

Draft EIS/EIR Appendices D and G-2

Project Operations

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Project Operations

D.1 Introduction

The Species Conservation Habitat (SCH) ponds are intended to be operated in a manner that would both provide a partial in-kind replacement for some of the near-term habitat losses at the Salton Sea (the Sea) and answer key questions regarding the development of shallow-water habitat as part of a long-term restoration program at the Sea. Operations of the Salton Sea SCH Project (Project) components would have to balance habitat requirements necessary to achieve desired objectives against competing constraints such as environmental limitations (physical, water quality, and climatological conditions); compatibility with existing and future adjacent land uses (agricultural fields, geothermal development, and other habitat projects at the Sonny Bono Salton Sea National Wildlife Refuge); and habitat values (at the refuge); and consistency with the applicable requirements of the Imperial Irrigation District (IID) Habitat Conservation Plan/Natural Communities Conservation Plan. Decisions necessary to strike this balance and meet the objectives would be made within an adaptive management framework.

This appendix provides a conceptual overview of the range of operations that could be used to provide suitable habitat (for species dependent on the Salton Sea) and to test different operational scenarios as part of the “proof-of-concept” aspect of the SCH Project. Key indicators of physical, chemical, and biological attributes of that habitat would be monitored to determine the effects of different operational scenarios, and any adjustments would be implemented as needed in accordance with the SCH Monitoring and Adaptive Management Framework, as described in Appendix E.

D.2 Key Project Components

The general facilities necessary for each alternative include river water diversion, sedimentation basin, saline water diversion, SCH ponds, in-pond habitat features, and an agricultural drain interception ditch.

D.2.1 River Water Diversion

River water would be diverted for the use of producing shallow-water aquatic habitat in one of two manners. For Alternatives 1 and 4, river water would be diverted via a lateral weir placed on the edge of the river channel. The diversion weir would be located upstream of the SCH ponds to provide sufficient hydraulic head to convey the water to the SCH ponds with gravity. For Alternatives 2, 3, 5, and 6, river water would be diverted via electrically driven pumps located adjacent to the SCH ponds.

D.2.2 Sedimentation Basin

Waters in the New and Alamo rivers contain suspended sediment that would need to be removed prior to conveyance and delivery to the SCH habitat ponds. The concentration of the suspended sediment in the rivers is recently reported at about 219 milligrams per liter (mg/L) for the New River and 280 mg/L for the Alamo River. The water diverted to the SCH ponds from the rivers would have to go through a sedimentation basin to remove the sediment load before the water is released to the SCH ponds. For alternatives using a gravity diversion, the sedimentation basin would be located upstream of the SCH ponds near the point of diversion. For alternatives using the pumped diversion, the sedimentation basin would be located within the SCH pond footprint.

The sedimentation basin would be operated to hold the water just long enough for the sediment to settle out. The settling time is a function of the size of the particles suspended in the water column.

1 Sedimentation basins elsewhere in the Imperial Valley store water for about 5 days. Routine operations
2 would include the removal and disposal of the sediments collected in the sedimentation basin. The
3 frequency of these actions and amount of material to be removed would be determined once an alternative
4 were selected for design and could be modified during the life of the SCH Project as a result of sediment
5 control measures being independently implemented as part of the Clean Water Act Section 303(d)
6 requirements (Total Maximum Daily Loads).

7 **D.2.3 Saline Water Diversion**

8 Saline water would be diverted by electrically driven pumps placed on a structure in or adjacent to the
9 Salton Sea to produce the desired salinity in the SCH ponds. The water must be pumped (lifted) because
10 the Sea's elevation is less than the desired pond elevation of -228 feet mean sea level (msl).
11 Currently, the water would have to be lifted about 4 feet in elevation from the Sea to the SCH ponds. As
12 the Sea's elevation declines over time, the height that the saline water would have to be lifted would
13 increase, along with the distance that the water had to be conveyed to reach the ponds.

14 **D.2.4 SCH Pond Berms**

15 The SCH pond complex would be formed by constructing low height (up to approximately 8-foot-high)
16 berms to contain water and separate the SCH ponds from the remainder of the Salton Sea and its recently
17 exposed playa. Internal berms would segment the SCH ponds into experimental units.

18 The SCH ponds would be constructed primarily on recently exposed playa following the existing
19 topography (ground-surface contours) where possible. The ground surface within the SCH ponds would
20 be excavated (with a balance between cut and fill) to acquire material to build the berms and habitat
21 islands. The borrow areas for the berms would generally form adjacent channels, swale channels, and
22 shallow excavations. The maximum water surface elevation would be -228 feet msl. Pond depth would
23 range from near zero toward the shoreline (-228 msl) to 6 feet at the exterior berm. Maximum depth in
24 excavated areas would be up to 10 feet. Outflow structures would be constructed in the outer berms, and
25 maximum outflow from the SCH pond complex to the Salton Sea would total approximately 130 cubic
26 feet per second.

27 Berms would be maintained to repair damage due to structural failures, differential settling, surface
28 erosion, access, and water management functions. Berms may require future strengthening by others to
29 accommodate other compatible land uses (e.g., geothermal development).

30 **D.2.5 In-Pond Habitat Features**

31 Several constructed bird and fish habitat structures would be included in the SCH ponds, such as swales,
32 holes, and habitat islands. Swales are 2-foot or deeper channels within the pond units that would be
33 constructed with scrapers and excavators. They ultimately would serve as habitat features to increase
34 aquatic habitat heterogeneity, connect shallow and deep areas of a pond unit, and provide deeper refugia
35 near shallow areas. Each SCH pond would include several islands for bird habitat: one to three nesting
36 islands (suitable for tern species) and three to six smaller roosting islands (suitable for cormorants and
37 pelicans). The overall SCH pond complex could also include one or more large (2- to 10-acre) islands that
38 have rocky and sandy substrate (suitable for cormorant nesting).

39 **D.2.6 Agricultural Drain Interception Ditch**

40 Water from adjacent agricultural drains that currently flows (or is pumped) directly into the Salton Sea
41 would be rerouted around the SCH ponds. The interception ditch would allow for the continuation
42 connection of these drains to the Salton Sea and not disturb the flow of agricultural drainwater from the

1 adjacent fields. IID would maintain operational control of these drains and continue to provide all
2 maintenance activities necessary on these drains.

3 D.3 Operational Variables and Range

4 D.3.1 Habitat Requirements and Operational Constraints

5 SCH ponds are intended to:

- 6 • Provide habitat suitable for production of fish dependent on the Salton Sea. Likely fish candidates are
7 one or more varieties of tilapia, which are an important forage species for fish-eating birds. Other
8 fishes that could become established in the SCH ponds include desert pupfish (*Cyprinodon*
9 *macularius*), sailfin mollies (*Poecilia latipinna*), mosquitofish (*Gambusia affinis*), and threadfin shad
10 (*Dorosoma petenense*).
- 11 • Provide habitat suitable to support fish-eating birds and other birds dependent on the Salton Sea.
12 Foraging habitat would be a key attribute, but other features to meet habitat needs for nesting and
13 resting would also be included.

14 SCH pond operations would attempt to meet Project goals and objectives given certain constraints of
15 physical conditions, water quality, and climate. The general characteristics of the aquatic habitat that
16 would likely be present for fish include:

- 17 • Highly eutrophic, shallow-water ponds that would be highly turbid in spring through fall.
- 18 • Low temperatures below 50 degrees Fahrenheit (°F) (10 degrees Celcius [°C]) during short periods of
19 the winter and high temperatures in the low-to mid 90s °F (low 30s °C) in the late spring through
20 early fall.
- 21 • Dissolved oxygen (DO) concentrations ranging from zero mg/L at the mudline to super-saturated
22 during daylight hours in spring to fall.

23 SCH Project operations would be constrained by the physical characteristics of the ponds (e.g., depth,
24 area, and bottom profile), but certain water quality conditions could be modified, within some range of
25 conditions, as needed, by adjusting the limited operational controls to create more desirable habitat
26 conditions in the ponds. The primary operational variables that could be controlled are:

- 27 • Salinity of the water within the ponds;
- 28 • Volume of water in the ponds;
- 29 • Residence time of the water in the ponds;
- 30 • Pond depth;
- 31 • Fish species stocked in the ponds; and
- 32 • Physical cover elements.

33 Depending on the specific alternative and pond design selected, the habitat would be composed of a few
34 to several individual ponds. This design would allow the operators to try different combinations of
35 storage, salinity, and residence times to investigate how these factors could be adjusted to provide the best
36 conditions for fish and birds. Different operational scenarios would be tested during the proof-of-concept
37 phase, the first 10 years of Project operation (to approximately 2025). After the proof-of-concept phase,

1 pond variables would be managed to produce the best habitat for fish and wildlife dependent on the
2 Salton Sea.

3 The following discussion is based on the construction and operation of approximately 2,400 acres of
4 habitat, but the acreage could be less or more depending on the alternative selected and the funding
5 available for Project construction.

6 **D.3.2 Salinity of Stored Water**

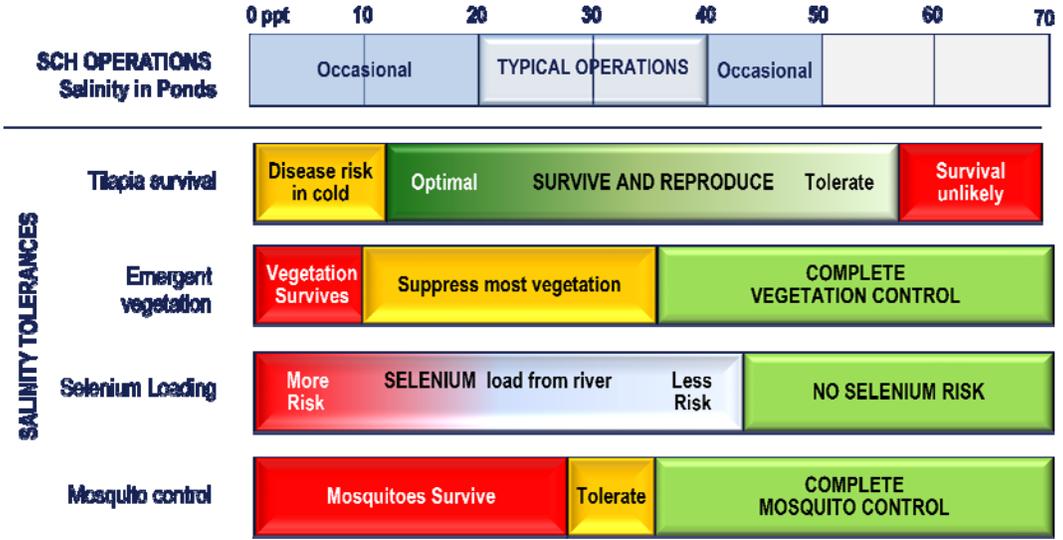
7 The SCH ponds would typically be operated within the range of 20 to 40 parts per thousand (ppt) salinity.
8 Water from the Alamo River or New River (salinity approximately 2 ppt) would be blended with water
9 from the Salton Sea (current¹ salinity approximately 53 ppt) to produce the desired pond salinity.
10 Blending the river water and seawater in different amounts would allow for a range of salinities to be used
11 in the ponds.²

12 Different ponds could be operated under different salinities to test which salinity regime results in the best
13 combination, or balance, of invertebrate and fish productivity, bird use, seasonal fish survival, and
14 exposure to selenium (Figure D-1). For example, cold tolerance by tilapia is better at lower salinities (20
15 ppt) than at higher salinities (60 ppt) (Lorenzi and Schlenk, in preparation), but selenium loading to the
16 pond is increased (more river water equals lower salinity but higher inputs of water-borne selenium)
17 (Appendix I, Selenium Management Strategies). Salinity in the ponds could also be increased as needed
18 to control mosquito populations (Appendix F, Mosquito Control Plan), control emergent vegetation
19 growth (Table D-1), and limit the development of aquatic habitat that would support freshwater fish
20 known to be predators of desert pupfish.

21 During the proof-of-concept phase, salinities would be typically managed between 20 to 40 ppt. This
22 range is generally sufficient to control many of the negative factors listed above and within the range to
23 be tolerated by the fish species expected to be used in the SCH ponds. Pond salinity may be allowed to
24 exceed this general range (from undiluted river water [2 ppt] up to 50 ppt) in the course of balancing
25 evaporation and water pumping, or if deemed appropriate to test specific fish management or habitat
26 value hypotheses. For example, it may be desirable to operate each pond at a different salinity (e.g.,
27 undiluted river water, 20 ppt, and 40 ppt) and monitor biological outcomes and long-term operational
28 feasibility. SCH ponds would not be operated with hypersaline conditions (greater than 50 ppt) because
29 they would result in decreased viability of the desired aquatic habitat.

¹ The salinity in the Salton Sea is expected to increase in the future, with salinity exceeding 100,000 ppt by 2030 (DWR and DFG 2007).

² Evapoconcentration, increasing the salinity through the evaporation process, was simulated in the water quality modeling for this Project and found to be ineffective in achieving the desired salinity range in a short period of time.



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Figure D-1 Operational Range of Salinities and Biological Constraints

**APPENDIX D
PROJECT OPERATIONS**

Table D-1 Salinity Tolerances of Local Plant Species				
Species	Habitat	Typical Salinity Preference	Widest Salinity Tolerated	Comments and Sources
California Bulrush (<i>Schoenoplectus californicus</i>)	Widespread in fresh and intermediate marsh zone	0-3.5 ppt	Approximately 10 ppt or greater will control populations	Stutzenbaker 1999 Prolonged exposure to extreme conditions (15-20 ppt) exceeds the typical salinity tolerance and populations decline (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002)
American Bulrush (<i>Scirpus americanus</i>) Olney's three-square bulrush (<i>Schoenoplectus americanus</i>)	Fresh to intermediate marshes	0-3.5 ppt	50% reduction at 4 ppt and no germination above 13 ppt	Stutzenbaker 1999; Uchytel 1992 Management and maintenance depends primarily on maintenance of water levels and secondarily on salinity levels (Uchytel 1992)
Saltmarsh Bulrush (<i>Scirpus maritimus</i> or <i>Scirpus robustus</i>)	Intermediate to brackish marshes, often on soils subject to tidal influence	3.5-10 ppt	Has been found in hypersaline lakes (~60 ppt) Germination reduced 50% at salinity = 9 ppt. No germination at salinity = 21 ppt.	Stutzenbaker 1999; International Lake Environment Committee 1998; Snyder 1991
Broad Leaf Cattail (<i>Typha latifolia</i>)	Freshwater aquatic normally, but also found in intermediate marshes	0-0.5 ppt	Found in intermediate marshes with salinity up to 3.5 ppt In marshes of southeastern Louisiana, occurred at salt levels up to 1.13%	Stutzenbaker 1999
Narrow Leaf Cattail (<i>Typha angustifolia</i>)	Freshwater aquatic normally, but also found in intermediate marshes; coastal	0-0.5 ppt	15-30 ppt	Stutzenbaker 1999; Reed et al. 1995
Southern Cattail (<i>Typha domingensis</i>)	Wetlands ranging from fresh to brackish	0-10 ppt	75% mortality occurred at 15 ppt	Stutzenbaker 1999; Glenn et al. 1995

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2 **D.3.3 Volume of Water in Storage**

3 Storage is the amount of water contained in the SCH ponds at a given time. The volume that could be
 4 stored would depend upon the size of the ponds, which varies by alternative. The storage would also be
 5 controlled by changing the inflow and outflow to the SCH ponds. A pond could be operated at a constant
 6 storage or varying storage, depending on the proof-of-concept testing. Reasons for varying storage (and
 7 hence the maximum depth and inundated area) include responding to water quality conditions, desire to
 8 create different habitat conditions in the pond (e.g., shallow-water habitat), vector control, or pond
 9 maintenance.

10 Water quality modeling performed for the SCH Project has shown that DO or temperature conditions
 11 respond to several operational parameters, including the depth of the water in a pond and pond shape (the
 12 relationship between water depth and surface area). Therefore, changing storage in the pond can alter
 13 these conditions by changing the amount of shallow- and deepwater habitat.

1 The storage could be operated at any amount from empty (e.g., for emergency maintenance) to full with a
2 maximum depth of approximately 6 feet at the terminal berm. Should the average depth of the pond be 3
3 feet, the storage at full depth would be approximately 7,200 acre-feet for a constructed pond complex of
4 2,400 acres. Operators would determine the appropriate depth and manage the total storage in the pond to
5 meet that depth.

6 D.3.4 Residence Time

7 Residence time is a measure of the time it would take the average unit of water volume to pass through
8 the SCH ponds (or loss to evaporation). The residence time defines the amount of water diverted from the
9 river and the Sea and in turn controls the diversion facilities, Project energy use, and cost. Residence time
10 may be an important parameter for the control of habitat conditions in the SCH operations.

11 SCH pond residence time would be altered as a result of other operations of the SCH ponds or could be an
12 experimental variable for operational testing. Residence time may vary in response to climatic conditions
13 (including temperature, wind frequency, direction and speed, and solar illumination) or may be modified
14 to test various hypotheses regarding the habitat value during differing climatic conditions and to control
15 anticipated negative conditions. These negative conditions would include the increased probability of
16 depleted DO concentration (anoxia) in portions of the water column or pond areas.

17 During the Project's proof-of-concept phase, pond residence time would be managed to test the
18 hypotheses developed through the use of the adaptive management process (see Appendix E). Based on
19 preliminary water quality modeling results (see Appendix J, Summary of Special Studies Supporting the
20 EIS/EIR Impact Analysis), it is anticipated that residence times could vary from a couple of weeks (2
21 weeks) to several months (32 weeks). This range is generally sufficient to support the proof-of-concept
22 testing while allowing for the control of potential negative factors and the production of the desired
23 habitat.

24 D.3.5 Pond Depth

25 The maximum and average depth of water in the SCH ponds would be varied to test various hypotheses
26 regarding habitat value during differing climatic conditions and to control anticipated negative conditions
27 listed above for residence time. Depth also could be controlled to manage predation on the fish in the
28 ponds. Different ponds could be operated at different depths, and pond depth could be changed to test
29 different scenarios. A range of depths would be created through excavation of material used for berms.
30 The depth (and pond area) could also be changed by varying the amount of water stored in a pond during
31 the year.

32 During the Project's proof-of-concept phase, pond depth would be managed to test the hypotheses
33 developed through the use of the adaptive management process (see Appendix F). Based on preliminary
34 water quality modeling results (see Appendix J), it is anticipated that the maximum pond depth at the
35 edge of the berms would be 6 feet. Pond depth may be managed outside this general range to test specific
36 fish management or habitat value hypotheses. Ponds may need to be drained or the elevation lowered for
37 emergency maintenance or to control aquatic conditions, but this drainage would not be a routine
38 occurrence.

39 D.3.6 Fish Stocking in Ponds

40 *Fish Species Selection*

41 The SCH ponds would be designed to support fish to serve as prey for piscivorous birds. Promising
42 candidate species must be able to forage, grow, and reproduce in fluctuating salinities using the soft, fine-

1 grained sediment that would naturally form the pond substrate. Fish that have evolved to deal with
2 environmental fluctuations would be better able to thrive in SCH ponds than those whose physiology is
3 less plastic when dealing with environmental extremes.

4 A number of species present in riverine or estuarine habitats of Southern California and Baja California,
5 Mexico, could be suitable candidates for a productive SCH fish community (DFG 2011). The main
6 attributes considered were foraging suitability for a wide range of piscivorous birds (e.g., no “bottom-
7 hugging” flatfish that would be inaccessible to most birds), resistance to perturbation (e.g., tolerates wide
8 fluctuations in temperature, DO, salinity), high productivity, and sustainability. These attributes were
9 weighed against potential risk to desert pupfish, potential risk for spread to new habitats not currently
10 occupied, and difficulty or expense in obtaining or producing sufficient numbers for stocking. For the
11 Project’s initial establishment, however, only those species currently inhabiting the Salton Sea and its
12 connected waters would be considered for use. Desert pupfish, a federally protected species, are present
13 around the Salton Sea and would be included in the SCH ponds. Selecting only fish species that currently
14 reside at the Sea would avoid any new impacts beyond what the Salton Sea desert pupfish population is
15 currently exposed.

16 Therefore, the fish assemblage proposed for initial deliberate introduction into the SCH ponds would
17 include one or more forms of tilapia and possibly threadfin shad, as well as desert pupfish, sailfin molly,
18 and mosquitofish. Stocking more than one fish species in the ponds would provide some redundancy and
19 improve sustainability of the fish community. If these initial species do not meet the Project objectives,
20 other candidate species evaluated by DFG (DFG 2011) would be considered.

