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Mapbook K3B
Seismic and Quaternary Faults
Out-of-State Rail Corridor
Vancouver Energy

LEGEND
- BNSF Railway
- State Boundary
- County Boundary

Peak Acceleration (%g) with a Probability of Exceedence in 50 years
- 4 - 8
- 8 - 16
- 16 - 24
- 24 - 32
- 32 - 200

Quaternary Faults
- Inferred
- Moderately constrained
- Well constrained

Sources:
- Seismic Hazards - USGS, 2008.

Note: The locations of faults as depicted on these maps may have errors of up to XX feet (Meters) or more.
Appendix P.2

Landslide Hazards
Mapbook K2A
Potential Landslide Areas
In State Rail Corridor
Vancouver Energy

LEGEND

- **BNSF Railroad**
- **County Boundary**

**Landslide Probability (WADNR)**
- Certain
- Probable
- Questionable
- Unknown

**Landslides Incidence and Susceptibility (USDOI)**
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5 % of the area is involved)
- No data

Sources:
Washington State Department of Natural Resources, 2010.
ESRI USDOI USGS Landslide Map Service.
LEGEND

- **BNSF Railroad**
- **County Boundary**

**Landslide Incidence and Susceptibility (USDOI)**
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5% of the area is involved)
- No data

**Landslide Probability (WADNR)**
- Certain
- Probable
- Questionable
- Unknown

Sources:
- ESRI USDOI USGS Landslide Map Service.
LEGEND

- **BNSF Railroad**
- **County Boundary**

**Landslide Probability (WADNR)**
- Certain
- Probable
- Questionable
- Unknown

**Landslides Incidence and Susceptibility (USDOI)**
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5% of the area is involved)
- No data

Mapbook K2A
Potential Landslide Areas
In State Rail Corridor
Vancouver Energy

Sheet 4 of 9
Sources:
Washington State Department of Natural Resources, 2010.
ESRI USDOI USGS Landslide Map Service.
LEGEND

BNSF Railroad
County Boundary
Landslide Incidence and Susceptibility (USDOI)
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5 % of the area is involved)
- No data

Sources:
Washington State Department of Natural Resources, 2010.
ESRI USDOI USGS Landslide Map Service.
LEGEND

BNSF Railroad
County Boundary

Landslides Incidence and Susceptibility (USDOI)
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5% of the area is involved)
- No data

Sources:
Washington State Department of Natural Resources, 2010.
ESRI USDOI USGS Landslide Map Service.
Mapbook K2A
Potential Landslide Areas
In State Rail Corridor
Vancouver Energy

LEGEND

- BNSF Railroad
- County Boundary

Landslide Probability (WADNR)
- Certain
- Probable
- Questionable
- Unknown

Landslides Incidence and Susceptibility (USDOI)
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and moderate incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5% of the area is involved)
- No data

Sources:
Washington State Department of Natural Resources, 2010.
ESRI USDOI USGS Landslide Map Service.
Mapbook K2B
Landslide Susceptibility
Out of State Rail Corridor
Vancouver Energy

Sources:

Landslides Incidence and Susceptibility
- High landslide incidence (over 15% of the area is involved in landsliding)
- Moderate landslide incidence (1.5 - 15% of the area is involved)
- High susceptibility to landsliding and moderate incidence
- High susceptibility to landsliding and low incidence
- Moderate susceptibility to landsliding and low incidence
- Low landslide incidence (less than 1.5% of the area is involved)
- No data
Mapbook K2B
Landslide Susceptibility
Out of State Rail Corridor
Vancouver Energy

Sources:
LEGEND
- Columbia River 1/4 Mile Buffer
- State Boundary
- County Boundary
- Landslide Probability
  - Certain
  - Probable
  - Questionable
  - Unknown

Mapbook K2C
Potential Landslide Areas
Columbia River Marine Corridor
Vancouver Energy

Washington State Department of Natural Resources, 2010.
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LEGEND

BNSF Railroad
BNSF Rail Corridor One Mile Buffer (half mile each side of railway)
Washington Water Resource Inventory Area (WRIA)
County Boundary

Wetlands within Corridors
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond

Pipeline
Stream/River- Perennial
Stream/River- Intermittent
Stream/River- Ephemeral

