Pacific Connector Gas Pipeline, LP

Resource Report No. 10

Alternatives

Pacific Connector Gas Pipeline Project

March 2017

Alternatives Location of Information to Satisfy Minimum Filing Requirements	
	Section
Address the “no action” alternative.	10.2.1
For large projects, address the effect of energy conservation or energy alternatives to the project.	10.2.2
Identify system alternatives considered during the identification of the project and provide the rationale for rejecting each alternative.	10.3
Identify major and minor route alternatives considered to avoid impact on sensitive environmental areas (e.g., wetlands, parks, or residences) and provide sufficient comparative data to justify the selection of the proposed route.	10.4
Identify alternative sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site.	10.5

Resource Report No. 10
Alternatives

Table of Contents

10.1 Introduction 1
10.2 No Action Alternative 2
10.2.1 No Action Alternative 2
10.2.2 Energy Alternatives 2
10.3 System Alternatives 2
10.3.1 Coos County Pipeline 3
10.3.2 Northwest Pipeline System 3
10.3.3 Gas Transmission Northwest 4
10.3.4 Summary 6
10.4 Route Alternatives 6
10.4.1 Major Route Alternatives 7
10.4.2 Route Variations or Deviations 12
10.4.3 Alternative Route Segments Considered but Eliminated from Detailed Analysis 13
10.5 Alternative Sites for Aboveground Facilities (Compressor Station) 20
10.6 Alternative Layout/Design (Compressor Station) 22
10.7 References 23

List of Tables

Table 10.4.1.1 Coos Bay Avoidance Alternatives 8
Table 10.4.1.2 Comparison of the Proposed Route and the Blue Ridge Routes 11
Table 10.4.2.1 Route Variations or Deviations Incorporated into the Proposed Route since 2015 FEIS 12

List of Figures

Figure 10.3-1 System Alternatives 4
Figure 10.4-1 Alternate Segment Analysis ..... (end of report)
Figure 10.4-2 Coos Bay Alternatives ..... (end of report)
Figure 10.4-3 Blue Ridge Route Variations ..... (end of report)
Figure 10.4-4 Straight Line, All Highway, & Klamath-Avoidance Alternatives ..... (end of report)
Figure 10.4-5 Klamath Compressor Station Site Alternatives ..... (end of report)

List of Appendices
(to be filed with application)

Appendix 10A Summary of Additional Major Route Alternatives, Route Deviations, and Variations Previously Eliminated From Further Consideration

List of Abbreviations and Acronyms

AASHTO	American Association of State Highway Transportation Officials
ACEC	Area of Critical Environmental Concern
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
CCPL	Coos County Pipeline
CR	county road
Dth/d	dekatherms per day
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
GTN	Gas Transmission Northwest
HDD	horizontal directional drill
JCEP	Jordan Cove Energy Project, L.P.
LiDAR	light detection and ranging
LNG	liquefied natural gas
LSOG	Late Successional/Old-Growth
LSR	Late Successional Reserve
MAMU	marbled murrelet
MAOP	maximum allowable operating pressure
MP	milepost
NFS	National Forest Service
NPS	National Park Service
NSO	northern spotted owl
NWI	National Wetland Inventory
NWP	Northwest Pipeline
ODFW	Oregon Department of Fish and Wildlife
PCGP	Pacific Connector Gas Pipeline
PG&E	Pacific Gas and Electric
SR	state road
TEWA	temporary extra work area
UCSA	uncleared storage area

10. ALTERNATIVES

10.1 INTRODUCTION

Pacific Connector Gas Pipeline, L.P. ("PCGP") is seeking authorization from the Federal Energy Regulatory Commission ("FERC" or "Commission") under Section 7 of the Natural Gas Act ("NGA") to construct and operate a new approximate 235-mile-long, 36-inch-diameter natural gas transmission pipeline ("Pipeline") capable of transporting approximately 1,200,000 dekatherms per day ("Dth/d") of natural gas from interconnections with two existing interstate natural gas pipelines (Ruby Pipeline LLC's Ruby Pipeline and Gas Transmission Northwest LLC's GTN Pipeline) near Malin, Oregon, to the proposed Jordan Cove Liquefied Natural Gas ("LNG") export facility ("LNG Terminal") being developed by Jordan Cove Energy Project, L.P. ("JCEP"). The Pipeline and the LNG Terminal are referred to, collectively, as the "Project." This resource report addresses only the Pipeline alternatives.

The overall Project purpose and need is to construct a natural gas liquefaction and deep-water export terminal capable of receiving and loading ocean-going LNG carriers, that receives its natural gas supply from a point near the intersections of the GTN Pipeline system and Ruby Pipeline system in Malin, Oregon. The Pipeline receipt point in Malin is strategically located to give international customers in Asia access to abundant supplies of natural gas from two burgeoning natural gas supply basins – one in the U.S. Rocky Mountains (through the existing Ruby Pipeline) and a second in western Canada (through the existing GTN Pipeline). The LNG Terminal, on the bay side of the North Spit of Coos Bay, would support receipt, liquefaction, storage, and loading of LNG onto ocean-going LNG tankers for delivery to export markets. The Project is a market-driven response to the availability of these burgeoning and abundant natural gas supplies, giving those supplies an efficient and cost-effective outlet. The Project is also a market-driven response to the growth of international, particularly Asian, natural gas markets.

A complete discussion and detailed descriptions of the Pipeline facilities, land requirements, proposed construction and operation procedures, and schedule are provided in Resource Report 1. The General Location map in Figure 1.1-1 in Resource Report 1 shows the proposed location of the Pipeline and its facilities. A complete discussion and detailed description of the proposed LNG Terminal is included in the JCEP Resource Report 1.

This resource report describes the process that PCGP used to select the proposed route for the Pipeline ("Proposed Route"), as well as the alternative routes or routing segments that were considered. Alternatives to the Proposed Route can be classified among the following categories: no action alternative, system alternatives, and major route alternatives. These alternatives, as well as a summary of some of the more significant route alternatives that were eliminated from further analysis, are described in this resource report.

The Proposed Route has been developed through an iterative process that included numerous meetings with landowners, federal and state agencies, the Confederated Tribes of Coos, Coquille Indian Tribe, The Klamath Tribes, Confederated Tribes of Siletz Indians and The Confederated Tribes of Grand Ronde The Proposed Route is based on routes that were publicly scoped, reviewed, and analyzed as part of FERC's NEPA

process under Docket CP07-441-000, which is documented in FERC's Draft EIS (FERC 2008) and Final EIS (FERC 2009) as well as under Docket CP13-492-000, which is documented in FERC's Draft EIS (FERC 2014) and Final EIS (FERC 2015). The following agencies participated as cooperating agencies in preparation of the Draft EISs and Final EISs during development of both the 2009 FEIS and the 2015 FEIS:

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
Douglas County, Oregon (2009)

10.2 NO ACTION ALTERNATIVE

10.2.1 No Action Alternative

In licensing and permitting situations, the No Action Alternative reflects the scenario in which the necessary federal permits and authorizations are not granted, and the proposed action is not undertaken. If the Commission selects the No Action Alternative and denies the authorizations for the Project, the Project will not be developed, and certain short- and long-term environmental impacts associated with the construction and operation would not occur.

Under the No Action Alternative, because the Project would not be constructed, the Project's purpose and need would not be met. The environmental impacts caused by development of the Project 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 purpose and need of this proposed Project (*i.e.*, to make other sources of natural gas available for LNG export to Asian markets).

10.2.2 Energy Alternatives

As discussed above, the purpose of the Project is to provide U.S.-produced LNG for export to foreign markets, particularly in Asia. As a result, there are no domestic energy alternatives or energy conservation measures that would meet the Project's purpose and need. The Project will not displace alternative energy sources from being utilized in the U.S. LNG exported to foreign markets can serve as a complement to intermittent renewable energy sources in those markets and provide consuming nations with an alternative to fossil fuels that emit higher levels of carbon dioxide, such as coal (USDOE National Energy Technology Laboratory 2014).

