APPENDIX G – Greenhouse Gas Report

GREENHOUSE GAS REPORT

DEVIL'S GATE RESERVOIR SEDIMENT REMOVAL AND MANAGEMENT PROJECT

Pasadena, California
(Los Angeles County)

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Acronyms and Abbreviations

Action Plan	City of Pasadena Green City Action Plan
BAU	business as usual
CalEEMod™	California Emissions Estimator Model
CARB	California Air Resources Control Board
CCAR	California Climate Action Registry
CEQA	California Environmental Quality Act
CFC	chlorofluorocarbons
CH_4	methane
City	City of Pasadena
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
EMFAC2011	CARB's tool for estimating emissions from on-road vehicles
EPA	United States Environmental Protection Agency
GGR	Greenhouse Gas Report
GHG	greenhouse gas
GWP	global warming potential
IHP	International Hydrological Programme
IPCC	Intergovernmental Panel on Climate Change
LACDPW	Los Angeles County Department of Public Works
M	million
$MtCO_2e$	million tonnes of carbon dioxide equivalents
N_2O	nitrous oxide
SCAQMD	South Coast Air Quality Management District
t	abbreviation for tonne (or metric ton)
tCO_2e	tonne of carbon dioxide equivalents
TIA	Traffic Impact Analysis
tonne	metric ton (1.102 U.S. tons)
UEA	United Nations Urban Environmental Accords
UNESCO	United Nations Educational, Scientific and Cultural Organization

SECTION 1.0 – INTRODUCTION

1.1. REPORT PURPOSE

The purpose of this Greenhouse Gas Report (GGR) is an analysis of potential climate change / greenhouse gas (GHG) impacts that could occur with the sediment removal and management at the Devil's Gate Reservoir Sediment Removal and Management Project (Proposed Project). The Proposed Project consists of a comprehensive sediment removal project at Devil's Gate Reservoir that will restore flood capacity and establish a reservoir configuration more suitable for routine maintenance activities including sediment management and enhanced water conservation. The Proposed Project is being undertaken in order to restore reservoir capacity to the facility to meet its intended level of flood protection for downstream communities.

1.2. PROJECT LOCATION

The Proposed Project is located in the City of Pasadena, in Los Angeles County approximately 14 miles north of downtown Los Angeles. The City of La Cañada Flintridge and the community of Altadena are located near the Proposed Project site to the west and east, respectively. Lying south of the San Gabriel Mountains, the Proposed Project site is located in the lower portion of the Arroyo Seco watershed. The Arroyo Seco extends approximately 11 miles from the border of the Angeles National Forest to its confluence with the Los Angeles River. Approximately 20,416 acres (39.1 square miles) of both residential and undeveloped land drain into Devil's Gate Reservoir.

1.3. PROJECT PURPOSE AND NEED

The Proposed Project is designed to remove sediment that has accumulated behind the dam to restore the capacity of Devil's Gate Reservoir to minimize the level of flood risk to downstream communities along the Arroyo Seco. In its current condition, the reservoir no longer has the capacity to safely contain another major debris event and the outlet works have a risk of becoming clogged and inoperable. The Proposed Project would remove sediment from the reservoir behind Devil's Gate Dam to restore flood control capacity and establish a reservoir configuration more suitable for routine maintenance activities including sediment management.

The proposed excavation will remove approximately 2.9 million cubic yards of current excess sediment in the reservoir in addition to any sediment that accumulates prior to project commencement. The proposed configuration will involve approximately 178 acres of the reservoir. Excavated sediment will be trucked off-site to existing disposal site locations which are currently available to accept the sediment. The sediment will be trucked off-site either to the east and placed at the primary disposal site locations, the Vulcan Materials and the Waste Management facilities in Azusa or the Manning Pit Sediment Placement Site in Irwindale, or to the west and placed in one of the facilities in Sun Valley. Removed vegetation and organic debris will be hauled to Scholl Canyon Landfill, located in the City of Glendale.

SECTION 2.0 – EXISTING ENVIRONMENT

2.1. INTRODUCTION

2.1.1 <u>Background</u>

Constituent gases that trap heat in the Earth's atmosphere are called "greenhouse gases" (GHGs), analogous to the way a greenhouse retains heat. GHGs play a critical role in the Earth's radiation budget by trapping infrared radiation emitted from the Earth's surface, which would otherwise have escaped into space. Prominent GHGs contributing to this process include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). Without the natural heat-trapping effect of GHGs, the earth's surface would be about 34 °F cooler[1]. This is a natural phenomenon, known as the "Greenhouse Effect," is responsible for maintaining a habitable climate. However, anthropogenic emissions of these GHGs in excess of natural ambient concentrations are responsible for the enhancement of the "Greenhouse Effect", and have led to a trend of unnatural warming of the Earth's natural climate known as global warming or climate change, or more accurately Global Climate Disruption. Emissions of these gases that induce global climate disruption are attributable to human activities associated with industrial/manufacturing, utilities, transportation, residential, and agricultural sectors.

The global warming potential (GWP) is the potential of a gas or aerosol to trap heat in the atmosphere. Individual GHG compounds have varying GWP and atmospheric lifetimes. The reference gas for the GWP is CO_2; CO_2 has a GWP of one. The calculation of the CO_2 equivalent (CO_2e) is a consistent methodology for comparing GHG emissions since it normalizes various GHG emissions to a consistent metric. Methane's warming potential of 21 indicates that methane has a 21 times greater warming affect than CO_2 on a molecule per molecule basis. A CO_2e is the mass emissions of an individual GHG multiplied by its GWP. GHGs are often presented in units called tonnes (t) (i.e. metric tons) of CO_2e (tCO_2e).

2.1.1.1 GHG Emission Levels

In 2004, total worldwide GHG emissions were estimated to be 20,135 million (M) t of CO_2e ($MtCO_2e$), excluding emissions/removals from land use, land use change, and forestry. In 2004, GHG emissions in the U.S. were 7,074 $MtCO_2e$.

In 2009, total California greenhouse gas emissions were 457 $MtCO_2e$ and the net emissions were 453 $MtCO_2e$; reflecting the influence of sinks (net CO_2 flux from forestry). The transportation sector accounted for approximately 38 percent of the total emissions, while the industrial sector accounted for approximately 20 percent. Emissions from electricity generation were about 23 percent.

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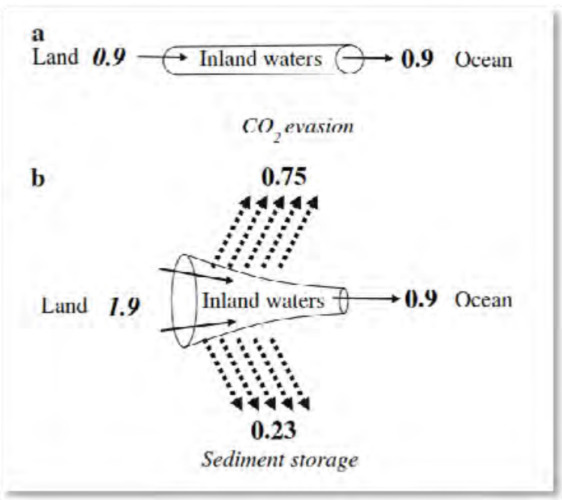
[1] Climate Action Team Report to Governor Schwarzenegger and the California Legislature. California Environmental Protection Agency, Climate Action Team. March 2006.

2.1.2 Reservoir Implications

All freshwater systems, whether they are natural or manmade, emit GHGs due to decomposing organic material. This means that lakes, rivers, estuaries, wetlands, seasonal flooded zones and reservoirs emit GHGs. They also bury some carbon in the sediments[2]. In the global description of the carbon cycle, freshwater ecosystems have traditionally been relegated to neutral pipes or gutters, explaining that water systems only transport the carbon and do not play an active role. For example, in describing the role of rivers in continental-scale geomorphology, Leopold and others (1964)[3] described rivers as ''the gutters down which flow the ruins of continents''.

However, the present science of carbon fluxes in freshwater ecosystems strongly indicates that continental hydrologic networks, spanning from river mouths to the smallest tributaries far upstream, do not act as neutral pipes or gutters, but instead are active players in the carbon cycle despite their modest size. Leopold's continental ruins do not merely flow; they are actively processed within inland waters. Scientist are now studying four different fluxes related to inland waters, gas exchange with the atmosphere, burial or storage in the sediments, export to the ocean, and importation of carbon from the land. Figure 1 depicts the two scenarios, i.e. (a) shows Leopold's "gutters" and (b) shows more current result of scientific measurements.

