VEGETATION TECHNICAL REPORT
FOR THE CROSS CASCADE PIPELINE
PROJECT

For

OLYMPIC PIPELINE COMPANY
D&M JOB NO.: 05591-023-020
May 3, 1999

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Olympic Pipe Line Company (OPL) is proposing to build an approximately 230-mile-long underground petroleum products pipeline from Woodinville to Pasco, Washington. As part of the Cross Cascade Pipeline Project, Olympic proposes to build six pump stations and a storage and distribution terminal. The proposed route begins along an existing OPL north-south pipeline just north of the Woodinville pump station (Thrasher Station) and ends at the existing Northwest Terminalling facility at Pasco (Figure 1).

An application for a State of Washington Site Certification Agreement was submitted to the Energy Facility Site Evaluation Council (EFSEC) in February 1996. This application addresses the issues associated with the project and shows in greater detail the location of the pipeline, the pump stations, and the storage and distribution terminal (see Appendix A of the EFSEC application).

To minimize impacts to vegetation and other natural resources, the proposed pipeline follows previously disturbed areas to the extent possible, such as rights-of-way, logging roads, and trails. In doing this, the amount of forested vegetation to be cleared has been greatly reduced.

1.2 VEGETATION STUDIES

A vegetation study was conducted as part of this project, and this report describes the results of the study. Included in the study was an analysis of the plant communities that occur along the proposed route, an assessment of potential impacts to these plant communities and identification of mitigation measures to be implemented, and a rare plant survey. Each component of the vegetation study is discussed in greater detail in the following sections.

This report addresses upland vegetation (wetland plant communities are discussed in a separate wetlands report prepared for this project). The following defines the corridor widths as used in this report:

- The **study area** refers to an area within a ½ mile of the proposed route.
- The **study corridor** refers to a 200-foot-wide swath centered on the proposed pipeline route (i.e., 100 feet to each side of the proposed pipeline route).
- The **construction corridor** refers to the area which will be cleared and graded during pipeline construction (usually 60 feet wide in areas composed of upland vegetation).
- The **maintained right-of-way** refers to the area which will be kept clear of large, woody vegetation (in areas composed of upland vegetation, the maintained right-of-way will be a 30-foot-wide swath centered over the pipeline).

A preliminary study was conducted in the summer of 1995. At that time plant communities were mapped on aerial photographs and limited field sampling was conducted to verify the mapping. In addition, resource agency publications were collected and reviewed, and personnel were contacted to determine potential rare plant locations. A subsequent vegetation study was conducted in the spring and summer of 1996 to (1) map the coniferous forest and shrub-steppe plant communities in greater detail and (2) identify and map rare plant locations along the proposed route. Information collected from these field studies was used to calculate potential impacts to vegetation.

2.0 UPLAND PLANT COMMUNITIES

2.1 METHODS

Prior to conducting any field work, Dames & Moore biologists and ecologists reviewed publications, aerial photographs, and maps to determine the upland plant community types that would be expected to occur in the study area. Publications reviewed for this project include Natural Vegetation of Oregon and Washington (Franklin and Dyrness 1988) and Steppe Vegetation of Washington (Daubenmire 1970). Based on the data review as well as knowledge of the study area, a list of plant communities expected to occur in the study area was produced. This list was revised during vegetation studies conducted in the spring and summer of 1996 in order to better describe the coniferous forest and shrub-steppe plant communities occurring within the study area (coniferous forest and shrub-steppe are the two most common and diverse vegetation types occurring along the proposed route). The revised list of plant communities is shown in Appendix A. Plant communities identified for this project reflect the dominant cover type, and, to some extent, the composition of the plant communities.

As part of the vegetation study conducted in 1995, plant communities occurring in the study area were mapped in the Geographic Information System (GIS) using digital aerial photographs of the proposed route. The mapped plant communities are included in the map atlas (Appendix A of the EFSEC application). Limited field sampling was conducted prior to submitting the EFSEC application to verify the accuracy of the mapping. Based on the field studies conducted in 1996, the plant community mapping was refined and corrected as necessary in the GIS.

Field work for this component of the vegetation study was conducted simultaneously with the rare plant study. Verification and refinement of plant community mapping in the field was conducted within the 200-foot-wide study corridor and focused primarily on coniferous forest plant communities and shrub-steppe plant communities. Field work focused on these two plant communities because they comprise much of the natural vegetation occurring along the proposed route. The following lists the segments of the route dominated by coniferous forest and shrub-steppe vegetation which were included in the 1996 field study (see Appendix A of the EFSEC application dated February 1996 for mile post locations):

- mile post 22.3 - 24.1
- mile post 30.5 - 31.1
- mile post 40.4 - 41.1
- mile post 47.7 - 48.0
- mile post 53.6 - 53.8
- mile post 54.8 - 55.0
- mile post 80.4 - 80.7
- mile post 94.3 - 227.1

In the field, botanists compared plant community mapping with the vegetation occurring in the study corridor. Plant community types and boundaries were confirmed or corrected as necessary.

2.2 REGIONAL CONDITIONS

2.2.1 Review of Published Information

The proposed pipeline route traverses a landscape that is affected by a broad range of factors, all of which influence vegetation patterns. The climate in the study area ranges from moist to arid. Soils in the Puget lowlands have formed since glaciation while basaltic rocky areas and dry, windblown soils (loess and sandy soils) are common east of the Cascades. The elevation ranges from near sea level to about 4,000 feet in the mountainous areas near Snoqualmie Pass. In mountainous areas, aspect may affect vegetation patterns.

The study area extends through the following vegetational areas (Franklin and Dyrness 1988):

- western hemlock (*Tsuga heterophylla*) zone,
- subalpine forest -- includes silver fir (*Abies amabilis*) and mountain hemlock (*Tsuga mertensiana* -- zone,
- Douglas fir (*Pseudotsuga menziesii*) zones,
- ponderosa pine (*Pinus ponderosa*) zone, and
- shrub-steppe - with big sagebrush (*Artemisia tridentata*) - zone.

The western hemlock zone occurs in the Puget Sound region. Western hemlock is the climax species, but western red cedar (*Thuja plicata*) may be a co-dominant in the climax stage. Trees in this zone are important for timber production and little of the climax community still exists. Western hemlock and western red cedar are also dominant during the seral stages as is the subclimax species, Douglas fir. This zone has a wet, mild, maritime climate. Summers are relatively dry, with most of the precipitation in the winter.

The silver fir zone occurs primarily on the western slopes of the Cascades, at a higher elevation than the western hemlock zone. This zone is wetter and cooler than the western hemlock zone, and receives considerable more precipitation in the form of snow. The forest composition varies, depending upon stand age, history, and locale. In the seral stages, Douglas fir, noble fir (*Abies procera*), and/or western hemlock may occur.