21 *Tilapia*

22 Tilapia satisfy the entire suite of attributes sought in a candidate species, more than any other single
23 species being considered for the SCH Project (DFG 2011). This family of fishes has wide tolerances for
24 water quality conditions, flexible diet including algae and invertebrates, high fecundity, and distribution
25 throughout the water column. Furthermore, they could also support sport fishing. This species is highly
26 tolerant of a wide range of salinities, including high salinities, as demonstrated by their current dominance
27 in the hypersaline Salton Sea. Juvenile Mozambique hybrids can be slowly acclimated up to 95 grams per
28 liter and survive at least for 5 days if the temperature is kept constant at 73 to 77 °F (23 to 25 °C)
29 (Sardella et al. 2004a). Tilapia are less capable of dealing with high salinity under extreme temperatures
30 (Sardella et al. 2004b). The preferred temperature range for optimum tilapia growth is 82° to 86°F (28 to
31 30°C). Growth diminishes significantly at temperatures below 68°F (20°C) and death would occur below
32 50°F (10°C) (Rakocy and McGinty 1998). At temperatures below 54°F (12°C), tilapia are more
33 vulnerable to infections by bacteria, fungi, and parasites. The temperature regime in the SCH ponds
34 would be expected to be more extreme than that of the current lake (DWR and DFG 2007). Models of
35 water temperatures for the SCH ponds predict temperatures below the lethal threshold for Mozambique
36 hybrid tilapia (Appendix J).

37 Tilapia are remarkably tolerant of low DO concentrations, considerably below tolerance limits for most
38 fish. Tilapia can thrive at DO concentrations of 2 mg/L, can survive extended periods of 1 mg/L, and can
39 tolerate routine dawn DO concentrations of less than 0.3 mg/L (Popma and Masser 1999). In low DO
40 conditions, fish frequently are found near the surface taking in water in the thin surficial layer that
41 remains somewhat oxygenated (personal communication, K. Fitzsimmons 2010). Such behavioral coping
42 responses could increase the vulnerability of fish to bird predation near the surface.

43 Their main drawback, other than potential competition with desert pupfish, is whether they could handle
44 the lowest water temperatures predicted for SCH ponds. Stocking different tilapia species or strains
45 (individually or in combination) among the SCH ponds could test which species is most sustainable and

1 resilient, and could enhance stability of the fishery resource in the ponds in the face of seasonal and
2 annual fluctuations in water quality parameters. The three tilapia species under consideration for stocking
3 in the SCH ponds include the following:

4 **California Mozambique Hybrid Tilapia** – California Mozambique hybrid tilapia (“Mozambique
5 tilapia”) are a hybrid of *Oreochromis mossambicus* and *O. urolepis hornorum*. This species is currently
6 the dominant species in the Salton Sea and is widely used in aquaculture including at fish farms in the
7 Salton Sea watershed. Advantages of this species are its demonstrated ability to survive, thrive, and
8 achieve high productivity in hypersaline conditions, as well as its presumed importance as a suitable
9 forage fish for all piscivorous birds at the Salton Sea. The risk from using Mozambique tilapia as the sole
10 forage species is the potential for population crashes, as seen with the massive fish die-offs at the
11 beginning of the decade. The proposed SCH operations would be designed to keep water quality
12 conditions within known tolerances and, therefore, population fluctuations may be dampened.

13 **Blue Tilapia** – Blue tilapia (*Oreochromis aureus*) have a lower tolerance for salinity, but handle colder
14 temperatures than the other two tilapia (Popma and Masser 1999). Tilapia resembling blue tilapia are
15 currently only present in the New and Alamo rivers. The genetic makeup of this tilapia assemblage is
16 uncertain, but likely includes *O. aureus* and possibly Mozambique tilapia genetic material given the
17 checkered history of tilapia introductions and movements in southern California (personal
18 communication, K. Fitzsimmons 2010).

19 **Redbelly Tilapia** – Redbelly tilapia (*Tilapia zillii*) were once the dominant tilapia species in the Salton
20 Sea, when salinity was lower. Although they were replaced by the Mozambique tilapia, they are still
21 thriving in some of the agricultural drains. The difference in their tolerance to salinity and temperature, as
22 well as a different breeding strategy, may provide plasticity in response to perturbation for a fish
23 community that contains both species.

24 The relative tolerances of these species to combinations of salinities (20 ppt, 45 ppt, and 60 ppt) and
25 temperatures (cold 11-16°C [52-61 °F]), warm 23-28°C [73-82 °F], and hot 33-38°C [91-100°F]) were
26 tested experimentally (Lorenzi and Schlenk, in preparation). The tested fish included Mozambique tilapia
27 (two strains: wild fish from Salton Sea and an aquaculture strain from a local fish farm), fish from a blue
28 tilapia assemblage in the New River, and redbelly tilapia from the New River. The best survival at cold
29 temperatures was observed with the wild Mozambique tilapia, while the aquacultural strain of
30 Mozambique tilapia was the best performer overall for all salinities at warm temperatures. The blue
31 tilapia strain surprisingly did not have better survival than Mozambique tilapia in cold conditions.
32 Redbelly tilapia results were equivocal, due to other sources of mortality in captivity. While most strains
33 and species had moderately good survival in 45 ppt and 60 ppt conditions at warm temperatures, all
34 species showed poor survival in hot high-salinity (60 ppt) conditions.

35 *Desert Pupfish*

36 Desert pupfish are listed as an endangered species under both Federal and California Endangered Species
37 Acts. They currently inhabit the agricultural drains and creeks that feed into the Salton Sea, shallow areas
38 of the Sea itself, and numerous created refuge habitats. A study of IID agricultural drains found an
39 abundance of desert pupfish positively correlated with western mosquitofish, salfin molly, and
40 Mozambique hybrid tilapia (Martin and Saiki 2005). Desert pupfish are observed most frequently in
41 shallow water less than about 1 foot (30 centimeters) deep with velocities less than about 1 foot/second
42 (Black 1980). They are capable of moving freely between the relatively fresh water in the agricultural
43 drains and the highly saline environment in the Salton Sea (DWR and DFG 2007).

1 Desert pupfish are very tolerant of extreme water quality conditions, and have been held in the laboratory
2 in water with salinity greater than 98 ppt (Barlow 1958, as cited in Moyle 2002). The ability of desert
3 pupfish to tolerate high salinity, high pH, and low DO contributes to their ability to persist at the Salton
4 Sea. Moyle (2002) summarized the life history of desert pupfish as follows, with additional information
5 as noted. This species can tolerate salinities ranging from freshwater to considerably greater than seawater
6 (up to 68 ppt in the wild), DO from saturation to as low as 0.1 to 0.4 mg/L (parts per million), and
7 temperatures from 39.9°F (4.4°C) in winter (Schoenherr 1990) to 108.3°F (42.4°C) in summer (Carveth et
8 al. 2006). Individuals can survive daily temperature fluctuations of up to 78.8°F (26°C) and salinity
9 changes of 10 to 15 ppt. Larvae have a higher salinity tolerance (up to 90 ppt) than do adults (68 ppt) and
10 can withstand sudden salinity changes of up to 35 ppt.

11 Under current conditions at the Salton Sea, individual desert pupfish inhabiting creeks and drains that
12 flow into the Sea are presumed to move along the Sea's margins and among drains. This movement,
13 which provides the opportunity for genetic exchange among desert pupfish, reduces the potential
14 deleterious effects of isolation of individual populations. It also provides the opportunity to recolonize
15 these same areas in the event a local population is extirpated (DWR and DFG 2007). Therefore, the SCH
16 Project design would include features to maintain connectivity among populations.

17 Desert pupfish would likely thrive at the SCH ponds, as seen at the Bureau of Reclamation/U.S.
18 Geological Survey Saline Habitat Ponds (Miles et al. 2009). The ponds that had pupfish were mostly less
19 than 1 meter deep and had salinities ranging from 12 to 70 ppt (Miles et al. 2009). Pupfish were the most
20 abundant fish in the Saline Habitat Ponds; over one million were captured when the ponds were drained
21 in late 2010 (personal communication, J. Crayon 2010).

22 *Sailfin Molly and Mosquitofish*

23 Sailfin mollies and mosquitofish are sympatric with desert pupfish in the Salton Sink. Due to their
24 presence in the Colorado River, they also occupy much of the agricultural water supply and drainage
25 systems around the Salton Sea. Like desert pupfish, they demonstrate plasticity in their diet, and tolerance
26 of high water temperature, high salinity, and low oxygen levels. They inhabit the shallow edges of water
27 bodies, usually less than 2 feet deep. As livebearers, they require no special substrate or structure for
28 reproduction.

29 Desert pupfish, sailfin mollies, and mosquitofish overlap considerably in their trophic roles where they
30 co-exist in the Salton Sink. They would provide diversity and a degree of redundancy in the SCH fish
31 community, which could buffer the effects of perturbation in a dynamic system. Birds that forage for
32 small fish would prey on all three species; however, surface gleaners and skimmers would find sailfin
33 mollies and mosquitofish more accessible, since these fishes are usually active higher in the water column
34 than are desert pupfish.

35 *Threadfin Shad*

36 Threadfin shad form schools near the surface in open water. They can live in seawater but do not
37 reproduce at that salinity. Spawning takes place in open water near floating or partially submerged objects
38 to which the fertilized eggs stick. Threadfin shad feed heavily on larger zooplankton and can greatly
39 reduce the abundance of these organisms (Moyle 2002).

40 *Filling and Stocking of SCH Ponds*

41 The SCH ponds would be stocked with fish species currently in the Salton Sea Basin and captured from
42 local drainages. The initial SCH aquatic community would be comprised of four primary types of fish:
43 tilapia, sailfin molly, mosquitofish, and desert pupfish. Unintentional invasion of other fish from the river

1 waters, such as common carp (*Cyprinus carpio*), various Centrarchid species, red shiners (*Cyprinella*
2 *lutrensis*), and threadfin shad, may also occur. All but the shad would be unable to survive in waters
3 above 20 ppt salinity.

4 Following construction, the SCH ponds would be filled with water for the first time and allowed to
5 “season” for a period of several weeks while undergoing various stages of chemical and biological
6 succession. Water chemistry would fluctuate as compounds leach from the newly wetted soils and
7 microbial communities are initiated. Once phyto- and zooplankton are established and salinity exceeds 20
8 ppt, fish could be introduced, starting with sailfin mollies and mosquitofish.

9 The first fishes introduced would likely be small species. Sailfin mollies are ubiquitous in the Salton Sea
10 and the agricultural drains surrounding it. They could be easily trapped/and or seined for stocking into
11 SCH ponds. The most productive collection of sailfin mollies would take place in the spring, when the
12 young-of-the-year would still have an approximately 1:1 sex ratio and have not yet been exhausted by the
13 energetic costs of reproduction. Mosquitofish are numerous in the agricultural drains at the Salton Sea’s
14 southern end. They also could be easily trapped and/or seined for stocking, or alternately could be
15 obtained from aquaculture or vector control agencies. Pupfish would be trapped and/or seined from
16 several natural localities and created refuges to insure a good representation of available genetic diversity.

17 Several species and strains of tilapia are present in the waters of the Salton Sea drainage, and each
18 requires a different approach for securing sufficiently large numbers of founders. Mozambique hybrid
19 tilapia are currently abundant in the Salton Sea and large numbers could easily be captured for stocking
20 into SCH ponds. However, their long-term availability is tenuous with the increasing salinity in the Sea.
21 The same fish is available from local aquacultural facilities, but may not perform as well as wild caught
22 fish, given the selection pressure on the wild population that would likely result in greater tolerance of the
23 Sea’s salinity and temperature range (Lorenzi and Schlenk, in preparation). Redbelly tilapia are abundant
24 in drains at the Sea’s northern end, particularly those filled by tilewater. These populations should persist,
25 due to the consistency of water quality in those drains, and fish would be available for seining/trapping
26 for SCH ponds in the future. Finally, tilapia resembling blue tilapia are present in the rivers, agricultural
27 drains, and Brawley Wetlands.

28 The release of tilapia into SCH ponds should only take place after phytoplankton and zooplankton are
29 established. If stocks were from freshwater habitats or held in freshwater while captive, they would be
30 first acclimated to the salinity in the ponds. This acclimation could be done under captive maintenance, or
31 by sequestering in a small part of the ponds and allowing the salinity to gradually rise to pond levels
32 before releasing fish into the larger habitat.

33 *Fish Rearing*

34 Due to ever-increasing salinity and degraded water quality in the Salton Sea, the Mozambique hybrid
35 tilapia population in the Sea may have declined seriously by the time of construction of the SCH ponds. If
36 so, extremely intense predation pressure on the fish initially stocked in the ponds may occur. A supply of
37 fish would be needed for initial stocking of the SCH ponds and possible restocking if severe fish die-offs
38 occur. It would be important to stock fish in sufficient numbers to start a sustainable population in the
39 face of predation. Securing an adequate number of fish for stocking may require producing a generation
40 in captivity from captured wild fish. Tilapia could be collected now from local sources while wild stocks
41 remain and held for captive propagation at one or more of the private licensed aquaculture facilities in the
42 area (within 15 miles of all alternative sites). Several trips (fewer than ten) by small (½ to 1 ton) trucks
43 would be required if cultured fish are to be delivered from an aquaculture facility to SCH ponds.

1 *Physical Cover*

2 Heterogeneity in physical habitat structure could be manipulated in the SCH ponds to enhance cover and
3 refugia for fish from predators and possible thermal fluctuations. Refugia from predators would be
4 necessary to allow a sustainable population of fish to persist in the face of expected heavy predation by
5 piscivorous birds, especially when fishery resources in the Salton Sea decline and disappear. Refugia or
6 cover could be provided by deeper waters or physical structural complexity. Types of cover elements
7 considered include:

8 **Swales and Channels** – Having water deeper than 3 feet in proximity to shallower areas would allow fish
9 to disperse into areas where they would be more dispersed and/or less visible due to turbidity. These
10 constructed regions of greater depth would provide this element.

11 **Submerged Aquatic Vegetation** – Vegetation could also provide cover from predators, especially for
12 small fish. Widgeon grass (*Ruppia* spp.) is expected to become established in the SCH ponds. This
13 vegetation would likely enhance food supplies by providing more microhabitat structure to support
14 invertebrate diversity and productivity. Widgeon grass establishes from seed and needs sufficient light for
15 photosynthesis to reach the pond bottom. Given the projected turbidity, it would be limited to shallow
16 areas of SCH ponds.

17 **Floating Islands** – These artificial structures could be used to provide visual cover and shading for
18 potential thermal refugia. Floating islands could be deployed in different areas, and would likely be most
19 useful in shallower areas where other cover is limited. More information would be necessary to evaluate
20 the applicability and feasibility of floating islands.

21 While many of these components would be considered part of the initial pond construction, placement
22 and size of floating islands could be manipulated to test habitat function. Monitoring of their effectiveness
23 would be a component of the adaptive management approach for the SCH design and operations.

24 **D.4 Possible Operational Scenarios**

25 Possible operational scenarios are shown in Tables D-2 to D-7. These scenarios are meant to test different
26 concepts for creating sustainable saline habitat for fish and wildlife that minimizes risks of impacts such
27 as fish die-offs, ecotoxicity from selenium, and diseases vectors. Upper and lower extremes of the
28 operational range would be tested to detect any effect of that variable on Project performance. Operational
29 values for each variable could be held constant over time or could be adjusted seasonally according to
30 expected outcomes.

31 The ranges of operational variables to be tested are as follows:

32 **Salinity** – 20-40 ppt.

33 **Storage** – Approximately 80 to 100 percent of capacity (the volume would depend on the actual
34 alternative selected and amount of ponds constructed). For example, for a constructed pond complex of
35 2,400 acres, storage could range from 6,000 to 7,200 acre-feet, assuming an average depth of 3 feet deep
36 over 2,400 acres).

37 **Residence Time** – 2 to 32 weeks. This range reflects rate of inflow and outflow.

38 **Fish Species** – Fishes considered for initial introduction into SCH ponds would include one or more
39 forms of tilapia, threadfin shad, desert pupfish, sailfin molly, and mosquitofish.

1 Several constraints and potential impacts were considered in the design of the operational scenarios:

2 **Water Quality Tolerances of Target Fish** – The fish species used in the ponds would have to survive
3 and reproduce given the expected water quality conditions, both managed (salinity) and uncontrolled (air
4 temperature, wind mixing, DO) conditions. Tilapia appear to meet many of the requirements for a
5 productive, sustainable fishery resource for piscivorous birds. For some tilapia species or strains, cold
6 tolerance (below 13°C [55°F]) is impaired at higher salinities (Lorenzi and Schlenck, in preparation).
7 Hydrological modeling suggests that water temperatures could drop below 11-13°C (52-55°F) during
8 December through February. DO concentrations could dip below tilapia minimum tolerances. Nutrient
9 concentrations are high in the New and Alamo rivers, due to contributions from agricultural runoff. Water
10 quality modeling suggests high levels of algal growth are possible, along with oxygen deprivation
11 problems that accompany hot weather algal blooms (B. Barry and M. Anderson, University of California
12 Riverside, unpublished data). Also, seasonal anoxia could be more frequent and prolonged in spring
13 (March through May) and fall (October) due to algal blooms.

14 **Relative Selenium Loading** – Selenium in river water supplying the ponds could bioaccumulate through
15 the food web from invertebrates and fish to birds (see Appendix I, Selenium Management Strategies).
16 Shorter residence time and lower salinity means greater inputs of river water, which would increase
17 overall selenium loading to the ponds.

18 **Vector Risk** – Mosquitoes that breed at the ponds could pose a potential human health risk. The
19 likelihood for mosquito vector impacts is based on (1) breeding season (March through November) and
20 (2) salinity tolerance of mosquito larvae (can survive up to 25 ppt, some reduction in populations between
21 25-28 ppt, < 28 ppt, reduced population 28-34 ppt, control 35 ppt).

22 **Emergent Vegetation Control** – The SCH ponds would be managed using elevated salinity to reduce
23 establishment of emergent vegetation, such as cattails and bulrush. Most vegetation is inhibited by 10 ppt
24 salinity, but some strains could tolerate salinities up to 35 ppt (Table D-2).

