4.6 Air Quality and Greenhouse Gases

4.6.1 Introduction to Resources and Regulatory Requirements

The East Link Project is located in King County in the Puget Sound Region and therefore falls within the jurisdiction of the Puget Sound Clean Air Agency (PSCAA) for local air quality regulation. Characterizing the existing air quality environment is essential in developing a baseline to assess how changes in vehicle traffic patterns related to the East Link Project might affect existing air pollutant concentration levels. Air quality is characterized in this section by discussing the applicable regulatory framework for the Puget Sound region, describing the existing attainment status with established air quality standards in the project vicinity for each regulated pollutant, and presenting existing air quality monitoring data that support the trend of how existing air pollution control measures improve air quality in the region.

On May 3, 2007, the State of Washington passed Senate Bill 6001, which aims to achieve 1990 greenhouse gas (GHG) levels by 2020, a 50 percent reduction below 1990 levels by 2030, and more by 2050. On October 6, 2010, the White House Council on Environmental Quality (CEQ) released Guidance on Federal Greenhouse Gas Accounting and Reporting that establishes government-wide requirements for measuring and reporting GHG emissions associated with federal agency operations. Currently, the Washington State Department of Ecology (Ecology) has prepared a working paper to assist in applying the State Environmental Policy Act (SEPA) to proposals that will result in GHG emissions or that may be vulnerable to the impacts of those emissions: climate change. A final draft is expected to be released in 2011. Although GHG emissions are federally regulated for large industrial sources, guidance on how to address GHG emissions in environmental documents is currently being developed.

4.6.2 Affected Environment

4.6.2.1 Regulatory Agencies and Requirements

Air quality in the Puget Sound region is regulated and enforced by federal, state, and local agencies—the U. S. Environmental Protection Agency (EPA), Ecology, and PSCAA—each with its own role in regulating air quality. Following the requirements of the federal Clean Air Act (CAA), EPA sets the criteria for National Ambient Air Quality Standards (NAAQS) and conformity requirements and has oversight authority over both PSCAA and Ecology. Ecology strives to improve air quality throughout the state by overseeing the development and conformity of the State Implementation Plan (SIP), which is the state's plan for meeting and maintaining NAAQS. The PSCAA has local authority for setting regulations and permitting of stationary air pollutant sources and construction emissions.

EPA's NAAQS sets limits on concentration levels of certain pollutants, commonly referred to as the "criteria pollutants." The six criteria pollutants are carbon monoxide (CO), lead, nitrogen dioxide (NO_2), particulate matter less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) in diameter, ozone (O_3), and sulfur dioxide (SO_2) (EPA, 2007b). The NAAQS for these criteria pollutants are separated into two standard categories: the Primary and the Secondary standards (40 Code of Federal Regulations [CFR] 50). The Primary standards were created to protect public health; the secondary pollutant standards were established to protect public welfare and the environment.

Table 4.6-1 displays the Primary and Secondary NAAQS for these six criteria pollutants. Ecology and PSCAA have authority to adopt more stringent standards, although many of the state and local standards are equivalent to the federal mandate.

4.6.2.2 Conformity Requirements

The CAA amendment of 1990 and State of Washington regulation require all transportation projects located in air quality maintenance and nonattainment areas in Washington to follow conformity requirements promulgated in their respective regulations (40 CFR Part 93 and Washington Administrative Code [WAC] 173-420) and to conform to the SIP. By conforming to the SIP, the proponent demonstrates that the transportation project will not add any new air quality violations to the area, will not worsen the current violations, and/or will not delay the attainment goals of the NAAQS. The state regulation requires Ecology and the Washington State Department of Transportation (WSDOT) to develop air quality-based criteria for transportation projects to demonstrate conformity to the SIP, for attaining and maintaining the NAAQS, and for meeting all standards of the CAA.

TABLE 4.6-1
Ambient Air Quality Standards by Government Jurisdiction

Pollutant	National Primary	National Secondary	Washington State	Puget Sound Region
Nitrogen Dioxide (NO_2)				
Annual Average	0.053 ppm	0.053 ppm	0.05 ppm	0.05 ppm
Carbon Monoxide (CO)				
1-hour average	35.0 ppm[a]	NS	35.0 ppm	35.0 ppm
8-hour average	9.0 ppm[a]	NS	9.0 ppm	9.0 ppm
Ozone (O_3)				
8-hour average (1997 standard)	0.08 ppm[b]	0.08 ppm[b]	NS	NS
8-hour average (2008 standard)	0.075 ppm[b1]	0.075 ppm[b1]	NS	NS
Lead				
Maximum arithmetic mean (averaged over a calendar quarter)	1.5 μg/m^3	1.5 μg/m^3	NS	1.5 μg/m[c]
Sulfur Dioxide (SO_2)				
1-hour average	NS	NS	0.40 ppm	0.40 ppm
3-hour average	NS	0.5 ppm	NS	NS
24-hour average	0.14 ppm[a]	NS	0.10 ppm	0.10 ppm
Annual arithmetic average	0.03 ppm	NS	0.02 ppm	0.02 ppm
Particulate Matter (PM_{10})				
24-hour average	150 μg/m^3	150 μg/m^3[(c)]	150 μg/m^3	150.0 μg/m^3
Annual arithmetic average	Revoked[d]	Revoked[d]	50 μg/m^3	50.0 μg/m^3
Particulate Matter ($PM_{2.5}$)				
24-hour average	35 μg/m^3[(e)]	35 μg/m^3[(e)]	NS	NS
Annual arithmetic average	15.0 μg/m^3[(f)]	15 μg/m^3[(f)]	NS	NS
Particulate Matter (TSP)				
24-hour average	NS	NS	150 μg/m^3	NS
Annual geometric average	NS	NS	60 μg/m^3	NS

Source: EPA, June 2010, Washington State Dept of Ecology**, 2010**

[a] Not to be exceeded more than once per year.

[b] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor station within an area over each year must not exceed 0.08 ppm.

[b1] The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard. EPA is in the process of reconsidering these standards (set in March 2008).

[c] Not to be exceeded more than once per year on average over 3 years.

[d] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).

[e] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor station within an area must not exceed 35 μg/m^3 (effective December 17, 2006).

[f] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitor station must not exceed 15.0 μg/m^3.

ppm = parts per million

μg/m^3 = microgram per cubic meter

NS = no standard established

TSP = total suspended particulates

The East Link Project is located in the Puget Sound region, which is a maintenance area for CO, with a portion of the project also located in the Duwamish PM_{10} maintenance area. The area is in attainment for all other criteria pollutants.

The project is required to meet conformity requirements both on a regional and project level.

Regional conformity is demonstrated if the project is included in a conforming regional transportation plan (RTP) and a regional transportation improvement program (RTIP). Project-level conformity is demonstrated when three conditions are met:

- The project does not increase the severity or frequency of existing exceedances of the CO and PM_{10} standards.
- The project does not cause a new exceedance of the CO and PM_{10} standards.
- The project does not delay the timely attainment of the CO and PM_{10} standards.

4.6.2.3 Climate and Air Quality

The East Link Project is in the Puget Sound Lowland, which comprises a narrow strip of land along the western side of Puget Sound extending from the Strait of Juan de Fuca in the north to the southern cities of Centralia and Chehalis, and a somewhat wider strip along the eastern side of Puget Sound extending north to the Canadian border. Buffered by the Olympic and Cascade mountain ranges and Puget Sound, the Puget Sound Lowland has a relatively mild, marine climate with cool summers and mild, wet, and cloudy winters.

The prevailing wind direction in the summer is from the north or northwest. The average wind velocity is less than 10 miles per hour (mph). Persistent high-pressure cells often dominate summer weather, creating stagnant air conditions. This weather pattern sometimes contributes to the formation of photochemical smog.

During the winter wet season, the prevailing wind direction is south or southwest. Cold air occasionally flows southward from the interior of Canada through the Fraser River canyon into the Puget Sound Lowland. In the fall and winter, severe storms can produce strong winds that cross the state from the southwest.

Although the Puget Sound Lowland area is the most densely populated and industrialized area in Washington, there is sufficient wind most of the year to disperse air pollutants released into the atmosphere. Air pollution is usually most noticeable in the late fall and winter, under conditions of clear skies, light wind, and a sharp temperature inversion. Temperature inversions occur when cold air is trapped under warm air, preventing vertical mixing in the atmosphere. Inversions can last several days and can prevent pollutants from being dispersed by the wind. Inversions are most likely to occur during the months of October to January. If poor dispersion persists for more than 24 hours, the PSCAA can declare an "air pollution episode" or local "impaired air quality."