Water Resource Features
Wetlands, Streams, Floodplains

Sources:
Hydrography - USGS National Hydrography Dataset (NHD)
Washington Water Resource Inventory Area (WRIA)
Wetlands - USFWS National Wetlands Inventory (NWI)
Floodplains - FEMA Flood Insurance Rate Maps (FIRM) and WA Dept. of Ecology.
All available digital FEMA floodplain data within study corridors is shown. Digital floodplain data is not currently available for the following Oregon counties: Hood River, Wasco, Sherman and Gilliam.
LEGEND

Columbia River 5-mile River Markers
BNSF Railroad
BNSF Rail Corridor One Mile Buffer (half mile each side of railway)
Mid-Columbia River Half Mile Buffer (1/4 mile each side of river)
Washington Water Resource Inventory Area (WRIA)
County Boundary

Wetlands within Corridors
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine

Water Resource Features
Wetlands, Streams, Floodplains

Sources:
All available digital FEMA floodplain data within study corridors is shown. Digital floodplain data is not currently available for the following Oregon counties: Hood River, Wasco, Sherman and Gilliam.
LEGEND

- Columbia River 5-mile River Markers
- BNSF Railroad
- BNSF Rail Corridor One Mile Buffer (half mile each side of railway)
- Mid-Columbia River Half Mile Buffer (1/4 mile each side of river)
- Washington Water Resource Inventory Area (WRIA)
- County Boundary

Water Resource Features

Wetlands, Streams, Floodplains

Sources:
- Hydrography - USGS National Hydrography Dataset (NHD)
- Washington Water Resource Inventory Area (WRIA)
- Wetlands - USFWS National Wetlands Inventory (NWI)
- Floodplains - FEMA Flood Insurance Rate Maps (FIRM) and WA Dept. of Ecology.

All available digital FEMA floodplain data within study corridors is shown. Digital floodplain data is not currently available for the following Oregon counties: Hood River, Wasco, Sherman and Gilliam.
LEGEND

- Columbia River 5-mile River Markers
- Columbia River Half Mile Buffer (1/4 mile each side of river)
- Washington Water Resource Inventory Area (WRIA)
- County Boundary

Wetlands within Corridors
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Other

Water Resource Features
Wetlands, Streams, Floodplains

Sources:
- Hydrography - USGS National Hydrography Dataset (NHD)
- Washington Water Resource Inventory Area (WRIA)
- Wetlands - USFWS National Wetlands Inventory (NWI)
- Floodplains - FEMA Flood Insurance Rate Maps (FIRM) and WA Dept. of Ecology.

All available digital FEMA floodplain data within study corridors is shown. Digital floodplain data is not currently available for the following Oregon counties: Hood River, Wasco, Sherman and Gilliam.
LEGEND

Columbia River 5-mile River Markers
Columbia River Half Mile Buffer (1/4 mile each side of river)
Washington Water Resource Inventory Area (WRIA)
County Boundary

Wetlands within Corridors
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Canal/Ditch
- Stream/River- Perennial
- Stream/River- Intermittent

100 Year Flood Zone

Water Resource Features
Wetlands, Streams, Floodplains

Sheet 11 of 11

Sources:
ESRI World Topographic Map Service, 2014
Hydrography - USGS National Hydrography Dataset (NHD)
Washington Water Resource Inventory Area (WRIA)
Wetlands - USFWS National Wetlands Inventory (NWI)
Floodplains - FEMA Flood Insurance Rate Maps (FIRM) and WA Dept. of Ecology.
All available digital FEMA floodplain data within study corridors is shown. Digital floodplain data is not currently available for the following Oregon counties: Hood River, Wasco, Sherman and Gilliam.
LEGEND

- BNSF Railroad
- BNSF Rail Corridor One Mile Buffer (half mile each side of railway)
- County Boundary

- Points of Diversion Washington
- Wellhead Protection Zones 5-year (Washington)
- Sole Source Aquifer
- Surface Water Intake
- Drinking Water Well
- Community Water System
- Non-Community Water System

Water Sources and Water Supply

Washington State Department of Ecology Geographic Water Information System
Oregon State Water Right Points of Diversion
Oregon State Surface Water Drinking Water Source Areas
Oregon State Groundwater Drinking Water Source Areas
Washington State Department of Health, Office of Drinking Water and Division of Information Resource Management
National Sole Source Aquifer
BerganABAM