10.3 SYSTEM ALTERNATIVES

System alternatives would involve the use of other existing or proposed natural gas transmission systems in lieu of construction of some or all of the Pipeline. Although

existing pipeline systems are in place in the region to provide natural gas service to Coos Bay (see Figure 10.3-1), they do not have the capacity to deliver the 1,200,000 Dth/d required to meet the needs of the Project, nor do they have the supply diversity to provide access to either 1,200,000 Dth/d of Canadian supplies or 1,200,000 Dth/d of Rocky Mountain supplies on a given day to the LNG Terminal. Therefore, modifications to and expansions of these existing facilities would be required to deliver the same gas volume to be provided by the Pipeline.

As seen from Figure 10.3-1, there are three potential natural gas pipeline systems that, with modifications, could deliver natural gas to the LNG Terminal:

- Coos County Pipeline ("CCPL")
- Northwest Pipeline ("NWP")
- Gas Transmission Northwest ("GTN")

Each of these alternatives is discussed below.

10.3.1 Coos County Pipeline

CCPL (operated by the Northwest Natural Gas Company) is the only pipeline system currently providing natural gas service to the Coos Bay area. It is a 12-inch diameter pipeline that extends approximately 60 miles from the Roseburg area to Coos Bay; however, it is limited in capacity. The CCPL has a maximum allowable operating pressure ("MAOP") of 1,000 psig and was designed to receive gas from NWP Grants Pass Lateral near Roseburg, Oregon, and deliver it to the south side of Coos Bay, Oregon. The terminus of the CCPL is approximately 7.65 miles south of the proposed LNG Terminal, which is located on the North Spit. Northwest Natural Gas Company built a pipeline from the terminus of the CCPL across Coos Bay over to the North Spit, but it is designed as the backbone of its distribution system and not as a transmission system, and it would have to be extended by approximately 2-3 miles to reach the LNG Terminal.

Assuming the necessary extensions could be made to the CCPL to allow gas flow to the LNG Terminal from NWP Grants Pass Lateral (896 psig MAOP), the maximum gas flow through the CCPL would be less than 5 percent of the capacity required for the proposed LNG Terminal. At a normal operating pressure of 600 psig on NWP Pipeline's Grants Pass Lateral, the maximum volume of natural gas that can be transported on the CCPL to the City of Coos Bay and on the Northwest Natural pipeline to the North Spit is 18,000 Dth/d at a delivery pressure of 554 psig. At an operating pressure of 800 psig on NWP Grants Pass Lateral, the maximum volume of natural gas that can be transported on the CCPL to the City of Coos Bay and on Northwest Natural's pipeline to the North Spit is 36,000 Dth/d at a delivery pressure of 680 psig.

Given the capacity constraints of the pipeline in both volumetric and pressure terms, this line would have to be looped with a much larger diameter line. PCGP reviewed the CCPL corridor to determine if it was feasible to parallel this corridor with a new pipeline. As discussed in more detail in Section 10.4.3.9, because of multiple construction constraints associated with installation of a 36-inch pipeline as well as other environmental and residential impacts, PCGP determined that this alternative is not feasible.

10.3.2 Northwest Pipeline System

NWP is an approximately 3,900-mile bi-directional transmission system crossing Washington, Oregon, Idaho, Wyoming, Utah and Colorado. The NWP bi-directional

system provides access to British Columbia, Alberta, Rocky Mountain, and San Juan Basin gas supplies. Of note, NWP interconnects with GTN in Umatilla County, Oregon.

Although NWP does not pass near the LNG Terminal or through Coos County, a lateral could be installed from the NWP lateral from Eugene to Grants Pass as was done for CCPL near Roseburg, Oregon. As discussed in 10.3.1, installing a lateral parallel to CCPL is not feasible. However, a new lateral interconnect could be made to the NWP Grants Pass lateral near Myrtle Point, Oregon, and a new pipeline installed identical to the Proposed Route from this new interconnect to the LNG Terminal.

PCGP reviewed the NWP Camas to Eugene and Eugene to Grants Pass laterals. The NWP Camas to Eugene Lateral connects to the Ignacio to Sumas system at Washougal, Washington. This system includes a 16-inch lateral that is partially looped by 30-inch and 20-inch pipeline segments. The lateral extends south 118.4 miles to Eugene, Oregon. From Eugene, NWP 16-inch and 10-inch Eugene to Grants Pass Lateral extends 131.5 miles south to its terminus near Grants Pass, Oregon. Neither the Camas to Eugene nor the Eugene to Grants Pass laterals, which approximately follow the Interstate 5 (I-5) corridor, has the capacity to deliver the gas volumes necessary to meet the Project's purpose and need without major system modifications and expansions.

Additionally, the NWP Eugene to Grants Pass laterals are fed from an interconnect to NWP Ignacio to Sumas transmission system, which is a bi-directional transmission system that crosses Washington, Oregon, Idaho, Wyoming, Utah, Colorado, and New Mexico. This system provides access to British Columbia, Alberta, the Rocky Mountain states, and San Juan Basin natural gas supplies. While this system has a peak design capacity of 3.4 Bcf/d (FERC 2009), system modifications and expansions would be required to maintain service to existing customers as well as to transport the gas volume required by the Project. System modifications and expansion on NWP system would depend on the gas source (British Columbia, Alberta, Rocky Mountain, etc.) and cannot be reasonably quantified due to the inability to access the necessary proprietary data. To create the supply diversity and capacity that the Pipeline would provide, it would require a 1 Bcf/d expansion to obtain access to similar Canadian supplies, as well as a south-end expansion of 1 Bcf/d to obtain access to Rocky Mountain supplies.

For these reasons, the NWP alternative as described is not a reasonable alternative.

10.3.3 Gas Transmission Northwest

GTN includes 612 miles of pipeline beginning at Kingsgate, British Columbia, traversing through northern Idaho, southeastern Washington, central Oregon, and terminating near Malin, Oregon, where it interconnects with the Tuscarora, Ruby, and Pacific Gas and Electric pipeline systems. Natural gas supplies for the GTN system originate primarily from the Western Canadian Sedimentary Basin although it can receive Rocky Mountain gas through interconnections, with NWP near Spokane and Palouse, Washington, and Stanfield, Oregon, as well from the Ruby Pipeline at Malin, Oregon.

In theory, with the interconnection between the Ruby Pipeline and the GTN system, Rocky Mountain gas supplies could be transported north on the GTN system to NWP Ignacio to Sumas transmission system at Stanfield, Oregon (see Figure 10.3-1). However, this would require a significant expansion on NWP system to provide sufficient gas to the LNG Terminal to meet its daily requirements. Moreover, due to an inability to access proprietary information PCGP is unable to determine what facility upgrades would be required such that the GTN system could meet the purpose and need of the LNG Terminal. For these reasons, the GTN system is not a reasonable alternative.

Figure 10.3-1
System Alternatives

10.3.4 Summary

Based on the above analysis, these system alternatives would not have the supply diversity and gas-on-gas competition of the Pipeline (access to Canadian and Rocky Mountain gas supplies). Moreover, in order to supply the volumes of gas needed by the LNG Terminal on a daily basis, these system alternatives would require extensive modification, which would result in prohibitive costs, associated rates, and similar or greater environmental impacts when taking into account required expansions on NWP and other upstream pipeline systems. Therefore, none of these system alternatives can meet the purpose and need of the Project and are not reasonable alternatives under NEPA.

10.4 ROUTE ALTERNATIVES

Preliminary Route Selection Process

PCGP developed a multidisciplinary team, including engineering, construction and environmental specialists, to identify potential corridors in the area between the interconnects with the two interstate natural gas pipeline systems near Malin, Oregon, and the proposed LNG Terminal that could be utilized as preliminary pipeline routes. During the initial phase of the routing process, the primary selection criterion was to identify existing corridors such as roads, railroads, pipelines and powerlines which could be paralleled. Other than existing highway corridors, few contiguous corridors (powerline, pipeline, or railroad) were identified in this area.

Route Feasibility Analysis

PCGP established field offices in Roseburg and Medford, Oregon, to evaluate the feasibility of the preliminary routes that had been identified. To conduct the route feasibility analysis, PCGP staffed the field offices with senior routing specialists who had decades of experience in the pipeline industry designing, constructing and operating natural gas transmission lines throughout the U.S., including the Pacific Northwest.