**APPENDIX D
PROJECT OPERATIONS**

1 Table D-2 Constant Salinity (20 ppt) and Constant Storage Operational Scenario

	Scenario Name	Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1a Constant Salinity (low range), Constant Storage													
Operating Variables	Salinity (ppt)	20	20	20	20	20	20	20	20	20	20	20	20
	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100%
	Residence time (weeks)	4	4	4	4	4	4	4	4	4	4	4	4
Potential Constraints and Impacts	Dissolved oxygen	Anoxia						Anoxia more common					
	Fish temperature tolerance			Potentially too cold									
	Selenium loading ¹	High relative selenium loading											
	Mosquito vector relative risk ²	High	Low mosquito risk				High mosquito risk						
1b	Residence time (weeks)	16	16	16	16	16	16	16	16	16	16	16	16
	Selenium loading ¹	Medium relative selenium loading											

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

Residence Time	Relative Selenium Loading			
	Salinity range ppt			
	10-19	20-29	30-39	40-50
4-8 weeks	Higher	High	Medium	Low
10-16 weeks	High	Medium	Low	Lower

2
3
4

1 Table D-3 Constant Salinity (35 ppt) and Constant Storage Operational Scenario

Scenario Name		Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2 Constant Salinity (high range), Constant Storage													
Operating Variables	Salinity (ppt)	35	35	35	35	35	35	35	35	35	35	35	35
	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100
	Residence time (weeks)	16	16	16	16	16	16	16	16	16	16	16	16
Potential Constraints and Impacts	Dissolved oxygen	Anoxia				Anoxia more common							
	Fish temperature tolerance					Potentially too cold							
	Selenium loading ¹	Low relative selenium loading											
	Mosquito vector relative risk ²	Low mosquito risk											

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

	Relative Selenium Loading			
	Salinity range ppt			
Residence Time	10-19	20-29	30-39	40-50
4-8 weeks	Higher	High	Medium	Low
10-16 weeks	High	Medium	Low	Lower

2

3

**APPENDIX D
PROJECT OPERATIONS**

1

2 Table D-4 Variable Salinity (20-35 ppt) and Variable Storage Operational Scenario

Scenario Name		Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
3 Operating Variables	Variable Salinity, Variable Storage												
	Salinity (ppt)	20	20	20	20	20	20	25	30	35	35	30	25
	Storage (% of capacity)	100	100	100	100	100	95	90	85	80	80	90	95
	Residence time (weeks)	8	6	4	4	6	8	10	12	16	16	12	10
Potential Constraints and Impacts	Dissolved oxygen	Anoxia						Anoxia more common					
	Fish temperature tolerance			Potentially too cold									
	Selenium loading ¹	High relative selenium loading						Medium	Low relative selenium loading				Medium
	Mosquito vector relative risk ²	High	Low mosquito risk				High	Medium		Low risk		Medium	

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

Residence Time	Relative Selenium Loading			
	Salinity range ppt			
	10-19	20-29	30-39	40-50
4-8 weeks	Higher	High	Medium	Low
10-16 weeks	High	Medium	Low	Lower

3

4

Table D-5 Variable Salinity (20-35 ppt) and Constant Storage Operational Scenario

	Scenario Name	Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
4	Variable Salinity, Constant Storage												
Operating Variables	Salinity (ppt)	20	20	20	20	20	20	25	30	35	35	30	25
	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100
	Residence time (weeks)	8	6	4	4	6	8	10	12	16	16	12	10
Potential Constraints and Impacts	Dissolved oxygen	Anoxia					Anoxia more common						
	Fish temperature tolerance	Potentially too cold											
	Selenium loading ¹	High relative selenium loading						Medium		Low relative selenium		Medium	
	Mosquito vector relative risk ²	High	Low mosquito risk				High	Medium		Low		Medium	

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

	Relative Selenium Loading			
	Salinity range ppt			
Residence Time	10-19	20-29	30-39	40-50
4-8 weeks	Higher	High	Medium	Low
10-16 weeks	High	Medium	Low	Lower

**APPENDIX D
PROJECT OPERATIONS**

Table D-6 Highly Variable Salinity (20-40 ppt) and Constant Storage Operational Scenario

Scenario Name		Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
5 Variable Salinity, Constant Storage													
Operating Variables	Salinity (ppt)	20	20	20	20	20	20	30	40	40	40	40	30
	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100
	Residence time (weeks)	12	10	8	8	10	12	16	20	20	20	20	16
Potential Constraints and Impacts	Dissolved oxygen	Anoxia						Anoxia more common					
	Fish temperature tolerance			Potentially too cold									
	Selenium loading ¹	High relative selenium loading				Medium		Low	Lower relative loading				Low
	Mosquito vector relative risk ²	High	Low mosquito risk				High	Medium	Low				Medium

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

Residence Time	Relative Selenium Loading			
	Salinity range ppt			
	10-19	20-29	30-39	40-50
4-8 weeks	Higher	High	Medium	Low
10-16 weeks	High	Medium	Low	Lower

Table D-7 Highly Variable Salinity (20-40 ppt) and Variable Storage Operational Scenario

	Scenario Name	Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
6	Variable Salinity, Variable Storage												
Operating Variables	Salinity (ppt)	20	20	20	20	20	20	30	40	40	40	40	30
	Storage (% capacity)	100	100	100	100	100	95	90	85	80	80	90	95
	Residence time (weeks)	12	10	8	8	10	12	16	20	16	20	20	16
Potential Constraints and Impacts	Dissolved oxygen	Anoxia						Anoxia more common					
	Fish temperature tolerance			Potentially too cold									
	Selenium loading ¹	High relative loading				Medium		Low	Very Low relative loading			Low	
	Mosquito vector relative risk ²	High	Low mosquito risk				High	Medium	Low			Medium	

1. Relative selenium loading –shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

	Relative Selenium Loading			
	Salinity range ppt			
Residence Time	10-19	20-29	30-39	40-50
4-8 weeks	Higher	High	Medium	Low
10-16 weeks	High	Medium	Low	Lower

1 D.5 Testing Operational Scenarios

2 Different operational scenarios would be tested in the proof-of-concept period for approximately 10 years
3 (estimated 2015–2025). Two or more operational scenarios would be implemented simultaneously in
4 separate ponds, and outcomes monitored to test performance in meeting objectives and minimizing
5 impacts. Key indicators of important physical, water quality, and biological attributes would be
6 monitored.

7 Certain indicators of flow and water quality would be frequently monitored to guide daily or weekly pond
8 operations. These operational triggers include pumping or inflow rates of river water and saline water,
9 outflow rates, and salinity of water at inflow and in ponds.

10 Indicators of Project performance would be identified based on the SCH objectives. Thresholds or desired
11 conditions for each indicator would be defined, and progress toward meeting those objectives measured
12 according to the Monitoring and Adaptive Management Framework (Appendix E). For example,
13 measuring abundance and community composition of fishes in different ponds would be an indicator of
14 SCH Project effectiveness at providing foraging habitat for piscivorous birds (Objective 1) and creating
15 sustainable aquatic habitat (Objective 3).

16 D.6 Maintenance Activities

17 SCH Project implementation would also include standard maintenance that would not be varied
18 experimentally. These types of operations would include:

- 19 • Sedimentation basin operations;
- 20 • Infrastructure maintenance;
- 21 • Erosion control structure maintenance;
- 22 • Vegetation control; and
- 23 • Vector control (see Appendix F, Mosquito Control Plan).

24 D.6.1 Sedimentation Basin Operations

25 There would be two sedimentation basins. Operation and maintenance would occur throughout the year
26 and at the end of the year. One basin would be operated at any given time, storing water and settling
27 sediment. The other basin would be drained of water, the sediment dried, and sediment excavated down to
28 original design elevation. Excavated sediment would be used on the Project to maintain berms, offset
29 settling of berms, and create additional habitat islands if necessary.

30 D.6.2 Infrastructure Maintenance

31 Monitoring of physical structures would be conducted on a regular basis to check condition, and and
32 maintenance or repairs implemented on an ongoing basis as needed. Project infrastructure for the water
33 supply includes pumps, pump facilities and pipelines and inlet structures. Infrastructure for the water
34 control structures includes culverts, gates, and weirs between ponds and from the ponds to the Salton Sea.

35 D.6.3 Erosion Control

36 Berm structure, riprap, and roadways on the crown would be checked periodically for seepage, cracking,
37 erosion, and extensive burrowing by animals. Areas that would potentially receive more wave action due

1 to extended wind fetch would receive closer scrutiny. Typical maintenance activities could include adding
2 riprap, filling cracks or eroded areas, or spreading gravel on the roadway.

3 D.6.4 Vegetation Control

4 Unwanted vegetation at SCH infrastructure could include cattails, tules and salt cedar. Measures would be
5 implemented to control vegetation on berms that could compromise structural integrity. Vegetation would
6 also be removed from the sedimentation basin, interception ditch, and around the river pump station to
7 maintain storage and flow capacity. Best management practices for vegetation control would be
8 implemented as appropriate, including but not limited to physical removal and chemical control
9 appropriate near waterways.

10 D.7 Emergency Operations

11 Under certain circumstances, it may be necessary to enact rapid response operations in response to a
12 sudden threat or emergency, such as:

- 13 • Avian disease outbreak;
- 14 • Rapid drawdown of ponds for emergency actions; and
- 15 • Mosquito-borne diseases (see Appendix F, Mosquito Control Plan).

16 D.7.1 Avian Disease Outbreak

17 Birds would be monitored regularly for signs of disease outbreaks, and monitoring would be intensified if
18 signs of disease are present. Dead and dying birds would be collected to disrupt cycles of infectious
19 diseases. Potentially infectious carcasses would be incinerated at the Sonny Bono Refuge. For diseases
20 that can be treated, such as the early stages of botulism, sick birds would be collected for rehabilitation
21 and release, as is currently done on the Salton Sea.

22 D.7.2 Pond Drawdown

23 Under certain conditions it may become necessary to rapidly reduce water elevations a pond, such as
24 emergency repair of water control structures or berms, sudden change in pond water quality, or noxious
25 species control. The drawdown would involve raising the flashboards on the outlet control structure(s) to
26 release water to the Sea. Draining of the ponds could occur as a result of a breach in one or more berms,
27 but complete draining would not be utilized as a typical pond management action. Under certain
28 emergency conditions, such as a pesticide spill in the SCH source waters, or to eradicate a noxious
29 aquatic invader, SCH ponds could be deliberately drained. In such an event, low areas of the ponds'
30 would retain water and act as temporary refugia for fish by design, by allowing either the salvage of the
31 remaining fish or leaving fish in place as recruitment stocks for re-establishing fish populations.

32 D.8 References

33 Barry, B., and M. Anderson. University of California Riverside, unpublished data.

34 Black, G.F. 1980. Status of the desert pupfish *Cyprinodon macularius* (Baird and Girard), in California.
35 Inland Fisheries Endangered Species Program, Special Publication 80-1. California
36 Department of Fish and Game.

37 California Department of Fish and Game (DFG). 2011. Fish matrix: An analytical tool for selecting an
38 aquatic community for proposed Species Conservation Habitat. Memorandum, dated April
39 22.

APPENDIX D
PROJECT OPERATIONS

- 1 California Department of Water Resources (DWR) and California Department of Fish and Game (DFG).
2 2007. Salton Sea Ecosystem Restoration Program Final Programmatic Environmental Impact
3 Report.
- 4 Carveth, C.J., A.M. Widmar, and S.A. Bonar. 2006. Comparison of upper thermal tolerances of native
5 and nonnative fish species in Arizona. Transactions of the American Fisheries Society
6 135(6):1433-1440.
- 7 Glenn, E., T.L. Thompson, R. Frye, J. Riley, and D. Baumgartner. 1995. Effects of salinity on growth and
8 evapotranspiration of *Typha domingensis*. Environmental Research Laboratory, Tucson, AZ.
9 Accepted May 16, 1995; Available online March 29, 2000.
- 10 International Lake Environment Committee. 1998. Biological features. In Management of Inland Saline
11 Waters, Vol. 6, Chapter 3, p. 27. Available online at:
12 http://www.ilec.or.jp/eg/pubs/guideline/chapter/Vol.6_chapter/Vol.6_Chapter3.pdf.
- 13 Lorenzi, V. and D. Schlenk. In preparation. Draft report for Task Order #5 - Fish Tolerance. University of
14 California Riverside.
- 15 Louisiana Coastal Wetlands Conservation and Restoration Task Force. 2002. Vegetative plantings, west
16 Hackberry demonstration (CS-19). October. Available online at:
17 <http://lacoast.gov/reports/gpfs/CS-19.pdf>.
- 18 Martin, B.A., and M.K. Saiki. 2005. Relation of desert pupfish abundance to selected environmental
19 variables in natural and manmade habitats in the Salton Sea Basin. Environmental Biology of
20 Fishes 73(1):97-107.
- 21 Miles A.K., M.A. Ricca, A. Meckstroth, and S.E. Spring. 2009. Salton Sea ecosystem monitoring project.
22 U.S. Geological Survey Open File Report 2009-1976.
- 23 Moyle, P.B. 2002. Inland fishes of California. Berkeley and Los Angeles: University of California Press.
- 24 Popma, T., and M. Masser. 1999. Tilapia life history and biology. Southern Regional Aquaculture Center
25 Publication SRAC-283. March. Website
26 (<http://aqua.ucdavis.edu/DatabaseRoot/pdf/283FS.PDF>) accessed March 29, 2011.
- 27 Rakocy, J.E., and A.S. McGinty. 1989. Pond culture of tilapia. Southern Regional Aquaculture Center
28 Publication SRAC-280. Website (<http://aqua.ucdavis.edu/DatabaseRoot/pdf/280FS.PDF>)
29 accessed March 29, 2011.
- 30 Reed, S.C., R.W. Crites, and E J. Middlebrooks. 1995. Natural Systems for Waste Management and
31 Treatment. Second Edition. New York: McGraw-Hill Inc.
- 32 Sardella, B.A., V. Matey, J. Cooper, R.J. Gonzalez, and C.J. Brauner. 2004a. Physiological, biochemical,
33 and morphological indicators of osmoregulatory stress in 'California' Mozambique tilapia
34 (*Oreochromis mossambicus* x *O. urolepis hornorum*) exposed to hypersaline water. The
35 Journal of Experimental Biology, 207:1399-1413.
- 36 Sardella, B.A., J. Cooper, R.J. Gonzalez, and C.J. Brauner. 2004b. The effect of temperature on juvenile
37 Mozambique tilapia hybrids (*Oreochromis mossambicus* x *O. urolepis hornorum*) exposed to

1 full-strength and hypersaline seawater. Comparative Biochemistry and Physiology, Part
2 A(137):621–629.

3 Schoenherr, A.A. 1990. A comparison of two populations of the endangered pupfish (*Cyprindon*
4 *macularius*). Second annual report. California Department of Fish and Game.

5 Snyder, S.A. 1991. *Bolboschoenus robustus*. In Fire Effects Information System. U.S. Department of
6 Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory
7 (Producer). Website
8 (<http://www.fs.fed.us/database/feis/plants/graminoid/bolrob/introductory.html>) accessed
9 October 29, 2010.

10 Stutzenbaker, C.D. 1999. Aquatic and Wetland Plants of the Western Gulf Coast. Austin: Texas Parks
11 and Wildlife Press. Pp. 115, 123-125, 333-337.

12 Uchytel, R.J. 1992. *Schoenoplectus americanus*. In Fire Effects Information System. U.S. Department of
13 Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory
14 (Producer). Website
15 (<http://www.fs.fed.us/database/feis/plants/graminoid/schame/introductory.html>) October 29,
16 2010.

17 D.9 Personal Communications

18 Crayon, Jack. 2011. California Department of Fish and Game, personal communication with Ramona
19 Swenson, Cardno ENTRIX, on May 17.

20 Fitzsimmons, Kevin. 2010. University of Arizona. Personal communication with Ramona Swenson,
21 Cardno ENTRIX, July 28.

22

Air Quality/Greenhouse Gas Emissions Calculations

G-1 & G-2 Emissions Summary

Table G-1 Estimated Construction Energy Consumption for Proposed Project (mitigated)						
Onroad Vehicle Type	Project Alternative					
	1	2	3	4	5	6
	gallons	gallons	gallons	gallons	gallons	gallons
California Ultra-Low Sulfur Diesel Fuel	562,000	465,000	644,000	329,000	296,000	384,000
Source: EPA 1996						
Note: Values shown rounded to nearest 1,000 gallons						

Table G-2 Estimated Construction Trip Counts for Proposed Project (mitigated)						
Onroad Vehicle Type	Project Alternative					
	1	2	3	4	5	6
	trips	trips	trips	trips	trips	trips
Tractor Trailer (heavy heavy duty) - Local	6,450	5,520	7,920	2,100	2,000	2,160
Tractor Trailer (heavy heavy duty) - Import	190	130	150	160	100	130
Water Truck (medium duty)	470	470	470	470	470	470
Pickup/SUV (light duty)	6,540	5,340	7,740	4,140	3,740	4,940
Source: Applicant						
Notes: For Tractor Trailer, local is construction-related trips For Tractor Trailer, import is bringing in equipment from other areas in state (SD, LA, SF, SAC) Applicant real number data converted to up-rounded integer values to avoid undercounts Trip count values shown rounded to nearest 10 to reflect approximate nature of estimates						

G-3 Schedule

Table G-3 Estimated Equipment and Vehicle Schedule for Proposed Project Alternatives													
Phase or Activity	Equipment and Vehicles			Two-Year Construction Schedule					Annual Maintenance Schedule				
	Type	Category	BHP	quantity	days	hrs/day	trips/day	mi/trip	quantity	days/yr	hrs/day	trips/day	mi/trip
ALTERNATIVE 1 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		50	43		3	50	1	37		2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		17	11		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	3	325	8			1	28	8		
Low ground pressure haulers	Dump Truck	offroad	300	12	261	8			1	18	8		
Tracked excavator	Excavator	offroad	200	3	375	8			1	35	8		
Low ground pressure dozer	Dozer	offroad	125	2	233	8			1	5	8		
Small motor grader	Grader	offroad	140	1	25	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	3	265	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	20	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	24	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		3	470		0.33	65					
Equipment Operator	Pickup/SUV	onroad LD		36	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 2 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		40	46		3	50	1	34	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		11	12		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	3	264	8			1	27	8		
Low ground pressure haulers	Dump Truck	offroad	300	10	265	8			1	19	8		
Tracked excavator	Excavator	offroad	200	3	291	8			1	38	8		
Low ground pressure dozer	Dozer	offroad	125	2	163	8			1	6	8		
Small motor grader	Grader	offroad	140	1	28	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	2	269	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	235	8			1	11	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		27	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 3 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		60	44		3	50	1	45	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		14	11		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	4	265	8			1	28	8		
Low ground pressure haulers	Dump Truck	offroad	300	14	267	8			1	19	8		
Tracked excavator	Excavator	offroad	200	4	291	8			1	44	8		
Low ground pressure dozer	Dozer	offroad	125	3	146	8			1	6	8		
Small motor grader	Grader	offroad	140	1	34	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	4	264	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	28	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		3	470		0.33	65					
Equipment Operator	Pickup/SUV	onroad LD		45	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					

G-3 Schedule

ALTERNATIVE 4 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		20	35		3	50	1	20	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		18	9		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	2	307	8			1	26	8		
Low ground pressure haulers	Dump Truck	offroad	300	7	260	8			1	18	8		
Tracked excavator	Excavator	offroad	200	2	309	8			1	26	8		
Low ground pressure dozer	Dozer	offroad	125	2	156	8			1	5	8		
Small motor grader	Grader	offroad	140	1	14	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	1	296	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	6	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		18	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 5 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		18	37		3	50	1	20	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		10	10		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	2	258	8			1	26	8		
Low ground pressure haulers	Dump Truck	offroad	300	7	250	8			1	18	8		
Tracked excavator	Excavator	offroad	200	2	220	8			1	27	8		
Low ground pressure dozer	Dozer	offroad	125	2	102	8			1	5	8		
Small motor grader	Grader	offroad	140	1	19	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	1	253	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	7	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		15	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 6 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		24	30		3	50	1	26	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		16	8		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	3	222	8			1	27	8		
Low ground pressure haulers	Dump Truck	offroad	300	10	239	8			1	18	8		
Tracked excavator	Excavator	offroad	200	2	284	8			1	29	8		
Low ground pressure dozer	Dozer	offroad	125	2	133	8			1	5	8		
Small motor grader	Grader	offroad	140	1	22	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	2	249	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	13	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		24	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
Source: Applicant													
<u>Notes:</u>													
LD = light duty, MD = medium duty, HHD = heavy heavy duty, BHP = brake horsepower													
Overall project life expected to be 2 years, 47 weeks/year average to account for holidays, vacations, weather, illness, etc.													
For 235 work days in a year, managers and foremen commute 2 or 3 per vehicle, all other workers commute 3 per vehicle, 65 miles per round trip average (New River or Alamo River).													
Short Trip: Hauling gravel and riprap rock into the project site from nearby quarries; assume 50 miles per round trip.													
Long Trip: Hauling construction equipment and facility materials to the project site from major distribution centers, such as San Diego; assume 280 miles round trip.													
Daily equipment operating hours assume typical average utilization over the life of the project to allow for staging, breaks, lunch, maintenance, repairs, etc.													