4.6.2.4 Pollutants of Concern

Air quality is affected by pollutants that are generated by both natural and manmade sources. In general, the largest manmade contributors to air emissions are transportation vehicles and power-generating equipment, both of which typically burn fossil fuels. The main criteria pollutants of interest for transportation projects are CO, PM, O_3 and the O_3 precursors, volatile organic compounds (VOCs), and oxides of nitrogen (NO_x). Both federal and state standards regulate these pollutants, along with two other criteria pollutants, SO_2 and lead. However, since the Puget Sound region is in attainment and not a maintenance area for NOx, lead, and SO_2, these pollutants are not addressed in this analysis.

The largest contributors of pollution related to transportation projects are motor vehicles. The main pollutants emitted from motor vehicles are CO, particulates, O_3, GHGs, and air toxic pollutants. Motor vehicles also emit pollutants that contribute to the formation of ground-level ozone. This section discusses the main pollutants of concern and their impact on public health and the environment.

Carbon Monoxide

In assessing the localized air quality impacts of transportation projects, CO is the main pollutant of concern. CO is a colorless, odorless, and tasteless gas that results from the incomplete combustion of fuel. CO is ingested into the body by breathing. In low concentrations, CO can cause fatigue in healthy people and chest pain in people with heart conditions. At higher concentrations, CO can cause dizziness, impaired vision and coordination, confusion, headaches, and nausea. In exceptionally high concentrations, CO can be fatal.

The major source of CO is vehicular traffic, along with industry, wood stoves, and slash burns. For urban areas, motor vehicle internal combustion engines are the principal sources of CO that cause ambient air quality levels to exceed the NAAQS. CO concentration increases occur during vehicle cold-starts and winter months when meteorological conditions favor the build-up of directly emitted contaminants. CO is a pollutant whose impact is usually localized, with the highest ambient concentrations of CO occurring near congested roadways and intersections.

Particulate Matter

Particulate matter consists of small particles of dirt, soot, metals, and organic matter. PM of 10 microns in diameter and smaller pose the greatest health problems because it can bypass the natural filtration systems of the nose and throat and enter deep into the lungs, heart, and even the bloodstream, which can cause difficulty with breathing, aggravation of asthma, irregular heartbeat, nonfatal heart attacks, and death in people with heart or lung problems. Due to the size of PM_{10} and $PM_{2.5}$, the wind easily picks up the particles and transports them over long distances to settle on either the ground or water. PM that lands on the ground has the potential to deplete nutrients in the soil, damage sensitive crops, and change the structure of the ecosystem. PM that lands on water can change the acidity in lakes and streams and change the nutrient balance in coastal waters and large river basins. Major sources of PM are construction activity, smokestacks, fires, power plants, and automobiles.

The EPA has set standards for two different size categories of PM. The first standard set is for PM_{10}: particles that are larger than 2.5 microns and smaller than 10 microns in size. These particles are considered "inhalable course particles" and can be found near roadways and dusty industries. The second set of standards is for $PM_{2.5}$: particles that measure 2.5 microns in size and smaller. These particles are called "fine particles" and can usually be found in smoke and haze. These particles are normally directly emitted from forest fires or they can be formed from gases emitted from power plants and automobiles.

Ozone

Normally, O_3 is not emitted directly into the air; however, at ground level, NO_x and VOCs react under the presence of sunlight to form O_3. Emissions from industrial and electric facilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are major sources of NO_x and VOCs.

Ground-level and stratosphere-level O_3 share the same chemical structure; however, their effects differ greatly due to their positions in the atmosphere. Ground-level O_3 has adverse effects due to its potential impacts on human health, while stratospheric ozone has a protective effect by shielding the earth's surface from harmful radiation. When O_3 is inhaled, it can cause a variety of health problems, such as chest pain, coughing, throat irritation, and congestion. The effects can potentially worsen to bronchitis, emphysema, and asthma, reducing lung function and inflaming the linings of the lungs. Repeated exposure can eventually lead to permanent scarring of the lung tissue. Not only does O_3 cause negative human health effects, but it also causes damage to the environment. O_3 can cause sensitive plants to be more susceptible to certain diseases, insects, and other pollutants, which can lead to reduced crop yields, forest growth, and potentially to impacts on species diversity in ecosystems.

O_3 is also the primary element of smog. Sunlight and hot weather are the main causes of the formation of ground-level O_3. As a result, O_3 is referred to as a summertime air pollutant. Many urban areas tend to have high levels of O_3, although even rural areas are subject to increased O_3 levels because the wind can carry O_3 and the pollutants that form O_3 miles away from their original sources.

Climate Change and Greenhouse Gases

Global climate change refers to changes in average climatic conditions on Earth as a whole, including changes in temperature, wind patterns, precipitation, and storms. Global temperatures are moderated by naturally occurring atmospheric gases, including water vapor, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which are known as GHGs. These gases allow solar radiation (sunlight) into the Earth's atmosphere, but prevent radiative heat from escaping, thus warming the Earth's atmosphere. Gases that trap heat in the atmosphere are often called GHGs, analogous to a greenhouse. GHGs are emitted by both natural processes and human activities. The accumulation of GHGs in the atmosphere regulates the Earth's temperature. Without these naturally occurring GHGs, the Earth's temperature would be about 61° Fahrenheit cooler (California EPA, 2006) than it is today. Emissions from human activities, such as electricity production and vehicle use, have elevated the concentration of these gases in the atmosphere, leading to even higher ambient temperatures.

Global warming is a regional and ultimately a worldwide concern. Historical records indicate that global climate changes have occurred in the past due to natural phenomena. However, data indicate that the current global conditions differ from past climate changes in rate and magnitude. Since GHG effects are experienced on a global scale, it is impossible to discuss direct effects of a single development project with future specific climate change.

CO_2 is the most abundant GHG and the primary GHG pollutant emitted by the combustion of fossil fuels. Although they are released by natural processes, burning of fossil fuels by humans produces substantial amounts of these gases. Changes in global CO_2 emissions from fossil fuel combustion are influenced by many long-term and short-term factors, including population and economic growth, energy price fluctuations, technological changes, and seasonal temperatures.

In contrast to most criteria pollutants, emissions of GHGs have been rising from many sources (i.e., industrial, residential, commercial, and transportation). Two of the largest contributors to GHG emissions in the United States are transportation and energy production, although residences, offices, and industries contribute as well. In 2003, it was found that combustion of transportation fuels, the largest source of CO_2, contributed 28 percent of the U.S. GHG emissions. In Washington, the transportation sector accounts for roughly 47 percent of GHG emissions, measured in million metric tons of carbon dioxide ($MMTCO_2e$) (Exhibit 4.6-1). One reason that transportation makes up such a large portion of GHG emissions is that in Washington there is a larger percentage of hydroelectric power than in many other states, so GHG use for electricity production is less than the national average, thereby decreasing the state's total GHGs. The decrease in total GHGs increases the percentage of GHGs from transportation.

The state legislature and mayors of the impacted cities intend to address transportation-related GHGs by reducing their communities' GHG emissions by certain percentages by 2020. GHG emissions from transportation sources are directly related to energy consumption and primarily result from the combustion of fossil fuels in vehicles. The GHG emissions associated with electrical transportation vary widely, depending on the source of electricity. For example hydro-electric generation produces much less GHG emissions than coal plants do. Generally, combusting fuel at a power plant to produce electricity is more efficient than fuel combustion in vehicles. To reduce GHG emissions from transportation sources, effective planning must incorporate modes of transport that use less energy per person per mile traveled and/or use energy derived from fuels that have low carbon content per unit of energy. For example, by changing bus fleets from diesel to natural gas, GHG emissions can be reduced through the use of a low carbon-intensity fuel, and they can be further reduced by increasing regional transit ridership, which uses less energy per person per mile traveled than single-occupant vehicles.