The mountain hemlock zone is the highest forested zone along the western slopes and crest of the Cascade Mountains. This zone is wet and is the coolest of the forested zones in western Washington. The forest composition changes with elevation. In the lower limits of this zone, there is mostly continuous forest cover, while at the higher elevations, patches of trees are interspersed within the shrubby or herbaceous subalpine communities.

The Douglas fir zone occurs in eastern Washington. The Douglas fir zone has a more mesic climate than that of the ponderosa pine zone, as well as a cooler average temperature, more precipitation, and more favorable soil moisture conditions.

The ponderosa pine zone occurs throughout much of eastern Washington and the trees usually occupy some of the driest sites of any of the forest types. This zone is characterized by short growing seasons and minimal summer precipitation. Most of the precipitation this zone receives is in the form of snow in the winter.

Shrub-steppe vegetation occurs in the rain shadow of the Cascade Range and occupies a relatively large region. Sagebrush and bunchgrass dominant the landscape. This area has low precipitation, warm-to-hot dry summers, and relatively cold winters. The shrub-steppe habitat has been extensively altered since the arrival of Europeans.

2.2.2 Plant Communities in the Study Area

The plant communities occurring along the route fall into five main categories: forested, shrub, herbaceous, agricultural, and developed areas. These categories are based on the dominant cover type. Due to changes in climate, substrate, and elevation along the route, vegetation varies greatly. The route begins in the wet, temperate environment of the Puget lowlands, crosses the Cascade Mountains, and ends in the arid environment of eastern Washington. Based on the information review and knowledge of the area, the following plant communities were identified as potentially occurring in the study area:

- Forested plant communities: second-growth coniferous forest (western hemlock, silver fir, mountain hemlock, Douglas fir, and ponderosa pine); regenerating coniferous forest; and old-growth plant communities; deciduous forest; and mixed forest;
- Shrub plant communities: scrub-shrub, shrub-steppe (the list of shrub-steppe plant communities occurring along the route are listed in Appendix A);
- Herbaceous plant communities: grass/forb;
- Agricultural plant communities: hay/pasture, cropland, orchard; and
- Developed areas.

The following sections discuss these upland plant communities in greater detail. Wetlands consisting of forested, scrub-shrub, and emergent vegetation as well as open-water wetlands are described in the wetlands report prepared for this project (Dames & Moore 1996).

2.3 FORESTED PLANT COMMUNITIES

Forested plant communities are extensive in the study area (nearly 30 percent) and include coniferous forest, regenerating coniferous forest (i.e., recently replanted clearcuts), old-growth, deciduous forest, and mixed forest. Much of the study area from the Thrasher Pump Station to the Yakima River (about 95 miles) is forested. The construction corridor, however, will be located in existing corridors for most of the first 95 miles. Existing Bonneville Power Authority (BPA) easements, logging roads, and railbeds will be used to minimize the amount of forested vegetation cleared for this project.

Forested plant communities are classified based on the dominant cover types. Forested plant communities

in which 75 percent or more of the cover consists of coniferous trees is considered to be a coniferous forest plant community. Similarly, a cover type dominated by deciduous tree (with a cover of 75 percent or more) is considered to be a deciduous forest plant community. If neither the deciduous cover or the coniferous cover is greater than 75 percent, then these areas are considered to be a mixed forest plant community. Mixed forest plant communities are dominated by both deciduous and coniferous trees.

2.3.1 Coniferous Forests

2.3.1.1 Second-growth Coniferous Forests

The coniferous forests of the Puget lowlands (including the foothills west of the Cascade Mountains) are dominated by western hemlock and Douglas fir. Western red cedar occurs sporadically, and in some places is a dominant or co-dominant species. Big-leaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) are intermittently interspersed within the coniferous forest, but account for less than 25 percent of the total forest cover. The understory varies along the route from no vegetation at all to areas that are very dense, although most of the route has some understory vegetation. Common understory plants include, but are not limited to, salmonberry and blackberries (*Rubus* spp.), salal (*Gaultheria shallon*), Oregon grape (*Mahonia* spp.), vine maple (*Acer circinatum*), wild roses (*Rosa* spp.), snowberry (*Symphoricarpos albus*), red elderberry (*Sambucus racemosa*), sword fern (*Polystichum munitum*), bleeding heart (*Dicentra formosa*), false lily-of-the-valley (*Maianthemum dilatatum*), and foamflower (*Tiarella trifoliata*). Segments of the route composed of this forested plant community are mapped as "WH" (western hemlock) in Appendix A.

Coniferous forests on the west slopes of the Cascade Mountains include western hemlock, Douglas fir, and Pacific silver fir in the overstory. Noble fir, big-leaf maple, and red alder occur to a limited extent. Dominant understory vegetation is similar to that listed above for the Puget lowlands. Segments of the route composed of this forested plant community are mapped as "SF" (silver fir) in Appendix A.

The pipeline route crosses the Cascade Mountains through an existing tunnel near Snoqualmie Pass. Over the crest of the Cascades, Pacific silver fir and mountain hemlock are dominant species, and they are joined by western hemlock, western red cedar, and subalpine fir (*Abies lasiocarpa*). Understory vegetation is dominated by huckleberry (*Vaccinium*) species in the shrub layer and ferns, grasses,and sedges along with broadleaf ground covers such as false lily-of-the-valley, brambles (*Rubus* spp.), twinflower (*Linnea borealis*), and bunchberry (*Cornus canadensis*). Segments of the route composed of this forested plant community are mapped as "MH" (mountain hemlock) in Appendix A.

On the east slope of the Cascade Mountains, much of the proposed pipeline route is coniferous forest dominated by Douglas fir or ponderosa pine. Toward the east, the rainfall decreases, and the forests are dominated by Douglas fir, grand fir, and ponderosa pine. In the driest forested sites, ponderosa pine tends to be a lone dominant. Along the proposed pipeline route, the eastern limits of the ponderosa pine is Swauk Creek. In the vicinity of the Yakima River, shrub-steppe vegetation may be interspersed within the open ponderosa pine forest. Common understory shrubs include huckleberry, Oregon grape, snowberry, buckbrush (*Ceanothus velutinus* or *C. sanguineus*), and buffalo berry (*Shepherdia canadensis*), and in the

drier areas, bitterbrush (*Purshia tridentata*) and big sagebrush may be dominant in the understory. Segments of the route composed of these plant communities are mapped as "DG" (Douglas fir) or "PP" (ponderosa pine) in Appendix A.