PCGP developed a survey documentation protocol prior to initiating the feasibility analysis so that comparable information for each of the preliminary route segments would be systematically documented using both existing information as well as field assessment, where reasonable. Documentation for each of the route segments included information such as:

- Length of the route segment;
- Potential environmental issues;
- Criteria that would require excessive construction disturbance;
- Special construction requirements;
- Unstable areas; and
- Summary of general route observations.

During the initial route feasibility analysis, more than 1,000 miles of route segments were reviewed. The feasibility analysis also included mapping and driving surveys (where feasible) along existing road corridors. Because access was restricted in numerous areas – either because of private land or road limitations – aerial surveys were ultimately required and extensively used for all route segments.

Route Selection Criteria

PCGP analyzed the preliminary routes based on the following criteria/objectives:

- Construction feasibility to safely construct and operate a large diameter underground, high pressure welded steel natural gas transmission pipeline;
- Pipeline stability (avoiding geohazards where possible, minimizing side hill slopes, and maximizing ridgeline alignments where possible);
- Avoidance of known designated sensitive natural resource areas, including national parks, national monuments, wild and scenic rivers, scenic byways, wilderness areas, and Areas of Critical Environmental Concern;
- Utilization of existing corridors and rights-of-ways;
- Minimization of disturbance to sensitive areas such as:
    - Reducing waterbody and wetland crossings;
    - Reducing landowner encumbrances by avoiding populated areas (towns, population centers, commercial areas, and residential subdivisions);
    - Minimizing disturbance near scenic waterways and/or byways;
    - Avoiding identified cultural and historic resources when feasible; and
    - Avoiding or minimizing removal of significant habitat for protected species;
- Most direct route taking into consideration the above factors.

During the route selection process, although the alignments of the various alternative route segments may have paralleled existing roads and railroads, routing the pipeline within the existing transportation easements or in roadbeds was an avoidance objective. 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 Transportations Official's ("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 to continue to adhere to the stricter AASHTO policies (FERC 2015). 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 (FERC 2015).

Working within road easements also creates a public safety hazard, impedes traffic during construction, and creates a long-term safety consideration with the potential of third-party damage to the pipeline. Road expansions or improvement projects may also require the pipeline within the road easements to be relocated in the future, which then may create unforeseen environmental, landowner, and system impacts.

During routing analysis of the Pipeline, PCGP reviewed more than 1,000 miles of alternative alignments for development of the Proposed Route. Many of these alternatives were reviewed and analyzed as part of FERC's NEPA process under Docket CP13-492-000, which is documented in FERC's Draft EIS (FERC 2014) and Final EIS (FERC 2015). A summary table of these alternatives and other route deviations and variations that were previously eliminated from further consideration is included as Appendix 10A (to be included with final application).

10.4.1 Major Route Alternatives

The Pipeline has been designed to transport 1,200,000 Dth/d of natural gas to the LNG Terminal. The Proposed Route was designed to minimize impacts to the environment by following existing roads and utility corridors to the extent feasible considering safety and design parameters. The primary considerations used to determine the Proposed Route were construction and integrity requirements for a 36" diameter, high pressure,

natural gas transmission pipeline; minimization of impacts to landowners, water bodies; and avoidance of scenic waterways, byways, wilderness areas, national parks and monuments. The Proposed Route is shown on Figure 10.4-1 along with the alternative route segments that were considered during route selection.

Major route alternatives deviate from the Proposed Route for an extended distance (*e.g.*, for several miles) or are several miles away from the Proposed Route. Major route alternatives typically are geographically different routes and are primarily considered for new pipeline projects. There are two major route alternatives to the Proposed Route, Haynes Inlet and Blue Ridge.

10.4.1.1 Haynes Inlet

PCGP considered a route segment variation for the proposed crossing of Haynes Inlet. PCGP completed a desktop analysis and conducted site visits with engineering and construction personnel, trenchless crossing contractors (Michels Corporation), and geotechnical consultants to assess the feasibility of the Proposed Route. The investigation aligned the Proposed Route and the East Avoidance Alternative to avoid the Coos Bay estuary by utilizing two horizontal directional drills ("HDDs"), approximately 6,100 feet and 2,600 feet long. Based on desktop preliminary design of the geometry for the HDDs and topographic information, it was determined that the HDD crossings are feasible. Geotechnical soils samples will have to be completed to confirm the final design. The East Avoidance Alternative is not preferable to the Proposed Route based on analysis of the information provided in Table 10.4.1.1. The alignment of the East Avoidance Alternative also crosses dikes associated with the Larson Inlet Flood Damage Reduction ("FDR") Project located along Larson Slough.

Table 10.4.1.1
Coos Bay Avoidance Alternatives
(MPs 1.47H to 6.64R, see Figure 10.4-2)[1]

Impact/Issue		Proposed Route (Haynes Inlet Avoidance)	Haynes Inlet East Avoidance Alternative
General			
Total length (miles)		7.15 (1.65 HDD)	8.13 (1.94 HDD)
Acres of construction right-of-way [2]		65.52	71.28
Number of Temporary Extra Work Areas ("TEWAs") [3]		30	Not Designed
Acres of TEWAs [3]		60.92	Not Designed
Total acres of construction disturbance		126.44	Not Designed
Acres affected during operations (permanent easement) [4]		36.30	49.27
Landowner parcels crossed		36	57
Number of residences within 50 feet of construction right-of-way		0	1 (HDD)
Land Ownership (miles)	Private	5.48	2.21
	State	1.67	5.92
	Federal (BLM/NFS – Lands)	0.00	0.00
Waterbodies and Wetlands [5]			
Number of waterbodies crossed		8	16
Total waterbody crossing length (feet)		172.90 (6,759.00 avoided by 2 HDDs)	452.41 (6,511.8 avoided by 2 HDDs)
Number of wetlands crossed		12	9
Total wetland crossing length (feet)		3,711.44	14,363.64
Land Use			
Agricultural land affected (miles)		0.45	2.59
Forest lands affected (miles) [6]		3.49	2.95

Impact/Issue	Proposed Route (Haynes Inlet Avoidance)	Haynes Inlet East Avoidance Alternative
Miles of right-of-way that would be parallel or adjacent to existing rights-of-way	1.88	2.52
U.S. Army Corps of Engineers 408 facilities [7]	0	1
Critical Habitat		
Miles of critical habitat for federal threatened or endangered species (Oregon Coast Coho Salmon, Green Sturgeon) and EFH species	0 (1.28 crossed by HDD)	0 (1.23 crossed by HDD)

[1] Mileposts correspond with topographic maps provided in the Mapping Supplement.
[2] The construction right-of-way for the Proposed Route and the Haynes Inlet East Avoidance Alternative is 95 feet wide in upland areas and where HDDs are proposed, the right-of-way width has been removed.
[3] TEWAs for the Haynes Inlet East Avoidance Alternative have not been designed and are not included in the total acres of disturbance.
[4] The assumed permanent easement width is 50 feet.
[5] NWI coverages and photo interpretation were used for the Proposed Route and the Haynes Inlet East Avoidance Alternative.
[6] Includes all forestland types: Evergreen forest, Mixed conifer, Regenerating forests and clear-cuts. Neither late successional nor old-growth forests are crossed by the 2 routes.
[7] The alignment of the Haynes Inlet East Avoidance Alternative crosses dikes associated with the Larson Inlet Flood Damage Reduction (FDR) Project located along Larson Slough. According to the National Levee Database (http://geoplatform.usace.army.mil/home), the Larson Inlet FDR Project is a federally-authorized and constructed and a non-federally operated and maintained, agricultural flood-protection project.

10.4.1.2 Blue Ridge Route

The Pipeline route between about MPs 9.0R and 21.8 in Coos County was the subject of significant stakeholder involvement in previous route development activities. In particular, a group of landowners objected to the route PCGP filed with its June 2013 FERC application, and these landowners suggested that the FERC consider an alternative route. PCGP conferred with the landowners and developed the Modified Blue Ridge 2013 Alternative Route ("Blue Ridge Route") that it believes is buildable. The Proposed Route (which corresponds with what has been called the "June 2013/2015 FEIS Route") and the Blue Ridge Route are illustrated on Figure 10.4-3. Figure 10.6-3 also shows a "Landowner Amended Route" that was mostly incorporated into the Blue Ridge Route, and is therefore not analyzed as a separate alternative.

