Millennium Bulk Terminals—Longview SEPA Environmental Impact Statement

SEPA Climate Change Technical Report

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Acronyms and Abbreviations

°F	degrees Fahrenheit
Applicant	Millennium Bulk Terminals—Longview
BNSF	BNSF Railway Company
CCC	Cowlitz County Code
CDID	Consolidated Diking and Improvement District
CFR	Code of Federal Regulations
CMIP5	Fifth Coupled Model Intercomparison Project
GHG	greenhouse gas
LVSW	Longview Switching Company
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
PUD	Public Utility District
RCP	Representative Concentration Pathway
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
UP	Union Pacific Railroad
USC	United States Code
VOC	volatile organic compound
WAC	Washington Administrative Code

Chapter 1
Introduction

This technical report discusses the potential impacts of climate change in relation to the proposed Millennium Bulk Terminals—Longview project (Proposed Action). The impacts are evaluated in two categories. First, the potential impacts of climate change on the Proposed Action and the No-Action Alternative (e.g., impact of increased precipitation on the Proposed Action and No Action Alternative) are summarized. Second, the impacts of climate change on other resource areas to determine if it may exacerbate or relieve the impacts of the Proposed Action (e.g., droughts exacerbating the impact of the Proposed Action on water quality in the Columbia River).

1.1 Project Description

Millennium Bulk Terminals—Longview, LLC (Applicant) is proposing to construct and operate a coal export terminal (Proposed Action) in Cowlitz County, Washington along the Columbia River (Figure 1). The coal export terminal would receive coal from the Powder River Basin in Montana and Wyoming, and the Uinta Basin in Utah and Colorado via rail shipment. The coal export terminal would receive, stockpile, and load coal onto vessels and transport the coal via the Columbia River and Pacific Ocean to overseas markets in Asia.

1.1.1 Proposed Action

Under the Proposed Action, the Applicant would develop the coal export terminal on 190 acres (project area) primarily within an existing 540-acre site that is currently leased by the Applicant (Applicant's leased area). The project area is adjacent to the Columbia River in unincorporated Cowlitz County, Washington near Longview, Washington (Figure 2). The Applicant currently operates and would continue to operate a bulk product terminal within the Applicant's leased area.

BNSF Railway Company (BNSF) or Union Pacific Railroad (UP) trains would transport coal on BNSF main line routes in Washington State, and the BNSF Spur and Reynolds Lead in Cowlitz County to the project area. Coal would be unloaded from rail cars, stockpiled, and loaded by conveyor onto ocean-going vessels for export at two new docks (Docks 2 and 3) located in the Columbia River.

Once construction is complete, the Proposed Action could have a maximum annual throughput capacity of up to 44 million metric tons of coal per year. The coal export terminal would consist of one operating rail track, eight rail tracks for storing up to eight unit trains, rail car unloading facilities, a stockpile area for coal storage, conveyor and reclaiming facilities, two new docks in the Columbia River (Docks 2 and 3), and shiploading facilities on the two docks. Dredging of the Columbia River would be required to provide access to and from the Columbia River navigation channel and for berthing at the two new docks.

Vehicles would access the project area from Industrial Way (State Route 432), and vessels would access the project area via the Columbia River. The Reynolds Lead and BNSF Spur track—both jointly owned by BNSF and Union Pacific Railroad (UP) and operated by Longview Switching Company (LVSW)—provide rail access to the project area from a point on the BNSF main line (Longview Junction) located to the east in Kelso, Washington. Coal export terminal operations would occur 24 hours per day, 7 days per week. The coal export terminal would be designed for a minimum 30-year period of operation.

At full terminal operations, approximately 8 loaded unit trains each day would carry coal to the export terminal, 8 empty unit trains each day would leave the export terminal, and an average of 70 vessels per month or 840 vessels per year would be loaded, which would equate to 1,680 vessel transits in the Columbia River annually.

Figure 1. Project Vicinity

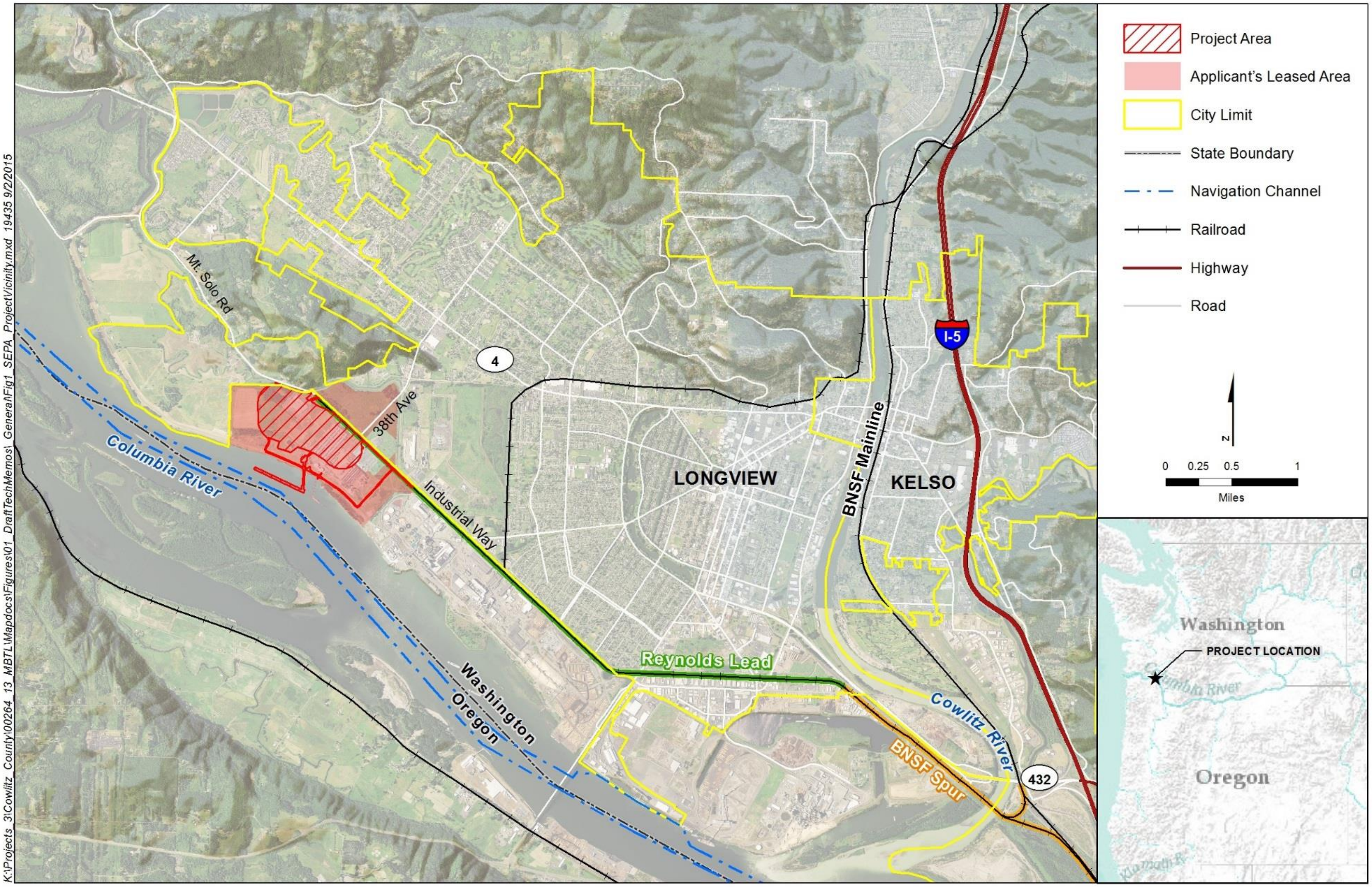
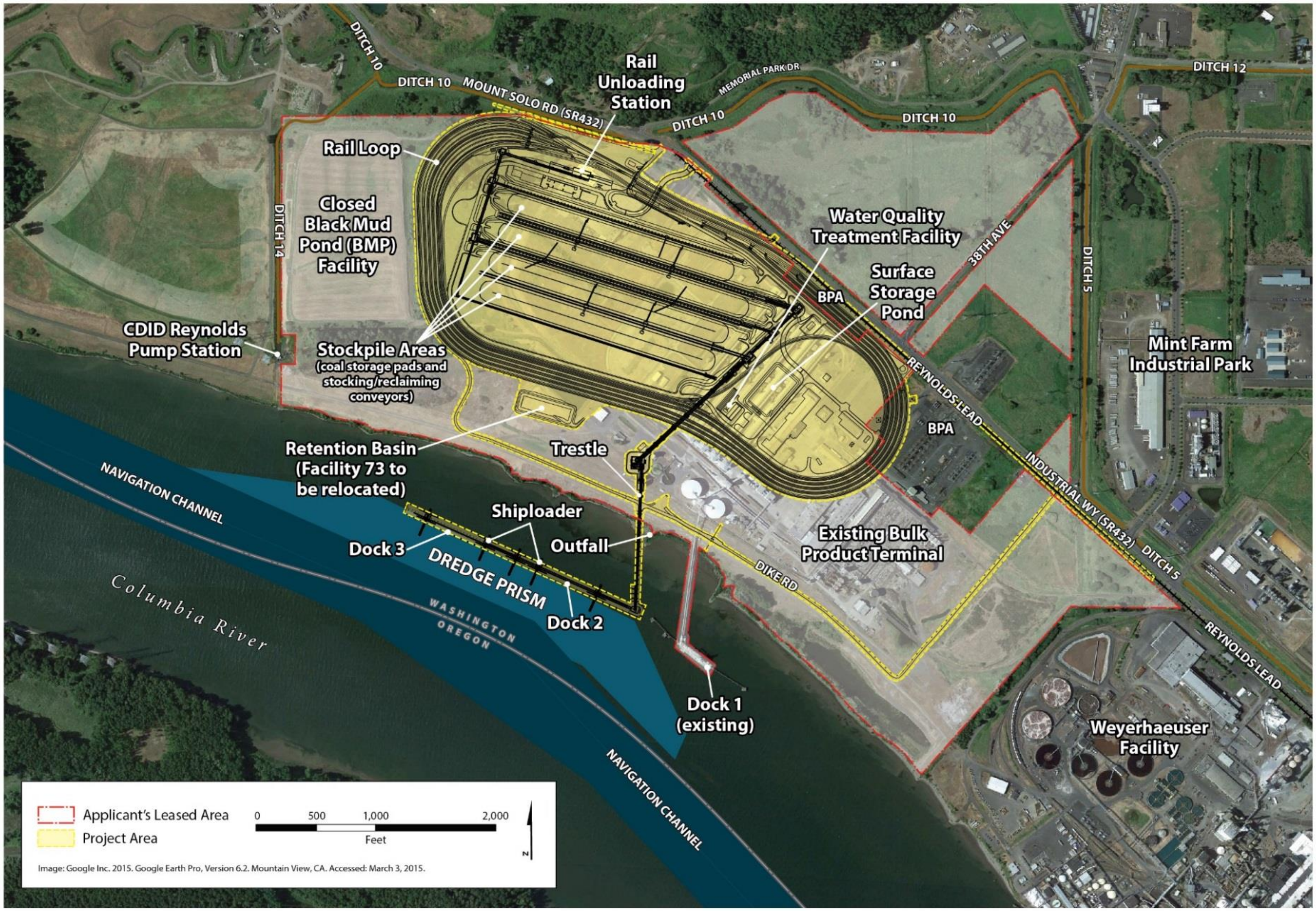