2.3.1.2 Regenerating Coniferous Forest

Regenerating coniferous forests, including tree farms, are dominated by planted species such as Douglas fir and western hemlock, although other young trees may be present. Understory vegetation may include young red alder, blackberry, salmonberry, salal, Oregon grape, sword fern, and bracken fern (*Pteridium aquilinum*).

2.3.1.3 Old-growth

Stands of old-growth occur in the study area, but none occur within the proposed construction corridor. Patches of old-growth occur in the western hemlock, silver fir, and mountain hemlock plant communities between mile post 13 and 57 (see Appendix A of the EFSEC application for milepost locations). Old-growth forest will not be affected by the project. All coniferous trees removed during construction will be second-growth or from regenerating coniferous forest.

2.3.2 Deciduous Forests

Deciduous forests occur on both sides of the Cascade Mountains, although along the proposed pipeline route, most of the deciduous forest occurs to the west of the mountains. West of the Cascades, deciduous forests occur, for the most part, in patches throughout the residential and commercial areas of Snohomish and King Counties and along riparian corridors. Big-leaf maple and red alder are the dominant species. While big-leaf maple usually occurs in the uplands, red alder may occur in the uplands or in wetlands (see the Wetlands Report prepared for this project for more information on forested wetlands). Other deciduous trees such as black cottonwood (*Populus trichocarpa*), cascara (*Rhamnus purshiana*) and willows (*Salix* spp.) as well as some of the coniferous trees listed in the above section occur in the deciduous forest plant communities to a limited extent. Understory vegetation in the deciduous forests of western Washington is similar to those listed in the section describing the understory vegetation of western Washington coniferous forests.

East of the Cascade Mountains, patches of quaking aspen (*Populus tremuloides*) are scattered in wet sites, and garry oak (*Quercus garryana*) occurs primarily in the vicinity of Swauk Creek. Much of the deciduous vegetation in eastern Washington occurs in the wetlands and riparian areas, and includes such species as willows and Russian olive (*Elaeagnus angustifolia*).

2.3.3 Mixed Forest

Most of the mixed forest plant communities occur west of the Cascades, and mixed forest stands are common along much of the segment of the route in western Washington. Dominant trees in this plant community include western hemlock, Douglas-fir, big-leaf maple, and red alder. Understory vegetation listed in the discussion of western Washington coniferous forest also occurs in mixed forest plant communities of western Washington.

Along the portion of the route east of the Cascades, patches of mixed forest occur in the vicinity of Cabin Creek and the City of Easton. Dominant vegetation includes western hemlock, Douglas fir, black cottonwood, and red alder.

2.4 SHRUB PLANT COMMUNITIES

Shrub plant communities are also extensive within the study area, covering approximately 33 percent of the study area. Included in this category are the scrub-shrub plant communities and the shrub-steppe plant communities. These plant communities are dominated by shrubby vegetation, but herbaceous vegetation is usually present as understory vegetation or interspersed in the shrubby areas.

2.4.1 Scrub-shrub Plant Communities

Scrub-shrub vegetation typically occurs in intensively-managed areas (such as BPA transmission line easements) in western Washington. Commonly occurring shrubs in western Washington include vine maple (*Acer circinatum*), young black cottonwood, Scot's broom, salal, blackberries, salmonberry, beaked hazelnut (*Corylus cornuta*), wild roses, snowberry, and young red alder and willows.

2.4.2 Shrub-steppe Plant Communities

Shrub-steppe plant communities are extensive in the area and occupy most of the study area mapped as shrubland. Along the proposed route, shrub-steppe vegetation occurs from the Yakima River to Pasco, which includes Kittitas, Grant, Adams, and Franklin Counties. The proposed pipeline route crosses little shrub-steppe habitat that is pristine, with most of the shrub-steppe vegetation having been altered to varying extents for agricultural purposes. Livestock grazing is common in Kittitas, Grant, and Adams Counties. In Franklin County, much of the remaining shrub-steppe habitat along the proposed route occurs in small patches between agricultural circles. Other signs of disturbed habitat occurring along the proposed route includes old road scars, evidence of fires, and signs of herbicides having been sprayed. Segments of the route which have remained relatively natural are located for the most part on or near the Yakima Training Center.

Dominant shrub species in the shrub-steppe plant communities include big sagebrush, stiff sagebrush (*Artemisia rigida*), green rabbitbrush (*Chrysothamnus viscidiflorus*), gray rabbitbrush (*Chrysothamnus*

nauseosus), bitterbrush, and buckwheat (*Eriogonum* spp.). Spiny hopsage (*Atriplex spinosa*) is a commonly-occurring shrub. The herbaceous vegetation in the shrub-steppe plant communities is very diverse and is determined in part by a number of factors including location, substrate, elevation, and degree of disturbance. Commonly-occurring herbaceous plant species include, but are not limited to, Sandberg's bluegrass (*Poa sandbergii*), bluebunch wheatgrass (*Agropyron spicatum*), cheat grass (*Bromus tectorum*), bulbous bluegrass (*Poa bulbosa*), balsamroot (*Balsamorhiza* spp.), erigeron (*Erigeron* spp.), milk-vetch (*Astragalus* spp.), desert-parsley (*Lomatium* spp.), wild onion (*Allium* spp.), long-leaved phlox (*Phlox longifolia*), and sagebrush violet (*Viola trinervata*).

2.5 HERBACEOUS PLANT COMMUNITIES

This plant community type represents approximately one percent of the study area, and includes the grass/forb plant community. This plant community typically occurs at previously disturbed areas such as roadsides, vacant lots that have been cleared, and fallow or abandoned pastures and farm fields. Herbaceous plants (graminoids and forbs) occur in these communities. Dominant plant species include orchard grass (*Dactylis glomerata*), redtop and colonial bentgrass (*Agrostis alba* and *A. tenuis*), thistle (*Cirsium* spp.), sword fern, ox-eye daisy (*Chrysanthemum leucanthemum*), plantain (*Plantago* spp.), clover (*Trifolium* spp.), and red fescue (*Festuca rubra*).

The dominant weedy herbaceous plants east of the Cascades Mountains include cheat grass, tumblemustard (*Sisymbrium altissimum*), alfilaria (*Erodium cicutarium*), fiddleneck (*Amsinckia lycopsoides*), and knapweed (*Centaurea* spp.). These species are typically found in previously disturbed areas such as roadsides or along irrigation canals.

2.6 AGRICULTURAL PLANT COMMUNITIES

Agricultural plant communities occur throughout the proposed corridor (except for the areas between North Bend and Easton) and cover approximately 29 percent of the study area. Along the proposed pipeline route, the majority of agriculture west of the Columbia River is hay and pasture. In these plant communities, weeds are the commonly-occurring plant species and include tall fescue (*Festuca arundinacea*), redtop and colonial bentgrass, orchard grass, and soft rush (*Juncus effusus*). East of the Columbia, agricultural lands include orchards, cropland, and hay and pasture. See Section 5.1.7 (Agricultural Crops/Animals) for additional information on agricultural crops.

