

**Technical Report
Air Quality Section
Supplemental Environmental Impact Statement
47° North Project
Cle Elum, Washington**

September 2020

Prepared for

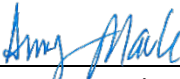
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Cle Elum, Washington



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Air Quality Section
Supplemental Environmental Impact Statement
47° North/Bullfrog Flats Project
Cle Elum, Washington**

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LIST OF ABBREVIATIONS AND ACRONYMS

BMP.....	best management practice
CEMC.....	Cle Elum Municipal Code
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e.....	carbon dioxide equivalent
Ecology.....	Washington State Department of Ecology
EPA.....	US Environmental Protection Agency
FEIS.....	Final Environmental Impact Statement
GHG.....	greenhouse gas
I-90.....	Interstate 90
KCC.....	Kittitas County Code
LAI	Landau Associates, Inc.
mpg.....	miles per gallon
N/A.....	not applicable
NAAQS.....	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO ₂	nitrogen dioxide
PM.....	particulate matter
PM _{2.5}	particulate matter less than or equal to 2.5 micrometers in size
PM ₁₀	particulate matter less than or equal to 10 micrometers in size
RCW	Revised Code of Washington
RV.....	recreational vehicle
SEIS.....	Supplemental Environmental Impact Statement
SEPA.....	State Environmental Policy Act
sq ft.....	square foot/feet
SR 903	State Route 903
UGA.....	urban growth area
VMT.....	vehicle miles traveled
VOC.....	volatile organic compound
WAC.....	Washington Administrative Code

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1.0 INTRODUCTION

At the request of the City of Cle Elum, Landau Associates, Inc. (LAI) under contract with EA Engineering, Science, and Technology, Inc. prepared this report, which provides background information and analysis to support the Air Quality section of the Supplemental Environmental Impact Statement (SEIS) for the 47° North Project in Cle Elum, Kittitas County, Washington. This analysis and associated SEIS supplements the 2002 Trendwest Properties: Cle Elum Urban Growth Area (UGA) Environmental Impact Statement (2002 FEIS; City of Cle Elum 2002) and is being completed because the City of Cle Elum concluded that proposed revisions to the Master Site Plan approved in 2002 constitute a “major amendment” to the original project.

The 2002 Cle Elum UGA EIS analyzed five alternatives, of which Alternative 5 (Bull Frog Subarea Plan Mixed-Use Zoning and Master Plan Application) was carried forward and approved as the Original Bullfrog Flats Master Site Plan. For the purposes of this analysis and associated SEIS, SEIS Alternative 5 (No Action Alternative) is considered the Approved Bullfrog Flats Master Site Plan. “47° North” refers to the project under its current ownership, and SEIS Alternative 6, or “Project” alternative, refers to the corresponding Proposed 47° North Master Site Plan Amendment.

Impacts of the following two alternatives are analyzed, and greenhouse gas (GHG) emission rates generated by the two alternatives are forecast at a screening level¹:

- SEIS Alternative 6 – “Proposed 47° North Master Site Plan Amendment”
- Development of SEIS Alternative 5, the Approved Bullfrog Flats Master Site Plan, updated to reflect current conditions (No Action).

SEIS Alternative 5 has been updated to reflect current background conditions and regulations. The Final Environmental Impact Statement (FEIS) Alternative 5 (as presented in the 2002 Cle Elum UGA EIS) was compared to the updated, or SEIS, Alternative 5. The difference in estimated GHG emissions between the FEIS and SEIS Alternatives 5 were found to be approximately 0.01 percent (see Table 2); therefore, the two Alternatives 5 are considered equivalent for the purposes of this analysis.

The following sections describe the current air quality conditions in the region, policies and regulations that govern air pollutant emissions, and regulations and policies that have been developed to reduce GHG emissions. Impacts of the 47° North SEIS Alternative 6 are compared to the No Action SEIS Alternative 5. GHG emission rates generated by the Project and the No Action alternative are forecast at a screening level. This analysis assumes that full buildout of SEIS Alternative 6 will be complete by 2037. Although the assumed buildout for SEIS Alternative 5 is 2051, for analysis and comparative purposes the amount of development that would occur by 2037 is used for comparison with SEIS Alternative 6, as well as forecast GHG emissions at full buildout of SEIS Alternative 5 in 2051.

¹ Screening-level tools are used to develop a protectively conservative estimate of project impacts using representative data in order to determine whether more refined modeling or mitigation measures are necessary.

The 47° North project area is located east and south of Bullfrog Road, North of Interstate 90 (I-90) and the Washington Horse Park, and southwest of State Route 903 (SR 903).

2.0 AIR QUALITY/GREENHOUSE GAS EXISTING CONDITIONS

2.1 Existing Air Pollution Sources

Air pollution sources in the 47° North/Bullfrog Flats study area² include vehicular traffic along nearby I-90, SR 903, Bullfrog Road, and within the residential areas surrounding the project area. These existing sources cause emissions of criteria pollutants including carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen dioxide (NO₂), particulate matter (PM), and to a lesser extent sulfur dioxide.

Every year, the Washington State Department of Ecology (Ecology) prepares an inventory of air contaminant emissions for facilities with air operating permits (major sources emit 100 tons or more per year of any single criteria pollutant, 10 tons or more per year of any hazardous or toxic air pollutant, or 25 tons or more per year of combined hazardous air pollutants). The nearest reported major point source is more than 30 miles from the project area, east of Wenatchee. Additionally, every 3 years, Ecology inventories “non-point” sources, including motor vehicles, wood stoves, outdoor burning, agriculture, and natural sources. In 2014 (the most recent year published), the most significant overall source of air emissions in Kittitas County was wildfires. On-road mobile sources (vehicle traffic) were the largest contributor of nitrogen oxides (including NO₂), and the second largest contributor of CO (Ecology; accessed January 7, 2020).

A lumber mill and Ellensburg Cement Products surface mining operation, both located south of I-90, have expanded since the issuance of the 2002 FEIS. Suncadia’s Prospector and Rope Rider Golf Courses, north of the project area, opened in 2005 and 2011, respectively. Residential development around the golf courses has also increased. The Washington State Horse Park is now open immediately south of the eastern portion of the project area. The lumber mill and surface mining operation may contribute increased emissions to background air quality in the area. Increased traffic related to the golf courses, Horse Park, and residences, as well as residential wood-burning appliance emissions in surrounding neighborhoods, impact background air quality in the rural areas in and around the study area.

2.2 National Ambient Air Quality Standards

The US Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS), and specified future dates for states to develop and implement plans to achieve these standards. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety, and the latter to protect environmental values, such as plant and animal life. Ecology established the Washington State Ambient Air Quality Standards for the six criteria air pollutants that are at least as stringent as the national standards.

² “Project area” refers to the area within the boundaries of the 47° North project. “Study area” refers to the project area plus adjacent and nearby properties potentially impacted by the project.

2.2.1 Key Criteria Air Pollutants

The following paragraphs describe the sources and environmental effects of key criteria pollutants (CO, ozone, and PM) considered in this analysis.

CO is a product of incomplete combustion generated by mobile sources, residential wood combustion, and industrial fuel-burning sources. CO is a concern related to on-road mobile sources because it is the pollutant emitted in the greatest quantity for which short-term health standards exist. CO is a pollutant whose impact is usually localized, and CO concentrations typically diminish within a short distance of roads. The highest ambient concentrations of CO usually occur near congested roadways and intersections during wintertime periods of air stagnation.

Ozone is a highly reactive form of oxygen created by an atmospheric chemical reaction of nitrogen oxides and VOCs, both of which are emitted directly from industrial and mobile sources. Ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over a period of time, and because, during the delay between emission and ozone formation, ozone precursors can be transported far from their sources. Transportation sources such as automobiles and trucks are some of the sources that produce ozone precursors.