High-capacity transit is integral to fostering the urban villages and growth patterns encouraged by the Washington State Growth Management Act (GMA) and *VISION 2040* (PSRC, 2008). Transit provides an alternative to cars and therefore to the dependence on burning fossil fuels, and it reduces individual vehicle miles estimates. Across the country, studies show how rail-based transit is spurring high-quality, dense transit-oriented development (Cervero, 2008). Focusing growth in "urban centers"—and the density and mix of land uses it implies—is intended to enable residents to live near jobs and other urban activities, to

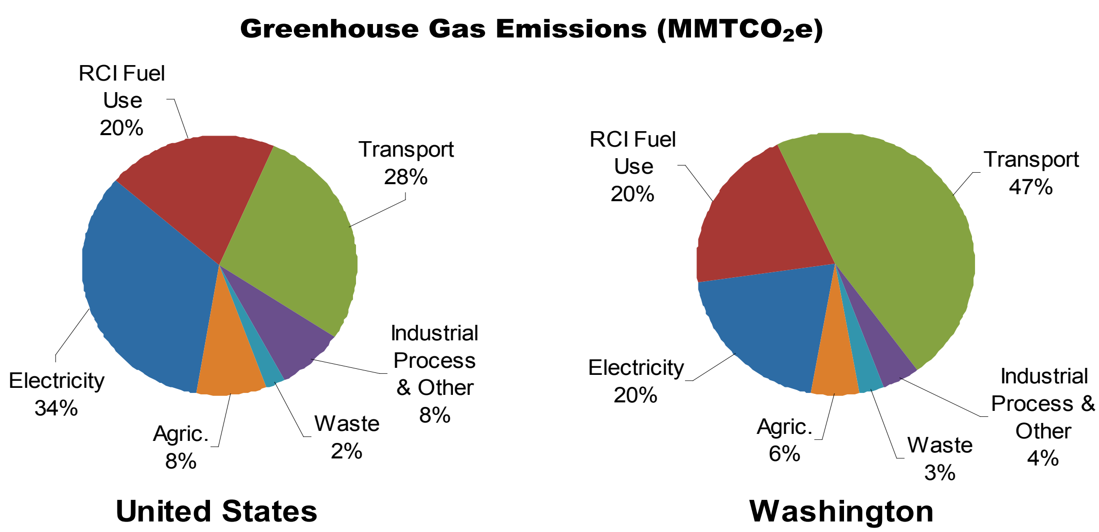

EXHIBIT 4.6-1
Comparison of National and Washington Greenhouse Gas Emissions
Source: Ecology, 2008
(RCI = Residential, Commercial, and Industrial)

help strengthen existing communities, and to promote bicycling, walking, and transit use. The benefits of more walkable communities and convenient alternatives to single-occupant vehicles are well-understood but not easily quantified.

Air Toxic Pollutants

Other pollutants known to cause cancer or other serious health effects are called air toxics. Ecology began monitoring air toxics at the Seattle Beacon Hill site in 2000. In addition to regulating the criteria pollutants, the CAA identifies 188 air toxics, also known as hazardous air pollutants. EPA assessed this expansive toxics list and identified a group of 21 air toxics as mobile source air toxics (MSATs), which are set forth in an EPA final rule, Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 *Federal Register* [FR] 17235). The EPA then extracted a subset of this list of 21, which it labels the seven priority MSATs: benzene, formaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, naphthalene, polycyclic organic matter, and 1,3-butadiene. Exposure to these pollutants for long durations and sufficient concentrations increases the chances of cancer or other serious health effects, including damage to the immune system, neurological problems, and reproductive, developmental, respiratory, and other serious health problems.

The 2004 PSCAA inventory shows that on-road vehicles continue to be the greatest contributors to both criteria pollutant and air toxics emissions in the Puget Sound airshed (PSCAA, 2007). Transportation projects with high potential for MSAT impacts are required to perform project-level MSAT analysis.

4.6.2.5 Air Quality Monitoring and Trends

An area is designated a "nonattainment area" when measured concentrations exceed the NAAQS for a particular pollutant. The area remains a nonattainment area for that particular pollutant until concentrations are in compliance with the NAAQS. Only after measured concentrations have fallen below the NAAQS can the state apply for redesignation to attainment, and it must then submit a 10-year plan for continuing to meet and maintain air quality standards that follow the CAA. During this 10-year period, the area is designated as a "maintenance area." The Puget Sound region, including King County, is currently classified as a maintenance area for CO. The 1-hour O_3 standard was revoked by EPA on June 15, 2005 (40 CFR 50.9(6) and 70 FR 44470). The area currently meets the 8-hour standard; therefore, the maintenance designation for O_3 no longer applies in the Puget Sound region. The approval for PM_{10} in the Seattle Duwamish area came in December 2000 and was redesignated as a maintenance area on March 13, 2002.

The PSCAA monitors criteria air pollutant concentrations at eight facilities in King County, but there are no facilities monitoring NO_2, SO_2, or lead near the project vicinity. CO concentrations are measured at two locations; four locations are currently monitoring O_3 concentrations; three locations are monitoring $PM_{2.5}$ concentrations; and two locations are measuring PM_{10} concentrations. One monitoring station located near Beacon Hill and near the project vicinity measures concentrations of all four pollutants: CO, PM_{10}, $PM_{2.5}$, and O_3. Table 4.6-2 displays the last 3 years of monitoring data to show that the air pollutant concentration trends for these pollutants remain below the NAAQS.

Emission projections and ongoing monitoring throughout the Central Puget Sound region indicate that the ambient air pollution concentrations for CO and PM_{10} have been decreasing over the past decade. Measured O_3 concentrations, in contrast, have remained fairly static. The decline of CO is due primarily to improvements made to emission controls on motor vehicles and the retirement of older, higher-polluting vehicles. However, PSRC estimates that by 2040, the Puget Sound region population will grow by 1.7 million people, increasing 52 percent, to reach a population of 5 million people (PSRC, 2009).

The highest population increase is estimated to be in King County. Estimates like this indicate that CO, PM_{10}, and O_3 emissions will increase , which could lead to future violations. With half of the region's GHG emissions coming from transportation activities, PSRC's *VISION 2040* calls for developing a more sustainable transportation system. The transportation policies call for reducing pollution through cleaner cars, buses, and trucks; cleaner fuels; and fewer vehicle miles traveled. Future mobility needs must consider alternatives to fossil fuels, new transportation technologies, and more alternatives to driving alone. If none of these methods succeed in maintaining emissions, more stringent standards might be needed for the central Puget Sound region to stay in attainment for all criteria pollutants.

Air toxic pollutant emissions are also of concern because of the projected growth in vehicle miles traveled (VMT). EPA has been able to reduce benzene, toluene, and other air toxics emissions from mobile sources by placing stringent standards on tailpipe emissions and requiring the use of reformulated gasoline. Future regulations on fuel and motor

TABLE 4.6-2
Ambient Air Quality Monitoring Data at Beacon Hill in Seattle

Pollutant	2006 Maximum Concentration	2007 Maximum Concentration	2008 Maximum Concentration	NAAQS/PSCAA Standard[a]
Carbon Monoxide[b]				
1-hour average	2.3 ppm	1.4 ppm	1.4 ppm	35 ppm
8-hour average	1.5 ppm	1.0 ppm	0.9 ppm	9 ppm
Ozone[c]				
8-hour average	ND	0.05 ppm	0.052	0.08ppm/NS
Particulate Matter (PM_{10})[b]				
24-hour average	42.0 μg/m^3	ND	ND	150 μg/m^3
Particulate Matter ($PM_{2.5}$)[d]				
24-hour average	26.0 μg/m^3	29.4 μg/m^3	20.5 μg/m^3	35 μg/m^3 /NS
Annual arithmetic average	7.9 μg/m^3	7.19 μg/m^3	7.25 μg/m^3	15 μg/m^3 /NS

[a] Source: http://www.epa.gov/air/data/geosel.html NAAQS standard is listed first.

[b] NAAQS and PSCAA standards are the same.

[c] No PSCAA ozone standard has been established. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor station within an area over each year must not exceed 0.08 ppm.

[d] Only an NAAQS standard has been established for $PM_{2.5}$.

Notes:
Monitoring location was at 4103 Beacon Avenue South, Seattle, WA.
ND no data collected
ppm parts per million
μg/m^3 micrograms per cubic meter
NS no standard

vehicles are expected to reduce air pollutant emissions from 1990 by more than 75 percent by 2020 (EPA, 2007a).

4.6.3 Air Quality Impacts

Operational impacts are assessed at both the regional and local scale of the project.

4.6.3.1 Regional Operational Impacts

Regional operational impacts were assessed by calculating tailpipe emissions for all criteria and toxic air pollutants for the East Link Project using the annual traffic forecast for the full-length, low-ridership, and high-ridership projects for 2020 and 2030. These two conditions represent the full range of potential operational impacts for the project. The year 2020 was chosen as the project's initial forecast year and is the estimated year of opening. The year 2030 represents the future forecast year that is consistent with the regional transportation plan adopted when the analysis began (PSRC, 2001).

