4.9 Greenhouse Gas Emissions

4.9.1 Introduction

This section describes the affected environment and environmental consequences related to greenhouse gas emissions (GHG) from operation of the NEPA Alternatives. Information in this section is based on Terry A. Hayes Associates Inc. (2016) *VTA's BART Silicon Valley – Phase II Extension Project Air Quality Study* (included as a technical report with this SEIS/SEIR).

4.9.2 Environmental and Regulatory Setting

4.9.2.1 Environmental Setting

GHG emissions refer to a group of emissions that are generally believed to affect global climate conditions. The greenhouse effect compares Earth and the atmosphere surrounding it to a greenhouse with glass panes. The glass panes in a greenhouse let heat from sunlight in and reduce the amount of heat that escapes. GHGs, as defined in accordance with Section 19(i) of Executive Order (EO) 13514 (Focused on Federal Leadership in Environmental, Energy, and Economic Performance), include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These GHGs, in addition to water vapor, keep the average surface temperature of Earth close to 60 degrees Fahrenheit (°F).

CO_2 is the most abundant pollutant that contributes to climate change through fossil fuel combustion. The other GHGs are less abundant but have higher global warming potential than CO_2. To account for this higher potential, emissions of other GHGs are frequently expressed in the equivalent mass of CO_2, denoted as CO_2e.

The Bay Area Air Quality Management District (BAAQMD) has published an emissions inventory that includes direct GHG emissions due to human activities within the boundaries of the BAAQMD (BAAQMD 2015). The emissions are estimated for industrial, commercial, transportation, residential, forestry, and agriculture activities. For generation of electricity, both direct GHG emissions from locally generated electricity in the Bay Area and indirect emissions from electricity generated elsewhere for consumption in the region are reported.

In 2011, 86.6 million metric tons of CO_2e ($MMTCO_2e$) GHG were emitted by the Bay Area (83.9 $MMTCO_2e$ were emitted within the Bay Area Air District and 2.7 MMT CO_2e were indirect emissions from imported electricity).

CO2 accounts for 90.3 percent of total Bay Area GHG emissions in 2011. CO_2 emissions are mainly associated with carbon-bearing fossil fuel combustion. Other activities that produce CO_2 emissions include mineral production, waste combustion, and land use and forestry changes.

CH_4 emissions also contribute to climate change and represent 3.0 percent of the Bay Area's total CO_2e emissions. Major sources of CH_4 emissions in the Bay Area are municipal solid waste landfills, raising of livestock and other agricultural activities, stationary and mobile fuel combustion, gas and oil production fields, and natural gas distribution systems.

N_2O emissions account for 1.7 percent of the total 2011 GHG emissions inventory. Municipal wastewater treatment facilities, fuel combustion, and agricultural soil and manure management are the major contributors of N_2O emissions in the Bay Area.

Emissions from high-global warming potential (GWP) gases such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) make up about 4.9 percent of the total CO_2e. High-GWP gases are substitutes for stratospheric ozone depleting substances (e. g., chlorofluorocarbons). These gases are used in applications such as refrigeration and air-conditioning, semi-conductor/electronic industry manufacturing processes, and electric power distribution systems.

4.9.2.2 Regulatory Setting

Relevant to GHG emissions and climate change, NEPA recognizes "the profound impact of man's activity on the interrelations of all components of the natural environment." (U.S. Code, Title 42, Section 4331). It was enacted to "promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man." (U.S. Code, Title 42, Section 4321). In December 2009, the U.S. Environmental Protection Agency (EPA) Administrator signed two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act (CAA). The Endangerment Finding found that the current and projected concentrations of the six key GHGs (i.e., CO_2, CH_4, nitrous oxides, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride) in the atmosphere threaten the health and welfare of current and future generations. The Cause or Contribute Finding found that the combined emissions of these GHGs from new motor vehicles and motor vehicle engines contribute to GHG pollution, which threatens public health and welfare. These findings were necessary prerequisites for implementing GHG emissions standards for vehicles. In collaboration with the National Highway Traffic Safety Administration, EPA finalized emissions standards for light-duty vehicles (2012–2016 model years) in May 2010 and heavy-duty vehicles (2014–2018 model years) in August 2011.