G-4 Activity

Table G-4 Estimated Equipment and Vehicle Activity for Proposed Project Alternatives													
Phase or Activity	Equipment and Vehicles			Const. Daily		Const. Total		Maint. Daily		Maint. Total		Total Trip Counts	
	Type	Category	BHP	hrs	VMT	hrs	VMT	hrs	VMT	hrs	VMT	Const.	Maint.
ALTERNATIVE 1 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			7,500		322,500		100		3,700	6,450	74
Import equipment from other areas	Tractor Trailer	onroad HHD			4,760		52,360		-		-	187	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	24		7,800		8		224			
Low ground pressure haulers	Dump Truck	offroad	300	96		25,056		8		144			
Tracked excavator	Excavator	offroad	200	24		9,000		8		280			
Low ground pressure dozer	Dozer	offroad	125	16		3,728		8		40			
Small motor grader	Grader	offroad	140	8		200		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	24		6,360		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		160		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		192			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			780		312,000		65		15,275	4,800	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 2 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			6,000		276,000		100		3,400	5,520	68
Import equipment from other areas	Tractor Trailer	onroad HHD			3,080		36,960		-		-	132	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	24		6,336		8		216			
Low ground pressure haulers	Dump Truck	offroad	300	80		21,200		8		152			
Tracked excavator	Excavator	offroad	200	24		6,984		8		304			
Low ground pressure dozer	Dozer	offroad	125	16		2,608		8		48			
Small motor grader	Grader	offroad	140	8		224		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	16		4,304		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,880		8		88			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			585		234,000		65		15,275	3,600	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-

G-4 Activity

ALTERNATIVE 3 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			9,000		396,000	72	100		4,500	7,920	72
Import equipment from other areas	Tractor Trailer	onroad HHD			3,920		43,120		-		-	154	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	32		8,480		8		224			
Low ground pressure haulers	Dump Truck	offroad	300	112		29,904		8		152			
Tracked excavator	Excavator	offroad	200	32		9,312		8		352			
Low ground pressure dozer	Dozer	offroad	125	24		3,504		8		48			
Small motor grader	Grader	offroad	140	8		272		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	32		8,448		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		224			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			975		390,000		65		15,275	6,000	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 4 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			3,000		105,000		100		2,000	2,100	40
Import equipment from other areas	Tractor Trailer	onroad HHD			5,040		45,360		-		-	162	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	16		4,912		8		208			
Low ground pressure haulers	Dump Truck	offroad	300	56		14,560		8		144			
Tracked excavator	Excavator	offroad	200	16		4,944		8		208			
Low ground pressure dozer	Dozer	offroad	125	16		2,496		8		40			
Small motor grader	Grader	offroad	140	8		112		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	8		2,368		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		48			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			390		156,000		65		15,275	2,400	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-

G-4 Activity

ALTERNATIVE 5 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HDD			2,700		99,900	98	100		2,000	1,998	98
Import equipment from other areas	Tractor Trailer	onroad HDD			2,800		28,000		-		-	100	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	16		4,128		8		208			
Low ground pressure haulers	Dump Truck	offroad	300	56		14,000		8		144			
Tracked excavator	Excavator	offroad	200	16		3,520		8		216			
Low ground pressure dozer	Dozer	offroad	125	16		1,632		8		40			
Small motor grader	Grader	offroad	140	8		152		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	8		2,024		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		56			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HDD			10		4,700		10		250	470	10
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	64
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			325		130,000		65		15,275	2,000	64
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 6 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HDD			3,600		108,000	98	100		2,600	2,160	98
Import equipment from other areas	Tractor Trailer	onroad HDD			4,480		35,840		-		-	128	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	24		5,328		8		216			
Low ground pressure haulers	Dump Truck	offroad	300	80		19,120		8		144			
Tracked excavator	Excavator	offroad	200	16		4,544		8		232			
Low ground pressure dozer	Dozer	offroad	125	16		2,128		8		40			
Small motor grader	Grader	offroad	140	8		176		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	16		3,984		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		104			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HDD			10		4,700		10		250	470	10
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	64
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			520		208,000		65		15,275	3,200	64
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-

G-4 Activity

Trip Count Totals					
ALTERNATIVE 1	Tractor Trailer (loc)	onroad HHD		6,450	74
	Tractor Trailer (imp)	onroad HHD		187	-
	Water Truck	onroad HHD		470	25
	Pickup/SUV	onroad LD		6,540	470
ALTERNATIVE 2	Tractor Trailer (loc)	onroad HHD		5,520	68
	Tractor Trailer (imp)	onroad HHD		132	-
	Water Truck	onroad HHD		470	25
	Pickup/SUV	onroad LD		5,340	470
ALTERNATIVE 3	Tractor Trailer (loc)	onroad HHD		7,920	72
	Tractor Trailer (imp)	onroad HHD		154	-
	Water Truck	onroad HHD		470	25
	Pickup/SUV	onroad LD		7,740	470
ALTERNATIVE 4	Tractor Trailer (loc)	onroad HHD		2,100	40
	Tractor Trailer (imp)	onroad HHD		162	-
	Water Truck	onroad HHD		470	25
	Pickup/SUV	onroad LD		4,140	470
ALTERNATIVE 5	Tractor Trailer (loc)	onroad HHD		1,998	98
	Tractor Trailer (imp)	onroad HHD		100	-
	Water Truck	onroad HHD		470	10
	Pickup/SUV	onroad LD		3,740	128
ALTERNATIVE 6	Tractor Trailer (loc)	onroad HHD		2,160	98
	Tractor Trailer (imp)	onroad HHD		128	-
	Water Truck	onroad HHD		470	10
	Pickup/SUV	onroad LD		4,940	128

Source: Applicant

Notes:

LD = light duty, MD = medium duty, HHD = heavy heavy duty, BHP = brake horsepower

Overall project life expected to be 2 years, 47 weeks/year average to account for holidays, vacations, weather, illness, etc.

For 235 work days in a year, managers and foremen commute 2 or 3 per vehicle, all other workers commute 3 per vehicle, 65 miles per round trip average (New River or Alamo River).

Short Trip: Hauling gravel and riprap rock into the project site from nearby quarries; assume 50 miles per round trip.

Long Trip: Hauling construction equipment and facility materials to the project site from major distribution centers, such as San Diego; assume 280 miles round trip.

Daily equipment operating hours assume typical average utilization over the life of the project to allow for staging, breaks, lunch, maintenance, repairs, etc.

G-5 Factors

Table G-5 Emission Factors for Proposed Project Alternatives

Phase or Activity	Equipment and Vehicles			VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	BHP	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit
ALTERNATIVE 1													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 2													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 3													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 4													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070

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G-5 Factors

ALTERNATIVE 5													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 6													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070

Sources: SCAQMD 2008, EPA 2010

Notes:

- SCAQMD emission factors for 2013
- Offroad diesel exhaust PM_{2.5} = 92% of PM₁₀ per EMFAC 2007 version 2.3
- Offroad N₂O per Annex 3, Table A-101
- Non-matching application-specific values interpolated or extrapolated
- EPA GWPs for CO₂ eqv (1, 21, 310)

G-6 Daily

Table G-6 Daily Emissions for Proposed Project Alternatives

Phase or Activity	Equipment and Vehicles		Maximum Daily		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		7,500	16.97	69.88	205.72	0.31	10.03	8.60	31,614	0.78	0.74	31,859
Import equipment from other areas	Tractor Trailer	onroad HHD		4,760	10.77	44.35	130.56	0.19	6.36	5.46	20,064	0.50	0.47	20,220
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	24		6.75	23.60	60.40	0.07	2.34	2.15	6,639	0.61	0.27	6,736
Low ground pressure haulers	Dump Truck	offroad	96		14.92	41.68	129.33	0.20	4.38	4.03	18,019	1.35	0.60	18,233
Tracked excavator	Excavator	offroad	24		2.93	13.50	23.38	0.03	1.12	1.03	3,065	0.26	0.12	3,107
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	24		3.72	12.70	34.15	0.04	1.24	1.14	4,322	0.34	0.15	4,376
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		780	0.58	5.53	0.56	0.01	0.07	0.05	859	0.05	0.02	866
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 2														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		6,000	13.58	55.91	164.58	0.25	8.02	6.88	25,291	0.63	0.59	25,487
Import equipment from other areas	Tractor Trailer	onroad HHD		3,080	6.97	28.70	84.48	0.13	4.12	3.53	12,983	0.32	0.30	13,083
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	24		6.75	23.60	60.40	0.07	2.34	2.15	6,639	0.61	0.27	6,736
Low ground pressure haulers	Dump Truck	offroad	80		12.43	34.73	107.77	0.16	3.65	3.36	15,016	1.12	0.50	15,194
Tracked excavator	Excavator	offroad	24		2.93	13.50	23.38	0.03	1.12	1.03	3,065	0.26	0.12	3,107
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	16		2.48	8.47	22.77	0.03	0.83	0.76	2,882	0.22	0.10	2,917
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		585	0.44	4.15	0.42	0.01	0.05	0.03	644	0.04	0.02	650
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 3														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		9,000	20.37	83.86	246.86	0.37	12.03	10.32	37,937	0.94	0.88	38,231
Import equipment from other areas	Tractor Trailer	onroad HHD		3,920	8.87	36.53	107.52	0.16	5.24	4.49	16,524	0.41	0.39	16,652
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	32		9.00	31.46	80.53	0.09	3.12	2.87	8,853	0.81	0.36	8,982
Low ground pressure haulers	Dump Truck	offroad	112		17.40	48.63	150.88	0.23	5.11	4.70	21,023	1.57	0.70	21,272
Tracked excavator	Excavator	offroad	32		3.90	18.00	31.17	0.05	1.49	1.37	4,087	0.35	0.16	4,143
Low ground pressure dozer	Dozer	offroad	24		3.19	12.22	19.50	0.02	1.63	1.50	1,700	0.29	0.13	1,746
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	32		4.96	16.93	45.54	0.06	1.66	1.53	5,763	0.45	0.20	5,834
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		975	0.73	6.91	0.69	0.01	0.09	0.06	1,073	0.07	0.03	1,083
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 4														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,000	6.79	27.95	82.29	0.12	4.01	3.44	12,646	0.31	0.29	12,744
Import equipment from other areas	Tractor Trailer	onroad HHD		5,040	11.41	46.96	138.24	0.21	6.74	5.78	21,245	0.53	0.50	21,409
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	16		4.50	15.73	40.26	0.05	1.56	1.44	4,426	0.41	0.18	4,491
Low ground pressure haulers	Dump Truck	offroad	56		8.70	24.31	75.44	0.11	2.56	2.35	10,511	0.79	0.35	10,636
Tracked excavator	Excavator	offroad	16		1.95	9.00	15.59	0.02	0.74	0.69	2,043	0.18	0.08	2,071
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	8		1.24	4.23	11.38	0.01	0.41	0.38	1,441	0.11	0.05	1,459
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		390	0.29	2.77	0.28	0.00	0.04	0.02	429	0.03	0.01	433
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144

G-6 Daily

ALTERNATIVE 5														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,700	6.11	25.16	74.06	0.11	3.61	3.09	11,381	0.28	0.27	11,469
Import equipment from other areas	Tractor Trailer	onroad HHD		2,800	6.34	26.09	76.80	0.11	3.74	3.21	11,803	0.29	0.28	11,894
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	16		4.50	15.73	40.26	0.05	1.56	1.44	4,426	0.41	0.18	4,491
Low ground pressure haulers	Dump Truck	offroad	56		8.70	24.31	75.44	0.11	2.56	2.35	10,511	0.79	0.35	10,636
Tracked excavator	Excavator	offroad	16		1.95	9.00	15.59	0.02	0.74	0.69	2,043	0.18	0.08	2,071
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	8		1.24	4.23	11.38	0.01	0.41	0.38	1,441	0.11	0.05	1,459
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD	10		0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD	325		0.24	2.30	0.23	0.00	0.03	0.02	358	0.02	0.01	361
Laborers	Pickup/SUV	onroad LD	130		0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,600	8.15	33.54	98.75	0.15	4.81	4.13	15,175	0.38	0.35	15,292
Import equipment from other areas	Tractor Trailer	onroad HHD		4,480	10.14	41.74	122.88	0.18	5.99	5.14	18,884	0.47	0.44	19,030
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	24		6.75	23.60	60.40	0.07	2.34	2.15	6,639	0.61	0.27	6,736
Low ground pressure haulers	Dump Truck	offroad	80		12.43	34.73	107.77	0.16	3.65	3.36	15,016	1.12	0.50	15,194
Tracked excavator	Excavator	offroad	16		1.95	9.00	15.59	0.02	0.74	0.69	2,043	0.18	0.08	2,071
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	16		2.48	8.47	22.77	0.03	0.83	0.76	2,882	0.22	0.10	2,917
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD	10		0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD	520		0.39	3.69	0.37	0.01	0.05	0.03	572	0.03	0.01	578
Laborers	Pickup/SUV	onroad LD	130		0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
Maximum Daily Construction Emissions														
	ALTERNATIVE 1, LBS			17.8	77.4	206.7	0.3	10.1	8.7	32,801	1.4	0.8	33,056	
	ALTERNATIVE 2, LBS			14.2	62.0	165.5	0.3	8.1	6.9	26,264	1.2	0.6	26,468	
	ALTERNATIVE 3, LBS			21.3	92.7	248.0	0.4	12.2	10.4	39,338	1.7	0.9	39,645	
	ALTERNATIVE 4, LBS			11.0	38.3	120.9	0.1	4.1	3.5	13,403	1.0	0.4	13,508	
	ALTERNATIVE 5, LBS			11.0	37.8	120.8	0.1	3.7	3.4	12,067	1.0	0.4	12,161	
	ALTERNATIVE 6, LBS			13.0	40.4	121.0	0.2	4.9	4.2	16,076	1.2	0.5	16,201	

Sources: SCAQMD 2008, EPA 2010

Notes:

SCAQMD emission factors for 2013

Offroad diesel exhaust PM_{2.5} = 92% of PM₁₀ per EMFAC 2007 version 2.3

Offroad N₂O per Annex 3, Table A-101

Non-matching application-specific values interpolated or extrapolated

EPA GWPs for CO₂ eqv (1, 21, 310)

Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)

G-7 Total

Table G-7. Total Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and Vehicles		Project Total		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		322,500	730	3,005	8,846	13	431	370	1,359,397	34	32	1,369,929
Import equipment from other areas	Tractor Trailer	onroad HHD		52,360	118	488	1,436	2	70	60	220,707	5	5	222,417
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	7,800		2,194	7,668	19,629	22	761	700	2,157,833	198	88	2,189,265
Low ground pressure haulers	Dump Truck	offroad	25,056		3,893	10,879	33,754	51	1,144	1,053	4,703,089	351	156	4,758,860
Tracked excavator	Excavator	offroad	9,000		1,098	5,063	8,767	13	419	386	1,149,378	99	44	1,165,102
Low ground pressure dozer	Dozer	offroad	3,728		495	1,899	3,030	3	254	233	264,110	45	20	271,201
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	6,360		986	3,366	9,051	11	330	303	1,145,444	89	40	1,159,575
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	1,018,478	86	38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	160		20	62	187	0	7	6	22,294	2	1	22,579
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		312,000	233	2,213	222	3	28	18	343,473	21	8	346,539
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 2														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		276,000	625	2,572	7,571	11	369	316	1,163,391	29	27	1,172,405
Import equipment from other areas	Tractor Trailer	onroad HHD		36,960	84	344	1,014	2	49	42	155,793	4	4	157,000
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	6,336		1,782	6,229	15,945	18	618	569	1,752,824	161	71	1,778,356
Low ground pressure haulers	Dump Truck	offroad	21,200		3,294	9,204	28,560	43	968	891	3,979,306	297	132	4,026,494
Tracked excavator	Excavator	offroad	6,984		852	3,929	6,803	10	325	299	891,917	77	34	904,119
Low ground pressure dozer	Dozer	offroad	2,608		346	1,328	2,119	2	177	163	184,763	31	14	189,724
Small motor grader	Grader	offroad	224		30	136	201	0	15	14	20,780	3	1	21,207
Barge with crane and clamshell bucket	Crane	offroad	4,304		667	2,278	6,125	8	223	205	775,156	60	27	784,719
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	1,018,478	86	38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,880		141	646	768	1	64	59	85,764	13	6	87,787
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		234,000	174	1,660	167	3	21	14	257,605	16	6	259,904
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757

G-7 Total

Table G-7. Total Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and Vehicles		Project Total		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 3														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		396,000	896	3,690	10,862	16	529	454	1,669,213	41	39	1,682,146
Import equipment from other areas	Tractor Trailer	onroad HHD		43,120	98	402	1,183	2	58	49	181,759	5	4	183,167
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8,480		2,385	8,337	21,340	24	827	761	2,345,952	215	96	2,380,124
Low ground pressure haulers	Dump Truck	offroad	29,904		4,646	12,983	40,285	61	1,365	1,256	5,613,073	419	186	5,679,635
Tracked excavator	Excavator	offroad	9,312		1,136	5,239	9,071	13	434	399	1,189,223	102	46	1,205,492
Low ground pressure dozer	Dozer	offroad	3,504		465	1,785	2,848	3	238	219	248,240	42	19	254,906
Small motor grader	Grader	offroad	272		36	165	244	0	18	17	25,233	3	1	25,751
Barge with crane and clamshell bucket	Crane	offroad	8,448		1,310	4,471	12,022	15	438	403	1,521,496	118	53	1,540,265
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	1,018,478	86	38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		390,000	291	2,766	278	4	35	23	429,341	26	11	433,174
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 4														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		105,000	238	978	2,880	4	140	120	442,594	11	10	446,024
Import equipment from other areas	Tractor Trailer	onroad HHD		45,360	103	423	1,244	2	61	52	191,201	5	4	192,682
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	4,912		1,382	4,829	12,361	14	479	441	1,358,882	125	55	1,378,675
Low ground pressure haulers	Dump Truck	offroad	14,560		2,262	6,321	19,614	30	665	612	2,732,957	204	91	2,765,365
Tracked excavator	Excavator	offroad	4,944		603	2,782	4,816	7	230	212	631,392	54	24	640,029
Low ground pressure dozer	Dozer	offroad	2,496		331	1,271	2,028	2	170	156	176,829	30	13	181,577
Small motor grader	Grader	offroad	112		15	68	101	0	7	7	10,390	1	1	10,604
Barge with crane and clamshell bucket	Crane	offroad	2,368		367	1,253	3,370	4	123	113	426,480	33	15	431,741
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	1,018,478	86	38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		156,000	116	1,106	111	2	14	9	171,736	10	4	173,270
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757

G-7 Total

Table G-7. Total Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and Vehicles		Project Total		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 5														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		99,900	226	931	2,740	4	134	115	421,097	10	10	424,360
Import equipment from other areas	Tractor Trailer	onroad HHD		28,000	63	261	768	1	37	32	118,025	3	3	118,940
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	4,128		1,161	4,058	10,388	12	403	371	1,141,992	105	47	1,158,626
Low ground pressure haulers	Dump Truck	offroad	14,000		2,175	6,078	18,860	28	639	588	2,627,843	196	87	2,659,005
Tracked excavator	Excavator	offroad	3,520		429	1,980	3,429	5	164	151	449,534	39	17	455,684
Low ground pressure dozer	Dozer	offroad	1,632		217	831	1,326	1	111	102	115,619	20	9	118,723
Small motor grader	Grader	offroad	152		20	92	137	0	10	9	14,101	2	1	14,391
Barge with crane and clamshell bucket	Crane	offroad	2,024		314	1,071	2,880	4	105	97	364,525	28	13	369,022
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	1,018,478	86	38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		130,000	97	922	93	1	12	8	143,114	9	4	144,391
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		108,000	244	1,006	2,962	4	144	124	455,240	11	11	458,767
Import equipment from other areas	Tractor Trailer	onroad HHD		35,840	81	334	983	1	48	41	151,072	4	4	152,243
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	5,328		1,499	5,238	13,408	15	520	478	1,473,966	135	60	1,495,436
Low ground pressure haulers	Dump Truck	offroad	19,120		2,971	8,301	25,757	39	873	803	3,588,883	268	119	3,631,441
Tracked excavator	Excavator	offroad	4,544		554	2,556	4,426	7	212	195	580,308	50	22	588,247
Low ground pressure dozer	Dozer	offroad	2,128		283	1,084	1,729	2	145	133	150,758	25	11	154,806
Small motor grader	Grader	offroad	176		23	106	158	0	12	11	16,327	2	1	16,663
Barge with crane and clamshell bucket	Crane	offroad	3,984		618	2,108	5,669	7	207	190	717,524	56	25	726,375
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	1,018,478	86	38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		208,000	155	1,475	148	2	19	12	228,982	14	6	231,026
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757

G-7 Total

Table G-7 Total Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and Vehicles		Project Total		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Total Construction Emissions														
ALTERNATIVE 1, TONS					5.5	19.6	48.4	0.07	1.9	1.8	6,310	0.5	0.2	6,388
ALTERNATIVE 2, TONS					4.5	16.1	40.3	0.05	1.6	1.4	5,227	0.4	0.2	5,292
ALTERNATIVE 3, TONS					6.2	22.2	55.1	0.08	2.2	2.0	7,241	0.5	0.3	7,330
ALTERNATIVE 4, TONS					3.3	11.8	29.3	0.04	1.1	1.0	3,701	0.3	0.1	3,748
ALTERNATIVE 5, TONS					2.9	10.4	26.3	0.03	1.0	0.9	3,328	0.3	0.1	3,370
ALTERNATIVE 6, TONS					3.8	13.4	33.6	0.05	1.3	1.2	4,311	0.3	0.2	4,366
Sources: SCAQMD 2008, EPA 2010														

Notes:

SCAQMD emission factors for 2013

Offroad diesel exhaust PM_{2.5} = 92% of PM₁₀ per EMFAC 2007 version 2.3

Offroad N₂O per Annex 3, Table A-101

Non-matching application-specific values interpolated or extrapolated

EPA GWPs for CO₂ eqv (1, 21, 310)

G-8 Daily Maintenance

Table G-8 Daily Maintenance Emissions for Proposed Project Alternatives

Phase or Activity	Equipment and Vehicles		Daily Maint,		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		100	0.23	0.93	2.74	0.00	0.13	0.11	422	0.01	0.01	425
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 2														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		100	0.23	0.93	2.74	0.00	0.13	0.11	422	0.01	0.01	425
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Table G-8 Daily Maintenance Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and Vehicles		Daily Maint,		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 3														
Haul equipment and materials to site	Tractor Trailer	onroad HHD	72	100	0.16	0.67	1.97	0.00	0.10	0.08	303	0.01	0.01	306
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 4														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		100	0.23	0.93	2.74	0.00	0.13	0.11	422	0.01	0.01	425
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-

G-8 Daily Maintenance

ALTERNATIVE 5														
Haul equipment and materials to site	Tractor Trailer	onroad HHD	98	100	0.22	0.91	2.69	0.00	0.13	0.11	413	0.01	0.01	416
Import equipment from other areas	Tractor Trailer	onroad HHD	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD	98	100	0.22	0.91	2.69	0.00	0.13	0.11	413	0.01	0.01	416
Import equipment from other areas	Tractor Trailer	onroad HHD	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD	65		0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	-
Maximum Daily Maintenance Emissions														
	ALTERNATIVE 1, LBS			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432	
	ALTERNATIVE 2, LBS			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432	
	ALTERNATIVE 3, LBS			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432	
	ALTERNATIVE 4, LBS			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432	
	ALTERNATIVE 5, LBS			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432	
	ALTERNATIVE 6, LBS			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432	

Sources: SCAQMD 2008, EPA 2010

Notes:

SCAQMD emission factors for 2013

Offroad diesel exhaust PM_{2.5} = 92% of PM₁₀ per EMFAC 2007 version 2.3

Offroad N₂O per Annex 3, Table A-101

Non-matching application-specific values interpolated or extrapolated

EPA GWPs for CO₂ eqv (1, 21, 310)

Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)

G-9 Annual Maintenance

Table G-9 Annual Maintenance Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and Vehicles		Annual Maint,		VOC	CO	NO _x	SO _x	PM ₁₀	PM _{2.5}	CO ₂	CH ₄	N ₂ O	CO ₂ eqv
	Type	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,700	8	34	101	0	5	4	15,596	0	0	15,717
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	224		63	220	564	1	22	20	61,969	6	3	62,871
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	280		34	158	273	0	13	12	35,758	3	1	36,248
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	192		14	66	78	0	7	6	8,759	1	1	8,966
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 2														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,400	8	32	93	0	5	4	14,332	0	0	14,443
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	216		61	212	544	1	21	19	59,755	5	2	60,626
Low ground pressure haulers	Dump Truck	offroad	152		24	66	205	0	7	6	28,531	2	1	28,869
Tracked excavator	Excavator	offroad	304		37	171	296	0	14	13	38,823	3	1	39,355
Low ground pressure dozer	Dozer	offroad	48		6	24	39	0	3	3	3,401	1	0	3,492
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	88		7	30	36	0	3	3	4,014	1	0	4,109
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-

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ALTERNATIVE 3														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		4,500	10	42	123	0	6	5	18,968	0	0	19,115
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	224		63	220	564	1	22	20	61,969	6	3	62,871
Low ground pressure haulers	Dump Truck	offroad	152		24	66	205	0	7	6	28,531	2	1	28,869
Tracked excavator	Excavator	offroad	352		43	198	343	1	16	15	44,953	4	2	45,568
Low ground pressure dozer	Dozer	offroad	48		6	24	39	0	3	3	3,401	1	0	3,492
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	224		17	77	92	0	8	7	10,219	2	1	10,460
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 4														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,000	5	19	55	0	3	2	8,430	0	0	8,496
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	208		59	204	523	1	20	19	57,542	5	2	58,380
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	208		25	117	203	0	10	9	26,563	2	1	26,927
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	48		4	16	20	0	2	2	2,190	0	0	2,241
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 5														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,000	5	19	55	0	3	2	8,430	0	0	8,496
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	208		59	204	523	1	20	19	57,542	5	2	58,380
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	216		26	122	210	0	10	9	27,585	2	1	27,962
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935

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Barge with crane and clamshell bucket	Crane	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-	-	-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	56	4	19	23	0	2	2	2,555	0	0	2,615	
Agricultural tractor with mower	Tractor	offroad	24	5	20	37	0	2	2	3,130	0	0	3,200	
Fugitive dust control	Water Truck	onroad HHD	250	1	2	7	0	0	0	1,054	0	0	1,062	
Manager	Pickup/SUV	onroad LD	15,275	11	108	11	0	1	1	16,816	1	0	16,966	
Foreman	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	
Equipment Operator	Pickup/SUV	onroad LD	15,275	11	108	11	0	1	1	16,816	1	0	16,966	
Laborers	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD	2,600	6	24	71	0	3	3	10,959	0	0	11,044	
Import equipment from other areas	Tractor Trailer	onroad HHD	-	-	-	-	-	-	-	-	-	-	-	
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	216	61	212	544	1	21	19	59,755	5	2	60,626	
Low ground pressure haulers	Dump Truck	offroad	144	22	63	194	0	7	6	27,029	2	1	27,350	
Tracked excavator	Excavator	offroad	232	28	131	226	0	11	10	29,628	3	1	30,034	
Low ground pressure dozer	Dozer	offroad	40	5	20	33	0	3	3	2,834	0	0	2,910	
Small motor grader	Grader	offroad	200	27	121	180	0	13	12	18,553	2	1	18,935	
Barge with crane and clamshell bucket	Crane	offroad	-	-	-	-	-	-	-	-	-	-	-	
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-	-	-	-	-	-	-	-	-	-	-	
Truck with crane for installed pilings	Crane Rig	offroad	-	-	-	-	-	-	-	-	-	-	-	
Medium backhoe loader	Backhoe	offroad	104	8	36	43	0	4	3	4,744	1	0	4,856	
Agricultural tractor with mower	Tractor	offroad	24	5	20	37	0	2	2	3,130	0	0	3,200	
Fugitive dust control	Water Truck	onroad HHD	250	1	2	7	0	0	0	1,054	0	0	1,062	
Manager	Pickup/SUV	onroad LD	15,275	11	108	11	0	1	1	16,816	1	0	16,966	
Foreman	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	
Equipment Operator	Pickup/SUV	onroad LD	15,275	11	108	11	0	1	1	16,816	1	0	16,966	
Laborers	Pickup/SUV	onroad LD	-	-	-	-	-	-	-	-	-	-	-	
Total Maintenance Emissions														
ALTERNATIVE 1, TONS				0.10	0.46	0.74	0.001	0.04	0.03	104	0.009	0.004	106	
ALTERNATIVE 2, TONS				0.10	0.45	0.73	0.001	0.04	0.03	103	0.009	0.004	104	
ALTERNATIVE 3, TONS				0.11	0.49	0.81	0.001	0.04	0.04	112	0.010	0.004	114	
ALTERNATIVE 4, TONS				0.09	0.40	0.64	0.001	0.03	0.03	90	0.008	0.003	92	
ALTERNATIVE 3, TONS				0.09	0.40	0.64	0.001	0.03	0.03	91	0.008	0.003	92	
ALTERNATIVE 4, TONS				0.09	0.42	0.68	0.001	0.03	0.03	96	0.008	0.004	97	
Sources: SCAQMD 2008, EPA 2010														

Notes:

SCAQMD emission factors for 2013

Offroad diesel exhaust PM_{2.5} = 92% of PM₁₀ per EMFAC 2007 version 2.3

Offroad N₂O per Annex 3, Table A-101

Non-matching application-specific values interpolated or extrapolated

EPA GWPs for CO₂ eqv (1, 21, 310)

G-10 Offroad Dust

Table G-10 Offroad Fugitive Dust Emissions for Proposed Alternatives

Earthmoving	Activity		Required Variables								Uncontrolled		Controlled Emissions				
	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Drop (d)	Speed (S)	Wind (U)	Den (D)	Rate (V)	PM ₁₀	PM _{2.5}	Control	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
	hours	hours	code	percent	percent	feet	mph	mph	ton/cy	cy/hr	lb/hr	lb/hr	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1																	
Tractor Scraper	24	7,800	B+C	20		3	5			30	0.04216	0.15507	95%	0.05	0.19	16.4	60.5
Dump Truck	96	25,056	B	20		6				30	0.06849	0.00316	95%	0.33	0.02	85.8	4.0
Excavator	24	9,000	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.01	0.00	2.6	0.4
Dozer	16	3,728	A	20	9						0.30548	0.17057	95%	0.24	0.14	56.9	31.8
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	24	6,360	B	20		9				30	0.09097	0.00493	95%	0.11	0.01	28.9	1.6
Crane Rig	8	160	C	20			1				0.03100	0.00120	95%	0.01	0.00	0.2	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	C	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 2																	
Tractor Scraper	24	6,336	B+C	20		3	5			30	0.04216	0.15507	95%	0.05	0.19	13.4	49.1
Dump Truck	80	21,200	B	20		6				30	0.06849	0.00316	95%	0.27	0.01	72.6	3.3
Excavator	24	6,984	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.01	0.00	2.0	0.3
Dozer	16	2,608	A	20	9						0.30548	0.17057	95%	0.24	0.14	39.8	22.2
Grader	8	224	C	20			4				1.98400	0.15360	95%	0.79	0.06	22.2	1.7
Clamshell Derrick	16	4,304	B	20		9				30	0.09097	0.00493	95%	0.07	0.00	19.6	1.1
Crane Rig	8	168	C	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,880	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	C	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 3																	
Tractor Scraper	32	8,480	B+C	20		3	5			30	0.04216	0.15507	95%	0.07	0.25	17.9	65.8
Dump Truck	112	29,904	B	20		6				30	0.06849	0.00316	95%	0.38	0.02	102.4	4.7
Excavator	32	9,312	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.01	0.00	2.7	0.4
Dozer	24	3,504	A	20	9						0.30548	0.17057	95%	0.37	0.20	53.5	29.9
Grader	8	272	C	20			4				1.98400	0.15360	95%	0.79	0.06	27.0	2.1
Clamshell Derrick	32	8,448	B	20		9				30	0.09097	0.00493	95%	0.15	0.01	38.4	2.1
Crane Rig	8	168	C	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	C	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0

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ALTERNATIVE 4																	
Tractor Scraper	16	4,912	B+C	20		3	5			30	0.04216	0.15507	95%	0.03	0.12	10.4	38.1
Dump Truck	56	14,560	B	20		6				30	0.06849	0.00316	95%	0.19	0.01	49.9	2.3
Excavator	16	4,944	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	1.4	0.2
Dozer	16	2,496	A	20	9						0.30548	0.17057	95%	0.24	0.14	38.1	21.3
Grader	8	112	C	20			4				1.98400	0.15360	95%	0.79	0.06	11.1	0.9
Clamshell Derrick	8	2,368	B	20		9				30	0.09097	0.00493	95%	0.04	0.00	10.8	0.6
Crane Rig	8	168	C	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	C	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 5																	
Tractor Scraper	16	4,128	B+C	20		3	5			30	0.04216	0.15507	95%	0.03	0.12	8.7	32.0
Dump Truck	56	14,000	B	20		6				30	0.06849	0.00316	95%	0.19	0.01	47.9	2.2
Excavator	16	3,520	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	1.0	0.2
Dozer	16	1,632	A	20	9						0.30548	0.17057	95%	0.24	0.14	24.9	13.9
Grader	8	152	C	20			4				1.98400	0.15360	95%	0.79	0.06	15.1	1.2
Clamshell Derrick	8	2,024	B	20		9				30	0.09097	0.00493	95%	0.04	0.00	9.2	0.5
Crane Rig	8	168	C	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	C	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 6																	
Tractor Scraper	24	5,328	B+C	20		3	5			30	0.04216	0.15507	95%	0.05	0.19	11.2	41.3
Dump Truck	80	19,120	B	20		6				30	0.06849	0.00316	95%	0.27	0.01	65.5	3.0
Excavator	16	4,544	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	1.3	0.2
Dozer	16	2,128	A	20	9						0.30548	0.17057	95%	0.24	0.14	32.5	18.1
Grader	8	176	C	20			4				1.98400	0.15360	95%	0.79	0.06	17.5	1.4
Clamshell Derrick	16	3,984	B	20		9				30	0.09097	0.00493	95%	0.07	0.00	18.1	1.0
Crane Rig	8	168	C	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	C	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
												Onsite Equipment		lbs/day	lbs/day	tons	tons
												ALTERNATIVE 1		1.5	0.4	0.11	0.05
												ALTERNATIVE 2		1.5	0.4	0.09	0.04
												ALTERNATIVE 3		1.8	0.5	0.12	0.05
												ALTERNATIVE 4		1.3	0.3	0.06	0.03
												ALTERNATIVE 5		1.3	0.3	0.05	0.02
												ALTERNATIVE 6		1.5	0.4	0.07	0.03

G-11 Onroad Dust

Table G-11 Onroad Fugitive Dust Emissions for Proposed Alternatives					
All Roads Travelled	Vehicle Category	Activity		Usage	
		Pk. Daily	Project	Unpaved	Paved
		VMT	VMT	%	%
ALTERNATIVE 1					
Tractor Trailer (materials/hauling)	onroad HHD	7,500	322,500	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	4,760	52,360	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	780	312,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 2					
Tractor Trailer (materials/hauling)	onroad HHD	6,000	276,000	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	3,080	36,960	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	585	234,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 3					
Tractor Trailer (materials/hauling)	onroad HHD	9,000	396,000	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	3,920	43,120	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	975	390,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%

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ALTERNATIVE 4					
Tractor Trailer (materials/hauling)	onroad HHD	3,000	105,000	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	5,040	45,360	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	390	156,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 5					
Tractor Trailer (materials/hauling)	onroad HHD	2,700	99,900	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	2,800	28,000	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	325	130,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 6					
Tractor Trailer (materials/hauling)	onroad HHD	3,600	108,000	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	4,480	35,840	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	520	208,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%

G-11 Onroad Dust

Unpaved Road Dust	Vehicle Category	Activity		Required Variables						Uncontrolled		Controlled Emissions				
		Pk. Daily	Project	EET	Moist (M)	Silt (s)	Weight (W)	Speed (S)	Precip (P)	PM ₁₀	PM _{2.5}	Control	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
		VMT	VMT	code	percent	percent	tons	mph	days/yr	lb/VMT	lb/VMT	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1																
Tractor Trailer (materials/hauling)	onroad HHD	825	35,475	G	20	9	30	20	20	1.89491	0.18933	95%	78.2	7.8	3,176.9	317.4
Tractor Trailer (equipment/supplies)	onroad HHD	48	524	G	20	9	30	20	20	1.89491	0.18933	95%	4.5	0.5	46.9	4.7
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	47	18,720	G	20	9	3	20	20	0.84222	0.08407	95%	2.0	0.2	745.1	74.4
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 2																
Tractor Trailer (materials/hauling)	onroad HHD	660	30,360	G	20	9	30	20	20	1.89491	0.18933	95%	62.5	6.2	2,718.9	271.7
Tractor Trailer (equipment/supplies)	onroad HHD	31	370	G	20	9	30	20	20	1.89491	0.18933	95%	2.9	0.3	33.1	3.3
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	35	14,040	G	20	9	3	20	20	0.84222	0.08407	95%	1.5	0.1	558.8	55.8
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 3																
Tractor Trailer (materials/hauling)	onroad HHD	180	7,920	G	20	9	30	20	20	1.89491	0.18933	95%	17.1	1.7	709.3	70.9
Tractor Trailer (equipment/supplies)	onroad HHD	39	431	G	20	9	30	20	20	1.89491	0.18933	95%	3.7	0.4	38.6	3.9
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	59	23,400	G	20	9	3	20	20	0.84222	0.08407	95%	2.5	0.2	931.4	93.0
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4

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ALTERNATIVE 4																		
Tractor Trailer (materials/hauling)	onroad HHD	60	2,100	G	20	9	30	20	20	1.89491	0.18933	95%	5.7	0.6	188.1	18.8		
Tractor Trailer (equipment/supplies)	onroad HHD	50	454	G	20	9	30	20	20	1.89491	0.18933	95%	4.8	0.5	40.6	4.1		
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2		
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%						
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3		
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3		
Pickup/SUV (operators/drivers)	onroad LD	23	9,360	G	20	9	3	20	20	0.84222	0.08407	95%	1.0	0.1	372.6	37.2		
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4		
ALTERNATIVE 5																		
Tractor Trailer (materials/hauling)	onroad HHD	162	5,994	G	20	9	30	20	20	1.89491	0.18933	95%	15.3	1.5	536.8	53.6		
Tractor Trailer (equipment/supplies)	onroad HHD	28	280	G	20	9	30	20	20	1.89491	0.18933	95%	2.7	0.3	25.1	2.5		
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2		
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%						
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3		
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3		
Pickup/SUV (operators/drivers)	onroad LD	20	7,800	G	20	9	3	20	20	0.84222	0.08407	95%	0.8	0.1	310.5	31.0		
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4		
ALTERNATIVE 6																		
Tractor Trailer (materials/hauling)	onroad HHD	216	6,480	G	20	9	30	20	20	1.89491	0.18933	95%	20.5	2.0	580.3	58.0		
Tractor Trailer (equipment/supplies)	onroad HHD	45	358	G	20	9	30	20	20	1.89491	0.18933	95%	4.2	0.4	32.1	3.2		
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2		
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%						
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3		
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3		
Pickup/SUV (operators/drivers)	onroad LD	31	12,480	G	20	9	3	20	20	0.84222	0.08407	95%	1.3	0.1	496.7	49.6		
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4		
<i>Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)</i>													Unpaved Roads		lbs/day	lbs/day	tons	tons
													ALTERNATIVE 1	81.6	8.2	2.30	0.23	
													ALTERNATIVE 2	65.5	6.5	1.97	0.20	
													ALTERNATIVE 3	21.0	2.1	1.15	0.11	
													ALTERNATIVE 4	8.1	0.8	0.61	0.06	
													ALTERNATIVE 5	17.6	1.8	0.75	0.07	
													ALTERNATIVE 6	23.2	2.3	0.87	0.09	

G-12 Maintenance Offroad Dust

Table G-12 Offroad Fugitive Dust Emissions for Maintenance Activities

Earthmoving	Activity		Required Variables								Uncontrolled		Controlled Emissions				
	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Drop (d)	Speed (S)	Wind (U)	Den (D)	Rate (V)	PM ₁₀	PM _{2.5}	Control	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
	hours	hours	code	percent	percent	feet	mph	mph	ton/cy	cy/hr	lb/hr	lb/hr	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1																	
Tractor Scraper	8	224	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	144	B	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	280	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	40	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	B	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	C	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	192	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	C	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 2																	
Tractor Scraper	8	216	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	152	B	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	304	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	48	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.7	0.4
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	B	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	C	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	88	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	C	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 3																	
Tractor Scraper	8	224	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	152	B	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	352	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	48	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.7	0.4
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	B	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	C	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	224	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	C	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 4																	
Tractor Scraper	8	208	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.4	1.6
Dump Truck	8	144	B	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	208	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	40	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	B	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	C	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	48	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	C	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1

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ALTERNATIVE 5																		
Tractor Scraper	8	208	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.4	1.6	
Dump Truck	8	144	B	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0	
Excavator	8	216	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0	
Dozer	8	40	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3	
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5	
Clamshell Derrick	-	-	B	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0	
Crane Rig	-	-	C	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0	
Backhoe	8	56	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0	
Tractor	8	24	C	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1	
ALTERNATIVE 6																		
Tractor Scraper	8	216	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7	
Dump Truck	8	144	B	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0	
Excavator	8	232	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0	
Dozer	8	40	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3	
Grader	8	200	C	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5	
Clamshell Derrick	-	-	B	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0	
Crane Rig	-	-	C	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0	
Backhoe	8	104	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0	
Tractor	8	24	C	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1	
													Onsite Equipment		lbs/day	lbs/day	tons	tons
													ALTERNATIVE 1		1.3	0.2	0.011	0.002
													ALTERNATIVE 2		1.3	0.2	0.011	0.002
													ALTERNATIVE 3		1.3	0.2	0.011	0.002
													ALTERNATIVE 4		1.3	0.2	0.011	0.002
													ALTERNATIVE 5		1.3	0.2	0.011	0.002
													ALTERNATIVE 6		1.3	0.2	0.011	0.002