Figure 1 – Schematic showing inland water role[4]



Reservoirs, in particular, are collection points for material coming from the whole drainage basin area upstream. As part of the natural cycle, organic matter is flushed into these collection points from the surrounding environment. In addition, domestic sewage, industrial waste, and agricultural pollution may

2 J.J. Cole, et al., "Plumbing the global carbon cycle: Integrating inland waters into the terrestrial carbon budget", Ecosystems, vol. 10, p. 171-184, 2007

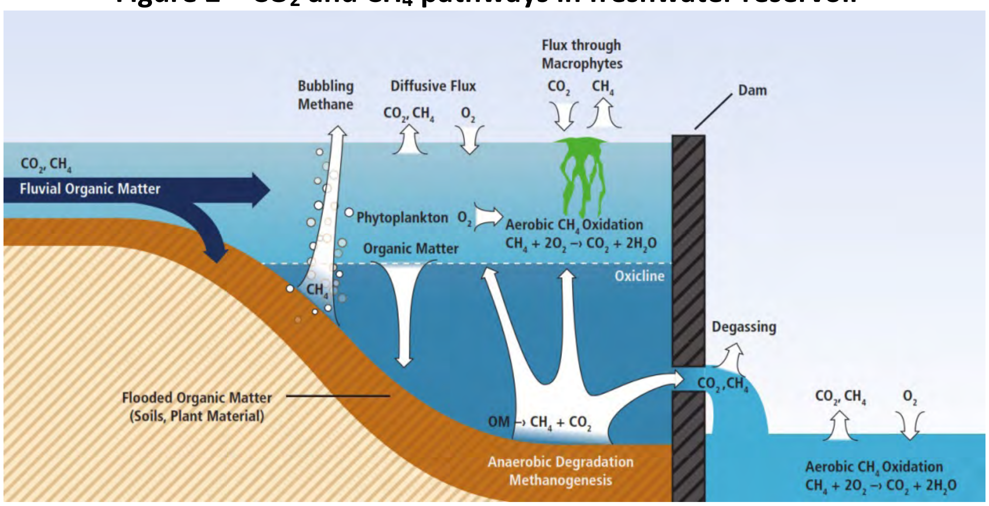
3 Leopold LB, Wolman MG, Miller JP. 1964. Fluvial Processes in Geomorphology. Freeman.

4 J.J. Cole, et al., *loc cit.*

also enter these systems and produce GHG emissions. The main GHGs produced in freshwater systems are CO_2 and CH_4. Warm climate reservoirs generate CH_4 when the reservoirs are stratified, in which the bottom layers are anoxic (i.e. they lack oxygen), leading to degradation of biomass through anaerobic processes. N_2O may also be of importance, particularly in reservoirs with large drawdown zones[5] or in tropical areas, but no global estimate of these emissions presently exists.

Two pathways of GHG emissions to the atmosphere are usually studied: diffusive fluxes from the surface of the reservoir and bubbling (See Figure 2). The United Nations Educational, Scientific and Cultural Organization/International Hydrological Programme (UNESCO/IHP) describes bubbling as the discharge of gaseous substances resulting from carbonation, evaporation, or fermentation from a water body[6].

Figure 2 – CO_2 and CH_4 pathways in freshwater reservoir[7]



Although the mass of methane emitted from aquatic systems is small compared to CO_2, CH_4, it has a disproportionately larger effect on climate warming, so we include it here. Because aquatic environments are frequently anoxic, some of the carbon gas efflux occurs as CH_4.

Man-made impoundments store large amounts of carbon in their sediments. Unlike the situation in lakes, carbon storage in reservoirs is mostly recent and likely short lived because dams are short lived. The first years or decades in the life of artificial impoundments are usually marked by exceptionally high rates of carbon burial due to enhanced particle trapping.

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5 The drawdown zone is defined as the area temporarily inundated depending on the reservoir level variation during operation. This zone requires special attention because emissions may be higher due to regrowth of vegetation when water levels are low, leading to their decomposition after re-flooding.

6 Greenhouse gas emissions related to freshwater reservoirs. United Nations Educational, Scientific, and Cultural Organization/International Hydrological Programme. January 2010.

7 From Guerin, F., 2006. Emissions de Gaz a Effet de Serre (CO_2 CH_4) par une Retenue de Barrage Hydroelectrique en Zone Tropicale (Petit-Saut,Guyane Francaise): Experimentation et Modelization. Thèse de doctorat de l'Université Paul Sabatier (Toulouse III). Reprinted with permission from the author.

2.1.3 Potential Environmental Effects of Climate Change

Worldwide, average annual temperatures are likely to increase by 3 °F to 7 °F by the end of the 21st century[8]. However, a global temperature increase does not directly translate to a uniform increase in temperature in all locations on the earth. Regional climate changes are dependent on multiple variables, such as topography. One region of the Earth may experience increased temperature, increased incidents of drought, and similar warming effects, whereas another region may experience a relative cooling. According to the Intergovernmental Panel on Climate Change's (IPCC) Working Group II Report[9], climate change impacts to North America may include diminishing snowpack, increasing evaporation, exacerbated shoreline erosion, exacerbated inundation from sea level rising, increased risk and frequency of wildfire, increased risk of insect outbreaks, increased experiences of heat waves, and rearrangement of ecosystems, as species and ecosystem zones shift northward and to higher elevations.

2.1.3.1 California Implications

Even though climate change is a global problem and GHGs are global pollutants, the specific potential effects of climate change on California have been studied. The California Natural Resources Agency[10] summarized the best known science on climate change impacts in seven specific sectors and provided recommendations on how to manage against those threats. Generally, research indicates that California should expect overall hotter and drier conditions with a continued reduction in winter snow (with concurrent increases in winter rains), as well as increased average temperatures, and accelerating sea-level rise. In addition to these changes, the intensity of extreme weather events is also changing. The impacts assessment indicates that extreme weather events, such as heat waves, droughts, and floods are likely to be some of the earliest climate impacts experienced. It is anticipated that temperatures in California could increase 5 °F by 2050 and 9 °F by 2100. Precipitation is expected to increase by 35 percent by 2050 and sea levels are expected to rise by 18 inches by 2050 and by 55 inches by 2100.

These changes in California's climate and ecosystems are occurring at a time when California's population is expected to increase from 34 million to 59 million by the year 2040[11]. As such, the number of people potentially affected by climate change as well as the amount of anthropogenic GHG emissions expected under a business as usual (BAU) scenario are expected to increase. Similar changes as those noted above for California would also occur in other parts of the world with regional variations in resources affected and vulnerability to adverse effects. GHG emissions in California are attributable to human activities associated with industrial/manufacturing, utilities, transportation, residential, and agricultural sectors[12] as well as natural processes.

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8 Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. International Panel on Climate Change. Website http://www.ipcc-nggip.iges.or.jp/gp/report.htm

9 Climate Change 2007: Impacts, Adaptation and Vulnerability. International Panel on Climate Change. Website http://www.ipcc.ch/ipccreports/ar4-wg2.htm

10 2009 California Climate Adaptation Strategy, A Report to the Governor of the State of California in Response to Executive Order S-13-2008. California Natural Resources Agency. December 2009.

11 Global Climate Change and California. Staff Final Paper. California Energy Commission. 2005.

12 *ibid*

SECTION 3.0 – REGULATORY CONTEXT

GHGs, similar to criteria air pollutants, are regulated at the national, State, and air basin level; each agency has a different degree of control. The U.S. Environmental Protection Agency (EPA) regulates at the national level; the California Air Resources Board (CARB) regulates at the State level; and the South Coast Air Quality Management District (SCAQMD) regulates at the air basin level in the Proposed Project area.

3.1. FEDERAL CLIMATE CHANGE LEGISLATION

The federal government is taking a number of common-sense steps to address the challenge of climate change. EPA collects various types of GHG emissions data. This data helps policy makers, businesses, and EPA track GHG emissions trends and identify opportunities for reducing emissions and increasing efficiency. EPA has been collecting a national inventory of GHG emissions since 1990 and in 2009 established mandatory reporting of GHG emissions from large GHG emissions sources.

EPA is also getting GHG reductions through partnerships and initiatives; evaluating policy options, costs, and benefits; advancing the science; partnering internationally and with states, localities, and tribes; and helping communities adapt.

3.2. STATE CLIMATE CHANGE LEGISLATION

3.2.1 Executive Order S 3-05

On June 1, 2005, the Governor issued Executive Order S 3-05 which set the following GHG emission reduction targets:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels;
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

To meet these targets, the Climate Action Team prepared a report to the Governor in 2006 that contains recommendations and strategies to help ensure the targets in Executive Order S-3-05 are met.

3.2.2 Assembly Bill 32 (AB 32)

In 2006, the California State Legislature enacted the California Global Warming Solutions Act of 2006, also known as AB 32. AB 32 focuses on reducing GHG emissions in California. GHGs, as defined under AB 32, include CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. AB 32 requires that GHGs emitted in California be reduced to 1990 levels by the year 2020. The CARB is the state agency charged with monitoring and regulating sources of emissions of GHGs that cause global warming in order to reduce emissions of GHGs. AB 32 also required that by January 1, 2008, the CARB had to determine what the statewide GHG emissions level was in 1990, and it had to approve a statewide GHG emissions limit so it may be applied to the 2020 benchmark. The CARB approved a 1990 GHG emissions level of 427 $MtCO_2e$, on December 6, 2007 in its Staff Report. Therefore, in 2020, emissions in California are required to be at or below 427 $MtCO_2e$.

Under the current BAU scenario, statewide emissions are increasing at a rate of approximately 1 percent per year as noted below. Also shown are the average reductions needed from all statewide sources (including all existing sources) to reduce GHG emissions back to 1990 levels.

- 1990: 427 $MtCO_2e$
- 2004: 480 $MtCO_2e$ (an average 11-percent reduction needed)
- 2020: 596 $MtCO_2e$ BAU (an average 28-percent reduction needed)

To achieve these goals, AB 32 mandates that CARB establish a quantified emissions cap, institute a schedule to meet the cap, implement regulations to reduce statewide GHG emissions from stationary sources, and develop tracking, reporting, and enforcement mechanisms to ensure that reductions are achieved. The following schedule outlines CARB actions mandated by AB 32:

- By January 1, 2008, CARB adopts regulations for mandatory GHG emissions reporting, defines 1990 emissions baseline for California (including emissions from imported power), and adopts it as the 2020 statewide cap.
- By January 1, 2009, CARB adopts plan to effect GHG reductions from significant sources of GHGs via regulations, market mechanisms, and other actions.
- During 2009, CARB drafts rule language to implement its plan and holds a series of public workshops on each measure (including market mechanisms).
- By January 1, 2010, early action measures take effect.
- During 2010, CARB, after workshops and public hearings, conducts series of rulemakings to adopt GHG regulations, including rules governing market mechanisms.
- By January 1, 2011, CARB completes major rulemakings for reducing GHGs, including market mechanisms. CARB may revise and adopt new rules after January 1, 2011 to achieve the 2020 goal.
- By January 1, 2012, GHG rules and market mechanisms adopted by CARB take effect and become legally enforceable.
- December 31, 2020, is the deadline for achieving the 2020 GHG emissions cap.

