Geology Technical Report

Wildwood – Wemme Project

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Oregon Department of Transportation

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Executive Summary

Affected Environment

The Wildwood to Wemme project lies along the Sandy River valley, within the western Cascades. Topography within the project is relatively flat.

The Wildwood to Wemme project is located on a terrace of the Sandy River. The terrace is made up of recent alluvium and glacial outwash consisting of predominantly sand and gravel with varying amounts of boulders, cobbles, silt, and clay.

The bedrock geology in the project area consists of Tertiary-age volcanic and volcaniclastic rocks of the Rhododendron Formation and basalt assigned to the Grande Ronde and Wanapum Formations of the Columbia River Basalt Group. Bedrock is not exposed within the project.

The geologic structure consists of NE-SW trending folds. One fault has been identified in the area of the project and is inferred to be present beneath the eastern end of the project near Wemme.

Soils within the project area developed on glacial and alluvial deposits. Where undisturbed, they are generally cobbly, loamy coarse sand and is moderately well to poorly drained.

Groundwater may be encountered at shallow depths along the embankment section of the project. Other areas of shallow groundwater may exist locally, controlled by local variations in soil type and drainage.

Environmental Consequences

No-Build Alternative

The No-Build Alternative would result in no construction and therefore, no impacts on the geologic environment would occur.

Widen to the North Alternative

Much of the overall alignment crosses semi-developed land. Cumulative impacts to the geologic environment will consist of relatively minor changes in topography and drainage patterns, minor settlement of near-surface materials, and potential changes in slope stability. These impacts will occur as a result of excavation, placement of structures and fills, and clearing and grading.

Impacts related to construction will be limited to stability of partially constructed slopes, temporary changes to drainage, erosion and resultant sedimentation. All earthwork will require temporary erosion protection and sediment control until permanent protection is established.

Proposed Mitigation

Site specific geotechnical investigations will be performed prior to final design. These investigations will detect problem areas and designs can be developed to mitigate any adverse long term effects on the geologic environment.

Short term (construction) slope stability will be considered as part of the design process. A construction sequence and schedule can be developed to minimize this impact. Development and implementation of a comprehensive erosion and sediment control plan will mitigate the most significant short term impact to the geologic environment.

Project Alternatives

No-Build Alternative

Widen to the North Alternative

The alternative, if implemented, would widen the highway to the north to accommodate four 12-foot travel lanes, a 14-foot median for continuous left-turns, and 8 foot shoulder/bikeways, two feet would be added where guardrail is needed. This proposal maintains the edge of pavement where it is on the south side of the highway. The proposal could be implemented within the state right of way* on the north side with few possible exceptions, possibly for water quality treatment or options described below for Lataurelle Avenue, E. Oregon Street, and E. Wildwood Avenue. The total paved cross-section of the highway would be 78-80 feet wide depending on the presence of guardrail on the north side. (Figure 1. Widen to the North Alternative footprint).

Two options would be considered to address the steep grade on both Lataurelle Avenue and E. Wildwood Avenue where they connect to US 26. The widening to the north would increase the grade on these side streets and affect the connections with the existing side roads below. Lataurelle Avenue would exceed the Clackamas County standard for road grades, but it may be possible for E. Wildwood Avenue to be at or under the County standard.

Option #1 would close Lataurelle and provide access to US 26 via E.Wildwood Avenue and Mountain Air Drive. East Oregon Street, which connects Lataurelle Avenue and E. Wildwood Avenue would be improved. Improvement could be grading and gravelling or paving.

Option # 2 would improve Lataurelle Avenue to a two lane street, but it would become steeper than it is now. An exception for grade would be needed from the county.

The access management strategy for the project would consolidate driveways on the south side of the highway where possible, close the east entry to E. Wemme Trail Road, and provide a private access to a property that shares access with the Hoodland Church.

* This may be an easement through the federal property administered by the Bureau of Land Management.

Affected Environment

The Wildwood to Wemme project is located on a terrace of the Sandy River. The terrace is made up of recent alluvium and glacial outwash consisting of predominantly sand and gravel with varying amounts of boulders, cobbles, silt, and clay (Qs).