Figure 2. Proposed Action



1.1.2 No-Action Alternative

The Applicant plans to continue operating its existing bulk product terminal located adjacent to the project area. Ongoing operations would include storing and transporting alumina and small quantities of coal, and continued use of Dock 1. Maintenance of the existing bulk product terminal would continue, including maintenance dredging at the existing dock every 2 to 3 years. The Applicant plans to expand operations at the existing bulk product terminal, which could include increased storage and upland transfer of bulk products utilizing new and existing buildings. The Applicant would likely need to undertake demolition, construction, and other related activities to develop expanded bulk product terminal facilities.

If the coal export terminal is not constructed, the Applicant would likely propose expansion of the bulk product terminal onto areas that would have been subject to construction and operation of the proposed coal export terminal. Additional bulk product transfer activities could involve products such as a calcined pet coke, coal tar pitch, cement, fly ash, and sand or gravel. Any new operations would be evaluated under applicable regulations. Upland areas of the project area are zoned Heavy Industrial and it is assumed future proposed industrial uses in these upland areas could be permitted. Any new construction would be limited to uses allowed under existing Cowlitz County development regulations.

1.2 Regulatory Setting

The jurisdictional authorities and corresponding regulations, statutes, and guidance for determining potential climate change impacts are summarized in Table 1.

Table 1. Regulations, Statutes, and Guidelines for Climate Change

Regulation, Statute, Guideline	Description
Federal	
National Environmental Policy Act (42 USC 4321 *et seq*.)	Requires the consideration of potential environmental effects. NEPA implementation procedures are set forth in the President's Council on Environmental Quality's Regulations for Implementing NEPA (49 CFR 1105).
Clean Air Act of 1963 (42 USC 7401)	Directs the control of air pollutants nationally. The U.S. Supreme Court in 2007 established that greenhouse gases are air pollutants, and are therefore covered under this Act.
State	
Washington State Environmental Policy Act (WAC 197-11, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.

Regulation, Statute, Guideline	Description
Requirements of Strategy—Initial Climate Change Response Strategy (RCW 43.21M.020)	Directs state agencies to develop an integrated climate change response strategy to enable state, tribal, and local governments and public and private organizations to prepare for and adapt to the impacts of changing climate conditions. *Preparing for a Changing Climate: Washington State's Integrated Climate Change Response Strategy* outlines strategies for protecting human health, safeguarding infrastructure and transportation systems, improving water management, reducing losses to agriculture and forestry, protecting sensitive and vulnerable species, and supporting communities by involving the public.
Washington State's Growth Management Act (WAC 365-195-920)	Requires counties and cities to include the "best available science" when developing policies and development regulations. Suggests the use of adaptive management as an interim approach for managing scientific uncertainty.
Local	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.

USC = United States Code; NEPA = National Environmental Policy Act; RCW = Revised Code of Washington; WAC = Washington Administrative Code; CCC = Cowlitz County Code; SEPA = Washington State Environmental Policy Act

1.3 Study Area

The study area for potential impacts from climate change on the Proposed Action and No-Action Alternative is defined as the project area for the Proposed Action and the access roads and rail leading to the project area.

The study area for the potential for climate change effects to exacerbate or alleviate the impacts of the project on other resource areas is equivalent to the study areas set for those specific resource areas.[1]

[1] For example, the analysis of the ability of climate change to exacerbate or alleviate the impacts of the project on geology and soils is the same as the study area defined in the SEPA Geology and Soils Technical Report (ICF 2017a).

Chapter 2
Climate Change and Projected Changes to Climate

This section summarizes the recent and projected future climate conditions in the study area. Trends and projections in temperature, precipitation, and snowfall are provided for current and historical conditions (generally from 1950 to 2005), the near-term future (2025 to 2049), and the midterm future (2050 to 2075)[2]. Midterm future conditions are typically considered in climate change analyses and are consistent with the likely operation of the Proposed Action. Future changes in climate will depend on the concentration of greenhouse gases (GHG) released to the atmosphere by human activities in the coming decades. As a result, climate projections are provided for both moderate and high GHG concentration scenarios.[3]

2.1 Greenhouse Effect

The Earth retains outgoing thermal energy and incoming solar energy in the atmosphere, thus maintaining heat temperature levels suitable for biological life. This retention of energy by the atmosphere is known as the greenhouse effect.[4] When solar radiation reaches the Earth, most of the solar radiation is absorbed by the Earth's surface, reflected by the Earth's surface and atmosphere, or to a lesser degree, absorbed by the Earth's atmosphere. Simultaneously, the Earth radiates its own heat and energy out into the Earth's atmosphere and space. Factors such as the reflectivity of the Earth's surface, the abundance of water vapor, or the extent of cloud cover affects the degree to which solar radiation may be absorbed and reflected. Figure 3 shows the energy flows to and from Earth and the role that the greenhouse effect plays in maintaining heat in the atmosphere.

The composition of gases in the Earth's atmosphere determines the amount of energy absorbed and re-emitted by the atmosphere or simply reflected back into space. The predominant gases in the Earth's atmosphere, nitrogen and oxygen (which together account for nearly 90% of the atmosphere) exert little to no greenhouse effect. Gases such as carbon dioxide, methane, and nitrous

[2] The very near term 2006–2024 is not addressed here. This term is typically covered by existing procedures and examination of current conditions are adequate for planning purposes. Further, the very near term does not allow future climatic changes to be realized and assessed. Hence, this period is excluded from consideration in this report.