3.2.3 Cap-and-Trade

The AB 32 Scoping Plan identified a cap-and-trade program as one of the strategies California will employ to reduce the GHG emissions that cause climate change. CARB designed a California cap-and-trade program that is enforceable and meets the requirements of AB 32. The development of this program included a multi-year stakeholder process and consideration of potential impacts on disproportionately impacted communities. The program started on January 1, 2012, with an enforceable compliance obligation beginning with the 2013 GHG emissions. The Program includes market monitoring activities such as a Compliance Instrument Tracking System Service; quarterly allowance auctions; a Compliance Offset Program designed to give offset credits to GHG reductions or sequestered carbon that meet regulatory criteria; an Adaptive Management Plan focusing on localized air quality impacts from the regulation and forest impacts from the U.S. Forest Protocol; and a Voluntary Renewable Electricity Program.

3.3. LOCAL CLIMATE CHANGE POLICY

The City of Pasadena (City) created a Green City Action Plan (Action Plan) in 2006[13] that launched a comprehensive environmental action plan that guides the City towards sustainability and accelerates the City's environmental commitment. The framework for the Action Plan is based on the 21 specific UEA goals to be accomplished by World Environment Day 2012. As of the 2010, the Green City Indicator Report[14] documents that 8 Goals have been achieved, 10 Goals are likely, and 3 of the 21 Goals are listed as undetermined. However, the Proposed Project does not fit into any of the existing long-term GHG Reduction strategies presented in the City's Plan.

13 Green City Action Plan. City of Pasadena, Planning and Development Department. September 18, 2006.

14 2010 Green City Indicators Report. City of Pasadena Green Team.

SECTION 4.0 – BASELINE CONDITIONS

4.1. LOCAL GHG INVENTORY

In October 2009, the City of Pasadena conducted a Greenhouse Gas Emissions Inventory and Reduction Plan[15] that determined that in 2007 the total GHG emissions being produced by City residents, businesses, and municipal operations using the best available data was approximately 7.8 $MtCO_2e$. Table 1 shows the breakdown of those emissions separated into United Nations Urban Environmental Accords (UEA) categories.

Table 1 – City of Pasadena 2007 Net Total Emissions[16]

UEA Category	GHG Emissions (tCO_2e)
Energy	1,075,811
Solid Waste	1,105,498
Urban Nature	2,175
Transportation	5,610,910
TOTAL	7,794,394

Transportation sources account for approximately 72 percent of the total. These emissions do not include pass-through traffic on the freeways within the City of Pasadena and only account for vehicle trips related to Pasadena land uses as starting points and destinations.

15 Greenhouse Gas Emissions Inventory and Reduction Plan. City of Pasadena. October 2009.

16 ibid

SECTION 5.0 – THRESHOLDS

5.1. GREENHOUSE GAS EMISSIONS THRESHOLDS

The California Air Quality Act (CEQA) requires lead agencies to evaluate potential environmental effects based to the fullest extent possible on scientific and factual data. Significance conclusions must be based on substantial evidence, which includes facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts.

To provide guidance to local lead agencies on determining significance for GHG emissions in their CEQA documents, SCAQMD Board adopted an Interim CEQA GHG Significance Threshold for Stationary Sources, Rules, and Plans[17]. The Interim Guidance uses a tiered approach to determining significance. Whereas, this Interim Guidance was developed primarily to apply to stationary source/industrial projects where the SCAQMD is the lead agency under CEQA, in absence of more directly applicable policy, the SCAQMD's Interim Guidance is often used as general guidance by local agencies to address the long-term adverse impacts associated with global climate change.

Even though this Proposed Project does not fit the typical "land-use" project, this GGR proposes the use of the "Tier 3" quantitative thresholds for residential and commercial projects as a reasonable metric. The SCAQMD proposes that if a project generates GHG emissions below 3,000 tCO_2e annually, it could be concluded that the Proposed Project's GHG contribution is not "cumulatively considerable" and is therefore less than significant under CEQA. If the Proposed Project generates GHG emissions above the threshold, the analysis must identify mitigation measures to reduce GHG emissions.

In addition, CEQA Appendix G states that a project would have potentially significant GHG emission impacts if it would:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment or
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

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17 Interim CEQA GHG Significance Threshold for Stationary Sources, Rules, and Plans. South Coast Air Quality Management Board. Adopted December 5, 2008.

SECTION 6.0 – IMPACT ANALYSIS

6.1. ANALYSIS METHODOLOGY

Consistent with CEQA, indirect and direct impacts of the Proposed Project are required to be analyzed in the CEQA document for a Proposed Project. The analysis of direct GHG impacts is relatively straightforward as onsite GHG sources or directly related offsite GHG sources, such as worker commute trips, are generally readily identifiable. Indirect GHG emission sources are less obvious, but the California Climate Action Registry (CCAR) includes indirect emissions from grid-delivered electricity use and indirect emissions from imported steam, district heating or cooling and electricity from a co-generation plant. This Proposed Project does not include any indirect source.

Short-term sediment removal and long-term maintenance GHG emissions were assessed in accordance with methodologies and formulas recommended by the CCAR, EPA, CARB, and SCAQMD. Modeled emissions were compared with SCAQMD's Interim Thresholds[18] to determine potential significance. Calculations were based, in part, on information about vehicle trip generation from the Traffic Impact Analysis[19] (TIA) prepared for this project. Information on off-road equipment and project scheduling and logistics were supplied by the Los Angeles County Department of Public Works (LACDPW).

For the purposes of determining whether or not GHG emissions from affected projects are significant, project emissions will include direct, indirect, and, to the extent information are available, life cycle emissions during construction (sediment removal) and operation (maintenance). The Interim Guidance suggest that construction emissions should be amortized over the life of the project, defined as 30 years, added to the operational emissions, and compared to the applicable interim GHG significance threshold tier. The following bullet points describe the basic structure of staff's tiered GHG significance threshold proposal for stationary sources.

6.2. ANALYSIS OF IMPACTS

IMPACT 1: Would the Project generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?

GHG emissions are generated from the exhaust of off-road equipment used to remove the sediment, including four front loaders with 4 cubic yard buckets, two D-8 dozers, an excavator, a grader, water truck, and sorters/crushers. In addition, GHG is emitted from the exhaust of the dump trucks proposed to haul approximately 4,800 cubic yards per day, which is expected to require an average of 50 truck trips in and out per hour, with an estimated maximum of 425 truck trips in and out per day during sediment removal activities. The disposal trucks will dispose of material either to the east and placed at the primary disposal site locations, the Vulcan Materials or Waste Management facilities in Azusa or the Manning Pit Sediment Placement Site in Irwindale or to the west and placed in one of the facilities in

18 _ibid_

19 Traffic Impact Analysis for Devil's Gate Reservoir Sediment Removal and Management Project. Hall & Foreman, Inc. March 28, 2013.

Sun Valley. Removed vegetation and organic debris will be hauled to Scholl Canyon Landfill, located in the City of Glendale. It is estimated that for approximately 3 weeks during the first year of the Proposed Project approximately 50 percent of the debris will be trucked to greenwaste facility at Scholl Canyon and the remaining will be distributed to the other sites. After the first year including maintenance activities, during the first week approximately 25 percent of the debris will be trucked to the Scholl site and the remaining will be distributed to the other sites. Proposed Project emissions were estimated using the following assumptions and methods:

- On-Road Truck Emissions: To estimate emissions from on-road sediment dump trucks, mileages between the Proposed Project site and each of the disposal sites using haul routes assumed in the TIA were measured. For the five year life of the Proposed Project it is estimated that approximately 3 percent of the trips will travel to the Scholl Canyon site, 78 percent will be delivered to the Irwindale sites, and 19 percent will go to the Sun Valley sites. During Maintenance activities, only 2 percent of the trips are assigned to Scholl Canyon, 75 percent will be delivered to the Irwindale sites, and 23 percent will go to the Sun Valley sites.

  To generate expected CO_2 emissions from exhaust, this GGR used CARB's EMFAC2011 Web Based Data Access[20] with emission rate data for Los Angeles County for the years 2015, 2017, and 2020. This GGR used "T7 single construction" as the most representative EMFAC2011 vehicle category for the sediment dump trucks. To generate expected CH_4 and N_2O emissions, factors from the Local Governments Operations Protocol[21] were applied.

- Off-Road Equipment Emissions: Off-road equipment CO_2 and CH_4 emission factors were obtained from the CalEEMod Users Guide[22].

- Employee Vehicle Emissions: To generate expected CO_2 emissions from employee vehicle exhaust, this GGR used CARB's EMFAC2011 Web Based Data Access as mentioned above in the section on on-road trucks. In order to more accurately represent the type of vehicles used by the potential employee work pool, a weighted average emission factor was generated using 69 percent of the pool using light-duty automobiles and the rest using light-duty trucks. The appropriate percentages were derived from the distribution of VMT from EMFAC2011.