The Proposed Route would be slightly longer (14.4 miles) than the Blue Ridge Route (14.0 miles), and affect a greater number of landowners (see Table 10.4.1.2). Nearly 52 percent of the corresponding segment of the Proposed Route would be co-located with a Bonneville Power Administration ("BPA") powerline right-of-way, while 63 percent of the Blue Ridge Route would parallel logging roads. The Blue Ridge Route 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 Bureau of Land Management ("BLM"). The Proposed Route would cross 61 privately owned parcels, while the Blue Ridge Route would cross 23 private parcels. The Blue Ridge 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 Route object to it, believing that the alternative would affect the value of their properties, clear more forest including old growth areas, and impact wildlife and waterbodies, particularly Daniels Creek.

In order to provide an equal comparison, FERC's 2014 DEIS used publicly available data for both the Blue Ridge Route and corresponding segment of Proposed Route,

even though field data was available for only a portion of the Proposed Route. FERC's 2014 DEIS found that the Blue Ridge Route did not provide a significant environmental advantage because additional clearing of Late Successional/Old-Growth ("LSOG") forest and northern spotted owl ("NSO") and marbled murrelet ("MAMU") habitats along the Blue Ridge Route could cause long-term impacts and an irretrievable loss of suitable and occupied habitat that could not be easily mitigated. FERC received a number of comments on the 2014 DEIS that requested that FERC re-evaluate the assessment of the Blue Ridge Route.

In response, FERC sent data requests to PCGP in 2015 asking for more information about the Blue Ridge Route in comparison to the Proposed Route, including data collected from on-site surveys. PCGP was able to collect on-the-ground environmental information along the 7.6 miles of federal lands crossed by the Blue Ridge Route. FERC's 2015 FEIS was updated to include field data where available for the Blue Ridge Route, as well as field data previously collected by PCGP where access was granted along the corresponding segment of Proposed Route. Environmental characteristics are compared in Table 10.4.1.2.

Based on field-collected data, the Blue Ridge Route 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 Route would cross 1.2 miles of wetlands compared to 2.2 miles crossed by the corresponding segment of the Proposed Route.

The Proposed Route would affect four stands presumed to be occupied by MAMU; these stands have potential MAMU nesting structure based on available light detection and ranging and MAMU habitat modeling, but permission has not been granted to evaluate habitat. These four stands will continue to be analyzed as presumed occupied by MAMU. Construction of the Proposed Route would result in removal of 2.61 acres of MAMU suitable habitat.

The Blue Ridge Route would cross three BLM-delineated occupied stands and 11 additional stands that had MAMU occupied behavior documented during PCGP's survey efforts in 2015. The Blue Ridge Route would also cross seven additional stands that were not surveyed due to access being denied by the landowner (presumed occupied). Construction of the Blue Ridge Route would result in removal of 34 acres of MAMU suitable habitat.

Based on the assessment, FERC concluded that the Blue Ridge Route 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 Route 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.

Since the 2015 FEIS, 7 route modifications were incorporated into the June 2013/2015 FEIS route (see Figure 10.4-3 – Proposed Route) to minimize effects. The primary purpose of these modifications was to improve the topographic conditions of the route based on detailed civil survey. The modifications maximize ridgeline alignments to minimize sidehill construction, grading and cut/fill requirements, disturbance, and soil/spoil handling. Several of the route enhancements facilitate construction and minimize the number of stream crossings, including fish bearing streams. One of the reroutes avoids a landslide hazard area. Two of the modifications avoid landowner parcels and another facilitates topsoil salvage in pastures.

Table 10.4.1.2
Comparison of the Proposed Route and the Blue Ridge Routes
(MPs 9.45 to 21.6)

Impact/Issue		Proposed Route (MP 11.29R – MP 21.77)	Blue Ridge Route (MP 11.29R – MP 23.35R)
Length (miles) a/		14.4	14.0
Construction right-of-way (acres)		165.4	161.4
TEWAs (acres)		62.0	37.0
Uncleared Storage Areas (acres)		1.1	45.4
Temporary Access Roads (TARs) Permanent Access Roads (PARs)		0 1 (PAR 15.54 to BV#2)	0 0
Permanent easement (acres) b/		87.3	85.0
Landownership (miles)	Private	12.91	6.46
	BLM	1.42	7.54
	State	0.05	0.0
Number of landowner parcels crossed (centerline)	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 150 feet of the construction right-of-way c/		0	0
Number of waterbodies crossed	Pacific Northwest Hydrography Framework Clearinghouse data d/	12	9
	Field survey data	66 e/ 43 perennial 23 intermittent	8 e-1/ 4 perennial 4 intermittent
Length of wetland crossings (miles)		2.2 miles f/, g/	1.2 miles f-1/, g/
Riparian Reserves (acres)		14	17
Agricultural pastures affected (acres construction right-of-way)		8.3	8.4
Coniferous forest (acres construction right-of-way) h/	LSOG	6.8	40.5
	Mid-seral	50.2	41.8
	C – R	117.0	77.1
LSRs/Unmapped LSRs crossed (miles/acres)		0 miles / 0 acres	0.4 mile / 6.6 acres i/
Northern Spotted Owl (NSO) home range (1.5 mile radii)		1 NSO Home Range crossed (42310)	1 NSO Home Range crossed (42310))
High NRF and NRF habitat removed (acres)		7	66
Marbled Murrelet (MAMU) stands intersected by the alignment	Number of stands crossed by right-of-way	4 presumed occupied stands	3 occupied stands (C1027, C1040, C1042); 11 additional occupied stands identified during PCGP's 2015 surveys; and another 7 presumed occupied stands
	Acres of stand (suitable habitat) removed	2.61	Occupied: 26 acres Presumed: 8.04 acres
Anadromous fish-bearing streams crossed j/	Known (Assumed)	9 (5)	4 (0)
Fisheries critical habitat (streams crossed)	Coho k/ (Known)	8	4
	Green Sturgeon l	5	0
Geologic hazards (number, feet) m/	Published Sources	5 slides, 7,137 feet	2 slides, 3,276 feet
	GeoEngineers Identified	2 slide, 3,257 feet	2 slides, 1,088 feet
Number of known cultural resources sites		0	1 n/ o/
Number of newly identified cultural resources		0	0 n/
Miles of right-of-way parallel or adjacent to existing rights-of-way (percent of route length) p/		7.4 (51.8 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 and MP engineering stations.
b/ Acres of permanent easement calculated based on a 50-foot permanent easement.
c/ OWRD (2013).
d/ http://hydro.reo.gov/
e/ Includes waterbodies not crossed by the centerline, but within the right-of-way.
e-1/ Field surveys on BLM lands and table top analysis on private lands.
f/ Field surveys identified 1.97 miles.

Impact/Issue	Proposed Route (MP 11.29R – MP 21.77)	Blue Ridge Route (MP 11.29R – MP 23.35R)

f-1/ Field surveys on BLM lands and table top analysis on private lands identified 0.85 mile.
g/ Based on NWI mapping.
h/ 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.
i/ Note that miles and acres of unmapped LSRs only include known MAMU occupied stands that have been delineated by Coos Bay BLM and do not include the 9 additional areas on Matrix lands where PCGP's 2015 survey efforts (to date) observed MAMU occupied behavior. Coos Bay BLM has not delineated occupied MAMU stands for these 9 areas, but delineation of these stands could increase Unmapped LSRs crossed by 1.4 miles (20.8 acres affected), which would result in reducing Matrix lands crossed by 1.4 miles (20.8 acres affected).
j/ ODFW (2014).
k/ NMFS(2008a).
l/ NMFS (2009).
m/ GeoEngineers (2015).
n/ Surveys incomplete on approximately 6.0 miles (43.1 percent) of the route on private lands.
o/ The historic Barker-Morris Families Cemetery, dating to 1872, is located on private land in Township 27 S, Range 12 W, Section 14. The historic cemetery is situated at MP 24.3 of the Blue Ridge Route. The cemetery is shown on the McKinley 7.5-minute quadrangle approximately 24 meters east of the construction right-of-way. However, cultural survey has not been conducted on this privately-owned parcel, and the exact location of the cemetery has not been verified. The cemetery is listed in the Oregon Burial Site Guide but has not been recorded as an archaeological site with the Oregon State Historic Preservation Office.
p/ Approximately 5.6 miles (39 percent) of the proposed route is co-located/adjacent to a BPA Powerline corridor, whereas the Blue Ridge Route is adjacent/co-located with logging roads.