The geology of the project area is shown in Figure 1. The bedrock geology in the project area consists of Quaternary to Tertiary-age volcanic and volcaniclastic rocks of the Rhododendron Formation (Trn), basalt assigned to the Grande Ronde and Wanapum Formations of the Columbia River Basalt Group (Tcr) and younger basalt and andesite (QTb). Bedrock is not exposed within the project.

The geologic structure consists of NE-SW trending folds. One fault has been identified in the area of the project and is inferred to be present beneath the eastern end of the project near Wemme.

Columbia River Basalt Group (Tcr)

Although not exposed within the project, flows belonging to two members of the Columbia River Basalt Group are exposed on both sides of the Sandy River adjacent to the project. These flows are tholeiitic flood-basalts erupted from vents in northeastern Oregon, eastern Washington and western Idaho, approximately 17 to 6 million years ago. Some of these flows extend for thousands to tens of thousands of square miles and are hundreds to thousands of cubic miles in volume. The Columbia River Basalt Group is divided into five formations. These formations are, in turn, divided into many members and individual flows. Flows from two of these formations, the Wanapum and Grande Ronde, are present in the project area. They are middle Miocene in age.

Rhododendron Formation (Trn)

The Rhododendron Formation is exposed northeast of the project area along the Sandy River and southeast of the project area along the Zigzag River. Rocks of the Rhododendron Formation include pyroclastic tuff breccia, laharic (mudflow) breccia, conglomerate, sandstone and mudstone, tuff and some interbedded andesite flows. The Rhododendron Formation is middle to late Miocene in age.

Olivine Basalt and Andesite (QTb)

These undifferentiated rocks underlie most of the highlands around the project area. Rock types include andesite, olivine basalt and basalt. Ages of these rocks range from late Miocene to as late as Quaternary.

Soils

Soils within the project area developed on glacial and alluvial deposits (Qs). Where undisturbed, they are generally cobbly, loamy coarse sand and is moderately well to poorly drained.

Groundwater may be encountered at shallow depths along the embankment section of the project. Other areas of shallow groundwater may exist locally, controlled by local variations in soil type and drainage.

Geologic Hazards

Earthquake Hazards

The Northwest is a seismically active area. Oregon is located on the western edge of the North American Plate. Offshore, the Juan de Fuca Plate is being subducted (diving beneath) the North American Plate along what is known as the Cascadia Subduction Zone. The volcanoes of the Cascade Range are a result of this subduction.

Oregon has the potential for three types of earthquakes: crustal, intraplate, and subduction zone (Governor's task force, 1996). Although earthquake prediction is an inexact science, it is safe to assume that earthquakes will occur in Oregon. When they will occur and how severe they might be can only be speculated. Research of the seismic history of western Oregon is complicated by dense vegetation, poor rock outcrop distribution, and rapid erosion and deposition.

Crustal earthquakes are the most common in Oregon. Crustal earthquakes occur at depths less than 20 miles along relatively smaller faults. Magnitudes of crustal earthquakes rarely exceed 6.0, but earthquakes with magnitudes approaching 7.0 are possible. The Scotts Mills earthquake of March 1993 was a crustal earthquake with a magnitude of 5.6 (Madin and others, 1993). This type of earthquake is relatively common in the Portland area and the northern Willamette Valley. Recent crustal earthquakes with magnitudes greater than 4.5 have occurred in the Portland area in 1953, 1961, 1962, and 1963 (Bott and Wong, 1993; Wong and Bott, 1995).

Intraplate earthquakes occur at greater depths, roughly 20 to 40 miles deep, and occur within the subducted portion of the Juan de Fuca Plate. Intraplate earthquakes could occur anywhere beneath the Coast Range or Willamette Valley, although current research indicates that the likelihood is small (Wong, 2005). Intraplate earthquakes occurred in the Puget Sound area in 1949 (magnitude 7.1) and 1965 (magnitude 6.5). The 1949 earthquake caused damage in the Portland area as well as northwestern Washington.

Subduction zone earthquakes occur along actively subducting plate margins. These earthquakes are among the most powerful, with magnitudes of 8 to 9. These earthquakes are commonly associated with coastal subsidence (sinking) and tsunamis. The 1964 "Good Friday Earthquake" in Alaska, magnitude 9.2, is an example of a subduction zone earthquake.