Sheet 2 of 11
LEGEND

- Columbia River 5-mile River Markers
- BNSF Railroad
- BNSF Rail Corridor One Mile Buffer (half mile each side of railway)
- Mid-Columbia River Half Mile Buffer (1/4 mile each side of river)
- County Boundary

Water Sources and Water Supply

- Points of Diversion Washington
- Wellhead Protection Zones 5-year (Washington)
- Surface Water Intake
- Drinking Water Well
- Community Water System
- Non-Community Water System

LEGEND

Columbia River 5-mile River Markers

BNSF Railroad

BNSF Rail Corridor One Mile Buffer (half mile each side of railway)

Mid-Columbia River Half Mile Buffer (1/4 mile each side of river)

County Boundary

Points of Diversion Washington

Points of Diversion Oregon

Surface Water Drinking Water Source Areas (Oregon)

Ground Water Drinking Water Source Areas (Oregon)

Wellhead Protection Zones 5-year (Washington)

Surface Water Intake

Drinking Water Well

Community Water System

Non-Community Water System

Water Sources and Water Supply


Sheet 5 of 11
Appendix P-5

Public Lands
LEGEND

- BNSF Rail Corridor Half Mile Buffer
- County Boundary
- Bureau of Land Management (BLM)
- Army Corps of Engineers
- City Land
- Conservation Easement (Private Landowner)
- County Land
- Fish and Wildlife Service (FWS)
- Forest Service (USFS)
- Joint Ownership
- Land Trust
- National Park Service (NPS)
- State Department of Natural Resources
- State Fish and Wildlife
- State Park & Recreation
- The Nature Conservancy (TNC)
- WA Dept Fish & Wildlife

Mapbook K7A
Public Lands
In State Rail Corridor
Vancouver Energy

Sources:
US Geological Survey (USGS) Gap Analysis Program (GAP).
LEGEND

- BNSF Rail Corridor Half Mile Buffer
- County Boundary
- Bureau of Land Management (BLM)
- Army Corps of Engineers
- City Land
- Conservation Easement (Private Landowner)
- County Land
- Fish and Wildlife Service (FWS)
- Forest Service (USFS)
- Joint Ownership
- Land Trust
- National Park Service (NPS)
- State Department of Natural Resources
- State Fish and Wildlife
- State Park & Recreation
- The Nature Conservancy (TNC)
- WA Dept Fish & Wildlife

Mapbook K7A
Public Lands
In State Rail Corridor
Vancouver Energy

Sources:
US Geological Survey (USGS) Gap Analysis Program (GAP).
Mapbook K7A
Public Lands
In State Rail Corridor
Vancouver Energy

Sources:
US Geological Survey (USGS) Gap Analysis Program (GAP).
Mapbook K7C
Public Lands
Columbia River Marine Corridor
Vancouver Energy

Sources:
US Geological Survey (USGS) Gap Analysis Program (GAP)
Marcellus Shrub-steppe Preserve

Columbia Plateau Trail

Rosenau Easement

Columbia Basin Wildlife Area Complex

Salnave Park

Sutton Park

Myers Park

Public Lands and Select Recreation Sites In Study Corridors

Sources:
Protected Areas Database of the United States;
USGS Gap Analysis Program (GAP)
ESRI Recreation Areas, 2014
City of Spokane, Clark County
Appendix P-7

Previously Recorded Archaeological Resources within Study Area
Previously Recorded Archaeological Resources within the Study Area

Sources:
Previously Recorded Archaeological Resources within the Study Area

LEGEND

- Cities
- 5-mile interval
- BNSF Rail Corridor Half Mile Buffer (each side of railway)
- County Boundary

Archaeological Resources (count)

0
1 - 5

Sources:
Previously Recorded Archaeological Resources within the Study Area

Sources:
Previously Recorded Archaeological Resources within the Study Area

LEGEND
- Cities
- 5-mile interval
- BNSF Rail Corridor Half Mile Buffer (each side of railway)
- County Boundary

Archaeological Resources (count)
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 50
- 51+