Criteria Pollutant Emissions

The tailpipe emission burden was determined using Sound Transit's comparison of annual vehicle-miles for each alternative and the pollutant emission rate data from PSRC. The pollutant emission rates vary depending upon the year examined (2007, 2020, and 2030) and the average speed, ranging from 37.7 to 38.3 mph.

Tailpipe emissions for existing conditions were compared to the 2020 and 2030 No Build Alternatives to illustrate the future trend in pollutant emissions for the Puget Sound regional airshed. Table 4.6-3 summarizes tailpipe emissions for the existing, No Build 2020, and No Build 2030 conditions as well as for the low-ridership and high-ridership projects as determined through ridership modeling. Emission rates for all pollutants would fall from existing conditions to 2030 under all ridership conditions represented. All criteria pollutants under the build alternatives would be well below existing conditions and at or below the No Build pollutant levels. Other pollutants would also be at or below the No Build pollutant levels.

Mobile Source Air Toxics

Regional impacts of MSATs must be evaluated in accordance with the Federal Highway

Administration's (FHWA's) Interim Guidance on Air Toxic Analysis in National Environmental Policy Act (NEPA) Documents (FHWA, 2009). Currently, there are no established criteria for determining when MSAT emissions should be considered a problem. For the purpose of MSAT impact evaluation under NEPA, FHWA has developed a tiered approach for analyzing MSATs. Based on this tiered approach, the East Link Project would be considered to have a low potential MSAT effect because it would not add substantial traffic volumes or change the traffic mix considerably from the No Build Alternative. As a result, the East Link Project would generate minimal air quality impacts for CAA criteria pollutants and would not be linked with any special MSAT concerns. Consequently, MSATs impacts are not expected to occur as a result of the East Link Project. EPA has developed several emission control programs for vehicle engines and fuels that will reduce MSATs over the next 20 years. These programs include reformulated gasoline, a product of CAA legislation that targets the nation's more acute O_3 nonattainment areas; National Low Emissions Vehicle standards; Tier 2 motor vehicle emission standards and associated gasoline sulfur control requirements; heavy-duty engine standards and on-highway diesel sulfur control requirements; the final rule for non-road diesel engines; and proposals for marine and locomotive engines and the 2001 MSAT rule toxic emissions performance standard. According to an FHWA analysis, using the EPA's MOBILE6.2 model (2003), implementing these control programs will decrease MSAT emission rates by 72 percent from 1999 to 2050, even if VMT increases by 145 percent (FHWA,2009).

Regardless of the build alternative chosen, emissions would likely be lower than existing levels in the 2030 design year as a result of the EPA's national control programs. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures; however, the magnitude of the EPA-projected reductions is remarkable in that MSAT emissions in the project vicinity are likely to be lower in the future in nearly all cases.

4.6.3.2 Localized Operational Impacts

The East Link Project would generate minimal air pollutant emissions during operation because the proposed trains are electrically powered. However, air quality in the project vicinity could be affected by changes in traffic flow and volumes locally and regionally and as a result of increased vehicular traffic near the light rail stations and park-and-ride lots.

Light rail is anticipated to improve air quality by shifting commuters from motor vehicle to train ridership. Compared to the No Build Alternative, increased use of light rail is projected to decrease peak-hour morning (AM) and afternoon (PM) traffic volumes locally and regionally, although intersections located near the stations and park-and-ride lots would experience an increase in traffic congestion as more commuters transfer at these locations.

corridor. WASIST uses predefined traffic data to estimate the project-generated CO emissions by inputting a combination of worst-case scenarios simultaneously into the model in an effort to produce the highest possible level of CO emissions. High-volume, signalized intersections with a level of service (LOS) of D or worse would produce traffic congestion that could cause localized CO hotspots, thereby impacting air quality.

Traffic data were collected for the project to determine which intersections would meet this criterion and further degrade the LOS from D to E or F under the future build alternatives. Screened intersections meeting this criterion underwent a CO hot-spot modeling analysis. If the worse-case intersections do not cause an air quality impact, all other intersections would have a lesser impact. Exhibits 4.6-2 through 4.6-4 show all the intersections considered and those that meet the WASIST criteria for modeling CO concentrations.

The initial step in the WASIST modeling process is to perform a "pre-screen." If the pre-screen does not provide a passing result, a complete WASIST analysis is required to better estimate the intersection's impact on ambient CO concentrations. Additional information on how the WASIST model was applied to this project is described in the technical memorandum in Appendix F4.6. The results of the WASIST model are also presented in Appendix F4.6.

Affected intersections were modeled using the WASIST pre-screening analysis. However, they all initially were above the WASIST pre-screen analysis, requiring a complete WASIST analysis, for existing conditions and for the future No Build and build alternatives. The tables in Appendix F4.6 provide the model results at all intersections requiring analysis. Although there are CO NAAQS for both 1-hour and 8-hour averaging periods, past monitoring data show that only the 8-hour NAAQS of 9 parts per million (ppm) has the potential to be exceeded, and, therefore, only the 8-hour CO concentrations from the highest receptor at each affected intersection are reported.

EXHIBIT 4.6-2
Segment A Intersections Analyzed for CO Concentrations with WASIST Model

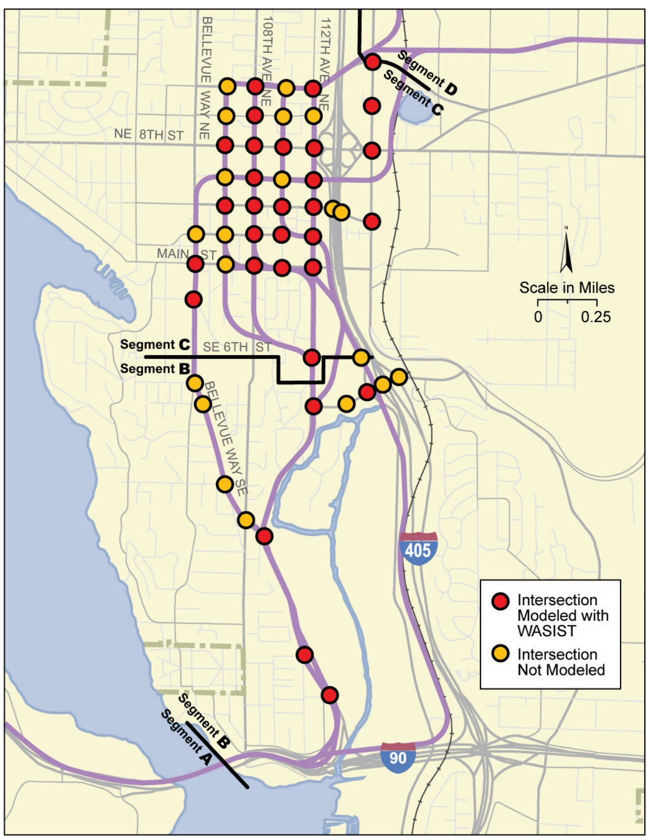

EXHIBIT 4.6-3
Segment B and C Intersections Analyzed for CO Concentrations with WASIST Model

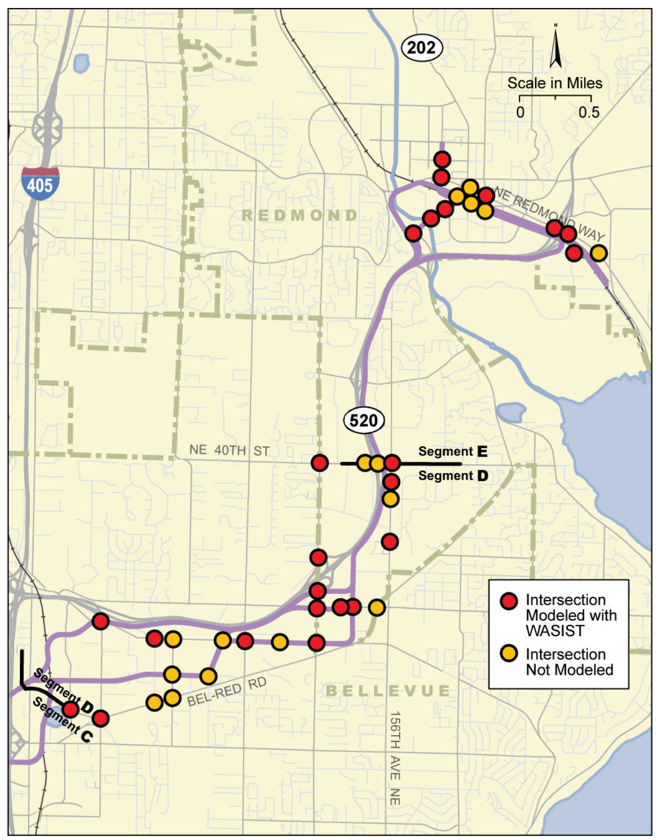

EXHIBIT 4.6-4
Segment D and E Intersections Analyzed for CO Concentrations with WASIST Model

The modeled CO concentrations did not exceed the NAAQS in each case and therefore passed the complete WASIST analysis. Modeled results indicated that the highest CO concentrations would occur under existing conditions. However, these CO levels are still below the 8-hour standard. When existing CO concentrations levels were compared to those in future years, for both the No Build Alternative and the build alternatives, the results indicated a decreasing trend with time.