Particulate matter is generated by industrial emissions, residential wood combustion, motor vehicle tailpipes, and fugitive dust from roadways, haul roads, and unpaved surfaces. When first regulated, particle pollution was based on “total suspended particulates,” which included all size fractions. As sampling technology has improved and the importance of particle size and chemical composition has become clearer, ambient standards have been revised to focus on the size fractions thought to be most dangerous to people. At present, there are standards for PM less than or equal to 10 micrometers in size (PM₁₀) and PM less than or equal to 2.5 micrometers in size (PM_{2.5}), because these sizes of PM contribute the most to human health effects, regional haze, and acid deposition. The highest ambient concentrations generally occur near the emission sources, which in the study area would be from motor vehicle tailpipes from I-90 and major roads. The lumber mill and surface mine could also be sources of particulate matter within the study area. PM_{2.5} has a greater impact than PM₁₀ at locations far from the emitting source, because it remains suspended in the atmosphere longer and travels farther.

2.3 Air Quality Attainment Status

Based on monitoring information collected over a period of years, the EPA and Ecology designate regions as being attainment or non-attainment areas for regulated air pollutants. Attainment status indicates that air quality in an area meets the NAAQS, and non-attainment status indicates that air quality in an area does not meet those standards. If the measured concentrations in a non-attainment area improve so they are consistently below the NAAQS, Ecology and EPA can reclassify the non-attainment area to a maintenance area.

Kittitas County is currently designated as an attainment area for all criteria air pollutants.

2.3.1.1 Transportation Conformity Analysis

All federal- or state-funded, significant transportation projects (including constructing or widening roadways and signalized intersections) that are proposed within non-attainment or maintenance areas are subject to the Transportation Conformity Regulations (Code of Federal Regulations, Title 40, Parts 51 and 93; Chapter 173-420 Washington Administrative Code [WAC]). These regulations ensure that transportation projects, plans, and programs will conform to existing plans and timetables for attaining or maintaining NAAQS. The project is located in an attainment area for all criteria pollutants; therefore, a conformity analysis, or “hot spot” analysis, is not required.

2.4 Air Toxics Issues

No existing conditions within the study area pose special issues related to air toxics. The project area is not near any major industrial facilities that emit large amounts of toxic air pollutants. I-90 is adjacent to the project, and heavy diesel trucks traveling along the highway have the potential to emit toxic air pollutants. It is expected that existing and future air quality in the study area could be affected by minor to moderate concentrations of toxic air pollutants, emitted primarily from traffic on I-90.

According to the EPA’s National Air Toxics Assessment 2014 database, the existing respiratory cancer risk in the Cle Elum area is roughly 20×10^{-6} or 20 cancer cases per million population (EPA 2018; accessed January 7, 2020). This reported respiratory cancer risk is typical of other rural areas located near freeways in Washington State.

2.5 National Environmental Policy Act Requirement for Climate Change Analysis

On December 7, 2009, the EPA signed the Endangerment and Cause or Contribute findings for GHGs under Section 202(a) of the Clean Air Act (EPA 2009). Under the Endangerment Finding, the EPA determined that the current and projected concentrations of the six key well-mixed GHGs—carbon dioxide (CO₂), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—in the atmosphere threaten the public health and welfare of current and future generations. Under the Cause or Contribute Finding, the EPA determined that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG emissions that threaten public health and welfare.

In 2019, the Council on Environmental Quality issued draft National Environmental Policy Act (NEPA) guidance on the consideration of the effects of climate change and GHG emissions (CEQ 2019). This guidance advises federal agencies to consider opportunities to reduce GHG emissions caused by federal actions, adapt their actions to climate change impacts throughout the NEPA process, and address these issues in their agency NEPA procedures. Where applicable, the scope of the NEPA

analysis should cover the GHG emission effects of a proposed action and alternatives and the relationship of climate change effects to a proposed action or alternatives. However, this guidance document does not set numerical thresholds for what levels of GHG emissions would constitute a significant impact, nor does the guidance document specify what types of mitigation measures should be required by local municipalities. This EIS is being prepared pursuant to the requirements of the State Environmental Policy Act (SEPA), not NEPA.

2.6 Washington State Greenhouse Gas Requirements

Washington State Executive Order 07-02 was issued in February 2007, establishing the following GHG reduction goals (CAT 2008):

- Reduce emissions to 1990 levels by 2020, 25% below 1990 levels by 2035, and 50% below 1990 levels by 2050.
- Increase “green economy jobs” to 25,000. The term “green economy jobs” means the design, manufacture, marketing, and installation of equipment to support sustainable development both within and beyond Washington State.
- Reduce expenditures on fuel imported into Washington State by 20% by 2020.

The above-noted GHG reduction goals apply state-wide, but they do not specify any requirements for local government agencies to implement measures to reduce emissions within their local jurisdictions.

The Washington Legislature enacted Chapter 70.235 of the Revised Code of Washington (RCW), Limiting Greenhouse Gas Emissions, into state law. This law codifies the GHG reduction goals of Executive Order 07-02 and specifies them as “limits” rather than “goals.” The law also adds a fourth requirement to help achieve the GHG reduction targets:

- Decrease the annual per capita vehicle miles traveled 18% by 2020, 30% by 2035, and 50% by 2050.

The state law applies only to actions taken by Washington State agencies and local governments. State regulations on GHG emissions include prerequisites for distribution of capital funds for infrastructure and economic development projects, where projects receiving funding must be evaluated for consistency with state and federal GHG limits and state vehicle miles traveled (VMT) goals (RCW 20.235.070).

In 2010 and 2011, Ecology issued guidance documents describing how SEPA reviews related to GHG emissions may be conducted when the SEPA lead agency is a state or local government and what may constitute a significant impact. However, these guidance documents have since been removed from Ecology’s website, are no longer provided by the agency, and do not provide direction for SEPA analysis. There is, therefore, currently no state- or federal-level guidance for what constitutes a significant GHG-related impact or when mitigation measures should be considered. However, a tool to

calculate GHG emissions that was included in the guidance document is frequently used in SEPA documents.

In 2011, the Washington State Department of Commerce released an updated Washington State Energy Strategy for 2012 (WSDOC 2011), which includes short- and long-term policy options to meet the following goals:

- Maintain competitive energy prices that are fair and reasonable for consumers and businesses and support Washington's continued economic success.
- Increase competitiveness by fostering a clean energy economy and jobs through business and workforce development.
- Meet the state's obligations to reduce GHG emissions.

The Washington State Energy Strategy outlines strategies for meeting these goals in the categories of transportation efficiency, building efficiency, distributed energy and pricing.

2.7 Outdoor Burning

As of December 31, 2006, residential burning (yard waste) and burning of land-clearing debris is not allowed at any time in the Cle Elum Urban Growth Area (WAC 173-425-040) (WSOFM 2011). Outdoor burning is allowed in other portions of Kittitas County, including immediately adjacent to the project area to the north and west (opposite Bullfrog Road) and south (opposite I-90). Kittitas County Code (KCC 15.08) delegates responsibility to the County Fire Marshal to establish prohibitions against burning due to fire danger. The KCC does not include a provision for prohibition of burning due to air quality concerns.

3.0 IMPACTS

This section describes the qualitative air quality issues associated with SEIS Alternatives 5 and 6.

3.1 Methods

3.1.1 Greenhouse Gas Significance Threshold

For the purposes of this analysis, the GHG emissions are expressed in terms of the differences between the future No Action condition (SEIS Alternative 5) and future proposed Project condition (SEIS Alternative 6). There is currently no state- or federal-level guidance for what constitutes a significant GHG-related impact or when mitigation measures should be considered; therefore, no SEPA significance threshold for increased GHG emissions is required or provided for this analysis. Project-related increases in GHG emissions were compared to projected state-wide emissions. Baseline GHG emissions at the city/county level were not available for comparison; in any event, because the project area is currently undeveloped, baseline GHG emissions for the project area would be near zero.