Construction Earthmoving	Activity		Required Variables								Uncontrolled		Controlled Emissions				
	Pk. Daily hours	Project hours	EET code	Moist (M) percent	Silt (s) percent	Drop (d) feet	Speed (S) mph	Wind (U) mph	Den (D) ton/cy	Rate (V) cy/hr	PM ₁₀ lb/hr	PM _{2.5} lb/hr	Control %	PM ₁₀ lb/day	PM _{2.5} lb/day	PM ₁₀ lbs	PM _{2.5} lbs
	Bulldozer (tracked)			A	7	9						1.32827	0.66775	56%	0.00	0.00	0.0
Bulldozer (wheeled)			A	7	9						0.99621	0.50081	56%	0.00	0.00	0.0	0.0
Scraper			B+C	7		3	5			30	0.89477	0.15562	56%	0.00	0.00	0.0	0.0
Dump Truck/ADT			B	7		6				30	0.09385	0.00432	56%	0.00	0.00	0.0	0.0
Clamshell Derrick			B	7		9				30	0.12465	0.00675	56%	0.00	0.00	0.0	0.0
Dragline (small)			B	7		12				60	0.30491	0.01854	56%	0.00	0.00	0.0	0.0
Grader			C	7			4				1.98400	0.15360	56%	0.00	0.00	0.0	0.0
Tractor			C	7			3				0.83700	0.05612	56%	0.00	0.00	0.0	0.0
Compactor			C	7			2				0.24800	0.01358	56%	0.00	0.00	0.0	0.0
Crane			C	7			1				0.03100	0.00120	56%	0.00	0.00	0.0	0.0
Backhoe			D	7				6.7	1.5	20	0.00836	0.00129	56%	0.00	0.00	0.0	0.0
Bobcat			D	7				6.7	1.5	10	0.00418	0.00065	56%	0.00	0.00	0.0	0.0
Drill auger			D	7				6.7	1.5	10	0.00418	0.00065	56%	0.00	0.00	0.0	0.0
Excavator			D	7				6.7	1.5	60	0.02507	0.00387	56%	0.00	0.00	0.0	0.0
Front end loader			D	7				6.7	1.5	30	0.01254	0.00194	56%	0.00	0.00	0.0	0.0
Concrete grinder			E	10					1.9	40	0.18240	0.03040	78%	0.00	0.00	0.0	0.0
Screener (coarse)			F	18					1.9	40	0.66120	0.04560	92%	0.00	0.00	0.0	0.0

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EET Code A

AP-42 Chapter 11.9 for bulldozer, tractor dozer (Tables 11.9-1):

$$E = 0.75 * 1.0 * (s)^{1.5} / (M)^{1.4} \text{ for PM}_{10}$$

$$E = 0.105 * 5.7 * (s)^{1.2} / (M)^{1.3} \text{ for PM}_{2.5}$$

Simplifies to $E = 0.75 * (s)^{1.5} / (M)^{1.4}$ for PM_{10}

Simplifies to $E = 0.60 * (s)^{1.2} / (M)^{1.3}$ for $\text{PM}_{2.5}$

E = lb/hr fugitive

s = silt content, percent

M = moisture content, percent

EET Code B

AP-42 Chapter 11.9 for small dragline, clamshell, dumping, scraper (Table 11.9-1):

$$E = 0.75 * 0.0021 * (d)^{0.7} / (M)^{0.3} \text{ for PM}_{10}$$

$$E = 0.017 * 0.0021 * (d)^{1.1} / (M)^{0.3} \text{ for PM}_{2.5}$$

Simplifies to $E = 1.6e-3 * (d)^{0.7} / (M)^{0.3}$ for PM_{10}

Simplifies to $E = 3.6e-5 * (d)^{1.1} / (M)^{0.3}$ for $\text{PM}_{2.5}$

E = lb/cy * cy/hr = lb/hr fugitive

M = moisture content, percent

d = drop distance = 12 feet (small dragline)

d = drop distance = 9 feet (clamshell)

d = drop distance = 6 feet (dump truck/ADT)

d = drop distance = 3 feet (scraper)

EET Code C

AP-42 Chapter 11.9 for scraper, grader, tractor, compactor, crane (Table 11.9-1):

$$E = S * 0.60 * 0.051 * (S)^{2.0} \text{ for PM}_{10}$$

$$E = S * 0.031 * 0.040 * (S)^{2.5} \text{ for PM}_{2.5}$$

Simplifies to $E = 0.031 * (S)^{3.0}$ for PM_{10}

Simplifies to $E = 0.0012 * (S)^{3.5}$ for $\text{PM}_{2.5}$

E = lb/VMT * VMT/hr = lb/hr fugitive

S = Mean Vehicle Speed = 5 mph (scrapers)

S = Mean Vehicle Speed = 4 mph (graders)

S = Mean Vehicle Speed = 3 mph (tractors)

S = Mean Vehicle Speed = 2 mph (compactors)

S = Mean Vehicle Speed = 1 mph (cranes)

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EET Code D

AP-42 Chapter 13.2.4 Loading/Handling (backhoe, Bobcat, drill auger, excavator, backhoe, front end loader):

$$E = V * D * 0.35 * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4} \text{ for PM}_{10}$$

$$E = V * D * 0.053 * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4} \text{ for PM}_{2.5}$$

Simplifies to $E = V * D * 1.1e-3 * (U/5)^{1.3} / (M/2)^{1.4}$ for PM_{10}

Simplifies to $E = V * D * 1.7e-4 * (U/5)^{1.3} / (M/2)^{1.4}$ for $PM_{2.5}$

V = cy/hr

M = moisture content, percent

E = lb/ton * tons/cy * cy/hr = lb/hr fugitive

D = 1.3 tons/cy for sand or cinder concrete

D = 1.5 tons/cy for soil (typical)

D = 1.9 tons/cy for sandstone or stone concrete

D = 2.1 tons/cy for granite rock

U = wind speed = 1 m/s or 2.2 mi/hr (light air)

U = wind speed = 2 m/s or 4.5 mi/hr (light breeze)

U = wind speed = 3 m/s or 6.7 mi/hr (light breeze)

U = wind speed = 4 m/s or 8.9 mi/hr (gentle breeze)

U = wind speed = 5 m/s or 11.2 mi/hr (gentle breeze)

U = wind speed = 6 m/s or 13.4 mi/hr (moderate breeze)

U = wind speed = 7 m/s or 15.7 mi/hr (moderate breeze)

EET Code E

AP-42 Chapter 11.19.2 Coarse Tertiary Crushing

$$E = 0.0024 \text{ lb/ton uncontrolled PM}_{10}$$

$$E = 0.0004 \text{ lb/ton uncontrolled PM}_{2.5}$$

$$E = D * V * 0.0024 \text{ lb/hr uncontrolled PM}_{10}$$

$$E = D * V * 0.0004 \text{ lb/hr uncontrolled PM}_{2.5}$$

V = cy/hr

E = lb/ton * tons/cy * cy/hr = lb/hr fugitive

D = 1.3 tons/cy for sand or cinder concrete

D = 1.9 tons/cy for sandstone or stone concrete

D = 2.1 tons/cy for granite rock

Control efficiency = 78% where applicable (water spray)

EET Code F

AP-42 Chapter 11.19.2 Coarse Screening

$$E = 0.0087 \text{ lb/ton uncontrolled PM}_{10}$$

$$E = 0.0006 \text{ lb/ton uncontrolled PM}_{2.5}$$

$$E = D * V * 0.0087 \text{ lb/hr uncontrolled PM}_{10}$$

$$E = D * V * 0.0006 \text{ lb/hr uncontrolled PM}_{2.5}$$

V = cy/hr

E = lb/ton * tons/cy * cy/hr = lb/hr fugitive

D = 1.3 tons/cy for sand or cinder concrete

D = 1.9 tons/cy for sandstone or stone concrete

D = 2.1 tons/cy for granite rock

Control efficiency = 92% where applicable (water spray)

G-13 Maintenance Onroad Dust

Table G-13 Onroad Fugitive Dust Emissions for Maintenance Activities					
All Roads Travelled	Vehicle Category	Activity		Usage	
		Pk. Daily	Project	Unpaved	Paved
		VMT	VMT	%	%
ALTERNATIVE 1					
Tractor Trailer (materials/hauling)	onroad HHD	100	3,700	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 2					
Tractor Trailer (materials/hauling)	onroad HHD	100	3,400	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 3					
Tractor Trailer (materials/hauling)	onroad HHD	100	4,500	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%

G-13 Maintenance Onroad Dust

Table G-13 Onroad Fugitive Dust Emissions for Maintenance Activities					
All Roads Travelled	Vehicle Category	Activity		Usage	
		Pk. Daily	Project	Unpaved	Paved
		VMT	VMT	%	%
ALTERNATIVE 4					
Tractor Trailer (materials/hauling)	onroad HHD	100	2,000	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 5					
Tractor Trailer (materials/hauling)	onroad HHD	100	2,000	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 6					
Tractor Trailer (materials/hauling)	onroad HHD	100	2,600	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%

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Unpaved Road Dust	Vehicle Category	Activity		Required Variables						Uncontrolled		Controlled Emissions				
		Pk. Daily	Project	EET	Moist (M)	Silt (s)	Weight (W)	Speed (S)	Precip (P)	PM ₁₀	PM _{2.5}	Control	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
		VMT	VMT	code	percent	percent	tons	mph	days/yr	lb/VMT	lb/VMT	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1																
Tractor Trailer (materials/hauling)	onroad HHD	11	407	G	20	9	30	20	20	1.89491	0.18933	95%	1.0	0.1	36.4	3.6
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
ALTERNATIVE 2																
Tractor Trailer (materials/hauling)	onroad HHD	11	374	G	20	9	30	20	20	1.89491	0.18933	95%	1.0	0.1	33.5	3.3
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
ALTERNATIVE 3																
Tractor Trailer (materials/hauling)	onroad HHD	2	90	G	20	9	30	20	20	1.89491	0.18933	95%	0.2	0.0	8.1	0.8
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-

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ALTERNATIVE 4																		
Tractor Trailer (materials/hauling)	onroad HHD	2	40	G	20	9	30	20	20	1.89491	0.18933	95%	0.2	0.0	3.6	0.4		
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-		
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9		
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%						
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6		
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-		
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6		
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-		
ALTERNATIVE 5																		
Tractor Trailer (materials/hauling)	onroad HHD	6	120	G	20	9	30	20	20	1.89491	0.18933	95%	0.6	0.1	10.7	1.1		
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-		
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9		
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%						
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6		
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-		
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6		
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-		
ALTERNATIVE 6																		
Tractor Trailer (materials/hauling)	onroad HHD	6	156	G	20	9	30	20	20	1.89491	0.18933	95%	0.6	0.1	14.0	1.4		
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-		
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%						
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9		
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%						
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6		
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-		
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6		
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-		
<i>Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)</i>													Unpaved Roads		lbs/day	lbs/day	tons	tons
													ALTERNATIVE 1	2.2	0.2	0.06	0.01	
													ALTERNATIVE 2	2.2	0.2	0.06	0.01	
													ALTERNATIVE 3	1.3	0.1	0.05	0.00	
													ALTERNATIVE 4	1.3	0.1	0.05	0.00	
													ALTERNATIVE 5	1.7	0.2	0.05	0.01	
													ALTERNATIVE 6	1.7	0.2	0.05	0.01	

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Paved Road Dust	Vehicle Category	Activity		Required Variables						Uncontrolled		Controlled Emissions				
		Pk. Daily	Project	EET	Moist (M)	Silt (sL)	Weight (W)	Speed (S)	Precip (P)	PM ₁₀	PM _{2.5}	Control	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
		VMT	VMT	code	percent	g/m ²	tons	mph	days/yr	lb/VMT	lb/VMT	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1																
Tractor Trailer (materials/hauling)	onroad HHD	89	3,293	H	--	0.2	30	--	20	0.01633	0.00401	--	1.5	0.4	53.0	13.0
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H	--	0.015	30	--	20	0.00155	0.00038	--	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Dump Truck (soil/sand/gravel transport)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Water Truck (dust control)	onroad HHD	1	25	H	--	0.2	30	--	20	0.01633	0.00401	--	0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			H	--	0.2	8	--	20	0.00424	0.00104	--				
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
ALTERNATIVE 2																
Tractor Trailer (materials/hauling)	onroad HHD	89	3,026	H	--	0.2	30	--	20	0.01633	0.00401	--	1.5	0.4	48.7	12.0
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H	--	0.015	30	--	20	0.00155	0.00038	--	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Dump Truck (soil/sand/gravel transport)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Water Truck (dust control)	onroad HHD	1	25	H	--	0.2	30	--	20	0.01633	0.00401	--	0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			H	--	0.2	8	--	20	0.00424	0.00104	--				
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
ALTERNATIVE 3																
Tractor Trailer (materials/hauling)	onroad HHD	98	4,410	H	--	0.2	30	--	20	0.01633	0.00401	--	1.6	0.4	71.0	17.4
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H	--	0.015	30	--	20	0.00155	0.00038	--	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Dump Truck (soil/sand/gravel transport)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Water Truck (dust control)	onroad HHD	1	25	H	--	0.2	30	--	20	0.01633	0.00401	--	0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			H	--	0.2	8	--	20	0.00424	0.00104	--				
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-

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ALTERNATIVE 4																
Tractor Trailer (materials/hauling)	onroad HHD	98	1,960	H	--	0.2	30	--	20	0.01633	0.00401	--	1.6	0.4	31.6	7.7
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H	--	0.015	30	--	20	0.00155	0.00038	--	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Dump Truck (soil/sand/gravel transport)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Water Truck (dust control)	onroad HHD	1	25	H	--	0.2	30	--	20	0.01633	0.00401	--	0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			H	--	0.2	8	--	20	0.00424	0.00104	--				
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
ALTERNATIVE 5																
Tractor Trailer (materials/hauling)	onroad HHD	94	1,880	H	--	0.2	30	--	20	0.01633	0.00401	--	1.5	0.4	30.3	7.4
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H	--	0.015	30	--	20	0.00155	0.00038	--	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Dump Truck (soil/sand/gravel transport)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Water Truck (dust control)	onroad HHD	1	25	H	--	0.2	30	--	20	0.01633	0.00401	--	0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			H	--	0.2	8	--	20	0.00424	0.00104	--				
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
ALTERNATIVE 6																
Tractor Trailer (materials/hauling)	onroad HHD	94	2,444	H	--	0.2	30	--	20	0.01633	0.00401	--	1.5	0.4	39.4	9.7
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H	--	0.015	30	--	20	0.00155	0.00038	--	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Dump Truck (soil/sand/gravel transport)	onroad HHD			H	--	0.2	30	--	20	0.01633	0.00401	--				
Water Truck (dust control)	onroad HHD	1	25	H	--	0.2	30	--	20	0.01633	0.00401	--	0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			H	--	0.2	8	--	20	0.00424	0.00104	--				
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H	--	0.2	3	--	20	0.00156	0.00038	--	0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	H	--	0.2	3	--	20	0.00156	0.00038	--	-	-	-	-

G-13 Maintenance Onroad Dust

Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)

EET Code G

Unpaved Road Dust (AP-42 Section 13.2.2):

$$E = [1.5 \cdot (s/12)^{0.9} \cdot (W/3)^{0.45}] \cdot P_C \cdot (1-CE) \text{ for } PM_{10}$$

$$E = [1.8 \cdot (s/12)^{1.0} \cdot (S/30)^{0.5} / (M/0.5)^{0.2} - 0.00047] \cdot P_C \cdot (1-CE) \text{ for } PM_{10}$$

$$E = [0.15 \cdot (s/12)^{0.9} \cdot (W/3)^{0.45}] \cdot P_C \cdot (1-CE) \text{ for } PM_{2.5}$$

$$E = [0.18 \cdot (s/12)^{1.0} \cdot (S/30)^{0.5} / (M/0.5)^{0.2} - 0.00036] \cdot P_C \cdot (1-CE) \text{ for } PM_{2.5}$$

Equation pairs calculated for average factoring of both vehicle weight and speed

s = silt content, percent

W = average vehicle weight (see below)

M = moisture content, percent

S = mean vehicle speed = 5-10 mph for watering trucks

S = mean vehicle speed = 15 mph for haul roads (general mitigation measure)

S = mean vehicle speed = 20 mph for graded dirt/gravel roads

E = lb/VMT fugitive

$$P_C = (365-P)/365$$

P = Number of wet days over 0.01 in precipitation for averaging period (from AP-42 Figure 13.2.1-2)

Note: precipitation correction not used ($P_C = 1$) for worst case day calculations

CE = control efficiency for watering (moisture content)

Light Duty = 3 tons average

Medium Duty = 8 tons average

Heavy Heavy Duty = 30 tons average (loaded 40 tons, unloaded 20 tons)

EET Code H

Paved Road Dust (New AP-42 Section 13.2.1):

$$E = 0.0022 \cdot (sL)^{0.91} \cdot (W)^{1.02} \cdot P_C \text{ for } PM_{10}$$

$$E = 0.00054 \cdot (sL)^{0.91} \cdot (W)^{1.02} \cdot P_C \text{ for } PM_{2.5}$$

E = lb/VMT fugitive

sL = Silt Loading from Table 13.2.1-2

W = Average weight of vehicles in tons (below)

$$P_C = (1-P/4N)$$

P = Number of wet days over 0.01 in precipitation for averaging period (from AP-42 Figure 13.2.1-2)

N = days of period = 365 days (4N = 1460)

Note: precipitation correction not used ($P_C = 1$) for worst case day calculations

Light Duty = 3 tons average (loaded)

Medium Duty = 8 tons average (loaded)

Heavy Heavy Duty = 30 tons average (loaded 40 tons, unloaded 20 tons)

Paved Roads	lbs/day	lbs/day	tons	tons
ALTERNATIVE 1	1.7	0.4	0.05	0.01
ALTERNATIVE 2	1.7	0.4	0.05	0.01
ALTERNATIVE 3	1.8	0.4	0.06	0.01
ALTERNATIVE 4	1.8	0.4	0.04	0.01
ALTERNATIVE 5	1.7	0.4	0.04	0.01
ALTERNATIVE 6	1.7	0.4	0.04	0.01

All Roads	lbs/day	lbs/day	tons	tons
ALTERNATIVE 1	3.8	0.6	0.11	0.02
ALTERNATIVE 2	3.8	0.6	0.11	0.02
ALTERNATIVE 3	3.1	0.6	0.11	0.02
ALTERNATIVE 4	3.1	0.6	0.09	0.01
ALTERNATIVE 5	3.4	0.6	0.09	0.01
ALTERNATIVE 6	3.4	0.6	0.09	0.02

G-14 Indirect GHG Emissions

Table G-14 Operational Indirect GHG Emissions from Electric Power Consumption (water pumping)							
Parameter	Units	Alternative					
		1	2	3	4	5	6
Total Pumping Output Power	BHP	975	838	1,288	600	350	1,013
Conversion Efficiency	percent	92%	92%	92%	92%	92%	92%
Input Power	KW	791	679	1,044	487	284	821
Daily Schedule	hours	24	24	24	24	24	24
Daily Power Requirement	KW-hrs	18,974	16,298	25,055	11,676	6,811	19,704
Annual Schedule	hours	8,760	8,760	8,760	8,760	8,760	8,760
Annual Power Requirement	MW-hrs	6,925	5,949	9,145	4,262	2,486	7,192
Carbon Dioxide (GHG - CO ₂)	lb/MW-hr	724.12	724.12	724.12	724.12	724.12	724.12
Methane (GHG - CH ₄)	lb/MW-hr	0.0302	0.0302	0.0302	0.0302	0.0302	0.0302
Nitrous Oxide (GHG - N ₂ O)	lb/MW-hr	0.0081	0.0081	0.0081	0.0081	0.0081	0.0081
Carbon Dioxide Equivalent (CO ₂ eqv)	lb/MW-hr	727.27	727.27	727.27	727.27	727.27	727.27
Carbon Dioxide (GHG - CO ₂)	tonnes/yr	2,275	1,954	3,004	1,120	817	2,362
Methane (GHG - CH ₄)	tonnes/yr	0.05	0.08	0.05	0.13	0.03	0.10
Nitrous Oxide (GHG - N ₂ O)	tonnes/yr	0.03	0.02	0.01	0.03	0.01	0.03
Carbon Dioxide Equivalent (CO₂ eqv)	tonnes/yr	2,284	1,962	1,324	1,406	820	2,373
Source: CCAR 2009 (CAMX - California), EPA 2010							