Higher concentration levels under existing conditions can be attributed to an older vehicle fleet with higher emissions. Under the future years of 2020 and 2030, modeled CO levels decrease as vehicle emissions decrease based on expected future improvements in inspection and maintenance programs, improved vehicle fuel efficiency, and improvements directed by the SIP.

The differences in CO concentrations between the No Build and build alternatives rely mainly on their differences in traffic volume or longer vehicle idle times at intersections. Generally, build CO concentrations were similar to No Build concentrations, except in a few instances where increases in CO concentrations under the build alternatives could be attributed to an intersection's proximity to one of the stations or park-and-ride lots. Minor CO concentration variations would occur among the build alternatives because of increases in traffic volumes resulting from an alternative and increases in extended idle times causing vehicles to remain longer at intersections. However, as shown in the tables presented in Appendix F4.6, none of the CO concentrations are predicted to exceed the 8-hour CO standard of 9.0 ppm with the project alternatives. The modeled impact levels for the various alternatives are between 3.6 ppm and 6.6 ppm at intersections. Often there are negligible differences between the No Build and the build alternatives at congested intersections, but none exceed the 8-hour standard. A summary by segment is provided in the following subsections.

Segment A

With *Preferred Interstate 90 Alternative (A1),* intersection operations generally would improve in Seattle, especially along Rainier Avenue, because East Link would reduce the amount of auto demand on this corridor and near the Interstate 90 (I-90) HOV ramp (D2 Roadway) terminus at 5th Avenue South and Airport Way/Dearborn Street (vehicle access to the ramp would be restricted). Although these improvements would not change the LOS conditions in the project study area, the reduction in volume would provide a slight air quality benefit at intersections in Seattle. This is indicated by the negligible decrease in CO concentrations from 4.2 to 4.1 during 2020 at the Rainier Avenue South and 23rd Avenue South intersection. CO concentrations for the other affected intersections of South Royal Brougham Way and 4th Avenue South, Dearborn Street, and Rainier Avenue South under this alternative would remain unchanged for both 2020 and 2030.

On Mercer Island, nearly all intersections would maintain a LOS of C or better for future No Build and build alternatives. However, the intersection of North Mercer Way and Island Crest Way would experience a degradation of LOS from existing to future 2020 and 2030 conditions. However, as shown in Appendix F4.6, CO concentrations would remain below the current 8-hour standard of 9 ppm. Further CO concentrations would remain unchanged between the No Build and build levels for 2020 and 2030. All predicted CO concentrations would not exceed current standards, so no potential air quality impacts would be likely.

Segment B

In general, with *Preferred 112th SE Modified Alternative (B2M) to C11A*, CO concentrations at the affected intersections would remain unchanged from the No Build Alternative for both 2020 and 2030. However, minor traffic increases would occur under this alternative that would affect the intersections at 112th Avenue SE/Bellevue Way SE and SE 8th Street/118th Avenue SE, resulting in a negligible increase in CO concentrations over the No Build Alternative in both 2020 and 2030. As shown in Appendix F4.6, CO concentrations for the No Build and build alternatives for 112th Avenue SE and Bellevue Way SE would be 4.6 ppm for 2020 and 5.2 ppm for 2030, which remains below the current 8-hour standard of 9 ppm.

Furthermore, CO concentrations for *Preferred Alternative B2M to C9T* would also experience a negligible increase in CO concentrations over the No Build Alternative similar to *B2M to C11A* at the intersection of 112th Avenue SE and Bellevue Way SE for 2020.

Depending on which Segment B alternative is chosen, minor traffic increases would occur and slightly degrade the LOS from the No Build Alternative at the following intersections:

- Bellevue Way SE at the park-and-ride lot intersection would be affected by an increase in traffic to the site under all other Segment B alternatives except BNSF Alternative (B7).

- 112th SE At-Grade Alternative (B2A) is expected to create additional vehicle delay at the Bellevue Way SE and 112th Avenue SE intersection.
- Alternative B7 is expected to degrade intersection operations at SE 8th Street and 118th Avenue SE due to the increase in vehicle traffic from the 118th Station.

These minor traffic increases would result in minor differences in CO concentrations among the alternatives.

All CO concentrations with the other alternatives in Segment B would experience the same CO concentrations as *Preferred Alternative B2M* for both build years 2020 and 2030. No air quality impacts would be expected from *Preferred Alternative B2M* or any of the other alternatives in Segment B.

Because all predicted CO concentrations would not exceed current standards, no potential air quality impacts would be likely.

Segment C

Modeled CO concentrations for *Preferred 108th NE At-Grade Alternative (C11A)* are nearly identical to the No Build Alternative. For 2020, negligible increases in concentrations with *Preferred Alternative C11A* could be found at the following intersections, resulting from minor increases in vehicle volumes from the No Build to *C11A*:

- Main Street and 112th Avenue NE
- NE 4th Street and 108th Avenue NE
- NE 4th Street and 110th Avenue NE
- NE 8th Street and 106th Avenue NE
- NE 8th Street and 116th Avenue NE

For 2030 there would be no increases in CO concentrations from the No Build Alternative to *Preferred Alternative C11A*. At the intersection of NE 4th Street and 110th Avenue, the CO concentrations would have a negligible decrease with *Preferred Alternative C11A*: 4.8 ppm with No Build Alternative and 4.6 ppm with *C11A*. In this instance, traffic volumes decrease slightly under *Preferred Alternative C11A*.

There would be slight increases in CO concentrations between the No Build Alternative and *Preferred Alternative C11A* in 2020 that would not occur in 2030 because improvements in signal timing and vehicular traffic patterns would reduce congestion and offset the increases in traffic in 2030. As a result, CO concentrations would remain unchanged between the No Build Alternative and *Preferred Alternative C11A* in 2030.

Because all predicted CO concentrations would not exceed current standards, no potential air quality impacts would be expected with *Preferred Alternative C11A*.

Modeled CO concentrations for *Preferred 110th NE Tunnel Alternative (C9T)* are similar to those of *Preferred Alternative C11A*. There would be some negligible changes in CO concentrations from the No Build to *Preferred Alternative C9T* for 2020 and 2030.

In general, there would be a shift to mass transit from personal vehicle use with the East Link Project. The use of transit is expected to provide a slight air quality benefit at intersections in the Downtown Bellevue area. Intersections that would be altered under the various Segment C alternatives due to turn movements, travel lane reduction, safety improvements, and the median requirements for the light rail tracks would not have a noticeable impact on CO concentrations. All CO concentrations for the other Segment C alternatives would be nearly identical to the No Build Alternative. None of the modeled CO concentration exceeded 5.4 ppm under the 2030 Segment C build alternatives.

Modeled CO concentrations for all other alternatives are relatively similar to the CO concentrations predicted for *Preferred Alternatives C11A* and *C9T*. Because all predicted CO concentrations would not exceed current standards, no potential air quality impacts would be likely with any Segment C build alternative.

Segment D

Preferred NE 16th At-Grade Alternative (D2A) would result in minor changes in traffic volumes at the NE 20th Street and 140th Avenue NE, NE 20th Street and 148th Avenue NE, and NE 40th Street and 156th Avenue NE intersections. The increases and decreases in traffic volumes would result from changes in vehicular circulation patterns that cause CO concentrations to fluctuate accordingly. For example, for the NE 20th Street/140th Avenue NE and NE 20th Street/148th Avenue NE intersections, CO concentrations would have a negligible decrease in 2020 from the No Build levels as traffic volumes slightly decrease at these intersections. CO concentrations increases would be negligible near the NE 40th Street and 156th Avenue NE intersection in 2020.