2.7 DEVELOPED AREAS

Developed areas cover nearly five percent of the study area. Developed (barren) areas include land which is essentially cleared of all vegetation, such as roads, industrial parks, and buildings and other facilities. Vegetation in these areas is usually sparse and has been planted for landscaping. However, developed (vegetated) areas are landscaped but have more vegetation than the "barren" areas, and includes such areas as residential property, parks, and golf courses. These areas are typically dominated by lawns, shrubs,

and/or trees that are relatively intensively managed through mowing, pruning, cultivating, and fertilizing.

2.8 KITTITAS TERMINAL AND PUMP STATION SITES

Along the pipeline route, six pump stations are proposed, including a storage and distribution facility at Kittitas. The Kittitas pump station, and storage and distribution facility is located at mile post 119.9. The other five pump stations will be located at Thrasher (mile post 0.0), North Bend (mile post 36.1), Stampede (mile post 65.7), Beverly-Burke (mile post 149.3), and Othello (mile post 185.8).

The site of the Kittitas Terminal is about 26 acres, and is currently used as cropland. The five pump station sites are each approximately two acres. The Thrasher Station site is dominated by grasses and forbs, Scot's broom, and a few Douglas fir trees. The North Bend site is presently being used as pasture, and is covered with grasses and forbs. The Stampede Station site is a meadow, dominated by native grasses and forbs. The Beverly-Burke and Othello Station sites are cropland.

3.0 IMPACT ASSESSMENT AND MITIGATION

3.1 METHODS

Impacts were assessed for construction-related activities, operational impacts, and cessation of operations. Construction impacts will occur as the construction corridor is cleared of vegetation and graded for pipeline construction and installation. In areas composed of upland vegetation, the construction corridor will be a maximum of 60 feet wide. Using the GIS, construction impacts were calculated based on a 60-foot-wide swath of vegetation being cleared. Note that in some segments of the route, vegetation will not be removed because existing cleared areas will be used. These areas are considered to be areas for which there will be no impacts to upland vegetation and are identified in the following section.

Operational impacts will occur as the 30-foot-wide pipeline right-of-way is maintained (kept clear of trees and large shrubs). This type of impact usually affects woody vegetation (trees and shrubs) which will not be allowed to re-grow over the right-of-way (woody vegetation limits visual observations of the pipeline route). Most other plant communities (e.g., pastures, residential lawns) will become reestablished when construction is complete and will not have operational impacts. Operational impacts are calculated for those areas in which a 30-foot-wide swath would be maintained as a different plant community type when construction is complete. This includes the forested plant communities and the scrub-shrub plant communities.

The proposed pipeline route was entered into the GIS as a data layer. By overlaying the pipeline route with the plant community data layer in the GIS, impacts to upland vegetation were calculated. Construction and operational impact acreages were calculated by plant community along the length of the proposed route.

Impacts associated with construction of the facilities (pump stations, storage and distribution terminal) were determined from the proposed dimensions of the each of the structures. Impacts from facilities construction

was considered to be a permanent impact to existing vegetation. Total construction impacts to upland vegetation are 1399.0 acres,with the majority of impacts associated with clearing and grading along the pipeline corridor (1355.9 acres). Approximately 37.4 acres will be affected by construction of the facilities and about 5.7 acres will be affected by construction of the starting and ending sites at the two directional drilling locations (Little Bear Creek and Columbia River).

3.2 PIPELINE CONSTRUCTION

Construction impacts to upland vegetation will occur from right-of-way preparation and equipment staging. Right-of-way preparation will include surveying, clearing, grading, and the installation of temporary fencing, siltation fences and the placement of straw bales and other erosion control structures. Construction and installation of the pipeline will generally include trenching, pipe stringing, moving trucks and other equipment along the corridor, bending, welding and x-raying the pipeline, joint coating, pipe laying, and backfilling.

The width of the construction corridor along most of the route will be 60 feet (in areas composed of upland vegetation), and all vegetation within the construction corridor will be cleared. In some forested areas, however, the pipe will be placed in existing logging roads and rail-trails. In these areas, there will be no clearing of vegetation during construction because specialized construction equipment will be used (which will allow for conducting construction-related activities within a narrower construction corridor). The following lists segments of the route for which there will be no vegetation clearing:

- Cedar Falls Trail (mile post 32.7 to 39.7),
- Homestead Valley Road (mile post 42.8 to 44.9),
- John Wayne Trail (mile post 41.3 to 42.8; 44.9 to 47.6; 54.05 to 55.45; 57.65 to 72.5),
- Tinkham Road (mile post 47.95 to 53.45), and
- Snoqualmie Pass Tunnel (mile post 55.45 to 57.65).

In these areas, some overhanging branches may be removed to provide for adequate overhead work area.

Construction-related impacts were calculated using GIS. Table 1 presents the total impact acreage by cover type.

TABLE 1
TOTAL CONSTRUCTION IMPACT ACREAGES BY COVER TYPE

Cover Types	Impact Acreage
Western hemlock	68.7
Silver fir	2.1
Mountain hemlock	0.0
Douglas-fir	10.6

Ponderosa pine	20.6
Deciduous forest	9.6
Mixed forest	21.9
Young (regenerating) coniferous forest	67.6
Old-growth coniferous forest	0.0[(a)]
Scrub-shrub	140.3
Shrub-steppe	562.6
Grass/forb	9.6
Cropland	284.8[(b)]
Hay/pasture	141.3
Orchard	5.3
Developed (vegetated)	10.9
Total	1355.9

(a) The route avoids potential impacts to old-growth forest.
(b) Most impacts to agricultural land will occur prior to the growing season.

The pipeline will impact approximately 201.1 acres of forested vegetation. Of this, 102.0 acres is coniferous, 9.6 acres is deciduous, 21.9 acres is mixed forest, and 67.6 acres is regenerating coniferous forest. No old-growth vegetation will be impacted by the project. Impacts to forested vegetation will occur when as the pipeline traverses from one existing right-of-way to another. Forested impacts will occur primarily in western Washington. Ponderosa pine forests and the east slopes of the Cascades will not be affected because the pipeline will be placed in existing BPA rights-of-way or rail-trails. However, some oak and aspen trees may be cleared for the project, most of which are near Swauk Creek (i.e., individual trees may be removed, but the pipeline will not cross stands of these trees).