3.1.2 Greenhouse Gas Emission Calculation Methods

This section describes the methods used for estimating projected GHG emissions based on SEIS Alternative 6, Proposed 47° North Master Site Plan Amendment, and SEIS Alternative 5, Approved Bullfrog Flats Master Site Plan. Screenshots of Greenhouse Gas Emission Calculation tools are included in Appendix A.

For this analysis, GHG emissions are expressed as metric tons of carbon dioxide equivalent (CO₂e) per year. For the purposes of comparing alternatives and determining impacts under SEPA, forecast GHG emission increases are based on comparing the future emission rates for SEIS Alternative 6 to the forecast future emission rate of SEIS Alternative 5.

The “SEPA GHG Calculation Tool”—acquired through Ecology’s “Guidance Document Including GHG Emission in SEPA Reviews”—was used to evaluate existing and projected future (2037, the assumed buildout year for the 47° North project) GHG emissions for the action alternative and VMT. This analysis provides a screening-level estimate of life-cycle “business as usual” emissions for residential, institutional, commercial, and industrial land uses, not including individual large stationary industrial sources or any special project-level emission reduction measures or other mitigation measures.

The available input data used for the GHG emission calculations were limited to aggregate housing units for single- and multi-family housing, recreational and commercial infrastructure. Because available GHG calculation tools do not provide a category for “recreational” land uses, recreational vehicles were counted as “multi-family housing” for the purposes of the GHG Calculation Tool. Multi-family housing units are associated with fewer square feet of living space and a lower number of occupants than single-family housing, and represent the most comparable land-use category in

terms of energy use and associated vehicle travel. RV travel peaks during the nine-month spring through fall season, with lower use during the winter off-season. During the peak season, the highest use days are expected to be weekends, with lower use mid-week. The number of units has been scaled to 50 percent to represent the seasonal and weekend use of the RV Resort. The GHG impact of the vehicles driving to and from the site will be included in the estimated “Vehicle Miles Traveled” calculation and qualitatively discussed in the Traffic section of this report. This method of analysis is considered an adequate screening-level tool for the purpose of forecasting GHG emission rates.

Three types of life-cycle emissions were estimated using the SEPA GHG Calculation Tool: stationary combustion equipment, energy, and transportation. Energy emissions are generated by stationary combustion (i.e., furnace combustion of natural gas for space heating) and electricity consumption throughout the lifespan of a building. These emission estimates are based on the US Energy Information Administration’s residential and commercial energy consumption surveys.

Transportation emissions include tailpipe emissions generated by on-road vehicles used by building occupants. This evaluation accounts for transportation emissions for the residents, delivery vehicles, and other visitors in residential areas. The transportation emissions do not account for vehicles passing through the study area unless they are directly associated with the buildings being evaluated.

For projections of 2037 transportation emissions, the default value for the average fuel economy in the calculations listed above was 32.3 miles per gallon (mpg). This value reflects the EPA and National Highway Traffic Safety Administration’s current “Safer Affordable Fuel-Efficient” vehicle mileage standard for cars and light trucks for 2026 (40.4 mpg), reduced by 20 percent to reflect real-world CO₂ emission rates (NHTSA; accessed June 10, 2020).

3.1.2.1 ‘Soil Carbon’ Greenhouse Gas Emissions from Permanent Removal or Restoration of Biomass

The general term “soil carbon GHG emissions” refers to the effect of permanently removing vegetation for the purpose of constructing new development. This exacerbates global climate change by two mechanisms. First, the biomass consisting of aboveground vegetation and underground root mass is immediately removed and disposed of, which immediately causes the biomass to decay and release carbon dioxide to the atmosphere. Second, the aboveground vegetation that was permanently removed is no longer available to remove CO₂ from the atmosphere during natural photosynthesis. Likewise, the restoration and replanting of vegetation in areas that have already been cleared of vegetation is a way to recapture carbon by locking the carbon into the plant structure and releasing oxygen into the atmosphere.

Proposed development under either alternative will require removal of some of the existing vegetation, which will lead to soil carbon GHG emissions. Soil carbon GHG emissions for each alternative were estimated using the calculation tool developed by Build Carbon Neutral (Build Carbon Neutral; accessed June 10, 2020), which queries for acreage of disturbed vegetation type that is

removed or replanted and calculates the annualized GHG emission rate. The project site evaluated in this analysis is located in a “northwest forested mountain” region, and the disturbed landscape was evaluated as “forest.” As shown in Table 1, 333 acres of land would be cleared under SEIS Alternative 6 and 401 acres of land would be cleared under SEIS Alternative 5. However, much of the cleared land would be replanted, leaving only 166 acres of impermeable surfaces (roads, parking areas, or building roofs) under SEIS Alternative 6 versus 247 acres of impermeable surfaces under SEIS Alternative 5. Replanted vegetation was conservatively evaluated as “short grass or lawn.” Emission estimates were divided by an average estimated project lifespan of 60 years to determine the estimated annual GHG emissions.

3.1.3 Land-Use Values for Greenhouse Gas Calculations

For the purposes of this analysis, the GHG emissions are expressed in terms of increase in GHG emissions over the pre-development condition. SEIS Alternative 6 is compared to the No Action SEIS Alternative 5. Table 1 lists the projected land-use values used for calculating GHG emissions for each alternative. Differences between the SEIS and FEIS Alternative 5 were found to be negligible, so SEIS Alternative 5 was modeled. Where land use associated with the FEIS alternative differs, acreage is shown in parentheses. The baseline land use is assumed to be the undeveloped land; therefore, the values listed for both alternatives represent the increase compared to the pre-development condition. SEIS Alternative 6 was modeled at full buildout in 2037. SEIS Alternative 5 was modeled at partial buildout in 2037 for comparison to SEIS Alternative 6 and at full buildout in 2051.

Table 1: Increase in Land Use for Greenhouse Gas Emission Calculation (2037 and 2051)

Land Use Category (Plan)	Land Use Category (model designation)	Units	SEIS Alternative 6: Revised Master Plan (2037)	SEIS Alternative 5 [FEIS Alternative 5, if different](2037)	SEIS Alternative 5 [FEIS Alternative 5, if different](2051)
Residential					
Single-family	Single-family	DUs	527	587	810
Multi-family	Multi-family	DUs	180	524	524
RV Resort	Multi-family	DUs	627 [314] (a)	-	-
Amenity Center					
Clubhouse	Health Club	1,000 sq ft	11	-	-
Spa/Fitness	Health Club	1,000 sq ft	5.5	N/A	N/A
Recreation/ Game Center	Health Club	1,000 sq ft	11	N/A	N/A
Registration/Welcome	General Retail	1,000 sq ft	4.0	N/A	N/A
Adventure Center (b)	General Retail	1,000 sq ft	3.5	N/A	N/A
Potential Future Commercial (c)					
Grocery Store	Supermarket	1,000 sq ft	45	N/A	N/A
Retail	General Retail	1,000 sq ft	25	N/A	N/A
Restaurant (d)	Restaurant – fast food	1,000 sq ft	20	N/A	N/A
Medical Offices	Office Space – Medical	1,000 sq ft	60	N/A	N/A
Combined commercial (e)	Light Industrial	1,000 sq ft	N/A	450	950
Total Cleared Land	Cleared Land	Acres	333	401 [403]	401 [403]
Impervious Surfaces	Cleared Land	Acres	166	247	247
Cemetery Expansion Site	Cleared Land	Acres	13	10	10
Undeveloped Open Space (f)	Vegetated/Not Cleared	Acres	471	524 [450]	524 [450]
FEIS & SEIS Alternative 5 Only					
Recreational Expansion	N/A	Acres	N/A	11	11
School Expansion Site	N/A	Acres	N/A	35	35
Water Treatment Plant	N/A	Acres	N/A	12	12
Horse Park, Open Space, Buffer	N/A	Acres	N/A	175	175

Notes:

- (a) RV Resort was modeled as multi-family housing at 50 percent occupancy to account for seasonal use. See Section 3.1.2.
- (b) Adventure center consists primarily of outdoor recreational opportunities with a 3,500-sq-ft registration building.
- (c) Potential future commercial development is not located within the SEIS Alternative 6 site area (see SEIS Section 2.6.2.1).
- (d) All restaurants were conservatively assumed to be fast-food.
- (e) Future commercial development under SEIS Alternative 5 could include light industrial, research and development, warehousing, offices, and retail uses.
- (f) Includes general undeveloped, steep slopes, wetlands, powerline right-of-way, and residential buffers.
- (g) Not included in the model; space has been set aside for these uses under all alternatives.

