modified Mercalli Intensity scale as follows:

> *Steering of cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.* (USGS 1931)

The USGS (1931) indicates that instrumental intensities of IX up to XII are seismic conditions where damage to pipelines may occur. The potential damage to buried pipelines from the ground shaking intensity at the site is, therefore, considered to be low.

Surface Rupture Potential from Faulting

Differential, or shear, movements of fault surfaces can be entirely subsurface, or they can extend to the ground surface as surface fault rupture. The nature of the shear movements at the surface depend on the character of fault movement. In general, surface fault rupture across a pipeline alignment can result in rapid differential ground displacements across the pipe, with displacement magnitudes ranging from a few inches to several feet.

Based on the USGS Faults and Folds Database (USGS 2010) and the DOGAMI geologic mapping (Black and Madin 1995; Personius 2002a; Mertzman et al. 2007; Mertzman 2008; Hladky and Mertzman 2002), the pipeline alignment crosses the following regional Quaternary and Holocene age fault zones:

- Lake of the Woods fault, near MPs 172 to 175;
- The Sky Lakes fault zone, east of Klamath Falls near MPs 174 to 182;
- West Klamath Lake fault zone, near MP 187;
- Lower Klamath Lake section of the Klamath Graben fault system near MPs 204 and 205 (4 crossings); and
- The South Klamath Lake section of the Klamath Graben fault system near MP 213.

The mapped Holocene age fault (defined by the USGS as active within the last 10,000 years) that would be crossed by the pipeline alignment occurs within the South Klamath Lake section of the Klamath Graben fault system, in the vicinity of Klamath Falls near MP 213. Review of USGS data sources (Personius 2002a, 2002b) does not provide potential earthquake magnitude along this fault, but provides other information about slip rate and fault length. Light detection and ranging (LiDAR) imagery of recent alluvial sediments in this area does not show linear features typical of fault movements at the ground surface. Recently acquired color stereo aerial photographs do not show linear features or changes in soil color indicative of fault movement at the ground surface. Pacific Connector has committed to engaging a geotechnical firm to evaluate and design the pipeline crossing (approximate MP 213) of the Klamath Graben Fault system, South Klamath Lake Section. This evaluation would be completed prior to pipeline installation.

Pacific Connector proposes to have the pipeline trenches carefully examined during construction by a qualified professional (following State of Oregon license standards for Professional Geologists and/or Professional Engineers) for evidence of stratigraphic offsets potentially related to ground rupture. If such features are observed, Pacific Connector would implement additional mitigation measures at these locations. Specific unique designs for fault mitigation would be developed at that time, however the intent would be to follow published guidance to estimate the potential amount and direction of fault offsets as well as the magnitude of strain accumulation at the pipe crossing location (Takada et al. 2001; Honegger and Nyman 2004). Such measures could include burying the pipe in a wide trench that was backfilled with loose gravel or sand, which would allow for relatively unrestrained movement of the buried pipe within the zone of fault movement.

Liquefaction Potential

The potential for soil liquefaction from an earthquake is a function of the intensity or strength of the earthquake shaking (high PGA), the duration of strong earthquake shaking, the nature of the soil (it must generally be loose to medium dense and granular such as silt or sand), and groundwater conditions (the soil must be saturated with a shallow groundwater table). In general, liquefaction that results in permanent ground deformation or buoyant displacement of buried pipelines has the potential to result in pipeline damage (O'Rourke and Liu 1999). The evaluation of liquefaction potential is complex and depends on numerous site parameters, including soil grain size, soil density, age of soil deposit, depth and gradient of water table, site geometry, static stresses, and design accelerations.

The potential for liquefaction along the pipeline was evaluated based on topography and soil conditions obtained from geological maps, NRCS soil surveys and, at some sites, limited geotechnical boring data. Liquefaction potential was identified for portions of the proposed route that would be expected to encounter loose to medium dense sandy soils (generally occurring in alluvial valleys or near rivers, streams, sloughs, lakes or other waterbodies). The characteristics were incorporated into a numerical liquefaction analysis used to characterize the potential risk of liquefaction. The numerical analysis was used to confirm liquefaction potential rather than used to predict liquefaction-induced settlement magnitude, which would be accomplished during pipeline design, in process and scheduled for completion during 2015. Based on the numerical analyses, sites that were underlain by strata with a safety factor against liquefaction of less than 1 are shown as having a "High" risk for potential liquefaction. These areas are listed in table 4.2.2.2-2 as having potential for liquefaction and/or lateral spreading. The potential for liquefaction and lateral spreading along the proposed route is characterized as low to high, unknown, or mitigated. Those listed as low potential include sites with subsurface conditions of fine-grained soils that are not susceptible to liquefaction or soils that are not expected to be saturated. Those listed as high potential include sites that are underlain by potentially saturated loose to medium dense granular soils. The unknown potential site is an area of private property where no site-specific subsurface information is available due to lack of access. Sites identified as mitigated include areas where the pipeline would be buried below the liquefiable materials (for protection from scour), or where the pipeline would be installed by HDD and would be beneath the anticipated zone of potential liquefaction or lateral spreading.

TABLE 4.2.2.2-2

Summary of Potential Liquefaction and Lateral Spreading Hazards

From MP	To MP	Feature	Liquefaction Potential/ Lateral Spreading Potential	Ownership
1.47R	2.20R	Haynes Inlet	High/High	Private, State
2.20R	4.20R	Haynes Inlet	High/Low	Private, State
6.20R	6.40R	Kentuck Inlet	High/High	Private, State
8.26R	8.47R	Willanch Slough	High/High	Private, State
11.0R	11.3R	Coos River	High a/	Private, State
10.10	10.40	Stock Slough	Low/Low	Private
10.80	11.40	Catching Slough	Low/Low	Private, State
15.72	15.77	Boone Creek	Low/Low	Private
22.60	23.10	North Fork Coquille River	Low/Low	Private
27.00	27.15	Park Creek (aka Middle Creek)	Low/Low	BLM, Private
29.41	30.20	East Fork Coquille River	Low/Low	Private
48.02	48.40	Deep Creek	Low/Low	County, Private, BLM
49.70	50.45	Middle Fork Coquille River	Low/Low	Private
55.80	56.60	Alluvial Valley	Low/Low	Private
56.90	59.00	Olalla Creek	Low/Low	Private
66.85	67.05	Willis Creek	High/High	Private
68.95	69.80	South Umpqua River #1	High a/	ODOT
88.20	88.65	Days Creek	Low/Low	Private
94.55	94.80	South Umpqua River #2	High a/	Private
122.55	122.75	Rogue River	High a/	Private, State
128.50	128.70	Indian Creek	Unknown b/	Private
132.01	132.14	Neil Creek	Low/Low	Private
191.60	199.00	Klamath Valley	High/Low	Private
199.00	201.00	Klamath River	High a/	Private, State, Reclamation
201.00	214.00	Lost River Valley	Low/Low	Private, State, Reclamation
217.10	218.33	Alluvial valley	Low/Low	Private
221.80	224.40	Alluvial valley	Moderate/Low	Private

a/ A potential for occurrence may exist, but hazard would be mitigated.
b/ Landowner permission to evaluate site was not granted.

Pipeline damage associated with liquefaction typically occurs where a sharp transition exists between liquefiable and non-liquefiable materials. Shear or bending movements at such sharp transitions can damage pipelines. In addition, liquefaction can change the buoyancy forces such that the pipeline may float if not mitigated during design. Mitigation for these conditions can include avoidance by routing around or under the potentially liquefiable materials, by reinforcing the pipe with thicker walls, and/or by weighting the pipe with a concrete coating. Pacific Connector proposes to cross four river crossings (Coos River, Rogue River, Klamath River, and South Umpqua River) using HDD and DP technology in order to minimize the environmental impacts of construction and to install the pipeline below zones of potentially liquefiable soil.

High liquefaction and/or lateral spreading potential were identified at six sites (Haynes Inlet, Kentuck Inlet, Willanch Slough, Willis Creek, Rogue River, and Klamath Valley) along the pipeline route. Pacific Connector would conduct numerical modeling for these sites prior to construction to estimate the magnitude of liquefaction-induced settlement and lateral spreading that would be expected during the design earthquake event. If the numerical modeling indicates

that liquefaction settlement and/or lateral spreading would result in excessive pipe stress conditions, as analyzed by Pacific Connector, further mitigation design would be needed. Mitigation options may include deeper burial below the liquefiable soils, thicker pipe and/or weighting the pipe with a concrete coating, if necessary. Potential ground improvement measures would also be considered including vibroflotation, stone columns, compaction grouting, and deep dynamic compaction. Primary geotechnical factors involved in selecting the type of mitigation include: the depth of liquefiable soils, fines content, groundwater depth, the potential for obstructions (i.e., buried logs), and the density of overburden soils over the liquefiable soils.

Even with these measures, it is not possible to completely mitigate the risk of pipeline damage in Coos Bay resulting from lateral spreading during a megathrust seismic event. If such an event should occur and cause a pipeline failure in Coos Bay, the MLVs that would be installed on either side of the bay crossing would need to be shut to stop delivery of gas to the pipeline and isolate the damaged section. The pipeline would be inspected and repairs made to damaged sections of the pipeline as appropriate before the line would be placed back in service.

Liquefaction requires the presence of loose granular soils submerged in water (saturated). Areas along the proposed pipeline that are subject to being under water within the pipeline depth are generally limited to valley floors. The groundwater table is not expected to be encountered within the mountainous terrain. Excavations within the gently sloping valley floors crossed by the pipeline would be limited to the pipeline trench. The pipeline trench backfill is not considered to be of sufficient volume to liquefy during an earthquake. Moreover, the pipeline trench backfill is not expected to be placed in a sufficiently loose state to liquefy. Additionally, trench breakers would be installed in the pipeline trench at regular intervals to prevent the trench from capturing and conveying near surface groundwater.

Lateral Spreading Potential

In addition to settlement or pipeline buoyancy, the possibility exists that liquefaction could result in lateral spreading. Lateral spreading involves lateral displacement of surficial blocks of non-liquefied soil as the underlying soil layer liquefies. Lateral spreading generally develops in areas where sloping ground is present or near a free face, such as along the banks of rivers, sloughs, canals, or lakes. If liquefaction were to occur within loose to medium dense saturated sand deposits, there would be a high potential for lateral spreading to occur along slopes or near a free face.

Because lateral spreading is associated with liquefaction of soils, the potential for lateral spreading along the pipeline alignment was evaluated based on the same criteria as liquefaction potential. If an area is characterized as having a high liquefaction potential and the topography is sloping or adjacent to a free face, then the potential for lateral spreading to occur as well is high. Lateral spreading can occur on very gentle slopes; therefore, all areas with liquefaction potential also are considered to have potential for lateral spreading. Identified areas of potential lateral spreading include areas of loose saturated fill soils in the North Spit area, the embankments of the existing Highway 101–Trans-Pacific Parkway intersection, and the existing levee fills and river channel in the northern portion of the Project.

Pacific Connector stated it would perform numerical modeling for pipeline locations where soil liquefaction–induced settlement and lateral spreading would be expected during an earthquake prior to final design of the pipeline project. In particular, numerical modeling would be performed for Haynes Inlet, Kentuck Slough, Willanch Slough, Cooston Channel, Willis Creek, Indian Creek, Klamath Valley, and the alluvial valleys between pipeline MPs 221.8 and 224.4 and between MPs 229.0 and 230.9. For any location where the analysis indicates that the pipeline would be subject to stresses during a seismic event, measures would be implemented to prevent damage and protect the pipeline during a seismic event. Pacific Connector would engage a pipeline engineering firm to evaluate specific hazards related to liquefaction and lateral spreading and design protective measures. Ground improvements or other mitigations would be designed to address lateral spreading risk areas.

Seismically Induced Landslides and Rockfalls

Strong ground shaking associated with an earthquake may induce landslide failures at great distances from the earthquake source (Keefer 1984). The potential exists, at least locally along portions of the proposed route, for ground shaking to induce rockfalls, landslides, or soil slumps (USGS 2010, 2002). Potential areas of seismically induced landslides include the mapped existing landslides summarized in Table B-2 of GeoEngineers (2013e) *Geologic Hazards and Mineral Resources Report* from Pacific Connector's application to the FERC.

Areas of potential ground shaking of sufficient intensity to initiate landslides or rockfalls include the areas of greatest seismic activity: the Klamath Falls region (with relatively recent events of magnitudes 5.9 and 6.0) and the Coos Bay region (with the potential for very large, long recurrence interval, megathrust events). The proposed route has been selected to avoid areas with a high potential for landslide and rockfall hazards to the extent practicable.

Landslide Hazards

An initial landslide hazards evaluation was conducted in three phases: initial office review; aerial reconnaissance; and surface reconnaissance. The purpose of the first phase study was to identify existing landslides as well as areas susceptible to landslides within one-quarter mile of the initial alignment by reviewing published maps and digital data (Burns et al. 2011a, 2011b), aerial photographs and LiDAR-generated hillshade models. The purpose of following two phases was to further evaluate only those landslide hazard sites that represent potentially moderate or high risk to the pipeline, based on the results of the previous phase of evaluation. These initial evaluation phases are described in greater detail below. No landslide hazards were identified at the aboveground facility locations.

Landslide Hazard Types and Their Effects on Pipelines

Many types of landslides occur that can affect property and public safety. However, most landslides can be placed in two general categories: (1) shallow-rapid landslides (debris slides/flows) and (2) deep-seated landslides. Shallow-rapid, or rapidly moving, landslides generally originate on very steep slopes, often where no prior indications of movement are present. In the Coast Range, especially in the Tyee formation, recurring debris flows produce debris chutes. These are evident by narrow concave gullies containing activity indicators such as bare rock, soil generation, and vegetation stratification. Fans and coalescing fans (from multiple chute discharges) form plains. Deep-seated landslide movement can occur where no previous

movement is evident, but commonly occurs where topographic and vegetative indications of past or chronic slope movements are present.

Rapid-shallow landslides, inclusive of debris slides/avalanches and channelized debris flows, typically originate on very steep and strongly convergent hill slopes variously termed colluvial swales, hollows, or headwalls. Mass-movement of rapid-shallow landslides is typically triggered by large, infrequent storm events. Channel gradient and junction angle strongly influence the effect of the debris flow on the stream channel: scour, transport, or deposition. Related discussion of the assessment and protection for riparian and aquatic environments is provided in section 4.1 of this EIS and in the ACS technical report (appendix J). Deep-seated landslides range in depth from tens to hundreds of feet and can occur anywhere on a hill slope. The larger deep-seated landslide complexes may occupy several square miles of terrain. These features can usually be identified on topographic maps or aerial photos based on distinctive contour or vegetative patterns. Slope movement can vary from rapid to nearly imperceptible, and may entail small to large displacements. The greatest risk of deep-seated landslide movement arises from existing (dormant) features that can reactivate in response to land management practices, seismic activity, stream erosion and/or prolonged periods of precipitation.

Risk is greatest where the direction of slide movement is across (perpendicular to) the pipeline alignment. This typically occurs where the pipeline crosses a slope instead of descending straight down the fall line. Although the greatest risk is where a pipeline crosses a landslide, headward (upslope) expansion of the slide could eventually involve a pipeline located upslope of an active landslide.

Significant strain can develop within a pipeline from slope movements. Strain can develop slowly from a deep-seated landslide as a result of long-term slow movement, or it can develop quickly as a result of a single movement event. Shallow-rapid landslides are unlikely to induce long-term strain to a pipeline, but rather more likely to expose the pipe and result in a loss of support where it crosses a debris slide source area. Once mobilized into a debris flow, shallow-rapid landslides often have tremendous erosional potential. Debris flows that originate upslope of the pipeline also have the potential to scour, expose, and damage the pipeline by debris impact.

Rapidly Moving Landslide Risk Assessment

Rapidly moving landslides (RMLs) typically occur on steep (generally greater than 50 percent) slopes within zero-order stream basins (a zero-order basin is also known as a headwall swale, bedrock hollow or convergent slope immediately upslope of a first-order channel) and can mobilize into debris flows and torrents, traveling great distances along defined stream channels. These landslides generally occur quickly during heavy or prolonged storm events with little or no warning. DOGAMI, in cooperation with other agencies, produced a map of Potential Rapidly Moving Landslide Hazards in Western Oregon (Hofmeister et al. 2002). This map was limited to western Oregon because the vast majority of historical RML occurrence has been within that portion of the state. Pacific Connector has provided geologic hazards maps in the *Geologic Hazards and Minerals Resources Report* (GeoEngineers 2013e) that show the slopes in and around the pipeline alignment in western Oregon that have been mapped as potential RML hazards. Creation of the map involved the use of GIS modeling, checking and calibration with limited field evaluations, and making comparisons with historical landslide inventories. The

intent was to identify areas that have some potential to be affected by RMLs so that they would be considered and evaluated appropriately.

The portion of the pipeline alignment that crosses the Coast Range physiographic province has the greatest risk of being affected by rapidly moving landslides because of rugged terrain composed of relatively weak sedimentary bedrock and relatively high precipitation rates. In particular, studies indicate that the Tyee Core Area within this province has a higher susceptibility to rapidly moving landslides than other areas of the pipeline (Robinson et al. 1999).

The potential for rapidly moving landslides to occur east of MP 166 (east of the Cascade Range) generally is considered to be relatively low based on geological conditions, relatively little rainfall, and statistically fewer past historical rapidly moving landslide occurrences (Hofmeister et al. 2002). Climate change models predict a drier climate east of the Cascade Range, including less snowpack (and snowmelt), more rain instead of snow in low elevation basins, lower summer and early fall streamflows, and decreased soil moisture (University of Oregon 2008). These conditions are not likely to increase the potential for rapidly moving landslides in this region. Slopes east of MP 166 were reviewed to identify high-risk sites based on general guidelines of the ODF (ODF 2000). Based on available topographic mapping, no slopes along the pipeline alignment east of MP 166 exceed 65 percent or appear to be at high risk of rapidly moving landslide occurrence.

Pacific Connector conducted an initial risk assessment to evaluate the potential risk where the pipeline alignment crosses the mapped hazard areas using some of the input parameters used for the DOGAMI model (Hofmeister et al. 2002). Depositional, transport, and source zones were primarily distinguished with a simplified approach based on slope/channel gradient without consideration of other factors such as stream junction angles.

The initial relative risk to the pipeline posed by the source, transport, and depositional zones are considered to be high, moderate, and low, respectively. If a pipeline was located within a rapidly moving landslide source area, the pipeline could lose support as a result of displacement of the slide mass, and could be subject to excessive strain depending on the orientation of the pipeline and the distance over which support was lost. Once mobilized into the “transport” zone, a rapidly moving landslide has the potential to erode and scour the slope and could potentially expose a buried pipe, at which time debris could impact and damage the pipeline. Based on research and empirical data, the scour potential is greater where rapidly moving landslides are confined within stream channels. This risk is discussed further in later sections.

Other factors that influence the potential risk from rapidly moving landslides include the slope form (geometry) and the orientation of the pipeline to the slope. For instance, convergent (concave) slopes are generally less stable and have a higher potential for landslide occurrence than planar or divergent slopes. In general, the risk of landslide occurrence and mobilization increases with slope gradient and with the degree of convergence (concavity).

Using LiDAR where available, 10-meter digital elevation model and aerial photography, Pacific Connector identified moderate and high risk rapidly moving landslide sites along the proposed route. Pacific Connector then conducted a surface reconnaissance of these sites to further evaluate potential risk.

A total of 304 pipeline segments were initially identified within rapidly moving landslide hazard areas. Based on the risk assessment, approximately 128 of these sites were considered to be a potentially moderate or high risk and were selected for further study. Site-specific reconnaissance was conducted in certain areas with the potential for shallow-rapid landslide hazards, as documented on Tables B-3a and B-3b of Appendix B in GeoEngineers (2013e).

Deep-seated Landslide Risk Assessment

Deep-seated landslides can range in thickness from tens to hundreds of feet and can occur anywhere on a slope. Larger landslides can usually be identified from topographic maps (including LiDAR) and aerial photographs. Movement can be complex, ranging from slow to rapid, and may include small to large slope displacements.

The greatest risk of deep-seated landslide movement is from existing (dormant) deep-seated landslides reactivating in response to human activity, seismic activity, stream erosion, or heavy precipitation. Assuming unchanged conditions, it is much less common for a deep-seated landslide to occur on a previously undisturbed and intact slope than reactivation of an existing landslide feature. Therefore, areas susceptible to deep-seated landslide movement were identified from existing geological maps and from topographic or photographic indications of historical or ancient landslide movement.

Table B-2 from GeoEngineers (2013e) lists the identified deep-seated landslides, the data source, and the initial risk to the pipeline. High hazard landslides were identified where the alignment crosses landslide mass or is located on the slope such that the slide could move or expand to involve the pipeline. Surficial, geomorphic, and vegetative features suggest that the landslide is active or dormant historic (past movement less than 100 years ago) (Keaton and DeGraff 1996). Moderate hazard landslides were identified where the alignment crosses landslide mass or is located on the slope such that the slide could move or expand to involve the pipeline, and where surficial, geomorphic and vegetative features suggest that the landslide is dormant-young (last movement 100 to 5,000 years ago) (Keaton and DeGraff 1996). Fifteen of the landslides were judged to pose a moderate to high potential risk to the pipeline. In these instances, Pacific Connector either rerouted its proposed route to avoid the hazard or assessed the feature further through aerial reconnaissance and risk assessment. The subsequent aerial reconnaissance of the deep-seated landslides identified as moderate to high risk included assessments of geomorphic and vegetative conditions. These data were incorporated into a model of potential risk related to each deep-seated landslide. Pacific Connector then identified potential alternative routes around moderate- to high-risk landslides that appeared to be active or to have the potential to reactivate. Six landslides were identified as posing a moderate to high potential risk and were evaluated further in the field. Five of these six landslides are located in Coos County within the Coast Range physiographic province.

Landslide Hazards Avoidance and Minimization of Adverse Effects

For the purposes of landslide hazard evaluation in this report, a distinction is made between the hazard associated with a landslide and the risk associated with that hazard. In the following discussions, statements of risk apply to the potential for damage or failure of the pipeline from earth movements. It is recognized that the consequences of a pipeline failure may be catastrophic and involve fire and/or explosion. However, those consequences are location-

specific and are not considered in the following evaluations of risk to the pipeline. Pacific Connector has worked to avoid landslides along the proposed route. Ridgetops are generally considered to be stable and, therefore, an attempt has been made to route the vast majority of the pipeline along ridgetops.

Risks associated with landslides include both the risk that installation of the pipeline may adversely affect slope stability, and that post-construction land movements could damage the pipeline. Pacific Connector selected its proposed route to avoid existing landslides and areas susceptible to landslides. Appendix B from GeoEngineers (2013e) identifies where Pacific Connector's initial proposed route was changed to avoid identified landslides and landslide hazard areas.

Table B-2 from the GeoEngineers (2013e) indicates where reroutes were completed to avoid identified landslides. Tables B-3a and B-3b from the same report indicate where reroutes were incorporated into the proposed route to avoid moderate- and high-hazard RML hazard areas. All of the moderate- and high-hazard deep-seated landslides identified along the alignment were avoided where feasible during final route selection. Although most moderate- and high-hazard RML hazards were avoided, two moderate-hazard RML sites (MPs 18.1 to 18.2 on private land, and MP 36.9 on BLM land) could not be avoided. However, the risks to the pipeline at these sites are not considered hazardous enough to require additional mitigation or rerouting. Hazards include both the potential for the planned construction to adversely affect slope stability and the potential for post-construction landslide movement to damage the planned pipeline.

Pacific Connector has prepared and would implement the ECRP included in its POD to avoid and minimize impacts from pipeline construction, including reducing the potential for construction to adversely affect slope stability. Because the pipeline would cross extensive areas of rugged terrain, there is potential for previously unidentified landslides or new landslides to affect the pipeline after it is installed. Monitoring higher-risk areas along the pipeline can aid in detecting landslide occurrence and movement so that action can be taken to prevent damage to the pipeline. Monitoring can range from visual surface observations from the air or ground to the use of strain gauges and subsurface instrumentation, such as inclinometers, to detect and measure slope movements (typically, these instrumentation methods are used only on pipeline segments affected by active slope movement).

All known hazardous landslides thought to pose a risk to the pipeline have been avoided through routing. At this time, no sites have been identified as requiring additional monitoring beyond the standard monitoring protocols for the entire pipeline. Pacific Connector and its consultants are confident that the methods used (LiDAR interpretation, helicopter-based reconnaissance, and ground-based reconnaissance) were adequate to evaluate the potential hazard posed by these specific landslides. Pacific Connector has agreed to perform additional ground-based observations and interpretations requested by FERC pending landowner access permission for the following Landslide Numbers: 34, 46, 50, 51, 56, 57, 76, 77, 80, and 83. Pacific Connector would develop monitoring protocols and/or mitigation measures prior to construction if warranted based on findings from the ground-based reconnaissance.

One commenter was concerned about the instability of slopes through which the pipeline is passing in the vicinity of MP 4 due to a previous slope failure and ground seepage. The commenter stated that this area was repaired by the county about 15 years ago. Aerial photograph review of this area during the investigation did not identify current slope instabilities.

However, if hazardous conditions are identified during pipeline construction, remedial or monitoring measures would be implemented by Pacific Connector.

Pacific Connector intends to implement a like level of landslide and pipeline easement monitoring currently performed on existing Williams-owned pipeline facilities in southwestern Oregon. Monitoring would consist of weekly air patrol, annual helicopter survey, and quarterly class location. Class location consists of land patrol (including leak detection), semi-annual class 1 and class 2 location land patrol, and annual cathodic protection survey. Observed areas of active third-party activities such as logging or development and areas affected by unusual events such as landslides, severe storms, flooding, earthquake or tsunami may require additional inspection and monitoring determined on an individual basis.

The purpose of the monitoring would be to detect potential movement or pipe strain before it compromised the structural integrity of the pipeline. If movement were detected, immediate action would be taken to reduce the risk to the pipeline. Every landslide is unique, and there are no standard methods for reducing or eliminating landslide-related risks to buried pipelines. However, in concept, initial response actions generally include measures to reduce the stresses in the pipeline caused by slide movements. Secondary response actions are directed at improving the stability of the slide so that movements in the vicinity of pipeline are halted or the impacts to the pipeline are minimized. Tertiary response actions involve rerouting the pipeline to avoid landslide hazards by relocating the pipeline to a safer location.

Exposure of the pipe by excavation is the initial response action typically taken to reduce stresses in the pipe. By exposing the pipe on both sides, the pipe is allowed to rebound to a position where it carries little residual stress.

Improvements in surface drainage also are important initial response measures. Typical drainage improvement measures include: (1) placement of impermeable liners over the ground surface to limit infiltration of precipitation and erosion; (2) ditching to divert surface water around landslide areas; and 3) routing surface flows across slide areas within tightline drain pipes. If surface drainage improvements would impact jurisdictional resources under Section 404 of the CWA these impacts would need to be permitted as appropriate. See section 4.4 of this EIS.

Once the landslide area is initially stabilized, a decision of permanent action must be made. Permanent mitigation can include repairs and stabilization of the landslide area. Permanent repairs can include drainage improvements, loading and/or stabilization of the toe of the slope, decreasing the load at the head of the slope, or retaining structures at the base or within the slope. If the landslide is large and complex and stabilization is not a reasonable option, rerouting the pipeline around the slide may be the preferred mitigation.

Specialized trench backfill is utilized where pipelines cross landslides or fault zones where differential movement or shearing across the pipeline is expected. For steep slopes, trench breakers and water bars are utilized to minimize the potential for erosion or mass wasting of trench backfill. Section 11.0 of the ECRP provides special backfill and compaction criteria for restoring site grades on slopes greater than 3H:1V. Specifications include use of structural fill, benching slopes to receive fill, and compaction of fill in lifts.

Because the geological and other natural hazards are considered significant to the design, construction, and operation of the facility, information on the final mitigation measures and monitoring protocols of the pipeline in areas which were not accessible during previous studies are required to evaluate slope stability conditions. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Pacific Connector should file with the Secretary, stamped and sealed by the professional engineer-of-record registered in Oregon, the final monitoring protocols and/or mitigation measures for all landslide areas that were not accessible during previous studies, to evaluate slope stability conditions.**

Stream Migration and Scour Hazards

The principal hazard resulting from channel migration and streambed scour is complete or partial exposure of the pipeline within the channel from streambed and bank erosion, or within the floodplain from channel migration or avulsion. Related discussion of the assessment and protection for riparian and aquatic environments is provided in section 4.1 of this EIS and in the ACS technical report (appendix J). Minimizing the effects of migration and scour hazards to the pipeline can be accomplished with the following approaches.

- At each channel crossing, bury the pipe below the estimated depth of streambed scour. Where bedrock is encountered at shallower depths than the estimated scour depth, the elevation of competent bedrock represents the limit of scour.
- Where feasible, place the pipe into bedrock.
- Within floodplains adjacent to migrating channels, bury the pipe below the projected depth of the channel thalweg (the line of lowest elevation within a watercourse) within the 25-year and 50-year channel migration zones.
- Avoid stream crossings that are potentially hazardous to the integrity of the pipeline, and therefore to public safety, where possible.

The pipeline crossing streams also could provide a new path for groundwater to flow into the pipeline trenches even after following backfilling. Water diversion would be prevented by implementing the ECRP, which requires installing trench breakers around the pipeline and in the trench on slopes. Pacific Connector also would install trench plugs after the pipeline was installed in the trench and prior to trench backfilling. Pacific Connector would use sandbags (or foam, only if approved by regulatory agencies or the land management agency) for trench plug construction. Topsoil would not be used to fill the bags. Where necessary, Pacific Connector would use bentonite trench plugs to prevent flow from wetlands or streams into the trench and to preserve the original wetland and/or waterbody hydrology. Trench breakers and trench plugs would be keyed into the trench sidewalls.

Erosion and channel migration hazards to pipelines potentially exist on the banks and beds of stream channel crossings. No scour hazards, were identified at the pipeline aboveground facilities locations. Portions of the Coos Bay estuary, including the terminal delta areas of the Coos River and Catching Slough, also would be subject to scour from flood events, tidal currents, and tsunamis. Pacific Connector conducted analyses to assess the potential for channel migration and the depth of streambed scour in the streams and the estuary. The results of the migration and scour studies are summarized below and are discussed in detail in the *Channel Migration and Scour Analysis* report (GeoEngineers 2013f). Scour results for Haynes Inlet and

the delta areas are presented in detail in the Coos Bay crossing scour evaluation technical report for the Pacific Connector Pipeline Project (CHE 2010a).