The pipeline will impact approximately 702.9 acres of shrub vegetation. Of this, 140.3 acres is scrub-shrub, while 562.6 acres of shrub-steppe will be affected. Much of the natural vegetation between mile post 95 and 227 is shrub-steppe. For this reason, the shrub-steppe plant communities will have the greatest total acreage impact of all the plant communities along the proposed corridor. Most of the construction corridor crosses degraded shrub-steppe habitat, however, the pipeline does cross patches of relatively high-quality shrub-steppe habitat such as that in the vicinity of the Yakima Training Center.

The pipeline will impact approximately 9.6 acres of herbaceous plant communities. The grass/forb plant community consists of weedy species. this plant community will have a seed source and will revegetate naturally once construction is complete. To prevent permanent construction impacts to the meadow plant community (i.e., preventing non-natives and/or invasives from becoming established), the meadows must be revegetated as soon as construction is complete.

The pipeline will impact approximately 431.4 acres of agricultural land. Of this, 284.8 acres is cropland, 141.3 acres is hay/pasture, and 5.3 acres is orchards. Construction-related impacts are expected to be minimal for cropland and hay/pasture because of a relatively short revegetation time period (about one growing season). However, impacts to orchards will be a relatively long-term impact. See Section 5.1.7.2 (Agricultural Crops/Animals Impacts) for more information on impacts to agricultural areas.

The pipeline will impact approximately 10.9 acres of developed (vegetated) land.

3.3 STAGING AREAS

At all wetland and stream crossings (except the Little Bear Creek and the Columbia River crossings), the construction corridor in the adjacent uplands will be used as staging areas. In using the 60-foot-wide construction corridor, additional work areas will not needed at aquatic resource crossing.

Upland vegetation will be impacted at the two directional drilling locations. Additional work areas will be needed for the sending and receiving pits. Each pit will be a maximum of 250' x 250' and two pits will be required at each crossing. Construction of the work areas for the Little Bear Creek crossing will affect 2.87 acres of agricultural land. Work areas at the Columbia River crossing will affect about 2.87 acres of shrub-steppe vegetation. The shrub-steppe plant communities near the Columbia River have been degraded by previous development projects, including construction of the Wanapum Dam and installation of transmission lines. Clearing and grading activities associated with construction of the work areas will not affect unique or high-quality plant communities.

3.4 KITTITAS TERMINAL AND PUMP STATION CONSTRUCTION

Clearing and grading will occur at the proposed pump station locations and at the storage and distribution facility in Kittitas. The vegetation on the proposed Kittitas facility and pump stations sites will be permanently lost. Construction of these facilities will result in the loss of approximately seven acres of grass/forb vegetation, and a small number of second- or third-growth trees, as well as about 30 acres of cropland.

3.5 PIPELINE OPERATION

Maintenance of the pipeline corridor will require the permanent removal of trees and some shrubs growing within a 30-foot-wide swath along the pipeline route. This will be necessary to allow inspection of the pipeline from the air and to prevent the roots of woody vegetation from damaging the pipe. Right-of-way maintenance results in permanent impacts to areas covered with woody vegetation because trees and shrubs will be prevented either from becoming established in the easement or from growing to their full height. Shrub-steppe vegetation will be replanted and allowed to grow over the pipeline corridor, resulting in no operational impacts to these plant communities. Herbaceous plant communities, agricultural land, and developed areas are not included as an operational impact because these areas will be allowed to grow naturally once the pipe has been installed. Table 2 shows the acreage impacts to forested and shrub vegetation from maintaining the right-of-way.

TABLE 2
TOTAL OPERATIONAL IMPACT ACREAGES BY COVER TYPE

Cover Type	Impact Acreage
Western hemlock	33.9
Silver fir	1.1
Mountain hemlock	0.0
Douglas-fir	4.7
Ponderosa pine	10.6
Deciduous forest	4.8
Mixed forest	10.3

Young (regenerating) coniferous forest	34.0
Old-growth forest	0.0
Scrub-shrub	72.2
Shrub steppe	0.0
Orchard	2.2
Developed (vegetated)	5.3
Total	179.1

(a) The route avoids potential impacts to old-growth forest.
(b) Most impacts to agricultural land will occur prior to the growing season.

The above impact calculations were based on a 30-foot-wide corridor. Section 3.0 addresses revegetation of the portions of the construction corridor that will not be maintained as right-of-way.

3.6 MITIGATION MEASURES

Mitigation strategies, in order of priority, are: (1) avoidance; (2) minimization; (3) restoration; and (4) compensation.

3.6.1 Avoidance

Avoidance of impacts to upland plant communities will be accomplished in a number of ways. Route alignment and engineering design have resulted in avoiding vegetation impacts along portions the proposed corridor, most notably some of the forested plant communities.

Along some segments of the route that are forested, there are logging roads and rail-trails that can be used as a construction corridor. In the forested areas where existing roads and trails are available, specialized construction equipment will be used so that the adjacent forested vegetation will not be cleared (although some overhanging branches may need to be cleared to provide sufficient overhead work space). Given the amount of the route that is forested, this construction technique will significantly reduced the impacts to forested areas.

Construction equipment will use existing access roads to access the construction corridor. Therefore, vegetation will not be removed to access the work areas. By not constructing any new access roads, additional vegetation impacts have been avoided.

In some cases, impacts to priority vegetation habitats (such as oak woodlands and old-growth forest) will be avoided by routing the pipeline around these plant communities.

Petroleum products spills will be avoided by employing the Spill Prevention Plan prepared for this project. For details on this plan, refer to Section 2.9 (Spill Prevention and Control) in the EFSEC document.

Where avoidance of upland impacts is not feasible, the following mitigation measures will be used.

3.6.2 Minimization

Impact minimization includes measures taken to reduce the amount of vegetation affected by the construction of the pipeline as well as measures taken to prevent invasive plant species from becoming established in cleared areas. Impacts will be minimized by utilizing the narrowest construction corridor feasible. The construction corridor will be a maximum of 60 feet in width. To ensure that vegetation beyond the construction corridor is not unnecessarily removed or crushed by equipment, the pipeline alignment and construction corridor boundaries will be clearly staked and marked to minimize equipment impacts. Temporary fencing will be installed to prevent unanticipated vegetation impacts. Stumps of trees and roots of shrubs will only be removed where absolutely necessary (e.g., where excavation and grading will occur).

Specific measures will be employed to minimize the invasion and spread of undesirable plant species. They include:

- straw bales will be used instead of hay bales for erosion control to limit the number of weed seeds introduced to disturbed areas;
- disturbed areas will be replanted with native species after the topsoil has been replaced;
- trees and shrubs will be replanted in all appropriate disturbed areas outside the maintained corridor to shade out undesirable grasses and weeds; and
- recommendations from the State and County Noxious Weed Control Boards will be used.