Table 2 provides a summary of the GHG emission estimates for the Proposed Project. Operational emissions, defined as the on-going maintenance activities beginning in 2020, were calculated using the same methodology as before. Table 3 shows estimated emissions from ongoing maintenance activities. Details of the air quality calculations are included in Appendix A.

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20 http://www.arb.ca.gov/msei/modeling.htm#emfac2011_web_based_data

21 Local Government Operations Protocol: For the quantification and reporting of greenhouse gas emissions inventories. Version 1.1. California Air Resources Board, California Climate Action Registry, ICLEI - Local Governments for Sustainability, and The Climate Registry. May 2010

22 CalEEMod Users Guide - Appendix D, CalEEMod User's Tips (June 2011)

Table 2 – Sediment Removal GHG Emissions

Emission Source	GHG Emissions (tonnes/year)			
	CO_2	CH_4	N_2O	CO_2e
Off-Road	745.8	0.071	N/A	747.3
On-Road Trucks	4,422.6	1.681	1.546	4,937.3
Employees	46.4	0.005	0.005	48.2
Totals	**5,215**	**1.76**	**1.55**	**5,773**

Table 3 – Maintenance Activity GHG Emissions

Emission Source	GHG Emissions (tonnes/year)			
	CO_2	CH_4	N_2O	CO_2e
Off-Road	96.8	0.007	N/A	96.9
On-Road Trucks	546.1	0.208	0.191	609.7
Employees	6.5	0.001	0.001	6.7
Totals	**649**	**0.22**	**0.19**	**713**

Typical developmental projects have short-term construction and long-term operational GHG emissions, where the operational activities generate the majority of the GHG emissions. In order to assess the overall lifetime project GHG emissions, the SCAQMD developed an Interim Guidance that recommends that construction emissions should be amortized over the life of the project, defined in the Guidance as 30 years, which is then added to the operational emissions and compared to the applicable interim GHG significance threshold tier. For this Proposed Project, construction emissions are described as the sediment removal process and operational emissions are the on-going maintenance operations. Using the above annual emission rates, the Proposed Project is expected to produce 5,733 tCO_2e per year for 5 years, for a 5-year total of 28,664 tCO_2e. Amortized over 30 years the Proposed Project would produce 951 tCO_2e per year. Adding that amount to the 713 tCO_2e per year expected during maintenance would yield a Proposed Project total annual emissions of 1,669 tCO_2e, which is less than the Tier 3 threshold of 3,000 tCO_2e; therefore the Proposed Project is not "cumulatively considerable" and is therefore less than significant under CEQA.

In addition the Proposed Project may prove a positive effect on climate change. High ambient temperatures coupled with important demand for oxygen due to the degradation of substantial organic matter amounts favor the production of CO_2, the establishment of anoxic conditions, and thus the production of CH_4. If the reservoir is left as it is, the large quantity of biomass currently existing may exacerbate the condition. With the removal and disposal of most of the organic mass in the Scholl

Canyon Landfill, which uses the greenwaste primarily as "alternative daily cover" (ADC), the overall benefit to the carbon ecosystem will be positive since a Report by Kong, Huitric, Iacoboni, and Chan[23] demonstrates that since prior to using greenwaste for ADC, larger amounts of cover soil had to be imported into the landfill from offsite sources. Therefore, use of the greenwaste ADC reduced fossil fuel use for cover soil importation and so reduces GHG emissions.

Level of Significance before Mitigation

The Proposed Project would result in less than significant impacts.

Mitigation

No mitigation measures are necessary.

Level of Significance After Mitigation

No significant adverse impacts were identified and no mitigation measures are necessary.

IMPACT 2: Would the Project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs?

AB 32 identified a 2020 target level for GHG emissions in California of 427 MMT of CO_2e, which is approximately 28.5% less than the year 2020 BAU emissions estimate of 596 MMT CO_2e. To achieve these GHG reductions, there will have to be widespread reductions of GHG emissions across California. Some of those reductions will need to come in the form of changes in vehicle emissions and mileage standards, changes in the sources of electricity, and increases in energy efficiency by existing facilities. The remainder will need to come from requiring new facility development to have lower carbon intensity than BAU conditions. Therefore, this analysis uses a threshold of significance that is in conformance with the state's goals.

On December 12, 2008, CARB adopted the AB 32 Scoping Plan, which details specific GHG emission reduction measures that target specific GHG emissions sources. Project-related GHG emissions would be reduced as a result of several AB 32 Scoping Plan measures. The Scoping Plan considers a range of actions that include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market based mechanisms (e.g., cap-and-trade system.

Some examples include the following:

- Mobile-source GHG emissions reduction measures
    - Pavley emissions standards (19.8% reduction)
    - Low carbon fuel standard (7.2% reduction)
    - Vehicle efficiency measures (2.8% reduction)

[23] Evaluation of Green Waste Management Impacts on GHG Emissions – Alternative Daily Cover Compared with Composting. Kong, D., Huitric, R., Iacoboni, M., and Chan, G. Los Angeles County Sanitation Districts, Solid Waste Division.

- Energy production related GHG emissions reduction measures
    - Natural gas transmission and distribution efficiency measures (7.4% reduction)
    - Natural gas extraction efficiency measures (1.6% reduction)
    - Renewables (electricity) portfolio standard (33.0% reduction)

These reductions in mobile-source and energy production GHG emissions would occur with or without development of the Proposed Project. Overall, the Proposed Project would be consistent with the AB 32 goal of reducing statewide GHG emissions to 1990 levels by year 2020. Currently, no other GHG reduction plan (i.e., SCAG, SCAQMD, or County) applies to the Proposed Project. The Proposed Project would not conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs; therefore, impacts would be less than significant.

Level of Significance before Mitigation

The Proposed Project would result in less than significant impacts.

Mitigation

No mitigation measures are necessary.

Level of Significance After Mitigation

No significant adverse impacts were identified and no mitigation measures are necessary.

Greenhouse Gas Report Appendix A

Criteria Emissions Summary

Sediment Removal — Unmitigated

Emission Source	Criteria Emissions (lbs/d)				
	ROG	**CO**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-road	7.54	33.99	55.18	2.87	2.87
On-road Trucks	7.15	34.87	314.93	5.33	4.91
Employees	0.07	2.44	0.24	0.00	0.00
Fugitive	0.00	0.00	0.00	5.46	0.89
TOTALS	***14.8***	***71.3***	***370.3***	***13.7***	***8.7***
SCAQMD Daily Threshold	*75*	*550*	*100*	*150*	*55*
ON-SITE TOTALS	***7.5***	***34.0***	***55.2***	***8.3***	***3.8***
LST Threshold	*N/A*	*1,540*	*148*	*12*	*7*

Sediment Removal — Mitigated

Emission Source	Criteria Emissions (lbs/d)				
	ROG	**CO**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-road	4.20	33.99	21.88	0.22	0.22
On-road Trucks	7.15	34.87	18.90	1.07	0.98
Employees	0.07	2.44	0.24	0.00	0.00
Fugitive	0.00	0.00	0.00	5.46	0.89
TOTALS	***11.4***	***71.3***	***41.0***	***6.8***	***2.1***
SCAQMD Daily Threshold	*75*	*550*	*100*	*150*	*55*
ON-SITE TOTALS	***4.2***	***34.0***	***21.9***	***5.7***	***1.1***
LST Threshold	*N/A*	*1,540*	*148*	*12*	*7*

Maintenance Activities

Emission Source	Criteria Emissions (lbs/d)				
	ROG	**CO**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Off-road	2.86	17.29	19.26	0.98	0.98
On-road Trucks	2.17	12.16	74.62	1.13	1.04
Employees	0.02	0.76	0.07	0.00	0.00
Fugitive	0.00	0.00	0.00	3.30	0.75
TOTALS	***5.0***	***30.2***	***94.0***	***5.4***	***2.8***
SCAQMD Daily Threshold	*75*	*550*	*100*	*150*	*55*
ON-SITE TOTALS	***2.9***	***17.3***	***19.3***	***4.3***	***1.7***
LST Threshold	*N/A*	*1,540*	*148*	*12*	*7*

GHG Emissions Summary

Sediment Removal

Emission Source	Total GHG Emissions (tonnes)			
	CO_2	CH_4	N_2O	CO_2e
Off-road	745.8	0.071	N/A	747.3
On-road Trucks	4,422.6	1.681	1.546	4,937.3
Employees	46.4	0.005	0.005	48.2
TOTALS	***5,215***	***1.76***	***1.55***	***5,733***

Maintenance

Emission Source	Total GHG Emissions (tonnes)			
	CO_2	CH_4	N_2O	CO_2e
Off-road	96.8	0.007	N/A	96.9
On-road Trucks	546.1	0.208	0.191	609.7
Employees	6.5	0.001	0.001	6.7
TOTALS	***649***	***0.22***	***0.19***	***713***

Construction Amortization

Year #	CO_2e		
1	5,733		
2	5,733		
3	5,733		
4	5,733		
5	5,733		**Plus**
Total	**28,664**		**Maintenance**
Amortized over 30 years =		955	1,669