Fluvial erosion may represent a hazard to the pipeline where streams have the potential to expose the pipe as a result of significant lateral bank erosion (channel migration), avulsion, or widening and/or downcutting (scour) of the streambed. Lateral channel migration is the movement over time of an entire channel segment perpendicular to the direction of stream flow. Channel avulsion is the sudden abandonment of an active channel for a newly created, or previously abandoned, channel located on the floodplain. Channel widening is defined as the erosion and subsequent recession of one or both streambanks that widens the channel without changing the channel location. Streambed scour is erosion of the streambed resulting in the development of deep pools and/or the systematic lowering of the channel floor elevation. Streambed scour may also result from the passage of debris flows and debris torrents. Debris flows and torrents consist of large volumes of water, soil, rock fragments and boulders, wood and other organic materials moving rapidly downstream as a fluid through a defined channel. Debris flows and torrents often start as rapidly moving landslides that liquefy as the landslide mass progresses downslope.

All streams that would be crossed by the pipeline route were evaluated with respect to potential risk to the pipeline. The evaluation was conducted in two phases: a preliminary evaluation in which all stream crossings were ranked for potential risk, and detailed analyses of stream crossings posing potentially significant risk to the pipeline (GeoEngineers 2013c). Potential risk was evaluated based on the likelihood of migration, avulsion, and/or scour as determined through evaluations of aerial photographs and GIS data.

During the initial phase evaluation, 45 crossings were identified as Level 1, 10 crossings were identified as Level 2, and the remaining crossings were identified as Level 0. Level 0 crossings present very low risk from channel migration or streambed scour when standard pipeline construction methods are utilized. Level 1 stream crossings, though presenting a low to moderate erosion risk, do not pose a significant risk to the pipeline provided that standard pipeline construction techniques and BMPs are utilized. Level 2 stream crossings represent a high scour or migration risk and were analyzed in additional detail and on a case-by-case basis. Because portions of the alignment were revised after completion of the initial phase evaluation, the second phase also included reviewing all stream crossings along the final pipeline alignment, and evaluating the risk levels of any adjusted initial phase crossing locations. The full list of crossings and their assigned risk level from the initial phase is presented in Table B-4 in Appendix B of GeoEngineers (2013e) and in the *Channel Migration and Scour Analysis* report (GeoEngineers 2013f).

In addition to the 10 initial Level 2 stream crossings, Pacific Connector evaluated 12 Level 1 crossings during the second phase, for a total of 22 sites. These 22 sites were subjected to field reconnaissance and detailed analyses regarding potential migration, avulsion and/or scour. The approach to evaluating potential migration and scour includes three primary elements: (1) develop a geomorphic characterization for each site; (2) conduct detailed migration analyses as necessary; and (3) conduct detailed scour analyses as necessary. Steps 2 and 3 were conducted only at those sites where field reconnaissance confirmed the potential for migration and/or scour.

Pacific Connector estimated the 25-, 50-, and 100-year Channel Migration Zones (CMZs) for each crossing. The width of the CMZ identifies the distance the channel could travel in 25, 50, or 100 years, respectively, in the absence of confining structures. These were estimated based on historical channel

occupation tracts, the character of migration in each reach, the maximum rate of lateral and downstream migration for each reach, and the locations of ancient and historic abandoned channels. Based on evaluations of each crossing, the 25-year CMZ best represents future migration potential for all crossings. The applicability of the 50-year CMZ depends on site-specific conditions, and the 100-year CMZ is least representative of future channel migration potential and channel location for all crossings. Based on a detailed analysis of the 25-year and 50-year CMZs, Pacific Connector would design all waterbody crossings for the 50-year condition. This level of design would be protective of the pipeline, and therefore public safety, given the level of natural channel migration at each site.

The scour analysis included surveying several channel cross sections upstream, downstream and at the crossing location; modeling channel hydrology and hydraulic conditions at each site; evaluating depth to bedrock beneath crossings; and calculating scour depths for multiple flow events based on the results of hydraulic modeling using HEC-RAS (Hydrologic Engineering Center-River Analysis System), geomorphic evaluation, and observed field conditions. Hydraulic output from HEC-RAS was used to evaluate stream scour for the 10-, 25-, and 50-year peak flow events. Return intervals were calculated from regional regression equations or peak discharge statistics from nearby USGS gaging stations (GeoEngineers 2013e).

Scour was analyzed at all identified Level 2 crossings along the pipeline alignment that display a high scour hazard; crossings where bedrock is identified shallower than pipeline burial depth were not analyzed further for scour. For the North Myrtle Creek and Middle Creek crossings, the alignment was shifted after the field data were collected and analysis completed. Scour results calculated for the original crossings were considered and adjusted in relation to the new crossing locations. The assessment of channel conditions at the new (proposed) crossings is based on an initial desktop interpretation of geomorphic conditions, and a follow-up site visit conducted in January 2007.

A summary of the scour results is presented below and in table 4.2.2.2-3. Potential scour from debris flows could occur where the pipeline crosses streams within rapidly moving landslide hazards.

TABLE 4.2.2.2-3

Summary of Scour Results using HEC-RAS

Stream Name at Crossing	Milepost	Expected Scour Depth Based on Interpreted Depth (feet) to Bedrock	Calculated Total Potential Scour Depth (feet) in Alluvium (10/25/50/100yr)	Ownership
Coos River	11.13R	-	3 b/	Private
Catching Slough	11.11	_	3 b/	Private
Middle (Park) Creek	27.04	2 - 7.0 a/	7.0/9.0/9.0/10.5 c/,d/	BLM
South Fork Elk Creek e/	34.46	--	4.0/5.0/5.0/6.0	Private
Olalla Creek	58.77	--	6.0/7.0/7.0/7.5	Private
North Myrtle Creek	79.12	--	5.0/6.0/6.0/6.5 c/	Private
South Umpqua River Crossing No. 2	94.73	0.7 - 8.7 a/	11.0/13.5/16.0/18.0 d/	Private
Rogue River	122.65	0.9 - 6.9 a/	13.5/16.5/18.5/20.5 d/	State

a/ Depth to bedrock interpreted from nearby boring logs and outcrops. Depth of scour is expected to be limited by bedrock.
b/ Results of CHE (2007) scour evaluation.
c/ Minimum scour depth calculated at October 2006 crossing location. Pipeline subsequently moved to current location.
d/ Calculated depth of scour assumes absence of bedrock.
e/ Alignment modification improves crossing conditions.

A site reconnaissance was performed at these crossings where they had the potential for scour based on the apparent gradient measured from 10-meter digital elevation model and LiDAR. Table B-3b of Appendix B from GeoEngineers (2013e) presents the data collected during the site reconnaissance and conclusions regarding the potential risk of rapidly moving landslide scour.

The pipeline alignment crosses streams that are within RML hazards mapped by DOGAMI. A site reconnaissance was performed at stream crossings that were within RML hazard areas and that had the potential for scour based on the apparent gradient measured from 10-meter digital elevation model and LiDAR.

Based on risk criteria, the stream crossing at MP 50 was initially identified as having a potential high risk of RML scour. Where no bedrock was observed within channel, and the stream gradient exceeded 15 percent, the channel was classified as high risk. Where the channel was composed of bedrock or the channel gradient was less than 15 percent, the channel was classified as low risk. RMLs typically occur on steep (greater than 50 percent) slopes (GeoEngineers 2007b). Based on the findings of subsequent site reconnaissance, the proposed route near MP 50 was rerouted to avoid this crossing.

Shallow bedrock was observed in the vicinity of Middle Creek, South Umpqua River Crossing No. 1, South Umpqua River Crossing No. 2, and Rogue River stream crossings (note that an HDD crossing method is proposed for the Rogue River at MP 122.7). At these crossings, depth to bedrock was interpreted based on observed bedrock contacts, outcrops, and borings drilled nearby. For each of these crossings, bedrock is likely to be encountered at shallower depths than the calculated scour depth. It is assumed that the upper elevation of competent bedrock represents the limit of scour for all flows at these crossings (GeoEngineers 2013e).

The Klamath River crossing is proposed to be completed using HDD methods. The HDD plan has the pipeline at a depth of at least 60 feet below the river bottom. Based on the anticipated burial depth, the potential risk of exposure by river scour is thought to be very low. Therefore, Pacific Connector does not plan to evaluate the potential scour depth of the Klamath River.

Potential scour depth from Coos Bay currents of approximately 3 feet was estimated at the pipeline crossing of the Coos River. The scour estimate is based on modeling the sediment as silt, and do not factor any sediment load in the Coos River, which results in very conservative scour estimates. Modeling results indicate that no significant scouring would occur over the pipeline from vessel-induced pressure fields or propeller wash. Pacific Connector proposes to cross the Coos River by HDD, which would place the pipeline well below the potential scour depth. Additional discussion of these areas is provided below.

Haynes Inlet and Coos Bay Tributaries Erosion and Scour Hazards

Pacific Connector conducted analysis and numerical modeling to assess the potential locations where erosion and scour could occur along the proposed route within Coos Bay. The results are described in separate reports (CHE 2007, 2010a) and are summarized in this EIS. Processes that were identified as potentially affecting the sediment cover over the pipeline or stability of the bottom in which the pipeline would be buried are:

- tidal currents (bottom scour);

- tidal channels and bay shoreline morphology (channel and dredged material disposal island migration and scour);
- waves generated by wind blowing over the surface of Coos Bay (bay bottom scour and shoreline erosion);
- effects by vessel wakes, pressure fields, and propeller wash of vessels operating in Coos Bay (bay bottom scour and shoreline erosion); and
- tsunami inundation and retreat.

Numerical models and analytical methods specific to each of the identified processes were applied to assess the scour hazard potential and to estimate the magnitude (depth) of erosion and scour in Coos Bay. To account for unexpected possible short-term migration of sediment resulting from currents or wind-generated waves, a conservative estimate of up to 1 foot of potential scour should be assumed. The following summarizes the findings as reported in CHE (2007, 2010a).

Based on very conservative estimates (CHE 2007, 2010a), the model output suggests that limited scour may occur along the pipeline trench within Coos Bay due to currents or extreme wind events.

The Haynes Inlet and tributaries within the Coos Bay estuary (Kentuck Slough, Willanch Slough, and Coos River) and adjacent areas were modeled to evaluate hydrodynamic conditions that could contribute to bay bottom and tidal channel scour and erosion. Specific attention in the modeling and analysis was addressed to areas of the pipeline adjacent to natural tidal channels, navigation channels, bridges, and dredged material disposal areas. These areas have been identified as having a higher potential (likelihood) of erosion and scouring hazards occurring, which can result in deleterious consequences to natural resources and the pipeline. In these cases the risk is assigned as high.

The findings indicate the following:

- No significant or limited bottom scour would occur along the pipeline in Haynes Inlet resulting from combined tidal and Haynes Inlet and Coos Bay tributaries flow during extreme events, if the cover of the buried pipeline is of the same material and quality as currently exists on the bottom. However, considering the generalization of bottom material, other random factors, and practical experience with previous projects, CHE (2010a) recommends that a 1-foot scour depth be assumed in the areas within Haynes Inlet and Coos Bay tributaries because of tidal and river flows for the entire length of the pipeline. To address this recommendation, Pacific Connector would maintain a minimum of 5 feet of cover through this area to compensate for the 1-foot potential scour depth.
- In the Coos River, more significant scour of approximately 3 feet was estimated at the pipeline crossing. Because sediment size here was assumed to be fine silt, and no sediment load was input into the model in the Coos River, this scour estimate is likely to be extremely conservative. Pacific Connector proposes to use HDD methods at this crossing, which would place the pipeline well below the potential scour of 3 feet.

Analysis of the Haynes Inlet estuary morphological changes was conducted to assess the erosion and scour hazards present along the proposed route. The geomorphologic analysis focused on

three landforms in the Upper Coos Bay area that could potentially be a hazard to the pipeline because of possible long-term morphological changes. These areas included the Coos River delta, dredged material disposal sites and the navigation channel.

River delta meandering was investigated by comparison of historical NOAA navigation charts for the period 1862 to 1997. The charts were visually evaluated for recognizable delta and river thalweg location changes near the proposed route. Thalweg positions relative to one another were then measured at locations of noticeable change and tabulated for comparative analysis. It was found that meandering of the channel thalweg is limited and is within the level of accuracy of the analysis procedure. However, because of uncertainties with the accuracy of historical data, Pacific Connector considered thalweg meandering plus/minus 100 feet relative to the existing position. For the pipeline located in the vicinity of tidal channels, the pipeline burial depth would be 5 feet below the thalweg (low point) for a distance of 100 feet on either side of the channel thalweg.

The coastal areas of Oregon, including Coos Bay, could experience some effects of tsunamis generated by strong ground motions associated with offshore earthquakes and submarine landslides. The potential for scour in the Coos Bay estuary associated with hydrodynamic conditions generated from tsunami floodwaters was evaluated for the pipeline alignment. The tsunami generated scour analysis by CHE was based on current sea levels and did not account for or predict future sea level rise. It is expected that sea level rise would change (expand) areas subject to tsunami inundation; however, such sea level rise is not expected to significantly change the calculated scour within the areas of tsunami inundation.

GeoEngineers (2013e) conducted a review of recent tsunami modeling by DOGAMI that was completed for various magnitudes of earthquakes (DOGAMI 2012b, 2012c, 2012d, 2012e, 2012f, and 2012g). Hydrodynamic forces and sediment transport resulting from tsunami wave impact and flows in Coos Bay (Haynes Inlet) were evaluated for the pipeline alignment using a two-dimensional depth-averaged flow simulation and sediment transport model. The model is capable of simulating water level fluctuations (waves), currents, overland inundation, sediment transport, bottom morphology and water/sediment quality. The numerical model domain covered a region of approximately 900 square miles, starting approximately 40 miles offshore and extending throughout Coos Bay and up into the rivers and streams. Tsunami wave input was developed so as to match the ocean tsunami amplitude reported in the Tsunami Hazard Map of the Coos Bay Triangle, Coos County, Oregon (Priest et al. 2002).

A design tsunami event was simulated using a numerical model (CHE 2010a), whereby the tsunami waves inundated the barrier between the Pacific Ocean and Coos Bay, and propagated into Coos Bay over the dune and between the jetties. The modeling analysis showed that some temporary scour, followed by sedimentation, may occur in Coos Bay in the area of the pipeline alignment where it would cross Hayes Inlet during inundation of the tsunami (approximately 1 to 2 hours). In order to eliminate the concern of temporary scour, and to satisfy the conservative approach to scour analysis, CHE (2010a) recommended designing for a scour hazard depth of 3 feet.

Recent modeling for the Coquille River system does not indicate a potential risk for tsunami inundation at the pipeline crossing (MP 50.3) (Witter et al. 2011).

GeoEngineers (2013e) indicated that the pipeline would be susceptible to scour only within Coos Bay where it would cross Hayes Inlet (between MPs 1.7 and 4.1). Pacific Connector proposes to install the pipeline within Coos Bay with 5 feet of cover, which would protect the pipeline from scour resulting from regular tidal or current movements, or in the event of a tsunami.

Volcanic Hazards

The USGS assumed that a lahar flow (rapidly flowing mixture of rock and water originating from volcanoes) from Mt. Mazama (this is also known as the Crater Lake area, which is located about 45 miles to the northeast) could impact the Rogue River; however, the chances are remote because the Lost Creek reservoir would intercept the lahar. Two other sources of impacts are airborne tephra ejected from a volcano and a volcanic eruption near the pipeline. The tephra would not impact the pipeline because the pipeline would be buried. Based upon the USGS estimates, the chance of volcanic eruption near the pipeline is very low, less than 0.01 percent. Therefore, the chance of a volcanic event to affect the pipeline is very low.

Mine Hazards

Mine hazards potentially exist in areas underlain by or adjacent to underground mine workings and surface mines that have not been properly stabilized, closed, and made safe in accordance with applicable local, state, and federal laws. Pacific Connector identified surface and subsurface mines within 0.5 mile of the proposed construction right-of-way from USGS topographic maps, BLM and Forest Service databases, DOGAMI GIS data, published reports, published and unpublished maps, and county mineral overlay maps. No mine hazards, were identified at the aboveground facilities locations.

The primary hazards involve the potential for:

- subsidence in areas underlain by or adjacent to air shafts, tunnels, underground workings, and mine tailings;
- rockfalls and slides caused by the failure of unstable benches, slopes, and tailing piles in nearby surface mines, including those benches and slopes occurring within water-filled pits; and
- the presence of tailings or waste piles containing naturally occurring metals.

According to Pacific Connector's application (Table B-5 of Appendix B from GeoEngineers 2013e), the pipeline alignment was identified as being located within 500 feet of potential mine hazards based on the information provided in the databases at 22 locations. Fifteen of the 22 mines identified within 500 feet of the alignment are aggregate or quarry-related mines. The aggregate or quarry-related mines are likely to consist of open excavations. The primary potential hazards at these mines would be related to failure of steep slopes and/or high walls. These are expected to be localized conditions. Civil survey crews involved with surveying the right-of-way did not observe these conditions along or adjacent to the alignment. Consequently, these potential hazards are not expected to pose a threat to the pipeline.

The remaining non-aggregate-related mines were investigated by field reconnaissance on January 23 and 24, 2007, and June 13 and 15, 2007. The database indicated that these mines are located at MPs 9.8, 10.0, 16.2, 58.8, 75.3, 105.6, 108.7, 109.3, 109.4, 111.7, 142.6, and 150.5. The reconnaissance of these mines did not identify any apparent mine workings located within

500 feet of the pipeline alignment. Adits associated with the Nivinson Prospect/Mars Fraction Lode and Thomason mines were identified within 500 feet of the pipeline location. Therefore, a site-specific mine hazards assessment was completed for those prospects as well as the nearby Red Cloud Mine, and the findings of that study were provided in a stand-alone report dated August 23, 2007, and its 2009 addendum (GeoEngineers 2007c, 2009b). The following summarizes the report findings with regard to the proposed route.

Nivinson Prospect/Mars Fraction Mercury Mine

The pipeline alignment at MPs 108.6-108.7 does not cross the Nivinson Prospect mercury mine and is approximately 200 feet upslope from it. Based on documented excavated depths, trends, and distances from the pipeline, it was concluded from the field investigation that the adits of the Nivinson Prospect mercury mine likely do not extend into the right-of-way and do not pose a risk to the pipeline.

Red Cloud Mercury Mine

The pipeline alignment is approximately 400 feet west of the Red Cloud mercury mine at MP 109.3. No evidence of the mine was observed during site reconnaissance of the alignment.

Thomason Mine (Inactive)

The pipeline alignment at MP 109.4 crosses the mapped location of the Thomason Mine. No evidence of the Thomason Mine was observed during site reconnaissance of the alignment. Approximately 260 feet downslope of the mapped Thomason Mine location at MP 109.4, the proposed route crosses East Fork Cow Creek. The proposed route crosses the East Fork Cow Creek outside of the Thomason Mining Group boundaries and all other mining groups mapped by Brooks (1963).

4.2.2.3 Mineral Resources

Mineral resources that occur in the pipeline area include the following metals: chromite, copper, gold, manganese, mercury, and silver. Other mineral resources include basalt, cinders, coal, conglomerate, limestone, natural gas (including coal bed methane), sand and gravel, sandstone, shale, silica, talc, and tuff/breccia. Most of the non-metal minerals are mined to produce aggregate. Mineral resources, surface and subsurface mines, and oil and gas fields located within one-half mile of the Pacific Connector pipeline construction right-of-way were identified from USGS topographic maps, BLM and Forest Service mineral resource databases (including oil and gas leases, geothermal leases, and mining claims), ODOT aggregate resources GIS data, DOGAMI GIS data, published reports, published and unpublished maps, and county mineral overlay maps. Detailed maps showing mineral resources, mines, leases, mining claims, and related features are included in Appendix G of GeoEngineers (2013e).

Portions of the pipeline alignment cross six areas with county zoning that recognizes the potential for future mineral resource development. This zoning implies that mines and oil and gas wells could be sited at any location within these areas in the future as long as the zoning remains compatible with the resource extraction operations.

Table B-7 of Appendix B from GeoEngineers (2013e) identified the active, inactive, and planned mineral resources or mining sites (organized by MP) within 0.25 mile of the pipeline. Twenty mineral or mine locations were identified as within 500 feet of the pipeline.

Table B-8 of Appendix B from GeoEngineers (2013e) identified areas where the pipeline would cross: (1) areas where county land-use zoning allows mineral resource extraction, or (2) federal land that has been or is available for mineral resource or geothermal leases. Coos County recognizes six coal-basin resource areas between MPs 1.47R and 10.7; and one between MP 17.2 and 18.2. Thirty-eight oil and gas areas are located between MP 11.2 and 45.7 in Coos County. Two mine claims are located near MP 1.4R in Coos County. Seven oil and gas areas, two placer claims, four mines, seven lode claims, a chromite resource, and a quarry are located in the vicinity of the pipeline alignment between MPs 46.9 and 109.4 in Douglas County. Twenty-four oil and gas areas, eight lode claims, and a basalt resource are located in the vicinity of the pipeline alignment between MPs 115.4 and 166.4 in Jackson County. One lode claim, two mineral resource areas, one oil and gas area, and three geothermal resources areas are located in the vicinity of the pipeline alignment between MPs 170.6 and 220.6 in Klamath County.

The pipeline could potentially interfere with future mining and reclamation activities on lands adjacent to the right-of-way. Future expansions of surface mines near the pipeline right-of-way potentially could be limited or precluded in some cases because mineral resources could not be extracted from slopes immediately above or below the pipeline right-of-way or from beneath the pipeline. Similarly, the presence of the pipeline could limit or preclude the stockpiling of mineral resources or development of a processing area on slopes above or below the pipeline. These considerations also could limit or preclude reclamation activities at mine sites near the pipeline because of the potential to disturb the slopes above and below the pipeline and right-of-way. Any impact would be site-specific and would depend on topography, drainage, and subsurface conditions in that area.

4.2.2.4 Rock Sources and Permanent Disposal Sites

Pacific Connector has identified 42 potential rock source and permanent disposal sites that total approximately 175 acres along the proposed route. Of these 42 rock source/disposal sites, 20 sites—8 of which are TEWAs—are existing quarries/gravel pits (87 acres). These sites are listed in table 4.2.2.4-1.

Rock source sites may contain useable mineral deposits that may be extracted and/or purchased for use during construction. Disposal sites were identified for final placement of unusable, non-merchantable materials. These sites are typically exhausted areas within active quarries or abandoned quarries and may include commercial sites. Other permanent storage sites, including some TEWAs, were identified for permanent storage of excavated material. The material disposed of in these areas would be properly graded, drained (if necessary), and revegetated. The sites identified are not proposed for expansion beyond their proposed permitted or authorized boundaries. Use of any site would be permitted as required by the appropriate jurisdiction or landowner, and Pacific Connector would comply with applicable

TABLE 4.2.2.4-1

Rock Source and/or Permanent Disposal Sites

Site	Size (acres)	Milepost	Land Use	Jurisdiction
Coos County				
TEWA-11.90-W	0.10	11.90	Mixed forest land, regenerating evergreen forest land	Private
TEWA 12.53-N	2.32	12.53	Clearcut forest land, transportation, communication, utilities corridors	Private
TEWA 14.60-N	0.61	14.60	Regenerating evergreen forest land, transportation, communication, utilities corridors	Private
TEWA 17.82-W	0.93	18.11	Timber, clearing, regenerating evergreen forest land	Private
TEWA 20.96	2.00	20.96	Clearcut forest land, regenerating evergreen forest land	Private
TEWA 27.86-N	0.47	27.86	Clearcut forest land, transportation, communication, utilities corridors, regenerating evergreen forest land	Private
TEWA 38.86-W/ Sandy Creek Quarry	4.51	38.93	Strip mines, quarries, and gravel pits, clearcut forest land, regenerating evergreen forest land, transportation, communication, utilities corridors	Private
TEWA 42.56-W (Plum Creek)	4.10	42.55	Regenerating evergreen forest land, clearcut forest land, transportation, communication, utilities corridors	Private
Douglas County				
Signal Tree Road Quarry – Sec.	1.22	45.86	Quarries	BLM Roseburg District
TEWA 45.84-W/	0.41	45.84	Evergreen forest land, regenerating evergreen forest land, transportation, communication, utilities corridors	Private
Signal Tree Road Quarry – Sec. 35	1.09	47	Quarries	BLM-Coos Bay District
Weaver Road Quarry Site 1	1.62	47	Quarries	BLM-Coos Bay District
Weaver Road Quarry Site 2	1.30	47	Quarries	BLM-Coos Bay District
Signal Tree Quarry Site – Sec. 15	1.75	47	Quarries	BLM-Roseburg District
TEWA 52.23-N	2.62	52.23	Quarries	Private
TEWA 54.83-W	0.50	54.83	Clearcut forest land	Private
Private Quarry Benedict Rd.	1.49	56.75	Quarries	Private
Kent Creek Commercial Quarry	17.52	63.90	Quarries	Private
Private Quarry DG 105	10.79	67.00	Quarries	Private
Roth – Existing Quarry #1	0.77	72.61	Quarries	Private
Roth – Existing Quarry #2	0.34	72.61	Quarries	Private
TEWA 75.28-W/ (BLM Quarry Site)	0.48	75.28	Abandoned quarry, Mixed forest land	BLM-Roseburg District
TEWA 77.72-N	1.08	77.72	Mixed forest land, herbaceous rangeland, transportation, communication, utilities corridors, streams and canals, evergreen forest land	Private
TEWA 79.85-N (BLM Quarry Site)	3.61	79.85	Quarries, transportation, communication, utilities corridors, regenerating evergreen forest land	BLM-Roseburg District
Pct Quarry DG-176	2.22	81.45	Quarries	Private
TEWA 84.19-W	1.06	84.19	herbaceous rangeland	Private
TEWA 93.01	0.55	93.01	Evergreen forest land	Private and BLM-Roseburg District
TEWA 94.52-W (Reclaimed Quarry) (Pvt DG-155)	23.42	94.56	Reclaimed Quarry, transportation, communication, utilities corridors, Commercial and services, transitional areas, nonforested wetlands, herbaceous rangeland,	Private

TABLE 4.2.2.4-1

Rock Source and/or Permanent Disposal Sites

Site	Size (acres)	Milepost	Land Use	Jurisdiction
Hatchet Quarry MP 102.30	2.00	102.30	Strip mines, quarries, gravel pit, transportation, communication, utilities corridors	FS-Umpqua
Rock Disposal MP 104.12	3.36	104.12	Mines, quarries, and gravel pits, transportation, communication, utilities corridors, regenerating forest land	FS-Umpqua
Jackson County				
TEWA 110.73 (Peavine Quarry)	15.87	110.73	Mines, quarries, gravel pit and evergreen forest	FS-Umpqua
Rock Source and Disposal MP 119.51	7.66	119.51	Mines, quarries, gravel pit, regenerating evergreen forest land, evergreen forest land	BLM-Medford District
TEWA 149.97-N	0.32	149.97	Deciduous forest land, transportation, communication, utilities corridors, mixed forest land	Private
TEWA 150.31-W (Heppsie Mountain Quarry)	5.56	150.31	Mines, quarries, and gravel pits, mixed rangeland, evergreen forest land, mixed forest land, transportation, communication, utilities corridors, regenerating evergreen forest land, clearcut forest land,	Private and BLM-Medford District
Rum Rye MP 160.41	4.91	160.41	Strip mines, quarries, and gravel pits	FS-Rogue River-Siskiyou
TEWA 160.54-W (Big Elk Cinder Pit) (Ichabod Rock Quarry)	15.26	160.54	Mines, quarries and gravel pits, transportation, communication, utilities corridors, evergreen forest land	FS-Rogue River-Siskiyou
Klamath County				
Rock Source and Disposal MP 180.56	7.76	180.56	Mines, quarries, gravel pit, transportation communication and utilities corridors, and regenerating forest land	Private
Rock Source and Disposal MP 180.71	2.95	180.71	Mines, quarries, gravel pits, Clearcut forest land	Private
Rock Source and Disposal MP 182.40	5.66	182.40	Quarries, gravel pits	Private
Rock Source and Disposal MP 201.61	4.96	201.61	Transitional areas, cropland and pasture, transportation communication and utilities corridors	Private
Rock Source and Disposal MP 224.95	7.60	224.95	Mines, quarries, gravel pits, shrub and brush rangeland, transportation communication and utilities corridors, evergreen forest land, transitional area	Private
TEWA (14) Total			**16.52**	
TEWAs associated with existing quarries (8)			**71.33**	
Existing quarries and rock source and disposal sites—Total			**86.97**	
TOTAL			**174.82**	

Source: GeoEngineers (2013e)

permits/stipulations. The disposal of mineral material to Pacific Connector from rock sources proposed to be utilized on BLM lands would follow regulations in 43 CFR 3600. Table 7A-1 in Appendix 7 of RR 7 filed with Pacific Connector's application to the FERC lists the rock source and disposal sites, their sizes, approximate mileposts in relation to the pipeline, jurisdiction, existing land use, and the soil mapping unit and sensitive soil characteristics of the sites. Sensitive soil information was not provided for the existing quarry sites because soils at these sites have been significantly altered. Only the disposal sites (and not the TEWAs) listed in table 4.2.2.4-1 are being proposed for use as permanent disposal sites.

Of the 42 identified potential rock source and permanent disposal sites, 20 sites are existing quarries/gravel pits or abandoned quarries/gravel pits. Although some of the existing/abandoned sites appear to have land use types other than quarries/gravel pits, Pacific Connector does not intend to expand these sites beyond the existing or previously disturbed footprints. If Pacific Connector acquired rock from these sources or permanently disposed of excavated material, all available topsoil would be salvaged. The salvaged topsoil would be used to restore the site as required by landowner stipulations. Rock resource areas managed and developed by Pacific Connector would need quarry Operation and Reclamation Plans, to the extent required by DOGAMI's regulatory authority (OAR 632-030-0005 through 0070 and ORS 517.750 through 990). Appropriate BMPs would be implemented, such as those in Norman et al. (1998). No impacts are anticipated from the rock sources and permanent disposal sites.

4.2.2.5 Blasting During Trench Excavation

Blasting could be required for pipeline trench excavation in areas where hard, non-rippable bedrock occurs. The bedrock units where blasting could be necessary would consist primarily of volcanic and metavolcanic rocks in the Klamath Mountains and volcanic rocks in the Cascade Range as well as along the ridges in the Basin and Range physiographic province. In addition, local areas of well-lithified sedimentary rock may need to be blasted in the Coast Range.