DUs = Dwelling Units

Source: EA Engineering

3.2 Construction Impacts

During demolition and construction, dust from excavation and grading could cause temporary, localized increases in the ambient concentrations of fugitive dust and suspended particulate matter.

Construction activity must comply with local regulations requiring a plan for dust control during grading, excavation or filling (Cle Elum Municipal Code [CEMC] 15.30.050). Regardless, construction activity could cause localized fugitive dust impacts at homes and businesses near the construction site.

Construction activities would likely require the use of diesel-powered, heavy trucks and smaller equipment such as generators and compressors. These engines would emit air pollutants that could slightly degrade local air quality in the immediate vicinity of the activity. However, these emissions would be temporary and localized, and the resulting construction tailpipe emissions would likely be far outweighed by emissions from existing traffic in the region.

Some construction activities could cause odors detectable to some people in the vicinity of the activity, especially during paving operations using tar and asphalt. Such odors would be short-term and localized. Stationary equipment used for the construction activities must comply with Ecology regulations requiring the best available measures to control the emissions of odor-bearing air contaminants.

Construction equipment and material hauling could temporarily increase traffic flow on streets adjacent to a construction area. If construction delays traffic enough to significantly reduce travel speeds in the area, general traffic-related emissions would increase.

Development under all the alternatives will require removal of some of the existing vegetation. As described above, removal of vegetation leads to soil carbon GHG emissions. Existing wooded areas in the western portion of the site would be preserved in the form of designated open spaces and public trail parks.

3.2.1 Greenhouse Gas Impacts Associated with Manufactured and Modular Housing vs. Built-in-Place Housing

Single-family homes and some of the multi-family homes developed under SEIS Alternative 6 will consist of modular or manufactured housing (the remainder of the multi-family homes will be built-in-place.) The term “manufactured home” refers to homes constructed fully offsite (prefabricated), while “modular homes” are semi-prefabricated and partially assembled on site. Manufactured and modular home construction makes up more than 25 percent of the total residential construction in the United States (Quale et al. 2012).

The construction sector is one of the seven dominant sectors responsible for substantial GHG emissions worldwide (IPCC 2008) and represents the largest single end-use emitter of GHG in the

United States. In conventional construction, the construction phase generally accounts for 2 to 26 percent of GHG emissions, with most of the GHG emissions associated with operation of the resulting structures (heating/cooling, lighting, etc.); however, life cycle assessment research indicates that in optimally energy-efficient buildings, material production and construction can account for as much as 60 percent of life cycle energy consumption (Quale et al. 2012). Studies suggest that prefabricated construction methods could minimize embodied carbon and GHG emissions related to building construction. The studies cited below have proposed methods of quantifying the environmental impact of prefabrication in residential construction.

Quale et al. 2012 compared environmental impacts of modular versus site-build homes based on data provided by three residential modular construction companies in the eastern United States, including utility bills, worker commuting information, building materials and waste procedures, construction schedules, employee schedules, and other relevant information. Information was scaled to a common unit of a 2,000-square-foot, two-story home. Five onsite homebuilders were asked to estimate construction schedule, equipment and energy needs, staff and subcontractor numbers, and commuting information for equivalent site-built homes. The study found that impacts from modular construction are, on average, lower than those from onsite construction, but noted significant variation between companies. On average, GHG emissions from onsite construction were calculated to be approximately 6 metric tons CO₂e higher for onsite construction per 2,000-square-foot home (Quale et al. 2012).

Hammad and Akbarnezhad proposed a framework for comparing modular versus conventional construction approaches, taking into account embodied carbon associated with building materials (life-cycle emissions of materials including mining, timber harvest, and manufacture, obtained from material emission databases), construction equipment, transportation of supplies and completed modules, project duration, and construction cost. In a case study comparing a typical 2,400-square-foot home, modular construction was found to be responsible for 19 percent lower embodied carbon in comparison to conventional construction. Operational emissions were assumed not to be dependent on construction method and were therefore omitted from the model (Akbarnezhad and Hammad 2017).

3.3 Operational Impacts

No new industrial development is planned for SEIS Alternative 6. Light industrial development is possible as part of SEIS Alternative 5; therefore, only impacts from residential, commercial, light industrial (SEIS Alternative 5), and recreational development have been considered. Impacts from residential development including heating, wood-burning, and transportation-related impacts are described in the subsections below.

3.3.1 Regional Air Quality Impacts

Photochemical smog (the regional haze produced by ozone and fine particles) is largely caused by regional tailpipe emissions of cars and trucks traveling on public streets throughout the region, rather than localized emissions from any individual neighborhood. Tailpipe emissions caused by either alternative would be proportional to the regional VMT caused by each alternative.

SEIS Alternatives 5 and 6 would increase regional VMT, which would contribute to tailpipe emissions throughout Washington State. When added to the forecast population and economic growth throughout the state, the increased emissions caused by development at the 47° North site may slightly contribute to future worsening of regional air quality. However, the change in tailpipe emissions for the SEIS alternatives would be very small relative to the overall regional tailpipe emissions in Washington State.

Photochemical smog was a serious concern in the more densely populated regions of the state (specifically the Puget Sound region) before the late 1980s, but federal tailpipe emission regulations have reduced vehicular emissions. Air quality in Kittitas County has not historically exceeded thresholds for ozone; therefore, the county is and has been a designated attainment area for ozone, CO, nitrogen oxides, and PM_{2.5}. Because the change in tailpipe emissions associated with the 47° North Project is expected to be small compared to the overall tailpipe emissions in the state and because Kittitas County is currently designated an attainment area, tailpipe emissions are qualitatively discussed, and it is concluded that none of the alternatives would result in a significant impact on regional air quality.

3.3.2 Mobile Source Air Toxics

Development of the 47° North site would include the addition of roadways and improvements to existing roadways. When a street is widened and, as a result, moves closer to receptors, the localized level of mobile source air toxics emissions could be higher. On a regional basis, the EPA's vehicle and fuel regulations (coupled with ongoing future fleet turnover) will over time cause substantial reductions that will cause region-wide mobile source air toxics levels to be significantly lower than today in most cases. Therefore, the SEIS alternatives are not expected to be significant generators of mobile air toxics.

3.3.3 Emissions from Vehicle Travel

Tailpipe emissions from vehicles traveling on public roads would be the major source of air pollutant emissions associated with development at the 47° North site. Potential air quality impacts caused by increased tailpipe emissions are divided into two general categories: CO hot spots caused by localized emissions at heavily congested intersections and regional photochemical smog caused by combined emissions throughout the state.