Mileages for Disposal Sites

Disposal Area	Haul Route #	Mileage (round trip)			
		P-H	Highway	H-D	Total
Vulcan Materials	9	1.4	31.0	1.0	33.4
Manning's Pit	2A	1.4	31.0	4.7	37.1
Waste Management Pit	3A	1.4	31.0	3.2	35.5
Average of Irwindale Sites		**1.4**	**31.0**	**3.0**	**35.3**
Scholl Canyon Landfill	4A	1.4	8.6	3.2	13.2
Greenwaste Site		**1.4**	**8.6**	**3.2**	**13.2**
Sheldon Pit	5C	1.1	24.4	10.0	35.5
Cal-Mat Pit	6C	1.1	24.4	10.1	35.7
Bradley Landfill	7C	1.1	24.4	12.8	38.3
Boulevard Pit	8C	1.1	24.4	18.8	44.3
Average of Sun Valley Sites		**1.1**	**24.4**	**12.9**	**38.5**

Distributions	SedRem	Maint
Estimated Total Truck Trips per Day =	425	200
% of trips to Scholl Canyon =	3%	2%
% of trips to Irwindale sites =	78%	75%
% of trips to Sun Valley sites =	19%	23%
Scholl Canyon Trips per Day =	11	4
Irwindale Trips per Day =	333	150
Sun Valley Trips per Day =	81	46
	425	213

P-H = Project to highway

H-D = Highway to disposal site

"Percent to Scholl" Calculations

	3	weeks	2015	5.8%
	1	week	2016+	1.9%
For first 5 years	7	weeks	SedRem	2.7%

On-Road Trucks Criteria Emissions
Unmitigated

Sediment Removal - Unmitigated

Route/Type	Round Trip (mi)	Trips per day	VMT per day	Emissions (pounds per day)				
				ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Scholl Canyon Site - Surface Streets	5	11	53	0.04	0.16	1.18	0.02	0.02
Scholl Canyon Site - Highways	8.6		99	0.04	0.21	2.04	0.04	0.03
Irwindale Sites - Surface Streets	4	333	1,445	1.01	4.46	32.45	0.47	0.43
Irwindale Sites - Highways	31		10,323	4.43	22.29	213.12	3.74	3.44
Sun Valley Sites - Surface Streets	14	81	1,135	0.79	3.50	25.47	0.37	0.34
Sun Valley Sites - Highways	24.4		1,970	0.85	4.25	40.68	0.71	0.66
Totals		***425***	***15,024***	***7.2***	***34.9***	***314.9***	***5.3***	***4.9***

Maintenance - Unmitigated

Route/Type	Round Trip (mi)	Trips per day	VMT per day	Emissions (pounds per day)				
				ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Scholl Canyon Site - Surface Streets	5	4	17	0.01	0.03	0.20	0.00	0.00
Scholl Canyon Site - Highways	8.6		33	0.01	0.05	0.31	0.01	0.01
Irwindale Sites - Surface Streets	14	150	2,108	0.93	3.41	24.15	0.23	0.21
Irwindale Sites - Highways	24.4		3,660	0.82	6.00	34.31	0.63	0.58
Sun Valley Sites - Surface Streets	4	46	200	0.09	0.32	2.29	0.02	0.02
Sun Valley Sites - Highways	31		1,426	0.32	2.34	13.37	0.24	0.23
Totals		***200***	***7,393***	***2.2***	***12.2***	***74.6***	***1.1***	***1.0***

Notes:

Trip distribution during sediment removal is 3% Scholl Canyon, 78% Irwindale SitesIrwindale, and 19% Sun Valley.

Trip distribution during maintenance is 2% Scholl Canyon, 79% Irwindale, and 19% Sun Valley.

Surface streets use vehicle speeds from 5 to 45 mph

Highway use vehicle speeds from 50 to 70 mph

On-Road Trucks Criteria Emissions
Mitigated

Sediment Removal — Mitigated

Route/Type	Round Trip (mi)	Trips per day	VMT per day	Emissions (pounds per day)				
				ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Scholl Canyon Site - Surface Streets	5	11	53	0.04	0.16	0.07	0.00	0.00
Scholl Canyon Site - Highways	8.6		99	0.04	0.21	0.12	0.01	0.01
Irwindale Sites - Surface Streets	4	333	1,445	1.01	4.46	1.95	0.09	0.09
Irwindale Sites - Highways	31		10,323	4.43	22.29	12.79	0.75	0.69
Sun Valley Sites - Surface Streets	14	81	1,135	0.79	3.50	1.53	0.07	0.07
Sun Valley Sites - Highways	24.4		1,970	0.85	4.25	2.44	0.14	0.13
Totals		***425***	***15,024***	***7.2***	***34.9***	***18.9***	***1.1***	***1.0***

Maintenance — Mitigated

Route/Type	Round Trip (mi)	Trips per day	VMT per day	Emissions (pounds per day)				
				ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Scholl Canyon Site - Surface Streets	5	4	17	0.01	0.03	0.03	0.00	0.00
Scholl Canyon Site - Highways	8.6		33	0.01	0.05	0.04	0.00	0.00
Irwindale Sites - Surface Streets	4	150	651	0.93	3.41	3.14	0.11	0.10
Irwindale Sites - Highways	31		4,650	0.82	6.00	4.46	0.30	0.28
Sun Valley Sites - Surface Streets	14	46	646	0.09	0.32	0.30	0.01	0.01
Sun Valley Sites - Highways	24.4		1,122	0.32	2.34	1.74	0.12	0.11
Totals		***200***	***5,351***	***2.2***	***12.2***	***9.7***	***0.5***	***0.5***

On-Road Trucks Total GHG Emissions

Sediment Removal

Disposal Sites	Round Trip (mi)	Trips per day	Trips per year	VMT per year	CO_2	CH_4	N_2O	CO_2e
Scholl Canyon Site - Surface Streets	5	11	2,693	12,332	23	0.007	0.007	25
Scholl Canyon Site - Highways	8.6			23,156	36	0.014	0.013	40
Irwindale Sites - Surface Streets	4	333	78,136	339,111	622	0.205	0.188	685
Irwindale Sites - Highways	31			2,422,218	3,764	1.462	1.345	4,212
Sun Valley Sites - Surface Streets	14	81	18,947	266,211	488	0.161	0.148	538
Sun Valley Sites - Highways	24.4			462,317	718	0.279	0.257	804
Totals		***425***	***80,829***	***2,784,484***	***4,423***	***1.681***	***1.546***	***4,937***

Emissions (tonnes per year)

Maintenance

Disposal Sites	Round Trip (mi)	Trips per day	Trips per year	VMT per year	CO_2	CH_4	N_2O	CO_2e
Scholl Canyon Site - Surface Streets	5	4	248	1,134	2	0.001	0.001	2
Scholl Canyon Site - Highways	8.6			2,130	3	0.001	0.001	4
Irwindale Sites - Surface Streets	4	150	9,777	39,107	72	0.024	0.022	79
Irwindale Sites - Highways	31			303,080	471	0.183	0.168	527
Sun Valley Sites - Surface Streets	14	46	2,998	41,975	77	0.025	0.023	85
Sun Valley Sites - Highways	24.4			73,156	114	0.044	0.041	127
Totals		***200***	***10,024***	***344,318***	***546***	***0.208***	***0.191***	***610***

Emissions (tonnes per year)

Notes:

	Sed	Main
Months per year =	9	3
Days per month =	26.1	21.7
Days per year =	235	65

On-Road Truck Mitigation Calculation

For T7 - single construction in Los Angeles Co

Year	Running Exhaust Emissions (grams per mile)	
	NO_X	PM_{10}
2015	9.7926	0.1547
2020	4.7230	0.0637

Conversion Factor for HHDT (Class 8B)

3.031 bhp-hr/mi

Year	Running Exhaust Emissions (grams per bhp-hr)	
	NO_X	PM_{10}
2015	3.2308	0.0511
2020	1.5582	0.0210

EPA HHDV Standard - 2007+ (g/bhp-hr)	
0.20	*0.01*

Year	% Reduction to EPA Standard	
2015	*-94%*	*-80%*
2020	*-87%*	*-52%*

Conversion Factor from *Update Heavy Duty Emission Conversion Factors for MOBILE6: Analysis of BSCFs and Calculation of Heavy-Duty Engine Conversion Factors* . USEPA, Motor Vehicle Emissions Laboratory. EPA420-P-98-015. May 1998

Employee Commute

Vehicle Activity

Activity	Days per Year	Trips per Day	Round Trip (mi)	VMT per day	VMT per Year
Sediment Removal	235	17	40	680	159,557
Maintenance	65	9	40	340	22,161

Criteria Emissions

Activity	Pounds per day				
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Sediment Removal	0.07	2.44	0.24	0.00	0.00
Maintenance	0.02	0.76	0.07	0.00	0.00

GHG

Activity	Total Tonnes per Year			
	CO_2	CH_4	N_2O	CO_2e
Sediment Removal	46.4	0.0046	0.0054	48.2
Maintenance	6.5	0.0006	0.0007	6.7

Notes:

Months per year = 9

Days per month = 30.4

Days per year = 274

2015 EMFAC2011 On-road Vehicle Emission Factors

Veh Type	Emission Factors (grams per mile)							
	ROG	CO	NO_X	CO_2	PM_{10}	$PM_{2.5}$	CH_4	N_2O
LDA	0.0399	1.3143	0.1167	318.1	0.0023	0.0021	0.0278	0.0294
LDT1	0.1158	3.6051	0.3508	378.3	0.0057	0.0052	0.0315	0.0433
LDT2	0.0528	1.9105	0.2243	454.7	0.0024	0.0022	0.0315	0.0433
Weighted Average - Surface Streets	*0.0488*	*1.6293*	*0.1597*	*354.3*	*0.0026*	*0.0023*	*0.0289*	*0.0337*
T7 single construction - Surface Streets	0.3170	1.3991	10.1837	1,834.9	0.1461	0.1344	0.6037	0.5554
T7 single construction - Highways	0.1945	0.9793	9.3643	1,554.1	0.1642	0.1511	0.6037	0.5554