Pacific Connector identified areas where blasting may be necessary by reviewing the NRCS soils maps and descriptions to identify soil units that typically contain bedrock within 5 feet of the ground surface. Soils data, geological maps, and topographic relief were used to rank the qualitative likelihood for blasting along the pipeline as follows:

- No Potential – Areas containing deep soils and alluvial, fluvial, lacustrine, and estuarine sediments that could be readily excavated. General occurrence: the coastal and Klamath basin lowlands and the major valleys and floodplains in all of the physiographic provinces.
- Low Potential – Areas containing soft sedimentary rock and tuff that can typically be excavated without ripping. General occurrence: Coast Range, and local areas of the Klamath Mountains, Cascade Range, and the Basin and Range physiographic provinces.
- Moderate Potential – Areas containing fractured, faulted, or weathered metamorphic or volcanic rocks that generally can be excavated with ripping, but that could require local blasting. General occurrence: local areas in the Klamath Mountains, Cascade Range, and the Basin and Range physiographic provinces.
- High Potential – Areas containing hard or fresh plutonic (for example, granitic) and volcanic rocks that could not be excavated without blasting. General occurrence: local areas of the Klamath Mountains physiographic province, portions of the Cascade Range physiographic province, and local areas in the Basin and Range physiographic province.

Table 4.2.2.5-1 provides a summary of the blasting potential along the pipeline. Blasting would not likely be required to construct the first 78 miles of the pipeline because the materials are expected to consist of soil, sediments, and rippable sedimentary rocks. Although the blasting potential is classified as high for about 100 miles of the proposed route, this distance estimate includes local areas as much as 0.9 mile in length that contain valley fill, thick soils, and soft volcanic rocks (such as tuffs) that would not need to be blasted. In addition, some of the proposed route classified as having a high or moderate potential for blasting may contain weathered rock that could instead be ripped by conventional excavation equipment.

TABLE 4.2.2.5-1

Summary of Blasting Potential Along the Proposed Pacific Connector Pipeline

From MP	To MP	Blasting Potential	Material	Ownership
1.47R	60.0	None to Low	Soil, sediments, sedimentary rocks and valley fill	Private, State, BLM
60.0	70.1	None to Moderate	Sedimentary rocks and metamorphic rocks with local valley fill	Private, BLM
70.1	78.5	Low to Moderate	Sedimentary and metamorphic rocks	Private, BLM
78.5	88.7	High a/	Igneous rocks with sedimentary rocks and local valley fill	Private, BLM
87.7	89.2	None to Low	Sedimentary rocks with local valley fill	Private
89.2	89.6	High	Igneous rocks	Private
89.6	90.8	Moderate	Sedimentary rocks	Private, BLM
90.8	94.5	Low	Sedimentary rocks	Private, BLM
94.5	108.9	High	Sedimentary and igneous rocks with local valley fill	Private, BLM
108.9	109.5	Low	Landslide deposit	Private
109.5	112.3	Low	Soft igneous rock	Forest Service
112.3	135.4	Moderate to High	Igneous rock, tuffs, breccias, conglomerates, lahar deposits, local valley fill	Forest Service, Private, BLM, State
135.4	138.7	Moderate to High	Igneous and locally tuffaceous rock	Private, BLM
138.7	143.8	Moderate to High	Igneous rock, tuffs, breccias, conglomerates, lahar deposits, local valley fill	Private, BLM
143.8	145.6	Low	Landslide deposit (LS-57)	Private
145.6	172.0	High	Igneous rock and locally tuffaceous rock with local valley fill	Forest Service, Private
172.0	174.4	None	Thick soil	Forest Service, Private
174.4	181.1	High	Lava flows	Private, BLM,
181.1	182.9	Low	Unconsolidated volcanic deposits	Private
182.9	191.5	Moderate to High	Igneous rocks with local soil and sediment	Private, State
191.5	218.9	None to Moderate	Soft igneous rocks with local sediment and valley fill	Private, State, Reclamation
218.9	221.8	High	Igneous rocks	Private
221.8	227.7	None to Moderate	Soil, soft igneous rocks valley fill	Private, Reclamation
227.7	228.1	High	Igneous rocks	Private

a/ Blasting potential intermittently rated as None where pipeline crosses a valley floor or thick soil.

Pacific Connector would conduct all blasting in accordance with all federal, state, and local regulations and Pacific Connector Construction Specifications. Pacific Connector would include specifications in any blasting contract to control adverse impacts, including measures to minimize vibrations and flyrock, measures for safe blasting practices near active pipelines, and seasonal restrictions to protect wildlife, as needed. Pacific Connector would have blasting inspectors present to ensure that all specifications were met and to perform pre- and post-blast inspections of nearby structures and wells.

Drilling and blasting would be done with the Pacific Connector inspector present and with the inspector's approval to proceed prior to each blast. Blasting operations would be conducted by or under the direct and constant supervision of experienced personnel legally licensed and certified to perform such activity in the jurisdiction where blasting occurs. Pacific Connector would require their contractor to provide site-specific Blasting Plans at least 5 working days prior to any proposed blasting-related activity, and the contractor would be required to obtain Pacific Connector approval in writing prior to starting work. The Blasting Plan would include the following information:

- explosive type, product name and size, weight per unit, density, and equivalent energy release ratio (N) (the blasting agent Ammonium Nitrate and Fuel Oil [ANFO] would not be allowed);
- delay type, sequence, and delay (ms);
- initiation method (detonating cord, blasting cap, or safety fuse);
- stemming material and tamping method;
- hole depth, diameter, and pattern;
- explosive depth, distribution, and maximum weight per delay;
- number of holes per delay;
- distance and orientation to nearest aboveground structure;
- distance and orientation to nearest underground structure, including pipeline;
- procedures for storing, handling, transporting, loading, and firing explosives, fire prevention, inspections after each blast, misfires, fly rock and noise prevention, stray current accidental-detonation prevention, signs and flagmen, warning signals prior to each blast, notification prior to blasting, and disposal of waste blasting material;
- seismograph company, personnel, equipment, and sensor location, if required;
- copies of all required federal, state, and local permits;
- blaster's name, company, copy of license, and statement of qualifications;
- magazine type and locations for explosives and detonating caps; and
- typical rock type and geology structure (solid, layered, or fractured).

Pre-blast inspections would be completed for structures and wells that are within the influence zone of the blasting. The pre-blast inspections would include but not be limited to an inventory of existing structural integrity and signs of structural distress such as cracks. Post-blasting inspections would include an inspection and comparison of the same elements observed for the pre-blast inspection. If blast related damage is identified by Pacific Connector inspectors and confirmed to be a result of the blasting activities, then damaged structures or wells would be returned to pre-construction conditions or better.

Blasting for grade or trench excavation would be utilized only after all other reasonable means of excavation have been used and are unsuccessful in achieving the required results. Pacific Connector may specify locations (foreign line crossings, near-by structures, etc.) where consolidated rock would be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Every precaution would be taken to prevent damage to aboveground and underground structures during blasting operations; and every precaution would be taken to prevent injuries and damage to persons or inconvenience to the general public. Blasting mats or padding would be used on all shots where necessary to prevent scattering of loose rock onto adjacent property and to prevent

damage to nearby structures and overhead utilities. Blasting would not begin until occupants of nearby buildings, residences, places of business, places of public gathering, and farmers have been notified sufficiently in advance to allow for protection of personnel, property, and livestock.

Blasting for trench excavation could result in impacts on wells, wetlands, slopes, structures, and other adjacent buried utilities, as described below. We conclude that use of Pacific Connector's proposed monitoring and mitigation measures would avoid or reduce the likelihood of local failures of unstable rock and soil, and damage to structures or utilities from blasting vibrations.

Water Wells and Springs

In general, vibration effects to wells would be expected to be limited to the immediate proximity of the blasting. A common measurement unit for vibration is the peak particle velocity (PPV) of blasting-induced ground motion in inches per second. Siskind (1999) summarizes information on four blasting studies conducted to evaluate vibration effects on wells. One study showed, "There were no physical vibration effects on the wells even as close as 300 feet." The maximum velocities for this testing ranged from 0.84 to 5.44 inches per second, with four of the five sites exceeding 2 inches per second. In another study, a well was tested for casing cement bond damage. The study indicated initial bond losses occurred at 4.7 inches per second. A third study indicated that wells outside the blast pattern were exposed to as much as 8.7 inches per second at a distance of 31 feet and no damage occurred; however, the construction details for these wells are not described in the Siskind (1999) report. Nearly all households in the Shady Cove area (between about MPs 122 and 123) obtain water from wells that are located in the vicinity of relatively high density development. Such development has included previous blasting and associated impacts to wells.

Pacific Connector developed a *Groundwater Supply Monitoring and Mitigation Plan* to identify monitoring and mitigation measures to prevent and/or minimize impacts to groundwater, including from blasting. The plan would include identification of groundwater supplies through records review, field surveys, and landowners; the determination of susceptibility of identified supplies, and pre- and post-construction monitoring at the landowners request and with the landowners permission. Should it be determined after construction that there has been an impact on groundwater supply (either yield or quality), Pacific Connector would work with the landowner to ensure a temporary supply of water, and if determined necessary, Pacific Connector would replace a permanent water supply. Mitigation measures would be coordinated with the individual landowner in order to meet the landowner's specific needs. Mitigation measures for groundwater wells, springs, and seeps would be specific to each property and would be determined during landowner negotiations. Pacific Connector would request approval for any specific mitigation measures in such cases from appropriate regulatory agencies and from land management agencies with specific jurisdiction. Yields from perennial springs could decrease if blasting vibrations damaged the related aquifer. Pacific Connector would request authorization from landowners to test and document the baseline condition, yield, and water quality of any private wells or springs being used as permitted water supplies within 200 feet of the pipeline construction right-of-way. This testing would occur before the pipeline construction started in the nearby area, and the testing results would be shared with the property owner, if requested. Data collected during the dry season may prove most useful in determining potential effects. Testing of non-permitted wells and springs may be necessary to determine whether these would be affected. Similar information would be gathered for any public water wells or water supply springs located within 400 feet of the pipeline construction right-of-way.

Maximum PPV of 2 inches per second would be specified at the locations of private and public water supply wells. In specific cases, vibration could be reduced by drilling relief boreholes between the portion of the trench being blasted and any private or public water wells located within 200 feet of the pipeline construction right-of-way. The number and location of the relief boreholes would be determined on a site-specific basis.

Any turbidity in wells or springs caused by the blasting vibrations would be expected to be temporary and would likely dissipate shortly after blasting or after the well was pumped several times. Water quality impacts to groundwater or springs from blasting agents, if any, would be expected to be temporary and localized because only small amounts of these agents generally would be needed for trench excavation.

Wetlands

Blasting could potentially redirect surface water and groundwater flows to and from wetlands. In addition, turbidity and blasting agent by-products could possibly temporarily degrade surface water and groundwater quality.

Any turbidity resulting from blasting is expected to be temporary and to dissipate shortly after blasting. Water quality impacts to wetlands from blasting agents, if any, would be expected to be temporary and localized because only small amounts of blasting agents generally would be needed for trenching. Specific blasting agents would be listed in the *Blasting Plan* prior to the initiation of any blasting. The use of ANFO would not be allowed.

Slopes

Unstable rock and soil slopes could locally fail as a result of blasting vibrations. Pacific Connector would complete a reconnaissance of slopes in the vicinity of the blasting, including measuring slope inclinations and observing areas adjacent to planned blasting locations for potential indicators of unstable slopes. Identified slope areas that could be impacted by blasting would be monitored and evaluated for hazards to people and property during the blasting operations.

Structures

Blasting vibrations and flying debris could potentially damage aboveground structures. If structures were present in areas where blasting was necessary, Pacific Connector would request authorization from landowners to inspect structures located within 200 feet of the pipeline construction right-of-way before and after blasting. Blasting mats or padding also would be used when blasting near structures to limit potential damage from flying rocks. To limit potential damage to structures, maximum ground motion velocities of 2 inches/second would be specified at the locations of structures, which is consistent with the language of the *Blasting Plan*.

As an additional precaution, Pacific Connector would require the contractor conducting blasting to limit the size of charges in accordance with the scaled distance factor (SD) guidelines developed by the Office of Surface Mining Reclamation and Enforcement (OSMRE). The SD is equal to the distance from the blast to an aboveground structure divided by the square root of the charge (pound per delay). For distances less than 300 feet, OSMRE states that the SD shall exceed 50.

Adjacent Pipelines and Buried Utilities

Blasting vibrations could potentially damage adjacent underground pipelines and utilities. In general, blasting would not be allowed within 10 feet of an existing pipeline or buried utility. In cases where blasting near an existing utility was necessary, the pipeline or utility owner would be notified in advance of the blasting, and measures would be taken to minimize the potential for utility damage.

4.2.2.6 Paleontological Resources

There are no state or federal laws or regulations that protect paleontological resources on private lands (Niewendorp, DOGAMI, personal communication, 2008). The Antiquities Act of 1906 protects "objects of antiquity" on federal lands. The Paleontological Resources Preservation Act of 2009 applies to federal lands including BLM and NFS lands, as well as "Indian" lands, but does not apply to private land.

4.2.3 Environmental Consequences on Federal Lands

4.2.3.1 Geologic Hazards on Federal Lands

The seismic hazard evaluation included surface rupture from faulting, liquefaction potential, and lateral spreading. For sites where data were available, the evaluation indicates that the seismic hazard risk to the pipeline is generally low. There is potential for surface rupture from faulting where the pipeline would cross traces of the Quaternary-age Sky Lakes fault zone near MP 174 within the Winema National Forest. As mitigation for this pipeline crossing, during construction Pacific Connector would have the pipeline trench carefully examined by a qualified professional for evidence of stratigraphic offsets potentially related to ground rupture. If such features are observed, Pacific Connector would implement additional mitigation measures, with the specific mitigation developed at that time. However, the intent would be to follow published guidance to estimate the potential amount and direction of fault offsets as well as the magnitude of strain accumulation at the pipe crossing location (Takada et al. 2001; Honegger and Nyman 2004). Such measures could include burying the pipe in a wide trench that was backfilled with loose gravel or sand, which would allow for relatively unrestrained movement of the buried pipe within the zone of fault movement.

Two areas crossed by the pipeline within BLM Coos Bay and Roseburg District lands (Park Creek near MP 27 and Deep Creek near MP 48, respectively), and one area within Reclamation lands (near MP 201 to MP 203) are characterized as having low potential for liquefaction and lateral spreading. Low potential include sites with subsurface conditions of fine-grained soils that are not susceptible to liquefaction or soils that are not expected to be saturated.

High liquefaction and/or lateral spreading potential were identified at one site near Reclamation land (MP 201) associated with the Klamath Valley/Klamath River along the proposed route. Pacific Connector would conduct numerical modeling for this site prior to construction to estimate the magnitude of liquefaction-induced settlement and lateral spreading that would be expected during the design earthquake event. If the numerical modeling indicates that liquefaction settlement and/or lateral spreading would result in excessive pipe stress conditions, as analyzed by Pacific Connector, further mitigation design would be needed. Mitigation options may include deeper burial below the liquefiable soils, thicker pipe, and/or weighting the pipe with a concrete coating, if necessary. The primary mitigation measure being considered by

Pacific Connector to address liquefaction risks is ground improvement. Potential ground improvement measures include vibroflotation, stone columns, compaction grouting, and deep dynamic compaction. Primary geotechnical factors involved in selecting the type of mitigation include: depth of liquefiable soils, fines content, groundwater depth, the potential for obstructions (i.e., buried logs), and the density of overburden soils over the liquefiable soils.

The potential exists locally along portions of the proposed route on federal lands for seismically induced ground shaking to induce rockfalls, landslides, or soil slumps. Pacific Connector selected its proposed route to avoid existing landslides and areas susceptible to landslides. Pacific Connector was able to modify its proposed route to avoid most moderate- and high-risk RML hazards; however, two moderate-risk RML sites could not be avoided, including one site at MP 36.92 on land managed by the BLM Coos District. Additional investigation of this site resulted in a final risk determination of low (GeoEngineers 2013e). The landslide risk at this site is not considered hazardous enough to require additional mitigation or rerouting. To minimize landslide risk, Pacific Connector would implement its ECRP during pipeline construction, which would reduce the potential for construction to adversely affect slope stability.

Because the pipeline would cross a predominance of rugged terrain within BLM and NFS lands, there is potential for previously unidentified landslides or new landslides to affect the pipeline after it is installed. As part of its pipeline operation, Pacific Connector would conduct regular monitoring of the pipeline right-of-way, which would aid in detecting landslide occurrence or slope movement. On federal lands, Forest Service and BLM representatives would conduct monitoring with Pacific Connector personnel. Mitigation could include the use of shutoff valves. If movement is detected, immediate action would be taken to reduce the risk to the pipeline. Actions would include initial response to reduce the stresses on the pipeline, and follow-up actions to stabilize the slide. If the slide is large and complex enough such that stabilization would not be feasible, the pipeline could be relocated around the slide area.

Pacific Connector intends to implement a level of landslide and pipeline easement monitoring like that currently performed on existing Williams-owned pipeline facilities in southwestern Oregon. Monitoring would consist of weekly air patrol, annual helicopter survey, and quarterly class location. Class location consists of land patrol (including leak detection), semi-annual class 1 and class 2 location land patrol, and annual cathodic protection survey. Observed areas of active third-party activities such as logging or development and areas affected by unusual events such as landslides, severe storms, flooding, earthquake or tsunami may require additional inspection and monitoring determined on an individual basis.

Pacific Connector conducted analyses to assess the potential for channel migration and the depth of streambed scour in the waterbodies that would be crossed by the pipeline. Site-specific stream assessments were conducted by NSR on behalf of the BLM and Forest Service at crossings of perennial streams on federal lands (NSR 2014) for the purpose of providing direction on channel restoration, not to specifically address channel migration and/or depth of streambed scour. For each of these crossings, a site-specific crossing restoration plan was developed and submitted to FERC subsequent to issuance of the DEIS. The BLM and Forest Service consider these plans to be a supplement to the POD prepared by Pacific Connector.

4.2.3.2 Mineral Resources on Federal Lands

Oil and gas leases exist on BLM lands located between MPs 17 and 55, MPs 131 and 167, and around MP 205 (GeoEngineers 2013e). However, all of these leases are reported to be closed. In addition, the BLM is reported to have three areas of geothermal leases. These geothermal leases are located near MP 193 and between MPs 216 and 221. Mining claims on federal lands are reported to exist between MPs 74 and 119 as well as near MPs 140 and 170; records indicate that most of these claims are closed. A placer claim reported to exist on federal land near MP 1.5R is also indicated as being closed. Discussions with BLM and Forest Service staff indicate that no new mining resources permits have been submitted for operations on federal lands (Yamamoto 2012) since an evaluation was last completed in 2009.

The Green Butte Quarry was identified at MP 101.8 within the Umpqua National Forest. However, GeoEngineers (2013e) indicated that this quarry was never opened and there are no plans for its future development. The proposed route between MPs 108.6 and 110.9 avoids the Peavine Quarry within the Umpqua National Forest. The pipeline alignment at MP 150.5 is within approximately 100 feet northeast of the Heppsie Mountain quarry on BLM land. Based on aerial photograph review of the quarry depths, trends, and distances from the pipeline, it was concluded that the quarry likely would extend into a stable rock outcrop that currently parallels the proposed route and does not pose a risk to the quarry or the pipeline project (GeoEngineers 2013e). POD attachments include the *Blasting Plan*, *Right-of-Way Clearing Plan*, and *Right-of-Way Marking Plan*, all of which would serve to ensure the avoidance of quarries.

Near MP 109, the pipeline would be about 0.3 mile and 0.5 mile east of the Nivinson and Red Cloud mercury mines, respectively. Construction and operation of the pipeline would not affect these mines. The proposed route would cross areas mapped as volcanic and volcanogenic rocks at the current crossings of the East Fork Cow Creek. These bedrock units have not been identified as a significant source of naturally occurring mercury. Naturally occurring mercury in this area typically is associated with metamorphic bedrock units such as amphibolite.

The Forest Service reports that naturally occurring mercury exists in the vicinity of the Mars Prospect located near MP 108.7 (Broeker 2010b). Broeker concluded that naturally occurring mercury is present in the disrupted soil regolith and underlying bedrock strata throughout the upper reaches of the East Fork Cow Creek watershed. Although localized, mercury values are sufficiently high enough to have warranted exploration, development and minor production between the 1930s and 1960s. Geochemical analysis of six soil samples collected along a 2,000-foot section of Pacific Connector's previously proposed route in this area that crossed partly through the historic Thomason mining claims near the East Fork Cow Creek determined the area to have very low concentrations of naturally occurring mercury mineralization. Pacific Connector subsequently rerouted its proposed route in this area approximately 2,500 feet from where the samples were taken.

Based on the analytical results, mapped bedrock at the proposed route, and the distribution/location of mercury mines, it is unlikely that the soils underlying the currently proposed crossing of the East Fork Cow Creek would have concentrations of naturally occurring mercury exceeding those measured in samples obtained from the previous crossing location and most likely would have lower levels. Additional details on the literature research, field observations and soil sampling and analysis completed for the prospects and mines located near MPs 108 to 110 are provided in GeoEngineers (2013e). Soil sampling and analysis results also support that mercury specific health and safety protocols would not be needed for the

construction activities. It is expected that the planned erosion and sediment control measures described in the Pacific Connector's ECRP would protect the ecological health of upland and in-stream areas from the naturally occurring mercury concentrations.

The pipeline could potentially interfere with future mining and reclamation activities on lands adjacent to the right-of-way. Future expansions of surface mines near the right-of-way potentially could be limited or precluded in some cases because mineral resources could not be extracted from slopes immediately above or below the pipeline right-of-way or from beneath the pipeline. Similarly, the presence of the pipeline could limit or preclude the stockpiling of mineral resources or development of a processing area on slopes above or below the pipeline. These considerations also could limit or preclude reclamation activities at mine sites near the pipeline because of the potential to disturb the slopes above and below the pipeline and right-of-way. Any impact would be site-specific and would depend on topography, drainage, and subsurface conditions in that area.

4.2.3.3 Rock Sources and Permanent Disposal Sites on Federal Lands

Rock source sites may contain useable mineral deposits that may be extracted and/or purchased for use during construction. Disposal sites were identified for final placement of unusable, non-merchantable materials. These sites are typically exhausted areas within active quarries or abandoned quarries and may include commercial sites. Other permanent storage sites, including some TEWAs, were identified for permanent storage of excavated material. The material disposed of in these areas would be properly graded, drained (if necessary), and revegetated. The sites identified are not proposed for expansion beyond their proposed permitted or authorized boundaries. Use of any site would be permitted as required by the appropriate jurisdiction or landowner, and Pacific Connector would comply with applicable permits/stipulations. The disposal of mineral material to Pacific Connector from rock sources proposed to be utilized on BLM lands would follow regulations in 43 CFR 3600.

Pacific Connector has identified 42 potential rock source and permanent disposal sites that total approximately 175 acres along the pipeline route. Of these 42 rock source/disposal sites, 22 are located within federal lands as shown in table 4.2.2.4-1. Fourteen of these sites have been previously used and disturbed by quarry operations and/or strip mining. Most of these sites continue to have ongoing quarry operations. Only the disposal sites (and not the TEWAs) listed in table 4.2.2.4-1 are being proposed for use as permanent disposal sites.

Pacific Connector does not intend to expand these sites beyond the existing or previously disturbed footprints. If Pacific Connector acquired rock from these sources or permanently disposed of excavated material, all available topsoil would be salvaged. The salvaged topsoil would be used to restore the site as required by landowner stipulations. Rock resource areas managed and developed by Pacific Connector would need quarry Operation and Reclamation Plans, to the extent required by DOGAMI's regulatory authority (OAR 632-030-0005 through 0070 and ORS 517.750 through 990). Appropriate BMPs would be implemented, such as those in Norman et al. (1998). No impacts are anticipated from the rock sources and permanent disposal sites.

4.2.3.4 Blasting During Trench Excavation on Federal Lands

Pacific Connector identified areas where blasting may be necessary by reviewing the NRCS soils maps and descriptions to identify soil units that typically contain bedrock within 5 feet of the

ground surface. Soils data, geological maps, and topographic relief were used to rank the qualitative likelihood for blasting along the pipeline.

Table 4.2.2.5-1 provides a summary of the blasting potential along the pipeline. Although the blasting potential is classified as high for about 100 miles of the proposed route, this distance estimate includes local areas as much as 0.9 mile in length that contain valley fill, thick soils, and soft volcanic rocks (such as tuffs) that would not need to be blasted. In addition, some of the proposed route classified as having a high or moderate potential for blasting may contain weathered rock that could instead be ripped by conventional excavation equipment. The potential for blasting on BLM lands includes the following areas: MPs 1.47R–60.0, 60.0–70.1, 70.1–78.1, 78.1–88.6, 89.6–90.8, 90.8–94.5, 94.5–109.4, 136.3–136.8, 136.8–138.7, 138.7–159.9, and 174.4–181.1. The potential for blasting on NFS lands includes the following areas: MPs 110.9–112.1, 112.1–135.4, 159.9–172.0, and 172.0–174.4. The potential for blasting on Reclamation lands includes the following area: MPs 191.7–227.2.

Blasting for grade or trench excavation would be utilized only after all other reasonable means of excavation have been used and are unsuccessful in achieving the required results. Pacific Connector may specify locations (foreign line crossings, near-by structures, etc.) where consolidated rock would be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Pacific Connector would conduct all blasting in accordance with all federal, state, and local regulations and Pacific Connector Construction Specifications. Pacific Connector would include specifications in any blasting contract to control adverse impacts, including measures to minimize vibrations and flyrock, measures for safe blasting practices near active pipelines, and seasonal restrictions to protect wildlife, as needed. Pacific Connector would have blasting inspectors present to ensure that all specifications were met and to perform pre- and post-blast inspections of nearby structures and wells.

Drilling and blasting would be done with the Pacific Connector inspector present and with inspector's approval to proceed prior to each blast. Blasting operations would be conducted by or under the direct and constant supervision of experienced personnel legally licensed and certified to perform such activity in the jurisdiction where blasting occurs. Pacific Connector would require their contractor to provide a Blasting Plan at least five working days prior to any blasting-related activity, or two weeks prior to blasting on federal lands, and the contractor would be required to obtain Pacific Connector approval in writing prior to starting work.

4.2.3.5 Paleontological Resources on Federal Lands

Paleontological resources on federal lands are regulated, as outlined in 36 CFR Ch. 11 261.9 (i). Pacific Connector consulted with federal land management agencies for information on potential paleontological resources crossed by or within the pipeline right-of-way.

Potential Paleontological Resources on NFS Lands

Pacific Connector states that consultation with staff of the Real Estate and Mineral Resources Section of the Umpqua National Forest reported that there were no known paleontological resources on the portions of the pipeline right-of-way located within the boundaries of the Umpqua, Rogue River, and Winema National Forests. According to Paleontology Associates,

only the Umpqua and Rogue River National Forests bear potentially favorable lithologic units for fossil content along the pipeline corridor. These units occur in:

- Umpqua National Forest MPs 106 to 109—Fisher formation-volcanic ash and lacustrine siltstone;
- Umpqua National Forest MPs 109.5 to 115.5—Little Butte and Colestin formations-tuffaceous sediments;
- Rogue River National Forest MPs 120 to 121—Colestin formation-tuffaceous sediments; and
- Rogue River National Forest MPs 155 to 158—No formal formation designation-tuffaceous sediments, lahars, waterlaid tuffs.

Based on the information provided regarding the lack of identified paleontological resources within the pipeline right-of-way on NFS lands, no measures appear necessary for the avoidance and minimization of adverse effects to paleontological resources on NFS lands. Pacific Connector does not plan to monitor for lithologic units on NFS lands.

Potential Paleontological Resources on BLM Lands

The BLM required an assessment of the potential for paleontological resources on the portion of the right-of-way located on the lands it manages. Pacific Connector completed an assessment that indicates there is a limited potential for encountering paleontological resources on BLM lands and only localized monitoring would need to occur during pipeline construction. The following sections summarize the findings from the paleontological resource assessment. The full assessment report is contained in the *Final Paleontology Assessment, Pacific Connector Gas Pipeline Project, Coos Bay to Malin, Oregon* (GeoEngineers 2013g).

A formal analysis of existing paleontological data was completed for the portions of the pipeline right-of-way on BLM lands. The analysis, completed by Dr. William Orr, who is recognized by the BLM as a qualified paleontologist, was conducted in general accordance with BLM Manual H-8270-1 (BLM 1998b).

Fossil-bearing rock formations along the portions of the right-of-way located on BLM lands range in age from the Jurassic period (almost 200 million years old) to the Pleistocene Epoch (about 12,000 years before present). Between MPs 17 and 54, the right-of-way on BLM lands almost entirely traverses Eocene units of the southern Coast Range. The units span the entire epoch, with a wide variety of clastics ranging from coarse conglomerates to very fine-grained deep water silts and shales. Paleocene Epoch intervals in the lower Roseburg Formation could potentially contain plants, invertebrates, reptiles (turtles) and odontocete cetacea (primitive toothed whales). In addition, Pleistocene intervals in localized swamp boggy areas of the Roseburg Formation could potentially yield bones of large Ice Age mammals.

The portion of the BLM lands in the Klamath Mountain interval between MPs 54 and 97 has some of the oldest and most complex rocks in Oregon. Because most of the Klamath rocks are mapped as tectonic accretionary terranes, even the most fragmentary fossils discovered would be significant.

BLM lands would be crossed between MPs 110 and 123, MPs 128 and 137, and MPs 167 and 172 in the Cascade Range. Two formations in this region, the Colestin and Little Butte, have a potential for producing plant fossils. Both of these formations were deposited in nonmarine,

continental settings with volcanogenic ash, tuff and silts mixed with extrusive volcanics of basalt, basaltic andesite and related igneous rocks. Despite the wide range of ages and environments, the floral lists at any given site for either formation are limited. As a result, any new taxa recorded or salvaged in the course of the construction activities would add to the knowledge of the Cascade geologic history.

Between MPs 216 and 217, the pipeline right-of-way crosses BLM lands in the Basin and Range province. Lake sediments of Cascade ash dating between 5 million to 11,000 years ago in this area bear a limited, but stratigraphically important fauna.

Paleontology Field Monitoring Protocols for BLM Lands

Pacific Connector conducted a field survey of the above-referenced portions of the pipeline right-of-way that occur on BLM lands. The locations observed during the survey were selected using the results of the formal analysis of the existing data and a mile-by-mile evaluation of the geologic formations along the right-of-way.

The field survey results were used to classify the potential for encountering paleontological resources on BLM lands during construction. The classifications used for the project were consistent with classes 1 through 5 in the BLM Potential Fossil Yield Classification procedure (revised H-8270-1).

All but 1 mile of the right-of-way on BLM lands has been classified as meeting Class 3a or 3b, based on the formal analysis and the field survey. An approximately 0.25-mile segment from MP 216.5 to 216.75 is classified as Class 4a. For approximately 25 miles of the Class 3a or 3b lands, the BLM would require limited spot monitoring during pipeline construction because the potential presence of fossils cannot be completely eliminated. The 1-mile-long area not classified as Class 3 is divided into two approximately 0.5-mile-long areas classified as Class 1 and Class 2. To satisfy BLM requirements, Pacific Connector would continuously monitor both of these segments for the potential presence of paleontological resources during pipeline construction. The spot or continuous monitoring during construction would be conducted by a field paleontologist working under the supervision of the lead paleontologist.