The Cascadia Subduction Zone, located off the coast of Oregon and Washington, has the potential to produce earthquakes with magnitudes greater than 8.0. A great deal of effort is being expended to study the history of and potential for great subduction earthquakes off the Oregon coast. No subduction zone earthquakes are documented in the roughly 200 year historical record. Evidence contained in many coastal bays and marshes suggests that these great earthquakes (magnitude 8.0+) occur every 300 to 600 years, with the last event about 300 years ago. The potential for damage from subduction zone earthquakes is great because of the combination of strong ground shaking, long duration of shaking and the wide area which is affected. A subduction zone earthquake off the Oregon coast could cause damage throughout much of western Oregon.

Earthquakes impacting the Wildwood to Wemme project would most likely be crustal earthquakes associated with the nearby Mount Hood Volcano. Although small earthquakes occur frequently in the Mount Hood vicinity, larger earthquakes would likely be related to eruptions of the volcano.

Landslide Hazards

The potential for major landslides within the Wildwood to Wemme project is very limited. The topography is relatively gentle and the geologic conditions are generally favorable.

Volcanic Hazards

Volcanic hazards within the project area that could adversely impact the roadway include earthquakes, ashfall, floods, and lahars (volcanic mudflows) related to an eruption of nearby Mount Hood. Lahars likely pose the greatest threat to the highway with about a 30-minute travel time from the anticipated source to the project area (Scott, 1997).

Soil and Rock Resources

No economic minerals are known within the Wildwood to Wemme project. The Brightwood Quarry, located just west of the project area may be offered as an aggregate source. The quarry is on land owned by the BLM. The quarry was established and operated by ODOT under a program administered by FHWA to provide rock materials for construction and operation of US 26. Rock materials may be taken from this quarry (if offered) or another source at the discretion of the contractor.

Environmental Consequences

Much of the overall alignment crosses semi-developed land. Long-term impacts to the geologic environment will consist of relatively minor changes in topography and drainage patterns, minor settlement of near-surface materials; potential increased erosion, and potential minor changes in slope stability. These impacts will occur as a result of excavation, placement of structures and fills, and clearing and grading.

Site specific geotechnical investigations will be performed prior to final design. These investigations will detect problem areas and designs can be developed to mitigate any adverse effects.

No Build Alternative

As the title implies, the No-Build Alternative would result in no construction and therefore, no impacts on the geologic environment would occur.

Build Alternative

The proposed changes to US 26 include widening the existing roadway, northward, about 16 feet and reconfiguring intersecting roadway approaches.

The wider mainline will require a wider embankment. Retaining walls may be employed to limit the impact to visual resources adjacent to the embankment section. Additional stormwater structures will be necessary. These will require excavation and, potentially, low embankments.

New cut slopes and other soil surfaces may be subject to increased erosion.

Settlement of the newly constructed embankments and walls is possible. Failures are possible in the newly constructed embankment and cut slopes.

Secondary Impacts

No secondary impacts are anticipated.

Cumulative Impacts

The surficial geologic units have been significantly impacted by prior activities within the existing roadway prism. The changes that will occur due to this project include clearing and grubbing for embankment foundation, localized grade changes, minor changes in slope stability, and minor changes in erosion potential. Additional development along the corridor may add to the amount of disturbed soil.

Aggregate sources either within or outside the corridor will be used to provide rock materials for the highway construction. This will result in incremental depletion of this resource. Future highway construction planned for the corridor will further this depletion.

Construction Impacts

Construction operations that have potential to increase erosion and sedimentation include clearing and grubbing in unpaved areas; removal of existing pavement; foundation excavations; grading of subgrade; construction of temporary access roads and work areas; and construction of embankments.

Construction operations that have potential to cause settlement or adversely impact slope stability include embankment and cut construction and grade changes on existing slopes.

Mitigation Measures

Site specific geotechnical investigations will be performed prior to final design. These investigations will detect problem areas and designs can be developed to mitigate any adverse long term effects on the geologic environment.