10.4.2 Route Variations or Deviations

As noted above, since 2005, PCGP has been developing and perfecting the Proposed Route, and as such, has evaluated hundreds of variations or deviations, eliminating minor route alternatives. Moreover, since issuance of the 2015 FEIS, there have been 56 variations or deviations to the 2015 FEIS route that have now been incorporated into the Proposed Route. Table 10.4.2.1 summarizes those variations or deviations that include a centerline modification of 1000 feet or less, all of which were incorporated as a result of landowner requests.

Table 10.4.2.1
Route Variations or Deviations Incorporated into the Proposed Route since 2015 FEIS

Proposed Route		Centerline Modification Length (Ft)	Centerline Deviation (Ft) [1]	Surface Owner	Route Modification Purpose	
MP	Map Page				Category	Summary
1.47H to 4.21R	1 of 35	5,069.80	4,069	PVT	Avoid Haynes Inlet Crossing	Coos Bay estuary alternative route.
10.06 to 10.44	2 of 35	1,967.65	10.18	PVT	Landowner - Facilitate Topsoil Salvage/Storage - within Right-of-Way	Centerline modification within construction right-of-way with no footprint changes in wetland pasture
42.12 to 42.31	7 of 35	1,003.40	91.61	PVT	Landowner Request to Abut/Follow Road Alignment & Topographic Enhancement	Minor route modification to better co-locate centerline with existing road to minimize encumbrance (within clear-cut regenerating forest)
51.32 to 51.63	8 of 35	1,620.55	63.72	PVT	Landowner Request	Route and construction right-of-way modification based on landowner request to avoid water well, power pole and drainage. Modification moves construction footprint closer to barn but reduces the construction footprint by 0.66 acre.
53.72 to 54.33	9 of 35	3,306.24	40.35	PVT	Landowner Request to Minimize Parcel Encumbrance	Minor modification incorporated by flipping the working side of the right-of-way to abut centerline closer to adjacent BLM parcel to minimize parcel encumbrance.

Proposed Route		Centerline Modification Length (Ft)	Centerline Deviation (Ft) [1]	Surface Owner	Route Modification Purpose	
MP	Map Page				Category	Summary
75.52 to 75.88	12 of 35	1,889.28	39.54	PVT	Landowner Request to Avoid Landings and to Align Centerline with Road Edge	Minor alignment modifications based on civil survey to better align with existing road edge and ensure ridge line alignment. No changes in construction footprint (construction right-of-way or TEWA).
81.30 to 82.63	13 of 35	7,305.94	517.36	PVT	Landowner Requested Alignment to Minimize Encumbrance, Visibility & Topographic Enhancement on Seneca Jones Parcels	Modified alignment to edge of hayfield/pasture to minimize field/parcel encumbrance and realigned route off of ridge to valley to minimize visual effects for landowner residence as requested. Based on civil survey, adjusted alignment on Seneca Jones to optimize ridgeline alignment. Alignment modification increases centerline length by 291 feet but overall acres of construction footprint (right-of-way and TEWA) are reduced by 2.9 acres (within hayfield pastures, forestlands and clear-cuts)
189.14 to 190.26	30 of 35	5,944.31	971.65	PVT	Topographic Enhancement; Minimize Rock Excavation/Blasting; Landowner Request	Reroute incorporated based on landowner request to avoid building site and to avoid problematic powerline crossing/structure. Incorporated reroute will minimize crossing shallow soils/bedrock and blasting requirements. The reroute will avoid 3 landowner parcels and add a new parcel of an affected landowner. All landowners on the reroute have provided survey permission. Realignment increases centerline length by 605 feet and construction footprint effects by 1.21 acres within rangelands/woodlands.
209.27 to 210.21	33 of 35	4,964.91	435.77	PVT	Landowner Request	Modified route based on landowner request to abut edge of field and Highway 39 easement to minimize field encumbrances in organic alfalfa field. Modification increases pipeline length (360 feet) and construction footprint effects (1.4 acres).

10.4.3 Alternative Route Segments Considered but Eliminated from Detailed Analysis

10.4.3.1 Segment 1-C (Powers Highway/Shasta Costa Road)

Segment 1-C was identified as an existing road corridor from Coos Bay to Grants Pass, Oregon (see Figure 10.4-1). From Grants Pass, access to the east and Malin was potentially provided by various other route segments. Segment 1-C followed state, county, and local roads (*i.e.*, SR 42, Coast Hwy 242/Rogue-Coquille Scenic Byway, County Road 219, Agness Road, Forest Road 23, Galice-Hellgate Back Country Byway) through or near the communities of Gaylord, Powers, Agness, Galice, and Merlin. For the following reasons, PCGP eliminated this alternative route segment from further analysis:

- Significantly increased overall pipeline length;
- Paralleled the South Fork of the Coquille River for a significant distance between Myrtle Point and Agness; and
- Paralleled and crossed the Rogue River within an area designated as a Wild and Scenic Waterway.

10.4.3.2 Segment 3A (State Highway 138/GTN Route)

Segment 3A was identified as an existing road and pipeline corridor from Malin to Roseburg (see Figure 10.4-1). From Roseburg, potential access to the west to Coos Bay could be provided by various other route segments. Segment 3A followed the GTN pipeline easement north from Malin to State Highway 138. Segment 3A then followed Highway 138 west immediately north of Crater Lake and south of Mount Thielsen Wilderness, past Diamond Lake, Steamboat, Glide and Dixonville and then to Roseburg. This segment paralleled the North Umpqua River and was eliminated from further analysis for the following reasons:

- Increased the overall project length significantly (see discussion in Section 10.4 describing potential impacts associated with increased project length);
- Required extensive clearing/grading and cuts that would be highly visible to the public due to the height of the hills;
- Increased impacts to residential and commercial areas, especially along the alignment adjacent to Highway 138 between Roseburg, Dixonville, and Glide;
- Traversed scenic areas with high recreation value and use:
  - Paralleled the North Umpqua River for a significant length, which is a designated Scenic Waterway and a world class fishery (numerous recreational sites are located along the river which provide whitewater opportunities and access to trails and campgrounds);
  - Paralleled Highway 138, which is designated a Scenic Byway;
  - Traversed the Umpqua National Forest for a significant length of the segment;
  - Crossed a significant number of high-value tributaries that flow to the North Umpqua River; and
  - Located in close proximity (< 0.25 mile) to Crater Lake National Park, Boulder Creek Wilderness, and Mount Thielsen Wilderness areas.

10.4.3.3 State Highway 42 (Alternative Route Segments 1B, 1B-1, and 1B-2)

State Highway 42 was identified as a potential route segment during preliminary route selection. However, after initial review this route was eliminated from further analysis due to construction feasibility, cost, and significant environmental/land impacts. The highway heads west from Roseburg, through the communities of Winston, Tenmile, Camas Valley, Remote, Bridge, Myrtle Point and Coquille (see Figure 10.4-1). Highway 42 is a high volume, major access and truck route from I-5 to the coast. This route was eliminated for several reasons, which included:

- The topography along the route is extremely steep in some areas and the highway and the Middle Fork of the Coquille River are immediately adjacent to the route. Steep rock side slopes prevent offsetting the pipeline from the highway which would force the pipeline to be routed in the highway in many places;
- In-highway construction would create a public safety issue and would impede residential, recreational, and truck traffic for a substantial period of time;
- Residential and commercial area impacts would be increased;
- The Coquille River would be crossed multiple times (six or more);
- The route would cross through several parks/waysides along the Coquille River; and

- Fiber optic cables are buried along both sides of the highway right-of-way, thereby creating another restriction to installing the pipeline in or near the highway.