Procedures for Recovering Significant Discoveries of Vertebrate or Invertebrate Fossil Remains on BLM Lands

Although the likelihood of discovering paleontologically significant fossils on BLM lands is considered remote, such a discovery could potentially occur during the proposed surveys, brush clearing, or construction activities. The field inspector or field paleontologist identifying a fossil of potential interest would be responsible for notifying the lead paleontologist immediately of the discovery. The lead paleontologist would, in turn, evaluate the significance of the finding relative to the salvage parameters. If the fossil was considered salvageable material, it would be recovered under the direction of the lead paleontologist and Pacific Connector. Pacific Connector proposes to designate the University of Oregon Museum of Natural and Cultural History as the repository for any salvageable material recovered from the portion of the pipeline right-of-way located on BLM lands.

4.3 SOILS AND SEDIMENTS

The five principal factors of soil formation include parent material, climate, relief, living organisms or biological activity, and time. In the project area, soils have formed as a result of these five factors and soil differences are primarily a result of the relative importance, or dominant influence, of the various soil formation factors.

4.3.1 Jordan Cove LNG Terminal

4.3.1.1 Shoreline Along the Waterway for LNG Vessel Marine Traffic

Jordan Cove conducted a study to evaluate shoreline impacts during the transit of LNG vessels in the waterway to and from the LNG terminal (CHE 2011b).[37] The analysis indicated that pressure fields in the Coos Bay navigation channel generated by LNG vessels would be less than those currently caused by deep-draft cargo ships using the Port. There would be a small increase in wake-generated sediment transport from LNG vessels combined with assisting tugs and escort boats. However, it is not expected that soils along the waterway would be adversely affected by the wave action from LNG vessel traffic in the waterway because the LNG vessels would transit the bay at slow speeds and would not produce wakes large enough to erode the shoreline.

4.3.1.2 Soil Composition

The NRCS Soil Survey of Coos County, Oregon, indicates that the LNG terminal tract comprises primarily Waldport Fine Sand (59D and 59E), Heceta Fine Sand (28), Dune Land (16), Waldport-Heceta Fine Sand (61D), and Udorthents (57) (NRCS 2012a). Coquille silt loam (12) is found at the Kentuck Slough wetland mitigation site. With the exception of the Coquille silt loam, these soils are predominantly sands. Soil types for the U.S. Highway 101–Trans-Pacific Parkway intersection are not listed in NRCS sources; however, the geotechnical investigation completed in this area indicates that soils consist of manmade fill composed predominately of sand.

Construction of the Jordan Cove Project (including temporary and permanent effects) would disturb a total of about 397 acres as shown in table 4.3.1.2-1. This would include about 45 acres of Dune Land soils, 56 acres of Heceta Fine Sand soils, 98 acres of Waldport Fine Sand soils, 119 acres of Waldport-Heceta Fine Sand, 49 acres of Udorthents, and less than 1 acre of Heceta-Waldport Fine Sand.

TABLE 4.3.1.2-1

Acres of Impacts at the Jordan Cove LNG Terminal, by Soil Type

Soil Type	Acres a/	Percent
Jurisdictional Project Area		
Heceta Fine Sand	35	21.2%
Waldport-Heceta Fine Sand	53	32.2%
Heceta-Waldport Fine Sand	<1	0.3%
Waldport Fine Sand	54	32.8%
*Water	29	NA
Dune Land	22	13.4%
Udorthents, level (57)	<1	0.2%
Subtotal	**195**	**100.0%**

[37] See Coast & Harbor Engineering, 9 March 2011, Volume 2 – Jordan Cove Energy Project and Pacific Connector Pipeline Coastal Engineering Modeling and Analysis, filed as Appendix H.2 in Resource Report 2 of Jordan Cove's May 2013 application to the FERC.

TABLE 4.3.1.2-1

Acres of Impacts at the Jordan Cove LNG Terminal, by Soil Type

Soil Type	Acres a/	Percent
Non-Jurisdictional Project Area		
Waldport-Heceta Fine Sand	61	93.2%
Waldport Fine Sand	5	6.8%
Subtotal	**66**	**100.0%**
Temporary Construction Areas		
Dune Land	23	16.9%
Waldport Fine Sand	39	28.5%
Heceta Fine Sand	21	15.4%
Waldport-Heceta Fine Sand	5	3.7%
Udorthents, level (57)	48	35.5%
Subtotal c/	**136**	**100.0%**
Totals by Soil Type (entire terminal project)		
Heceta-Waldport Fine Sand	<1	0.1%
Dune Land	45	12.3%
Waldport Fine Sand	98	26.6%
Waldport-Heceta Fine Sand	119	32.5%
Heceta Fine Sand	56	15.2%
Water b/	29	NA
Udorthents	49	13.3%
Project Total	**397**	**100.0%**

a/ Column may not add correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
b/ Although it is acknowledged that water is not a soil, water is included because it is included in the soils mapping categories. Water is not included in percentage calculations and is denoted as "NA" for not applicable.
c/ The North Point Workforce Housing Complex adds an additional 2 acres to the temporary construction areas subtotal and project total that is not reflected in the table (see chapter 2). Soils in the housing project area are primarily Udorthents. This modification does not change the overall conclusions regarding soils impacts.

Waldport Fine Sand comprises approximately 27 percent of the project area. The Waldport Fine Sand is a deep, excessively drained soil, located on stabilized sand dunes. It is formed in aeolian deposits. Permeability of the Waldport soil is very rapid, but runoff is slow. This soil is susceptible to wind and water erosion and has the potential for severe erosion hazard.

Heceta Fine Sand comprises 15 percent of the project area. This is a deep, poorly drained soil found in deflation basins and depression areas between dunes. It is formed on aeolian materials. Permeability of this soil is rapid, and runoff is ponded. It only has a slight potential for water erosion.

Waldport-Heceta Fine Sands comprise approximately 33 percent of the project area. The soil is composed of 50 percent Waldport Fine Sand and 50 percent Heceta Fine Sand (both described above). This soil is characterized for its susceptibility to erosion and past erosion damage.

Dune Land soil makes up 12 percent of the project area. It consists of fine and medium textured sands on hills and ridges, formed in eolian deposits. Permeability is very rapid and runoff is slow. This soil type is susceptible to slight water and severe wind erosion.

Udorthents soils comprise 13 percent of the project area. They occur on floodplains, marshes, and tidal flats and in areas that have been filled and leveled for commercial and industrial uses. Areas on floodplains are made up of sandy, silty, or clayey material; and areas on marsh and tidal flats are made up of dredging spoil, dune sand, and wood chips. Soils at the proposed LNG terminal and the planned South Dunes Power Plant site have been previously disturbed by the operations of the Menasha and Weyerhaeuser companies and from the placement of fill material. At the Ingram Yard, the fill material, derived from COE dredging of the Coos Bay navigation channel in the 1970s, is more than 10 feet deep in some areas and mantles much of the terminal site. More

recent testing and grading in the area of the Ingram Yard revealed the presence of ash-amended soils from 6 to 12 inches.[38]

The surficial fill materials present on portions of the terminal site are predominantly sand with some small percentage of silt. The material is typically characterized as loose to medium dense, brown sand. The material is fine grained and contains scattered shell fragments to a depth of 10 feet and a trace of silt. While not classified by the NRCS, it was assumed that these materials have similar properties and characteristics to adjacent soil types. Permeability of the fill materials is rapid. Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of wind erosion is moderate to severe. GRI performed geotechnical investigations in the area of the LNG storage tanks and process area of the proposed LNG terminal, including 11 deep borings.[39] The subsurface data revealed that generally the area was mantled by relatively clean, fine-grained sand, with traces of silt that is underlain by weathered sandstone. The sand layer extended from the surface to a depth of at least 124 feet.

Another geotechnical investigation was performed by GRI in April 2012 (GRI 2012) in the area where the planned South Dunes Power Plant (or "mill site") would be located, which included 12 deep borings. Typically, the upper 10 to 20 feet of the mill site is mantled with fill. The majority of the fill consists of reworked dune sand. The subsurface data revealed that generally underlying the fill was a relatively clean, fine-grained sand, with traces of silt, underlain by weathered siltstone.

GRI geotechnical explorations at the proposed Kentuck Slough wetland mitigation site indicate that the site consists of interbedded layers of sand and silt that extend from beneath an approximately 1- to 2-foot-thick surface layer of fill to a depth of about 35 feet, followed by silt to depths of about 70 to 100 feet. High moisture contents measured in the soil suggest the silt and sand may have a high organic content.

Sampling of the area to be dredged for the terminal access channel and marine slip was conducted during October 2006. A comprehensive sediment sampling and analysis program (SAP) protocol was prepared and submitted on August 17, 2006, for review by the COE. Results indicate that most of the materials consisted of sand. Grain size distribution analysis completed on 20 samples indicated the average percentage of sand was greater than 99 percent. No rock was encountered in the explorations for the SAP.

4.3.1.3 Soil Limitations

Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion as determined by the U.S. Department of Agriculture (NRCS 2012b). Prime farmland can include land that possesses these characteristics but is being used currently to produce livestock and timber. Urbanized land and

[38] SHN, 2015, Letter to Robert Braddock, Jordan Cove Energy Project, regarding the Ingram Yard Test Pile and Ground Improvement Project, Chronology of Events, filed with FERC on February 3, 2015.
[39] GRI, 23 April 2013, Task Order No. 5, Geotechnical Investigation Proposed Jordan Cove LNG Facility Coos County, Oregon, attached as Appendix A.6 in Resource Report 6 of Jordan Cove's May 2013 application to the FERC.

open water are excluded from prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., using artificial drainage or irrigation).

Heceta Fine Sand does not meet the criteria for prime or unique farmland, but is considered to be farmland of statewide importance. This classification includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods (see section 4.3.2.1 for additional discussion of the "farmland of statewide importance" designation). However, no areas associated with the Jordan Cove Project are currently being used for cropland. The Ingram Yard and former mill site have been previously modified by industrial activities and the placement of fill. No prime farmland soils would be taken out of production by construction and operation of the Jordan Cove LNG terminal and related facilities.

Hydric Soils

Hydric soils are defined as "soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Federal Register 1994). Soils that are artificially drained or protected from flooding (e.g., by levees) are still considered hydric if the soil in its undisturbed state would meet the definition of a hydric soil. These soils are typically associated with jurisdictional wetlands, which must meet three required criteria: hydric soils, wetland hydrology, and hydrophytic vegetation, except in "atypical wetland situations" where not all criteria are evident. These situations are defined in the regional interim supplements to the COE's Wetland Delineation Manual (Environmental Laboratory 1987).

The Heceta Fine Sand soils are characterized as predominantly hydric and have mostly been covered with dredged material at the Jordan Cove Project site. These soils are located on the western edge of the terminal site, between Henderson Marsh and the forested dune, and on the northwestern corner of the area for the proposed marine slip. The Waldport-Heceta Fine Sands are partially hydric. The remaining site soils are non-hydric or predominantly non-hydric.

Jordan Cove has conducted wetland delineations of the site (see section 4.4 for a discussion of wetland delineations), which included evaluation of hydric soils. Construction of the Project would temporarily impact 21 acres of Heceta Fine Sand and 5 acres of Waldport-Heceta Fine Sand soils; and would impact 35 acres of Heceta Fine Sand and 53 acres of Waldport-Heceta Fine Sand soils that are located in the jurisdictional project area (NRCS 2012a).

Impacts on hydric soils would be reduced by Jordan Cove following the measures outlined in its *Plan* and *Procedures*. In addition, Jordan Cove proposed a *Compensatory Wetland Mitigation Plan* to mitigate impacts on wetlands. See section 4.4 for additional details regarding wetlands.

Erosion Potential

Erosion is a continuing natural process that can be accelerated by human disturbances. Factors that influence soil erosion include soil texture, structure, length and percent of slope, vegetative cover, and rainfall or wind intensity. Soils most susceptible to erosion by wind or water are typified by bare or sparse vegetative cover, non-cohesive soil particles with low infiltration rates,

and moderate to steep slopes. Wind erosion processes are less affected by slope angles but highly influenced by wind intensity.

The potential for soil erosion at the proposed Jordan Cove LNG terminal varies based on the erosion mechanism and the soil characteristics. The soils at the terminal site occur within an area of high wind intensity and are in wind erodibility groups 1 (extreme) and 2 (high), which are the most susceptible to wind erosion. For the 98 acres of Waldport Fine Sand, the potential for water erosion is moderate to severe and the potential for wind erosion is extreme to severe when winds are strong.

The 56 acres of the Heceta Fine Sand and 45 acres of the Dune Land soils that would be impacted both have a slight potential for water erosion and high to severe potential for wind erosion, with the Dune Lands considered severe. The utility corridor would be constructed in the Dune Land soil. Runoff from the approximately 119 acres of Waldport-Heceta Fine Sand and 49 acres of Udorthents soils that would be impacted is slow, and the hazard of water erosion is slight to moderate, and the hazard to wind erosion is moderate to severe.

The erosion potential of soils at the terminal site is severe in some areas unless properly stabilized by the erosion and sedimentation BMPs to be implemented during construction. Temporary ditches, sediment fences and silt traps would be installed as necessary to minimize soil loss during construction and operation of the facility. Individual excavations would be made for equipment foundations. Following completion of foundations, the site would be filled, compacted, and brought up to final grade. Final grading and landscaping would consist of gravel-surfaced areas, asphalt-surfaced areas, concrete-paved surfaces, and grass areas. Areas disturbed by construction activities that would not be permanently covered with hard surface would be grassed using a seed mixture specified by the NRCS as being capable of surviving in highly permeable, xeric regimes, binding loose sand, and withstanding burial and deflation from aeolian process. Native species would be used and, if any non-native species are required for specific problem in extreme cases areas, species would be selected that would not become nuisance species to the surrounding areas.

Jordan Cove would adopt the provisions of the FERC's *Plan* and Jordan Cove's *Plan* to ensure that potential effects on soils due to construction are minimal. To minimize potential for soil loss due to erosion, all temporary erosion controls would be installed and maintained in accordance with Jordan Cove's *Plan*. In addition to temporary erosion controls, long-term erosion and sedimentation would be minimized by using county and state BMPs such as removing temporary sediment barriers and installing permanent erosion control measures as necessary. Permanent erosion control measures may include vegetation, vegetated swales, infiltration or settling basins, stormwater runoff diversion and control through ditches, check dams, or other velocity dissipaters.

For portions of the storm surge/tsunami barrier and terminal areas above +25 feet in elevation, which are not expected to normally be subjected to severe wind or water conditions, alternative erosion control would be used. The slope areas would be protected from potential tsunami runups using either concrete cellular mattresses, grout injected geotextile fabric mattresses, or other suitable means as determined during detailed design. The design of the slope protection against waves would be developed through consultation with DOGAMI. The erosion control measures would be designed in accordance with the ODOT Erosion Control Manual. By implementing the above-mentioned erosion control measures, construction of the LNG terminal and slip would not result in significant soil erosion by water or wind.

Erosion of the engineered slopes within the marine slip is not anticipated under normal conditions due to hydraulic mechanisms. The erosion control methods would be designed to withstand expected rainfall runoff and would be in accordance with the ODOT Erosion Control Manual. The east side of the slip would contain the LNG berth, and the north side would have the tug berth. The marine slip would be protected from LNG vessel and tugboat propeller scour with shore armor extending from the toe of the slope to above the water line where it would be tied into other slope stabilization techniques (concrete cellular mattresses, grout injected geotextile fabric mattresses, and/or geotextile reinforced vegetative planting). Additional discussion and description of the LNG terminal and slip design is included in sections 2.1.1 and 2.4.1 of this EIS.

Compaction Potential

Soil compaction is the process by which soil pore air space is reduced in size because of physical pressure exerted on the soil surface. Compaction results in soil conditions that reduce infiltration, permeability, and gaseous and nutrient exchange rates of the soil. Physical resistance to root growth can occur with high soil bulk densities. Soil compaction changes the soil structure by reducing the porosity and increasing the bearing strength of the soil. As a result, the ability to receive water is reduced, leading to an overall reduction in the moisture-holding capacity of the soil. The degree of compaction depends on the moisture content at the time of compaction and soil texture. Compaction decreases infiltration and thus increases runoff and the hazard of water erosion. Fine-textured soils with poor internal drainage are the most susceptible to compaction. Sandy loam, loam, and sandy clay loam soils compact more easily than silt, silt loam, silty clay loam, silty clay, or clay soils (NRCS 2012b).

Construction equipment traveling over wet soils could further disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting. Further compaction and rutting of impacted areas would be more likely to occur when soils were moist or saturated. However, based on previous activities at the Roseburg tract, and when Weyerhaeuser owned the terminal parcel, including dredge and fill activities, the soils at the terminal site are considered to be compacted. During most dredge and fill operations, material placed onto the land surface is compacted using heavy machinery. Jordan Cove would test subsoil for compaction at regular intervals in areas disturbed by construction activities.

The proposed cut and fill is largely balanced for the movements of the materials from the marine slip, the leveling of the LNG terminal site and the filling of the South Dunes Power Plant site. Approximately 60,000 cy of sand materials would be transported via trucks from the LNG terminal site to be used on the Kentuck Slough site for creation of the estuarine mitigation site. This fill is necessary to establish the appropriate vertical profile to establish tidelands influenced habitat. For additional information regarding the mitigation site, see discussions and information provided in sections 2.1.1.12 and 4.4.3 of this EIS.

Potentially Contaminated Upland Soils

Jordan Cove conducted multiple Phase I and Phase II ESAs at the terminal tract to determine if it contains contaminated soils. Phase I protocols consist of record searches, inventories, site visits, and other methods, but are not intrusive. Phase II protocols consist of intrusive sampling. Phase II ESAs were conducted to address the findings of the Phase I ESAs (CH2M Hill 1996; Thiel Engineering 2004; GRI 2005; PES Environmental 2006; GRI 2007c; GSI Water Solutions 2012). The ESAs are provided in Jordan Cove's Resource Report 7, Appendices C through F, dated May 21, 2013.

The site of the LNG terminal, referred to as the Ingram Yard, was the location of a livestock ranch until 1958. After it was acquired as part of the mill complex, the tract was occasionally used for log sorting activities. In 1972-1973, the COE spread materials dredged during maintenance of the Coos Bay navigation channel on the site. From the late 1970s through the early 1980s sand, boiler ash, and wood debris from milling operations were placed on the property. Weyerhaeuser, which acquired the mill in 1981, spread decant solids from its wastewater treatment facility at the Ingram Yard between 1985 and 1994.

In 1996, Weyerhaeuser had CH2M Hill conduct Phase II ESA investigations that found, with the exception of one sample, potential contaminants in the fill at the Ingram Yard were below levels that would necessitate cleanup work (CH2M Hill 1996). Polychlorinated biphenyl (PCB) concentrations in one sample were above the residential cleanup level but below the industrial level. Concentrations of arsenic were within natural background levels.

Additional Phase II ESA investigations were conducted by PES Environmental, Inc. (PES) in 2006. Eight composite samples were taken, at depths up to 18 inches, from the northern portion of the Ingram Yard. Trace amounts of barium, chromium, lead, and mercury were detected, but below screening levels. Low levels of dioxins, furans, and butyltin compounds were also detected in soil samples from the site. The amount of these contaminants were found to be below the EPA screening levels that represent a risk to human health for either residential or industrial land use (PES 2006).

A third Phase II ESA investigation was done at the LNG terminal site by GRI in October 2006 (GRI 2007c). Twelve test pits between 4 to 9 feet deep were excavated at the Ingram Yard, and two additional pits were located along the proposed eastern access road to the LNG terminal on the Roseburg property. Samples collected in areas where the black ashy mill waste was deposited typically had higher concentrations of contaminants than those taken at locations consisting only of sand. Volatile organic compounds (VOCs) and tributyltin were not detected. Detected levels of polynuclear aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons were below state and federal guidelines. Dioxins and furans were detected throughout the site at levels below the preliminary remedial goals for individual compounds. The toxic equivalent value for one sample collected at a depth of 2 feet was above federal guidelines for a dioxin/furan compound (2,3,7,8TCDD), but the statistical level for the site as a whole is below state requirements. Chromium and arsenic values for one sample were above naturally occurring levels, but that was likely caused by decaying treated wood waste. GRI recommended that when Jordan Cove conducts excavations for the marine slip the former mill waste should be separated, placed in the center of the bermed disposal areas at the South Dunes Power Plant area, and managed according to ODEQ standards and regulations (GRI 2007c).

GRI performed a Phase II ESA investigation of the Roseburg property in 2005 (GRI 2005). The Roseburg property includes northeastern portions of the LNG terminal area and a portion of the slip area. Roseburg has been using the property for wood processing activities since 1968. Geoprobe explorations were advanced to a maximum depth of 16 feet below the ground surface. Contaminants were detected in several locations throughout the area that would be used for temporary construction facilities. Detected levels of barium, chromium, and lead are within normal background levels for soils in Oregon. Soil samples from around an old burn pile (located to the east of the former shipping building) indicated contamination from VOCs. The detected compounds were petroleum hydrocarbons constituents found only in soils samples and not in

groundwater samples. The detected concentrations were below the ODEQ Risk-Based Concentrations (RBCs) for residential soils (ODEQ 2012g). Contaminated areas were also found in the two existing buildings. Petroleum hydrocarbon constituents were found in the soil within the former sawmill building. Groundwater analysis indicated solvent constituents in the former sawmill building and petroleum hydrocarbon constituents in the former shipping building. Measured concentrations of the petroleum hydrocarbons, benzene, ethylbenzene, naphthalene, 1,2,4-trimethylbenezene and total xylenes are all within the ODEQ RBCs for residential soils and groundwater (ODEQ 2012g).

The Phase I ESA literature review that covered the South Dunes Power Plant area indicated that there were previous reports of spills of contaminated or hazardous waste. The site was originally developed as a sulfite pulp and paper mill by the Menasha Wood Ware Corporation in 1961. It was acquired by Weyerhaeuser in 1981, and converted to a recycle paper mill in 1995. The mill was closed in 2003. Between 1981 and 1992, Weyerhaeuser leased the southern portion of the property adjacent to the geographic Jordan Cove portion of Coos Bay to a fish hatchery operation. The buildings for both the mill and the fish hatchery have been removed. The Weyerhaeuser mill is included in the ODEQ's Environmental Cleanup Site Information (ECSI) database and in the Oregon Emergency Response Information System for a release of hydraulic oil to the ground surface in 1995. The fish hatchery has a separate entry in the ECSI database, identified as a level II area of concern, from a release of diesel fuel.

PES conducted Phase II testing in portions of the South Dunes Power Plant area. Concentrations of contaminants, including VOCs, PAHs, PCBs, dioxins and furans, and metals detected in soil and groundwater samples were below screening levels that would represent a risk to public health (PES 2006). The ODEQ issued Weyerhaeuser a "partial no further action" determination for the Ingram Yard and mill site, and included conditions that certain wastes be managed appropriately if they are disturbed (SHN 2015).

ODEQ approved the *Revised Work Plan for Joint Regulatory Closure Settling Basins, Petroleum-Contaminated Soil, Asbestos Waste, and Mill Waste Former `Weyerhaeuser Mill Site and Ingram Yard Properties* on July 22, 2013. The plan describes redevelopment of the South Dunes Power Plant site that would involve increasing existing site grades a minimum of 3 feet with clean structural fill consisting of sand from the new slip to be excavated on the Ingram Yard property. Development over the existing mill wastewater system settling basins would require over-excavation of geotechnically unsuitable (highly organic) sludge in the basins and replacement with clean, compacted structural fill. A qualified contractor familiar with handling potentially contaminated materials would be mobilized, and a dredge would be used to remove the basin sludge to a dewatering system. Potentially contaminated material would be transported off-site to an approved ODEQ-regulated facility that would be identified prior to construction.

The landfill Cell #3 located at the former Weyerhaeuser linerboard mill property is approximately 5.8 acres in extent. Jordan Cove plans to relocate the materials from this landfill to a qualified landfill site at the Columbia Ridge Landfill in Arlington, Oregon, managed by Waste Management (approximately all but 2 acres of the site will be filled in). This would be a benefit to the Jordan Cove Project and the overall site arrangement and would further protect the area and groundwater from this historically installed landfill. The landfill materials would be loaded in railcars and transported to the Columbia Ridge licensed existing landfill and properly disposed. This removal

would be done in conjunction with the overall *Mill Site Closure Plan* that was approved by the ODEQ on July 22, 2013.

Jordan Cove filed supplemental information with the FERC on February 3, 2015, concerning Jordan Cove's Ingram Yard Test Pile and Ground Improvement Project. It comprises a February 2, 2015, letter to Jordan Cove from its contractor, SHN Consulting Engineers & Geologists, Inc. (SHN), and 12 attachments. The letter summarizes the chronology of activities for the test project, in particular as related to contaminated soils and a buried septic tank. During the final grading of the test pile staging area, a loader encountered a buried concrete tank on the southeast corner of Ingram Yard near the sheet pile staging area. The tank lid was punctured by the loader and liquids within the tank were observable. Inspection of the tank revealed no discernible odors or visual clues to suggest that the tank had petroleum residuals or volatile compounds, or signs of contamination in the soils around the top of the tank. Instead, the liquids in the tank were determined to be indicative of an old septic/holding tank. In early June 2014, after the test pile and ground improvement program was completed, tank liquids were tested and determined to be suitable for disposal as sewage. Once the tank contents were removed and properly disposed of, the tank was decommissioned by breaking the concrete into rubble and backfilling the void with clean sand.

On February 3, 2015, Jordan Cove filed the results of its 2014 geotechnical testing program at the Ingram Yard with the FERC. Grading for the north access road and the ground improvement test site required excavating between 12 inches to 60 inches of clean and low-level contaminated soils from a 2-acre area. Ash-amended soils were encountered during the site-grading activities occurring April 7 through April 15, 2014, with a total of 5,600 cubic yards of ash/soil mixture excavated and stockpiled on-site in berms as indicated in the 1200C permit.

During the grading of the site, an OSHA site inspection was performed and did not find exposure levels of concern among individuals working around the ash/soil mixture. While monitoring results indicated no worker exposure from the low-level contaminants in the soil, the OSHA site visit did initiate development of a site-specific health and safety plan for Ingram Yard (Attachment 7 of the supplemental filing with the FERC) was prepared by an industrial hygienist using past Phase 2 waste characterization studies. Based upon potential for inhalation exposure from the contaminants of concern, the health and safety plan identified that control of air born particulates (dust) would be beneficial for protecting workers from low-level contaminants in the ash/soil mix; and an air monitoring plan was also prepared (Attachment 9 of the supplemental filing with the FERC) and implemented during the ground improvement program. Real-time air monitoring of dust during the ground improvement project proved effective, and at no time did dust levels exceed job site threshold levels set for protection of workers.

On May 8, 2014, ODEQ conducted an on-site investigation of Ingram Yard activities. Based on ODEQ's site visit, it was determined that the low-level contaminated soils had been excavated and stockpiled on-site. These actions, while not prohibited, required a solid waste letter of authorization before commencement of grading activities. Because the work had already been initiated prior to being notified, ODEQ issued a "Warning Letter with Opportunity to Correct" (Attachment 10 of the supplemental filing with the FERC). The correction required Jordan Cove to obtain a solid waste authorization letter. On July 16, 2014, a solid waste authorization letter was submitted to ODEQ (Attachment 11 of the supplemental filing with the FERC). Per guidance from ODEQ, Jordan Cove would provide prior notice to ODEQ should any grading or ground

disturbance activities be planned to occur on Ingram Yard. Ultimately, provisions for long-term disposal of disturbed Ingram Yard soils and any other specific mitigation measures would be specified in detail in the final engineering design.

Jordan Cove has prepared an *Unanticipated Hazardous Waste Discovery Plan* that includes the following measures that would be implemented in the event that unanticipated soil contamination is discovered during construction of the LNG terminal facilities:

- contractor would stop work in the vicinity of the suspected contamination;
- contractor would cordon off or otherwise restrict access to the suspected area;
- contractor would immediately notify Jordan Cove's on-site EI; and
- Jordan Cove's on-site EI would immediately notify the Environmental, Health and Safety Division of Jordan Cove in the event that unanticipated soil contamination is discovered.

If Jordan Cove's Environmental, Health and Safety Division determines that additional action is necessary, Jordan Cove would implement the following measures:

- contact a qualified consultant and/or testing laboratory to assist with the determination of the extent and nature of the contamination;
- devise a plan for additional site-specific investigations as necessary;
- conduct the necessary level of site-specific testing and/or laboratory analysis to determine extent and nature of contamination;
- notify all applicable environmental authorities as required by law, including ODEQ;
- devise a site-specific plan depending on the nature and extent of the contamination encountered for continuation of construction. This step may involve evaluation avoidance options as necessary to support the construction of the proposed facilities;
- devise a strategy or plan for handling wastes in an appropriate manner including waste characterization, hauling, manifesting, and disposal necessary to support continuing construction;
- devise a plan for site stabilization and backfilling; and
- complete all required and necessary agency follow-ups and reporting.

Spills or leaks of fuels, lubricants, or coolant from construction equipment could contaminate soils. The effects of contamination would typically be minor because of the low frequency of spills and leaks. However, the soil and sand on the LNG terminal site have high permeabilities, shallow groundwater (10 feet or less), and rapid transmissivity. If a spill occurred, it would spread quickly (in three dimensions) before mitigation and/or remediation could begin. Jordan Cove would implement a water quality management plan that includes an SPCCP. These plans describe spill prevention practices, spill handling and emergency notification procedures, and training requirements and would be implemented during construction of the LNG terminal and pipeline. The SPCCP addresses the unique soil and subsurface conditions of the LNG terminal site, including the high permeability, shallow groundwater, and rapid transmissivity. With the design features and SPCCP, construction of the LNG terminal is not anticipated to spread existing contamination or cause additional soil contamination.

Potentially Contaminated Bay Sediments

The Port developed a SAP (SHN 2006b) that details the sediment collection and testing program conducted on the proposed dredged material. The SAP was developed based on procedures outlined in

the Lower Columbia River Management Area Dredged Material Evaluation Framework (DMEF) (COE et al. 1998). The sediment sampling and analysis program followed the DMEF Tier IIB approach for physical and chemical evaluation of the proposed dredged material. Four horizontally delineated areas were selected within the proposed dredging footprint to characterize the proposed slip access channel sediments (figure 4.3-1). Areas 1 and 2 were closest to the shoreline, whereas areas 3 and 4 were offshore, parallel to the Coos Bay navigation channel. Generally, two core locations were designated within each area in locations with the thickest deposits of proposed dredged materials (dredge prism). A total of eight sediment core borings were completed using direct-push methodology.