Development under the SEIS alternative would increase vehicle travel on existing public roads. In non-attainment or maintenance areas, increased traffic and congestion can cause localized air pollutant concentrations at local intersections to form a hot spot (i.e., a localized area where air pollutant concentrations exceed NAAQS). However, as discussed in Section 2.3.1.1, the project is located in an attainment area for all criteria pollutants; therefore, it is unlikely that increased traffic and congestion would cause hot spot formation and a conformity analysis, or “hot spot” analysis, is not required.

Furthermore, EPA motor vehicle regulations have steadily decreased tailpipe emissions from individual vehicles. Continuing decreases from individual vehicle emissions are expected to more than offset the increase in vehicle traffic, leading to a decrease in total GHG emissions from transportation sources, even as populations increase (EPA; accessed July 2, 2020). For these reasons, it is unlikely that air quality impacts at local intersections would be significant.

3.3.4 Space Heating Emissions in Residential Buildings and Recreational Vehicles

Air emissions would be generated by natural gas, and/or propane combustion used for space heating (stationary combustion) at new dwellings. However, per-building space heating emissions are expected to decrease in response to energy conservation issues and as future residents purchase more fuel-efficient furnaces. Therefore, future space heating emissions at the 47° North site are not expected to cause significant air quality impacts.

3.3.5 Emissions Associated with Recreational Vehicle Camping

The 47° North project includes an RV camping area, consisting of 627 sites for temporary vacation use. Vehicle traffic associated with the RVs (arrival, departure, and excursions during stays) has been incorporated into the estimated vehicle miles traveled. Wood-fueled outdoor recreational fires would be prohibited within the RV resort; however, propane campfires would be permitted.

Additional potential emissions associated with RVs include diesel generator use. While diesel generators will not be prohibited, each camping site will be supplied with power hookups, meaning that generator use for power production will be unnecessary and therefore minimal.

Contained open fires (outdoor fires contained within an approved enclosure) are allowed in Cle Elum year-round, subject to CEMC 8.24. Fire season, set each year by the city council at the recommendation of the fire chief, is defined as a period during spring, summer, and fall during which fires are deemed to be especially hazardous. Recreational outdoor burning is allowed during fire season only within fireplaces or barbecue pits that have previously been inspected and approved by the fire chief. Contained open fires associated with the RV camping area (as well as surrounding residential areas) will contribute to particulate matter emissions in the Cle Elum area.

3.3.6 Residential Wood Burning

Residential wood-burning appliances elevate concentrations of particulate matter and toxic air pollutants especially when heavy wood burning is combined with stagnant weather conditions. The ambient air pollutant concentrations caused by residential wood combustion generally occur in the immediate vicinity of the wood-burning appliance.

Wood-burning stoves would not be permitted in newly constructed homes within the 47° North project. Additionally, Washington State has regulations in place to improve regional air quality by limiting PM_{2.5} emissions from wood stoves. Continued enforcement of these regulations and policies ensures that future emissions from residential wood combustion would prevent ambient pollutant concentrations in heavily populated areas from approaching health-based NAAQS limits.

3.3.7 Emissions Associated with Commercial and Light Industrial Development

A 25-acre property located off site, adjacent to the site's eastern boundary, could be developed for commercial use at some point in the future by the property owner, New Suncadia, LLC. This potential commercial development could include uses such as a grocery store, general retail, restaurants, and medical offices. Air emission impacts related to this type of commercial development are similar to those associated with residential development; however, commercial development is generally associated with a greater amount of vehicle traffic (employees, customers, and diesel delivery truck traffic). Mechanical equipment (such as commercial boilers and heating units), and trucks at loading docks at office and retail buildings could cause air pollution issues at adjacent residential properties. However, Ecology requires all commercial facilities to use equipment meeting minimum air emission standards, to obtain air permits before installing a new source of air pollution or modifying an existing source of air pollution, and to use best available control technology on stationary equipment to minimize emissions.

The potential commercial development is not part of the proposed 47° North Project; however, it is a component of SEIS Alternative 6. A separate analysis of the estimated GHG impacts associated with the potential commercial development has been included for reference.

Light industrial and business park development is a substantial part of SEIS Alternative 5 and has been included in the GHG impact analysis. The amount and nature of any commercial development associated with SEIS Alternative 5 has not been clearly defined, and is limited by a condition of approval, but is assumed to differ from the retail and office uses planned under SEIS Alternative 6. While this development was modeled using the category "light Industrial," actual associated emissions could be higher or lower than modeled emissions depending on actual uses.

3.4 Indirect/Cumulative Impacts

Development facilitated by the SEIS alternatives would result in indirect effects on air quality. For example, additional people and vehicles in and around the 47° North site could lead to greater concentrations of pollutants that could adversely affect air quality.

The 47° North Project would increase local VMT. However, compared to other population and economic growth throughout the region, the increase attributed to the 47° North Project would be negligible, as shown in Table 4.

All future development in Washington State would also contribute to worldwide emissions of GHG, which would contribute to potential future effects caused by global climate change (e.g., changes in seasonal temperature, seasonal precipitation, and local sea level rise).

The annual GHG emissions for the SEIS alternative are calculated based on the future (2037 and 2051) land use listed in Table 1. Table 2 lists the life-cycle GHG emission increases caused by the combined future development at the 47° North site, compared to the SEIS Alternative 5.

Table 2: Comparison of Annual Greenhouse Gas Emissions (2037 and 2051)

GHG Emission Estimates	Projected Average Annual GHG Emissions (metric tons CO ₂ e per year)		
	SEIS Alternative 6 (Revised Master Site Plan; 2037) (a)	SEIS Alternative 5 (Approved Master Site Plan; 2037)	SEIS Alternative 5 (Approved Master Site Plan; 2051)
Forecast Emissions			
Emissions (Stationary Combustion)	4,526	4,907	6,383
Emissions (Electricity)	6,439	6,320	8,966
Emissions (Transportation)	23,972	32,537	56,030
Emissions (Soil Carbon)	782	988	988
Total Emissions	35,719	44,753	72,368
Difference from “No Action” (SEIS Alt 5) in 2037	(9,035)	N/A	

(a) Including potential future commercial development

As listed in Table 2, SEIS Alternative 6 would result in a smaller increase in GHG emissions than the FEIS or SEIS “No Action” Alternative 5. This difference is because SEIS Alternative 6 includes fewer single-family dwelling units, less commercial square footage, and less cleared land than SEIS and FEIS Alternative 5. Though total VMT associated with the FEIS or SEIS Alternative 5 in 2037 and in 2051 are lower than for SEIS Alternative 6 (see Table 4), transportation emissions associated with SEIS Alternative 5 are higher because vehicles with lower fuel efficiency (heavy trucks) are associated with commercial and industrial development. The difference in estimated GHG emissions between FEIS Alternative 5 and SEIS Alternative 5 is approximately 0.01 percent; therefore, the two Alternatives 5 are considered equivalent for the purposes of this analysis.

Total gross GHG emissions for Washington State are forecast to exceed 114,100,000 metric tons CO₂e per year in 2035 (Brant and Adair 2010). The GHG emissions increase associated with any of the alternatives would be only a small fraction (0.04 percent) of total statewide annual GHG emissions and no single project emits enough GHGs to solely influence global climate change.

Table 3 shows the portion of life-cycle GHG emission increases shown in Table 2 that are attributed to the potential future commercial development at the site under SEIS Alternative 6 (not including soil carbon; cleared land was not itemized separately for the potential future commercial development) in 2037.