Areas which are dominated by non-native and/or invasive species have the potential to return once construction is complete. Measures implemented to reduce the potential for invasive and/or non-native to become established will focus primarily on those areas which are composed of primarily native vegetation.

Recommendations from the County Noxious Weed Control Boards that will be implemented to minimize the spread of noxious weeds include re-vegetating the construction corridor with certified weed-free seeds, pressure washing construction equipment, and working with board representatives to control spread of weeds.

3.6.3 Restoration

Restoration will begin when construction is complete. Areas currently composed of herbaceous vegetation, as well as cropland and hay/pasture plant communities will be restored along the entire width of the construction corridor. Areas dominated by forested and shrub plant communities will be restored within the portion of the construction corridor not maintained as right-of-way. All vegetation planted or used in the seed mixes to restore natural segments of the alignment will be native to the area. The following identifies the plant species which will be included in the planting plan for each plant community type affected.

3.6.3.1 Coniferous Forest Plant Communities in Western Washington

When construction is complete, the construction corridor will be seeded to stabilize the topsoils. In late summer, the coniferous forest vegetation will be replanted in the portion of the construction corridor not maintained as right-of-way. Table 3 shows the plant species to be planted as part of the restoration of coniferous forests in the Puget lowlands and along the west slopes of the Cascade Mountains. All of the plant species listed in this table are native to the area. Species selected from this list should be appropriate to the area (e.g., silver fir should only be planted at the higher elevations along the route).

TABLE 3
CONIFEROUS FORESTED PLANT COMMUNITIES - WESTERN WASHINGTON

Scientific Name	Common Name
Trees (one-gallon containers)	
Tsuga heterophylla	western hemlock
Pseudotsuga menziesii	Douglas fir
Thuja plicata	western red cedar
Abies amabilis	silver fir
Shrubs (one-gallon containers)	
Rubus spectabilis	salmonberry
Amelanchier alnifolia	serviceberry
Oemleria cerasiformis	Indian plum
Acer circinatum	vine maple
Symphoricarpos album	snowberry
Sambucus racemosa	red elderberry
Corylus cornuta	beaked hazelnut
Rosa spp.	wild roses

Segments of the route dominated by regenerating coniferous forest will be revegetated with similar species as those removed. It is assumed that western hemlock and Douglas fir would be the two species planted in regenerating coniferous forest plant communities.

3.6.3.2 Coniferous Forest Plant Communities East of the Cascade Mountains

Coniferous forest will be restored in the portion of the construction corridor not maintained as right-of-way. Young trees and shrubs will be planted in early fall. Table 4 shows the plant species to be planted as part of the restoration of coniferous forests from the crest of the Cascade Mountains to Swauk Creek.

TABLE 4

CONIFEROUS FORESTED PLANT COMMUNITIES - EASTERN WASHINGTON

Scientific Name	Common Name
Trees (one-gallon containers)	
Pinus ponderosa	Ponderosa pine
Pseudotsuga menziesii	Douglas fir
Shrubs (one-gallon containers)	
Mahonia spp.	Oregon grape
Symphoricarpos albus	snowberry
Ceanothus spp.	buckbrush
Shepherdia canadensis	buffalo berry
Purshia tridentata	bitterbrush

3.6.3.3 Deciduous Forest Plant Communities

Deciduous forest will be restored in the portions of the construction corridor not maintained as right-of-way. Table 5 shows the plant species to be planted as part of the restoration of deciduous forests in the Puget lowlands and along the west slopes of the Cascade Mountains. In western Washington, the construction corridor will be seeded with a mix of grasses, and in late summer, young trees and shrubs will be planted. Big-leaf maple and red alder, the two most commonly-occurring deciduous trees occurring along the route, will be planted most frequently in the restoration areas. Cascara will be planted much less frequently.

TABLE 5
DECIDUOUS FOREST PLANT COMMUNITIES - WESTERN WASHINGTON

Scientific Name	Common Name
Trees (one-gallon containers)	
Acer macrophyllum	big-leaf maple
Alnus rubra	red alder
Rhamnus purshiana	cascara
Shrubs (one-gallon containers)	
Rubus spectabilis	salmonberry
Amelanchier alnifolia	serviceberry
Oemleria cerasiformis	Indian plum
Acer circinatum	vine maple
Symphoricarpos album	snowberry
Sambucus racemosa	red elderberry

Corylus cornuta	beaked hazelnut
Rosa spp.	wild roses

East of the Cascade Mountains, patches of deciduous plant communities will be impacted by the project. Native vegetation similar to the species composition will be used to restore the area not maintained as right-of-way. These species will be planted in the early fall. Plants from one-gallon containers will be used to replant in the portion of the construction corridor not maintained as right-of-way. Stands of oak and aspen will not be cleared for this project, however, a few individual trees may need to be removed. Fencing may be necessary to prevent cattle from trampling the young trees.

3.6.3.4 Mixed Forest Plant Communities

Mixed forest will be restored in the portion of the construction corridor not maintained as right-of-way. Table 6 shows the plant species to be planted as part of the restoration of mixed forest plant communities in the Puget lowlands and along the west slopes of the Cascade Mountains. These species will be planted in the portion of the construction corridor not maintained as right-of-way in late summer.

TABLE 6
MIXED FOREST PLANT COMMUNITIES - WESTERN WASHINGTON

Scientific Name	Common Name
Trees (one-gallon containers)	
Tsuga heterophylla	western hemlock
Pseudotsuga menziesii	Douglas fir
Thuja plicata	western red cedar
Acer macrophyllum	big-leaf maple
Alnus rubra	red alder
Shrubs (one-gallon containers)	
Rubus spectabilis	salmonberry
Amelanchier alnifolia	serviceberry
Oemleria cerasiformis	Indian plum
Acer circinatum	vine maple
Symphoricarpos album	snowberry
Sambucus racemosa	red elderberry
Corylus cornuta	beaked hazelnut
Rosa spp.	wild roses

East of the Cascade Mountains, small patches of mixed forest will be impacted by construction. Native vegetation similar to the species composition which was removed will be used to restore the area not maintained as right-of-way. Re-planting will occur in early fall.

3.6.3.5 Scrub-shrub Plant Communities in Western Washington

Scrub-shrub plant communities will be restored in the portion of the construction corridor not maintained as right-of-way. Table 7 shows the plant species to be planted as part of the restoration of scrub-shrub plant communities for the Puget lowlands and west slopes of the Cascade Mountains. The species in this list are native to the area. They will be planted in late summer.

