4.7 GREENHOUSE GASES

This section provides information on greenhouse gas (GhG) emissions, and includes an analysis of potential impacts related to GhG emissions resulting from implementation of the Project.

IMPACTS EVALUATED IN OTHER SECTIONS

The following subjects are related to GhG emissions, but are evaluated in another section of this document:

Air quality is evaluated in Section 4.3, Air Quality

SETTING AND REGULATORY FRAMEWORK

Climate change is the shift of "average weather" patterns observed on earth, and can be measured by such variables as temperature, wind patterns, storms, and precipitation. The temperature on earth is regulated, in part, by the "greenhouse effect," where naturally occurring gases, such as carbon dioxide, absorb infrared radiation emitted by the earth's surface and radiate it back to the surface, thus trapping heat within the atmosphere. Without this naturally occurring greenhouse effect, the earth's average temperature would be about 61 degrees Fahrenheit ($^{\circ}F$) cooler (California Action Team 2006). Changing the atmospheric abundance or properties of these greenhouse gases can lead to a warming or cooling of the climate system. Human activities result in emission of four principal GhGs: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and halocarbons (IPCC 2007b).

Of all human activities, the burning of fossil fuels is the largest contributor in overall GhG emissions, releasing CO_2 into the atmosphere (IPCC 2007b). The resulting increases in GhG emissions from human activities are leading to higher concentrations and a change in composition of the atmosphere. During the previous 10,000 years, up to 1750, CO_2 measured within the range of 280 ppm, plus or minus 20 ppm. During the industrial era, CO_2 rose to 367 ppm in 1999, 379 ppm in 2005 (IPCC 2007a), and 400 ppm as of May 9, 2013 (NASA 2013).

Many sources and models indicate that temperatures on earth are warming and will continue to warm at unprecedented rates. The global mean surface temperature has increased by 1.1 °F since the 19th century (IPCC 2001) and the 10 warmest years of the last 100 years all occurred within the last 15 years. The IPCC also reports that the average global temperature is expected to rise by 2.0 to 11.5 °F by the end of the 21st century – depending on future GhG emission scenarios (IPCC 2007a).

State of California

California is the second largest emitting state of GhG in the United States, after Texas. In 2004, California produced an estimated 492 million metric tons of CO_2 equivalents (MMTCO₂e), including emissions associated with imported electricity. Eighty-one percent of the emissions came from the combustion of fossil fuels. In California, the majority of GhG emissions caused by human activity come from transportation, industrial, electrical power generation, and agriculture/forestry practices. The transportation sector was the single largest source of California's GhG emissions in 2004, accounting for 41 percent of the total GhG emissions in the state. This sector was followed by the electrical power sector at 22 percent (including both in-state and out-of-state sources) and the industrial sector at 21 percent (California Energy Commission [CEC] 2006). In California, climate change already is impacting the State's coastlines, water supplies, agriculture, and public health, and putting millions of acres of forested land at increased risk of fire (CEC 2008).

In the Fall of 2006, the Governor signed AB32, the "Global Warming Solutions Act of 2006," committing the State of California to reducing GhG emissions to 1990 levels by 2020. The statute requires the California Air Resources Board (ARB) to track emissions through mandatory reporting, determine what 1990 emissions were, set annual emissions limits that will result in meeting the 2020 target, and identify a list of discrete early actions that directly address GhG emissions, are regulatory, and can be enforced by January 1, 2010.

AB 32 addresses six greenhouse gases:

Carbon Dioxide (CO_2) : CO_2 is an odorless, colorless gas. Natural sources include decomposition of dead organic matter, respiration of plants and animals, evaporation from oceans and volcanic outgassing. Human activities contribute to CO_2 emissions from the burning of fossil fuels for transportation, building heating and cooling, and the manufacturing of goods. In addition deforestation releases CO_2 and reduces its uptake by plants.

Methane (CH_4): CH_4 , a colorless, odorless gas, is the principal component of natural gas. CH_4 is released naturally through the anaerobic decay of organic matter such as the natural processes that occur in wetlands. Human activities contributing to CH_4 include agricultural activities and landfills. Global Warming Potential factors represent the ratio of the heat-trapping ability of each GhG to that of carbon dioxide. One ton of CH_4 has 21 times more ability to trap heat in the atmosphere than one metric ton of CO_2 .