CO concentrations under *Preferred Alternative D2A* would remain unchanged from both the 2020 and 2030 No Build Alternative at the intersection of NE 24th Street and 148th Avenue. This intersection also has the highest modeled future CO concentration of 5.7 ppm.

However, this modeled CO concentration does not exceed the 8-hour concentration standard of 9 ppm. Furthermore, modeled CO concentrations for all other Segment D alternatives are identical to the predicted CO concentrations for *Preferred Alternative D2A*.

No potential air quality impacts would be expected because predicted CO concentrations for all Segment D alternatives would not exceed current standards. None of the modeled CO concentration exceeded 5.7 ppm under any of the Segment D 2030 build alternatives.

Segment E

Modeled CO concentrations for *Preferred Marymoor Alternative (E2)* are nearly identical to the No Build Alternative. However, in 2030 for the Redmond Way and SR 520 eastbound intersection, No Build concentrations are 6.1 ppm and *Preferred Alternative E2* concentrations are 6.6 ppm. The negligible increase in CO concentrations from No Build to *Preferred Alternative E2* can be attributed to the increase in wait times for vehicles at intersection signal lights. For the No Build Alternative, the green light times would be longer, thus allowing more vehicles to pass through the intersection and leaving fewer vehicles to sit idle. Idle vehicles generate more emissions than vehicles traveling at a steady and consistent speed.

Modeled CO concentrations for the other Segment E alternatives were nearly identical to the No Build Alternative, with the exception of the intersection of Redmond Way and SR 520 eastbound in 2030. An increase of 0.5 ppm from No Build to Segment E build alternatives can be explained with the addition of the SE Redmond Station. Adding this station would change the light's cycle length times at this intersection, resulting in an increase of vehicles delayed at red lights. However, a CO concentration of 6.6 ppm is below the federal 8-hour standard of 9 ppm.

The modeled CO concentrations for all other alternatives in Segment E are relatively similar to the CO concentrations predicted for *Preferred Alternative E2*. Because all predicted CO concentrations are below current standards, no potential air quality impacts would be likely result from *Preferred Alternative E2* or the other Segment E alternatives. None of the modeled CO concentration exceeded 6.6 ppm under the 2030 build alternatives.

Greenhouse Gases from Operation

GHG emissions are normally presented as the total CO_2 equivalent (CO_2e) released. The CO_2e emissions take into account the global warming potential of chemical emissions from a source. The combustion of fossil fuels emits small amounts of N_2O and CH_4. The global warming potential of N_2O and CH_4 are, respectively, 310 and 21 times that of CO_2. The total CO_2e emissions take into account the other pollutants and their global warming potential.

Currently, transit operations are expected to reduce the automobile use that causes a high percentage of GHG emissions. The East Link Project would result in lower VMT and would reduce GHG emissions. Additional savings in VMT can be attained from transit-oriented development that is expected to occur around light rail stations. This discussion is expanded in Chapter 5, Cumulative Impacts.

A quantitative analysis was conducted on GHG emissions from project operations in the design year 2030. The potential CO_2e impacts during project operation include reductions from the decreased vehicular traffic, measured as VMT, resulting from the East Link Project. Brief methodology, assumptions, and a summary of the calculations for the GHG emissions analysis from construction and operation are provided in Appendix F4.6.

The analysis estimated fuel or energy consumption by vehicle type from vehicles operating in the region and the project study subarea. The East Link Project study subarea for GHG is defined as the transportation area zones that make up roughly the North and East subareas of the Sound Transit District and includes more than 90 percent of the East Link riders in the 2030 projections. Because most of the potential riders are within the subarea, it can be assumed that the majority of the impacts would occur within this subarea.

Regional and subarea transit bus VMT was allocated between diesel, hybrid, compressed natural gas, and trolley buses. As shown in Table 4.6-3, transit bus VMT was allocated by vehicle type based on the number of vehicles operated by the four transit authorities for the region. The U.S. Department of Energy produces the energy usage for different modes in terms of British thermal unit (Btu) per vehicle mile. This source was also used for light rail energy use. For buses, automobiles, and trucks, EPA's MOBILE6—Mobile Source Emission Factor Program (2003)—was applied as provided by the PSRC.

TABLE 4.6-3
Regional and Subarea Bus Fleet Mix

Type	Region	Subarea
Diesel	69%	75%
Hybrid	12%	19%
Compressed natural gas	11%	0%
Trolley	8%	6%
Total	**100%**	**100%**

Notes:
Regional fleet mix based on number of transit vehicles operated by Sound Transit, King County Metro, Pierce Transit, and Community Transit.

Subarea fleet mix based on fleet VMT reported by King County Metro.

Three fuel types are presented in Table 4.6-4. For this analysis, all energy consumption from trolley, light rail, and commuter rail was converted to gallons of gasoline (g/gal). However, an additional step was applied to East Link energy use because the energy provided for light rail includes non-GHG emission energy sources. Electricity for East Link would be drawn from Seattle City Light for those portions of the route in Seattle and from Puget Sound Energy for the portions on Mercer Island, Bellevue, and Redmond. Both Seattle City Light and Puget Sound Energy rely heavily on hydropower and other non-petroleum energy resources that generate low GHG emissions (See Section 4.10, Energy). In fact, Seattle City Light plans to continue to meet a goal of zero net GHG emissions.

TABLE 4.6-4
CO_2e Emission Rates by Fuel Type

Fuel Type	CO_2e g/gal
Diesel	10,156
Gasoline	8,970
Compressed natural gas	7,899

g/gal = gallons of gasoline

Source: The Climate Registry, 2008.

In 2006 and 2007, Puget Sound Energy sources ranged between 30 to 40 percent zero-GHG-emission and may soon offer clients the ability to choose their energy sources, thereby offering Sound Transit the option to only use non-GHG-emitting power, such as wind, hydropower, and solar. Sound Transit plans to use higher than average hydropower. Therefore, to be conservative, energy use for East Link was reduced by an additional 30 percent and light rail miles in Seattle were removed from the GHG calculation.

Table 4.6-5 shows the total projected GHG emissions for the No Build Alternative and 2030 high- and low-ridership conditions with the build alternatives. The build scenarios show that there would be a range of 21,535 to 28,835 metric tons annual reduction of CO_2e emissions in the region due to the reduction of VMT and the use of cleaner energy sources for operating the light rail system. The gains would be more pronounced in the subarea, as this is where most of the change in VMT would occur. Under the No Build Alternative, the subarea would contribute almost one-third of the Puget Sound region GHG emissions. Implementing the East Link Project could reduce the region's yearly GHG by almost 0.2 percent. This would result in a savings of 0.4 percent annually for the subarea.

According to EPA's website (EPA, 2011), the regional saving for the high ridership East Link Project estimated as 28,835 metric tons of CO_2e per year is the equivalent of the following:

- Supplying electricity for 3,175 homes for 1 year
- Consuming 60,834 barrels of oil per year
- Planting 670,735 trees or saving 248 acres of forest from deforestation

In addition, according to the California Air Resource Board, improving automobile speeds up to 46 miles per hour would reduce GHG emissions (Urban Land Institute, 2008). Sound Transit traffic modeling shows that the build alternatives would result in improved traffic speeds over the No Build Alternative on I-90 during congestion periods. For example, the build alternatives would improve traffic flow by 2 to 4 mph on average in the PM peak-hour commute.

However, there are some places where traffic flow would decrease by 1 mph (westbound between Mercer Island and Seattle) and other places where speeds would improve by as much as 30 mph (eastbound from Mercer Island). Overall, the project would result in an additional reduction in GHG emissions from improved traffic flow during project operation (see Chapter 3 of this Final EIS).