10.4.3.4 BPA Powerline Corridor

During initial routing investigation, PCGP reviewed the BPA powerline corridor between Medford and Days Creek west of Myrtle Creek (see Figure 10.4-1). This route was determined to be infeasible and eliminated from further consideration because the powerline spans severe side slopes, and dissected topography that would create significant pipeline operation, maintenance and integrity issues. This route would also require significant grading as well as significant increased cost for pipeline construction.

10.4.3.5 Straight Line Alternative

FERC received comments during the scoping period for Docket CP13-492-000 recommending that the pipeline route follow the shortest, most direct path, which is a straight line from Malin to Coos Bay (FERC 2015). This straight line alternative (see Figure 10.4-4) would be approximately 175 miles long compared to 235 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.

The straight line route would require change in existing law, and is otherwise not feasible 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. Finally, this route would result in significantly more environmental impacts than the Proposed Route.

10.4.3.6 All Highway Alternative

Another scoping comment in Docket CP13-492-000 suggested the pipeline follow existing highways as much as possible (FERC 2015). 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 (see Figure 10.4-4). 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. In addition, as discussed previously, Oregon generally does not allow utilities to occupy interstate rights-of-way for longitudinal uses. An all-highway route would not offer significant environmental advantages over the Proposed Route and is not considered further.

10.4.3.7 Round Top Butte National Natural Landmark Route Alternative

In Docket CP13-492-000, the National Park Service (“NPS”) requested that FERC 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 the 2015 FEIS). The Proposed Route would pass within about one-quarter mile of the eastern boundary for the NNL near MP 135.3. At this location, the Proposed Route would be within a saddle or gap between Round Top Butte on the west and Obenchain Mountain on the east. In order to move the pipeline route eastward away from the NNL

boundary, the route would be located on the steep slopes of Obenchain Mountain, which would 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, has taken a role in the siting of the pipeline on its lands and does not share the NPS's concerns about the Proposed Route in this area. Based on the above, PCGP eliminated this alternative from further analysis as it does not meet the selection criteria.

10.4.3.8 Klamath Project Avoidance Alternative Routes

During a 2015 site visit between representatives of PCGP and Reclamation, the Area Manager requested that PCGP consider route alternatives that would avoid in their entirety the irrigation features associated with Reclamation's Klamath Project. In an August 7, 2015, filing with the FERC, PCGP 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 (see Figure 10.4-4).

The Pipeline must begin at the proposed Klamath Compressor Station at MP 228.8, 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, PCGP developed two pipeline route alternatives between MPs 189.2 and 228.8 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, neither route alternative to avoid the Klamath Project features would provide a significant environmental advantage to the corresponding segment of the Proposed Route and therefore they have been eliminated from further analysis.

10.4.3.9 Coos County Pipeline (Alternative Route Segments 1A-1, 1A-2, 1A-2B, 1A-4 and 1A-8b)

The CCPL provides gas service to Coos Bay and North Bend, Oregon from NWP Grants Pass Lateral near Roseburg, Oregon (see Alternative Route Segments 1A-1, 1A-2B, 1A-2, 1A-4 and 1A-8b on Figure 10.4-1). Initially, this route appeared to provide a logical connection/corridor from Coos Bay to Roseburg. This route segment follows a BPA powerline corridor west through Douglas County. At the Coos/Douglas County line the CCPL then enters the Coos Bay Wagon Road easement through Brewster Canyon paralleling the East Fork of the Coquille River to the Brewster Valley. The CCPL continues in the Coos Bay Wagon Road easement through Dora, Frona Park, and McKinley, entering the BPA powerline corridor to Fairview where it again enters the Coos Bay Wagon Road easement through Sumner and the Coos County Country Club.

PCGP determined that it was infeasible to construct the Pipeline within the Coos Bay Wagon Road easement, because the alignment of the pipeline in Brewster Canyon is located in the "cut" portion of the road immediately adjacent to the borrow ditch. Significant portions of the road are extremely narrow and bounded by extremely steep canyon walls (many with exposed bedrock), and the East Fork of the Coquille River is immediately adjacent to or below the fill slope of the road. In numerous areas, the fill slope is also extremely steep. Construction within the road would require the road to be closed during construction, the CCPL removed and taken out of service (if possible), and the Pipeline installed using stovepipe construction techniques within the same ditch. Off-setting the proposed pipeline from the CCPL in these areas without removing the CCPL is not feasible without significantly widening the road corridor by cutting/blasting into the cut slope and drastically changing the character of this road. Stabilization of the hillside and long-term impacts to the road were also a consideration. Another significant construction and cost obstacle eliminating this route from further consideration is the sinuous character of the road in many sections that would require an unreasonable number of factory bends to build the pipeline. There is also a fiber-optic cable co-located in the road, further encumbering construction activities.

In addition, the sections of the CCPL within the BPA powerline corridor were also determined to have significant construction feasibility and pipeline integrity/stability concerns because of the extreme side hills traversed by this route. Construction issues related to installation of the CCPL are present in several areas along the powerline corridor, such as where the pipeline crosses Cherry Creek/Dora Ridge and near the Coos/Douglas County line near the crossing of Ten Mile Creek.

PCGP also chose to avoid utilizing the CCPL route segment (1A-8b) to avoid construction through the City of Coos Bay and North Bend, within city streets including thoroughfares such as Newmark Street, as well as to avoid the utilities that typically follow these streets. The alignment for 1A-8b would require approximately 8.0 miles of in-road work within congested areas of North Bend and Coos Bay. The route within the cities' congested areas would create interruptions to the public and services during construction and cause inconveniences to daily activities and traffic. Available workspace within the city streets would be severely limited, thereby unreasonably compromising safety for the public and the workers. Because of the lengthy construction schedules, impacts to local residents would occur over long periods of time. Future road expansions or improvement projects would possibly require the pipeline within the road easements to be relocated, which could then create unforeseen environmental, landowner, and system impacts to the pipeline, causing interruptions to gas customers. The City of North Bend also filed a letter to FERC opposing any routing through residential areas.

Additionally, the route followed existing 10- and 12-inch natural gas pipelines, but the location of the horizontal directional drill ("HDD") beneath Coos Bay was determined to not be viable because of the limited workspace available on the east side of the bay, which is necessary for an HDD of a large diameter pipeline. Because of the construction constraints along this route for installation of a 36-inch pipeline, as well as the other associated environmental and residential impacts, this alternative was eliminated from further consideration.

10.4.3.10 NWP Grants Pass Lateral (Alternative Route Segments 2A, 2A-1, 2A-2, 2A-3 and 2A4-C)

At the time of the Pipeline's initial route feasibility analysis in 2005, it was assumed that a logical connection/corridor from Roseburg to the Grants Pass area could be achieved

by paralleling NWP Grants Pass Lateral to the south (see Figure 10.4-1). From the terminus of the Grants Pass Lateral (near Grants Pass), it was anticipated that a feasible pipeline route could be identified east across the Cascades to Malin, Oregon.

The NWP 10-inch Grants Pass Lateral was constructed in 1963 and generally runs south from Roseburg along the I-5 corridor to Grants Pass, Oregon. Because NWP operates this lateral and has existing easements for the pipeline, PCGP initially assumed that this route was a feasible routing segment. However, after initial review it was concluded that co-locating the 36-inch diameter pipeline for the Pipeline with the Grants Pass Lateral was not feasible because of industrial and residential congestion that has developed in several areas since the installation of the Grants Pass Lateral. Furthermore, the lateral traverses areas of extremely steep slopes and along narrow ridgelines, which prevents co-locating in the existing easement due to the lack of space required to safely construct and operate an additional 36-inch diameter pipeline. To avoid routing the proposed pipeline along steep side slopes, a major reroute would be required. The reroute would require crossing I-5 at five different locations, several of which would be difficult to construct based on slope, rock, and available workspace.

This route was eliminated because of impacts to industrial and residential areas, and the challenges involved with steep rugged terrain, limited available workspace (in areas of steep slopes, narrow ridgelines and in canyons), and the presence of large volumes of hard rock and lack of workspace at several of the I-5 crossings.