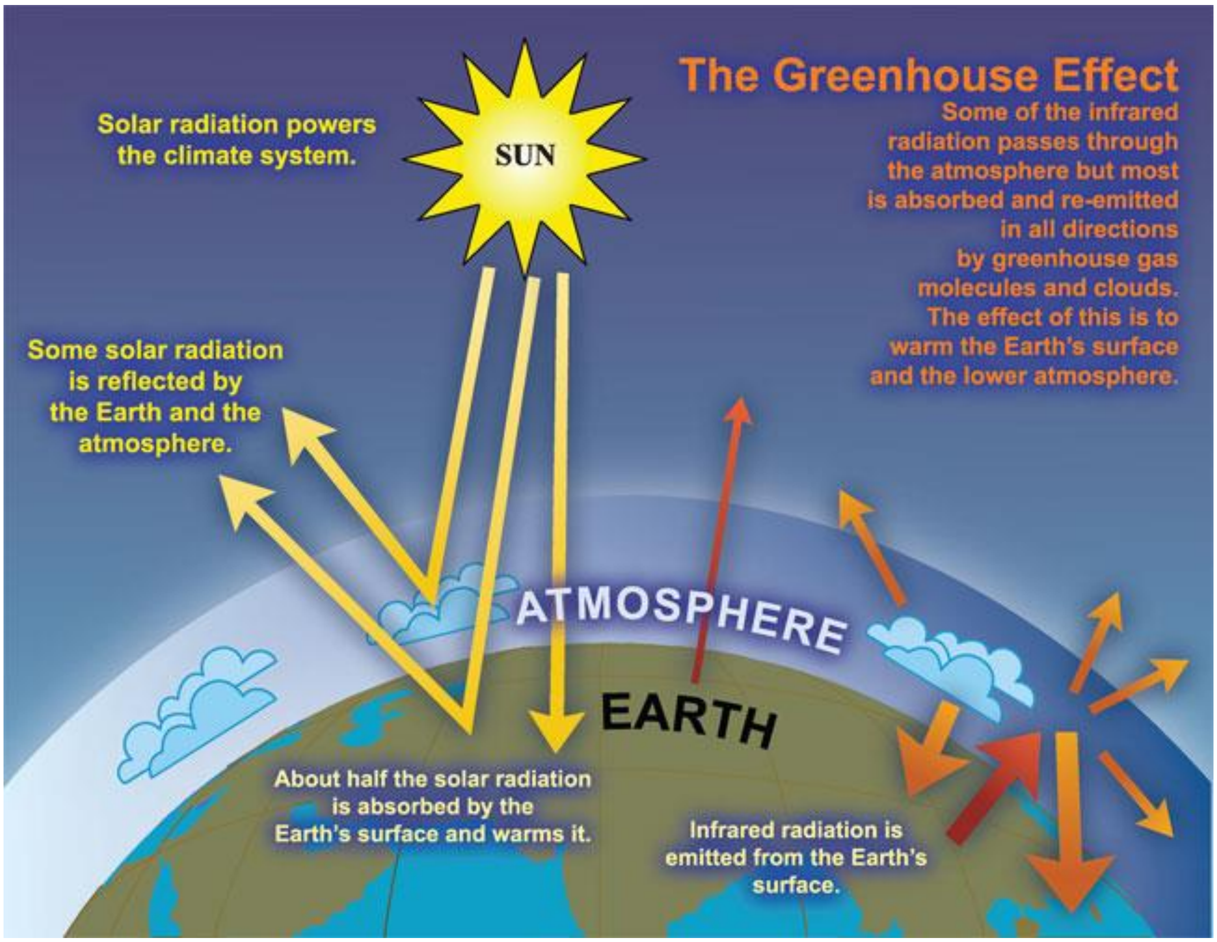
[3] Unless otherwise noted, the moderate concentration scenario corresponds to Representative Concentration Pathway (RCP) 4.5; the high concentration scenario corresponds to RCP 8.5. RCPs project increases in atmospheric concentrations of GHGs between now and 2100. They are used in international climate modeling to develop consistent future scenarios of climate change and have been adopted by the Intergovernmental Panel on Climate Change in its Fifth Assessment Report.

[4] The Intergovernmental Panel on Climate Change (2014) defines the greenhouse effect as follows:

The infrared radiative effect of all infrared-absorbing constituents in the atmosphere. Greenhouse gases, clouds, and (to a small extent) aerosols absorb terrestrial radiation emitted by the Earth's surface and elsewhere in the atmosphere. These substances emit infrared radiation in all directions, but, everything else being equal, the net amount emitted to space is normally less than would have been emitted in the absence of these absorbers because of the decline of temperature with altitude in the troposphere and the consequent weakening of emission. An increase in the concentration of greenhouse gases increases the magnitude of this effect; the difference is sometimes called the enhanced greenhouse effect. The change in a greenhouse gas concentration because of anthropogenic emissions contributes to an instantaneous radiative forcing. Surface temperature and troposphere warm in response to this forcing, gradually restoring the radiative balance at the top of the atmosphere.

oxide, trap outgoing energy and contribute to the greenhouse effect. These greenhouse gases are pollutants under the federal Clean Air Act. Additionally, manufactured pollutants, such as hydrofluorocarbons, can contribute to the greenhouse effect. Unlike most air pollutants (e.g., particulate matter) that have only a local impact on air quality, GHGs affect the atmosphere equally, regardless of where they are emitted, and thus are global pollutants. A ton of methane emissions in Asia affects the global atmosphere to the same degree as a ton of methane emissions in the United States.

Figure 3. An Idealized Model of the Natural Greenhouse Effect



Source: Intergovernmental Panel on Climate Change 2007

As the atmospheric concentrations of GHGs increase, the atmosphere's ability to retain heat increases as well. Since the instrumental record began in 1895, the U.S. average temperature has risen by approximately 1.3 to 1.9 degrees Fahrenheit (°F) (U.S. Global Change Research Program 2014). Furthermore, U.S. average temperatures throughout the 21st century are expected to increase at a faster pace, by 3°F to 10°F by 2100 above a 1970 to 1999 baseline (U.S. Global Change Research Program 2014).

The impacts of higher global surface temperatures include widespread changes in the Earth's climate system. Increased surface temperatures is causing sea level to rise both from thermal expansion of seawater as well as increased melting of ice sheets in the most northerly and southerly reaches. It is also changing weather patterns, including the frequency, severity, and duration of heat waves, drought, and extreme precipitation events. Incidences of drought are expected to become more frequent.

Climate change also affects the natural environment and virtually all aspects of society, including biodiversity, invasive species, human health, cultural resources, infrastructure, and other sectors. The impacts will vary by location and depend on the nature of the hazards experienced. Coastal areas are particularly at risk because of their exposure to sea level rise.

2.2 Climate Change Projections

This section describes the data and methods used to identify projected changes in climate and to evaluate the impacts of climate change on the Proposed Action and No-Action Alternative.

This report assesses available information on historical climate and projected changes in climate change for southwestern Washington State using[5] the U.S. Geological Survey National Climate Change Viewer (2014) and the 2014 National Climate Assessment (Melillo et al. 2014).

- **National Climate Change Viewer.** The National Climate Change Viewer contains historical and future climate projections at watershed, state, and county levels for the continental United States. The viewer contains *multimodel ensemble data* (*mean model*), combining the results from 30 independent climate models developed by researchers around the world under the coordination of the Fifth Coupled Model Intercomparison Project (CMIP5).[6] Multimodel data increases the robustness of projections and provides information on the level of uncertainty in the direction and magnitude of future climate trends. Climate information in the viewer has been *downscaled*, or processed using statistical analysis to provide projections with higher geographic resolution of temperature, precipitation, and snowfall. Historical values and future projections of temperature were examined for Cowlitz County where the Proposed Action would be located. Historical values and future projections of precipitation and snowfall were examined for the Lower Columbia River Basin.
- **2014 National Climate Assessment.** The 2014 National Climate Assessment was conducted by the U.S. Global Change Research Program (Melillo et al. 2014). This assessment summarizes the current and future impacts of climate change on the United States. Its findings, which have undergone extensive public and expert peer review, were compiled by a team of more than 300 experts guided by the 60-member Federal Advisory Committee of the National Academy of Sciences. The report uses multimodel ensemble projections developed under CMIP5, supplemented by information from an earlier phase of the project, CMIP3, where necessary. This report relies heavily on the chapters devoted to impacts in the Pacific Northwest whose convening lead authors were Phillip Mote, Oregon State University and Amy Snover, Climate Impacts Group, University of Washington.

[5] Both information sources rely on climate information developed by CMIP5. CMIP5 is the fifth phase of the World Climate Research Programme's Coupled Model Intercomparison Project, which has established a standard set of simulations for coordinated climate experiments among international climate modeling groups. CMIP5 data is accessible over the internet and has been used in the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report, an internationally vetted and authoritative report on global climate change.

[6] A list of the climate models can be found in Appendix 5 of the National Climate Change Viewer Tutorial (U.S. Geological Survey 2014b).

This section provides an overview of the likely climate impacts affecting the Pacific Northwest. The following sections focus more directly on the anticipated impacts at the project's location.