Dredged Material Management Units (DMMUs) were designated as "moderate" based on the DMEF ranking protocol with a maximum volume frequency of 40,000 cy for homogenous sediments. Two sediment bore locations were completed within each DMMU. Each sediment bore location was continuously cored in 4-foot intervals. Core intervals for each sediment bore were designated alphabetically, beginning with "A" representing the surface layer interval, and proceeding downward from the top in 4-foot increments. Each 4-foot DMMU depth interval was represented by one sample. The DMMU sample submitted for chemical analyses comprised core sections within the same sediment depth interval and with similar characteristics. Sample compositing was completed by the analytical laboratory. Four DMMUs were positioned on the proposed dredge area sediment surface that contained material from the depth interval 0 to 4 feet. This pattern was repeated for each subsequent depth interval of 4 feet, until the final designated characterization depth of -48 feet MLLW was attained or refusal was encountered. A total of 21 DMMUs representing the full dredge prism were characterized. Several sediment borings encountered refusal at deeper depths (25 to 35 feet below the sediment surface) and the deepest sediment sample collected at these locations was considered acceptable as a Z-sample. Z-samples represent the newly exposed sediment surface after dredging occurs.

During October 2006, direct-push boring samples were collected at eight locations specified in the revised SAP. The sediment core sections were segmented and sealed with Teflon tape and plastic end caps. The sediment core sections were transported by overnight courier to the analytical test laboratory for compositing. Collected samples were stored in iced coolers, or kept in a secured refrigeration unit at 39.2ºF.

Grain size analysis was immediately performed on all 21 DMMU composite samples following COE approved methods (COE et al. 1998). The results of the grain size distribution indicated the average percent of sand present in sediment samples was approximately 99.85 percent. The results of the total volatile solids (TVS) analysis indicated that the average percent TVS present in dredge prism sediments was approximately 0.71 percent.

Based on the results of the sediment sample analyses for grain size and TVS, and the DMEF guidelines for the Tiered Evaluation Process, no further analytical testing of sediment samples was completed. Specifically, DMEF Tier IIA states, "If the results of grain size analysis are at least 80 percent sand and TVS is less than 5 percent, the proposed dredging material qualifies for unconfined, aquatic disposal based on exclusionary status." The Port's report concluded that no areas of contaminated sediments were observed.

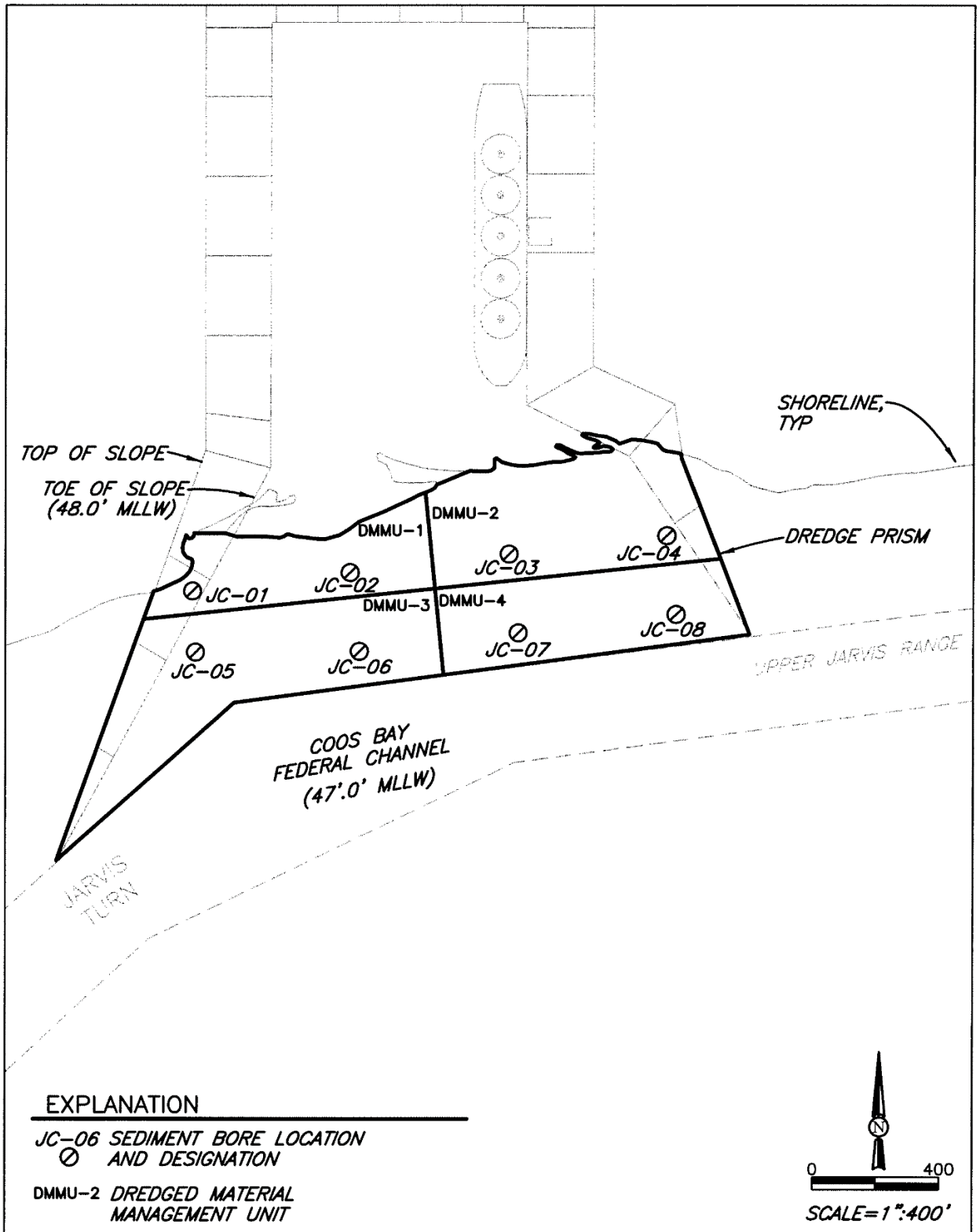

Figure 4.3-1

Dredged Material Management Units and Bore Locations

Extensive investigations regarding soil contaminants have been performed in close coordination with the COE at the Kentuck Slough mitigation site beginning in 2010. GRI has submitted four sampling and analysis plans and three sediment characterization reports for the site to the COE from September 2010 to November 2014. These studies document that chemical analysis of samples did not detect any contaminants above applicable screening levels and that the material is suitable for its intended use in the wetland mitigation site without restriction, with one exception. According to the sampling results documented in the November 13, 2014 Sediment Characterization Report, mercury is present at levels above Clean Fill screening criteria in sediments contained in the golf course irrigation pond. Oil-range hydrocarbons are also present at this location. Jordan Cove therefore plans to remove these sediments to an off-site disposal facility. COE approval of the reports is pending. In addition, no contaminants were detected that might be indicative of the previous existence of a methamphetamine lab on the property.

4.3.2 Pacific Connector Pipeline and Associated Facilities

Soils along the proposed pipeline route were identified using NRCS surveys for Coos, Douglas, Jackson, and Klamath Counties (NRCS 2004; SCS 1985, 1989, 1993); and NRCS State Soil Geographic Database (STATSGO) and Soil Survey Geographic Database (SSURGO) soil classifications (NRCS 2012a). The Forest Service soil resource inventories of the Umpqua, Rogue River, and Winema National Forests were used to assess soil resources in the National Forests (Forest Service 1976, 1977, and 1979). Information in the Forest Service surveys was supplemented by STATSGO and SSURGO data where available.

Regional maps from NRCS county soil surveys, coupled with SSURGO data, were used to provide descriptions of the soil associations that would be crossed by the pipeline and aboveground facility sites, including storage yards, rock sources, permanent disposal sites, proposed access roads, and proposed aboveground facilities. Generally, these associations are composed of two or three soil series. Each of the soil associations is a unique natural landscape with a distinctive pattern of soils, relief and drainage.

According to the NRCS Land Resource Regions and Major Land Resource Areas (MLRAs) (NRCS 2006b), the pipeline route would cross five MLRAs:

- the Sitka Spruce Belt including the Pacific Coast and Coos Bay area in Coos County;
- the North Pacific Coast Range, Foothills, and Valleys including Coos County and portions of Douglas County;
- the Siskiyou-Trinity Area including portions of Douglas and Jackson Counties, the Umpqua National Forest, and portions of the Rogue River National Forest; and
- the Klamath and Shasta Valleys and Basins in the southern part of Klamath County.

Soil associations crossed by the pipeline are shown in table 4.3.2-1 by MP, including the mileage percentage of the entire pipeline length. The Medco-McNull-McMullun and Vermisa-Vannoy-Josephine-Beekman soil associations are crossed by 15.5 and 14.2 percent of the pipeline length, respectively. The remaining soil associations are crossed by less than 9 percent of the pipeline length.

TABLE 4.3.2-1

Soil Associations Crossed by the Pacific Connector Pipeline

From	To	County	Soil Association (STATSGO)	Total Crossing Length (miles) a/	Percent of Project Mileage
MLRA 4A – Sitka Spruce Belt – MPs 1.47R to 19.22					
1.47R	1.78R	Coos	Nehalem-	2.8	1.2%
10.88R	9.11		Duneland	0	
10.6	11.34		Bullards	0	
			(s6398)	0	
1.74R	4.12R	Coos	Coos Bay Estuary	2.4	1.0%
4.12R 9.11 11.34	10.88R 10.6 19.22	Coos	Tolovana- Templeton- Salander- Reedsport' Fendall (s6399)	16.1	6.9%
			Total miles	**21.3**	
MLRA 1 – Northern Pacific Coast Range, Foothills, and Valleys – MPs 19.22 to 47.16					
19.22	22.4	Coos	Peavine-Olyic-Melby-	10.5	4.4%
23.36	27.79		Honeygrove-	0	
28.92	29.48		Blachly	0	
30.34	32.42		(s6396)	0	
22.4	23.36	Coos	Nekoma-Meda-	1.8	0.8%
29.48	30.31		Kirkendall-	0	
			Eilertsen	0	
			(s6402)	0	
27.79	28.93	Coos	Preacher-	14.5	6.9%
32.42	47.26	Douglas	Bohannon	1.6	
			(s6395)	0	
			Total miles	**28.0**	
MLRA5 – Siskiyou-Trinity Area – MPs 47.16 to 168.0					
47.26	48.05	Douglas	Windygap-	3.9	1.7%
52.5	55.14		Larmine-Bellpine-	0	
57.57	58.07		Bateman-Atring	0	
			(s6410)	0	
48.05	52.5	Douglas	Wapato-Waldo-	4.5	1.9%
			McAlpin-Cove-	0	
			Bashaw	0	
			(s6408)	0	
55.14	57.57	Douglas	Otwin-Oatman	3.3	1.4%
60.59	61.48		(s6397)	0	
58.07	60.59	Douglas	Vermisa-Vannoy-	32.9	14.2%
61.48	70.89		Josephine-	0	
71.72	89.37		Beekman	0	
91.88	95.23		(s6360)	0	
70.89	71.72	Douglas	Ruch-Medford	0.8	0.4%
			(s6385)	0	
73.19	75.22	Douglas	Lettia-Kanid-	7.4	3.2%
89.37	91.90		Atring-Acker	0	
95.23	96.52		(s6382)	0	
104.87	105.70			0	
109.38	110.10				
75.22	76.36	Douglas	Rock outcrop-	1.1	0.5%
			Pearsoll-	0	
			Dubakella-	0	
			Comutt	0	
			(s6377)	0	
96.52	104.87	Douglas	Tethrick-	8.4	3.6%
			Tallowbox-	0	
			Siskiyou-Shefflein	0	
			(s6383)	0	
105.7	109.38	Douglas	Thistleburn-	3.7	2.3%
110.1	111.77	Jackson	Telemon-	1.3	
			Scaredman-	0	
			Mellowmoon-	0	
			Lempira-Illahee14	0	

TABLE 4.3.2-1

Soil Associations Crossed by the Pacific Connector Pipeline

From	To	County	Soil Association (STATSGO)	Total Crossing Length (miles) a/	Percent of Project Mileage
			(s6390)	0	
111.77	117.75	Jackson	Straight-Geppert-	6.0	2.6%
			Freezener-	0	
			Dumont	0	
			(s6381)	0	
117.75	146.38	Jackson	Medco-McNull-McMullun	36.1	15.5%
146.86	152.42		(s6380 & S6386)	0	
153.07	155.02			0	
146.38	146.86	Jackson	Ruch-Medford	0.5	0.2%
			(s6385)	0	
152.42	153.07	Jackson/	Tatouche-	0.7	5.9%
155.04	168	Klamath	Pinehurst-Farva-	13.0	
			Bybee	0	
			(s6384)13	0	
			Total miles	**123.9**	
MLRA 21 – Klamath and Shasta Valleys and Basins MPs 168.0 to 228.13*					
168	174.69	Klamath	Oatman-Otwin	6.7	2.9%
			(s6387)13	0	
174.69	180.2	Klamath	Woodcok-Royst-	5.5	2.4%
			Pokegema	0	
			(s6388)	0	
180.2	189.9	Klamath	Sheld-Pinehurst-	9.7	4.2%
			Greystoke-Bly	0	
			(s656)	0	
189.9	190.83	Klamath	Lorella-Deven-	2.1	0.9%
197.86	198.59		Bieber-Adinot	0	
225.34	225.67		(s542)	0	
227.99	228.11				
190.72	193.6	Klamath	Tulebasin-Malin-	7.0	3.0%
194.43	197.86		Lather-Capjac	0	
198.59	199.27		(s1150)	0	
199.27	202.09	Klamath	Poe-Pit-Malin-	2.8	1.2%
			Laki-Henley	0	
			(s6357)	0	
202.09	214.7	Klamath	Fordney-Calimus	20.5	8.8%
215.9	216.25		(s6356)	0	
217.22	218.8			0	
221.75	225.34			0	
225.67	227.99			0	
228.11	228.19			0	
214.7	215.9	Klamath	Stukel-Salisbury-	5.1	2.2%
216.25	217.22		Lorella-Fiddler-	0	
218.8	221.78		Dehlinger-	0	
			Capona	0	
			(s6355)	0	
			Total miles	**59.5**	
			Project Total (miles)	**231.7 b/**	

a/ Mileages are rounded to the nearest tenth of a mile; therefore, column may not sum correctly.
b/ In an effort to maintain milepost continuity while adjusting the pipeline route, milepost equations have been incorporated into the alignment. This allows the mileposts, for the most part, to remain unchanged. However, the ending milepost no longer reflects the actual length of the proposed pipeline.
c/ Although alignment modifications made since the DEIS change the numerical information in this table, such changes would be slight and would not affect the evaluation of effects to soils. In addition, the alignment modifications were made to improve stream crossings and to minimize sidehill construction and grading and cut/fill requirements. Thus, overall impacts to soils and soil constraints would be reduced.

The dominant soil mapping units crossed by the pipeline in the McNull-Medco-McMullin soil association are the Medco-McMullin complex, 12 to 50 percent slopes; McMullin-Rock Outcrop, 3 to 35 percent slopes; McMullin-McNull gravelly loams, 35 to 60 percent slopes; Mcmullin-Medco Complex, 15-50 percent slopes; McNull loam, 12 to 35 percent north slopes; and McNull-

Medco complex, 12 to 50 percent slopes. Thirty-four other map units are crossed within this association. Each of the dominant soil map units has steep slopes, is susceptible to soil compaction, and has reclamation sensitivity potential. In addition, a few soils contain large stones, areas of shallow bedrock, and seasonal high water tables. One soil in this association is designated farmland of statewide importance.

The dominant soil mapping units for the Vermisa-Vannoy-Josephine-Beekman soil association crossed by the pipeline route are the Speaker-Beekman-Josephine complex, 60 to 90 percent north slopes; Josephine-Speaker complex, 30 to 60 percent north slopes; Speaker-Nonpareil complex, 30 to 60 percent slopes; Debenger-Brader complex, 12 to 30 percent slopes; Oakland-Nonpareil-Sutherlin complex, 30 to 60 percent slopes; and Speaker loam, 30 to 60 percent south slopes. Twenty-seven other soil map units are crossed by this association. All of the dominant soil map units are susceptible to soil compaction and have a reclamation sensitivity rating.

Much of these soils have steep slopes and water erosion potential and some have shallow bedrock. One soil has a shallow, seasonal water table, and one soil is listed as prime farmland (farmland of statewide importance).

Detailed descriptions of all soil associations crossed by the Project and their characteristics are provided in appendix G of this EIS. The remainder of this discussion focuses on the sensitive soils characteristics present along the pipeline route as shown in table 4.3.2-2.

To provide the highest level of detail in quantifying the soil properties and impacts, analysis was based on the characteristics of the individual soil mapping units crossed within each soil association. Major soil characteristics and limitations for the pipeline and aboveground facilities are discussed below. Table 4.3.2-2 provides a summary of soil limitations that could be encountered by the pipeline route, and table 4.3.2-3 provides a summary of the soil limitations associated with the aboveground facilities. These tables include footnotes to indicate where slight route changes were made and where four aboveground facilities were relocated. The soil parameter calculations were not revised because effects to soils in these areas are considered minor, and the slight route changes and facility relocations generally result in an overall improvement in terms of overall acreage and potential effects to soils.

TABLE 4.3.2-2

Acreages and Soil Characteristics Crossed by the Pacific Connector Pipeline

Milepost		Total Crossing Length		Sensitive Soil Groups and Estimated Crossing in Miles (acres) a/										
				Erosion From										
From	To	(miles)	County	Water b/	Wind c/	Steep Slopes d/	Large Stones e/	Restrictive Layer f/	Saline/ Sodic g/	Soil Compaction h/	Reclamation Sensitivity i/	High Water Table j/	Hydric Soils k/	Prime farmland l/
1.47R	1.78R	2.8	Coos	0.5	0.2	0.5	0.0	0.7	0	2.8	0.6	2	1.8	1.8
10.88R	9.11			(11)	(17)	(8)		(12)		(64)	(24)	(54)	(51)	(37)
10.60	11.34													
1.78R	4.12R	2.5	Coos	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.12R	10.88R	16.5	Coos	9.7	0.0	9.7	0.0	12.7	0.0	16.5	9.5	1.1	1.1	4.6
9.11	10.60			(140)		(140)	(<0.1)	(194)		(256)	(137)	(23)	(23)	(84)
11.34	19.22													
19.22	22.40	10.5	Coos	6.3	0.0	6.0	0.2	0.7	0.0	10.5	6.3	0.1	<0.1	0.1
23.36	27.79			(110)		(106)	(5.5)	(16)		(172)	(112)	(2)	(<1)	(2)
28.92	29.48													
30.34	32.42													
22.40	23.36	2.0	Coos	0.2	0.0	0.2	0.0	0.0	0.0	2.0	0.2	1.3	0.5	1.6
29.48	30.34			(4)		(3)				(34)	(3)	(19)	(7)	(27)
27.79	28.92	14.5	Coos	9.6	0.0	8.9	6.1	11.0	0.0	15.9	11.5	0.0	0.3	<0.1
32.42	47.26	1.6	Douglas	(153)		(140)	(101)	(210)		(263)	(183)		(3)	(1)
47.26	48.05	4.2	Douglas	1.9	0.0	1.3	0.3	3.4	0.0	4.2	3.7	0.7	<0.1	2.7
52.50	55.14			(27)		(19)	(4)	(46)		(59)	(52)	(9)	(<1)	(38)
57.57	58.07													
48.05	52.50	4.6	Douglas	0.7	0.0	0.7	0.0	2.9	0.0	4.6	4.6	1.2	0.5	3.4
				(4)		(9)		(47)		(68)	(67)	(18)	(6)	(52)
55.14	54.55	3.3	Douglas	1.4	0.0	1.4	<0.1	1.7	0.0	3.3	3.1	1.5	0.7	1.8
60.59	61.48			(23)		(23)	(3)	(28)		(51)	(49)	(23)	(10)	(27)
58.07	60.59	30.5	Douglas	19.1	0.0	19.1	2.3	20.4	0.0	30.2	27.5	6.2	1.0	10.4
61.48	70.89			(274)	(<1)	(274)	(67)	(317)		(502)	(451)	(98)	(16)	(218)
71.72	89.37													
91.88	95.23													
70.89	71.72	0.8	Douglas	0.5	0.0	0.5	0.3	1.1	0.0	1.3	0.9	0.7	0.3	0.8
				(7)		(7)	(5)	(16)		(19)	(7)	(9)	(9)	(11)
73.19	75.81	8.0	Douglas	4.3	0.8	5.0	3.2	5.4	0.00	7.0	6.5	0.9	0.3	2.4
89.37	91.88			(63)	(11)	(73)	(45)	(75)		(107)	(100)	(11)	(4)	(41)
95.23	96.51													
104.87	110.10													
75.81	76.36	1.2	Douglas	1.1	0.0	1.1	1.0	1.2	0.0	1.0	1.2	0.0	0.0	<0.1
				(19)		(19)	(17)	(20)		(18)	(20)			(1)
96.51	104.87	8.4	Douglas	8.2	4.4	8.2	2.9	8.0	0.0	4.3	8.4	2.4	0.0	0.1
				(119)	(61)	(119)	(41)	(121)		(64)	(121)	(35)		(2)
105.70	109.38	3.7	Douglas	3.2	3.2	5.0	4.8	4.8	0.0	0.4	4.8	0.0	0.0	0.0
110.10	111.77	1.3	Jackson	(44)	(44)	(85)	(82)	(82)		(6)	(82)	(3)		
111.77	117.75	6.0	Jackson	1.9	0.0	6.0	4.1	5.4	0.0	4.2	6.0	0.5	0.6	0.6
				(26)		(87)	(59)	(78)		(60)	(87)	(7)	(9)	(8)
117.75	146.38	35.9	Jackson	16.1	0.0	29	26.4	32.8	0.0	33.4	35.3	17.9	0.2	4.9
146.86	152.42			(257)		(448)	(409)	(511)		(552)	(548)	(274)	(6)	(77)
153.07	155.04													
146.38	146.86	0.5	Jackson	<0.1	0.0	<0.1	<0.1	0.5	0.0	0.5	0.5	0.5	0.0	0.4
				(1)		(1)	(1)	(6)		(6)	(6)	(6)		(5)
152.42	153.07	12.1	Jackson/	0.6	0.0	3.9	5.1	5.0	0.0	1.8	3.7	0.1	0.4	0.7
155.04	168.00	1.6	Klamath	(7)	(<1)	(83)	(95)	(79)		(29)	(98)	(22)	(6)	(12)

TABLE 4.3.2-2

Acreages and Soil Characteristics Crossed by the Pacific Connector Pipeline

Milepost		Total Crossing Length		Sensitive Soil Groups and Estimated Crossing in Miles (acres) a/										
				Erosion From										
From	To	(miles)	County	Water b/	Wind c/	Steep Slopes d/	Large Stones e/	Restrictive Layer f/	Saline/ Sodic g/	Soil Compaction h/	Reclamation Sensitivity i/	High Water Table j/	Hydric Soils k/	Prime farmland l/
168.00	174.69	6.8	Klamath	0.0	0.0	0.2 (3)	3 (40)	0.0	0.0	2.9 (40)	0.2 (3)	0.8 (12)	0.0	0.0
174.69	180.20	5.5	Klamath	1.9 (27)	0.0	1.9 (27)	0.5 (6)	2.5 (32)	0.0	0.0	4.4 (59)	0.0	0.0	0.7 (8)
180.2	189.90	9.7	Klamath	1.0 (13)	0.0	3.0 (37)	1.3 (17)	3.3 (41)	0.0	0.6 (7)	3.9 (49)	0.0	0.0 (0.6)	3.0 (40)
189.90 197.86 225.34 227.99	190.72 198.59 225.67 228.11	2.0	Klamath	0.5 (10)	0.4 (19)	0.9 (12)	0.9 (12)	1.1 (27)	0.3 (11)	1.6 (60)	1.0 (16)	0.3 (11)	0.2 (7)	1.4 (56)
190.72 194.43 198.59	193.60 197.86 199.27	7.1	Klamath	0.3 (8)	0.0	0.0 (<1)	0.0 (<1)	4.3 (91)	4.6 (99)	6.6 (137)	4.6 (99)	4.9 (106)	1.8 (42)	6.6 (137)
199.27	202.09	2.8	Klamath	0.0	0.2 (6)	0.0	0.0	1.4 (24)	2.0 (38)	2.6 (49)	2.0 (7)	2.3 (44)	0.4 (8)	2.6 (49)
202.09 215.90 217.22 221.75 225.67 228.11	214.70 216.25 218.80 225.34 227.99 228.13	20.5	Klamath	1.2 (17)	7.0 (121)	1.1 (16)	1.1 (16)	9.0 (157)	1.3 (24)	20.5 (340)	9.0 (157)	1.8 (35)	0.0	19.3 (342)
214.7 216.25 218.80	215.90 217.22 221.75	5.1	Klamath	4.0 (60)	0.0 (1)	4.0 (60)	4.0 (60)	4.0 (60)	0.0	5.1 (71)	4.3 (66)	0.0	0.0	1.4 (22)
	Project Total	**231.8** m/	**All**	**94.3 (1,428)**	**16.2 (279)**	**117.6 (1,798)**	**67.6 (1,083)**	**143.3 (2,294)**	**8.2 (172)**	**183.6 (3,045)**	**163.5 (2,457)**	**47.2 (821)**	**10.3 (210)**	**71.5 (1,297)**
			Percentage	**40.7%**	**7.0%**	**50.8%**	**29.2%**	**61.8%**	**3.5%**	**79.2%**	**70.6%**	**20.4%**	**4.4%**	**30.9%**

Rows and columns may not add correctly due to rounding. Acres rounded to nearest whole acre, miles to nearest tenth of a mile (values below 1 or 0.1, respectively, are shown as "<1"/ "<0.1").

a/ Numerical values shown are miles crossed by construction, including construction right-of-way and TEWAs. Acres affected shown in parenthesis. Soil data from NRCS 2004; SCS (1985, 1989, 1993); Forest Service 1976, 1977, and 1979. NRCS State Soil Geographic Database (STATSGO and SSURGO) soil classifications (NRCS 2012a).
b/ Soils with NRCS wind erodibility groups 1 and 2.
c/ Soils with NRCS rating of high or severe.
d/ Soils with slopes greater than 30 percent.
e/ Soils with greater than 25 percent cobbles and/or stones within pipeline trench depth.
f/ Soils with a restrictive soil layer (bedrock or cemented layer) within 60 inches of the soil surface.
g/ Soils with an electrical conductivity of 8 mmhos/cm or greater and/or a Sodium Adsorption Ratio (SAR) of 13 or greater.
h/ Soils with an NRCS rating of high or severe for the Haul Roads, Log Landings, and Soil Rutting category.
i/ Combined rating for soils with high or severe erosion potential, steep slopes, large stones, shallow soils, saline/sodic conditions, clayey soils (greater than 40 percent), and soil map units with dominant amounts of rock outcrop. The Reclamation/Sensitivity type does not include data related to the revegetation sensitivity studies on federally-managed lands (NSR 2015).
j/ Soils saturated within 60 inches of the surface in most years.
k/ Soils with at least one major named map unit included on the county hydric soil list.
l/ Soils with dominant map unit included on either the state or county list of farmland of importance.
m/ In an effort to maintain milepost continuity while adjusting the pipeline route, milepost equations have been incorporated into the alignment. This allows the mileposts, for the most part, to remain unchanged. However, the ending milepost no longer reflects the actual length of the proposed pipeline.