2020 EMFAC2011 On-road Vehicle Emission Factors

Veh Type	Emission Factors (grams per mile)							
	ROG	CO	NO_X	CO_2	PM_{10}	$PM_{2.5}$	CH_4	N_2O
LDA	0.0173	0.8203	0.0755	257.1	0.0021	0.0019	0.0278	0.0294
LDT1	0.0577	2.3351	0.2331	317.0	0.0042	0.0039	0.0315	0.0433
LDT2	0.0241	1.1647	0.1285	382.7	0.0021	0.0019	0.0315	0.0433
Weighted Average - Surface Streets	*0.0220*	*1.0170*	*0.1000*	*291.1*	*0.0022*	*0.0021*	*0.0289*	*0.0337*
T7 single construction - Surface Streets	0.1993	0.7337	5.1982	1,686.1	0.0493	0.0453	0.6037	0.5554
T7 single construction - Highways	0.1015	0.7440	4.2518	1,427.6	0.0779	0.0717	0.6037	0.5554

Notes: -

Criteria and CO_2 factors come from 2013 EMFAC2011 and represent Estimated Annual Emission Rates for Los Angeles County in the South Coast Air Basin

CH_4 and N_2O factors come from Local Government Operations Protocol: For the quantification and reporting of greenhouse gas emissions inventories. Version 1.1. California Air Resources Board, California Climate Action Registry, ICLEI - Local Governments for Sustainability, and The Climate Registry. May 2010

Surface street emission factors are generated from weighted factors for vehicle speeds from 5 to 45 mph

Highway emission factors are generated from weighted factors for vehicle speeds from 50 to 70 mph

Weighted Average is 69% LDA + 8% LDT1 + 23% LDT2 based on VMT

2015 Estimated Annual Emission Rates

EMFAC 2011

EMFAC 2011 Vehicle Categories
Los Angeles County

EMPLOYEE VEHICLES

Veh_Class	Fuel	VMT per day	Running Exhaust Emissions (grams per mile)					
			ROG	CO	NO_X	CO_2	PM_{10}	$PM_{2.5}$
LDA	GAS	124,228,301	0.0399	1.3180	0.1154	318.20	0.0022	0.0020
	DSL	421,930	0.0490	0.2495	0.4813	275.97	0.0367	0.0337
LDA - Average		**124,650,231**	**0.0399**	**1.3143**	**0.1167**	**318.05**	**0.0023**	**0.0021**
LDT1	GAS	13,920,097	0.1158	3.6095	0.3503	378.39	0.0056	0.0051
	DSL	19,325	0.0948	0.4229	0.6895	294.64	0.0793	0.0729
LDT1 - Average		**13,939,422**	**0.1158**	**3.6051**	**0.3508**	**378.28**	**0.0057**	**0.0052**
LDT2	GAS	41,671,607	0.0528	1.9112	0.2241	454.73	0.0024	0.0022
	DSL	19,382	0.0632	0.3251	0.6529	294.15	0.0506	0.0465
LDT2 - Average		**41,690,989**	**0.0528**	**1.9105**	**0.2243**	**454.65**	**0.0024**	**0.0022**
Employee Weighted Average			***0.0488***	***1.6293***	***0.1597***	***354.30***	***0.0026***	***0.0023***

DIESEL TRUCKS

Veh_Class	Speed (mph)	VMT per day	Running Exhaust Emissions (grams per mile)					
			ROG	CO	NO_X	CO_2	PM_{10}	$PM_{2.5}$
T7 single construction	5	273	3.5045	6.0256	30.4992	3,919.55	0.6823	0.6277
T7 single construction	10	1,111	2.0592	4.2149	21.1424	3,237.84	0.4737	0.4358
T7 single construction	15	3,273	1.0518	2.8594	14.7722	2,658.53	0.3148	0.2896
T7 single construction	20	8,864	0.4283	1.8513	11.0830	2,097.32	0.1942	0.1787
T7 single construction	25	19,082	0.3519	1.5998	10.5006	1,956.84	0.1622	0.1493
T7 single construction	30	25,882	0.2890	1.3886	10.0244	1,836.80	0.1384	0.1273
T7 single construction	35	19,419	0.2394	1.2176	9.6540	1,737.17	0.1226	0.1128
T7 single construction	40	18,869	0.2031	1.0867	9.3942	1,657.98	0.1150	0.1058
T7 single construction	45	18,189	0.1803	0.9965	9.2244	1,599.20	0.1155	0.1063
T7 single construction - Surface Streets		**114,962**	**0.3170**	**1.3991**	**10.1837**	**1,834.92**	**0.1461**	**0.1344**
T7 single construction	50	17,465	0.1709	0.9466	9.1607	1,560.84	0.1242	0.1142
T7 single construction	55	17,232	0.1748	0.9369	9.2018	1,542.90	0.1409	0.1296
T7 single construction	60	40,396	0.1922	0.9676	9.3450	1,545.38	0.1658	0.1525
T7 single construction	65	29,825	0.2228	1.0384	9.5996	1,568.30	0.1988	0.1829
T7 single construction	70	73	0.2730	1.1037	11.0294	1,612.93	0.2421	0.2228
T7 single construction - Highways		**104,990**	**0.1945**	**0.9793**	**9.3643**	**1,554.10**	**0.1642**	**0.1511**

Notes:

- *Surface street speeds are from 5 mph to 45 mph*
- *Highway speeds are from 50 mph to 70 mph*
- *Employee average = 69% LDA + 8% LDT1 + 23% LDT2 based on VMT*

2020 Estimated Annual Emission Rates

EMFAC 2011

EMFAC 2011 Vehicle Categories
Los Angeles County

EMPLOYEE VEHICLES

Veh_Class	Fuel	VMT per day	Running Exhaust Emissions (grams per mile)					
			ROG	CO	NO_X	CO_2	PM_{10}	$PM_{2.5}$
LDA	GAS	127,356,491	0.0173	0.8226	0.0746	257.22	0.0020	0.0019
	DSL	434,476	0.0227	0.1407	0.3355	225.91	0.0162	0.0149
LDA - Average		**127,790,967**	**0.0173**	**0.8203**	**0.0755**	**257.11**	**0.0021**	**0.0019**
LDT1	GAS	14,187,931	0.0577	2.3382	0.2328	317.17	0.0042	0.0039
	DSL	20,940	0.0490	0.2398	0.4558	231.83	0.0395	0.0363
LDT1 - Average		**14,208,871**	**0.0577**	**2.3351**	**0.2331**	**317.04**	**0.0042**	**0.0039**
LDT2	GAS	43,317,321	0.0241	1.1652	0.1284	382.80	0.0021	0.0019
	DSL	20,329	0.0299	0.1759	0.4450	243.31	0.0210	0.0194
LDT2 - Average		**43,337,650**	**0.0241**	**1.1647**	**0.1285**	**382.74**	**0.0021**	**0.0019**
Employee Weighted Average			***0.0220***	***1.0170***	***0.1000***	***291.08***	***0.0022***	***0.0021***

DIESEL TRUCKS

Veh_Class	Speed (mph)	VMT per day	Running Exhaust Emissions (grams per mile)					
			ROG	CO	NO_X	CO_2	PM_{10}	$PM_{2.5}$
T7 single construction	5	422	1.9483	3.8034	15.3144	3,600.96	0.0896	0.0824
T7 single construction	10	1,387	1.1342	2.3921	11.1428	2,974.64	0.0743	0.0684
T7 single construction	15	3,732	0.5763	1.4076	8.1470	2,442.41	0.0618	0.0568
T7 single construction	20	10,499	0.2464	0.7769	6.1362	1,926.81	0.0509	0.0468
T7 single construction	25	22,096	0.2139	0.7260	5.6152	1,797.75	0.0474	0.0436
T7 single construction	30	29,986	0.1854	0.6886	5.1763	1,687.47	0.0459	0.0423
T7 single construction	35	23,319	0.1610	0.6648	4.8200	1,595.96	0.0465	0.0428
T7 single construction	40	22,600	0.1405	0.6544	4.5465	1,523.23	0.0491	0.0452
T7 single construction	45	21,535	0.1240	0.6578	4.3446	1,469.21	0.0537	0.0494
T7 single construction - Surface Streets		**135,576**	**0.1993**	**0.7337**	**5.1982**	**1,686.10**	**0.0493**	**0.0453**
T7 single construction	50	23,100	0.1115	0.6747	4.2229	1,433.95	0.0604	0.0556
T7 single construction	55	27,435	0.1031	0.7052	4.1830	1,417.46	0.0691	0.0635
T7 single construction	60	48,002	0.0986	0.7493	4.2250	1,419.74	0.0798	0.0734
T7 single construction	65	38,081	0.0981	0.8068	4.3501	1,440.80	0.0925	0.0851
T7 single construction	70	95	0.0998	0.8564	5.2530	1,484.20	0.1105	0.1016
T7 single construction - Highways		**136,714**	**0.1015**	**0.7440**	**4.2518**	**1,427.60**	**0.0779**	**0.0717**

Notes:

Surface street speeds are from 5 mph to 45 mph
Highway speeds are from 50 mph to 70 mph
Employee average = 69% LDA + 8% LDT1 + 23% LDT2 based on VMT