Nitrous Oxide (N_2O): N_2O , commonly known as laughing gas, is a colorless gas with a slightly sweet odor. N_2O is released through natural processes in the soil and oceans. Human activities contribute to N_2O emissions through the use of fertilizers and the burning of fossil fuels. N_2O has a global warming potential 310 times greater than CO_2 .

Sulfur Hexafluoride (SF_6): SF_6 is a colorless, odorless, non-toxic and non-flammable gas. The most common human activity contributing to SF_6 is as an electrical insulator in high voltage equipment that transmits and distributes electricity replacing oil filled circuit breakers. SF_6 has a global warming potential 23,900 times greater than CO_2 .

Hydrofluorocarbons (HFCs): HFCs are synthetic man-made chemicals that are used as substitutes for Chlorofluorocarbons (CFCs) in applications such as automobile air conditioners and refrigerants. Of all the GhGs, they are one of three groups with the highest global warming potential ranging from 12 times greater than CO_2 for C_2H_5F to 11,700 times greater for CHF₃. Human activity use is increasing due to its use as a refrigerant.

Perfluorocarbons (PFCs): PFCs are a non-flammable, non-toxic gas. Natural geological emissions have been responsible for the PFCs that have accumulated in the atmosphere over a very long time. The two main human activity sources of PFCs are aluminum production and semiconductor manufacture. On average, PFCs have the highest global warming potential ranging from 6,500 times greater than CO_2 for CF_4 to 9,200 times greater for C_2F_6 .

In December 2007, ARB approved the 2020 emissions limit at 427 MMTCO₂e. Projected emissions for 2020 are 507 MMTCO₂e. Therefore, a reduction of 80 MMTCO₂e is needed to meet the goal.

On December 11, 2008 ARB approved the *Climate Change Proposed Scoping Plan*. This document is a comprehensive plan that identifies how California will meet the 2020 GhG emission limit. According to the Plan, the strategies would result in a reduction of 105.3 MMTCO₂e per year, or 24% more than is needed to reach the 427 MMTCO₂e limit.

Bay Area Air Quality Management District

In June 2010 the Bay Area Air Quality Management District (BAAQMD) released their final revised CEQA Air Quality Guidelines (updated May 2011 and May 2012). The 2011 document updates BAAQMD's 1999 guidelines and includes screening criteria and quantitative thresholds of significance for evaluating GhG emissions. Thresholds of significance for operational-related GhG emissions are broken into two categories:

- Land use development projects: residential, commercial, industrial, and public land uses and facilities.
- Stationary source projects: land uses that would accommodate processes and equipment that emit GhG emissions and would require a BAAQMD permit to operate (e.g., process equipment).

The guidelines do not include screening criteria or thresholds of significance for construction-related GhG emissions nor do they require a quantification of biogenic emissions (e.g., materials that are derived from living cells).

The BAAQMD CEQA thresholds were recently invalidated by a trial court because BAAQMD did not itself do a CEQA evaluation of the thresholds before their adoption. The court, however, did not rule on or question the adequacy of the BAAQMD CEQA *Air Quality Guidelines*, including the impact assessment methodologies, or the evidentiary basis supporting the thresholds, which are included in the Guidelines. Solano County, as Lead Agency for the proposed project, has the discretion to use the BAAQMD CEQA *Air Quality Guidelines* and methodology for analyzing greenhouse gas impacts under CEQA based on the evidence and technical studies supporting the Guidelines. The following analysis utilizes the impact assessment methodologies presented in the BAAQMD CEQA *Air Quality Guidelines* (BAAQMD 2011), including BAAQMD's *Revised Draft Options and Justification Report CEQA Thresholds of Significance* (BAAQMD 2009).

County of Solano

There are nearly 90 policies and programs identified in the Solano County General Plan (refer to Table HS-5 of the Solano County General Plan) that are related to climate change. Specifically Program HS-I.73 requires the development and adoption of a Climate Action Plan. The County completed this by adoption of a Climate Action Plan (CAP) on June 7, 2011. The CAP identifies the County's emissions at 960,000 MTCO₂ per year. The CAP establishes a communitywide GhG emissions reduction goal of 20 percent below 2005 levels by 2020. This goal is more aggressive than the State's reduction goal. The CAP identifies numerous GhG reduction measures in the agriculture, transportation and land use, energy use, water use, and solid waste sectors.