Table 3: Potential Future Commercial Development (2037)

GHG Emission Estimates	Projected Average Annual GHG Emissions (metric tons CO ₂ e per year)		
	SEIS Alternative 6 (Without Potential Future Commercial Development)	Potential Future Commercial Development Alone	Total SEIS Alt. 6 (47° North + Future Commercial)
Emissions (Stationary Combustion)	4,042	484	4,526
Emissions (Electricity)	4,663	1,776	6,439
Emissions (Transportation)	10,052	13,921	23,972
Total Emissions	18,757	16,180	35,719

Table 4 shows the future contribution to VMT from the 47° North project (including potential future commercial/light industrial development) in 2037 and for SEIS Alternative 5 in 2051. SEIS Alternative 6 would result in more VMT than the No Action SEIS Alternative 5 in 2037 and 2051 because retail and restaurant development is associated with more vehicle traffic than light industrial development. Additionally, the contribution of daily VMT attributable to any of the alternatives is only 0.1 or 0.2 percent of the statewide forecast daily VMT; therefore, the project is not expected to contribute significantly to regional VMT.

Table 4: Comparison of Vehicle Miles Traveled (2037 and 2051)

	SEIS Alternative 6 - Revised Master Plan (2037)	SEIS Alternative 5 (2037)	SEIS Alternative 5 (2051)
Washington State 2037 daily VMT (a)	132,800,000	132,800,000	132,800,000
Project-Related VMT (b)	240,830	139,611	199,826
Forecast Total Regional VMT	133,040,830	132,939,611	132,999,826
Contribution of Increase to Regional Tailpipe Emissions	0.2%	0.1%	0.2%

(a) 2018 Statewide VMT (WSDOT; accessed June 25, 2020) was scaled up to 2037 using compound annual growth based on a 1.1 percent baseline economic growth outlook (FHWA 2019; accessed June 25, 2020)

(b) Calculated using Ecology's SEPA GHG Calculation Tool.

4.0 MITIGATION MEASURES

The following mitigation measures could contribute to a reduction in GHG emissions associated with the 47° North alternative.

4.1 Incorporated Plan Features

The following features currently incorporated into the 47° North Project plan would contribute to a reduction in GHG emissions from the project:

- As described above, single-family residences would consist of manufactured housing. While projects vary, research has shown that GHG emissions associated with prefabricated residences are significantly less than residences constructed on site.
- Wood-burning stoves would not be permitted in newly constructed homes within the 47° North project area.
- Wood-fueled campfires would not be permitted in the RV resort area.

4.2 Applicable Regulations and Commitments

Additionally, all development in Washington is required to comply with the following regulations.

- National Ambient Air Quality Standards: As described in Section 2.2, the EPA establishes NAAQS and specifies future dates for states to develop and implement plans to achieve these standards.
- State Ambient Air Quality Standards: Ecology establishes state ambient air quality standards for the same six GHG pollutants that are at least as stringent as the national standards; in the case of sulfur dioxide, state standards are more stringent.
- Indoor Burning Smoke Reduction Zone: Ecology's regulatory framework for wood smoke, includes:
 - More stringent emission standards for new wood-burning devices than the federal EPA standards
 - Opacity standards for wood-burning appliances
 - Prohibitions on burning of certain materials or the use of non-certified wood stoves
 - Burn ban wood smoke curtailment program
 - Special attainment area provisions.
- Outdoor Burning: State outdoor burning is regulated by RCW 70.94 and WAC 173-425-040.
- Burning of slash or demolition debris is not permitted within the Cle Elum UGA.
- State of Washington GHG Laws: As described in Section 2.6, Washington enacted a law in 2008 establishing GHG reduction limits.

4.3 Potential Mitigation Measures

The following features are being considered by the applicant and could be incorporated into the 47° North Project plan, and if incorporated would contribute to a reduction in GHG emissions from the project:

- The applicant is considering using energy-efficient lighting in the project.
- The use of solar energy is being contemplated and will be analyzed further.

These potential measures will be revisited in the Final SEIS, based on review of the 47° North application.

4.3.1 Construction Emission Control

All construction contractors should be required to implement air quality control plans for construction activities at the 47° North site. Developers should be required to prepare a dust control plan that commits the construction crews to implement all reasonable control measures described in the Guide to Handling Fugitive Dust from Construction Projects (AGCW 2009). The air quality control plans should include best management practices (BMPs) to control fugitive dust and odors emitted by diesel construction equipment.

The following BMPs should be used to control fugitive dust:

- Use water sprays or other non-toxic dust control methods on unpaved roadways
- Minimize vehicle speed while traveling on unpaved surfaces
- Prevent track-out of mud onto public streets
- Cover soil piles when practicable
- Minimize work during periods of high winds when practicable.

The following mitigation measures should be used to minimize air quality and odor issues caused by tailpipe emissions:

- Maintain the engines of construction equipment according to manufacturers' specifications
- Minimize idling of equipment while the equipment is not in use
- If there is heavy traffic during some periods of the day, scheduling haul traffic during off-peak times (e.g., between 9:00 a.m. and 4:00 p.m.) would have the least effect on traffic and would minimize indirect increases in traffic-related emissions.

5.0 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

No significant unavoidable adverse operational impacts on regional or local air quality are anticipated. The 47° North project is located within an air quality attainment area for all criteria air pollutants and the project poses no issues related to air toxics.

No significant unavoidable adverse impacts on regional or local air quality are anticipated due to construction activities. Temporary, localized dust and odor impacts could occur during construction activities. The regulations and mitigation measures described above are adequate to mitigate any adverse impacts anticipated to occur as a result of the 47° North project.

Though no significance threshold currently exists for GHG impacts, modeled GHG emissions related to the project in 2037 under any alternative are less than 0.04 percent of forecast total statewide annual GHG emissions.

6.0 USE OF THIS REPORT

The conclusions made in this report are based on the results of a qualitative analysis of planning documents that did not include field measurements or incorporation of detailed site-specific information. While this review allows for a preliminary assessment of potential impacts, it does not constitute a site-specific study.

This screening-level study has been prepared for the use of the City of Cle Elum to support the preparation of a Supplemental Environmental Impact Statement for the 47° North Project in Cle Elum, Kittitas County, Washington. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk.

LAI warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. LAI makes no other warranty, either express or implied.

7.0 REFERENCES

- AGCW. 2009. Guide to Handling Fugitive Dust from Construction Projects. Associated General Contractors of Washington. February.
<https://www.wsdot.wa.gov/sites/default/files/2018/04/10/ENV-ANE-GuidetoHandlingFugitiveDust.pdf>.
- Akbarnezhad, Ali, and Ahmed W.A. Hammad. 2017. "Modular vs Conventional Construction: A Multi-Criteria Framework Approach." Proceedings of the 34th International Symposium on Automation and Robotics in Construction (ISARC), July 1.
- Brant, Justin, and Janice Adair. 2010. Path to a Low-Carbon Economy: Washington's Interim Plan to Address Greenhouse Gas Emissions. Publication No. 10-01-011. Climate Policy Group, Washington State Department of Ecology. December.
<https://fortress.wa.gov/ecy/publications/publications/1001011.pdf>.
- Build Carbon Neutral. "Construction Carbon Calculator." <http://buildcarbonneutral.org/>.
- CAT. 2008. Leading the Way: Implementing Practical Solutions to the Climate Change Challenge. Washington State Climate Action Team. November 7.
www.climatestrategies.us/library/library/download/958.
- CEQ. 2019. Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions. Federal Register, 30097-30099. Council on Environmental Quality. July 24.
<https://www.federalregister.gov/documents/2019/06/26/2019-13576/draft-national-environmental-policy-act-guidance-on-consideration-of-greenhouse-gas-emissions>.
- City of Cle Elum. 2002. Trendwest Properties: Cle Elum Urban Growth Area Final Environmental Impact Statement. March 18.
- Ecology. "Air Emissions Inventory Summaries." Washington State Department of Ecology.
<https://ecology.wa.gov/Air-Climate/Air-quality/Air-quality-targets/Air-emissions-inventory>.
- EPA. "History of Reducing Air Pollution from Transportation in the United States." US Environmental Protection Agency. <https://www.epa.gov/transportation-air-pollution-and-climate-change/accomplishments-and-success-air-pollution-transportation>.
- EPA. 2009. "Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Section 202(a) of the Clean Air Act." US Environmental Protection Agency.
<https://www.epa.gov/ghgemissions/endangerment-and-cause-or-contribute-findings-greenhouse-gases-under-section-202a-clean>.
- EPA. 2018. "2014 National Air Toxics Assessment." US Environmental Protection Agency.
<https://www.epa.gov/national-air-toxics-assessment>.
- FHWA. 2019. "Forecasts of Vehicle Miles Traveled: Spring 2019." Policy and Governmental Affairs, Office of Highway Policy Information, Federal Highway Administration.
https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm.
- IPCC. 2008. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change.
https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf.