TABLE 7
SCRUB-SHRUB PLANT COMMUNITIES - WESTERN WASHINGTON

Scientific Name	Common Name
Shrubs (one-gallon containers)	
Rubus spectabilis	salmonberry
Amelanchier alnifolia	serviceberry
Oemleria cerasiformis	Indian plum
Acer circinatum	vine maple
Symphoricarpos album	snowberry
Sambucus racemosa	red elderberry

3.6.3.6 Shrub-steppe Plant Communities

Seed mixes will be used to revegetate the construction corridor. The following species will be included in the seed mix: big sagebrush, rigid sagebrush, bluebunch wheatgrass, Sandberg's bluegrass, and Idaho fescue. The seed mix will be put out in early fall to ensure that they do not dry out during the dry summer months.

3.6.3.7 Herbaceous Plant Communities

Grass/forb plant communities are composed primarily of invasive and/or non-native plant species along roadsides and vacant lots. These areas will be reseeded when construction is complete to prevent soil erosion. Since the existing species are likely to out-compete the native vegetation, no additional planting are proposed for these areas.

3.6.3.8 Agricultural Plant Communities

When construction is complete in cropland and hay/pasture areas, the construction corridor will be replanted with native, non-invasive plant species or they will be returned to a condition agreed to by the landowner. Agreements with landowners will be reached before construction begins. See section 5.1.7.3 (Agricultural Crops/Animals Mitigation) for more information on restoration of agricultural plant communities.

3.6.3.9 Developed (Vegetated) Areas

All developed (vegetated) land will be returned to previous conditions. Lawns will be reseeded. Any trees and shrubs cleared will be mitigated for by re-planting trees and shrubs from one-gallon containers outside of the maintained right-of-way.

3.6.4 Compensation

All on-site mitigation is will occur as restoration of the construction corridor when construction is complete. No off-site compensation is proposed.

3.7 MONITORING

A five-year monitoring plan for upland vegetation, including contingency plans, will be developed and implemented. Parameters to be monitored will include the success of replanted vegetation, types and percentage cover of invasive species, damage to remaining vegetation along the corridor, such as blowdown or erosion of topsoil, and unanticipated impacts.

4.0 RARE PLANT STUDY

4.1 METHODS

Prior to conducting any field work, Dames & Moore contacted resource agencies to obtain information on rare plants that have the potential to occur in the project area.

4.1.1 Preliminary Data Collection

The U.S. Fish and Wildlife Service (USFWS) maintains a list of federally-listed endangered, threatened, and candidate plant (and animal) species. The USFWS was contacted for information on rare plants that may be present in the Cross Cascade Pipeline Project study area. The USFWS generated a list of rare plants that have the potential to occur within the study area as well as the status of the plant (endangered, threatened, proposed, or candidate).

The Washington State Natural Heritage Program (NHP) maintains a database of rare plant and high-quality native plant community locations within the state. A database search was requested of NHP to identify known rare plant and unique plant community locations in the vicinity of the study area. NHP generated a list of species and plant communities by township, range, and section.

In addition to database requests from these two resource agencies, NHP publications were reviewed to determine which rare plants had the potential to occur along the proposed route based on distribution and habitat requirements. The following publications were used:

- Endangered, Threatened & Sensitive Vascular plants of Washington (NHP 1994);
- An Illustrated Guide to the Endangered, Threatened and Sensitive Vascular Plants of Washington (NHP 1981); and
- Flora of the Pacific Northwest (Hitchcock and Cronquist 1973).

The U.S. Forest Service (USFS) provided Dames & Moore with a list of sensitive plant species for both the Mt.Baker-Snoqualmie and Wenatchee National Forests as well as USFS publications pertaining to sensitive plant species. The Yakima Training Center (YTC) provided Dames & Moore with a list of species of concern on YTC land. Dames & Moore also reviewed YTC rare plant maps and reports prior to conducting rare plant studies.

The list of rare plant species generated from the preliminary data evaluation was used as a guide in the field. This list includes federal and state listed threatened and endangered species, federal candidate species, state sensitive species, and Forest Service Region 6 sensitive species from the Mt. Baker-Snoqualmie and Wenatchee National Forests. In addition, a sensitive plant species lists provided by the Yakima Training Center was used while on YTC land. The list of species included in the survey is presented in Appendix B. This list was prepared prior to conducting any rare plant surveys. Federal listings for candidate species have changed. This list, therefore, includes plants which were listed as candidates at the time of field work which may no longer be listed by the USFWS.

4.1.2 Field Survey

Field surveys were conducted along the route in places where rare plants had the potential to occur. This includes the shrub-steppe habitat and forested areas where the route crosses from one logging road, rail-trail, or BPA easement to another. In addition, vegetation adjacent to existing forest service roads were field checked. Specifically, the following areas were included in the rare plant survey:

- mile post 22.3 - 24.1
- mile post 30.5 - 31.1
- mile post 40.3 - 41.1
- mile post 45.5 - 49.5
- mile post 53.6 - 53.8
- mile post 54.8 - 55.0
- mile post 58.3 - 69.0
- mile post 80.4 - 80.7
- mile post 94.3 - 227.1

The construction corridor was walked in the above-listed areas by two biologists. Along known right-of-ways (e.g., BPA easements, roadways), a minimum of a 60-foot-wide corridor was assessed for rare plants. In areas where new right-of-way would be needed, a minimum of a 200-foot-wide swath was surveyed in the field (i.e., 100 feet to each side of the proposed alignment). Biologists used aerial photographs and/or topographic maps to guide the survey and map rare plant locations. The biologists walked the above-listed areas in a meandering or "zig-zagging" path while surveying the study corridor. This method ensures that the proposed construction corridor is adequately surveyed. Along the John Wayne trail, habitats that could potentially contain rare plants were checked.

Rare plant surveys were conducted based on the plant species presented in Appendix B. This report documents rare plant locations for endangered, threatened, candidate, and sensitive plant species only. Monitor plant species locations are not included in this report, but the project will no have adverse affects on any monitor plant populations.

4.2 RESULTS

4.2.1 Preliminary Data Collection

No federally-listed threatened or endangered plant species were identified by the USFWS as potentially occurring in the study area. This agency has identified four federal candidate species which have the potential to occur within the study area. Candidate species are those species that may be proposed and listed (as threatened and endangered) in the future. These four species are: northern wormwood (*Artemisia campestris var. wormskioldii*), Columbia milk-vetch (*Astragalus columbianus*), Hoover's desert-parsley (*Lomatium tuberosum*), and Hoover's tauschia (*Tauschia hooveri*). These four species were listed as candidate species at the time of field surveys, but have since been dropped from federal listings.

The NHP has identified 12 plant species and six high quality native plant communities which have been identified in the vicinity of the study area. The plant species are presented in Table 9.