Lake Herman Quarry

The Quarry has implemented several energy improvement strategies and policies in recent years. For example, only energy efficient motors are purchased when a motor requires replacement. All of the mercury vapor and metal halide lighting on the site has been replaced with energy efficient T5 High Bay fluorescent lighting. Also, energy efficient motor soft starts are purchased to reduce electricity demand. A motor soft starter is an electronic device that reduces the torque in the power train of a motor. The Quarry also participates in PG&E programs to reduce energy use during peak hours. This includes the Base Interruptible Program and the Demand Building Program.

Energy use related to Quarry operations includes electricity and natural gas used by the buildings and equipment; vehicle miles travelled (VMT) by the haul trucks, employees, and delivery vehicles; and gasoline and diesel used by the off-road mobile sources.

The Quarry primarily serves or delivers aggregate to five cities: American Canyon, Benicia, Cordelia, Fairfield and Vallejo. Delivery of aggregate is the main contributor to VMT, estimated at approximately 2,671,800 VMT per year.

Policies and Programs of the Solano County General Plan and Climate Action Plan

The following are the policies and programs of the Solano County General Plan and CAP that relate to GhG emissions and that are applicable to the Project.

Solano County General Plan

- AG.P-21 Promote natural carbon sequestration to offset carbon emissions by supporting sustainable farming methods (such as no-till farming, crop rotation, cover cropping, and residue farming), encouraging the use of appropriate vegetation within urban-agricultural buffer areas, and protecting grasslands from conversion to non-agricultural uses.
- RS.P-6: Protect oak woodlands and heritage trees and encourage the planting of native tree species in new developments and along road rights-of-way.
- RS.P-49: Ensure energy conservation and reduced energy demand in the county through required use of energy-efficient technology and practices.
- RS.P-59: Encourage on-site renewable energy production and use and energy conservation measures.

- HS.P-47: Promote GHG emission reductions by supporting carbon efficient farming methods (e.g., methane capture systems, no-till farming, crop rotation, cover cropping, residue farming); installation of renewable energy technologies; protection of grasslands, open space, and farmlands from conversion to other uses; and encouraging development of energy-efficient structures.
- HS.I-73 Develop and adopt a climate action plan for Solano County. It is the intent of Solano County to coordinate and seek participation from all cities in preparation of a countywide baseline study and in preparation and implementation of the Climate Action Plan (CAP).
- HS.I-57: Comply with all federal and/or state GHG emission reduction targets to reduce the County's contribution to global climate change. The plan should include strategies to reduce vehicle miles traveled, energy consumption, and other sources of GHGs within the county.
- HS.I-64: Assess air quality impacts using the latest version of the California Environmental Quality Act Guidelines and guidelines prepared by the applicable Air Quality Management District.
- TC.P-26: Accommodate pedestrians and bicyclists in the design and construction of roadway improvements on County facilities.

County of Solano Climate Action Plan

- TC-3: Work with cities and STA to improve bicycle and pedestrian connectivity in the county.
- LU-2: Protect and preserve forested areas, agricultural lands, wildlife habitat, and wetlands that provide carbon sequestration.
- LU-3: Protect oak woodlands and heritage trees and encourage the planting of native tree species in new developments and along road rights-of-way. Require the planting of shade and roadside trees in development projects.