On August 1, 2016, the Council on Environmental Quality (CEQ) released revised final guidance that describes how federal departments and agencies should consider the effects of GHG emissions and climate change in their National Environmental Policy Act (NEPA) reviews.[1] The final guidance is designed to allow decision makers and the public to fully understand the potential climate impacts of federal actions, and in turn, assist agencies in comparing alternatives and considering measures to mitigate the impacts of climate change. In

[1] Council on Environmental Quality. 2016. *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*. August 1.

addition to providing agencies with a reasoned approach as to how to describe climate change impacts, the guidance:

- Advises agencies to quantify projected GHG emissions of proposed federal actions whenever the necessary tools, methodologies, and data inputs are available.
- Encourages agencies to draw on their experience and expertise to determine the appropriate level (broad, programmatic or project- or site-specific) and the extent of quantitative or qualitative analysis required to comply with NEPA.
- Counsels agencies to consider alternatives that would make the action and affected communities more resilient to the effects of a changing climate.
- Reminds agencies to use existing information and science when assessing proposed actions.

The federal guidance provides a common approach for assessing actions, while recognizing each agency's unique circumstance and authority. Agencies have discretion in how they tailor their individual NEPA reviews to accommodate the final guidance. The final guidance does not create new or additional regulatory requirements or NEPA implementing procedures. Importantly, the final guidance does not include a quantitative emissions limit that could be used to identify potential adverse effects.

Published on June 10, 2015, EO 13693, Planning for Federal Sustainability in the Next Decade, revokes multiple prior EOs and memorandum, including EO 13514. The goal of EO 13693 is to maintain federal leadership in sustainability and GHG emission reductions. The new EO outlines forward-looking goals for federal agencies in the area of energy, climate change, water use, vehicle fleets, construction, and acquisition. Federal agencies must, where life-cycle cost-effective, beginning in 2016 do the following.

- Reduce agency building energy intensity (as measured in British thermal units per square foot) by 2.5 percent annually through 2025.
- Improve data center energy efficiency at agency buildings.
- Ensure a minimum percentage of total building electric and thermal energy is from clean energy sources.
- Improve agency water use efficiency and management (including stormwater management).
- Improve agency fleet and vehicle efficiency and management by achieving minimum percentage GHG emission reductions.

4.9.3 Methodology

4.9.3.1 Overview

There are no adopted quantitative thresholds that are relevant to the NEPA analysis. Potential adverse effects of quantified GHG emissions are assessed by comparing the magnitude of emissions associated with the BART Extension Alternative to the No Build Alternative. Consistent with the CEQ's final GHG guidance, implications of climate change on the proposed action are qualitatively assessed.

4.9.3.2 Methods

Operational emissions associated with the BART Extension Alternative have been estimated related to changes to regional vehicle miles traveled (VMT) and electricity production to support facilities. Because BART provides an alternative to vehicle trips, it would contribute to a decrease in regional emissions from reductions in personal vehicle use (also known as mode shift). The America Public Transportation Association (APTA) (2009) recommends GHG analyses for transit projects account for this emissions "credit" associated with avoided car trips through mode shift. Consistent with APTA recommendations, FTA has used this methodology for other transit projects (i.e., Phase I Project) throughout the region.

Emissions from changes in regional VMT were estimated using the California Air Resources Board's (ARB's) emissions model (EMFAC2014) and daily VMT data obtained from *VTA's BART Silicon Valley – Phase II Extension Project Draft Traffic Impact Analysis* by Hexagon Transportation Consultants, Inc. The VMT data were provided in 5-mile-per-hour (mph) speed bins (or ranges) for the 2015 Existing, 2025 Opening Year, and 2035 Forecast Year under the with- and without-BART Extension Alternative scenarios.