Sediment Removal - Off-Road
Unmitigated

Equipment Activity

Type	BHP	Load Factor	Hours/Day	Total Days/Year	Total Hours/Year
Front Loaders	87	0.36	8	235	1,877
Front Loaders	87	0.36	8	235	1,877
Front Loaders	87	0.36	8	235	1,877
Front Loaders	87	0.36	8	235	1,877
D-8 Dozer	358	0.40	8	235	1,877
D-8 Dozer	358	0.40	8	235	1,877
Excavator	157	0.38	8	235	1,877
Grader	162	0.41	8	235	1,877
Water Truck	381	0.38	8	235	1,877
Sorters/Crushers	85	0.78	2	235	469

Notes:

Months per year = *9*
Days per month = *26.1*
Days per year = *235*

Criteria Emissions - Unmitigated

Type	Pounds per day				
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Front Loaders	0.44	2.18	2.78	0.23	0.23
Front Loaders	0.44	2.18	2.78	0.23	0.23
Front Loaders	0.44	2.18	2.78	0.23	0.23
Front Loaders	0.44	2.18	2.78	0.23	0.23
D-8 Dozer	1.59	6.75	12.98	0.53	0.53
D-8 Dozer	1.59	6.75	12.98	0.53	0.53
Excavator	0.56	3.54	3.95	0.21	0.21
Grader	0.70	3.93	5.12	0.28	0.28
Water Truck	1.10	3.17	7.55	0.27	0.27
Sorters/Crushers	0.23	1.13	1.47	0.13	0.13
Totals	***7.54***	***33.99***	***55.18***	***2.87***	***2.87***

GHG Emissions

Type	tonnes per year		
	CO_2	CH_4	CO_2e
Front Loaders	33.41	0.0042	33.50
Front Loaders	33.41	0.0042	33.50
Front Loaders	33.41	0.0042	33.50
Front Loaders	33.41	0.0042	33.50
D-8 Dozer	152.76	0.0151	153.08
D-8 Dozer	152.76	0.0151	153.08
Excavator	63.64	0.0054	63.76
Grader	70.86	0.0066	70.99
Water Truck	154.45	0.0098	154.65
Sorters/Crushers	17.68	0.0022	17.73
Totals	***745.80***	***0.0710***	***747.29***

Sediment Removal - Mitigated Off-Road

Equipment Activity

Type	BHP	Load Factor	Hours/Day	Total Days/Year	Total Hours/Year
Front Loaders	87	0.36	8	235	1,877
Front Loaders	87	0.36	8	235	1,877
Front Loaders	87	0.36	8	235	1,877
Front Loaders	87	0.36	8	235	1,877
D-8 Dozer	358	0.40	8	235	1,877
D-8 Dozer	358	0.40	8	235	1,877
Excavator	157	0.38	8	235	1,877
Grader	162	0.41	8	235	1,877
Water Truck	381	0.38	8	235	1,877
Sorters/Crushers	85	0.78	2	235	469

Notes:

Months per year = *9*

Days per month = *26.1*

Days per year = *235*

Mitigated Criteria Emissions

Type	Pounds per day				
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Front Loaders	0.22	2.18	1.31	0.01	0.01
Front Loaders	0.22	2.18	1.31	0.01	0.01
Front Loaders	0.22	2.18	1.31	0.01	0.01
Front Loaders	0.22	2.18	1.31	0.01	0.01
D-8 Dozer	0.92	6.75	4.28	0.05	0.05
D-8 Dozer	0.92	6.75	4.28	0.05	0.05
Excavator	0.32	3.54	2.13	0.02	0.02
Grader	0.40	3.93	2.77	0.02	0.02
Water Truck	0.64	3.17	2.49	0.03	0.03
Sorters/Crushers	0.12	1.13	0.69	0.01	0.01
Totals	***4.20***	***33.99***	***21.88***	***0.22***	***0.22***

Maintenance - Off-Road

Equipment Activity

Type	BHP	Load Factor	Hours/Day	Total Days/Year	Total Hours/Year
Front Loaders	87	0.36	8	61	487
Front Loaders	87	0.36	8	61	487
D-8 Dozer	358	0.40	8	61	487
Excavator	157	0.38	8	61	487
Water Truck	381	0.38	1	61	61
Sorters/Crushers	85	0.78	8	61	487

Notes:

Months per year = *2*
Days per month = *21.7*
Days per year = *61*

Criteria Emissions

Type	Pounds per day				
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Front Loaders	0.30	2.01	1.88	0.13	0.13
Front Loaders	0.30	2.01	1.88	0.13	0.13
D-8 Dozer	1.24	5.03	9.14	0.36	0.36
Excavator	0.37	3.54	2.06	0.10	0.10
Water Truck	0.10	0.36	0.50	0.02	0.02
Sorters/Crushers	0.55	4.35	3.80	0.24	0.24
Totals	***2.86***	***17.29***	***19.26***	***0.98***	***0.98***

GHG Emissions

Type	tonnes per year		
	CO_2	CH_4	CO_2e
Front Loaders	8.66	0.0007	8.68
Front Loaders	8.66	0.0007	8.68
D-8 Dozer	39.61	0.0031	39.67
Excavator	16.50	0.0009	16.52
Water Truck	5.01	0.0002	5.01
Sorters/Crushers	18.34	0.0014	18.37
Totals	***96.77***	***0.0071***	***96.92***

2015 Off-road Emission Factors

Veh Type	BHP	Load Factor	Emission Factor (g/bhp-hr)						
			ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Front loaders	87	0.36	0.805	3.945	5.041	0.415	0.415	568.3	0.072
D-8 dozers	358	0.40	0.628	2.672	5.138	0.211	0.211	568.3	0.056
Excavator	157	0.38	0.532	3.369	3.751	0.204	0.204	568.3	0.048
Grader	162	0.41	0.595	3.356	4.372	0.241	0.241	568.3	0.053
Water truck	381	0.38	0.431	1.241	2.956	0.105	0.105	568.3	0.036
Sorters/Crushers	85	0.78	0.797	3.859	5.040	0.430	0.430	568.3	0.071

SCAQMD Off-Road Emission Rates Table II

Percentage Reduction from Tier 2 to Tier 4

Engine Size (hp)	Percent Reduction		
	ROG	NO_X	PM_{10}
75 to 99	50%	53%	95%
100 to 174	43%	46%	93%
175 to 299	43%	68%	90%
300 to 600	42%	67%	90%

2015 Off-road Mitigated Emission Factors

Veh Type	BHP	Load Factor	Emission Factor (g/bhp-hr)						
			ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Front loaders	87	0.36	0.403	3.945	2.369	0.021	0.021	568.3	0.072
D-8 dozers	358	0.40	0.364	2.672	1.696	0.021	0.021	568.3	0.056
Excavator	157	0.38	0.303	3.369	2.026	0.014	0.014	568.3	0.048
Grader	162	0.41	0.339	3.356	2.361	0.017	0.017	568.3	0.053
Water truck	381	0.38	0.250	1.241	0.975	0.011	0.011	568.3	0.036
Sorters/Crushers	85	0.78	0.399	3.859	2.369	0.022	0.022	568.3	0.071

2020 Off-road Emission Factors

Veh Type	BHP	Load Factor	Emission Factor (g/bhp-hr)						
			ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4
Front loaders	87	0.36	0.542	3.636	3.404	0.228	0.228	568.3	0.048
D-8 dozers	358	0.40	0.491	1.990	3.619	0.144	0.144	568.3	0.044
Excavator	157	0.38	0.355	3.361	1.958	0.098	0.098	568.3	0.032
Water truck	381	0.38	0.310	1.136	1.561	0.057	0.057	568.3	0.028
Sorters/Crushers	85	0.78	0.473	3.722	3.249	0.206	0.206	568.3	0.042

From: CalEEMod Users Guide - Appendix D, CalEEMod User's Tips (June 2011), and 2011 Carl Moyer Program Guidelines and

Fugitive Dust - Excavation

Fugitive dust emissions from excavation are estimated using the methodology described in Section 11.9, Western Surface Coal Mining, of the EPA AP-42.

AP-42 estimates the emission factor of PM_{10} applying a scaling factor to that of PM_{15}. Similarly, the emission factor of $PM_{2.5}$ is scaled from that of total suspended particulates (TSP). The equations used to calculate the emission factors for PM_{15} and TSP and the scaling factor for those of PM_{10} and $PM_{2.5}$ are presented below:

Emission Factors (Dragline Overburden)

EF PM_{15} = $0.0021 \times d^{0.7} \div M^{0.3}$ = 0.003 lb/hr

EF PM_{TSP} = $0.0021 \times d^{1.1} \div M^{0.3}$ = 0.006 lb/hr

where: d = *drop height (ft)* *5* *(estimate)*

and: M = *material moisture content (%)=* *12* *(SCAQMD Handbook Table A9-9-G-1)*

EF PM_{10} = $EF_{PM15} \times F_{PM10}$ = 0.002 lb/hr

EF $PM_{2.5}$ = $EF_{PMTSP} \times F_{PM2.5}$ = 0.000 lb/hr

Where: EF_{PM10} = *PM_{10} scaling factor. The AP-42 default value is* *0.75*

and $EF_{PM2.5}$ = *$PM_{2.5}$ scaling factor. The AP-42 default value is* *0.017*

(Based on excavation of 7,650 yd^3/d)

Pollutant	Emissions *(lbs/day)*		Control Effectiveness for Rule 403 compliance
	Unmitigated	Mitigated	
PM_{10}	17.64	3.53	*80%*
$PM_{2.5}$	0.76	0.15	

Fugitive Dust - Grading

Fugitive dust emissions from excavation are estimated using the methodology described in Section 11.9, Western Surface Coal Mining, of the EPA AP-42.