Sources:
Previously Recorded Archaeological Resources within the Study Area

Sources:
Previously Recorded Archaeological Resources within the Study Area

<table>
<thead>
<tr>
<th>Archaeological Resources (count)</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5</td>
<td>Cities</td>
</tr>
<tr>
<td>6 - 10</td>
<td>5-mile interval</td>
</tr>
<tr>
<td>11 - 15</td>
<td>Columbia River 1/2 Buffer (1/4 mile each side of river)</td>
</tr>
<tr>
<td>21 - 50</td>
<td>BNSF Rail Corridor Half Mile Buffer (each side of railway)</td>
</tr>
<tr>
<td>51+</td>
<td>County Boundary</td>
</tr>
</tbody>
</table>

Previously Recorded Archaeological Resources within the Study Area

Sources:
Previously Recorded Archaeological Resources within the Study Area

Sources:
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Appendix P-8

Previously Recorded Historical Resources within Study Area
Previously Recorded Historic Resources within the Study Area

LEGEND
- Cities
- 5-mile interval
- BNSF Rail Corridor Half Mile Buffer (each side of railway)
- County Boundary

Historic Resources (count)
- 0
- 1 - 4
- 5 - 9
- 76
- 213

Sources:
Previously Recorded Historic Resources within the Study Area

Sources:
Previously Recorded Historic Resources within the Study Area

LEGEND
- Cities
- 5-mile interval
- BNSF Rail Corridor Half Mile Buffer (each side of railway)
- County Boundary

Historic Resources (count)
- 0
- 1 - 4
- 10 - 20

Sources:
Previously Recorded Historic Resources within the Study Area

LEGEND
- Cities
- 5-mile interval
- BNSF Rail Corridor Half Mile Buffer (each side of railway)
- County Boundary

Historic Resources (count)

Sources:
Previously Recorded Historic Resources within the Study Area

LEGEND

- Cities
- 5-mile interval

Columbia River 1/2 Mile Buffer (1/4 mile each side of river)
BNSF Rail Corridor Half Mile Buffer (each side of railway)
County Boundary

Historic Resources (count)

- 0
- 1 - 4
- 5 - 9

Previously Recorded Historic Resources within the Study Area

- Cities
- 5-mile interval
- Columbia River 1/2 Mile Buffer (1/4 mile each side of river)
- County Boundary

Legend:
- Historic Resources (count):
  - 0
  - 1 - 4
  - 526

Sources:
Appendix P-9

Previously Recorded Archaeological Resources within the Mid-Columbia Study Area
Previously Recorded Archaeological Resources within the Mid-Columbia Study Area

LEGEND
- Cities
- 5-mile interval
- Mid-Columbia Study Area
- County Boundary

Archaeological Resources (count)
- Yellow: 6 - 10
- Orange: 11 - 15
- Red: 16 - 20
- Dark Red: 21 - 50
- Maroon: 51 - 109

Sources:
Previously Recorded Archaeological Resources within the Mid-Columbia Study Area

Legend:
- Cities
- 5-mile interval
- Mid-Columbia Study Area
- County Boundary

Archaeological Resources (count):
- Yellow: 6 - 10
- Orange: 16 - 20
- Red: 21 - 50

Sources:
Previously Recorded Archaeological Resources within the Mid-Columbia Study Area

Sources:
Previously Recorded Archaeological Resources within the Mid-Columbia Study Area

Sources:
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Appendix P-10

Previously Recorded Historical Resources within the Mid-Columbia Study Area
Previously Recorded Historic Resources within the Mid-Columbia Study Area

Sources:
Previously Recorded Historic Resources within the Mid-Columbia Study Area

Sources:
Previously Recorded Historic Resources within the Mid-Columbia Study Area

Sources:
Previously Recorded Historic Resources within the Mid-Columbia Study Area

Sources:
Figure P.11-2 Transfer Pipeline System (Enlarged Figure 2-11)
Figure P.11-3  AERMOD Projected Maximum Criteria Pollutant Concentrations During Operations West (Enlarged Figure 3.2-3)

Source: BergerABAM, 2014

Note: The yellow lines depict Port parcels and the orange dots show the points of maximum concentrations.
Figure P.11-4  AERMOD Projected Maximum Criteria Pollutant Concentrations During Operations East (Enlarged Figure 3.2-4)