-
- NHTSA. "SAFE: The Safer Affordable Fuel-Efficient 'SAFE' Vehicles Rule." National Highway Traffic Safety Administration. <https://www.nhtsa.gov/corporate-average-fuel-economy/safe>.
- Quale, John, Matthew J. Eckelman, Kyle W. Williams, Greg Sloditskie, and Julie B. Zimmerman. 2012. "Construction Matters: Comparing Environmental Impacts of Building Modular and Conventional Homes in the United States." *Journal of Industrial Ecology*. 16 (2):243-253. doi: 10.1111/j.1530-9290.2011.00424.x. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1530-9290.2011.00424.x>. March 5.
- WSDOC. 2011. 2012 Washington State Energy Strategy. Washington State Department of Commerce. December. <http://www.commerce.wa.gov/Documents/2012WASStateEnergyStrategy.pdf>.
- WSDOT. "2018 Annual Mileage and Travel Information." Washington State Department of Transportation. <https://www.wsdot.wa.gov/mapsdata/travel/hpms/annualmileage.htm>.
- WSOFM. 2011. Cle Elum Urban Growth Area. Forecasting Division, Washington State Office of Financial Management. October 20. https://www.ofm.wa.gov/sites/default/files/public/dataresearch/pop/smallarea/maps/uga/saep_uga_kittitas.pdf.

Greenhouse Gas Emission Calculation Tools

SEPA Greenhouse Gas Calculation Tool

Inputs

Land Use Category (Plan)	Land Use Category (model designation)	Units	SEIS Alternative 6: Revised Master Plan (2037)	SEIS Alternative 5 [FEIS Alternative 5, if different] (2037)	SEIS Alternative 5 [FEIS Alternative 5, if different] (2051)
Residential					
Single-family	Single-family	DUs	527	587	810
Multi-family	Multi-family	DUs	180	524	524
RV Resort	Multi-family	DUs	314	-	-
Amenity Center					
Clubhouse	Health Club	1,000 sq ft	11	-	-
Spa/Fitness	Health Club	1,000 sq ft	5.5	N/A	N/A
Recreation/Game Center	Health Club	1,000 sq ft	11	N/A	N/A
Registration/Welcome	General Retail	1,000 sq ft	4.0	N/A	N/A
Adventure Center	General Retail	1,000 sq ft	3.5	N/A	N/A
Potential Future Commercial					
<i>Grocery Store</i>	<i>Supermarket</i>	<i>1,000 sq ft</i>	<i>45</i>	<i>N/A</i>	<i>N/A</i>
<i>Retail</i>	<i>General Retail</i>	<i>1,000 sq ft</i>	<i>25</i>	<i>N/A</i>	<i>N/A</i>
<i>Restaurant</i>	<i>Restaurant – fast food</i>	<i>1,000 sq ft</i>	<i>20</i>	<i>N/A</i>	<i>N/A</i>
<i>Medical Offices</i>	<i>Office Space – Medical</i>	<i>1,000 sq ft</i>	<i>60</i>	<i>N/A</i>	<i>N/A</i>
Combined commercial	Light Industrial	1,000 sq ft	N/A	450	950
Total Cleared Land	Cleared Land	Acres	333	401	401
Impervious Surfaces	Cleared Land	Acres	166	247	247

SEIS Alternative 6 (Without Commercial, 2037)

Project Emissions Summary					
	Stationary Combustion	Electricity Use	Transportation	Non-Combustion Emissions	Total
Emissions Summary (MTCO ₂ e)	4,042	4,663	10,052	-	18,757

Enter Data					
Select From Dropdown Menu					
Automatic Calculation (No Input Necessary)					

Stationary Combustion Method 3 - The size and land use of a proposed develop can be used to estimate operational stationary combustion emissions. This method uses national average fuel use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Single-family	Residential	Single Family (ITE 210)	# Homes	527	2,099
Multi-family	Residential	Multi-Family (ITE 220)	# Units	180	668
RV Resort (0.5)	Residential	Multi-Family (ITE 220)	# Units	313.5	1,163
Clubhouse	Retail	Health Club (ITE 492)	ksf	11	41
Spa/Fitness	Retail	Health Club (ITE 492)	ksf	5.5	20
Recreation/Game Center	Retail	Health Club (ITE 492)	ksf	10.5	39
Registration/Welcom	Retail	General Retail	ksf	4	7
Adventure Center (2)	Retail	General Retail	ksf	3.5	6
Grocery Store	Retail	Supermarket (ITE 850)	ksf	0	0
Retail	Retail	General Retail	ksf	0	0
Restaurant (5)	Retail	Fast-Food Restaurant (ITE 934)	ksf	0	0
Medical Offices	Office Space	Medical (ITE 720)	ksf	0	0
Subtotal					4,042

Electricity Use Method 2 - The size and land use of a proposed develop can be used to estimate operational electricity production emissions. This method uses national average energy use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Single-family	Residential	Single Family (ITE 210)	# Homes	527	2,853.9
Multi-family	Residential	Multi-Family (ITE 220)	# Units	180	552.6
RV Resort (0.5)	Residential	Multi-Family (ITE 220)	# Units	313.5	962.4
Clubhouse	Retail	Health Club (ITE 492)	ksf	11	101.9
Spa/Fitness	Retail	Health Club (ITE 492)	ksf	5.5	50.9
Recreation/Game Ce	Retail	Health Club (ITE 492)	ksf	10.5	97.2
Registration/Welcom	Retail	General Retail	ksf	4	23.5
Adventure Center (2)	Retail	General Retail	ksf	3.5	20.6
Grocery Store	Retail	Supermarket (ITE 850)	ksf	0	0.0
Retail	Retail	General Retail	ksf	0	0.0
Restaurant (5)	Retail	t-Food Restaurant (ITE 934)	ksf	0	0.0
Medical Offices	Office Space	Medical (ITE 720)	ksf	0	0.0
Subtotal					4,663

	Enter Data			
	Select From Dropdown Menu			
	Automatic Calculation (No Input Necessary)			

Transportation Method 3 - The size and land use of a proposed develop can be used to estimate operational transportation emissions. This method uses estimated trip generation rates in the Puget Sound for different land uses.

Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO2e)
Residential	Single Family (ITE 210)	# Homes	527	5,508
Residential	Multi-Family (ITE 220)	# Units	180	1,326
Residential	Multi-Family (ITE 220)	# Units	313.5	2,309
Retail	Health Club (ITE 492)	kfs	11	272
Retail	Health Club (ITE 492)	kfs	5.5	136
Retail	Health Club (ITE 492)	kfs	10.5	259
Retail	General Retail	kfs	4	129
Retail	General Retail	kfs	3.5	113
Retail	Supermarket (ITE 850)	kfs	0	0
Retail	General Retail	kfs	0	0
Retail	t-Food Restaurant (ITE 900)	kfs	0	0
Office Space	Medical (ITE 720)	kfs	0	0
			Subtotal	10,052

Vehicle Miles Traveled

Sector	Land Use	Building Unit	Data	Daily VMT
Residential	Single Family (ITE 210)	# Homes	527	55,335
Residential	Multi-Family (ITE 220)	# Units	180	13,320
Residential	Multi-Family (ITE 220)	# Units	313.5	23,199
Retail	Health Club (ITE 492)	kfs	11	2,728
Retail	Health Club (ITE 492)	kfs	5.5	1,364
Retail	Health Club (ITE 492)	kfs	10.5	2,604
Retail	General Retail	kfs	4	1,296
Retail	General Retail	kfs	3.5	1,134
Retail	Supermarket (ITE 850)	kfs	0	0
Retail	General Retail	kfs	0	0
Retail	t-Food Restaurant (ITE 900)	kfs	0	0
Office Space	Medical (ITE 720)	kfs	0	0
			Subtotal	100,980

SEIS Alternative 6 (Only Commercial, 2037)

Project Emissions Summary					
	Stationary Combustion	Electricity Use	Transportation	Non-Combustion Emissions	Total
Emissions Summary (MTCO _{2e})	484	1,776	13,921	-	16,180

Enter Data					
Select From Dropdown Menu					
Automatic Calculation (No Input Necessary)					

Stationary Combustion Method 3 - The size and land use of a proposed develop can be used to estimate operational stationary combustion emissions. This method uses national average fuel use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO _{2e})
Grocery Store	Retail	Supermarket (ITE 850)	ksf	45	123
Retail	Retail	General Retail	ksf	25	42
Restaurant (5)	Retail	Fast-Food Restaurant (ITE 934)	ksf	20	154
Medical Offices	Office Space	Medical (ITE 720)	ksf	60	164
Subtotal					484

Electricity Use Method 2 - The size and land use of a proposed develop can be used to estimate operational electricity production emissions. This method uses national average energy use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO _{2e})
Grocery Store	Retail	Supermarket (ITE 850)	ksf	45	914.8
Retail	Retail	General Retail	ksf	25	147.1
Restaurant (5)	Retail	t-Food Restaurant (ITE 934)	ksf	20	316.1
Medical Offices	Office Space	Medical (ITE 720)	ksf	60	397.5
Subtotal					1,776

Transportation Method 3 - The size and land use of a proposed develop can be used to estimate operational transportation emissions. This method uses estimated trip generation rates in the Puget Sound for different land uses.

Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO _{2e})
Retail	Supermarket (ITE 850)	ksf	45	3,449
Retail	General Retail	ksf	25	806
Retail	t-Food Restaurant (ITE 934)	ksf	20	7,444
Office Space	Medical (ITE 720)	ksf	60	2,222
Subtotal				13,921

Vehicle Miles Traveled

Sector	Land Use	Building Unit	Data	Daily VMT
Retail	Supermarket (ITE 850)	ksf	45	34,650
Retail	General Retail	ksf	25	8,100
Retail	t-Food Restaurant (ITE 934)	ksf	20	74,780
Office Space	Medical (ITE 720)	ksf	60	22,320
Subtotal				139,850

SEIS Alternative 5 (2037)

Project Emissions Summary					
	Stationary Combustion	Electricity Use	Transportation	Non-Combustion Emissions	Total
Emissions Summary (MTCO ₂ e)	4,907	6,320	32,537	-	43,765

Enter Data				
Select From Dropdown Menu				
Automatic Calculation (No Input Necessary)				

Stationary Combustion Method 3 - The size and land use of a proposed develop can be used to estimate operational stationary combustion emissions. This method uses national average fuel use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Single-family	Residential	Single Family (ITE 210)	# Homes	587	2,338
Multi-family	Residential	Multi-Family (ITE 220)	# Units	524	1,944
RV Resort (0.5)	Residential	Multi-Family (ITE 220)	# Units	0	0
Combined commercial	Industrial	Light Industrial (ITE 110)	ksf	490	626
Subtotal					4,907

Electricity Use Method 2 - The size and land use of a proposed develop can be used to estimate operational electricity production emissions. This method uses national average energy use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Single-family	Residential	Single Family (ITE 210)	# Homes	587	3,178.8
Multi-family	Residential	Multi-Family (ITE 220)	# Units	524	1,608.7
RV Resort (0.5)	Residential	Multi-Family (ITE 220)	# Units	0	0.0
Combined commercial	Industrial	Light Industrial (ITE 110)	ksf	490	1,532.5
Subtotal					6,320

Transportation Method 3 - The size and land use of a proposed develop can be used to estimate operational transportation emissions. This method uses estimated trip generation rates in the Puget Sound for different land uses.

Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Residential	Single Family (ITE 210)	# Homes	587	6,135
Residential	Multi-Family (ITE 220)	# Units	524	3,860
Residential	Multi-Family (ITE 220)	# Units	0	0
Industrial	Light Industrial (ITE 110)	ksf	490	22,542
Subtotal				32,537

Vehicle Miles Traveled

Sector	Land Use	Building Unit	Data	Daily VMT
Residential	Single Family (ITE 210)	# Homes	587	61,635
Residential	Multi-Family (ITE 220)	# Units	524	38,776
Residential	Multi-Family (ITE 220)	# Units	0	0
Industrial	Light Industrial (ITE 110)	ksf	490	39,200
Subtotal				139,611

SEIS Alternative 5 (2051)

Project Emissions Summary					
	Stationary Combustion	Electricity Use	Transportation	Non-Combustion Emissions	Total
Emissions Summary (MTCO ₂ e)	6,383	8,966	56,030	-	71,380

Enter Data				
Select From Dropdown Menu				
Automatic Calculation (No Input Necessary)				

Stationary Combustion Method 3 - The size and land use of a proposed develop can be used to estimate operational stationary combustion emissions. This method uses national average fuel use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Single-family	Residential	Single Family (ITE 210)	# Homes	810	3,226
Multi-family	Residential	Multi-Family (ITE 220)	# Units	524	1,944
RV Resort (0.5)	Residential	Multi-Family (ITE 220)	# Units	0	0
Combined commercial	Industrial	Light Industrial (ITE 110)	ksf	950	1,213
Subtotal					6,383

Electricity Use Method 2 - The size and land use of a proposed develop can be used to estimate operational electricity production emissions. This method uses national average energy use rates for different land uses.

Building Name	Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Single-family	Residential	Single Family (ITE 210)	# Homes	810	4,386.4
Multi-family	Residential	Multi-Family (ITE 220)	# Units	524	1,608.7
RV Resort (0.5)	Residential	Multi-Family (ITE 220)	# Units	0	0.0
Combined commercial	Industrial	Light Industrial (ITE 110)	ksf	950	2,971.2
Subtotal					8,966

Transportation Method 3 - The size and land use of a proposed develop can be used to estimate operational transportation emissions. This method uses estimated trip generation rates in the Puget Sound for different land uses.

Sector	Land Use	Building Unit	Data	Annual GHG Emission (MT CO ₂ e)
Residential	Single Family (ITE 210)	# Homes	810	8,466
Residential	Multi-Family (ITE 220)	# Units	524	3,860
Residential	Multi-Family (ITE 220)	# Units	0	0
Industrial	Light Industrial (ITE 110)	ksf	950	43,705
Subtotal				56,030

Vehicle Miles Traveled

Sector	Land Use	Building Unit	Data	Daily VMT
Residential	Single Family (ITE 210)	# Homes	810	85,050
Residential	Multi-Family (ITE 220)	# Units	524	38,776
Residential	Multi-Family (ITE 220)	# Units	0	0
Industrial	Light Industrial (ITE 110)	ksf	950	76,000
Subtotal				199,826