EVALUATION CRITERIA WITH THRESHOLDS OF SIGNIFICANCE

TABLE 4.7-1
Evaluation Criteria with Significance Threshold – Greenhouse Gases and Energy Use

Evaluation Criteria	As Measured by	Significance Threshold	Sources of Criteria
GG-1. Will the Project generate GhG emissions, either directly or indirectly, that may have a significant impact on the environment?	Land Use Emissions: GHG emissions from energy use (Watts, therms), and on- and off-site transportation (gallons and VMT) Stationary Emissions: GHG emissions from process equipment	Land Use Emissions: >1,100 metric tons of CO ₂ e per yr Stationary Emissions: >10,000 metric tons per yr	CEQA Guidelines Appendix G, Checklist Item VII (a); BAAQMD CEQA Air Quality Guidelines; Solano County General Plan
GHG-2. Will the Project conflict with any applicable plan, policy, or regulation of an agency with jurisdiction over the Project adopted for the purpose of reducing the emissions of GhGs?	Number of conflicts	Greater than 0 conflicts	CEQA Guidelines Appendix G, Checklist Item VII (b); Solano County General Plan

METHODOLOGY

The following describes the methodologies used in quantifying energy use and GhG emissions from expansion of the Project.

BAAQMD has adopted separate thresholds of significance for land use $(1,100 \text{ Metric Tons} \text{ (MT) CO}_2\text{e} \text{ per year})$ and stationary source $(10,000 \text{ MT CO}_2\text{e} \text{ per year})$ GhG emissions. The BAAQMD Guidelines state that stationary sources should be calculated separately from a project's land use related GhG emissions. A stationary source consists of a single emission source with an identified emission point, such as the Quarry's asphaltic concrete batch plant. For this Project, land use GhG emissions consists of associated energy usage from on-site buildings, process equipment, and mobile sources (i.e., VMT from aggregate delivery, on-site equipment use, and worker trips).

Because annual tonnage of aggregate processed and sold would remain the same as the existing conditions, emissions from stationary sources are not expected to change from implementation of the Project. Modifications to existing equipment are considered negligible and not considered further. The increase in oil temperature at the oil storage tank would be small (1.9%). Operation of the RAP handling equipment would be offset by the decrease in handling virgin material at each stationary source.

The haul distance between the excavation area and the processing would increase with implementation of the Project. To determine the Project emissions from the increase in haul distance, the baseline mobile emissions for the existing quarry were calculated. Emission factors for the haul trucks were taken from USEPA's report Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition and from EMFAC2011.

IMPACTS AND MITIGATION MEASURES

Impact: GG-1: Will the Project generate GhG emissions, either directly or indirectly, that

may have a significant impact on the environment?

Analysis: Less than Significant

No one single project can have a significant impact on GhG emissions, because the impact of GhG emissions is global in nature and, therefore, inherently cumulative. See the Cumulative Impacts section below for an analysis of the Project's cumulative impacts.

Mitigation: No mitigation is necessary.

Impact: GG-2: Will the Project conflict with any applicable plan, policy, or regulation of an

agency with jurisdiction over the Project adopted for the purpose of reducing the

emissions of GhGs?

Analysis: Significant

The Solano County General Plan contains a number of goals and policies which are intended to directly or indirectly reduce GhG emissions. In addition, the County has adopted a Climate Action Plan for the purpose of reducing GhG emissions. The following describes those portions of policies that are applicable to the Project.

AG.P-21, HS.P-47, and LU-2 seek to protect grasslands to promote natural carbon sequestration from conversion to non-agricultural uses. The Project would conflict with this policy by converting grasslands to an active quarry. This is considered a significant impact.

RS.P-6 and LU-3 seek to protect, and plant additional, oak woodlands and other native trees for the purpose of carbon sequestration and shading. The project would permanently remove oak woodland. This is considered a significant impact.

RS.P-49 and RS.P-59 seek to reduce energy demand in the County by implementing energy conservation measures. The applicant would continue to implement energy improvement strategies including, but not limited to, energy efficient motors and PG&E peak hours energy reduction programs. The Project would not conflict with these policies.

HS.I-64 states that Solano County shall assess air quality impacts using the latest version of BAAQMD CEQA Guidelines. The Project analysis uses those Guidelines. The Project is in compliance with HS.I-64.

TC.P-26 and TC-3 seeks to accommodate pedestrians and bicyclists in the design and construction of County roadway facilities and improve bicycle connectivity. Lake Herman Road is designated as a "Perimeter Loop Trail." The road improvements to Lake Herman Road that are part of the Project would not prevent the implementation of this trail. The Project is in compliance with TC.P-26 and TC-3.

Given the Project would conflict with policies AG.P-21 and HS.P-47, impacts are considered significant.