G-15 Offroad 2013

Table G-15 SCAB Fleet Average Emission Factors (Diesel)

A-19 Offroad 2013												
Air Basin		SC										
			(lb/hr)									
Equipment		MaxHP	ROG	CO	NOX	SOX	PM10	PM2.5	CO2	CH4	N2O	CO2 eqv
Aerial Lifts	Extrapolation (down)	10	0.0068	0.0352	0.0424	0.0001	0.0018	0.0017	5.8	0.0006	0.0003	5.9
		15	0.0101	0.0528	0.0637	0.0001	0.0027	0.0025	8.7	0.0009	0.0004	8.8
		25	0.0166	0.0503	0.0937	0.0001	0.0051	0.0047	11.0	0.0015	0.0007	11.2
		50	0.0592	0.1757	0.1840	0.0003	0.0156	0.0143	19.6	0.0053	0.0024	20.5
	Interpolation	85	0.0575	0.2091	0.2799	0.0004	0.0227	0.0209	28.8	0.0052	0.0023	29.7
		120	0.0558	0.2425	0.3758	0.0004	0.0299	0.0275	38.1	0.0050	0.0022	38.9
		500	0.1191	0.4671	1.5310	0.0021	0.0448	0.0413	213	0.0107	0.0048	214.6
	Extrapolation (up)	750	0.2221	0.8443	2.8534	0.0039	0.0825	0.0759	385	0.0200	0.0089	387.9
	800	0.2369	0.9006	3.0436	0.0041	0.0880	0.0810	410.4	0.0214	0.0095	413.8	
Aerial Lifts Composite			0.0529	0.1925	0.3059	0.0004	0.0202	0.0186	34.7	0.0048	0.0021	35.5
Air Compressors		15	0.0122	0.0484	0.0732	0.0001	0.0048	0.0044	7.2	0.0011	0.0005	7.4
		25	0.0266	0.0744	0.1306	0.0002	0.0081	0.0074	14.4	0.0024	0.0011	14.8
		50	0.0921	0.2546	0.2221	0.0003	0.0220	0.0203	22.3	0.0083	0.0037	23.6
		120	0.0825	0.3251	0.4991	0.0006	0.0456	0.0419	47.0	0.0074	0.0033	48.1
		175	0.1059	0.5054	0.8385	0.0010	0.0472	0.0434	88.5	0.0096	0.0042	90.0
		250	0.1007	0.2955	1.1320	0.0015	0.0347	0.0319	131	0.0091	0.0040	132.7
		500	0.1626	0.5399	1.7639	0.0023	0.0570	0.0525	232	0.0147	0.0065	234.1
		750	0.2547	0.8344	2.8139	0.0036	0.0898	0.0826	358	0.0230	0.0102	361.8
	1000	0.4190	1.4213	5.0841	0.0049	0.1474	0.1356	486	0.0378	0.0168	492.4	
Air Compressors Composite			0.0913	0.3376	0.6065	0.0007	0.0434	0.0399	63.6	0.0082	0.0037	64.9
Bore/Drill Rigs		15	0.0120	0.0632	0.0754	0.0002	0.0029	0.0027	10.3	0.0011	0.0005	10.5
		25	0.0193	0.0658	0.1226	0.0002	0.0049	0.0045	16.0	0.0017	0.0008	16.3
		50	0.0289	0.2282	0.2568	0.0004	0.0120	0.0110	31.0	0.0026	0.0012	31.5
		120	0.0447	0.4698	0.4583	0.0009	0.0257	0.0237	77.1	0.0040	0.0018	77.8
		175	0.0704	0.7538	0.6931	0.0016	0.0302	0.0277	141	0.0063	0.0028	142.1
		250	0.0795	0.3429	0.7632	0.0021	0.0221	0.0203	188	0.0072	0.0032	189.2
		500	0.1295	0.5517	1.1717	0.0031	0.0361	0.0332	311	0.0117	0.0052	313.2
		750	0.2565	1.0899	2.3376	0.0062	0.0715	0.0658	615	0.0231	0.0103	618.8
	1000	0.4163	1.6675	5.9553	0.0093	0.1544	0.1420	928	0.0376	0.0167	934.2	
Bore/Drill Rigs Composite			0.0786	0.5044	0.8125	0.0017	0.0302	0.0278	165	0.0071	0.0032	166.1
Cement and Mortar Mixers		15	0.0074	0.0386	0.0470	0.0001	0.0021	0.0020	6.3	0.0007	0.0003	6.4
		25	0.0270	0.0813	0.1510	0.0002	0.0083	0.0076	17.6	0.0024	0.0011	17.9
Cement and Mortar Mixers Composite			0.0091	0.0421	0.0556	0.0001	0.0026	0.0024	7.2	0.0008	0.0004	7.4
Concrete/Industrial Saws		25	0.0199	0.0678	0.1257	0.0002	0.0049	0.0045	16.5	0.0018	0.0008	16.8
		50	0.0955	0.2918	0.2858	0.0004	0.0247	0.0227	30.2	0.0086	0.0038	31.6
		120	0.1065	0.4836	0.7154	0.0009	0.0589	0.0542	74.1	0.0096	0.0043	75.7
		175	0.1569	0.8701	1.3612	0.0018	0.0706	0.0649	160	0.0142	0.0063	162.4

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Concrete/Industrial Saws Composite		0.1002	0.4088	0.5572	0.0007	0.0452	0.0416	58.5	0.0090	0.0040	59.9
Cranes	50	0.1015	0.2892	0.2394	0.0003	0.0239	0.0220	23.2	0.0092	0.0041	24.6
	120	0.0919	0.3618	0.5508	0.0006	0.0493	0.0453	50.1	0.0083	0.0037	51.5
	175	0.1031	0.4821	0.7769	0.0009	0.0445	0.0410	80.3	0.0093	0.0041	81.8
	250	0.1040	0.2948	0.9948	0.0013	0.0351	0.0323	112	0.0094	0.0042	113.6
	350	0.1245	0.3886	1.1661	0.0015	0.0418	0.0384	139.3	0.0112	0.0050	141.1
	500	0.1551	0.5292	1.4230	0.0018	0.0518	0.0477	180	0.0140	0.0062	182.3
	750	0.2625	0.8887	2.4614	0.0030	0.0885	0.0814	303	0.0237	0.0105	306.8
	1000	0.9491	3.3249	10.3665	0.0098	0.3189	0.2934	971	0.0856	0.0381	984.2
Cranes Composite		0.1348	0.4737	1.1934	0.0014	0.0508	0.0468	129	0.0122	0.0054	130.6
Crawler Tractors	50	0.1176	0.3246	0.2627	0.0003	0.0270	0.0248	24.9	0.0106	0.0047	26.6
	120	0.1293	0.4858	0.7686	0.0008	0.0677	0.0623	65.8	0.0117	0.0052	67.7
	125	0.1328	0.5093	0.8127	0.0008	0.0681	0.0626	70.8	0.0120	0.0053	72.7
	175	0.1674	0.7448	1.2529	0.0014	0.0713	0.0656	121	0.0151	0.0067	123.6
	250	0.1764	0.5000	1.5945	0.0019	0.0613	0.0564	166	0.0159	0.0071	168.7
	500	0.2542	0.9504	2.2389	0.0025	0.0868	0.0799	259	0.0229	0.0102	262.9
	750	0.4574	1.6983	4.1042	0.0047	0.1573	0.1447	465	0.0413	0.0183	471.2
	1000	0.6901	2.6950	7.3731	0.0066	0.2361	0.2172	658	0.0623	0.0277	668.0
Crawler Tractors Composite		0.1584	0.5900	1.1593	0.0013	0.0697	0.0641	114	0.0143	0.0064	116.3
Crushing/Proc. Equipment	50	0.1741	0.5009	0.4359	0.0006	0.0422	0.0389	44.0	0.0157	0.0070	46.5
	120	0.1402	0.5764	0.8552	0.0010	0.0779	0.0717	83.1	0.0127	0.0056	85.2
	175	0.1942	0.9615	1.5237	0.0019	0.0864	0.0795	167	0.0175	0.0078	170.0
	250	0.1848	0.5425	2.0202	0.0028	0.0620	0.0571	245	0.0167	0.0074	247.2
	500	0.2608	0.8480	2.7097	0.0037	0.0884	0.0813	374	0.0235	0.0105	377.4
	750	0.4147	1.3191	4.4498	0.0059	0.1418	0.1305	589	0.0374	0.0166	594.8
	1000	1.1270	3.6752	13.3218	0.0131	0.3880	0.3569	1,308	0.1017	0.0452	1323.9
Crushing/Proc. Equipment Composite		0.1733	0.6773	1.1752	0.0015	0.0748	0.0688	132	0.0156	0.0070	134.8
Dumpers/Tenders	25	0.0097	0.0320	0.0601	0.0001	0.0029	0.0027	7.6	0.0009	0.0004	7.8
Dumpers/Tenders Composite		0.0097	0.0320	0.0601	0.0001	0.0029	0.0027	7.6	0.0009	0.0004	7.8
Excavators	25	0.0198	0.0677	0.1253	0.0002	0.0047	0.0043	16.4	0.0018	0.0008	16.7
	50	0.0816	0.2841	0.2458	0.0003	0.0212	0.0195	25.0	0.0074	0.0033	26.2
	120	0.1086	0.5177	0.6791	0.0009	0.0586	0.0539	73.6	0.0098	0.0044	75.2
	175	0.1208	0.6668	0.8932	0.0013	0.0512	0.0471	112	0.0109	0.0048	114.0
	200	0.1220	0.5626	0.9741	0.0014	0.0466	0.0428	127.7	0.0110	0.0049	129.5
	250	0.1242	0.3541	1.1360	0.0018	0.0372	0.0343	159	0.0112	0.0050	160.5
	500	0.1735	0.5271	1.4763	0.0023	0.0516	0.0475	234	0.0157	0.0070	236.2
	750	0.2895	0.8731	2.5290	0.0039	0.0871	0.0802	387	0.0261	0.0116	391.6
Excavators Composite		0.1220	0.5338	0.9071	0.0013	0.0481	0.0442	120	0.0110	0.0049	121.3
Forklifts	50	0.0445	0.1623	0.1431	0.0002	0.0121	0.0111	14.7	0.0040	0.0018	15.3
	120	0.0438	0.2176	0.2788	0.0004	0.0241	0.0222	31.2	0.0040	0.0018	31.9
	175	0.0572	0.3307	0.4261	0.0006	0.0246	0.0226	56.1	0.0052	0.0023	56.9
	250	0.0570	0.1614	0.5281	0.0009	0.0168	0.0154	77.1	0.0051	0.0023	77.9
	500	0.0781	0.2208	0.6592	0.0011	0.0228	0.0210	111	0.0070	0.0031	112.1

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Forklifts Composite		0.0541	0.2235	0.3950	0.0006	0.0204	0.0188	54.4	0.0049	0.0022	55.2
Generator Sets	15	0.0149	0.0684	0.1016	0.0002	0.0058	0.0053	10.2	0.0013	0.0006	10.4
	25	0.0266	0.0908	0.1594	0.0002	0.0091	0.0083	17.6	0.0024	0.0011	18.0
	50	0.0872	0.2639	0.2847	0.0004	0.0234	0.0215	30.6	0.0079	0.0035	31.9
	120	0.1106	0.4905	0.7587	0.0009	0.0590	0.0543	77.9	0.0100	0.0044	79.5
	175	0.1347	0.7388	1.2314	0.0016	0.0592	0.0544	142	0.0122	0.0054	143.9
	250	0.1277	0.4365	1.6763	0.0024	0.0464	0.0427	213	0.0115	0.0051	214.3
	500	0.1818	0.7230	2.3955	0.0033	0.0690	0.0635	337	0.0164	0.0073	339.5
	750	0.3035	1.1671	3.9863	0.0055	0.1134	0.1044	544	0.0274	0.0122	548.1
1000	0.7957	2.8065	10.2314	0.0105	0.2844	0.2616	1,049	0.0718	0.0319	1060.0	
Generator Sets Composite		0.0767	0.3045	0.5430	0.0007	0.0324	0.0298	61.0	0.0069	0.0031	62.1
Graders	50	0.1080	0.3263	0.2772	0.0004	0.0262	0.0241	27.5	0.0097	0.0043	29.1
	120	0.1254	0.5310	0.7729	0.0009	0.0676	0.0622	75.0	0.0113	0.0050	76.8
	140	0.1331	0.6050	0.8989	0.0011	0.0660	0.0607	92.8	0.0120	0.0053	94.7
	175	0.1467	0.7345	1.1193	0.0014	0.0631	0.0581	124	0.0132	0.0059	126.0
	250	0.1492	0.4331	1.4184	0.0019	0.0494	0.0454	172	0.0135	0.0060	174.3
	500	0.1855	0.6289	1.6842	0.0023	0.0608	0.0559	229	0.0167	0.0074	232.1
	750	0.3952	1.3289	3.6674	0.0049	0.1306	0.1202	486	0.0357	0.0158	491.4
Graders Composite		0.1446	0.6053	1.1663	0.0015	0.0593	0.0546	133	0.0130	0.0058	134.8
Off-Highway Tractors	120	0.2113	0.7191	1.2368	0.0011	0.1078	0.0992	93.7	0.0191	0.0085	96.8
	175	0.2045	0.8335	1.5337	0.0015	0.0871	0.0801	130	0.0185	0.0082	133.3
	250	0.1641	0.4691	1.4453	0.0015	0.0601	0.0553	130	0.0148	0.0066	132.8
	750	0.6538	2.8815	5.8130	0.0057	0.2353	0.2165	568	0.0590	0.0262	577.5
	1000	0.9818	4.4978	10.0554	0.0082	0.3436	0.3161	814	0.0886	0.0394	828.4
Off-Highway Tractors Composite		0.2077	0.7649	1.7062	0.0017	0.0818	0.0753	151	0.0187	0.0083	154.4
Off-Highway Trucks	175	0.1441	0.7580	1.0305	0.0014	0.0602	0.0554	125	0.0130	0.0058	127.2
	250	0.1400	0.3837	1.2373	0.0019	0.0412	0.0379	167	0.0126	0.0056	168.6
	300	0.1554	0.4342	1.3471	0.0020	0.0457	0.0420	187.7	0.0140	0.0062	189.9
	500	0.2170	0.6362	1.7865	0.0027	0.0634	0.0583	272	0.0196	0.0087	275.4
	750	0.3542	1.0311	2.9938	0.0044	0.1046	0.0962	442	0.0320	0.0142	446.8
	1000	0.5484	1.6691	5.9808	0.0063	0.1796	0.1652	625	0.0495	0.0220	632.6
Off-Highway Trucks Composite		0.2141	0.6361	1.8543	0.0027	0.0644	0.0593	260	0.0193	0.0086	263.1
Other Construction Equipment	15	0.0118	0.0617	0.0737	0.0002	0.0029	0.0026	10.1	0.0011	0.0005	10.3
	25	0.0160	0.0544	0.1013	0.0002	0.0041	0.0037	13.2	0.0014	0.0006	13.4
	50	0.0753	0.2653	0.2585	0.0004	0.0205	0.0189	28.0	0.0068	0.0030	29.1
	120	0.1006	0.5277	0.7025	0.0009	0.0567	0.0522	80.9	0.0091	0.0040	82.3
	175	0.0935	0.5873	0.8011	0.0012	0.0420	0.0386	107	0.0084	0.0038	107.9
	500	0.1452	0.5234	1.5187	0.0025	0.0491	0.0452	254	0.0131	0.0058	256.3

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Other Construction Equipment Composite		0.0872	0.3765	0.7938	0.0013	0.0330	0.0304	123	0.0079	0.0035	123.9
Other General Industrial Equipmen	15	0.0066	0.0391	0.0466	0.0001	0.0018	0.0017	6.4	0.0006	0.0003	6.5
	25	0.0185	0.0632	0.1170	0.0002	0.0044	0.0040	15.3	0.0017	0.0007	15.6
	50	0.0980	0.2738	0.2243	0.0003	0.0232	0.0214	21.7	0.0088	0.0039	23.1
	120	0.1177	0.4487	0.6789	0.0007	0.0644	0.0593	62.0	0.0106	0.0047	63.7
	175	0.1261	0.5728	0.9333	0.0011	0.0549	0.0505	95.9	0.0114	0.0051	97.7
	250	0.1174	0.3177	1.2013	0.0015	0.0380	0.0350	136	0.0106	0.0047	137.3
	500	0.2135	0.6384	2.0642	0.0026	0.0693	0.0638	265	0.0193	0.0086	268.5
	750	0.3546	1.0522	3.5146	0.0044	0.1165	0.1072	437	0.0320	0.0142	442.5
1000	0.5246	1.6793	6.0067	0.0056	0.1805	0.1660	560	0.0473	0.0210	567.1	
Other General Industrial Equipmen Composite		0.1542	0.5159	1.3484	0.0016	0.0580	0.0533	152	0.0139	0.0062	154.4
Other Material Handling Equipment	50	0.1361	0.3789	0.3119	0.0004	0.0323	0.0297	30.3	0.0123	0.0055	32.3
	120	0.1144	0.4370	0.6628	0.0007	0.0628	0.0578	60.7	0.0103	0.0046	62.3
	175	0.1591	0.7257	1.1860	0.0014	0.0696	0.0640	122	0.0144	0.0064	124.4
	250	0.1241	0.3385	1.2829	0.0016	0.0405	0.0372	145	0.0112	0.0050	146.8
	275	0.1269	0.3506	1.3035	0.0017	0.0414	0.0381	149.7	0.0114	0.0051	151.5
	500	0.1521	0.4596	1.4883	0.0019	0.0498	0.0458	192	0.0137	0.0061	193.8
	1000	0.7021	2.2197	7.9424	0.0073	0.2379	0.2188	741	0.0634	0.0282	751.4
Other Material Handling Equipment Composite		0.1473	0.4951	1.3132	0.0015	0.0562	0.0517	141	0.0133	0.0059	143.3
Pavers	25	0.0247	0.0799	0.1500	0.0002	0.0075	0.0069	18.7	0.0022	0.0010	19.0
	50	0.1366	0.3592	0.2948	0.0004	0.0308	0.0283	28.0	0.0123	0.0055	29.9
	120	0.1387	0.5057	0.8357	0.0008	0.0729	0.0671	69.2	0.0125	0.0056	71.2
	175	0.1777	0.7784	1.3769	0.0014	0.0769	0.0707	128	0.0160	0.0071	130.8
	250	0.2072	0.6081	1.9469	0.0022	0.0756	0.0695	194	0.0187	0.0083	197.3
	500	0.2275	0.9254	2.1080	0.0023	0.0818	0.0752	233	0.0205	0.0091	236.5
Pavers Composite		0.1511	0.5357	0.8542	0.0009	0.0603	0.0555	77.9	0.0136	0.0061	80.1
Paving Equipment	25	0.0153	0.0520	0.0968	0.0002	0.0039	0.0036	12.6	0.0014	0.0006	12.8
	50	0.1166	0.3049	0.2514	0.0003	0.0263	0.0242	23.9	0.0105	0.0047	25.6
	120	0.1087	0.3958	0.6561	0.0006	0.0574	0.0528	54.5	0.0098	0.0044	56.1
	175	0.1387	0.6079	1.0816	0.0011	0.0602	0.0554	101	0.0125	0.0056	103.0
	250	0.1277	0.3763	1.2206	0.0014	0.0467	0.0430	122	0.0115	0.0051	124.1
Paving Equipment Composite		0.1142	0.4316	0.7709	0.0008	0.0536	0.0493	68.9	0.0103	0.0046	70.6
Plate Compactors	15	0.0050	0.0263	0.0314	0.0001	0.0012	0.0011	4.3	0.0005	0.0002	4.4
Plate Compactors Composite		0.0050	0.0263	0.0314	0.0001	0.0012	0.0011	4.3	0.0005	0.0002	4.4
Pressure Washers	15	0.0071	0.0328	0.0487	0.0001	0.0028	0.0025	4.9	0.0006	0.0003	5.0
	25	0.0108	0.0368	0.0646	0.0001	0.0037	0.0034	7.1	0.0010	0.0004	7.3
	50	0.0315	0.1037	0.1284	0.0002	0.0094	0.0086	14.3	0.0028	0.0013	14.7
	120	0.0302	0.1443	0.2235	0.0003	0.0157	0.0145	24.1	0.0027	0.0012	24.5
Pressure Washers Composite		0.0159	0.0619	0.0878	0.0001	0.0058	0.0053	9.4	0.0014	0.0006	9.6
Pumps	15	0.0125	0.0497	0.0752	0.0001	0.0049	0.0046	7.4	0.0011	0.0005	7.6
	25	0.0359	0.1004	0.1761	0.0002	0.0109	0.0100	19.5	0.0032	0.0014	20.0
	50	0.1052	0.3116	0.3228	0.0004	0.0275	0.0253	34.3	0.0095	0.0042	35.8
	120	0.1149	0.4984	0.7706	0.0009	0.0617	0.0568	77.9	0.0104	0.0046	79.6
	175	0.1385	0.7405	1.2344	0.0016	0.0611	0.0562	140	0.0125	0.0056	142.1
	250	0.1266	0.4210	1.6140	0.0023	0.0457	0.0421	201	0.0114	0.0051	203.2
	500	0.1952	0.7595	2.4849	0.0034	0.0734	0.0675	345	0.0176	0.0078	348.0
	750	0.3326	1.2556	4.2353	0.0057	0.1235	0.1136	571	0.0300	0.0133	575.5
1000	1.0536	3.7127	13.3750	0.0136	0.3744	0.3444	1,355	0.0951	0.0423	1369.9	