TABLE 4.6-5
Greenhouse Gas Emissions in Terms of $CO_{2}e$ During Light Rail Operation

	2030 No-Build	2030 High Ridership	2030 Low Ridership	Units
Regional				
Daily CO_2e	52,322	52,243	52,263	Metric tons CO_2e emissions daily
Daily CO_2e reduction	Not applicable	79	59	Metric tons CO_2e daily
Annual CO_2e reduction	Not applicable	28,835	21,535	Metric tons CO_{2e} annually
Subarea				
Daily CO_2e	18,807	18,736	18,755	Metric tons CO_2e emissions daily
Daily CO_2e reduction	Not applicable	71	52	Metric tons CO_2e daily
Annual CO_2e reduction	Not applicable	25,915	18,980	Metric tons CO_{2e} annually

Source: Entech Consulting Group GHG Emissions Calculations, 2010

Sound Transit adopted a Sustainability Initiative in 2007 that promotes and implements more energy-efficient alternatives than current practices. According to the initiative, Sound Transit will integrate efficient operating practices at existing and new facilities, use energy-saving equipment to reduce energy demand, and maximize intermodal transit connections to reduce automobile VMT. Many of these practices have been incorporated in the Central Link Initial Segment that opened in 2009. The implementation of the sustainability initiatives will reduce energy consumption and thus GHG emissions during East Link operations.

The East Link Project also includes the operation of a maintenance facility. The maintenance facility would be the equivalent of a light industrial site of approximately 18.344X10 Btu per year. Puget Sound Energy would provide power. Considering that over 30 percent of Puget Sound Energy is already provided by hydropower or other non-CO2e-emitting sources, the East Link maintenance facility would produce approximately 1,503 metric tons of CO_2e per year. This is approximately 8 percent of the yearly GHG emissions from the East Link Project.

4.6.3.3 Project Construction Impacts

During construction, the release of particulate emissions (airborne dust) associated with site preparation, fill operations, and roadway improvements is anticipated to be the primary cause of potential short-term air quality impacts from the East Link Project.

Emissions from construction equipment also are anticipated and would include CO, PM, NO_x, and VOCs. Site preparation and roadway construction would involve clearing, cut-and-fill activities, grading, removing or improving existing roadways, and paving roadway surfaces.

Construction-related impacts on air quality would be greatest during the site preparation phase because most engine emissions are associated with the excavation, handling, and transport of soils to and from the site. If not properly controlled, these construction-related activities would temporarily generate PM_{10}, $PM_{2.5}$, and small amounts of CO, SO_2, NO_x, and VOCs. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. PM_{10} and $PM_{2.5}$ emissions would vary from day to day, depending on the nature and magnitude of construction activity and local weather conditions. PM_{10} and $PM_{2.5}$ emissions would depend on soil moisture, silt content of soil, wind speed, and the amount of equipment operation. Larger dust particles would settle near the source, while fine particles would be dispersed over greater distances from the construction site.

In addition to PM_{10} and $PM_{2.5}$ emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would generate CO, SO_2, NO_x, and VOCs in exhaust emissions. If construction traffic were to reduce the speed of hauling trucks and other vehicles in the area, CO emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be temporary and limited to the immediate area surrounding the construction site. SO_2 is generated by oxidation during combustion of organic sulfur compounds contained in diesel fuel. Some phases of construction, particularly asphalt paving, would result in short-term odors from VOC in the immediate area of paving sites. Such odors would be quickly dispersed below detectable thresholds as distance from the sites increases.

Increases in air pollutant emissions from construction of the East Link Project are considered temporary impacts. The duration of civil construction for any one particular location along the East Link corridor is expected to range from about 2 to 5 years. The most intense activity, such as site preparation, would occur during the initial phase of construction.

Little is known at this time about the number and exact types of equipment that would be required for each alternative. In lieu of analyzing project construction impacts for each alternative within the different segments, Sound Transit selected two components that would involve a diversity of equipment and materials and potentially high dust and emissions in a concentrated area. These were evaluated to present a worst-case scenario for any given project construction period. The components that were chosen are the proposed garage at the South Bellevue Park-and-Ride Lot and the SE Redmond Maintenance Facility (MF5).

A projected pollutant emission inventory was developed for the parking garage and maintenance facility using a spreadsheet tool titled Road Construction Emissions Model Version 5.2, which was developed by the Sacramento Air Quality Management District (2007). This emission spreadsheet uses a number of default assumptions and detailed, project-specific information. The available project data included specific information about the disturbed surface area, the quantity of cut-and-fill material, and the construction duration period. The model's defaults were used for the number and types of project construction equipment needed, the number of construction workers commuting to the job sites, and the length of their commute.

Because there are no state or local guidelines for evaluating the degree of impact from construction pollutant emissions, criteria proposed in the *California Environmental Quality Act (CEQA) Air Quality Handbook*, prepared by the South Coast Air Quality Management District (SCAQMD, 1993), were used as a guideline for this project. The CEQA Air Quality Handbook establishes recommended daily thresholds for construction-related emissions from construction projects. Construction-related emissions that exceed these established threshold levels are considered to be a concern.

Table 4.6-6 presents the model emission results for the South Bellevue Park-and-Ride garage and MF5. The projected emissions from both of these facilities are essentially the same because, given the estimates that were available at the time of this analysis, they occupy approximately the same area (12 to 15 acres).

TABLE 4.6-6
Projected Construction Emissions

Pollutant	South Bellevue Park-and-Ride Garage (pounds per day)	SE Redmond Maintenance Facility (MF5) (pounds per day)	SCAQMD Construction Emission Threshold (pounds per day)
CO	32	32	550
NO_x	31	31	100
Reactive organic gases	7	7	75
Exhaust PM_{10}	2	2	NA
Fugitive dust	5	5	NA
Total PM_{10}	7	7	150

Source: CH2MHILL Construction Emission Calculations, 2008
CO carbon monoxide
NO_x oxides of nitrogen
PM particulate matter
SCAQMD South Coast Air Quality Management District

The construction emissions for the two facilities would be substantially below the daily emissions thresholds set by SCAQMD.

Greenhouse Gases from Construction

GHG associated with the construction phase of the East Link Project are expected to be consistent with other projects of this scale. In large-scale construction projects, the major sources of GHG emissions are fossil-fueled construction equipment (mobile and stationary). It was conservatively assumed that all of the fossil fuel used during construction would be diesel. The CO_2e factor for diesel used in the analysis is from The Climate Registry General Reporting Protocol (The Climate Registry, 2008).

The amount of GHG emissions produced by fossil-fueled construction equipment is directly proportional to the quantity of fuel used. Construction fuel consumption is based on recent experience in building light rail in the Seattle region and provides an order-of-magnitude estimate of GHG emissions. The estimate includes the following factors:

- Transportation of construction materials, waste, and fill material
- Equipment used during construction site preparation
- Construction of the rail track and guideway, rail stations, associated park-and-ride lots, and a representative maintenance facility

The fuel used also encompasses the difference in building at-grade, elevated, retained-cut, and tunnel profiles; specific station design; parking structures; and the need for a maintenance facility for the project.

Table 4.6-7 shows the range of the GHG emissions for constructing the project. The construction of one maintenance facility is included in the full project emissions calculation, which alone would be approximately 1,740 metric tons of CO_2e.

TABLE 4.6-7
CO_2e Emission for Construction of Full-Length Project

Project	Tons of CO_2e
High construction emissions	173,197
Low construction emissions	94,893
Potential difference in CO_2e	78,304

Source: CH2MHILL Construction Emission Calculations, 2008
CO_2e carbon dioxide equivalent

The highest potential GHG emissions for the East Link Project would result from building *Preferred Alternative A1* and Alternatives B2E, C2T, D3, and E1. The lowest GHG emissions for the project would result from building *Preferred Alternative A1* and Alternatives B7, C7E, D5, and E4. The difference would be largest in Segment C, where alternatives vary among at-grade, elevated, and tunnel profiles. The tunnels would have almost five to six times more GHG emissions than the elevated profile, and almost four times the emissions for at-grade profile alternatives. In all other segments, alternatives with extensive elevated profiles would result in more GHG emissions to construct over at-grade profile alternatives, but generally only about 10 percent more. One additional difference occurs in Segment D, where Alternative D3 would include a portion of retained-cut profile. Construction of this alternative would have almost 60 percent higher GHG emission than that of the lowest CO2e emissions alternative (Alternative D5), which is extensively elevated but also has two fewer stations than all other Segment D alternatives.

4.6.3.4 Hot Spot Analysis at Station Platforms

The East Link Project is unique in that several of the proposed stations (specifically, the Rainier, the Mercer Island [both in *Preferred Alternative A1*], and the Hospital/Ashwood stations) are along heavily traveled highways that may expose passengers standing at station platforms to CO concentrations resulting from automobile tailpipe emissions. The project would not substantially change the volumes of vehicular traffic in the project vicinity; however, the station platforms are representative of sensitive locations where passengers would be exposed to CO concentrations. The project vicinity is in an attainment maintenance area for CO. As presented in Table 4.6-8, data collected from CO monitoring sites in the project vicinity demonstrate that the area has not exceeded the CO NAAQS in the last 5 years.