The Forest Service inquired as to the feasibility of replacing the Grants Pass Lateral with the Pipeline. Since the Grants Pass Lateral is currently providing continuous firm transportation service from a single supply source on the north end to all of the customers along its route, it is not feasible to remove the existing 10-inch pipeline and replace it with the Pipeline. While the Pipeline could be re-designed with sufficient capacity to serve both existing NWP customers and new PCGP customers, existing customers on the Grants Pass Lateral could not be served during the construction process, which is currently anticipated to last more than a year.

10.4.3.11 Medford Route Segment Corridor (Alternative Route Segments, 3B-2, 3C, 3C-A, 3C-B, 3C-1, 3C3, 3C-4A, 3C-4B, 3C-6, 3D, 3D-2, 3D-3)

The purpose of these alternative route segments was ultimately to provide an acceptable pipeline route from the end of NWP Grants Pass Lateral to the terminus near Malin, Oregon (see Figure 10.4-1). Alternative Route Segments 3C-4A, 3C-4B, and 3C-6 are co-located with GTN's Medford Lateral. However, the Proposed Route was selected over all of the Medford alternative route segments for the following reasons:

- Avoidance of populated communities in an around Ashland, Talent, Phoenix, Medford/Central Point, Eagle Point, and Grants Pass;
- Avoidance of a number of large orchards;
- Avoidance of the area along the Rogue River between Grants Pass and Medford and along I-5, which is an area of limited construction feasibility (Alterative Route Segment 3D);
- Avoidance of the Cascade-Siskiyou National Monument (Alternative Route Segment 3C3); and
- Construction infeasibility of paralleling NWP Grants Pass Lateral with a 36-inch pipeline (see Section 10.5.3).

During PCGP's 2005 routing feasibility analysis it was determined that of the routes considered in the Medford Route Corridor, Segments 3C, 3C-B, and 3B-3b1 (as discussed below) would provide the least impact in this area based on the objectives provided in Section 10.4. Primarily, these route segments avoid the congestion in the Ashland/Medford area. However, these line segments (3C, 3C-B, and 3B-3b1) cross substantial areas of rural residential lots and irrigated and dry farmlands in the vicinity of Eagle Point and White City, as well as rural residential lots north of Upper Table Rock on the edge of Sams Valley and where 3C passes through Evans Valleys in the vicinity of Wimer, Oregon.

10.4.3.12 Highway 140 and Butte Falls Highway (Alternative Route Segments 3B-1 and 3B-3b1)

The Proposed Route was selected over Alternative Route Segments 3B-1 and 3B-3b1 because it shortened the overall project length, reducing potential impacts as described in Section 10.4. The Proposed Route also avoids numerous residential areas along the Butte Falls Highway (Alternative Route Segment 3B-1) in the vicinity of Butte Falls as well as along the highway as it parallels South Fork Butte Creek. Numerous residences are also along Alternative Route Segment 3B-1 near Derby along South Fork Reese Creek.

10.4.3.13 Cow Creek (Alternative Route Segment 1B-5)

After the NWP Grants Pass Lateral was eliminated from being a feasible route segment, PCGP conducted studies to find a feasible route that would connect the proposed cross-county route to the preferred Medford Route Segment 3C-B. Alternative Route Segment 1B-5 could potentially provide this connection and shorten the route, but this segment required a cross-county route traversing extremely rugged topography (see Figure 10.4-1). Given area topography constructing the Pipeline Segment in this area would require steep elevation changes along its length and an open-cut crossing of Cow Creek due to unfavorable geotechnical conditions, and there is extreme topography on either side of the waterbody. McCullough and Martin Creeks would be closely paralleled for more than a mile within a steep narrow drainage, and the rate would likely be constructed within an existing road. Additional construction constraints with this route included exposed rock and limited available access. This route segment would also bisect a large area (20 miles) of NSO critical habitat (OR-62). These numerous factors led to this route being eliminated from further analysis.

10.4.3.14 Highway 227 (Alternative Route Segment 3B)

The Proposed Route was also chosen to avoid serious limitations associated with this alternative route segment. These limitations included numerous residences located along the Highway 227 corridor, especially in the Eagle Point, Shady Cove, Days Creek, and Canyonville areas, as well as along Trail Creek and in the South Umpqua River valley (see Figure 10.4-1). In addition, the steep canyon walls in the area between Trail, Drew, Tiller, and Milo would confine the pipeline to the paved area of the highway, impeding future access to the pipeline, creating a public safety hazard during construction and causing travel delays during construction and any maintenance work. If the pipeline could be placed outside the roadbed, extensive cuts would be necessary in numerous areas. Substantial amounts of exposed rock are also present along the route affecting construction costs and schedules. This route would require several waterbody crossings including potentially 8 crossings of the South Umpqua River as well as Elk Creek and Trail Creek. Based on the above, this route was eliminated from further analysis.

10.4.3.15 Altamont/Klamath Falls (Alternative Route Segments, 3A, 3B-6, 3B-7, 3B-8 and 3B9)

Numerous alternate routes for the southeastern end of the pipeline were surveyed to select the Proposed Route. Segment 3B-6 heads east from Highway 97, south of the city of Klamath Falls, approximately following the route of GTN's Medford Lateral. This alternative segment passes along the north boundary of Klamath Falls Airport (Kingsley Airport) along Southside Expressway (Hwy 140) to avoid the town of Altamont. After crossing Hwy 39, Segment 3B-6 continues across irrigated croplands and rural residential lots to connect with Alternative Segment 3B-7. Segment 3B-7 continues eastwardly for approximately 11 miles, co-located with the Klamath Falls pipeline lateral north of Poe Valley Road. Alternative Segment 3B-7 connects with GTN's transmission system southwest of Bonanza. At this point, Alternative Route Segment 3A is co-located with the GTN's transmission system for approximately 11 miles south to the interconnect with the Ruby Pipeline and the Project's proposed Klamath Compressor Station and meter station site. The Proposed Route was selected over Alternative Segments 3A, 3B-7, and 3B-6 because the Proposed Route is approximately 4 miles shorter and would reduce residential effects by avoiding developed areas that Alternative Segment 3B-6 crosses near Altamont and along the Southside Expressway. The existing pipeline routes (3B-7) that service Klamath Falls also traverse steep slopes, side slopes, and encounter significant rock. The Proposed Route was chosen over these alternative route segments because it utilizes existing pipeline and powerline corridors to traverse the Klamath Basin and to minimize impacts to residences in the Altamont/Klamath Falls area, as well as avoiding the Kingsley Airport (see Figure 10.4-1).

Segment 3B9 would follow Highway 39 east from Merrill, then parallel the Klamath Falls – Malin Highway and the existing Burlington Northern Railroad corridor to Malin. This alternative would go through residential and commercial areas. The Proposed Route reduces the crossing of irrigated croplands compared to Alternative Segment 3B9, since the Proposed Route is co-located with a transmission corridor for approximately 6.5 miles through rangelands and is a shorter route, which minimizes additional impacts as described in Section 10.4. For these reasons, this alternative was eliminated from further consideration.

10.5 ALTERNATIVE SITES FOR ABOVEGROUND FACILITIES (COMPRESSOR STATION)

For operational efficiency, the Pipeline's compression facility must be located as closely as possible to the eastern terminus of the pipeline. The compressor station is a facility that helps to move the gas from one location to another. Since the eastern terminus is defined by the locations of the supply pipelines with which it will interconnect, the ideal location for the compressor station would be where those systems converge. If the systems converge in a location where it is not feasible to site a compressor station, inlet pipeline(s) must be constructed to connect one or both of the supply pipelines to the compressor station inlet. The selection criteria for a suitable compressor station site include:

- Location near the eastern terminus;
- Proximity to interconnecting pipeline facilities;
- Ability to co-locate the compressor station with interconnecting pipeline meter station facilities;

- Relatively flat area, approximately 31 acres (1,144 feet x 1,144 feet) in size to accommodate planned facilities and provide a buffer from local development;
- Minimization of environmental impacts;
- Compatibility with existing land uses;
- Remote or sparsely populated area to minimize potential noise and visual effects;
- Proximity to paved or all-weather access highway or road;
- Proximity to electrical power; and
- Proximity to telephone connectivity.