TABLE 4.3.2-3

Summary of Soils Limitations – Pacific Connector Pipeline Aboveground Facilities

Proposed Facility	Area (ac) a/	Soil Mapping Unit (STATSGO)	High Erosion Potential b/	Steep Slopes c/	Large Stones d/	Restrictive Layer e/	Saline/ Sodic f/	High Compaction Potential g/	Poor Revegetation Potential h/	High Water Table i/	Hydric Soil j/	Prime Farmland k/
Jordan Cove Receipt MS, BVA #1, Receiver Site	<1	S6398 (61D)	N/A l/	N/A l/	N/A l/	N/A l/	N/A l/	N/A l/	N/A l/	N/A l/	N/A l/	N/A l/
BVA #2 (Boone Creek Road) m/	<1	S6399 (54F)	No	No	No	Yes	No	No	No	No	No	Yes
BVA #3 (Myrtle Point Sitkum Rd)	<1	S6402 (47B)	No	No	No	No	No	Yes	No	Yes	Yes	Yes
BVA #4 (Deep Creek Rd)	<1	S6408 (52G)	Water	Yes	No	Yes	No	Yes	Yes	No	No	No
BVA #5 (S. of Ollala Creek)	<1	S6360 (14C)	No	No	No	No	No	Yes	No	Yes	No	Yes
Clarks Branch MS, BVA #6 Launcher/ Receiver & CT	<1	S6385 (189F)	Water	Yes	Yes	Yes	No	No	Yes	No	No	No
BVA #7 (Pack Saddle Rd)	<1	S6360 (270F)	Water	Yes	No	No	No	Yes	Yes	No	No	No
BVA #8 (Hwy 227)	<1	S6360 (183B)	No	No	No	No	No	Yes	Yes	No	No	Yes
BVA #9 (BLM Rd 33-2-12) n/	<1	S6381 (222)	No	Yes	Yes	Yes	No	No	Yes	No	No	No
BVA #10 (Shady Cove)	<1	S6380 (122E)	Water	Yes	Yes	Yes	No	Yes	Yes	No	No	No
BVA #11 (Butte Falls & Launcher/Receiver Site) o/	<1	S6380 (125F)	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No
BVA #12 (Heppsie Mtn Quarry)	<1	S6380 (111G)	Wind	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No
BVA #13 (Clover Creek Rd)	<1	S6387 (R6)	No	No	No	No	No	Yes	No	No	No	No
BVA #14 & Launcher/ Receiver Site	<1	S656 (129B)	No	No	Yes	Yes	No	No	Yes	No	No	No
BVA #15 Klamath River p/	<1	S1150 (40)	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes
BVA #16 (Hill Road)	<1	S6356 (7B)	No	No	No	No	No	Yes	No	No	No	Yes
Klamath Compressor Station, Klamath-Beaver and Klamath-Eagle Meter Stations, BVA #17, Launcher/Receiver & CT	31	S542 (19C)	Wind	No	No	No	No	Yes	No	No	No	Yes
Blue Ridge Communication Site	<1	S6396 (4D)	Water	No	No	No	No	Yes	Yes	No	No	No
Signal Tree Communication Site	<1	S6395 (50D)	No	No	Yes	Yes	No	Yes	Yes	No	No	No
Flounce Rock Communication Site	<1	S6380 (113G)	Water	Yes	No	Yes	No	Yes	Yes	No	No	No

TABLE 4.3.2-3

Summary of Soils Limitations – Pacific Connector Pipeline Aboveground Facilities

Proposed Facility	Area (ac) a/	Soil Mapping Unit (STATSGO)	High Erosion Potential b/	Steep Slopes c/	Large Stones d/	Restrictive Layer e/	Saline/ Sodic f/	High Compaction Potential g/	Poor Revegetation Potential h/	High Water Table i/	Hydric Soil j/	Prime Farmland k/
Robinson Butte	<1	S6388 (0038)	No	Yes	Yes	No	No	No	No	No	No	No
Stukel Mountain Communication Site	<1	S6388 (16E)	No	Yes	Yes	No	No	No	Yes	No	No	No

MS = meter station, BVA = block valve, CT = communication tower. Soil data from NRCS (2004); SCS (1985, 1989, 1993); Forest Service (1976, 1977, and 1979). NRCS State Soil Geographic Database (STATSGO and SSURGO) soil classifications (NRCS 2012a).

a/ Area of construction and operation disturbance. Construction disturbance is included within the pipeline construction right-of-way. Acreages rounded to nearest whole acre; values less than 1 are reported as <1.
b/ Soils with NRCS rating of high or severe.
c/ Soils with slopes greater than 30 percent.
d/ Soils with greater than 25 percent cobbles and/or stones within pipeline trench depth.
e/ Soils with a restrictive soil layer (bedrock or cemented layer) within 60 inches of the soil surface.
f/ Soils with an electrical conductivity of 8 mmhos/cm or greater and/or a SAR of 13 or greater.
g/ Soils with an NRCS rating of high or severe for the Haul Roads, Log Landings, and Soil Rutting category.
h/ Combined rating for soils with high or severe erosion potential, steep slopes, large stones, shallow soils, saline/sodic conditions, clayey soils (greater than 40 percent), and soil map units with dominant amounts of rock outcrop.
i/ Soils saturated within 60 inches of the surface in most years.
j/ Soils with at least one major named map unit included on the county hydric soil list.
k/ Soils with dominant map unit included on either the state or county list of farmland of importance.
l/ These aboveground facilities would be located entirely within the proposed Jordan Cove LNG terminal. This soil association has been previously disturbed and would be graded and built up during construction of the Jordan Cove LNG terminal prior to construction of the Pacific Connector pipeline.
m/ Relocated to avoid steep slope.
n/ Relocated to avoid NFS land.
o/ Relocated to improve access, minimize agricultural impacts, and reduce site acreage
p/ Relocated to improve spacing

4.3.2.1 Project-Specific Soil Limitations

Prime Farmland

The pipeline alignment crosses approximately 72 miles (31 percent of the pipeline) of soils where the dominant map unit in the MLRA is classified on either the NRCS state or county list of prime farmland or "farmland of statewide importance." Not all of these soils are currently in agricultural production. In some areas, land that does not meet the criteria for prime or unique farmland is considered to be "farmland of statewide importance" for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate state agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by state law (NRCS 2006b).

Impacts on prime farmland or farmland of statewide importance soils would include less crop or no crop production for a short term during the construction phase, which, depending on the crop being produced, could physically interrupt farming practices for one to two years. Following construction, the pipeline right-of-way could continue to be used for farming practices, with the exception of aboveground structures or long-term crops such as tree or fruit orchards or vineyards. Pacific Connector would implement mitigation measures to minimize impacts to prime farmland and crop yields, such as topsoil salvaging, scarification, and subsequent testing to ensure that potential compaction was removed. Topsoil salvaging and segregation would occur in areas mapped as prime farmland or active crops to minimize potential impacts to soil and agricultural productivity. Areas where topsoil salvaging and segregation would occur are shown by MP in table 4.3.2.1-1.

TABLE 4.3.2.1-1

Areas Where Topsoil Would be Salvaged Along the Pacific Connector Pipeline

Area/Land Use	From (MP)	To (MP)
Coos County		
Wetlands/Pasture	6.22R	6.31R
Wetlands/Pasture	6.34R	6.46R
Pasture	8.31R	8.48R
Pasture	10.96R	11.06R
Wetland/Pasture	11.19R	12.39R
Wetland/Pasture	8.58	8.67
Wetland/Pasture	10.05	10.40
Wetland/Pasture	10.81	11.08
Wetland/Pasture	11.14	11.39
Residential	14.24	14.29
Wetland/Pasture	15.70	15.78
Pasture/Hayfield	22.59	23.04
Pasture/Hayfield	29.49	29.83
Pasture/Hayfield	29.87	30.14
Douglas County		
Croplands/Pasture	49.50	50.25
Croplands/Pasture	50.30	50.55
Pasture/Residential	50.72	50.82
Pasture	51.31	51.55
Pasture	51.58	51.78
Pasture/Wetlands/Residential	55.83	56.56
Pasture/Wetlands/Residential	56.77	57.10

TABLE 4.3.2.1-1

Areas Where Topsoil Would be Salvaged Along the Pacific Connector Pipeline

Area/Land Use	From (MP)	To (MP)
Pasture/Wetlands/Residential	57.12	57.59
Wetlands/Pasture/Hayfield	57.61	57.83
Wetlands/Pasture/Hayfield	57.85	58.20
Wetlands/Pasture/Hayfield	58.21	58.53
Wetlands/Pasture/Hayfield	58.65	58.73
Wetlands/Pasture/Hayfield	58.79	59.60
Wetlands/Pasture/Hayfield	59.66	60.08
Pasture Pasture/Hayfield	60.15	60.24
Pasture Pasture/Hayfield	60.45	60.57
Pasture/Hayfield	60.58	60.66
Pasture/Hayfield	65.58	65.73
Pasture	66.88	66.94
Pasture	66.97	67.08
Pasture	69.22	69.49
Pasture	71.36	71.54
Pasture	76.41	76.47
Pasture	77.82	78.05
Pasture	79.00	79.03
Hayfield/Pasture	81.20	81.65
Pasture	88.29	88.50
Pasture	88.53	88.57
Pasture	88.61	88.70
Pasture/Wetlands	94.35	94.56
Pasture/Wetlands	94.87	95.07
Jackson County		
Pasture	118.84	118.91
Pasture	120.70	120.82
Pasture/Residential	120.84	120.90
Pasture/Hayfield	121.90	122.20
Pasture/Wetlands	128.47	128.69
Pasture	131.76	132.00
Pasture/Wetlands	132.12	132.68
Pasture/Wetlands	142.26	142.56
Pasture/Wetlands	142.58	142.66
Pasture Pasture/Wetlands	144.31	144.78
Pasture Pasture/Wetlands	145.05	145.95
Pasture	146.12	146.87
Klamath County		
Pasture/Hayfield/Wetlands	190.63	197.61
Pasture/Hayfield/Wetlands	197.74	198.21
Pasture/Croplands/Wetlands	199.60	214.67
Croplands	217.30	217.54
Pasture/Croplands	217.55	217.92
Pasture/Croplands	221.31	221.85
Pasture/Croplands	221.99	223.17
Pasture/Croplands	223.21	224.54
Pasture/Croplands	225.15	227.00
Pasture/Croplands/Residential	227.01	227.84

Note: For a description of topsoil segregation and effects to wetlands, see section 4.4. (Up to the top 12 inches of topsoil will be segregated from the area disturbed by trenching in wetlands, except in areas where standing water or saturated soils are present.)

Construction in the Klamath Basin would occur in the winter, outside of the typical agricultural period, to minimize impacts to agricultural activities. The winter construction schedule in the basin also would allow the irrigation canals to be crossed when they were mostly dry and out of operation. The *Winter Construction Plan for the Klamath Basin* is included in Appendix 1E of Pacific Connector's June 2013 FERC Application. The only permanent impacts on prime farmland soils from the proposed pipeline would be associated with the aboveground facilities located on prime farmland soils discussed in section 4.3.2.2 below.

Hydric Soils

Construction activities have the potential to result in structural damage to wet soils and soils with poor drainage. The Pacific Connector Pipeline Project would cross about 10 miles (4.4 percent of the Project length) of hydric soils. Some MLRAs contain at least one major soil unit that is classified as a hydric soil. Hydric soils are one of the three criteria that are used to designate jurisdictional wetlands.

Mitigation measures described in section 4.4 of this EIS and Pacific Connector's ECRP would be used during pipeline construction to minimize potential impacts to wetlands and hydric soils. With these measures, such as segregating topsoil, leaving root systems intact during vegetation removal, using low ground-weight equipment or prefabricated equipment mats, installing permanent and temporary erosion control near waterbodies, using trench breakers or sealing trench bottoms to maintain wetland hydrology, constructing during drier seasons, and monitoring, adverse impacts are not anticipated to hydric soils.

High Water Table

Soils that have a high water table have a saturated zone in the soil profile within 60 inches of the surface in most years. A saturated zone that lasts for less than a month is not considered a water table (NRCS 2012b). The pipeline alignment would cross 47.2 miles (20.4 percent of the pipeline length) in this sensitive soil group. Soils that are wet or poorly drained can experience structural damage from construction equipment.

Depending on the specific time of construction, trench dewatering may be required in some areas during excavation, pipe construction, and backfilling of the trench. All water from trench dewatering would be pumped into a filter structure in an upland area, and would not be directly discharged into wetlands or waterbodies.

Pacific Connector would reduce the potential for structural damage on wet soils by employing BMPs such as the use of low-ground-weight construction equipment, or operating normal equipment on timber riprap, prefabricated equipment mats, or terra mats. In addition, Pacific Connector would not conduct construction activities during extremely wet weather conditions. Wet or poorly drained soils are also generally identified as hydric soils, as discussed above. Pacific Connector would minimize impacts on wet soils by following the wetland crossing techniques outlined in the FERC's *Procedures*.

Erosion Potential

Accelerated erosion leads to the direct soil loss of plant nutrients. Erosion can also deposit sediments into waterbodies, which degrades water quality and stream conditions, and can adversely affect aquatic habitats and wildlife. Although sediment and wood debris inputs are part of a natural process, accelerated erosion can result in stream scouring, which degrades stream conditions, riparian zones, and fishery habitat.

The pipeline route would cross about 94.3 miles (40.7 percent of pipeline length) of soils with a high or severe water erosion potential. Soils that are susceptible to wind erosion are included in NRCS wind erodibility groups 1 and 2. Soil textures primarily range from very fine to coarse sand to silt loam soils with 5 percent or less clay and 25 percent or less of very fine sand. The proposed pipeline alignment crosses a total of 16.2 miles (7.0 percent of the pipeline length) of soils in this group.

Impacts on soils from erosion would be minimized by Pacific Connector following the FERC's *Plan* and *Procedures* and its project-specific ECRP. Pacific Connector would implement specific water erosion prevention measures such as covering temporary storage piles; covering, seeding and mulching of waste piles; and installation of sediment barriers, interceptor ditches or berms, or other measures where necessary, so that water is filtered or flows away from sensitive areas. With these measures, significant water erosion is not anticipated. Pacific Connector would implement reseeding efforts, apply mulch, and water for dust control to minimize potential erosion by wind on the disturbed soils during construction.

Pacific Connector would minimize impacts from erosion-and-sedimentation-producing actions and ensure the stability of the proposed pipeline alignment during the design phase by routing the pipeline along stable landscapes (such as ridgelines) and away from side slopes as much as practicable. In addition, as described in section 4.2 of this EIS, an extensive geotechnical review was conducted to ensure that the route avoided known or potential areas of mass soil movement. This effort required minor reroutes in numerous areas along the proposed alignment to ensure the safety and integrity of the pipeline.

Temporary erosion control measures would be installed immediately after clearing and prior to grading (initial soil disturbance). Near waterbodies and wetlands, the EIs would determine in the field if it is necessary to install temporary erosion control measures (i.e., sediment barriers) prior to clearing activities to minimize the potential for runoff to enter a wetland or waterbody. All erosion control devices would be routinely inspected and any damaged or temporarily removed structures would be replaced at the end of each working day. Temporary erosion control measures would be maintained until successful revegetation has been achieved.

Sediment barriers would be used to confine sediment to the construction right-of-way and would be constructed of either silt fence or straw bales. Generally, silt fence would be used where sediment barriers are required parallel to the right-of-way. Straw bales would generally be used in locations where sediment barriers are required to cross the construction right-of-way along the travel lane such as at waterbody and wetland crossings. Occasionally, silt fence is used across the construction right-of-way travel lane based on an evaluation of site-specific conditions. Sediment barriers would generally be placed as follows:

- at the base of slopes adjacent to road, wetland and waterbody crossings where sediment could flow from the construction right-of-way onto the road surface or into the wetland or waterbody;
- adjacent to wetland and waterbody crossings, as necessary, to prevent sediment flow in the wetland consistent with the requirements of the FERC's *Procedures*; and
- on the downslope side of the right-of-way where it traverses steep side slopes.

Pacific Connector would install temporary slope breakers to reduce runoff velocity, concentrated flow and to divert water off the construction right-of-way to avoid excessive erosion. Temporary slope breakers may be constructed of materials such as soil, silt fence, staked straw bales, straw wattles, or sand bags. If it becomes necessary to delay final cleanup, including final grading and installation of permanent erosion control measures, beyond 20 days (10 days in residential areas) after the trench is backfilled in a specific area, Pacific Connector would apply mulch on all disturbed slopes before seeding.

Trench breakers would be installed in the trench and keyed into trench walls on slopes prior to backfilling to slow the flow of subsurface water along the trench to prevent erosion of trench backfill materials. A permanent slope breaker and a trench breaker would be installed at the base of slopes near the boundary between the wetland and adjacent upland areas.

After backfilling, the pipeline would be hydrostatically tested in accordance with DOT regulations to ensure that the system is capable of operating at the maximum operating pressure. Permission to discharge the hydrostatic test water would be applied for concurrently with the request for coverage under the ODEQ General Stormwater Discharge Permit and permitted through a separate letter of approval. Hydrostatic test water would be discharged into erosion control devices in upland settings (where feasible), to minimize the potential for scour, erosion, and sedimentation into nearby wetlands and waterbodies, in accordance with Pacific Connector's ECRP. Straw bale barriers and silt fence would typically be used to retain sediment and reduce velocity. Discharge rates would range from several hundred gallons per minute to several thousand gallons per minute, depending on the length of the test section, profile, topography, vegetation cover, and soil type, as reviewed by the contractor and the EI. See additional discussion of hydrostatic testing in section 4.4 of this EIS.

Waterbody crossings would be stabilized and temporary sediment barriers installed within 24 hours of completion of backfilling in accordance with Section V.C.2 of the FERC's *Procedures*. Pacific Connector would install erosion control fabric (such as jute or excelsior) on streambanks at the time of recontouring. The fabric would be anchored using staples or other appropriate devices. The erosion control fabric to be used on streambanks and steep slopes would be designed for the proposed use and would be approved by the EI, and authorized agency representative on federal lands.

Permanent slope breakers (waterbars) would be installed across the right-of-way on slopes. The purpose of these structures is to minimize erosion by reducing runoff velocities, by shortening slope lengths, preventing concentrated flow, and by diverting water off the construction right-of-way. Slope breakers are also intended to prevent sediment deposition into sensitive resources.

Water associated with trench dewatering would be pumped to a discharge structure that is appropriately designed to accommodate the discharge volume, and to discharge the water in a manner that would not cause erosion.

Revegetation Potential

The pipeline alignment would cross a total of 163.5 miles (70.6 percent of the pipeline length) of soils that are rated as having poor revegetation potential according to information provided by the applicant prior to consideration of efforts specific to federal lands (NSR 2014). These soils may have a combination of characteristics that could require additional measures or BMPs to reduce erosion and sedimentation potential. Restoration of these soils in most cases requires adaptive seed mixtures and implementation of revegetation practices (i.e., fertilization, mulching, monitoring) to enhance revegetation success.

Section 10.0 of Pacific Connector's ECRP includes a detailed description of soil restoration procedures and requirements. Pacific Connector would implement revegetation procedures, such as topsoil segregation, recontouring, scarification, soil replacement, seedbed preparation, fertilization, seed mixtures, seeding timing, seeding methods, and supplemental plantings to ensure

revegetation success. Information contained in the BLM/Forest Service *Technical Memorandum Soil Risk and Sensitivity Assessment on BLM and National Forest System Lands* (NSR 2015a) will be used to identify and treat areas on BLM and Forest Service lands where specific and focused soils remediation measures may be required to minimize potential erosion and accomplish vegetation objectives. It is BLM and Forest Service's intent that FERC will use the assessment to supplement the ECRP, and the applicant would append this to the POD.

As previously discussed, topsoil segregation would be performed in croplands, hayfields, pastures, wetlands, and residential areas. Pacific Connector would stockpile topsoil separately from subsoil, and replace the horizons in the proper order during backfilling and final grading.

Pacific Connector would work with individual landowners to address restoration of active agricultural and residential landscaping, if affected by pipeline construction. In active agricultural areas, Pacific Connector would encourage the landowner to complete final restoration efforts in these areas and would compensate the landowner for these efforts. In residential areas, Pacific Connector would use contractors familiar with local horticultural and lawn establishment procedures for reclamation work or would compensate the landowner to restore these areas.

Seedbed preparation would be conducted, where necessary, immediately prior to seeding to prepare a firm seedbed conducive to proper seed placement and moisture retention. Seedbed preparation would also be performed to break up surface crusts and to eliminate weeds which may have developed between initial reclamation and seeding. A seedbed would be prepared in disturbed areas, where necessary, to a depth of up to four inches using appropriate equipment to provide a seedbed that is firm, yet rough. A rough seedbed is conducive to capturing or lodging seed when broadcasted or hydroseeded, and it reduces runoff and erosion potential. The rough seedbed would retain soil moisture for seedling germination and establishment.

In most areas, final right-of-way cleanup procedures are sufficient because they leave a surface smooth enough to accommodate a drill seeder pulled by a farm tractor and rough enough to catch broadcasted seed and trap moisture and runoff. Where residential and cropland areas are disturbed, more intensive ground and seedbed preparations may be required including rock collection, grading, and soil preparation/amending. The EI would be responsible for determining where seedbed preparation measures are required prior to seeding. Pacific Connector would use a standard fertilization rate of 200 pounds per acre bulk triple-16 fertilizer on all disturbed areas to be reseeded. This fertilizer application rate would apply 32 pounds per acre each of elemental nitrogen, phosphorous, and potassium. The NRCS did not recommend the addition of lime or other soil pH modifiers. Fertilizers would not be applied in wetlands, unless required in writing by the appropriate land management or state agency pursuant to the FERC's *Procedures*, and would not be applied within at least 100 feet of streams. Application of fertilizers would be avoided during heavy rain (0.3 inch/hour or greater) or when wind speed (25 mph or greater) could cause drift.

As required by the FERC's *Plan*, Pacific Connector has consulted with the NRCS and land management agencies regarding recommended seed mixtures for the project area. The seed mixtures developed for the Pacific Connector Pipeline Project are based on these agency recommendations and are provided in the ECRP. During right-of-way negotiations, private landowners may also request other seed mixtures than those proposed in the ECRP. These specific

landowner requested/specified seed mixtures would be documented in landowner right-of-way agreements.

Pacific Connector would acquire the seed through commercial source where available and would contract with vendors to collect native species where these species are not commercially available. Native seed would be collected during the two years prior to construction as well as during the two years of construction to ensure that an adequate quantity of seed is available for reseeding efforts. Seed collected in the years prior to construction would be dried, stored in labeled, sealed bags and appropriately stored to preserve viability. It is anticipated that adequate seed would be collected to allow for direct re-seeding without the need for farm-increasing; however, some vendors may choose to grow out a quantity of the seed they have collected for project use to minimize collection efforts and to ensure appropriate quantities of seed are available for restoration of the areas disturbed by pipeline construction.

Disturbed areas would be seeded within six working days of final grading, weather and soil conditions permitting, and if final grading occurs more than 20 days after pipe installation and backfilling, Pacific Connector would apply mulch on all disturbed areas prior to seeding, consistent with the FERC's *Plan*. Seeding would proceed in accordance with the ECRP.

Straw mulch would be certified weed-free by the appropriate state certification program. In non-forested areas, straw mulch would be uniformly applied at a rate of 2 tons/acre to cover the ground surface (except on slopes within 100 feet of waterbodies and wetlands where application rates would be increased to 3 tons/acre). Mulching would occur immediately after seeding where broadcast or drill seeding occurs. Anchoring the mulch is not expected to be necessary because strong winds, which could dislodge the mulch, typically occur during the winter rainy season when the moist conditions would bind the straw to the soils.

Compaction Potential

Soil compaction and displacement reduces water infiltration and often diverts lateral movement of the water within the soil. These conditions not only lead to increased erosion and sedimentation potential but could contribute to higher stormwater runoff from normal peak flows. The movement of heavy construction equipment, soil mixing or displacement from grading/excavation activities, or rutting from equipment or vehicle traffic would result in soil compaction and damage to soil structure.

The proposed pipeline alignment would cross a total of 183.6 miles (79.2 percent of the total pipeline length) of soils that are highly susceptible to compaction. Soils in this sensitive group were determined based on the NRCS rating of high or severe for the Haul Roads, Log Landings, and Soil Rutting categories. Soils in this group are rated based on Unified soil texture classification, rock fragments on or below the surface depth to a restrictive layer, depth to a water table and slope. However, most soils are susceptible to compaction depending on the number of passes of heavy equipment and the moisture content of the soils at the time of construction. Unmitigated soil compaction can result in long-term reductions of soil productivity and increased erosion from increased surface runoff.

Pacific Connector would minimize soil compaction, rutting, and structural damage to wet soils and soils with poor drainage reduce the potential for structural damage on wet soils by employing BMPs such as the use of low-ground-weight construction equipment, or operating normal

equipment on timber riprap, prefabricated equipment mats, or terra mats. In addition, Pacific Connector would not conduct construction activities during extremely wet weather conditions. During forest clearing activities, the potential for soil compaction would be minimized where cable and helicopter logging methods are used. Where log skidding occurs, several practices would be employed as described in Section 2.3 of Pacific Connector's *Right-of-Way Clearing Plan for Federal Lands* (Appendix U of the POD), where feasible, to minimize the potential for soil compaction.

The trench would be opened and backfilled after pipeline installation without a lot of machinery working over it. Therefore, there is a low potential for compaction of the material used to backfill the trench.

Regrading, recontouring, scarifying, and final cleanup activities after pipeline construction would mitigate potential soil compaction. However, these measures alone would not be sufficient to entirely address soil compaction, and additional measures including subsoil ripping and decompaction with hydraulic excavators would also be necessary to fully address soil compaction. Decompaction would be completed to achieve soil densities within 10 percent of adjacent bulk density.

Restrictive Layer

Soils that are rated as having a restrictive layer are shallow soils that have a lithic, paralithic, or other restrictive soil layer within 60 inches of the soil surface. The pipeline alignment would cross a total of about 143.3 miles (61.8 percent of the pipeline length) of soils with a restrictive layer. These soils have thin profiles, restrictive root zones and hold less available water for plant growth. Shallow and hard bedrock can also restrict trenching, requiring special equipment (rock hammers/saws) or blasting in some areas to efficiently excavate the trench to required design depths. Excavation of bedrock or cemented layers may require additional measures to provide suitable pipe bedding materials. Soils in this group are also included in the soils that have reclamation sensitivity. Section 4.2 of this EIS discusses shallow soils, rock lithology, potential blasting locations, rock removal, and disposal.

Steep Slopes

The pipeline alignment would cross a total of 117.6 miles (50.8 percent of the total pipeline length) of soils rated as has having slopes greater than 30 percent. This slope range was selected because the operation of rubber-tired equipment becomes hazardous when the slope approaches and exceeds 30 percent (NRCS 2004; Adams 1997; Garland 1997). Pacific Connector has routed the pipeline to ensure safety and integrity of the pipeline and has identified adequate work areas to safely construct. Mitigation for soil erosion would be required on soils with slopes less than 30 percent, but additional BMPs would typically be required when the slope approached or exceeded 30 percent; therefore, Pacific Connector would (see section 2.4.2.2 for more details):

- use appropriate construction techniques to minimize disturbance and to provide a safe working plane during construction;
- use temporary cribbing to store material on the slope;
- optimize construction during the dry season;
- use slope breakers/waterbars during construction;
- install trench breakers in the pipeline trench to minimize groundwater flow down the trench;
- backfill the trench according to Pacific Connector's construction specifications;

- restore the right-of-way promptly to approximate original contours or to stable contours after pipe installation and backfilling;
- install properly designed and spaced permanent waterbars;
- revegetate the slope with appropriate native, local source seed mixtures;
- provide effective ground cover from redistributing slash materials, mulching, or installing erosion control fabric on slopes; and
- monitor and maintain the right-of-way to ensure stability.

Large Stones

Soils with more than 25 percent cobbles and stones in the soil profile can present significant problems with surface reclamation because they hold less available water for plant growth and generally require broadcast seeding methods. Further, the introduction of stones or rocks from subsoils to surface soil layers during trenching or blasting can adversely affect agricultural productivity and agricultural equipment operation.

The pipeline route would cross a total of 67.6 miles (29.2 percent of the pipeline length) of soils containing cobbles and stones. Pacific Connector has developed measures that would reduce impacts on restoration and revegetation caused by rocks, cobbles, and stones near the soil surface. In agricultural and residential areas, topsoil would be segregated. A rock picker would be used to remove large fragments.

Rocks excavated from the trench would be kept separate from topsoil during construction and during surface preparation as part of restoration. Pacific Connector has identified rock disposal sites. These sites are listed in table 4.2.2.4-1 of section 4.2.2.4 of this EIS. Large rocks and boulders would also be used as OHV barriers along the right-of-way and at road crossings to control unauthorized OHV access to the right-of-way. Additionally, large rocks and boulders would be piled in upland areas along the right-of-way to create habitat diversity features where approved by the EI or Pacific Connector's authorized representative and the landowner or land management agency.

Saline/Sodic Soils

Sensitive soils in this group include soils that have an electrical conductivity of 8 millimhos (a scale used to measure salt levels) per centimeter (mmhos/cm) or greater, or a SAR of 13 or greater. Saline/sodic soils can be difficult to revegetate and generally require special seed mixes. The pipeline route would cross a total of 8.2 miles (3.5 percent of the pipeline length) of soils in this group, all in the Klamath Basin. Pacific Connector would revegetate saline/sodic soils using saline-tolerant seed mixes, listed in its ECRP.

Contaminated Soils

Federal and state databases were reviewed for documentation of National Priorities List sites, state hazardous waste sites, or landfills located within one-quarter mile of the proposed pipeline route. No known contaminated sites would be crossed by the pipeline; therefore, contact with contaminated soils during pipeline construction is not anticipated. One contractor yard would overlap a listed site. Use of the yard would not require excavation or ground disturbance; however, prior to using that yard Pacific Connector would further investigate the status of this site with the ODEQ. Implementation of Pacific Connector's SPCCP would prevent contamination from pipeline activities. Pacific Connector

has developed a *Contaminated Substances Discovery Plan*[40] that specifies the measures that would be implemented if unanticipated contaminated soils are encountered. Some of the measures outlined in that plan include that all construction work in the immediate vicinity of areas where hazardous or unknown wastes are encountered would be halted; that all construction, oversight, and observing personnel would be evacuated to a road or other accessible up-wind location until the types and levels of potential contamination can be verified, and that if an immediate or imminent threat to human health or the environment exists, one of Pacific Connector's emergency response contractors identified in the SPCCP or the National Response Team would be notified and mobilized.

4.3.2.2 Aboveground Facilities

Pacific Connector's aboveground facilities would be located within or immediately adjacent to the pipeline construction right-of-way. Each facility would be fenced and graveled immediately after construction.

Permanent impacts on soils would occur at aboveground facilities that would be graded and graveled or where facilities would be constructed. Soil limiting characteristics at aboveground facilities are listed on table 4.3.2-3. Soils at specific aboveground facilities are described below. Section 10.0 of Pacific Connector's ECRP includes a detailed description of erosion control and soil reclamation procedures and requirements.

Jordan Cove Meter Station

The Jordan Cove Meter Station (MP 1.5R) would be located adjacent to the planned South Dunes Power Plant, on the North Spit, in Coos County. This area was formerly the location of the Menasha-Weyerhaeuser mill (operated between 1961 and 2003), now dismantled. The meter station would occupy approximately almost 1 acre on the Bullards-Nehalem-Dune Land soil association. There are no known soil limitations that would affect the construction and use of this parcel for a meter station. The meter station site would be graded and its elevation built up by Jordan Cove from soils excavated and dredged from the LNG terminal access channel and marine slip. Those soils are described in appendix G. The Jordan Cove Meter Station would also contain MLV#1, a receiver, and a communication tower, within a fenced, graveled yard.

Clarks Branch Delivery Meter Station

The Clarks Branch Delivery Meter Station would be located at MP 71.5 in Douglas County. This station would be located on about 1 acre of the Philomath-Dixonville complex mapping unit within the Ruch-Medford soil association (see appendix G for soil descriptions). This mapping unit has few limitations, other than being cobbly. Although the area is currently used as a rangeland pasture, the mapping unit is not classified as prime farmland soil or farmland of statewide importance. The soil does not have a high water table and is not subject to flooding. However, some soil inclusions within this soil mapping unit may be hydric. The Clarks Branch Meter Station would also contain MLV#6, a launcher/receiver, and a communication tower within a graveled, fenced yard.

[40] The *Contaminated Substances Discovery Plan* was included in Pacific Connector's application to the FERC as Appendix E to the POD.

Klamath Compressor Station

The Klamath Compressor Station would be located at MP 228.1 in Klamath County. The site would also include the Klamath-Beaver and Klamath-Eagle meter stations, MLV #17, a launcher/receiver, and a communication tower. The compressor station would occupy a 31-acre site within the Fordney-Calimus Poman soil association. The two dominant soil mapping units at the site include the Fordney loamy fine sand and Calimus loam. These soil mapping units, which compose about 30 acres of the site, are considered prime farmland if irrigated; however, the site is not irrigated. The site supports rangeland vegetation and has a few scattered juniper trees. The Fordney soil comprises 77 percent of the site area and has a high wind erosion hazard due to its coarse loam sand texture. During construction clearing and grading activities, periodic watering would likely be necessary to minimize fugitive dust until the site has been stabilized with gravel.