Temperatures have already increased across the Pacific Northwest by 1.3°F since 1895. Precipitation has, as well, but to date these increases are small and vary with location within the region. Under the changing climate, temperatures could rise by as much as 9.7 °F by the end of the century. Future trends in average precipitation are very uncertain and may increase or decrease, but summer precipitation is projected to decrease by as much as 30% by 2100.

Snow pack averaged over the Cascade Mountains has declined by about 20% since 1950 (Mote et al. 2014). In the future, snowpack is expected to continue its downward trend, causing declines in snowmelt. According to Eisner, et al., The snow water equivalent on April 1 could decline by almost half (46%) by the 2040s and virtually disappear by the 2080s, greatly reducing streamflow in some areas. The incidence of extreme precipitation, which causes important impacts on infrastructure in the region, may have increased over time, but it has not yet been demonstrated to be statistically significant. It varies with location within the region. Under the changing climate in the Pacific Northwest, the number of days with daily rainfall greater than one inch could increase by 13% in the 2041–2070 period (Mote et al. 2014).

Sea levels are rising but uplift of the land in parts of the Pacific Northwest mitigates possible impacts from sea-level rise. By contrast, areas around Puget Sound are subsiding and causing larger than average increases in sea levels. For the Pacific Northwest, sea level rise is expected to be as little as five inches or less to greater than four feet by the end of the century. The impacts of the El Nino South Oscillation phenomenon on climate variability can be significant. During El Nino years regional sea levels can increase by 4 to 12 inches and last for many months (Mote et al. 2014).

Climatic changes in precipitation could have far-reaching effects for the Pacific Northwest. Reduced summer rainfall and reductions in snowmelt – demonstrated under all emission scenarios and with near 100% likelihood -- will probably result in reduced streamflow. This trend could cause trade-offs among the many water uses, including transport, agriculture, recreation, and others, and a possible reduction in hydropower. Human activities have extracted so much water that conflicts have already occurred in dry years. Despite these summertime reductions, increases in extreme precipitation could lead to increased flooding, especially in basins that derive their water from both rain- and snowfall. Rising sea levels could also lead to flooding of public and private property including ferry terminals, and roads and railways in coastal areas. Increasing temperatures and reduced precipitation could lead to an increase in wildfires, which are driven in part by water deficits. By the 2080s, the median area burned annually in the Pacific Northwest could quadruple compared to the 1916 to 2007 period (Mote et al. 2014).

Information on the potential impacts of climate change on resource areas was drawn from a diverse set of scientific literature, with reliance on two primary information sources:

- **2014 National Climate Assessment.** In addition to providing information on climate change projections, the National Climate Assessment also provides a summary of the potential impacts of climate change on a wide range of resource areas.
- **Climate Change Impacts and Adaptation in Washington State.** In 2013, the University of Washington produced a summary State of the Knowledge report on the likely effects of climate change on Washington State (University of Washington 2013). The report provides technical summaries detailing observed and projected changes for Washington's climate, water resources, forests, species and ecosystems, coasts and ocean, infrastructure, agriculture, and human health.

The report draws from major international, United States, and Pacific Northwest assessment reports.

2.3 Existing and Future Conditions

This section presents the historical and projected changes in temperature, precipitation, and the snowfall for the study area. Ocean acidification is not addressed here since its impacts on the Proposed Action are anticipated to be minimal.

2.3.1 Historical and Projected Changes in Temperature

Washington State has a varied climate with significant differences in temperature and precipitation on the east and west sides of the Cascade Mountains. Temperatures across the Pacific Northwest have increased from 1895 to 2011 by 1.3°F (Mote et al. 2014). West of the Cascades, where the study area is located, the climate is characterized by mild temperatures, and heavy annual rain and snow. From 1950 to 2005, the highest monthly average temperatures[7] in Cowlitz County were more than 75°F, cooler than Washington State as a whole (77.5°F) but warmer than the lower Columbia River Basin of which it is part (73.4°F). The highest monthly average temperature in Cowlitz County over this period was 77.2°F (August) (U.S. Geological Survey 2014). In general, the lowest monthly average temperatures in Cowlitz County during winter[8] were below 31.6°F from 1950 to 2005. The area has experienced a warming trend in the past five decades; the annual average maximum temperatures have increased by 0.9°F (U.S. Geological Survey 2014).

In the near-term future, seasonal temperatures in the study area are projected to increase. In Cowlitz County, hot summer temperatures could rise by as much as 4.3°F in the high GHG concentration scenario from 2025 to 2049, compared to baseline (U.S. Geological Survey 2014)[9]. Cold winter temperatures are projected to increase by 2.4 to 3.0°F in moderate and high GHG concentration scenarios over this period (U.S. Geological Survey 2014). This warming trend continues into the midterm future (2050 and 2075), where hot summer temperatures in Cowlitz County are projected to increase by 5.4 to 7.2°F. Coldest temperatures are expected to increase by as much as 5.2°F (U.S. Geological Survey 2014). These increases will likely bring the coldest temperatures near to or above the freezing point[10]. While some models project higher or lower increases in temperature, all 30 models agree that temperatures will increase in Cowlitz County. Table 2 summarizes these historical and projected changes in temperature.

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[7] The highest temperatures and precipitation are taken as the top 10% (i.e., 90th percentile) of temperature and precipitation readings or projections. The lowest temperatures and precipitation values are the bottom 10% (i.e., 10th percentile) of all readings or projections.

[8] For seasonal results, winter averages December, January, and February; spring averages March, April, and May; summer averages June, July, and August; and fall averages September, October, and November.

[9] The baseline is defined as 1950 to 2005, which is thought to represent a period during which relatively few changes had occurred because of climate change.

[10] Note that while the average monthly temperatures during winter will likely rise above 32°F, cold temperatures on any given day could still be below freezing.

Table 2. Historical and Projected Changes in Temperature in Cowlitz County, WA

Historical climate and observed changes (1950–2005)	Near-term projected changes (2025–2049 compared to 1950–2005)	Midterm projected changes (2050–2075 compared to 1950–2005)	Level of certainty in projections
The average monthly summer and winter temperatures (approximately 75°F and 32°F, respectively) reflect the moderate climate of the area.	Summer and winter temperature extremes are projected to increase.	Summer and winter temperature extremes are projected to increase.	There is excellent agreement across models on the direction of change.
Highest average monthly summer temperatures (top 10%, or 90th percentile) were above 75.0°F. Max monthly average temperature for August was 77.2°F.	90th percentile temperature is projected to increase by 3.8 to 4.3°F under moderate and high emissions scenarios.	90th percentile temperature is projected to increase by 5.4 to 7.2°F under moderate and high emissions scenarios.	Monthly average temperature is projected to increase in all months across all models compared to 1950–2005.
Lowest monthly average winter temperatures (10th percentile) were below 31.6°F.	10th percentile temperature is projected to increase by 2.4 to 3.0°F under moderate and high emissions scenarios.	10th percentile temperature is projected to increase by 4.0 to 5.2°F under moderate and high emissions.	

2.3.2 Historical and Projected Changes in Precipitation

Extreme precipitation especially during the winter months has frequently led to flooding events in the Pacific Northwest. These storms have caused billions of dollars of loss and have been responsible for about two-thirds of the presidential disaster declarations since 1955. Major flooding in January 2009 closed Interstate 5, heavily damaged the Howard Hanson Dam and put tens of thousands of people at risk (Warner et al. 2012). A key driver of these precipitation events is the phenomenon of atmospheric rivers that form in the Pacific Ocean and move eastward toward the Pacific Northwest. In December 2105, an atmospheric river formed and made landfall along the Washington coast, resulting in almost 16 inches of precipitation over three days across Oregon, Washington, and British Columbia, Canada.

The Columbia River is the fourth largest river in North America. It is influenced by multiple river basins from multiple states and British Columbia. The geographic and hydrologic characteristics of the river, which drains a 259,000 square mile basin, are suited to beneficial multiple-purpose storage development. Since the 1930s, numerous dams, both Federal and private, have been built to store water for flood control, to generate hydroelectric power, and for other purposes. Total storage capacity of these dams is about 25 percent of the 156 million acre foot average annual runoff volume for the Columbia River at its mouth. Federal projects in the basin have 19,900 megawatts of existing hydroelectric capacity, and non-federal projects add 10,700 megawatts (U.S. Army Corps of Engineers 2015).

According to the National Climate Assessment (Mote et al. 2014), the anticipated change in annual precipitation in the Pacific Northwest ranges from decreases (-11%) to increases (+12%) from 2030 to 2059 for the B1, A1B, and A2 scenarios.[11] This variability makes the analysis of potential impacts problematic. Typically, average monthly precipitation is greatest in winter (December through February) and least in summer (June through August) (U.S. Geological Survey 2014). From 1950 to 2005, precipitation in the lower Columbia River Basin averaged 0.40 inch per day in winter (U.S. Geological Survey 2014) and about half that in spring (0.22) and fall (0.25). By contrast, only 0.07 inch per day fell during the summer months.