TABLE 4.6-8
Ambient Air Quality Monitoring Data from CO Monitoring Sites in the Project Vicinity

Pollutant	Maximum Concentration (ppm)		
	2006	2007	2008
Beacon Hill Monitoring Site			
1-hour average	2.3 ppm	1.4 ppm	1.4 ppm
8-hour average	1.5 ppm	1.0 ppm	0.9 ppm
Bellevue Monitoring Site			
1-hour average	5.1 ppm	3.9 ppm	3.4 ppm
8-hour average	3.7 ppm	2.7 ppm	2.3 ppm

Source: EPA, (2010).
CO carbon monoxide
ppm parts per millions

A hot spot modeling analysis was performed for the East Link Project to quantify passenger CO exposure levels at station platforms. The WASIST modeling tool is formatted to estimate CO concentrations only at signalized intersections. Due to the stationary platforms locations near non-signalized highways, the WASIST model cannot be used to estimate CO concentrations at these specific locations. Therefore, two additional modeling programs approved by EPA—MOBILE6.2 and CALINE3—were used to predict CO concentration levels.

The highest predicted 1-hour CO concentration levels were obtained and compared to the EPA NAAQS 1-hour CO primary standard of 35 ppm. The longest amount of time passengers are expected to wait on the station platform is assumed to be 15 minutes. There is currently no 15-minute CO standard; however, it is assumed that if the highest predicted 1-hour CO standard is below the NAAQS, then the passengers' exposure levels for 15 minutes would also be acceptable.

Emission factors for 2030 were estimated using MOBILE6.2, a modeling program developed by the EPA to estimate current and future emissions from highway motor vehicles. This model was used to calculate the CO emission factor for use in the CALINE3 model. The CALINE3 model is used to calculate the dispersion of vehicle emissions and expected concentrations at select points in the vicinity of roadways. The CO emission factor is based on local climate, vehicle speed, and fuel and vehicle registration data specific to the Puget Sound region. Model inputs were provided by the PSRC (Peak, 2008).

Each station has a unique configuration, and the CALINE3 model was run separately for the Rainier, Mercer Island, and Ashwood/Hospital Stations. As shown in Table 4.6-9, the highest predicted 1-hour CO concentrations for all three station platforms were found to be well below the CO NAAQS 1-hour standard of 35 ppm.

TABLE 4.6-9
1-hour CO concentrations at Station Platforms

Station Name	1-hour CO concentrations (ppm)
Rainier Avenue Station [a]	5.5
Mercer Island Station [a]	7.7
Ashwood Station	7.1

Source: Entech Consulting Group CO Hot-Spot Modeling, 2010

[a] In *Preferred Alternative A1*
CO carbon monoxide
ppm parts per million

4.6.4 Conformity Determination

Under the Clean Air Act, a transportation project located in a nonattainment or maintenance area for a given pollutant is required to meet a conformity determination with the SIP. Conformity requirements are met when a project does not cause or contribute to an exceedance of the NAAQS. In air quality maintenance areas, regionally significant projects are evaluated for their conformity to Air Quality Maintenance Plans (AQMP). Projects that conform to the plan are not expected to cause exceedances of the standard. The East Link Project would be located in the Puget Sound region, which is a maintenance area for CO, with a portion of the project also located in the Duwamish PM_{10} maintenance area. In the Puget Sound region, PSRC determines regional conformity by including a project in the Metropolitan Transportation Plan (MTP) and the RTIP.

The proposed project is included in the region's MTP, *Vision 2040/Transportation 2040* (PSRC, 2009), and in the *2010-2013 Regional Transportation Improvement Program* (PSRC, 2010), both of which have been found to meet the CO and PM_{10} conformity tests as identified by federal and state conformity regulations. *Transportation 2040* was adopted in May 2010. The East Link Project is in the regional plan and RTIP, which meets regional conformity. Therefore, the East Link Project has met the requirement of being included in the regional plans, which have been found to conform to the SIP.

A project-level conformity determination was performed by conducting a CO hot spot analysis on affected intersections in the project vicinity. For project level conformity, the 2030 horizon year is consistent with the RTP that was adopted at the time the East Link analysis began in 2006 (PSRC, 2001). Based on modeling, intersections in the project vicinity currently do not exceed the CO NAAQS. Affected intersections under all build alternatives would not create any new exceedances of the CO NAAQS. Therefore, the project meets conformity requirements for CO.

A PM_{10} project-level hot spot analysis is not required for the East Link Project because it is not a project of air quality concern based on the FHWA PM_{10} guidance (2006). Projects of air quality concern are defined in 40 CFR 93.123(b)(1).

Operation of the East Link Project is expected to provide an air quality benefit to the surrounding area due to the shift of bus ridership to light rail ridership. The development of the Bus Integration Plan was created jointly by Sound Transit and King County Metro to coordinate reasonably foreseeable future changes in transit operations with changes specifically associated with East Link Project operations (e.g., reducing or removing overlapping light rail and bus service or changing routes to feed light rail). The Bus Integration Plan would convert existing bus lines to rail lines, thereby decreasing bus VMT, which in turn would decrease diesel particulate emissions generated from bus operations.

Furthermore, this project meets conformity requirements for PM_{10} by its inclusion in the MTP, the AQMP, and the RTIP, which have been found to meet the conformity test for PM_{10}.

4.6.5 Potential Mitigation Measures

There would be no operational impact requiring mitigation because the East Link Project would provide a net benefit over the No Build Alternative. In particular with the preferred alternatives, air quality modeling demonstrates that no air quality impacts would be expected from project operation. All predicted CO concentrations for the preferred alternatives are below the 8-hour federal NAAQS for CO concentrations; therefore, no mitigation measures would be necessary. However, consistent with Sound Transit's sustainability policies, further reductions in fuel and energy use would continue to reduce GHG emissions for project operations.

For construction activities, PSCAA regulates particulate emissions (in the form of fugitive dust). Any emission of fugitive dust requires the use of best practices to minimize impacts. The general policy of PSCAA and WSDOT is to prevent and reduce fugitive dust resulting from construction activities so as not to injure human health, plants and animals, or property, and so as not to unreasonably interfere with the enjoyment of life and property. To comply with PSCAA and WSDOT policy of preventing air quality degradation, the following mitigation measures may be used as necessary and in accordance with standard practice to control PM_{10}, $PM_{2.5}$, and emissions of CO and NO_x during construction of the project. Several of these measures would also reduce GHG emissions.

- Spray exposed soil with dust control agent as necessary to reduce emissions of PM_{10} and deposition of particulate matter.
- Cover all transported loads of soils and wet materials before transport, or provide adequate freeboard (i.e., space from the top of the material to the top of the truck) to reduce PM_{10} and deposition of particulate during transportation.
- Provide wheel washes to reduce dust and mud that would be carried off site by vehicles and to decrease particulate matter on area roadways.
- Remove the dust and mud that are deposited on paved, public roads to decrease particulate matter
- Route and schedule high volumes of construction traffic to reduce congestion during peak travel periods and reduce emissions of CO, NO_x, and CO_2e where practical.
- Require appropriate emission-control devices on all construction equipment powered by gasoline or diesel fuel to reduce CO and NO_X emissions in vehicular exhaust.
- Use well-maintained heavy equipment to reduce CO and NO_X emissions, which may also reduce GHG emissions.
- Cover, install mulch, or plant vegetation as soon as practical after grading to reduce windblown particulate in the area.

The following other readily available mitigation measures could potentially be used:

- Encourage contractors to employ emissions reduction technologies and practices for both on-road and off-road equipment/vehicles (e.g., retrofit equipment with diesel control technology and/or use of ultra-low sulfur diesel).
- Implement construction truck-idling restriction (e.g., no longer than 5 minutes).
- Locate construction equipment and truck staging zones away from sensitive receptors as practical and in consideration of other factors such as noise.

Emissions of CO, NO_X, and VOCs are best controlled through use of new construction equipment and proper maintenance of this equipment. Use of low-sulfur diesel fuel controls emissions of SO_2. SO_2 and NO_x emissions are considered precursor to $PM_{2.5}$ emissions; therefore, reductions in SO_2 and NO_x will also help reduce $PM_{2.5}$ emissions. All mitigation measures must comply with local regulations governing air quality, including those for controlling fugitive dust during construction.