Gas Control Communication Towers

Pacific Connector would install a series communication towers for gas control and system monitoring at 11 locations. As discussed above, three new communication towers would be erected within two meter stations and the compressor station. Pacific Connector would like to co-locate new communication facilities on existing towers at five locations: Blue Ridge, Signal Tree, Winston, Harness Mountain, and Starveout Creek. No soils would be disturbed where an existing tower would be utilized. Pacific Connector expects to erect new communication towers adjacent to existing facilities at three locations: Flounce Rock, Robinson Butte, and Stukel Mountain. Construction of the new towers would disturb about 0.2 acre at each location. Information on the soil characteristics for the new tower locations is provided in table 4.3.2-3. Soil limitations at Flounce Rock include the potential for water erosion, potential for compaction, presence of a restrictive layer, and poor revegetation potential. Robinson Butte is rocky. Soil limitations at Stukel Mountain includes stones and poor revegetation potential. Pacific Connector would minimize erosion by following its ECRP. Because the communication towers are industrial facilities, the presence of stones, restrictive layers, and poor revegetation potential would not be environmentally adverse factors in the construction and operation of the towers.

Launchers/Receivers and Mainline Block Valves

Seventeen MLVs would be located along the pipeline according to DOT spacing requirements (49 CFR Part 192 Section 192.179). Potential impacts from the MLVs are accounted for within the proposed pipeline because these facilities would be located entirely within the construction right-of-way. However, because these small (less than a tenth of an acre) sites would contain aboveground facilities, they would permanently affect soils. Six of the MLV locations would be located on soils designated as prime farmland, with five of these locations (MLVs 5, 8, 15, 16, and 17) located within existing cropland/pastures rangeland. Construction and operation of the launchers/receivers and MLVs would take a total of about one-third of an acre out of agricultural production, excluding acres that were already discussed under the meter stations. Loss of agricultural production would be a factor considered in compensation to landowners negotiated by Pacific Connector while obtaining easement agreements.

4.3.2.3 Temporary Storage Yards

Pacific Connector has identified 34 privately owned contractor and pipe storage yards in the general area of the pipeline that could be used temporarily during construction. Most (28) of the yards are located in existing industrial areas or sites that have been previously disturbed by filling,

grading, and gravelling activities, and therefore the soils resources at these locations have been significantly altered. Of the remaining storage yards, another two have been partially disturbed (Riddle Pasture and Rogue Aggregates). Only seven storage yards have not been disturbed previously. These include four storage yards that are currently used for agriculture (Days Creek Yard, Highway 99/Hayfield Yard, Klamath Falls North of Cross Road East, and Klamath Falls North of Cross Road West). The remaining undisturbed storage yards (Klamath Amuchastegui Building, and Klamath Falls Industrial Oil) are undeveloped land in industrial parks.

All the storage yards located in Coos County are in the Sitka Spruce Belt MLRA. Sitka Spruce Belt soils generally are shallow to very deep and well drained. However, soils in terrace and floodplain area of the MLRA can be poorly drained in areas. Soils in the storage yards in Douglas County are generally moderately deep to very deep, and can vary greatly from poorly drained to well drained, and from clayey to loamy textures. All six storage yards located in Jackson County are in the Siskiyou-Trinity Area MLRA. The Siskiyou-Trinity Area MLRA includes soils that generally are moderately deep or deep, well drained, and loamy. All eight storage yards located in Klamath County are in the Klamath and Shasta Valleys and Basins MLRA. These soils generally are well drained, but they may be poorly drained or very poorly drained in the basins. They generally are loamy, clayey, or sandy and are shallow to very deep (see table 4.3.2-1 and 4.3.2.3-1).

Soil associations, mapping units, and sensitive soil characteristics are listed for each of the storage yards in table 4.3.2.3-1. Hydric soils are not indicated for any of the yards, while one (Klamath Amuchastegui Building) is noted as having a seasonal high water table. Most of the yards are listed as being prime farmland or farmland of statewide importance. Poorly drained soils are noted at Days Creek Yard. Yards noted with soil compaction concern are Riddle Pasture and Highway 99 Hayfield Yard. Shallow bedrock is noted at the following yard sites: Klamath Falls Industrial Oil, Klamath Falls North of Cross Road East, and Klamath Falls North of Cross Road West.

TABLE 4.3.2.3-1

Contractor and Pipe Storage Yards with Sensitive Soil Characteristics (Pastures, Fields and Vacant Lots)

Name	County	Section, Township, Range	Acres a/	Description	Soil Association – Soil Mapping Units and Sensitive Soil Characteristics b/
Days Creek Yard	Douglas	Section 18, T. 30 S., R. 4 W.	177	Existing cropland, hayfield or pasture	Soil Association: Ruch-Medford-Takilma (OR058) Soil Mapping Units (Douglas County): 37A, 44A, 224B, 184A 81A, 81C & 164A Sensitive Soil Characteristics: 1, 2,
Riddle Pasture	Douglas	Section 45, T. 30 S., R. 6 W.	23	Industrial/cropland pasture being converted to industrial use	Soil Association: Ruch-Medford-Takilma (OR058) Soil Mapping Units (Douglas County): 14A &14C Sensitive Soil Characteristics: 1, 3
Highway 99 Hayfield Yard	Douglas	Section 7, T. 30 S., R.5 W.	96	Existing cropland, hayfield or pasture	Soil Association: Ruch-Medford-Takilma (OR058) Soil Mapping Units (Douglas County): 214A, 224B, 37A & 165A Sensitive Soil Characteristics: 1, 3,
Rogue Aggregates	Jackson	Section 20, T. 36 S., R. 2 W.	111	Existing gravel quarry/ and existing Cropland/Pasture	Soil Association: Ruch-Medford-Takilma (OR059) Soil Mapping Units (Jackson County): 10B, 31A, 55A, 133A Sensitive Soil Characteristics: 1,
Klamath Amuchastegui Building	Klamath	Section 10, T. 39 S., R. 9 E.	25	Vacant lot	Soil Association: Fordney-Calimus-Poman (OR059) Soil Mapping Units (Klamath): 19A, 90 Sensitive Soil Characteristics:19A – 1; 90 – 1, 6 & 6
Klamath Falls Industrial Oil	Klamath	Sections 8, 9 & 10, T.39 S., R. 9 E.	39	Industrial Lot	Soil Association: Malin-Laki-Henley (OR008) Soil Mapping Units (Klamath): 7C, 18A, 74D Sensitive Soil Characteristic: 1, 4

TABLE 4.3.2.3-1

Contractor and Pipe Storage Yards with Sensitive Soil Characteristics (Pastures, Fields and Vacant Lots)

Name	County	Section, Township, Range	Acres a/	Description	Soil Association – Soil Mapping Units and Sensitive Soil Characteristics b/
Klamath Falls North of Cross Road East	Klamath	Section 1, T. 40 S., R.9 E.	31	Agricultural Field	Soil Association: Fordney-Calimus-Poman (OR059) Soil Mapping Units (Klamath): 58A Sensitive Soil Characteristics: 1, 4
Klamath Falls North of Cross Road West	Klamath	Section 1, T. 40 S., R.9 E.	37	Agricultural Field	Soil Association: Fordney-Calimus-Poman (OR059) Soil Mapping Units (Klamath): 58A Sensitive Soil Characteristics: 1, 4

a Acreages are rounded to nearest whole acre.
b/ Sensitive Soil Characteristics
1 – All soils within this mapping unit (based on SSURGO geographic databases) are considered prime farmland soil or farmland of statewide importance.
2 – These soils are positioned on floodplains and stream terraces and have soil components within the mapping unit that may be poorly drained and have either seasonal high water tables at or near the surface and have surface soils that are susceptible to compaction impacts and some that are susceptible to occasional or rare flooding.
3 – These soils have low strength and are susceptible to compaction especially if wet.
4 – Shallow to bedrock or duripan
5 – Hydric
6 – Seasonal high water table

Pacific Connector would use appropriate erosion control measures to minimize potential impacts at the yards. After the pipeline is constructed, the temporary yards would be restored back to their previous condition and use.

Potentially Contaminated Groundwater Sites

A review of ODEQ's ECSI database (ODEQ 2013b) revealed that the Pacific Connector Pipeline Project would impact nine sites investigated by the ODEQ for the release of hazardous substances into the site's environment. Based on the latest Project design, two of the sites would no longer be used. Of the remaining seven sites, an online review of site notes shows that ODEQ has determined that four require no further action. The remaining three sites, as shown in table 4.3.2.3-2, potentially contain hazardous substances. Two of those sites are proposed as contractor/pipe storage yards; the third site on Jordan Point would contain the Jordan Cove Meter Station, the pipeline from MP1.5R-1.64R, a TEWA, and a pipeyard.

TABLE 4.3.2.3-2

Identified Cleanup Sites Along the Pacific Connector Pipeline

Milepost Range (Nearest MP)	Project Site Name	Site ID	County	Hazardous Substances/Waste Types	Media Contaminated	Potential Impact Notes	Investigative Status of Site a/
MP 1.5R - 1.6R Jordan Cover Meter Station TEWA 01.46 Weyerhaeuser Cove Yard	Weyerhaeuser – Jordan Cove (54.1 acres)	1083	Coos	Fuel oil, diesel, hydraulic oil, waste oil, mineral spirits, asbestos	Groundwater, Soil	Areas of Residual Contamination in Fill Area on Jordan Point Main Mill Complex	Partial No Further Action September 15, 2006
Near MP 18.9	Coquille Yard (21.8 acres)	1255	Coos	Heavy oils, polychlorinated biphenyl, benzene, xylenes, polyaromatic hydrocarbons, asbestos	Surface water, groundwater, soil	Asbestos present in on-site debris piles related to inadequate abatement and characterization. May present an air quality problem if disturbed.	No Further State Action Required February 19, 1998
Near MP 128.7	Eugene F. Burrill Lumber (64.1 acres)	597	Jackson	Petroleum	Soil	Insufficient information available. Further investigation needed.	Site Screening recommended (EV)

a/ No Further State Action Required: ODEQ has determined that a site poses no unacceptable risk to human health or the environment. A No Further Action (NFA) decision may follow remedial actions, or (if baseline risks are acceptable), may be issued in the absence of remedial action.
No Further Action (Conditional): ODEQ's NFA determination depends on long-term Operation & Maintenance, or ongoing application of Engineering or Institutional Controls. State law requires such sites to remain on ODEQ's Confirmed Release List and Inventory.
Partial No Further Action: ODEQ's NFA determination applies to only a specified geographic portion of a site, or to one media only (e.g., soil, but not groundwater).
State Expanded Preliminary Assessment recommended (XPA): An Expanded Preliminary Assessment, or XPA, adds limited sampling to sites where a PA has been completed
Site Screening recommended (EV): Site Screening recommended means that DEQ has not yet reviewed the site.

Source: ODEQ (2013b); Supplemental Filing (Docket Nos. CP13-483-000 and CP13-492-000) February 13, 2015.

While Pacific Connector has prepared a *Contaminated Substances Discovery Plan* that outlines practices to protect human health and worker safety as well as measures that would be taken to prevent further contamination, the plan is meant to be implemented in the event of an unanticipated discovery of contaminated soil, water, or groundwater during construction. According to the ECSI database, these known sites contain hazardous substances that have contaminated soil, water, and groundwater, with some affecting air quality if disturbed. Information filed by Pacific Connector with the FERC on February 13, 2015, includes specific plans detailing how contaminants at the three ECSI sites would either be avoided or removed.

The Jordan Cove Meter Station location and pipeline alignment are located in the general area of potential debris/fill; however, the TEWA usage has been reduced in size, and the debris/fill material would be avoided because the TEWA usage is strictly surface use for staging equipment or materials. To protect human health and ensure worker safety, Pacific Connector or qualified contractor personnel would collect representative samples of the debris/fill in the excavation zone for the meter station and pipeline alignment and surrounding materials for laboratory analysis. If contaminated materials are identified in laboratory analysis, the contaminated material would be removed and properly disposed of in accordance with appropriate federal and state regulations pertaining to asbestos containing waste. Pacific Connector would utilize an environmental contractor with experience and expertise in contaminated media to characterize the excavation area. If necessary, the excavation area would be prepared and excavated by a firm appropriately credentialed for the handling and management of asbestos-containing material. Where the removed fill must be stockpiled pending characterization or regulatory approval, Pacific Connector would take precautions to isolate the substances (e.g., appropriate liner for storage area, berms).

In addition, Pacific Connector would ensure workers are trained in the hazard control measures that will be used at the site (e.g., respirators, protective clothing, decontamination techniques) as required by pertinent worker safety regulations. If contaminated fill is encountered that requires off-site disposal at a licensed disposal site, the material would be handled, containerized and transported appropriately. Clean backfill would be utilized to backfill excavations. This approach is consistent with ODEQ recommendations for this general area (ODEQ - No Further Action Determination Letter, Former Weyerhaeuser Containerboard Mill North Bend, Coos County, Oregon Tax Lots #25S-13W-4-100, 25S-13W-3-200, and the Ingram Yard portion of 25S-13W-0-200 ECSI Site ID No. 1083). Lastly, Pacific Connector would include pipeline contractor training regarding this site's status and history and that site excavation and disturbance is to be limited. No excavation would be allowed without Pacific Connector's knowledge and approval.

The Coquille Yard is identified as a TEWA intended for use as a contractor yard for staging pipe, equipment, or other construction supplies and materials. Based on historical information provided in the filing with the FERC on February 13, 2015, contaminated soil at the site was removed and treated in a soil treatment area and the site was encapsulated with fill dirt from ODOT in 1995. In 1998, the ODEQ recommended No Further Action for the site. Pacific Connector has identified this yard for staging of pipe, equipment or other construction supplies and materials and the use would be surface use only. Minor surface grading would be limited to pushing berms as needed to support pipe joints. This limited use of the site is not expected to result in affects to the encapsulated area or in a potential effects to human health, worker safety or the environment. However, Pacific Connector would consult with ODEQ prior to use of the site to confirm that the intended use is consistent with the protections required for this property. In addition, Pacific Connector would include pipeline contractor training regarding this site's status and history and

that site excavation and disturbance is to be limited. No excavation would be allowed without Pacific Connector's knowledge and approval.

The Eugene F. Burrill Lumber site is identified as a contractor yard intended for staging pipe, equipment, or other construction supplies and materials. Supplemental information filed by Pacific Connector with the FERC indicates that this ECSI site represents the White City Plywood property that is not located in the specific area of the proposed Eugene F. Burrill Lumber (Burrill) Yard. Therefore, this site is not in an area of identified or suspected contamination, and avoidance or removal measures are not required.

4.3.2.4 Rock Disposal Areas

Pacific Connector has identified 42 potential rock source and permanent disposal sites that total 174.82 acres along the pipeline route. These sites are listed in table 4.2.2.4-1 of section 4.2.2.4 of this EIS. Most of these sites are located entirely or primarily within previously disturbed areas including numerous quarries; gravel pits; clearcut and regenerating forest land; transportation, utility, and communication corridors; cropland and pasture; and commercial areas. Therefore, soils at these sites are expected to have been disturbed to a large extent in quarries and gravel pits, and to lesser extent where there have been other land uses.

Pacific Connector would use appropriate erosion control measures to minimize potential impacts in the rock source and disposal areas.

4.3.2.5 Access Roads

Most access roads for the pipeline would be existing federal (BLM and Forest Service), state, county, and private roads that intersect the proposed pipeline alignment. Egress and ingress points from existing roads would be sufficient along most of the proposed pipeline to allow for safe, efficient construction and movement of equipment and materials. Where needed, Pacific Connector proposes to modify existing roads and construct new roads to ensure construction and operation access. Approximately 5 acres of soils would be affected to construct 13 TARs, and approximately 2 acres of soils would be affected to construct or reconstruct 17 PARs to provide permanent access to some of the aboveground facilities (i.e., MLVs, meter stations, and the compression station). The TARs would be constructed using appropriate BMPs to minimize potential impacts and would be designed and constructed for their intended use. All TARs would be reclaimed (i.e., regraded, scarified, and replanted) upon completion of construction according to the landowner or agency requirements. The PARs would permanently remove soils to allow for operation of the Project. Soils along PARs would be permanently compacted and unvegetated.

4.3.3 Soils and Sediments Specific to Consistency with Federal Land Management Plans

4.3.3.1 Project Impacts on Soils on BLM and NFS Lands

Subsequent to issuance of the DEIS, an assessment of soil risk and sensitivity specific to federal lands was conducted by NSR at the direction of the BLM and Forest Service (NSR 2015a). The objective of this assessment was to identify the areas where additional soil decompaction, erosion control, or other types of site-specific and focused remediation measures may be required on BLM and NFS lands to minimize erosion potential and/or accomplish agency revegetation objectives. This analysis utilized two key elements: risk and sensitivity to determine the type and scale of potential remediation measures that may be required to address revegetation sensitivity related to

both natural conditions and/or the level of disturbance related to the Pacific Connector Pipeline Project.

In the DEIS, table 4.3.3.1-1 provided a description of direct impacts on soil resources on federal lands by watershed and administrative unit. This section has been revised to incorporate the new information from the BLM and Forest Service on this topic.

Table 4.3.3.1-1 shows the structure of the site risk-sensitivity matrix developed and used to stratify BLM and NFS lands along the proposed Pacific Connector pipeline corridor.

TABLE 4.3.3.1-1

Location Risk-Sensitivity Matrix between Risk Class and Sensitivity to Disturbance, where Values range from 1 (very low), 2 (low), 3 (moderate), 4 (high), and 5 (very high)

		Sensitivity		
Risk	**Rating**	**0**	**1**	**2**
	1	1	2	3
	2	2	3	4
	3	3	4	5

Based on the current version of the ECRP, this stratification approach assumes that only the proposed Pacific Connector Pipeline Project construction corridor, including the TEWAs, requires revegetation. The "other" classifications and UCSAs are either not cleared or do not require revegetation. Table 4.3.3.1-2 summarizes the Risk and Sensitivity matrix rankings applied to the Pacific Connector project area.

TABLE 4.3.3.1-2

Summary of Risk and Sensitivity Ratings by Construction Feature (acres)

Soil Rank-Sensitivity Rating	Cleared Corridor	Cleared TEWA	Total Cleared	Percent of Area	Other	UCSA	Total
1–Very Low	193.1	74.06	267.16	25%	0.53	60.66	328.35
2 –Low	470.45	158.43	628.88	58%	1.45	187.41	817.74
3–Moderate	105.77	32.79	138.56	13%	0.48	43.78	182.82
4–High	39.12	10.84	49.96	5%	0.22	3.63	53.81
5–Very High	0.04	0	0.04	0%	0	0.02	0.06
Total	808.48	276.12	1084.6	100%	2.68	295.5	1382.78

Table 4.3.3.1-3 summarizes risk-sensitivity ratings by administrative unit and watershed.

TABLE 4.3.3.1-3

Risk/Sensitivity Ratings by Administrative Unit and Watershed (Acres)

		Risk-Sensitivity Rank				
Watershed	**Admin Unit**	**1–Very Low**	**2–Low**	**3–Moderate**	**4–High**	**5–Very High**
Coos Bay-Frontal Pacific Ocean	Coos Bay District BLM	0.68	1.63	0.44	0.44	
Coquille River	Coos Bay District BLM		0.62	0.71	0.04	
North Fork Coquille River	Coos Bay District BLM	4.61	22.12	8.2	7.63	
East Fork Coquille River	Coos Bay District BLM	12.73	26.31	4.49	2.30	
Middle Fork Coquille River	Coos Bay District BLM	8.52	57.54	5.91	9.00	0.02
Subtotal	**Coos Bay District BLM**	**26.54**	**108.22**	**19.75**	**19.41**	**0.02**
Middle Fork Coquille River	Roseburg District BLM	5.76	17.07	3.4	0.16	
Olalla Creek-Lookingglass Creek	Roseburg District BLM	9.81	9.94	4.74		
Clark Branch-South Umpqua River	Roseburg District BLM	2.39	7.48	1.36		

TABLE 4.3.3.1-3

Risk/Sensitivity Ratings by Administrative Unit and Watershed (Acres)

		Risk-Sensitivity Rank				
Watershed	**Admin Unit**	**1–Very Low**	**2–Low**	**3–Moderate**	**4–High**	**5–Very High**
Myrtle Creek	Roseburg District BLM	1.68	64.68	23.92	0.72	
Days Creek-South Umpqua River	Roseburg District BLM	12.76	146.24	16.46	3.14	
Elk Creek	Roseburg District BLM	0.17	1.98	0.01	0.35	
	Subtotal Roseburg District BLM	**32.57**	**247.39**	**49.89**	**4.37**	**0**
Days Creek-South Umpqua River	Umpqua NF		40.04	14.75		
Upper Cow Creek	Umpqua NF	6.8	39.06	15.05	9.43	0.04
Elk Creek	Umpqua NF	0.31	30.71	0.52		
Trail Creek	Umpqua NF	14.89	23.87			
	Subtotal Umpqua NF	**22.00**	**133.68**	**30.32**	**9.43**	**0.04**
Trail Creek	Medford District BLM	27.93	40.97	5.32		
Shady Cove-Rogue River	Medford District BLM	9.94	49.15	13.05	3.4	
Big Butte Creek	Medford District BLM	3.05	0.48	1.2	6.96	
Little Butte Creek	Medford District BLM	35.21	62.51	12.04	3.07	
	Subtotal Medford District BLM	**76.13**	**153.11**	**31.61**	**13.43**	**0**
Little Butte Creek	Rogue River NF	157.51	119.28	13.98	2.85	
	Subtotal Rogue River NF	**157.51**	**119.28**	**13.98**	**2.85**	**0**
Spencer Creek	Lakeview District BLM	1.66	0.45	11.91	0.85	
	Subtotal Lakeview District BLM	**1.66**	**0.45**	**11.91**	**0.85**	**0**
Spencer Creek	Winema NF	11.86	52.11	25.37	3.48	
	Subtotal Winema NF	**11.86**	**52.11**	**25.37**	**3.48**	**0**

Soil compaction is defined on BLM and NFS lands as a greater than 15 percent increase in bulk density on non-pumice soils and a greater than 20 percent increase on ash/pumice soils over an undisturbed reference soil condition. Areas that receive more than three passes by low ground pressure equipment may exceed these thresholds. Fewer passes by other equipment may result in soil compaction. Therefore, for the purpose of this EIS, it is assumed that soils within the 65-foot working side travel lane would be compacted by construction equipment. Within the trench, soils would be displaced. After the pipeline is installed, the trench would be backfilled; which may result in some soil mixing. The trench area may be compacted during restoration. Construction equipment would not be operating on the 20-foot-wide portion of the right-of-way used to store soils removed from the working side or excavated from the trench prior to pipeline installation. However, after backfilling the trench, equipment may work over the storage area during recontouring and restoration, resulting in compaction. All areas where vegetation is removed and soils disturbed should be considered at a high risk for soil erosion.

Unless otherwise noted, topsoil would not be segregated on BLM and NFS lands because doing so would increase the corridor width and hence impacts on other resources. Soil remediation using soil amendments such as biosolids may be required in areas with reclamation sensitivity to mitigate for the loss of topsoil. Biosolid availability and application rates would be done in coordination with ODEQ.

Surface Erosion

All soils are subject to erosion when disturbed. High intensity fires and rainfall have been the primary natural disturbance processes that affect soil erosion on BLM and NFS lands in the Project area (Everest and Reeves 2007). When site disturbances, such as severe fire, produce hydrologic conditions that are poor (less than 10 percent of the ground surface covered with plants and litter), surface runoff can increase over 70 percent and erosion can increase by three orders of magnitude.

Sediment yields approaching 50 tons/acre have been documented following wildfire (Robichaud et al. 2000). With good hydrologic condition (greater than 75 percent of the ground covered with vegetation and litter), only about 2 percent or less of rainfall becomes surface runoff, and erosion is low (Bailey and Copeland 1961, cited in Robichaud et al. 2001). Therefore, maintenance of ground cover during the rainy season is essential to minimizing soil erosion losses.

Acres of soils by risk/sensitivity ratings on BLM and NFS lands are summarized in table 4.3.3.1-3. Based on the BLM/Forest Service assessment, these ratings vary within the construction right-of-way due to soil characteristics, landscape features, and the nature of the construction/remediation actions proposed. During clearing and construction, all vegetation within the right-of-way would be removed and soils would be disturbed during grading, trenching, backfilling, and restoration activities (see the ECRP). Surface erosion risk would be highest in the first winter following clearing for the project. Without application of erosion control measures, significant surface erosion within the construction corridor would likely occur. Possible impacts of uncontrolled erosion include loss of topsoil and soil productivity, rill and gulley formation, and excessive sediment transport and deposition to stream systems. Where stream intersections occur, or where overland flows could reach stream channels, eroded material could be deposited in stream channels and adversely affect aquatic habitats.

No combination of erosion control measures can achieve 100 percent control of all erosion, however it is possible to substantially reduce surface erosion and off-site sediment transport. Seeding, while an excellent erosion control method, has a low probability of reducing the first season erosion because most of the benefits of the seeded grass occurs after the initial early season events that may cause surface erosion (Robichaud et al. 2000). Conversely, erosion control structures should be considered only as temporary expedients to hold the soil in place until vegetation can become established and stabilize streambanks and disturbed surfaces permanently (Forest Service 2013a). Effective control of surface erosion would require a combination of mechanical erosion control methods, maintenance of effective ground cover and aggressive reestablishment of native vegetation.

To minimize potential soil erosion, Pacific Connector has prepared an ECRP with active participation and engagement from the BLM and Forest Service. The ECRP incorporated into the POD for federal lands will include the recommendations provided as described in NSR (2015a). Acres of soils by risk/sensitivity ratings on BLM and NFS lands are summarized in section 4.3.3.4 and table 4.3.3.4-1. Section 4.3.3.4 also includes more aggressive soil remediation measures that might be used in areas of high soil sensitivity.

The project administrators representing the BLM and the Forest Service, in coordination with FERC EIs, will use this assessment and associated GIS files to determine where and what type of additional soil erosion risk reduction and/or site-specific remediation with biosolids and other organic materials may be necessary.

Pacific Connector would utilize the rating information to identify locations that may require additional measures to ensure a minimum percent effective cover of 65 to 85 percent of the disturbed areas consistent with the ECRP (as modified). Table 10.15-1 of the ECRP provides typical effective ground cover requirements based on specific site conditions.

The ECRP (as modified) for the Pacific Connector Pipeline Project describes the typical erosion control measures that would be implemented during corridor clearing to minimize transport of sediment to adjacent and nearby aquatic habitats. The project administrators representing the BLM and the Forest Service, in coordination with EIs will use the BLM/Forest Service assessment and associated GIS files based on site-specific field conditions determined during or immediately after timber clearing, grading and rehabilitation activities to determine where, and what type of additional soil erosion risk reduction and / or site specific remediation with biosolids and other organic materials may be necessary. These measures may include the following.

- Leaving slash generated during timber clearing operations on the corridor to reduce erosion over the following winter. This minimizes raindrop impacts and overland flow.
- Scarifying compacted surfaces, where appropriate, to promote infiltration and reduce runoff.
- Using additional slash/brush piles and coarse woody debris (limbs to large logs) at appropriate locations to minimize offsite runoff and sedimentation. Coarse woody debris placed on contour has been shown to be an effective hillslope measure to reduce erosion (Robichaud et al. 2000).
- Installation of slope breakers (water bars) at appropriate locations and spacings to shorten slope lengths, prevent concentrated flow, and divert runoff to stabilized areas. Waterbars are a proven and effective method of reducing the erosive energy of overland flow, diverting overland flow and minimizing sediment transport.
- Installation of silt fences and straw bale sediment barriers to prevent transport of sediment to aquatic habitats. Pacific Connector has committed to install and maintain erosion control structures including silt fences at stream crossings until effective ground cover is reestablished. When installed and maintained, silt fences are 90 to 95 percent efficient at trapping sediment (Robichaud et al. 2000).
- Temporary seeding (using appropriate quick-germinating cover crops such as annual ryegrass or other appropriate cover species), where not precluded by federal restrictions on introduced species.
- Mulching of corridor areas that do not have sufficient cover. Geotextile fabric erosion control blankets may also be used to provide temporary ground cover. Mulching reduces raindrop impacts, and when in contact with the ground, limits overland flow and sediment transport.

Mulch materials specified in the ECRP include:

- slash from clearing;
- wood fiber mulch applied during hydroseeding as hydromulch at 2,000 pounds/acre;
- bonded fiber mix (BFM) on slopes greater than 2.5 to 1 (i.e., 40 percent). BFM is similar to wood fiber mulch, but it has properties that allow it to remain strong and insoluble after its initial drying. BFM reduces erosion by (1) absorbing the impact of rainfall while still allowing water to filter through, and (2) absorbing water like a sponge to prevent overland water flow and rilling. It creates a strong and durable mat of interlocking fiber strands held together by a bonding agent which is water resistant and which would withstand re-exposure to moisture without re-dissolving or losing its adhesive quality. Once dry, it forms a water-absorbent protective mat which is porous and breathable and secures soil and seed until vegetation is established. BFM is designed to mix and flow easily when wet

and yet remain strong and insoluble once dry, protecting the soil surface from repeated rains and sheet flows. BFM can be applied prior to a rainy season or late in the year as it is formulated to endure the harsh conditions of heavy rains and snow. In time, BFM biodegrades completely into natural organic compounds that are beneficial to plant life. It is safe to use in riparian zones and watersheds. Because BFM is sprayed on, the site remains relatively undisturbed, further reducing the risk of erosion; and

- straw mulch that is certified weed-free by the appropriate state certification program. In 2009, Oregon established a voluntary pilot Weed Free Forage Program, which certifies both grass and alfalfa hay and straw. The contractor would deliver weed-free certification documents from this program to the EI prior to applying any straw mulch. However, if the certification program is not in place at the time of construction, or if there are not sufficient quantities of certified weed free straw available for the Project, the contractor would request review/inspection of the straw by the local soil and water conservation district, county agent, or other appropriate official or authorized agency representative on federal lands. Any straw that is found to contain noxious weeds during application would be immediately removed from the Project right-of-way and properly disposed of in a public landfill. In non-forested areas, the mulch would be uniformly applied at a rate of 2 tons/acre to cover the ground surface (except on slopes within 100 feet of waterbodies and wetlands where application rates would be increased to 3 tons/acre). Mulching would occur immediately after seeding where broadcast or drill seeding occurs. Anchoring the mulch is not expected to be necessary because strong winds, which could dislodge the mulch, typically occur during the winter rainy season when the moist conditions would bind the straw to the soil. Liquid mulch binders are not expected to be utilized unless hydromulch is applied. Liquid binders would not be used in wetlands or waterbodies.