GHG emissions to support BART electricity consumption associated with traction, station lighting, and station auxiliary power have been quantified using a power consumption rate of 0.00267 megawatt-hour per BART VMT per day. To calculate total daily power consumption, the above power consumption rate was multiplied by the total length of the BART Extension Alternative and the total number of train departures/arrivals in a day. It is assumed that there would be 6-minute headways between 6:00 a.m. and 7:30 p.m., 20-minute headways between 4:00 a.m. and 6:00 a.m., and between 7:30 p.m. and 1:30 a.m., resulting in 13.5 hourly train trips. The stations and related facilities built as part of BART Extension Alternative would also use electric power. This "other" energy requirement was calculated on a percentage basis. About 25 percent of BART's existing power requirements are for station and facilities operations, with the other 75 percent for vehicle propulsion. It was assumed this relationship would apply to the BART Extension as well. Based on data obtained from the air quality analysts, annual electricity consumption for vehicle propulsion along the BART Extension would be 1.4 million kilowatt-hours (kWh). Additional electricity consumed by other facilities was therefore estimated to be about 468,000 kWh per year. The electricity intensity factors were obtained from the CalEEMod and used to calculate CO_2

emissions associated with the production of electricity consumed by operation of the BART Extension (California Air Pollution Control Officers Association 2013).

4.9.4 Environmental Consequences and Mitigation Measures

This section identifies impacts and evaluates whether they would be adverse according to NEPA, using the criteria (i.e., context and intensity) identified in Section 4.9.3, *Methodology*. This section also identifies measures to avoid, minimize, or mitigate impacts.

4.9.4.1 No Build Alternative

The No Build Alternative consists of the existing transit and roadway networks and planned and programmed improvements (see Chapter 2, Section 2.2.1, *NEPA No Build Alternative*, for a list of these projects). Given the mix of projects, some of the projects may reduce GHG emissions by providing transit, bicycle and pedestrian improvements and also reducing congestion. Projects planned under the No Build Alternative would, however, undergo separate environmental review to determine whether the projects would result in adverse GHG effects. Several of these projects have already been programmed in the Regional Transportation Plans. Review would include an analysis of impacts and identification of mitigation measures to mitigate potential project impacts. Without the transit improvements, the No Build Alternative would not result in the GHG reduction benefits of the BART Extension Alternative.

As discussed above, other projects would undergo separate environmental review to determine whether they would result in adverse GHG effects. Review would include an analysis of impacts and identification of mitigation measures to mitigate potential project impacts.

4.9.4.2 BART Extension Alternative

Greenhouse Gas Emissions

The operational analysis for the BART Extension Alternative considers electricity-related emissions from operation of BART, as well as GHG benefits associated with vehicle mode shift. As discussed above, it is anticipated that the BART Extension Alternative would increase ridership, thereby decreasing regional passenger VMT through mode shift from private automobiles to transit. Accounting for GHG emissions reductions associated with mode shift is consistent with recommendations from APTA (2009).

As shown in Table 4.9-1, operation of the BART Extension Alternative would decrease GHG emissions because of reductions in VMT-related emissions. This is a beneficial effect of the BART Extension Alternative, and there would be no potential for an adverse effect associated with increased GHG emissions.

Table 4.9-1: Estimated Carbon Dioxide Emissions – BART Extension Alternative

Alternative	Carbon Dioxide Metric Tons per Year
2015 Existing	
No Build	7,907,605
BART Extension Alternative – VMT Related Emissions	7,864,744
BART Extension Alternative – Emissions Related to Electricity Production for Operations	615
Net Emissions (No Build minus BART Extension Alternative)	(-42,246)
2025 Opening Year	
No Build Change in Vehicular Emissions from Increased Ridership	6,154,061
BART Extension Alternative Change in Vehicular Emissions from Increased Ridership	6,124,275
BART Extension Alternative Electricity-Related Emissions	615
Net Emissions (No Build minus BART Extension Alternative)	(-29,171)
2035 Forecast Year	
No Build Change in Vehicular Emissions from Increased Ridership	5,314,428
BART Extension Alternative Change in Vehicular Emissions from Increased Ridership	5,291,677
BART Extension Alternative Electricity-Related Emissions	615
Net Emissions (No Build minus BART Extension Alternative)	(-22,136)
Source: ARB EMFAC2014, CalEEMod version 2013.2.2.	