In the near-term future, the mean model indicates slight increases in the winter, spring, and fall compared to the 1950 to 2005 average. The largest increase in precipitation is projected to occur in fall (4.1 to 2.1%)[12] and winter (2.3 to 4.8%). Very little increase is projected for the spring (0 to 1%) (U.S. Geological Survey 2014). By contrast, summers in the near-term future are projected to become drier by 10 to 12%, although some climate models disagree and instead project that summer precipitation will remain the same or increase (U.S. Geological Survey 2014). Overall, model agreement on precipitation is not strong. For example, in some cases just 19 models project decreases in June precipitation (and 11 indicate increases) for the near-term future. Agreement for the month of August, however, was closer, with 26 models showing decreases and only four demonstrating increases.

Similar changes are projected to continue in the midterm future: the winter, spring, and fall seasons could become wetter, while summers could become drier. In the lower Columbia River Basin, winter and fall precipitation levels are projected to increase by 4.9 to 7.1% and 3.6 to 1.5%, respectively, while spring levels remain relatively constant (0 to 1.8% increase) in moderate and high scenarios compared to the 1950 to 2005 average. Extreme precipitation[13] could increase as the highest events could increase by 5.0 to 6.1% in the near-term future and 6.1 to 8.0% in the midterm future (U.S. Geological Survey 2014), but studies of past trends in observed changes in extreme precipitation have yielded ambiguous results (Mote et al. 2014). Model discrepancies are similar with most models showing increases and others showing decreases. Table 3 summarizes these historical and projected changes in precipitation.

[11] The B1, A1B, and A2 scenarios refer to emissions scenarios from the Intergovernmental Panel on Climate Change's Special Report on Emissions Scenarios (2000). These scenarios have been superseded in the international climate modeling by Representative Concentration Pathway scenarios. The B1 and A2 scenarios are generally considered low and high emissions scenarios, respectively. The A1B scenario falls between them. Since not all projections have been updated with the latest GHG concentration scenarios, these scenarios have been retained where new information is not yet available.

[12] By convention, the value from the moderate emissions scenario is presented first even though the value from the high emissions scenario is lower.

[13] Extreme precipitation is determined as the magnitude of rain events in the 90th percentile (i.e., top 10% of all rain events for precipitation in a given period).

Table 3. Historical and Projected Changes in Precipitation in the Lower Columbia River Basin

Historical climate and observed changes (1950–2005)	Near-term projected changes (2025–2049 compared to 1950–2005)	Mid-term projected changes (2050–2075 compared to 1950–2005)	Level of certainty in projections
Average annual precipitation was 0.24 inch/day.	Wetter winter, spring, and fall seasons; possible drier summers.	Wetter winter, spring, and fall seasons; possible drier summers.	Some models show increases in precipitation while others show decreases. Incidence of extreme precipitation is more likely to increase.
The highest (90th percentile) monthly average precipitation was 0.43 inch/day.	Change in average precipitation by season under moderate and high emission scenarios. • Winter: +2 to 5% • Spring: 0 to +1% • Summer: -10 to -12% • Fall: +4 to +2%	Change in average precipitation by under moderate and high emission scenarios • Winter: +5 to +7% • Spring: +0 to +2% • Summer: -10 to -16% • Fall: +4 to +2%	A majority of models (18 to 26 of 30, depending on the scenario and timeframe) project that precipitation will decrease in the summer.
The lowest (10th percentile) monthly average precipitation was 0.06 inch/day.	Intensity of extreme precipitation could increase. • 90th percentile precipitation is projected to increase by 5 to 6% under moderate and high emissions scenarios.	Intensity of extreme precipitation could increase. • 90th percentile precipitation is projected to increase by 6 to 8% under moderate and high emissions scenarios.	Most models (20 of 30) project an increase in extreme precipitation.

2.3.3 Historical and Projected Changes in Snowpack

Melting snowpack in the Canadian Rockies and the Cascade Mountains provides much of the water flowing in the Columbia River. In contrast to the variable projections in overall precipitation, the anticipated changes in snowfall and snowpack are large and model agreement is very high.

Average annual snowfall was 5.6 inches per month from 1950 to 2005. Average winter and spring snowfall, when virtually all snowfall occurs, was about 29.7 and 33.3 inches, respectively. These levels are expected to decline by 39 to 45% in the near-term future for the moderate and high GHG emissions scenarios. This substantial decrease is projected to occur within relatively narrow bands (winter: 33 to 40%; spring: 41 to 47%). All models indicate decreases in annual, winter, and spring snowfall (U.S. Geological Survey 2014).

In the midterm future, these trends are expected to intensify. Winter snowfall could decline by as much as 62% (ranging from 49 to 62% under the moderate and high emissions scenarios); spring snowfall could decrease by as much as 75% under the moderate emissions scenario and 68% under the high emissions scenario.[14] Again, all models agree that snowfall will decline over time. Table 4 summarizes these historical and projected changes in snowfall.

Table 4. Historical and Projected Changes in Snow in the Lower Columbia River Basin

Historical climate and observed changes (1950–2005)	Near-term projected changes (2025–2049 compared to 1950–2005)	Mid-term projected changes (2050–2075 compared to 1950–2005)	Level of certainty in projections
Heaviest snowfall occurs in the winter and spring leading to high average annual snowfall totals.	Average annual, winter and spring snowfall will likely decline under the moderate and high emission scenarios in the near term.	Average annual, winter and spring snowfall will likely decline under the moderate and high emission scenarios in the mid-term.	There is excellent agreement on the direction of change.
Average annual snowfall was 5.6 inches/month.	Change in average monthly snowfall could decline by 39 to 45%.	Change in average monthly snowfall could decline by 54 to 66%.	All models agree on the direction of the impact.
Average winter and spring snowfall was 29.7 and 33.3 inches, respectively.	Change in average winter and spring snowfall under moderate and high emission scenarios. • Winter: -33 to -40% • Spring: -41 to -47%	Change in average winter and spring snowfall under moderate and high emission scenarios. • Winter: -49 to -62% • Spring: -75 to -68%	All models agree that snowfall will decline in the winter and spring in near- and mid-terms.

[14] Higher emissions do not necessarily equate to increases in precipitation. Note that under the higher emissions scenario, average precipitation declines can be either more or less than under the moderate emissions scenario. Existing models must take other variables such as weather patterns and topography into account when projecting future precipitation levels.

Chapter 3
Impacts

This chapter describes the potential impacts of climate change on the Proposed Action and the No-Action Alternative.

3.1 Proposed Action

This section describes the potential impacts of climate change on the construction and operation of the Proposed Action that could occur within the study area.

3.1.1 Impacts of Climate Change on the Proposed Action

Changes in current and historical patterns of temperature and precipitation may affect the infrastructure, operation, and service of the coal export terminal.

Impacts on the coal export terminal and to transportation routes could be caused by the following climate change impacts

Low water levels. Decreased snowfall in the lower Columbia River Basin, especially in the winter and spring, coupled with potential declines in rainfall in the summer could lead to abnormally low levels of water in the Columbia River, which could impede the passage of large ships to and from the docks at the project area. With the coal export terminal located some 50 miles inland from the Columbia River estuary, the main impact of sea level rise at the project area is expected to be minimal in and of itself, but may reduce the potential for service disruptions from low water and exacerbate the potential for flooding at discrete project locations.

Flooding. Potential precipitation increases and intense downpours could cause the Cowlitz or Columbia Rivers to flood, affecting the rail lines and docks that access the project area or the project area itself.

Wildfire. Higher temperatures could increase the likelihood of wildfire, although wetter summers with reduced wildfire likelihood cannot be ruled out.

3.1.1.1 Service Disruptions from Low Water

Decreased snowfall, especially in the winter and spring, coupled with potential declines in summer rainfall in the Lower Columbia River Basin, could lead to abnormally low levels of water in the Columbia River. Low water levels could impede the passage of large ships to and from the docks of the project area. Low water levels could raise costs for electricity or otherwise force difficult choices on competing water usage. Operational changes to the water management of the Columbia River system may be sufficient to address these potential impacts.

Snowfall is expected to decline substantially in the near and midterm futures (Section 2.3.3, *Historical and Projected Changes in Snowpack*). In the lower basin of the Columbia River, the amount of snow could be reduced by almost half and two-thirds by 2075 (U.S. Geological Survey 2014). In addition, while not all models agree, spring and summer precipitation levels could remain flat or decline over the same periods.