The east end of the Proposed Route was reviewed for locations that satisfy these criteria. Three locations were identified as possible sites for a compressor station: MP 225.43, MP 228.8, and MP 230.91 (see Figure 10.4-5). The MP 228.8 site was selected as the preferred location because it best meets the criteria listed above. The MP 225.43 site is feasible and is discussed further below. The MP 230.91 site was eliminated from further analysis as infeasible.

a) MP 228.8 (Proposed Klamath Compressor Station)

PCGP selected the MP 228.8 site for the compressor station for several reasons. First, the site's size allows the Klamath-Beaver Meter Station (which will provide an interconnect with the GTN Pipeline) and the Klamath-Eagle Meter Station (which will provide an interconnect with the Ruby Pipeline) to be co-located within the facility footprint. The location provides access on the south from Malin Loop Road and on the west from Morelock Road. The site is relatively flat and currently supports rangeland vegetation with a few scattered juniper trees. No croplands, irrigated hayfields, or pasture would be affected at this location. The nearest residential dwelling is within 1,000 feet of the center of the site, and two other residences are within 1,500 feet of the center of the site. However, PCGP has completed noise surveys and modeling for the site, which indicate that FERC's noise limit could be achieved with appropriate mitigation measures.

b) MP 225.43 (Alternate Compressor Station Site)

The alternate compressor station site at MP 225.43 is located about 2.0 miles north of the proposed Klamath Compressor Station, in Section 35, T. 40 S., R. 12 E., approximately 3.2 miles northeast of Malin. The site is located on a bench adjacent to the GTN transmission system and a PacifiCorp transmission corridor and is east and topographically about 200 feet above the valley floor. The site is located on rangelands with a few scattered juniper trees. At this location, PCGP has identified an approximate 48-acre area suitable for siting the compressor station (see Figure 10.4-5). The closest residence from the center of the site is approximately 0.7 mile to the northwest. This residence is located approximately 150 feet in elevation below and is topographically screened from view of the site. Noise surveys and modeling have not been completed for this site. In order for this site to meet the Pipeline's requirements, the following additional facilities would be required:

1) Upgrading between approximately 1.0 and 1.5 miles of existing dirt road for permanent all weather access. PCGP is evaluating three potential permanent access routes, which are shown on Figure 10.4-5 and which utilize an existing all weather road to a Pacific Power Substation facility.

2) Installing an interconnect with the Ruby Pipeline system near the proposed compressor station site at MP 228.8. The interconnect may require installation of pipe larger than 36-inch diameter depending on the final engineering requirements. PCGP has identified three potential route options for such an interconnect that are described below:

   a) Option-A is approximately 1.98 miles long and proceeds southerly to Ruby Pipeline's existing meter station abutting the proposed compressor station location at MP 228.8. This route deviates from the GTN transmission pipeline system to avoid irrigated croplands by crossing primarily range lands.

   b) Option-B is approximately 1.98 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 and then converges with the GTN transmission system for approximately 0.57 mile of the alignment. Approximately 0.20 mile of the southern portion of this alignment would cross an irrigated field.

   c) Option-C is approximately 1.91 miles long and proceeds to the south, co-located entirely with the GTN transmission pipeline system. This alignment would cross two irrigated fields for approximately 0.78 mile. PCGP has discussed this alignment with the landowner of the center pivot irrigated field, who is adamantly opposed to this route.

Selection of Alternate Compressor Station Site MP 225.43 would eliminate the need for PCGP to construct the proposed pipeline between MPs 225.43 and 228.8 (2.7 miles), which crosses through primarily irrigated croplands. However, in order for the Ruby Pipeline to deliver gas to Pacific Connecter, Ruby would have to construct one of the interconnection options described above. The existing GTN line is located adjacent to the Alternate Compressor Station Site and additional construction will consist of a tie-in to the station.

c) MP 230.91 (Additional Compressor Station Site Eliminated from Further Analysis)

The alternate site at MP 230.91 was the former location of the Tule Lake, Russell Canyon, and Buck Butte meter stations in Klamath County, Oregon, proposed for the Project under FERC Docket CP07-441-000. This location is located approximately 1.73 miles south of the proposed location, adjacent to the Oregon/California state line and approximately 2.7 miles southeast of Malin, Oregon, in Section 24, T. 41 S., R. 12 E. This site is located in an alfalfa field immediately north of County Road 108A. The site was eliminated from further consideration because the site was encumbered by construction of the Ruby Pipeline aboveground facilities, reducing available space; the location would require construction of 2.5 more miles of pipeline, affecting 11 additional landowner parcels; and the site would remove productive agricultural/prime farmland soils in the long-term.

10.6 ALTERNATIVE LAYOUT/DESIGN (COMPRESSOR STATION)

Electric-Driven Compressor Units

PCGP has evaluated the feasibility of installing electric-driven compressor units instead of natural gas driven units at the proposed Klamath Compressor Station. In making a decision regarding the feasibility of utilizing electric-driven compressor units, PCGP has considered a broad scope of factors including: proximity to existing electric power

sources, whether existing electric power sources need to be upgraded or new transmission or service lines need to be constructed; the requirement to have ancillary substation facilities constructed and the location of these facilities; and potential impacts to the environment and property owners not affected by the compressor station sites. PCGP also considered the installed and operational costs, as well as the need to meet applicable noise and emission standards compared to gas driven turbine compressor units. Additionally, the operational costs and the ability of power companies to obtain necessary approvals for the electric transmission facilities are significant considerations. One advantage of electric-driven motors, however, is that they require no air emission permit because no hydrocarbons are burned as fuel.

To use electric-driven compressor units, electric power at high voltage would be required. 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. Additionally, 13,200 hp electric-driven motors for each compressor would be required, primarily to start the motor and then for speed control of the compressor. All electric-driven motor compressor stations would require trained qualified electrical personnel to operate medium and high voltage equipment.

While there are no direct air emissions from electric-driven 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 avoid the construction of a new powerline and substation required by the electric-driven compressor alternative. PCGP estimates that the permitting, design, and installation of a substation and ancillary facilities would require a minimum of two years' time, but would likely be much longer. In comparison, existing gas pipelines could be utilized to feed gas turbines. Because the use of electric-driven compressor units at the Klamath Compressor Station would have greater overall impacts on residences and the environment, it is not preferable to PCGP's proposed facilities.

10.7 REFERENCES

Federal Energy Regulatory Commission. 2008. Jordan Cove Energy and Pacific Connector Gas Pipeline Project. Draft Environmental Impact Statement. Jordan Cover Energy Project, L.P. Docket No. CP07-444-000. Pacific Connector Gas Pipeline Project, L.P. Docket No. CP07-441-000. FERC/EIS 0223 D. August. Washington, DC.

Federal Energy Regulatory Commission. 2009. Jordan Cove Energy and Pacific Connector Gas Pipeline Project. Final Environmental Impact Statement. Jordan Cover Energy Project, L.P. Docket No. CP07-444-000. Pacific Connector Gas Pipeline Project, L.P. Docket No. CP07-441-000. FERC/EIS 0223 F. May. Washington, DC.

Federal Energy Regulatory Commission. 2014. Jordan Cove Energy and Pacific Connector Gas Pipeline Project. Draft Environmental Impact Statement. Jordan Cove Energy Project, L.P. Docket No. CP13-483-000. Pacific Connector Gas Pipeline Project, L.P. Docket No. CP13-492-000. FERC/EIS 0256D. November. Washington, DC.

Federal Energy Regulatory Commission. 2015. 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 Project, L.P. Docket No. CP13-492-000. FERC/EIS 0256F. September. Washington, DC.

GeoEngineers. 2013a. Technology Overview – Direct Pipe. File No. 16724-001-08 (May 3, 2013).

GeoEngineers. 2013b. Direct Pipe Feasibility Evaluation Haynes Inlet Direct Pipe Evaluation, Coos Bay, Oregon. File No. 16724-001-08 Task 1200 (May 1, 2013).

GeoEngineers. 2013c. Direct Pipe Feasibility Evaluation I-5/South Umpqua River Direct Pipe South Alternative - Revised, Douglas, Oregon. File No. 16724-001-08 Task 1200 (April 30, 2013).