Mitigation: BIO-2b Oak Woodlands

BIO-2c Native Grasslands

BIO-2d Non-Native Grasslands

After

Mitigation: Less than Significant

Mitigation Measures BIO-2b, BIO-2c and BIO-2d would mitigate grasslands and oak woodlands at a greater ratio than that which would be removed. Impacts are considered less than significant after mitigation.

CUMULATIVE IMPACTS

Impact: GG-1C: Will the Project plus cumulative projects generate GhG emissions, either

directly or indirectly, that may have a significant impact on the environment?

Analysis: Less than Significant

The BAAQMD Air Quality CEQA Guidelines do not include screening criteria or significance thresholds for GhG emissions from construction. Therefore, this analysis uses a qualitative approach in accordance with Section 15064.4(a)(2) of the CEQA Guidelines. For operation, the BAAQMD has adopted separate thresholds of significance for land use (1,100 MT CO₂e per year) and stationary source (10,000 MT CO₂e per year) GhG emissions. The following addresses these thresholds separately.

Construction

During construction of the Sulphur Springs Creek Bridge and Lake Herman Road Improvements, GhG emissions would be generated from construction equipment. However, construction would only last for approximately six months, and aggregate for construction would be supplied by the Quarry, thus significantly reducing emissions associated with importing and exporting material. In addition, Section 4.3 Air Quality includes Mitigation Measure AQ-2a Basic Mitigation Measures for Construction, which requires the contractor to reduce idling times and maintain and properly tune equipment in accordance with manufacturer's specifications. Although included to reduce air pollutants, this measure also would reduce GhG emissions.

Given the short construction period, the reduction in importing and exporting of material, and the inclusion of MM AQ-2a in Section 4.2, GhG emissions from construction would be less than significant.

Operation - Land Use

Implementation of the Project is not anticipated to change electricity usage, natural gas usage, or vehicle miles traveled as the amount of aggregate sold will not change from baseline conditions. However, the center of the quarry pit would shift such that the distance between excavation and the processing areas would gradually increase over time by approximately 500 feet.

As shown in Table 4.7-2, GhG emissions from the increased travel distance at full buildout would be 116 MT CO₂e per year. The increase is less than the BAAQMD Guidelines land use threshold of significance of 1,100 MT CO₂e per year. In addition, it is anticipated that implementation of State and federal regulations would result in a reduction of GhG emissions over the life of the Project¹. The Project's contribution to the cumulative impact would be less than significant.

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¹ CARBs Standard Emission Tool, CEPAM – 2009 Almanac, that was used to estimate off-road equipment emission changes in Section 4.3 Air Quality, does not include GhG emissions. Therefore, the future reduction was not estimated.

TABLE 4.7-2
Annual Project GhG Emissions – Land Use

	GhG Emissions (MT CO₂e)		
	Existing Quarry ¹	Existing plus Project	Impact (Proposed Project less Existing)
Off-Road Quarrying Equipment	2,627	2,732	105
BAAQMD Guid	1,100		

Source: Emission factors for the haul trucks were taken from USEPA's report Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition and from EMFAC2011 (Sierra Research 2013).

Operation - Stationary (Permitted) Sources

The Project does not include any new stationary sources, but existing sources would be modified. The emissions associated with the operation of the RAP handling equipment at the existing asphalt concrete batch plant (Permit Source 23) and asphalt concrete drum mix plant (Permit Source 80) would be offset by the decrease in handling virgin material at each stationary source. Any change from the oil storage tank (Permit Source 84) heater related to the small temperature increase is considered to be negligible. Therefore, the Project's contribution to stationary source emissions would not be cumulatively considerable.

Mitigation: No mitigation is necessary.

Impact: GG-2C: Will the Project plus cumulative projects conflict with any applicable plan,

policy, or regulation of an agency with jurisdiction over the Project adopted for the

purpose of reducing the emissions of GhGs?

Analysis: No Impact

The Project would either comply with applicable GhG reduction policies in the Solano County General Plan or would mitigate impacts to less than significant. The Project would therefore not contribute to any potential cumulative impact relative to conflicts with

applicable plans, policies, or regulations.

Mitigation: No mitigation is necessary.

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