Drought is already of concern. Washington State defines drought as 75% of normal water conditions (Revised Code of Washington 43.83B.400). In the past century, drought occurred from 1928 to 1932, 1992 to 1994, and1996 to 1997, and most recently in 2015. Drought has caused shipping costs to rise, sometimes requiring wheat growers to move their product by rail or truck instead of barge transport. Washington State estimates that it will experience severe or extreme drought 5% of the time in the future and more frequently east of the Cascade Mountains (Washington State Emergency Management Division 2012). This year's drought emergency includes all of Washington State (Washington State Department of Ecology 2015).

The Proposed Action would require ships of the Panamax class to berth at existing and newly installed docks to receive coal shipments. Panamax ships are midsized cargo ships, the largest that could fit through the Panama Canal prior to expansion. They have a capacity of 60,000 to 100,000 deadweight tonnage and require a draft of 42 to 49 feet. The depth of the Columbia River at Longview varies by season. Periodic dredging, as needed, part of the Proposed Action. If precipitation from snow and rain is reduced and low water levels occur on the Columbia River, shipping may be restricted or more dredging may be required.

At the project area, the Columbia River experiences tidal fluctuation, although less than at the mouth of the river. Tidal forces could replace some or all of the water needed for ship passage in the event of low runoff from reduced snowmelt and rainfall. Nonetheless, the impact of low tides on ship passage should be considered. The potential for low water disruptions may also be reduced by future sea level rise. However, because the project area is approximately 50 miles inland from the Columbia River estuary, the impact of sea level rise at the project area is expected to minimal. The Columbia River is also highly managed to provide water for multiple competing uses. For example, low water levels upstream of the project area have constrained recreational boating at times.

3.1.1.2 Damage and Service Disruptions from Flooding

The project area is directly on the Columbia River about 5 miles from the confluence of the Columbia and Cowlitz Rivers (ICF 2017a). The study area, including Longview, is protected from flooding by a levee maintained by the Consolidated Diking Improvement District, which is 34 feet above the Columbia River Datum.[15] It is also protected by a system of sloughs, ditches, and drains. The Federal Emergency Management Agency classifies the project area as Zone B in its Flood Insurance Rate Map, meaning the area is expected to flood every 100 to 500 years.

Water levels in the Columbia River vary by season and year, depending on the snow mass in the upper watershed. Historic crests on the Columbia River range from 13 to 24 feet with flood stage at 13.5 feet. Historic crests on the Cowlitz River range from 21 to 29.5 feet and have been recorded well above flood stage (21 feet). Above 28.5 feet, major flooding at Kelso (across the river from Longview) is expected. This flood stage could overtop the levee and increase erosion rates (ICF 2017b).

[15] The Columbia River Datum is the lowest level recorded on the river, which occurred on October 6, 1886. It is about 2.5 feet above the North American Vertical Datum 1988, which is the national standard geodetic reference for heights.

Under current conditions, flooding is expected to be minimal at the project area for the Proposed Action (ICF 2017a). In the future, flooding could be of concern, particularly from the Cowlitz River. In August 2014, the U.S. Army Corps of Engineers found that sediment buildup on the Cowlitz River was increasing the potential for flooding, Without further action, the flood risk level on the river (0.6%) would be exceeded by 2018 (U.S. Army Corps of Engineers 2014). While future precipitation is somewhat uncertain, the mean model indicates increases in fall and winter precipitation for both the near and midterm futures, which could increase flood risk. Future flood risk could be exacerbated by sea level rise in the Pacific Northwest. Seas are expected to rise by as little as five inches to as much as four feet depending on vertical land movements (either uplift or subsidence).

Additionally, wetlands provide an important buffer for absorbing increased runoff and river overflow during severe precipitation events. The project area currently includes almost 27 acres of natural wetland habitat. Under the Proposed Action, 24.10 acres would be permanently filled. The loss of these wetlands would cause a reduction in flood mitigation and stormwater treatment capacity.

The BNSF Spur and Reynolds Lead that would carry Proposed Action-related trains to the project area could be subjected to flooding. The rail line crosses the Cowlitz River near the confluence with the Columbia River and runs near the rivers for the 5 miles to the project area. Because historical and recent crests have been reported on the Cowlitz River, flood risk from sedimentation is increasing, and future precipitation could increase, flooding of the Reynolds Lead is possible. Cowlitz River flooding at this location would likely disrupt rail and terminal operations, and ballast supporting the rail line could be dislodged. Therefore, Proposed Action-related trains could be affected by a Cowlitz River flood.

3.1.1.3 Service Disruptions from Wildfires

Wildfire is a threat in Washington State. Cowlitz County is considered a high-risk area (Washington State Emergency Planning Division 2012c). Wildfires in Cowlitz County numbered more than 350 from 2004 to 2013, burning more than 561 acres. In late summer and early fall, dry easterly winds can produce extreme fire conditions. This threat has increased over time because of four factors: earlier snowmelt, higher summer temperatures, longer fire season, and an expanded vulnerable area of high-elevation forests. These factors are caused by increases in summer temperatures and past increases can be attributed to climate change (Washington State Emergency Planning Division 2012c). Increasing temperatures, extreme heat events, and drought could have an effect on fire regimes in Washington State by influencing the length of the fire season and contributing to drier conditions and the availability of readily combustible fuel for fires (Mote et al. 2014). Maximum temperatures are predicted to increase while summer precipitation is predicted to decrease in the study area, although there is some disagreement among the models, and some indicate that summers could become slightly wetter (Section 2.3.1, *Historical and Projected Changes in Temperature;* Section 2.3.2, *Historical and Projected Changes in Precipitation*). Hotter and drier summers will increase the likelihood of wildfires. The Proposed Action would be similarly affected by the risk of wildfire.

3.1.2 Impacts of Climate Change on Other Resource Areas

The impacts from construction and operations of the Proposed Action could be compounded by climate change. The following subsections qualitatively examine climate change effects on other resource areas to determine where the environment could be modified by the effects of climate change.

The effect of climate change on the impacts of the Proposed Action on resource areas are summarized as follows. More detail on each of these topic areas follows later in this section.

- **Social and Community Resources.** The combination of projected increases in wildfire risks due to climate change and the additional strain placed on the fire service by the Proposed Action (lCF and BergerABAM 2017) has the potential to increase impacts on community resources. However, fire risk in the project area would be addressed because fire and life safety systems in the project area would be installed according to fire code standards.
- **Cultural Resources.** The combination of projected increases in heavy precipitation events due to climate change and the expansion of impervious surfaces due to the Proposed Action has the potential to increase the risk of flooding events potentially damaging the Consolidated Diking Improvement District (CDID) #1 levee. Permit conditions would reduce the risk of impacts from climate change affecting the proposed export terminal, the Columbia River, and the CDID #1 levee.
- **Geology and Soils.** The projected increase in flooding from more frequent heavy precipitation events due to climate change is not expected to increase erosion or landslide potential in the study area because more than 90% of the project area would be impervious after construction. However, there is a nearby active landslide. The extent to which heavier and more frequent precipitation events due to climate change would result in the toe of the slide extending towards the project area is unknown.
- **Water Quality.** The combination of increased frequency of heavy precipitation events due to climate change, reduced wetlands, and pollutants from Proposed Action construction and operations could create risks of greater runoff pollution into local water bodies and absorption into groundwater. However, all stormwater runoff would be collected for treatment before reuse or discharge to the Columbia River.
- **Vegetation.** Climate change will alter local conditions (e.g., temperature, precipitation), and when coupled with greater land-use disturbances from the Proposed Action, could propagate the growth of noxious weeds that have a greater capacity to adapt than native vegetation species. However, noxious weeds on disturbed lands would be monitored.
- **Fish.** Climate change induced water quality threats, from downstream ocean acidification, warming water temperatures, greater runoff flows, and streamflow variations from climate change coupled with potential changes resulting from the Proposed Action could threaten native fish populations.
- **Wildlife.** Combined habitat disruption effects from climate change (i.e., warming temperatures, longer dry periods, increased heavy precipitation) and the Proposed Action (i.e., physical alteration or removal of habitat) could threaten native wildlife populations and potentially promote the proliferation of invasive wildlife species with a greater capacity for adaptation.

- **Energy and Natural Resources.** Climate change will generate longer and more intense summer droughts and could increase energy and groundwater consumption. However, if climate change were to affect groundwater supply in the project area, the water rights adjudication process would likely address this issue.
- **Air Quality**. Climate change-induced warming temperatures will drive secondary aerosol formation and create greater risks of wildfire, which when coupled with increased fossil fuel combustion from Proposed Action equipment use, could create greater air pollutant concentrations.

3.1.2.1 Built Environment

The following subsections summarize the effect that climate change may have on the impacts of the Proposed Action to the built environment resource areas.