Source: Berger/NDM, 2014

Note: The yellow lines depict Port parcels and the orange dots show the points of maximum concentrations.
<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>SERIES</th>
<th>GEOLOGIC UNIT</th>
<th>HYDROGEOLOGIC UNIT</th>
<th>LITHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUATERNARY</td>
<td>Holocene</td>
<td>Quaternary alluvium</td>
<td>Unconsolidated aquifer</td>
<td>Silt, sand, and clay comprise flood plain deposits of the Columbia and Willamette Rivers. Alluvium along major tributaries is sandy gravel. Late Pleistocene catastrophic floods of the Columbia River deposits on the basin floor are boulder gravel, sandy gravel, and sand with sandy silt extending to 400-foot altitude. Late Pleistocene terrace deposits are weakly consolidated thin sand and gravel beds.</td>
</tr>
<tr>
<td></td>
<td>Pleistocene</td>
<td>Holocene volcanics</td>
<td>Tillite gravel aquifer</td>
<td>Pleistocene volcanioclastic conglomerates derived from the Cascade Range are weakly to well consolidated sandy gravel with lithic sandstone lenses and beds. Trousdale Formation is cemented basaltic gravel with quartzite pebbles and micaceous sand matrix and lenses, as well as minor lithic- lithic sand beds. Boring lava that erupted from vents in the Portland area is fine to medium olivine basalt and basaltic andesite lava flows with less abundant pyroclastics. High Cascade Range volcanics are olivine basalts and basaltic andesite flows that erupted, and for the most part deposited east of the Sandy River. The upper 10 to 100 feet of the aquifer is weathered loess and residual soil.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand River Member</td>
<td>Confining unit 1</td>
<td>Bedded micaceous arkosic siltstone and sandstone with some thin lenses of lithic and vitric sandy tuffs and siltstone, and clay.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tualatin Formation</td>
<td>Trudell gravel aquifer</td>
<td>Coarse vitric sandstone and basaltic conglomerate interlayered with siltstone, sandstone, and claystone.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tualatin Formation</td>
<td>Confining unit 2</td>
<td>Bedded micaceous siltstone and sandstone with some thin lenses of lithic and vitric sand, tuffaceous silt and sandstone, and clay.</td>
</tr>
<tr>
<td>TERTIARY</td>
<td>Pleistocene</td>
<td>Columbia River Basalt Group</td>
<td>Fine-grained sedimentary rocks</td>
<td>Discontinuous beds of micaceous sand, gravel, and silt with localized vitric sandstone lenses. Upper part is gravelly along the Columbia River in east part of study area; elsewhere, upper part is interlayered with micaceous sand, silt, and clay.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Older rocks</td>
<td>Sand and gravel aquifer</td>
<td>Rhododendron Formation consists of lava flows and dense volcanic breccia. Columbia River Basalt Group is a series of basalt flows, some have fractured scoriaceous tops and bases. Marine sedimentary rocks are predominantly dense silts and sandstones. Skamania volcanics are dense flow rock, breccia and volcaniclastic sediment. Older basals are sequences of flows with some breccia and sediment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marine rocks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure P.11-6  Troutdale Aquifer System – Sole Source Aquifer Area (Enlarged Figure 3.3-7)
Figure P.11-7  Troutdale Aquifer System – Wellhead Protection Zones (Enlarged Figure 3.3-8)

Source: Clark County 2015.
Note: The wellhead protection areas show 1-, 5-, and 10-year zones. Each zone represents the length of time it would take a particle of water to travel from the zone boundary to the well.

Figure P.11-8  Contaminated Site Area (Enlarged Figure 3.3-9)

Source: BergerABAM 2015c.
Figure P.11-9  Land Use in the West Vancouver Area (Enlarged Figure 3.10-1)
Figure P.11-10  Recreational Sites within Proposed Action Study Area (Enlarged Figure 3.12-1)
Figure P.11-11  Cultural Resources Survey Area (Enlarged Figure 3.13-1)
Fire Protection Districts within the Rail Corridor Study Area (Enlarged Figure 3.15-1)
Figure P.11-13 Locations of Projects and Actions with additional Rail and/or Vessel Traffic (Enlarged Figure 5-2)