Erosion control following high-intensity fire provides a useful comparison for effectiveness of erosion control methods. It has been demonstrated that sediment transport in post-fire situations can be reduced by 80 to 95 percent and is most closely correlated with ground cover (Robichaud et al. 2000; Wagenbrenner et al. 2006). Effective erosion control requires a combination of actions. Effective ground cover prevents the mobilization of sediment by absorbing rain drop impacts and, when in contact with the ground, minimizing overland flow of water. Mulch has been shown to reduce sediment yield by 95 percent compared to control plots (Wagenbrenner et al. 2006). Waterbars minimize erosion by shortening the distance water can travel overland and diverting water off of disturbed slopes. Erosion control seeding provides temporary vegetation until permanent revegetation is accomplished. Maintained silt fences provide a backstop that is 90-95 percent effective at trapping sediment, including fine-grained silt (Robichaud et al. 2000). Weed-free straw bales placed as part of the installation behind silt fences reinforce the silt fence and create a resilient sediment barrier that requires little or no maintenance.

The combination of effective ground cover from mulch and coarse woody debris, waterbars to slow and divert water off of the construction area, installation and maintenance of silt fences and other sediment barriers, soil remediation with biosolids and woodchips where necessary, and aggressive grass seeding and fertilization followed by reestablishment of native vegetation is expected to reduce any off-site sediment movement by 80 to 95 percent from levels that would be experienced without application of these methods. Sediment contributions to streams from the pipeline corridor are expected to be at, or near background levels during dry summer months. During winter rains, some increase in sediment transport from the corridor may occur, but this is

expected to be minor and undetectable against background levels and well within the range of natural variability given the fire and erosion history southwest Oregon. When compared to current watershed conditions in watersheds crossed by the project, sediment contributions from existing roads and past management activities, any sediment mobilized from the project corridor would likely be an inconsequential contribution to the overall sediment budget of the affected watersheds. It is highly unlikely that the project corridor would become a chronic source of fine sediments with the effective application of erosion control measures and successful re-establishment of vegetation specified in the ECRP, success the first time, or continued until BLM and/or Forest Service acknowledge success.

If implementation or post-project monitoring show evidence, as defined by the BLM or Forest Service, of unacceptable surface erosion or unacceptable off-site sediment movement, Pacific Connector would be required by the terms of the Right-of-Way Grant to take additional erosion control measures as needed, as directed by the BLM or Forest Service, to reduce sediment transport to background levels. Evidence of "unacceptable" levels of sediment transport would include silt fences or other sediment barriers that are not maintained, lack of effective ground cover, visible turbidity at channel crossings, visible evidence of sheet or gulley erosion where sediment is transported off-site or to aquatic systems or chronic deposition of fine sediments as evidenced by turbidity or sediment deposition downstream of crossings.

Compaction

For the purposes of this analysis, all of the project area on the working side (65 feet or about 70 percent of the corridor width) of the construction corridor and TEWAs would be subject to multiple passes of heavy equipment and truck traffic and, as a result, would likely have some degree of compaction. The spoil storage area may experience some degree of compaction depending on the rate and scope of heavy equipment passage. Soil texture, moisture content, and exposure (number of passes and type of equipment) would determine the severity of compaction that may occur. Acres of soils with high potential for soil compaction on BLM and NFS lands are summarized by watershed and administrative unit in table 4.3.3.1-1 of the DEIS. Soils in this sensitive group were determined based on the NRCS rating of high or severe for the Haul Roads, Log Landings, and Soil Rutting category. Soils in this group are rated based on Unified soil texture classification, rock fragments on or below the surface depth to a restrictive layer, depth to a water table, and slope. Unmitigated soil compaction would result in long-term impacts on soil productivity and increased erosion due to increased runoff.

On slopes less than 35 percent that do not have high rock content, most soil compaction can be effectively treated with a winged subsoil ripper attached to a cat or operated with a hydraulic shovel. It effectively breaks up compacted subsoils and topsoils at a depth of 16 to 20 inches. Decompaction of soils would be accomplished to meet agency standards where possible to do so. Detrimental soil compaction is defined as an increase in bulk density of more than 15 percent when compared to adjacent undisturbed areas. On NFS and BLM lands, compaction testing on areas that are treated would confirm that compaction does not exceed a bulk soil density of 15 percent or more over adjacent undisturbed soils. On NFS lands, within 100 feet of perennial or intermittent streams, compaction would not exceed 10 percent of the activity area as confirmed through compaction testing.

Decompaction is not feasible in all areas. Where slopes exceed 35 percent, or where soils have high rock or boulder content, subsoiling is not feasible and compaction may not be fully treatable. Subsoil ripping is also not possible over the pipeline for safety reasons, so soil compaction in the backfilled trench area would be not be treated. Overall, considering steeper areas, and areas with high boulder content, and the trench area, an estimated 30 to 70 percent of the project area is likely to remain in a compacted soil condition.

Displacement and Mixing

Soil displacement and mixing may create detrimental soil conditions by increasing cobble and stone content, mixing soil horizons and removing or mixing nutrient-bearing "O" and "A" soil horizons with less productive subsurface layers. Soil mixing and displacement would be high in the trenched area. Some degree of displacement and mixing would likely occur on the spoil side of the corridor where excavated material is stored before reburying the pipeline and on the construction side from grading operations.

Severe disturbances such as soil mixing or displacement would reduce long-term site productivity by displacing the duff layer and soil surface ("A" horizon), thus reducing the soil's ability to capture and retain water and nutrients. Applying fertilizers to a damaged soil could offer a short-term boost to establishing grass and brush, but fertilizer alone would not mitigate the nutrient and moisture holding capacity of the original soil displaced from surface soil displacement and soil mixing.

Topsoil would not be segregated on BLM or NFS lands because this would require additional storage space necessitating a widened corridor and would cause additional resource impacts. LWD and slash would be placed back on the corridor for both erosion control and long-term nutrient restoration. The following method has been used with success on the Umpqua National Forest to help accelerate the start of the soil rehabilitation process and is recommended for this project.

- Cover the soil surface to be treated with some form of organic soil amendment (e.g., biochar, weed free straw [2 tons/acre], biosolids [300-pound N equivalence], wood chips [3-inch depth]) before decompacting the soil.
- Using an excavator and winged subsoiler attachment, fracture the soil to a minimum depth of 20 inches or to a restrictive layer if rocky. Pull undisturbed surface soil in from outside the disturbance edges to help inoculate the affected site.
- Using the excavator, pull litter and slash over the restored site before moving on.

Summary of Soil Impacts on BLM and NFS Lands

Soil compaction is treatable by subsoil ripping; however, it is unrealistic to assume all compacted areas would be restored to a condition with less than 15 percent increase in bulk density. Soil mixing, displacement, and compaction would be impossible to avoid on the backfilled trench and the spoils side of the corridor. Steep slopes in some locations, and rocky soils would limit soil decompaction. As a result, an estimated 30 to 70 percent of the project area would likely have detrimental soil conditions from mixing, displacement, or compaction. Complete rehabilitation would also require recovery of the soil biology, which requires restoration of the soil organic matter and time. Some surface erosion is likely to occur; however, 85 to 95 percent of surface erosion can be prevented or trapped on-site by application of measures in the ECRP. Any surface

erosion that does occur is expected to be minor, and within the range of natural variability for watersheds in southwest Oregon (see appendix J, section 2.1).

4.3.3.2 Road Sediment Reduction

The Project may cause sediment transport from construction clearing and use of roads by the project. As part of the Project mitigation, road sediment reduction projects are aimed at reducing the chronic contributions of fine-grained sediment from road surfaces and fill failures to stream systems. As described in chapter 2, table 2.1.4-1, mitigation activities include decommissioning of 85.2 miles (approximately 165 acres) of BLM and Forest Service roads. Proposed road decommissioning would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Project occur. Sediment reduction would also include closure of about 6.0 miles (approximately 12 acres) of Forest Service and BLM roads, reducing fine-grained sediments by eliminating traffic impacts.

Mitigation also includes road surfacing and drainage improvement to about 60.9 miles (approximately 118 acres with the assumption of a typical 16-foot-wide roadway) of Forest Service and BLM roads. Road surfacing reduces sediment by capping existing fine textured sediments in the running surface of a gravel road with coarser rock or by paving. Paving all but eliminates traffic-generated sediments. Drainage repair reestablishes outsloping cross-drains and in some cases ditchlines to ditch-relief culverts. These actions have the effect of getting water off the road before it can enter stream courses. Storm-proofing of 13.8 miles (approximately 27 acres) of Forest Service and BLM roads would reduce sediment from roads by increasing the resistance of a road to failure during high-intensity rainfall events. Storm-proofing strategies include improving drainage, reducing diversion potential at culverts, outsloping road surfaces and replacing culverts with hardened low water fords. Road sediment reduction activities would result in approximately 322 total acres of long-term sediment mitigation on federal lands. This mitigation would offset the short-term impacts during Project construction to over 1,000 acres of federal lands.

Road stabilization and culvert replacement of five sites on NFS and BLM lands would reduce road-related sediment by stabilizing or removing failing cut and fill slopes. Culvert replacement reduces sediment by replacing undersized or failing culverts with culverts that are appropriate to pass debris at higher flows. This reduces the probability of fill failure associated with plugged culverts.

The specific locations of the road sediment reduction activities are listed in table 4.3.3.2-1. Activities on BLM lands include road surfacing near the Coquille River East, Middle, and North Forks (Coos Bay); road drainage–culvert replacement near the Clark Branch South Umpqua (Roseburg); road stormproofing near the South Umpqua Days Creek (Roseburg); road drainage and surface enhancement near Myrtle Creek (Roseburg); and road stabilization in the Olalla-Looking Glass watershed (Roseburg).

TABLE 4.3.3.2-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity	Unit
Coos Bay BLM	East Fork Coquille River	Road Sediment Reduction	Road Surfacing	Road Surfacing –Yankee Run Spurs	0.9	miles a/
	East Fork Coquille River	Road Sediment Reduction	Road Surfacing	Road Surfacing –South Fork Elk Creek	2.6	miles
	East Fork Coquille River	Road Sediment Reduction	Road Surfacing	Road Surfacing –Yankee Run Mainline	2.0	miles
	Middle Fork Coquille River	Road Sediment Reduction	Road Surfacing	Road Surfacing –Fall Creek System	0.9	miles
	Middle Fork Coquille River	Road Sediment Reduction	Road Surfacing	Bridge Approach paving –Sandy & Jones Creek Roads	2	ea.
	North Fork Coquille River	Road Sediment Reduction	Road Surfacing	Bridge Approach paving –Woodward & Alder Creek Roads	2	ea.
Roseburg BLM	Clark Branch South Umpqua	Road Sediment Reduction	Road Drainage – Culvert Replacement	East Fork Willis Creek Tributary Culvert Replacement	1	project
	Clark Branch South Umpqua	Road Sediment Reduction	Road Drainage – Culvert Replacement	Judd Creek Culvert Removal	1	project
	Days Creek - South Umpqua	Road Sediment Reduction	Road storm-proofing	31-4-3.2 Road Storm-proofing	1	project
	Days Creek South Umpqua	Road Sediment Reduction	Culvert Replacement	Corn Creek	1	project
	Days Creek - South Umpqua	Road Sediment Reduction	Road Drainage and Surface Enhancement	South Umpqua Road Drainage and Surface Enhancement	10.0	miles
	Middle Fork Coquille River	Road Sediment Reduction	Road Drainage and Surface Enhancement	Camas Mountain Road Drainage and Surface Enhancement	3.5	miles
	Middle Fork Coquille River	Road Sediment Reduction	Road Surfacing and Cross Drain Replacements	Dice, Boulder, and Twelvemile Creek	11.0	miles
	Myrtle Creek	Road Sediment Reduction	Road Drainage and Surface Enhancement	Slide Creek Road Drainage and Surface Enhancement	1.0	miles
	Myrtle Creek	Road Sediment Reduction	Road Stabilization	South Myrtle Hill Slide Repair	1	project
	Olalla-Looking Glass	Road Sediment Reduction	Road Stabilization	Olalla Tie Road Renovation	1	project
	Olalla-Looking Glass	Road Sediment Reduction	Culvert Replacement	Unnamed Tributary to Lower Olalla Creek	1	project
	South Umpqua River	Road Sediment Reduction	Culvert Replacement	Corn Creek	1	project
Medford BLM	Big Butte Creek	Road Sediment Reduction	Road storm-proofing	Big Butte Creek Road Storm-proofing	6.4	miles
	Little Butte Creek	Road Sediment Reduction	Road Drainage and Surface Enhancement	Little Butte Creek Road Improvement	3.5	miles
	Little Butte Creek	Road Sediment Reduction	Road Decommissioning	Little Butte Creek Road Decommissioning Butte Falls RA	2.4	miles
	Little Butte Creek	Road Sediment Reduction	Road Surfacing	Little Butte Cr. Road Resurfacing, Butte Falls Resource Area	9.4	miles
	Shady Cove RR	Road Sediment Reduction	Road Drainage and Surface Enhancement	Shady Cove Road Improvement	1.3	mile
	Shady Cove RR	Road Sediment Reduction	Road Surfacing	Shady Cove Road Resurface	1.5	miles
	Trail Creek	Road Sediment Reduction	Road storm-proofing	Trail Creek Road Storm-proofing	4.3	miles
	Trail Creek	Road Sediment Reduction	Road Surfacing	Trail Creek Road Resurface	16.3	miles

TABLE 4.3.3.2-1

Mitigation Projects to Address LMP Amendments on BLM and NFS Lands

Unit	Watershed	Mitigation Group	Project Type	Project Name	Quantity	Unit
Lakeview BLM	Spencer Creek	Road Sediment Reduction	Road Drainage – Culvert Replacement	Keno Access Road Repair and Culvert Replacement	1	site
	Spencer Creek	Road Sediment Reduction	Road Drainage	Spencer Creek Drainage Improvements and Sediment Trap Removal	15	sites
	Spencer Creek	Road Sediment Reduction	Road Closure	Spencer Creek Repair Existing Road Closure	12	sites
Umpqua National Forest	Days Creek - South Umpqua	Road sediment reduction	Road Closure	Days Creek -South Umpqua Road Closure	0.5	miles
	Elk Creek - South Umpqua	Road sediment reduction	Road Storm-proofing	Elk Creek Road Storm-proofing	1.6	miles
	Elk Creek - South Umpqua	Road sediment reduction	Road Closure	Elk Creek Road Closure	2.8	miles
	Elk Creek - South Umpqua	Road sediment reduction	Road Decommissioning	Elk Creek Road Decommissioning	2.8	miles
	Trail Creek	Road sediment reduction	Road Decommissioning	Trail Creek Road Decommissioning	1.1	miles
	Trail Creek	Road sediment reduction	Road Storm-proofing	Trail Creek Storm-proofing	0.5	miles
	Upper Cow Creek	Road sediment reduction	Road Closure	Upper Cow Creek Road Closure	2.6	miles
	Upper Cow Creek	Road sediment reduction	Road Decommissioning	Upper Cow Creek Road Decommissioning	4.3	miles
Rogue River National Forest	Little Butte Creek	Road sediment reduction	Road Decommissioning	Little Butte Creek Road Decommissioning	53.2	miles
Winema National Forest	Spencer Creek	Road sediment reduction	Road Decommissioning	Spencer Creek Road Decommissioning	21.4	miles

a/ Mileages are rounded to nearest tenth of a mile.

4.3.3.3 National Forest Detrimental Soil Condition Thresholds

LRMPs for the Umpqua, Rogue River, and Winema National Forests have standards and guidelines that establish thresholds for detrimental soils conditions as shown in table 4.3.3.3-1.

TABLE 4.3.3.3-1

Thresholds for Detrimental Soil Conditions on NFS Lands

Watershed	Total Project Acres a/	Cleared Acres b/	Threshold Acres Allowed c/	Minimum Projected Acres in Detrimental Condition d/	Maximum Projected Acres in Detrimental Condition	Minimum Acres Over Threshold	Maximum Acres Over Threshold
Umpqua National Forest							
Days Creek- South Umpqua	53	21	11	6	15	-5	4
Elk Creek-South Umpqua	30	29	6	9	20		14
Upper Cow Creek	78	78	16	23	55	7	39
Trail Creek	62	53	12	16	37	4	25
Total Umpqua NF	***223***	***181***	***45***	***54***	***127***	***9***	***82***
Rogue River National Forest							
Little Butte Creek	276	206	28	62	144	34	116
Winema National Forest							
Spencer Creek, All Land Allocations other than Management Area 8	85	73	17	22	51	5	34
Spencer Creek Riparian Areas (Management Area 8)	7	7	1	2	5	<1	4

TABLE 4.3.3.3-1

Thresholds for Detrimental Soil Conditions on NFS Lands

Watershed	Total Project Acres a/	Cleared Acres b/	Threshold Acres Allowed c/	Minimum Projected Acres in Detrimental Condition d/	Maximum Projected Acres in Detrimental Condition	Minimum Acres Over Threshold	Maximum Acres Over Threshold
Total Winema NF	***92***	***80***	***18***	***24***	***56***	***5***	***38***
Total Cumulative Direct Effect, All NFS Lands	**591**	**467**	**91**	**140**	**327**	**48**	**236**

Rows and columns may not add correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
a/ Total Project Acres is all acres within the right-of-way. This includes cleared and uncleared areas.
b/ Cleared Acres are the construction corridor and TEWAs.
c/ Threshold Acres Allowed is the threshold from the standards and guidelines times the Total Project Acres.
d/ Projected Acres in Detrimental Conditions is estimated at 30 percent (minimum) to 70 percent (maximum) of the Cleared Acres.

Detrimental soil conditions are measured upon completion of a project after restoration and rehabilitation work is completed. Detrimental soil conditions are defined in each national forest LRMP, but generally include:

- compaction, which is defined as an increase in bulk density of 15 percent when compared to adjacent undisturbed soils for all soils except volcanic ash or pumice. For volcanic ash soils, compaction is defined as a 20 percent increase in bulk density when compared to adjacent undisturbed soils;
- displacement or mixing, which is the horizontal removal by mechanical means of 50 percent or more of the topsoil or "A" horizons, or mixing of these layers with less fertile subsurface mineral layers such that the continuity of the horizons is lost; and
- detrimental puddling, which is the physical change to soil structure that results when traffic ruts and molds a soil to a depth of 6 inches or more.

Precise estimates of detrimental soil conditions likely to exist at completion of a project are impossible to make. For the purposes of this assessment, 30-70 percent of the pipeline project area may be in a detrimental soil condition upon completion of all soil restoration and rehabilitation efforts. Table 4.3.3.3-1 has been updated from the DEIS and provides an estimate of predicted detrimental soil conditions. Where projected acres exceed the threshold, an amendment of the affected LRMP is necessary to make provision for the Pacific Connector Pipeline Project.

The impacts of detrimental soil conditions include:

- a possible reduction in soil productivity from mixing or displacement of nutrient-bearing soil layers; and
- a potential increase in runoff and erosion from decreased infiltration of compacted soils.

See section 4.3.3.1 for measures that would be applied on federal lands to address these issues.

Amendments of Forest Plans Related to Thresholds for Detrimental Soil Conditions

Where detrimental soil conditions exceed the threshold established in an LRMP, an amendment of the LRMP is necessary for the Project to proceed. The following amendments of National Forest LRMPs are proposed to waive limitations on detrimental soil condition thresholds to make provision for the Project.

UNF-3. Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions Within the Pacific Connector Right-of-Way in All Management Areas

Forest-Wide Soils Standard and Guideline #1 (LRMP IV-67) states:

> *The combined total amount of unacceptable soil condition (detrimental compaction, displacement, puddling or severely burned) in an activity area (e.g., cutting unit, range allotment, site preparation area) should not exceed 20 percent. All roads and landings, unless rehabilitated to natural conditions, are considered to be in detrimental condition and are included as part of this 20 percent.*

For planning purposes, soil impacts are considered long term. Soil compaction and displacement would be confined to the project area, but predicting how much would be affected is an estimate based on professional judgment and the nature of corridor construction. See section 4.3.3.1 for a discussion of environmental consequences.

The Project would likely result in a detrimental soil condition on 30 to 70 percent of the project area on the Umpqua National Forest (223 acres) due to displacement and compaction. Approximately 8 to 20 of those acres would likely be in Riparian Reserves. Compaction can largely be addressed by subsoil ripping, but displacement would be unavoidable because of the nature of the Project. Existing LRMP standards and guidelines allow up to 20 percent of the project corridor (about 45 acres of the corridor on the Umpqua National Forest) to be in a degraded soil condition upon completion of a project. The Pacific Connector Pipeline Project would exceed these thresholds by about 9 to 82 acres on the Umpqua National Forest. These impacts would be spread over four separate fifth-field watersheds. See section 4.1.3.5 and appendix J, Aquatic Conservation Strategy Assessment, for a watershed-specific evaluation. Amendment of the Umpqua National Forest LRMP to waive limitations on detrimental soil conditions is not expected to prevent attainment of ACS objectives (section 4.1.3.5 and appendix J, sections 2.4.6, 2.4.7, 2.4.8, and 2.5.3). See section 4.1.3.4 for a discussion of significance of this amendment in the context of the Umpqua National Forest LRMP.

RRNF–6. Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions Within the Pacific Connector Right-of-Way in All Management Areas

Standards and guidelines in the Rogue River National Forest LRMP (pp. 4-41, 4-83, 4-97, 4-123, 4-177, 4-307) state:

> *No more than 10 percent of an activity area should be compacted, puddled or displaced upon completion of project (not including permanent roads or landings). No more than 20 percent of the area should be displaced or compacted under circumstances resulting from previous management practices including roads and landings. Permanent recreation facilities or other permanent facilities are exempt.*

The Pacific Connector Pipeline Project would likely result in a degraded soil condition on an estimated 30 to 70 percent of the pipeline right-of-way on NFS lands in the Rogue River National Forest (all in the Little Butte Creek Watershed) due to displacement and compaction (Orton 2009). Compaction can largely be addressed by subsoil ripping, but displacement would be unavoidable because of the nature of the project. Existing LRMP standards and guidelines allow up to 10 percent or 28 acres of the pipeline corridor to be in a degraded soil condition on completion of a

project. Thus, the pipeline project would likely exceed this threshold by about 34 to 116 additional acres or 0.07 to 0.2 percent of the 57,234 acres (NFS lands only) within the Little Butte Creek Watershed upon completion. About 2 to 5 acres of degraded soil conditions above LRMP thresholds may be in Riparian Reserves. See section 4.1.3.5 and appendix J, Aquatic Conservation Strategy Assessment, for a watershed-specific evaluation of consequences. Amendment of the Rogue River National Forest LRMP to waive limitations on detrimental soil conditions is not expected to prevent attainment of ACS objectives (section 4.1.3.5 and appendix J, section 2.5.6). See section 4.1.3.4 for a discussion of this amendment in the context of the Rogue River National Forest LRMP.

WNF-4 and WNF-5: Site-Specific Amendment to Waive Limitations on Detrimental Soil Conditions within the Pacific Connector Right-of-Way in All Management Areas (WNF-4) and in Management Area 8 -Riparian Areas (WNF-5)

These standards and guidelines of the Winema National Forest LRMP restrict the amount of an area that may be in a degraded soil condition as a result of a management activity. They are considered together here because the assessment is the same for both standards.

> *The forest wide general standard and guideline requires detrimental soil conditions not exceed 20 percent of the total acres within the activity area (Forest Plan page 4-73) and Management Area 8—Riparian Areas requires the cumulative total area of detrimental soil conditions in riparian areas shall not exceed 10 percent of the total riparian acreage within an activity area (Forest Plan page 4-137). Detrimental soil conditions occur when soil is compacted, puddled, displaced over an area greater than 100 square feet, or are severely burned.*

The Pacific Connector Pipeline Project would likely result in a degraded soil condition on an estimated 30 to 70 percent project right-of-way on NFS lands in the Winema National Forest (all in the Spencer Creek Watershed) due to displacement and compaction (Orton 2009). Compaction can largely be addressed by subsoil ripping, but displacement would be unavoidable because of the nature of the project. Existing LRMP standards and guidelines allow up to 10 percent (1.5 acres) of the project corridor in Management Area 8 Riparian Areas or 20 percent (17 acres) in the pipeline corridor outside of Management Area 8 to be in a degraded soil condition on completion of a project. Thus, the pipeline project would likely exceed this threshold by an estimated 5 to 38 additional acres or 0.03 to 0.16 percent of the 22,307 acres (NFS lands only) within the Spencer Creek watershed upon completion. See section 4.1.3.5 and appendix J, section 2.6.3, for a watershed-specific evaluation of consequences. Amendment of the Winema National Forest LRMP to waive limitations on detrimental soil conditions is not expected to prevent attainment of ACS objectives (section 4.1.3.5 and appendix J, section 2.6.3). See section 4.1.3.4 for a discussion of the significance of this amendment in the context of the Winema National Forest LRMP.

Cumulative Impacts, All Units

Cumulatively, on the Umpqua, Rogue River, and Winema National Forests, detrimental soil conditions within the pipeline project area are expected to range between about 140 and 327 acres (table 4.3.3.3-1), or about 49 to 236 acres over the combined LRMP threshold for the pipeline project of 91 acres. Assuming an even distribution over the 30.6-mile NFS part of the pipeline

project area, this equals about 2 to 8 acres of detrimental soil conditions above the LRMP thresholds for each mile of pipeline, spread over six separate fifth-field watersheds.

4.3.3.4 Soil Risk and Sensitivity Assessment

At the request of the BLM and Forest Service, Pacific Connector identified areas on BLM and NFS lands along the proposed Project where there is a low vegetation recovery potential. These soils included combined characteristics including high or severe erosion potential, steep slopes, large stones, shallow soils, saline/sodic conditions, clayey soils (greater than 40 percent), and soil map units with dominant amounts of rock outcrop. Certain types of disturbed soils where residual soil compaction exists in subsurface soil layers, topsoil has eroded, soil horizons have been mixed, and/or topsoil has been removed, can lead to conditions where revegetation can be very difficult, no matter what mitigation methods are employed.

In order to specifically identify areas of revegetation concern where more rigorous mitigation might be required, a Soil Risk and Sensitivity Assessment was performed for the BLM and Forest Service (NSR 2015a). The intent of the assessment was to identify the areas where additional soil decompaction, erosion control, or other types of site-specific and focused remediation measures may be required on BLM and NFS lands to minimize erosion potential and/or accomplish agency revegetation objectives. Soil risk and sensitivity factors were identified by a BLM/Forest Service team including four criteria in the assessment of the risk element; plant mortality, soil erosion, slope rating and aspect; and three levels of sensitivity, primarily based on qualitative values related to management objectives.

As depicted in table 4.3.3.4-1, approximately 83 percent of the Project area, or about 1,143 acres, is rated as Level 1 – very low or Level 2 – low for combined risk and sensitivity. These are locations where revegetation measures are expected to be successful with decompaction and other standard methods described in the ECRP. Approximately 18 percent of the Project area, or about 237 acres, is rated as Level 3 – moderate or Level 4 – high for combined risk and sensitivity where more aggressive erosion controls and/or soil remediation are likely to be needed.

TABLE 4.3.3.4-1

Risk/Sensitivity Ratings by Administrative Unit by Watershed (Acres)

		Risk Sensitivity Rank				
Unit	**Watershed**	**1 (very low)**	**2 (low)**	**3 (moderate)**	**4 (high)**	**5 (very high)**
Coos Bay BLM	East Fork Coquille River	13	26	4	32	0
	Coquille River	0	<1	<1	<1	0
	North Fork Coquille River	5	22	8	8	0
	Middle Fork Coquille River	9	58	6	9	<1
	Coos Bay-Frontal Pacific Ocean	<1	2	<1	<1	0
	Subtotal	**27**	**108**	**20**	**19**	**<1**
Roseburg BLM	Clark Branch South Umpqua	2	7	1	0	0
	Olalla-Looking Glass	10	10	5	0	0
	Days Creek -South Umpqua	13	146	16	3	0
	Middle Fork Coquille River	6	17	3	<1	0
	Myrtle Creek	2	65	24	<1	0
	Elk Creek	<1	2	<1	<1	0
	Subtotal	**33**	**247**	**50**	**4**	**0**
Medford BLM	Big Butte Creek	3	<1	1	7	0
	Little Butte Creek	35	63	12	3	0
	Shady Cove RR	10	49	13	3	0
	Trail Creek	28	41	5	0	0
	Subtotal	**76**	**153**	**32**	**13**	**0**
Lakeview BLM	Spencer Creek	**2**	**<1**	**12**	**<1**	**0**

TABLE 4.3.3.4-1

Risk/Sensitivity Ratings by Administrative Unit by Watershed (Acres)

Unit	Watershed	Risk Sensitivity Rank				
		1 (very low)	2 (low)	3 (moderate)	4 (high)	5 (very high)
Umpqua National Forest	Days Creek - South Umpqua	0	40	15	0	0
	Elk Creek - South Umpqua	<1	31	<1	0	0
	Trail Creek	15	24	0	0	0
	Upper Cow Creek	7	39	15	9	<1
	Subtotal	**22**	**134**	**30**	**9**	**<1**
Rogue River National Forest	Little Butte Creek	**158**	**119**	**14**	**3**	**0**
Winema National Forest	Spencer Creek	**12**	**52**	**25**	**3**	**0**
	Total	**328**	**814**	**183**	**54**	**<1**

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").

Areas rated as Level 3 – moderate (about 183 acres or 13 percent of the Project) had either high risk **or** high sensitivity but not both, or were ranked as moderate for both criteria. Areas that ranked as Level 4 – high (about 54 acres or 4 percent of the Project) had both high sensitivity and high risk and would be considered high priority areas for aggressive soil remediation. Less than one acre was ranked Level 5 – very high and considered to have a very high priority for aggressive restoration measures.

Areas ranked a Level 3 – moderate to 5 – very high (237 acres total) would be recommended for more site-specific validation of the risk criteria used in this assessment to confirm that specific locations merit consideration of the more aggressive soil remediation measures listed below:

- biochar to increase the nutrient and moisture holding capacity of the soil and/or adjust soil pH;
- a thin organic Class-A compost (biosolids, 300 to 400 lb/acre N equivalent) to increase the nutrient level of the soil in a slow release form;
- a 2- to 3-inch organic mulch surface application (80 percent coverage) of woodchips, logging slash, and/or straw;
- adaptive seed mixes and vegetation to better fit site conditions;
- deep subsoil decompaction with hydraulic excavators that leave constructed corridor mounded and rough with maximum water infiltration so that water cannot flow downhill for any appreciable distance;
- more aggressive use of constructed surface water runoff dispersion structures such as closely placed and more pronounced slope dips and water bars, etc.;
- more aggressive use of constructed surface runoff entrapments such as silt fencing, sediment settling basins, or straw bale structures, etc.;
- more aggressive placement (100 percent coverage) and depth (3 to 4 inches) of ground cover using woodchips, logging slash, straw bales, wattles, etc.; and
- priority monitoring of results as needed to measure success or make future recommendations.

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