Social and Community Resources

As detailed in the SEPA Social and Community Resources Technical Report (ICF and BergerABAM 2017), construction and operation of the Proposed Action would place new demand on Cowlitz Fire & Rescue protection services. This demand could be compounded by the increasing risk of wildfires from warmer, drier conditions induced by climate change (University of Washington 2013). These conditions are specifically due to projected increases in global and regional average temperatures and reductions in summer precipitation volumes. However, fire risk in the project area would be addressed because the Applicant would be required to install fire and life safety systems in the project area according to fire code standards. These systems would be regularly inspected and maintained. The Applicant would also maintain a surface water storage pond with a reserve of 0.36 million gallons for fire suppression.

Cultural Resources

Potential climate change impacts associated with construction and operations of the Proposed Action could affect the CDID #1 levee. Climate change is expected to increase the frequency of heavy rainfall events throughout the Pacific Northwest, where days with precipitation greater than 1 inch is expected to increase 13% by 2050 (University of Washington, 2013). The Proposed Action would fill existing wetlands with impervious surfaces, reducing the area's natural capacity to control stormwater. The combination of projected increases in heavy precipitation events and the expansion of impervious surfaces has the potential to increase the risk of flooding events, potentially damaging the historic CDID #1 levee. The Proposed Action would construct a new on-site stormwater capture and treatment system to manage the stormwater flood risks. The Applicant would operate the terminal under a National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater Permit that would need to be issued for the Proposed Action. The NPDES permit would outline specific terms and conditions and would be required to adhere to the terms and conditions of that permit, which would reduce the risk of impacts from climate change affecting the proposed export terminal, the Columbia River, and the CDID #1 levee.

3.1.2.2 Natural Environment

The following subsections summarize the effect that climate change may have on the impacts of the Proposed Action to natural environment resource areas.

Geology and Soils

Climate change could affect geology and soils. For example, increases in the frequency of heavy precipitation events could result in high river flows and flooding and generate greater risks for riverside erosion and landslides. Sea-level rise could also increase the likelihood for flooding and erosion in the project area since the location is a tidally influenced segment of the river. However, the project area is within a federally designated diking district. Warming temperatures that create greater rainfall in place of typical snowfall upstream could alter the timing of seasonal flow conditions, such as the timing of spring high-flow events or summer low-flow periods (University of Washington 2013). Decreased rainfall in the spring and summer may increase the likelihood of wind-driven erosion of soils, due to changes in soil moisture content (U.S. Global Change Research Program 2014).

As described in the SEPA Geology and Soils Technical Report (ICF 2017b), the topography in the project area is relatively flat, minimizing the risk of landslides. While soils along the river have a high to moderate capacity for erosion, there is a slight risk for erosion on-site due to protective shoreline armoring, and the combination of a levee with a flat gradient. After construction is complete, the project area would be approximately 90% impervious surfaces, essentially eliminating any risk of erosion within the project area. The project area is near an active deep-seated landslide on the south flank of Mount Solo, but is more than 50 feet from its edge, which is the minimum distance required by the Cowlitz County Critical Areas Ordinance for landslide hazards. While periods of prolonged and intense rainfall (including multiyear periods) could activate this landslide, the extent to which climate change could potentially affect any shift in the landslide in terms of distances traveled or shifts in the leading edge of the landslide toward the project area cannot be predicted.

Water Quality

Climate change-induced impacts on local water quality from the Proposed Action would be associated with increased precipitation, combined with a decrease in local wetlands. Surface and groundwater resources could be affected by intense and sustained precipitation events that could overwhelm the stormwater facilities and inadvertently discharge untreated stormwater that could carry pollutants and debris, including coal dust, from the project area. Pollution that entered these local resources could degrade local water quality, which could affect aquatic and terrestrial species and aquatic habitats.

With reduced wetlands to capture and filter stormwater flows and coal terminal operations producing potential contaminants, surface and groundwater resources could be vulnerable to greater pollution during flood events or periods of sustained precipitation. If not treated, polluted stormwater runoff could seep into the groundwater or discharge to surface waters and degrade water quality. However, the local soils have low permeability for both shallow and deep aquifers, which reduces the risk of polluted water reaching the groundwater table, as described in the SEPA Groundwater Technical Report (ICF 2017e). Further, stormwater generated within the project area would be collected, treated, and either stored on-site for re-use or discharged to the Columbia River. Stormwater discharged to the Columbia River would be treated to meet the NPDES permit requirements. The Applicant would be required to update the NPDES discharge permit every 5 years, which would address future changes in stormwater and discharges.

Vegetation

As described in the SEPA Vegetation Technical Report (ICF 2017c), construction of the Proposed Action would remove over 26 acres of non-wetland vegetation. Operations of the Proposed Action could result in the introduction of invasive or noxious weeds from trains or vessels calling to the project area, which could increase the risk of impacts on native vegetation in and directly adjacent to the project area. Further, climate change could result in conditions favorable to the growth of unwanted invasive or noxious weeds, which are adapted to the changing climate and may be well suited to colonizing highly disturbed areas.

Climate change can support the colonization of invasive species or noxious weeds, where changes in local conditions, such as variations in precipitation events and/or temperature, are more suitable to nonnative plants, which may have a greater adaptive capacity (Bradley et al. 2010). This combination of climate change and Proposed Action impacts could threaten native vegetation populations in and near the project area. However, even if climate change compounds the colonization of invasive species or noxious weeds, the Applicant would monitor for noxious weeds on disturbed land during construction and operations, which would limit the potential for noxious weeds to colonize the project area and disturbed areas adjacent to the project area. In addition, the Applicant would be required to prevent the potential establishment and spread of noxious weeds per Washington State noxious weed regulations (Revised Code of Washington [RCW] 17.10).

Fish

Local fish populations are dependent on a sustained level of water quality, specific temperatures, specific habitat, and other environmental conditions, which may be at risk as climate change impacts are coupled with changes resulting from the Proposed Action. Tribal resources are also centered on local fish populations and the habitats that sustain them.

Stress from the Proposed Action to fish populations, particularly salmonids, could be compounded by warming freshwater temperatures. Downstream ocean acidification could reduce salmonid prey and hinder growth and survival of native fish populations (University of Washington 2015).

Wildlife

As described in the SEPA Wildlife Technical Report (ICF 2017g), the Proposed Action could disrupt local wildlife habitats during operations, which could compound stressors to wildlife populations from climate change. Wildlife species include common species of birds, rodents, mammals, amphibians, reptiles, and invertebrates. Climate change could promote the proliferation of invasive wildlife species that have a higher adaptive capacity in Washington State and the Columbia River (University of Washington 2013).

Construction activities would alter or permanently remove 59 acres of aquatic habitat and permanently remove 24.10 acres of wetland and 26.26 acres of upland terrestrial habitats. These impacts could disrupt normal wildlife behavior patterns. Climate change could further alter habitat conditions and wildlife species' life-cycle events through changes in seasonal weather patterns (i.e., changes in seasonal air and water temperatures, seasonal precipitation patterns) (U.S. Global Change Research Program 2014). Combined Proposed Action and potential climate change impacts may threaten native wildlife populations while promoting climatic shifts in weather and subsequent changes in habitat conditions that provide conditions more suitable to the proliferation of invasive species, which could have a greater capacity for adapting to these changed and variable conditions.

Energy and Natural Resources

As described in SEPA Energy and Natural Resources Technical Report (ICF 2017h), the coal export terminal would consume 6,624,000 kilowatt hours annually during operations, which represents an average of 4% of Cowlitz Public Utility District's (PUD's) electricity demand. Cowlitz PUD currently sources 82.5% of electricity from hydropower sources (Cowlitz Public Utility District 2016). Climate change is projected to intensify summer droughts in the Northwest through longer dry periods and increasing temperatures (U.S. Global Change Research Program 2014), which will reduce summer streamflows and limit the output of hydropower facilities (Seattle City Light 2015). Climate change will also reduce snowpack upstream of hydropower facilities and the project area due to higher average temperatures, creating greater risks for surface water shortages and reduced summer flows (University of Washington 2013).

Washington State is heavily dependent on hydropower for electricity. Approximately 75% of its electricity comes from hydropower generated by its systems of rivers and dams. The rivers also supply water for irrigation, municipalities, and industry. Drought-induced loss of hydropower could raise costs. As the supply of locally generated hydropower is reduced, utilities must seek additional sources of electricity, which could drive up electricity prices for construction and operation of the Proposed Action (Washington State Emergency Management Division 2012). As described in the SEPA Surface Water and Floodplains Technical Report (ICF 2017a) and the SEPA Groundwater Technical Report (ICF 2017e), the Proposed Action would increase on-site water demands. Total annual consumption of water is estimated at 3,387 acre-feet, where 89% would be sourced from existing groundwater wells and 11% from stormwater reuse facilities on-site; there would be no need for new wells. The existing groundwater wells draw from a deep aquifer with low permeability, reducing the capacity for natural recharge.