AP-42 estimates the emission factor of PM_{10} applying a scaling factor to that of PM_{15}. Similarly, the emission factor of $PM_{2.5}$ is scaled from that of total suspended particulates (TSP). The equations used to calculate the emission factors for PM_{15} and TSP and the scaling factor for those of PM_{10} and $PM_{2.5}$ are presented below:

Emission Factors (Bulldozing Overburden)

EF PM_{15} =	$1.0 \times s^{1.5} \div M^{1.4}$ =	0.764	lb/hr
EF PM_{TSP} =	$5.7 \times s^{1.2} \div M^{1.3}$ =	2.939	lb/hr

where: s =	*material silt content (%)*	*8.5*	*(estimate)*
and: M =	*material moisture content (%)=*	*12*	*(SCAQMD Handbook Table A9-9-G-1)*

EF PM_{10} =	$EF_{PM15} \times F_{PM10}$ =	0.573	lb/hr
EF $PM_{2.5}$ =	$EF_{PMTSP} \times F_{PM2.5}$ =	0.309	lb/hr

Where: EF_{PM10} =	*PM_{10} scaling factor. The AP-42 default value is*	*0.75*
and $EF_{PM2.5}$ =	*$PM_{2.5}$ scaling factor. The AP-42 default value is*	*0.105*

(Based on 10 hours per day of grading)

Pollutant	Emissions *(lbs/day)*	
	Unmitigated	Mitigated
PM_{10}	5.73	1.15
$PM_{2.5}$	3.09	0.62

Control Effectiveness for Rule 403 compliance

80%

Fugitive Dust - Material Loading

Fugitive dust emissions from excavation are estimated using the methodology described in Section 13.4.2, *Aggregate Handling and Storage Piles* , of the EPA AP-42.

Emission Factor Formula

Emissions = $k \times 0.0032 \times (U \div 5)^{1.3} \div (M \div 2)^{1.4}$ lb/ton

where: k =	*aerodynamic particle size multiplier*	*PM_{10} = 0.35*	*$PM_{2.5}$ = 0.053*
U =	*average wind speed (mph)*	*15*	*(AP-42)*
M =	*material moisture content (%)*	*12*	*(SCAQMD Handbook Table A9-9-G-1)*

EF PM_{10} = 3.80E-04 $lb\text{-}PM_{10}/ton_{mat}$

EF $PM_{2.5}$ = 5.76E-05 $lb\text{-}PM_{2.5}/ton_{mat}$

or

EF PM_{10} = 1.90E-07 $lb\text{-}PM_{10}/lb_{mat}$

EF $PM_{2.5}$ = 2.88E-08 $lb\text{-}PM_{2.5}/lb_{mat}$

or

EF PM_{10} = 5.13E-04 $lb\text{-}PM_{10}/yd^3_{mat}$

EF $PM_{2.5}$ = 7.77E-05 $lb\text{-}PM_{2.5}/yd^3_{mat}$

(based on 2,600 lbs/yd^3 density for aggregate)

(Based on excavation of 7,650 yd^3/d)

Pollutant	Emissions *(lbs/day)*	
	Uncontrolled	Compliance
PM_{10}	3.93	0.79
$PM_{2.5}$	0.59	0.12

Control Effectiveness for Rule 403 compliance

80%

Fugitive Dust - Summary

Uncontrolled

Category	Emissions (lb/day)	
	PM_{10}	$PM_{2.5}$
Excavation	17.64	0.76
Grading	5.73	3.09
Material Unloading/Loading	3.93	0.59
Total	***27.30***	***4.44***

Compliance

Category	Emissions (lb/day)	
	PM_{10}	$PM_{2.5}$
Excavation	3.53	0.15
Grading	1.15	0.62
Material Unloading/Loading	0.79	0.12
Total	***5.46***	***0.89***

Maintenance Fugitive Dust - Excavation

Fugitive dust emissions from excavation are estimated using the methodology described in Section 11.9, Western Surface Coal Mining, of the EPA AP-42.

AP-42 estimates the emission factor of PM_{10} applying a scaling factor to that of PM_{15}. Similarly, the emission factor of $PM_{2.5}$ is scaled from that of total suspended particulates (TSP). The equations used to calculate the emission factors for PM_{15} and TSP and the scaling factor for those of PM_{10} and $PM_{2.5}$ are presented below:

Emission Factors (Dragline Overburden)

EF PM_{15} =	$0.0021 \times d^{0.7} \div M^{0.3}$ =	0.003	lb/hr
EF PM_{TSP} =	$0.0021 \times d^{1.1} \div M^{0.3}$ =	0.006	lb/hr

where: d =	*drop height (ft)*	*5*	*(estimate)*
and: M =	*material moisture content (%)=*	*12*	*(SCAQMD Handbook Table A9-9-G-1)*

EF PM_{10} =	$EF_{PM15} \times F_{PM10}$ =	0.002	lb/hr
EF $PM_{2.5}$ =	$EF_{PMTSP} \times F_{PM2.5}$ =	0.000	lb/hr

Where: EF_{PM10} =	*PM_{10} scaling factor. The AP-42 default value is*	*0.75*
and $EF_{PM2.5}$ =	*$PM_{2.5}$ scaling factor. The AP-42 default value is*	*0.017*

(Based on excavation of 3,825 yd^3/d)

Pollutant	Emissions *(lbs/day)*	
	Unmitigated	Mitigated
PM_{10}	8.82	1.76
$PM_{2.5}$	0.38	0.08

Control Effectiveness for Rule 403 compliance

80%

Maintenance Fugitive Dust - Grading

Fugitive dust emissions from excavation are estimated using the methodology described in Section 11.9, Western Surface Coal Mining, of the EPA AP-42.

AP-42 estimates the emission factor of PM_{10} applying a scaling factor to that of PM_{15}. Similarly, the emission factor of $PM_{2.5}$ is scaled from that of total suspended particulates (TSP). The equations used to calculate the emission factors for PM_{15} and TSP and the scaling factor for those of PM_{10} and $PM_{2.5}$ are presented below:

Emission Factors (Bulldozing Overburden)

$EF\ PM_{15}$ =	$1.0 \times s^{1.5} \div M^{1.4}$ =	0.764 lb/hr
$EF\ PM_{TSP}$ =	$5.7 \times s^{1.2} \div M^{1.3}$ =	2.939 lb/hr

where: s = *material silt content (%)* *8.5* *(estimate)*

and: M = *material moisture content (%)=* *12* *(SCAQMD Handbook Table A9-9-G-1)*

$EF\ PM_{10}$ =	$EF_{PM15} \times F_{PM10}$ =	0.573 lb/hr
$EF\ PM_{2.5}$ =	$EF_{PMTSP} \times F_{PM2.5}$ =	0.309 lb/hr

Where: EF_{PM10} = *PM_{10} scaling factor. The AP-42 default value is* *0.75*

and $EF_{PM2.5}$ = *$PM_{2.5}$ scaling factor. The AP-42 default value is* *0.105*

(Based on 10 hours per day of grading)

Pollutant	Emissions *(lbs/day)*	
	Unmitigated	Mitigated
PM_{10}	5.73	1.15
$PM_{2.5}$	3.09	0.62

Control Effectiveness for Rule 403 compliance

80%

Maintenance Fugitive Dust - Material Loading

Fugitive dust emissions from excavation are estimated using the methodology described in Section 13.4.2, *Aggregate Handling and Storage Piles*, of the EPA AP-42.

Emission Factor Formula

Emissions = $k \times 0.0032 \times (U \div 5)^{1.3} \div (M \div 2)^{1.4}$ lb/ton

where: k =	*aerodynamic particle size multiplier*	*PM_{10} = 0.35*		*$PM_{2.5}$ = 0.053*
U =	*average wind speed (mph)*	*15*	*(AP-42)*	
M =	*material moisture content (%)*	*12*	*(SCAQMD Handbook Table A9-9-G-1)*	

EF PM_{10} = 3.80E-04 $lb\text{-}PM_{10}/ton_{mat}$

EF $PM_{2.5}$ = 5.76E-05 $lb\text{-}PM_{2.5}/ton_{mat}$

or

EF PM_{10} = 1.90E-07 $lb\text{-}PM_{10}/lb_{mat}$

EF $PM_{2.5}$ = 2.88E-08 $lb\text{-}PM_{2.5}/lb_{mat}$

or

EF PM_{10} = 5.13E-04 $lb\text{-}PM_{10}/yd^3_{mat}$

EF $PM_{2.5}$ = 7.77E-05 $lb\text{-}PM_{2.5}/yd^3_{mat}$

(based on 2,600 lbs/yd^3 density for aggregate)

(Based on excavation of 3,825 yd^3/d)

Pollutant	Emissions *(lbs/day)*	
	Unmitigated	Mitigated
PM_{10}	1.96	0.39
$PM_{2.5}$	0.30	0.06

Control Effectiveness for Rule 403 compliance

80%

Maintenance Fugitive Dust - Summary

Unmitigated

Category	Emissions (lb/day)	
	PM_{10}	$PM_{2.5}$
Excavation	8.82	0.38
Grading	5.73	3.09
Material Unloading/Loading	1.96	0.30
Total	***16.52***	***3.76***

Mitigated

Category	Emissions (lb/day)	
	PM_{10}	$PM_{2.5}$
Excavation	1.76	0.08
Grading	1.15	0.62
Material Unloading/Loading	0.39	0.06
Total	***3.30***	***0.75***