TABLE 9
NHP DATABASE RESPONSES

Common Name	Scientific Name	State Status
Columbia milk-vetch	*Astragalus columbianus*	Threatened
white eatonella	*Eatonella nivea*	Threatened
Hoover's desert-parsley	*Lomatium tuberosum*	Threatened
dwarf evening-primrose	*Oenothera pygmaea*	Threatened
Hoover's tauschia	*Tauschia hooveri*	Threatened
Paiute suncup	*Camissonia scapoidea*	Sensitive
Buxbaum's sedge	*Carex buxbaumii*	Sensitive
gray cryptantha	*Cryptantha leucophaea*	Sensitive
southern mudwort	*Limosella acaulis*	Sensitive
Snake Canyon desert-parsley	*Lomatium serpentinum*	Sensitive
coyote tabacco	*Nicotiana attenuata*	Sensitive
desert evening primrose	*Oenothera cespitosa*	Sensitive

The six high quality native plant communities identified by NHP are:

- big sagebrush/needle-and-thread community (*Artemisia tridentata/Stipa comata association*)
- tall gray rabbitbrush-bitterbrush/Indian ricegrass community (*Chrysothamnus nauseosus-Purshia tridentata/Oryzopsis hymenoides association*)
- red alder forest (*Alnus rubra* cover type)
- western hemlock/swordfern - three-leaved foamflower community (*Thuga heterophylla/Polystichum munitum - Tiarella trifoliata* community)
- big sagebrush/bluebunch wheatgrass association (*Artemisia trifoliata/Agropyron spicatum* association)
- stiff sagebrush/Sandberg's bluegrass association (*Artemisia rigida/Poa sandbergii* association).

The U.S. Forest Service (Mt. Baker-Snoqualmie National Forest and Wenatchee Nations Forest) provided lists of sensitive plant species from each of the Regional Districts. These lists were reviewed to determine which plants had the potential to occur along the proposed pipeline alignment based on habitat requirements and distribution. Species which had the potential to occur along the route were included in the matrix presented in Appendix B.

Additional species are included in this matrix. These species were identified from NHP documents as having the potential to occur in the study area based on the habitat and distribution of the species, and were included in the rare plant surveys.

4.2.2 Field Surveys

Two rare plant species were found in the shrub-steppe habitat. They are:

- Hoover's tauschia (*Tauschia hooveri*)
- Piper's daisy (*Erigeron piperianus*)

Hoover's tauschia was previously listed as a federal candidate. It is currently listed as threatened by the state. Piper's daisy is a state sensitive plant species (no federal listing).

4.2.2.1 Hoover's tauschia

Hoover's tauschia was found in township 17 north, range 21 east, section 27 along the ridge. The plants occurs in two locations which have over 100 individuals in each of the populations. Just east of these populations is a relatively small population in which about three plants were found. The populations found along the proposed pipeline route are in the vicinity of previously identified Hoover's tauschia populations which have been mapped by the YTC.

4.2.2.2 Piper's daisy

Piper's daisy was identified in several locations along the proposed pipeline route. In Grant County, two populations occur in township 16 north, range 25 east, section 11. One of the populations consists of about six plants and the other consists of about 10 plants. It may be possible to either relocate the construction corridor to avoid the populations or reroute the pipe to avoid or minimize the impacts to the populations.

In Adams County, a population of Piper's daisy occurs in the east half of township 15 north, range 28 east, section 23. This population consists of about 100 plants and appears to be located within the construction corridor. The population may be avoided by moving the pipeline closer to the irrigation canal. A second population is located in township 15 north, range 29 east, section 30, just to the east of the fence (between sections). This population could be avoided by keeping the route to the west of the fence line. Should the pipe be moved to the east side of the fence, additional field work will be needed to assess the population and identify mitigation measures. A single plant was found in township 15 north, range 28 east, section 25. This plant may be just south of the construction corridor and, depending on final alignment, may not be affected by the project.

4.2.3 Unique Plant Communities

Unique plant communities were identified on and in the vicinity of the Yakima Training Center. Determining factors include, but may not be limited to, overall proportion of native vegetation, level of previous disturbance, condition of microbiotic crust, and presence of livestock. Some segments of the route near the Yakima Training Center consist of relatively natural plant communities that are some distance from disturbed areas.

A patch of big sagebrush occurs at approximately mile post 163. This patch was considerably taller than sagebrush seen elsewhere along the route, with much of the sagebrush in this patch greater than five feet in height.

5.0 REFERENCES

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APPENDIX A

MAPPED PLANT COMMUNITIES OCCURRING IN THE STUDY AREA

PLANT COMMUNITIES

FORESTED PLANT COMMUNITIES
- Coniferous Forest
  - Western hemlock (WH)
  - Silver fir (SF)
  - Mountain hemlock (MH)
  - Douglas fir (DG)
  - Ponderosa pine (PP)
- Deciduous Forest (DF)
- Mixed Forest (MF)
- Young (Rrgenerating) Coniferous Forest (YCF)
- Old-growth (OG)

SHRUB PLANT COMMUNITIES
- Scrub-shrub (S)
- Shrub-steppe[a] (SS)
  - Sagebrush/rabbitbrush/cheatgrass
  - Sagebrush/native grass(es)
  - Buckwheat/native grass(es)
  - Bitter-brush/sagebrush/grass(es)
  - Sagebrush/rabbitbrush/cheatgrass/native grass(es)
  - Bitter-brush/grass(es)
  - Rabbitbrush/native grass(es)
  - Sagebrush/cheatgrass/native grass(es)
  - Rabbitbrush/buckwheat/grass(es)
  - Cheatgrass
  - Sagebrush/cheatgrass
  - Rabbitbrush/cheatgrass
  - Sagebrush/rabbitbrush/native grass(es)
  - Bitter-brush/rabbitbrush/native grass(es)
  - Native grass(es)
  - Spiney hopsage
  - Sagebrush/spiny hopsage/grass(es)
  - Sagebrush/buckwheats/grass(es)

HERBACEOUS PLANT COMMUNITIES
- Grass/forb (GF)

AGRICULTURAL PLANT COMMUNITIES
- Hay/Pasture (HP)
- Cropland (CL)
- Orchards (OR)

DEVELOPED AREAS
- Vegetated (DV)
- Barren (B)

[a] Sagebrush = big sagebrush and/or rigid sagebrush; rabbitbrush = gray rabbitbrush and/or green rabbitbrush; native grass(es) = Sandberg's bluegrass, bluebunch wheatgrass, and/or Idaho fescue; buckwheats = thyme buckwheat, Douglas' buckwheat, tall buckwheat, northern buckwheat, and/or snow buckwheat.

[b] Cover type not available = shrub-steppe information currently not available due to route revisions.

APPENDIX B

RARE PLANT SURVEY LIST

APPENDIX C

SHRUB-STEPPE PLANT COMMUNITY MAPPING

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