Climate Change Effects on the BART Extension Alternative

Several impacts on the environment are expected throughout California as a result of global climate change. The extent of these effects is being defined as climate modeling tools become more refined. Regardless of the uncertainty in precise predictions, it is widely understood that substantial climate change is expected to occur in the future. Potential climate change impacts include, but are not limited to, extreme heat events, increased water and energy consumption, and changes in species distribution and range. Certain low-lying parts of cities of San Jose and Santa Clara may be susceptible to flooding that has been influenced by climate-change events. Section 4.17, *Water Resources, Water Quality, and Floodplains*, includes a detailed discussion of potential flooding. Currently, all of the BART Extension Alternative within the floodplain is developed, partially developed, or zoned for development. Some of the projected base floodplain development would occur regardless of the BART Extension Alternative. In general, the BART Extension Alternative would be consistent with development plans for the area and would not significantly change the land use in the area because it is currently developed or zoned for development. The change in water surface elevation would be minimal because there would be minimal fill in the base

floodplains with proper minimization measures (WRECO 2015). The BART Extension Alternative would not expose people or structures to the risk of flooding, create floodplains, or result in an increase in the base flood elevation. Natural and beneficial floodplain values would not be affected by the BART Extension Alternative.

Regarding adapting to climate change, the Bay Area Joint Policy Committee (JPC) is tasked with producing a Bay Area Climate and Energy Resilience Strategy to provide guidance on how to include protecting the Bay Area's economy, public health, infrastructure, and ecosystems from sea-level rise, water shortages, high energy prices, and other impacts in long-term regional and local planning, including *Plan Bay Area*. This work focuses on the institutional structures and resources that will be needed to create a multi-stakeholder adaptive management process on regional resilience. In September 2012, the JPC adopted a work plan to develop a Regional Sea Level Rise Adaptation Strategy. The objective of the project is to ensure the ongoing health and ecological viability of regional natural resources, such as San Francisco Bay; coordinate adaptation mechanisms that transcend local jurisdictional boundaries; and share the costs of adaptation responses at a regional level, especially when regional resources are involved. The sea-level rise adaption strategy work plan focuses on providing enough background information and support to develop a "bottom-up" regional strategy where the regional agencies work with local entities to assess vulnerabilities and risks, identify critical assets, explore adaptation options, and use a balanced approach to identify costs, benefits, and adaptation strategies for the natural resources/ecosystem services provided by the Bay and its watersheds.

In addition, *Plan Bay Area* provides a long-range framework to minimize transportation impacts on the environment, improve regional air quality, protect natural resources, and reduce GHG emissions by encouraging new development to locate near transit rather than areas poorly served or not served by transit. Mitigation Measure 2.5(c) in *Plan Bay Area* states that, "[m]itigation measures that shall be considered by implementing agencies and/or project sponsors where feasible based on project-and site-specific considerations include, but are not limited to the following. The project sponsors and implementing agencies shall coordinate with BCDC, Caltrans, local jurisdictions (cities and counties), and other transportation agencies to develop Transportation Asset Management Plans (TAMPs) that consider the potential impacts of sea level rise over the asset's life cycle." As stated above, the BART Extension Alternative would not expose people or structures to the risk of flooding, create floodplains, or result in an increase in the base flood elevation.

A range of other potential climate change impacts may affect the BART Extension Alternative, including increased temperatures, heat stress days, and water supplies. The BART Extension Alternative would not exacerbate these issues.

4.9.5 NEPA Conclusion

For operation of the BART Extension Alternative, there would be a beneficial reduction in GHG emissions and *no adverse effect* related to climate change emissions under NEPA.

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