Climate change could induce longer, drier summers, which, coupled with a decreasing snowpack, could reduce river water levels during droughts, forcing local services to rely more on groundwater resources. Historically, the low permeability of the local aquifers and unaffected recharge from the Columbia River would make any groundwater recharge impacts from the Proposed Action negligible; however, the projected increase in the frequency and severity of droughts due to climate change could affect groundwater recharge. If groundwater recharge were to diminish due to an increase in the frequency and severity of droughts, any subsequent increased reliance on groundwater during times of drought could create greater risks for overdraft conditions, where groundwater is being withdrawn faster than it can be recharged. However, Proposed Action operations would withdraw groundwater under a state-approved water right, which would avoid or limit such an impact from occurring. If climate change were to affect groundwater supply in the project area, the water rights adjudication process would likely address this issue. The adjudication process is key to resolving and preventing water conflicts of increasing water demands and water supply impacts of climate change.

3.1.2.3 Operations

The following subsection summarizes the effect that climate change may have on the impacts of the Proposed Action on operations resource area.

Air Quality

As described in the SEPA Air Quality Technical Report (ICF 2017i), air quality impacts reflect air pollutant emissions from the Proposed Action. Recent research has shown secondary aerosols are primarily driven by increasing temperatures and humidity (Hessberg et al. 2009). With rising average temperatures due to climate change, secondary organic aerosol formation could be accelerated. Secondary aerosols generate particulate matter concentrations from volatile organic compounds (VOCs).

During Proposed Action operations, increased VOC emissions will come from fossil fuel combustion due to equipment and vehicle use on site. Warming temperatures from climate change could drive secondary aerosol formation, and when combined with greater local VOC emissions, could increase air quality risks within and near the project area. Higher temperatures can also lead to increased ground level ozone formation, where VOCs and nitrous oxide emissions from equipment and vehicle use are precursors to this reaction (Union of Concerned Scientists 2011).

Prolonged summer droughts from climate change could create risks for wind erosion, which are a source of particulate matter. These droughts can also create greater risks of regional wildfires, which can affect air quality in the surrounding area through spiked particulate matter emissions. Drought effects may compound the air quality impacts associated with greater fossil fuel combustion from operations.

3.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the coal export terminal and potential climate change impacts related to construction and operation of the Proposed Action would not occur. The Applicant would continue with current and future increased operations in the project area. The project area could be developed for other industrial uses, including an expanded bulk product terminal or other industrial uses. The Applicant has indicated that, over the long term, it would expand the existing bulk product terminal and develop new facilities to handle more products such as calcine petroleum coke, coal tar pitch, and cement.

Ongoing and expanded operations in the project area would be affected by climate change as described for the Proposed Action. These impacts could include possible service disruptions from low water levels, flooding, and wildfires, as well as impacts on local resource areas.

Chapter 4
References

Bradley, B.A., Blumenthal, D.M., Wilcove, D.S. and Ziska, L.H., 2010. Predicting plant invasions in an era of global change. *Trends in Ecology & Evolution*, 25(5), pp.310-318.

Cowlitz Public Utility District. 2016. *Fuel Mix*. Available: https://www.cowlitzpud.org/fuel-mix. Accessed: December 13, 2016.

Hessberg, C.V., Hessberg, P.V., Pöschl, U., Bilde, M., Nielsen, O.J. and Moortgat, G.K., 2009. Temperature and humidity dependence of secondary organic aerosol yield from the ozonolysis of β-pinene. *Atmospheric Chemistry and Physics*, *9*(11), pp.3583-3599.

ICF. 2017a. *Millennium Bulk Terminals —Longview, SEPA Environmental Impact Statement, SEPA Surface Water and Floodplains Technical Report*. April. Seattle, WA. Prepared for Cowlitz County. Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017b. *Millennium Bulk Terminals—Longview, SEPA Environmental Impact Statement. SEPA Geology and Soils Technical Report*. April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017c. *Millennium Bulk Terminals—Longview, SEPA Environmental Impact Statement. SEPA Vegetation Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017d. *Millennium Bulk Terminals—Longview, SEPA Environmental Impact Statement. SEPA Water Quality Technical Report*. April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017e. *Millennium Bulk Terminals—Longview, SEPA Environmental Impact Statement. SEPA Groundwater Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017f. *Millennium Bulk Terminals—Longview SEPA Environmental Impact Statement, SEPA Fish Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017g. *Millennium Bulk Terminals—Longview SEPA Environmental Impact Statement, SEPA Wildlife Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017h. *Millennium Bulk Terminals—Longview, SEPA Environmental Impact Statement, SEPA Energy and Natural Resources Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

ICF. 2017i. *Millennium Bulk Terminals—Longview SEPA Environmental Impact Statement, SEPA Air Quality Technical Report*. April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA in cooperation with Washington State Department of Ecology, Southwest Region.

ICF and BergerABAM. 2017. *Millennium Bulk Terminals—Longview SEPA Environmental Impact Statement, SEPA Social and Community Resources Technical Report.* April. Seattle, WA. Prepared for Cowlitz County, Kelso, WA, in cooperation with Washington State Department of Ecology, Southwest Region.

Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson (Eds.). Cambridge University Press, ISBN 978-0-521-88010-7(pb: 978-0-521-70597-4).

Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, L. L. White (Eds.). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. Available: http://ipcc-wg2.gov/AR5/report/. Accessed: May 31, 2014.

Melillo, J. M., T.C. Richmond, and G.W. Yohe (Eds.). 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program. 841 pp. doi:10.7930/J0Z31WJ2.

Mote, P., A. K. Snover, S. Capalbo, S. D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder. 2014. *Ch. 21: Northwest. Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 487-513. doi:10.7930/J04Q7RWX.

Seattle City Light. 2015. *Climate Change Vulnerability Assessment and Adaptation Plan.* Available: http://www.seattle.gov/light/enviro/docs/Seattle_City_Light_Climate_Change_Vulnerability_Assessment_and_Adaptation_Plan.pdf. Accessed: December 13, 2016.

Union of Concerned Scientists. 2011. *Climate Change and Your Health: Rising Temperatures, Worsening Ozone Pollution.* Available: http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/climate-change-and-ozone-pollution.pdf. Accessed: December 14, 2016.

University of Washington. 2013. *Washington State of Knowledge Report – Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers.* Available: http://cses.washington.edu/db/pdf/snoveretalsok816lowres.pdf. Accessed: November 21, 2016.

University of Washington. 2015. *State of Knowledge: Climate Change in Puget Sound.* Available: http://cses.washington.edu/picea/mauger/ps-sok/PS-SoK_2015.pdf. Accessed: December 6, 2016.

U.S. Army Corps of Engineers. 2014. *Mount St. Helens Long-Term Sediment Management Plan Update*. Available: http://www.nwp.usace.army.mil/Portals/24/docs/projects/MSH_EIS/ Final_Draft_MSH-LRR.pd. Accessed: May 28, 2015.

U.S. Army Corps of Engineers, Northwestern Division. 2015. *Mission-Water Management*. Available: http://www.nwd.usace.army.mil/Missions/Water.aspx. Accessed: December 4, 2015.

U.S. Geological Survey. 2014. *National Climate Change Viewer (NCCV), Washington, Cowlitz County, and the Lower Columbia River Basin. Mean Model Results*. U.S. Geological Survey (USGS). Last revised May 6, 2014. Available: http://www.usgs.gov/climate_landuse/clu_rd/nex-dcp30.asp. Accessed: May 24, 2014.

U.S. Geological Survey. 2014b. *National Climate Change Tutorial.* Available: http://www.usgs.gov/climate_landuse/clu_rd/apps/nccv_documentation_v1.pdf.

U.S. Global Change Research Program. 2014. *National Climate Assessment.* Available: http://nca2014.globalchange.gov/. Accessed: May 18, 2015.

Warner, Michael D., Clifford F. Mass, and Eric P. Salathé Jr., 2012: *Wintertime Extreme Precipitation Events along the Pacific Northwest Coast*: Climatology and Synoptic Evolution. *Mon. Wea. Rev.*, 140, 2021–2043. doi: http://dx.doi.org/10.1175/MWR-D-11-00197.1.

Washington State Department of Ecology. 2015. *Order and Determination by the Director*. Available: http://www.ecy.wa.gov/drought/images/pdf/05212015-droughtorder.pdf. Accessed: July 5, 2015.

Washington State Emergency Management Division. 2012. *Washington State Hazard Mitigation Plan: Drought* Profile. October 2012. Available: http://mil.wa.gov/uploads/pdf/emergency-management/drought_hazard_profile.pdf. Accessed: May 7, 2015.