Short term (construction) slope stability will be considered as part of the design process. A construction sequence and schedule can be developed to minimize this impact. Development and implementation of a comprehensive erosion and sediment control plan will mitigate this impact to the geologic environment.

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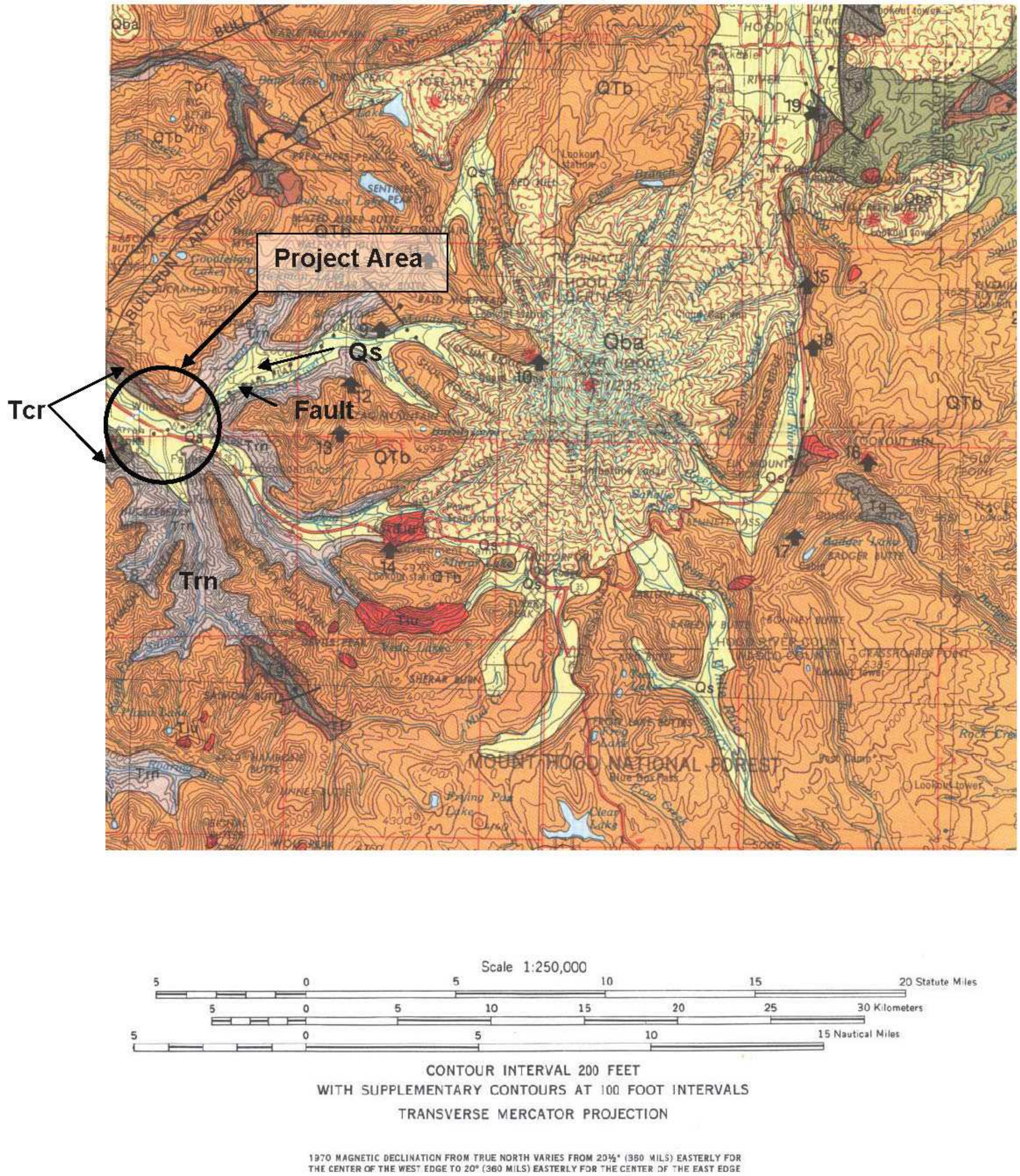

Figure 1. Geologic Map