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Pumps Composite		0.0748	0.2926	0.4705	0.0006	0.0323	0.0297	49.6	0.0067	0.0030	50.7
Rollers	15	0.0074	0.0386	0.0461	0.0001	0.0018	0.0016	6.3	0.0007	0.0003	6.4
	25	0.0161	0.0549	0.1023	0.0002	0.0041	0.0038	13.3	0.0015	0.0006	13.6
	50	0.1025	0.2911	0.2583	0.0003	0.0245	0.0225	26.0	0.0092	0.0041	27.5
	120	0.0986	0.4063	0.6253	0.0007	0.0534	0.0491	59.0	0.0089	0.0040	60.4
	175	0.1247	0.6199	1.0114	0.0012	0.0550	0.0506	108	0.0113	0.0050	109.9
	250	0.1262	0.3887	1.3124	0.0017	0.0451	0.0415	153	0.0114	0.0051	154.9
	500	0.1654	0.6313	1.6820	0.0022	0.0593	0.0545	219	0.0149	0.0066	221.5
Rollers Composite		0.0973	0.4060	0.6546	0.0008	0.0453	0.0417	67.1	0.0088	0.0039	68.4
Rough Terrain Forklifts	50	0.1181	0.3778	0.3316	0.0004	0.0300	0.0276	33.9	0.0107	0.0047	35.6
	120	0.0955	0.4327	0.5995	0.0007	0.0529	0.0487	62.4	0.0086	0.0038	63.8
	175	0.1352	0.7256	1.0448	0.0014	0.0592	0.0545	125	0.0122	0.0054	126.8
	250	0.1294	0.3798	1.2955	0.0019	0.0416	0.0382	171	0.0117	0.0052	172.7
	500	0.1824	0.5717	1.7096	0.0025	0.0584	0.0537	257	0.0165	0.0073	259.2
Rough Terrain Forklifts Composite		0.1009	0.4642	0.6526	0.0008	0.0532	0.0489	70.3	0.0091	0.0040	71.7
Rubber Tired Dozers	175	0.2119	0.8457	1.5561	0.0015	0.0893	0.0821	129	0.0191	0.0085	132.5
	250	0.2435	0.6833	2.0817	0.0021	0.0881	0.0810	183	0.0220	0.0098	187.0
	500	0.3211	1.4228	2.7305	0.0026	0.1133	0.1043	265	0.0290	0.0129	269.5
	750	0.4843	2.1329	4.1797	0.0040	0.1716	0.1579	399	0.0437	0.0194	405.7
	1000	0.7496	3.4322	7.4509	0.0060	0.2591	0.2384	592	0.0676	0.0301	602.6
Rubber Tired Dozers Composite		0.2986	1.1749	2.5452	0.0025	0.1064	0.0979	239	0.0269	0.0120	243.4
Rubber Tired Loaders	25	0.0204	0.0697	0.1292	0.0002	0.0050	0.0046	16.9	0.0018	0.0008	17.2
	50	0.1200	0.3641	0.3118	0.0004	0.0292	0.0269	31.1	0.0108	0.0048	32.9
	120	0.0971	0.4152	0.6015	0.0007	0.0525	0.0483	58.9	0.0088	0.0039	60.3
	175	0.1238	0.6274	0.9501	0.0012	0.0535	0.0492	106	0.0112	0.0050	108.1
	250	0.1259	0.3685	1.2125	0.0017	0.0417	0.0384	149	0.0114	0.0050	150.8
	500	0.1867	0.6397	1.7158	0.0023	0.0613	0.0564	237	0.0168	0.0075	239.7
	750	0.3850	1.3084	3.6184	0.0049	0.1276	0.1174	486	0.0347	0.0154	491.0
	1000	0.5190	1.8389	5.9660	0.0060	0.1795	0.1651	594	0.0468	0.0208	601.3
Rubber Tired Loaders Composite		0.1195	0.4763	0.9346	0.0012	0.0508	0.0467	109	0.0108	0.0048	110.3
Scrapers	120	0.1877	0.6943	1.1141	0.0011	0.0983	0.0904	93.9	0.0169	0.0075	96.6
	175	0.2070	0.9107	1.5564	0.0017	0.0884	0.0813	148	0.0187	0.0083	151.0
	250	0.2252	0.6408	2.0481	0.0024	0.0791	0.0727	209	0.0203	0.0090	212.7
	400	0.2813	0.9831	2.5165	0.0028	0.0976	0.0898	276.6	0.0254	0.0113	280.7
	500	0.3186	1.2113	2.8288	0.0032	0.1099	0.1011	321	0.0287	0.0128	326.0
	750	0.5525	2.0861	4.9949	0.0056	0.1918	0.1764	555	0.0499	0.0222	563.2
Scrapers Composite		0.2783	1.0395	2.4118	0.0027	0.1005	0.0925	262	0.0251	0.0112	266.5
Signal Boards	15	0.0072	0.0377	0.0450	0.0001	0.0018	0.0016	6.2	0.0006	0.0003	6.3
	50	0.1151	0.3456	0.3415	0.0005	0.0296	0.0272	36.2	0.0104	0.0046	37.8
	120	0.1176	0.5214	0.7807	0.0009	0.0644	0.0593	80.2	0.0106	0.0047	81.9
	175	0.1535	0.8341	1.3333	0.0017	0.0685	0.0630	155	0.0139	0.0062	156.7
	250	0.1632	0.5350	1.9963	0.0029	0.0580	0.0534	255	0.0147	0.0065	257.6
Signal Boards Composite		0.0192	0.0934	0.1399	0.0002	0.0077	0.0071	16.7	0.0017	0.0008	17.0
Skid Steer Loaders	25	0.0202	0.0620	0.1166	0.0002	0.0063	0.0058	13.8	0.0018	0.0008	14.1
	50	0.0517	0.2263	0.2279	0.0003	0.0157	0.0144	25.5	0.0047	0.0021	26.3
	120	0.0429	0.2748	0.3267	0.0005	0.0245	0.0225	42.8	0.0039	0.0017	43.4

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Skid Steer Loaders Composite		0.0468	0.2309	0.2522	0.0004	0.0179	0.0165	30.3	0.0042	0.0019	30.9
Surfacing Equipment	50	0.0477	0.1403	0.1359	0.0002	0.0119	0.0109	14.1	0.0043	0.0019	14.8
	120	0.0970	0.4215	0.6523	0.0007	0.0517	0.0475	63.8	0.0088	0.0039	65.2
	175	0.0894	0.4730	0.7742	0.0010	0.0392	0.0360	85.8	0.0081	0.0036	87.1
	250	0.1025	0.3374	1.1177	0.0015	0.0376	0.0346	135	0.0092	0.0041	136.3
	500	0.1532	0.6418	1.6597	0.0022	0.0567	0.0522	221	0.0138	0.0061	223.4
	750	0.2443	1.0046	2.6697	0.0035	0.0900	0.0828	347	0.0220	0.0098	350.5
Surfacing Equipment Composite		0.1277	0.5182	1.2760	0.0017	0.0468	0.0431	166	0.0115	0.0051	167.8
Sweepers/Scrubbers	15	0.0124	0.0729	0.0870	0.0002	0.0034	0.0031	11.9	0.0011	0.0005	12.1
	25	0.0237	0.0808	0.1496	0.0002	0.0058	0.0054	19.6	0.0021	0.0009	20.0
	50	0.1048	0.3425	0.3055	0.0004	0.0271	0.0249	31.6	0.0095	0.0042	33.1
	120	0.1107	0.5147	0.6989	0.0009	0.0622	0.0573	75.0	0.0100	0.0044	76.6
	175	0.1439	0.7997	1.1204	0.0016	0.0637	0.0586	139	0.0130	0.0058	141.1
	250	0.1146	0.3382	1.1784	0.0018	0.0362	0.0333	162	0.0103	0.0046	163.7
Sweepers/Scrubbers Composite		0.1148	0.5145	0.6862	0.0009	0.0510	0.0469	78.5	0.0104	0.0046	80.2
Tractors/Loaders/Backhoes	25	0.0195	0.0657	0.1237	0.0002	0.0056	0.0052	15.9	0.0018	0.0008	16.1
	50	0.0893	0.3199	0.2893	0.0004	0.0238	0.0219	30.3	0.0081	0.0036	31.6
	100	0.0751	0.3434	0.4087	0.0005	0.0342	0.0314	45.6	0.0068	0.0030	46.7
	120	0.0694	0.3529	0.4565	0.0006	0.0383	0.0352	51.7	0.0063	0.0028	52.7
	175	0.0988	0.5861	0.7696	0.0011	0.0428	0.0394	101	0.0089	0.0040	102.8
	250	0.1204	0.3666	1.1658	0.0019	0.0370	0.0340	172	0.0109	0.0048	173.5
	500	0.2290	0.7443	2.0659	0.0039	0.0701	0.0645	345	0.0207	0.0092	348.1
	750	0.3462	1.1159	3.2041	0.0058	0.1072	0.0986	517	0.0312	0.0139	522.2
Tractors/Loaders/Backhoes Composite		0.0792	0.3782	0.5392	0.0008	0.0387	0.0356	66.8	0.0071	0.0032	67.9
Trenchers	15	0.0099	0.0517	0.0617	0.0001	0.0024	0.0022	8.5	0.0009	0.0004	8.6
	25	0.0397	0.1355	0.2511	0.0004	0.0097	0.0090	32.9	0.0036	0.0016	33.5
	50	0.1566	0.4082	0.3432	0.0004	0.0353	0.0325	32.9	0.0141	0.0063	35.2
	120	0.1281	0.4684	0.7862	0.0008	0.0669	0.0615	64.9	0.0116	0.0051	66.7
	175	0.1955	0.8632	1.5520	0.0016	0.0849	0.0781	144	0.0176	0.0078	146.7
	250	0.2354	0.7089	2.2485	0.0025	0.0880	0.0810	223	0.0212	0.0094	226.3
	500	0.2985	1.3011	2.8470	0.0031	0.1105	0.1016	311	0.0269	0.0120	315.6
	750	0.5663	2.4440	5.4715	0.0059	0.2099	0.1931	587	0.0511	0.0227	595.0
Trenchers Composite		0.1427	0.4675	0.6684	0.0007	0.0549	0.0505	58.7	0.0129	0.0057	60.8
Welders	15	0.0104	0.0416	0.0629	0.0001	0.0041	0.0038	6.2	0.0009	0.0004	6.4
	25	0.0208	0.0581	0.1020	0.0001	0.0063	0.0058	11.3	0.0019	0.0008	11.6
	50	0.0979	0.2753	0.2535	0.0003	0.0240	0.0221	26.0	0.0088	0.0039	27.4
	120	0.0654	0.2659	0.4099	0.0005	0.0358	0.0330	39.5	0.0059	0.0026	40.4
	175	0.1101	0.5455	0.9083	0.0011	0.0490	0.0451	98.2	0.0099	0.0044	99.8
	250	0.0855	0.2618	1.0026	0.0013	0.0301	0.0277	119	0.0077	0.0034	120.3
500	0.1092	0.3838	1.2526	0.0016	0.0394	0.0363	168	0.0098	0.0044	169.2	
Welders Composite		0.0646	0.2096	0.2564	0.0003	0.0225	0.0207	25.6	0.0058	0.0026	26.5

Notes:

SCAQMD emission factors for 2014 (SCAQMD 2008)

Offroad diesel exhaust PM_{2.5} = 92% of PM₁₀ per EMFAC 2007 version 2.3 (SCAQMD 2008)

Offroad N₂O per Annex 3, Table A-101(EPA 2010)

Non-matching application-specific values interpolated or extrapolated

EPA GWPs for CO₂ eqv (1, 21, 310)

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Table G-16 SCAB Fleet Average Emission Factors

A-20 Onroad 2013

Air Basin

SC

	(lb/mi)									
Vehicle Type	ROG	CO	NOX	SOX	PM10	PM2.5	CO2	CH4	N2O	CO2 eqv
Light Duty (pickup trucks)	0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Medium Duty (work trucks)	0.00206	0.01408	0.01577	0.00003	0.00060	0.00050	2.78163	0.00010	0.00015	2.83046
Heavy Heavy Duty (tractor/trailers)	0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784

Notes:
 SCAQMD 2008
 HHD includes tire & brake wear
 Onroad N₂O per Annex 3, Table A-99



**Table G-17 Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks**

Projects in the SCAQMD (Scenario Years 2007 - 2026)
Derived from Peak Emissions Inventory (**Winter, Annual, Summer**)

**Vehicle Class:
Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)**

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model, taking the weighted average of vehicle types and simplifying into two categories:
Passenger Vehicles & Delivery Trucks.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle categories listed in the tables below, by use of the following equation:

$$\text{Emissions (pounds per day)} = N \times TL \times EF$$

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

This methodology replaces the old EMFAC emission factors in Tables A-9-5-J-1 through A-9-5-L in Appendix A9 of the current SCAQMD CEQA Handbook. All the emission factors account for the emissions from start, running and idling exhaust. In addition, the ROG emission factors include diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors include tire and brake wear.

Scenario Year: **2007**

All model years in the range 1965 to 2007

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.01155158	CO	0.02407553
NOx	0.00121328	NOx	0.02508445
ROG	0.00118234	ROG	0.00323145
SOx	0.00001078	SOx	0.00002626
PM10	0.00008447	PM10	0.00091020
PM2.5	0.00005243	PM2.5	0.00078884
CO2	1.10672236	CO2	2.72245619
CH4	0.00010306	CH4	0.00016030
N2O	0.00004173	N2O	0.00024936
CO2 eqv	1.12182256	CO2 eqv	2.80312488

Scenario Year: **2008**

All model years in the range 1965 to 2008

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.01054844	CO	0.02194915
NOx	0.00110288	NOx	0.02371258
ROG	0.00107919	ROG	0.00299270
SOx	0.00001075	SOx	0.00002565
PM10	0.00008505	PM10	0.00085607
PM2.5	0.00005293	PM2.5	0.00073933
CO2	1.09953226	CO2	2.71943400
CH4	0.00009465	CH4	0.00014769
N2O	0.00003832	N2O	0.00022974
CO2 eqv	1.11340004	CO2 eqv	2.79375469

Scenario Year: **2009**

All model years in the range 1965 to 2009

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00968562	CO	0.02016075
NOx	0.00100518	NOx	0.02236636
ROG	0.00099245	ROG	0.00278899
SOx	0.00001066	SOx	0.00002679
PM10	0.00008601	PM10	0.00080550
PM2.5	0.00005384	PM2.5	0.00069228
CO2	1.09755398	CO2	2.72330496
CH4	0.00008767	CH4	0.00013655
N2O	0.00003550	N2O	0.00021242
CO2 eqv	1.11039937	CO2 eqv	2.79202205

Scenario Year: **2010**

All model years in the range 1966 to 2010

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00826276	CO	0.01843765
NOx	0.00091814	NOx	0.02062460
ROG	0.00091399	ROG	0.00258958
SOx	0.00001077	SOx	0.00002701
PM10	0.00008698	PM10	0.00075121
PM2.5	0.00005478	PM2.5	0.00064233
CO2	1.09568235	CO2	2.73222199
CH4	0.00008146	CH4	0.00012576
N2O	0.00003298	N2O	0.00019563
CO2 eqv	1.10761811	CO2 eqv	2.79550969



Scenario Year: 2011

All model years in the range 1967 to 2011

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00826276	CO	0.01693242
NOx	0.00084460	NOx	0.01893366
ROG	0.00085233	ROG	0.00241868
SOx	0.00001077	SOx	0.00002728
PM10	0.00008879	PM10	0.00070097
PM2.5	0.00005653	PM2.5	0.00059682
CO2	1.10235154	CO2	2.75180822
CH4	0.00007678	CH4	0.00011655
N2O	0.00003109	N2O	0.00018130
CO2 eqv	1.11360103	CO2 eqv	2.81046029

Scenario Year: 2012

All model years in the range 1968 to 2012

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00765475	CO	0.01545741
NOx	0.00077583	NOx	0.01732423
ROG	0.00079628	ROG	0.00223776
SOx	0.00001073	SOx	0.00002667
PM10	0.00008979	PM10	0.00064975
PM2.5	0.00005750	PM2.5	0.00054954
CO2	1.10152540	CO2	2.76628414
CH4	0.00007169	CH4	0.00010668
N2O	0.00002903	N2O	0.00016594
CO2 eqv	1.11202923	CO2 eqv	2.81996552

Scenario Year: 2013

All model years in the range 1969 to 2013

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00709228	CO	0.01407778
NOx	0.00071158	NOx	0.01577311
ROG	0.00074567	ROG	0.00206295
SOx	0.00001072	SOx	0.00002682
PM10	0.00009067	PM10	0.00059956
PM2.5	0.00005834	PM2.5	0.00050174
CO2	1.10087435	CO2	2.78163459
CH4	0.00006707	CH4	0.00009703
N2O	0.00002716	N2O	0.00015094
CO2 eqv	1.11070222	CO2 eqv	2.83046413

Scenario Year: 2014

All model years in the range 1970 to 2014

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00660353	CO	0.01284321
NOx	0.00065484	NOx	0.01425162
ROG	0.00070227	ROG	0.00189649
SOx	0.00001069	SOx	0.00002754
PM10	0.00009185	PM10	0.00054929
PM2.5	0.00005939	PM2.5	0.00045519
CO2	1.10257205	CO2	2.79845465
CH4	0.00006312	CH4	0.00008798
N2O	0.00002556	N2O	0.00013685
CO2 eqv	1.11181980	CO2 eqv	2.84272697

Scenario Year: 2015

All model years in the range 1971 to 2015

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00614108	CO	0.01169445
NOx	0.00060188	NOx	0.01285026
ROG	0.00066355	ROG	0.00173890
SOx	0.00001070	SOx	0.00002741
PM10	0.00009259	PM10	0.00050307
PM2.5	0.00006015	PM2.5	0.00041268
CO2	1.10192837	CO2	2.81247685
CH4	0.00005923	CH4	0.00008076
N2O	0.00002398	N2O	0.00012562
CO2 eqv	1.11060625	CO2 eqv	2.85311641

Scenario Year: 2016

All model years in the range 1972 to 2016

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00575800	CO	0.01080542
NOx	0.00055658	NOx	0.01172881
ROG	0.00063254	ROG	0.00161521
SOx	0.00001071	SOx	0.00002767
PM10	0.00009392	PM10	0.00046606
PM2.5	0.00006131	PM2.5	0.00037868
CO2	1.10677664	CO2	2.83134285
CH4	0.00005623	CH4	0.00007355
N2O	0.00002277	N2O	0.00011441
CO2 eqv	1.11501568	CO2 eqv	2.86835526



Scenario Year: 2017

All model years in the range 1973 to 2017

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00537891	CO	0.00998101
NOx	0.00051297	NOx	0.01070034
ROG	0.00060109	ROG	0.00150242
SOx	0.00001079	SOx	0.00002723
PM10	0.00009446	PM10	0.00043131
PM2.5	0.00006192	PM2.5	0.00034605
CO2	1.10627489	CO2	2.84005015
CH4	0.00005300	CH4	0.00006663
N2O	0.00002146	N2O	0.00010365
CO2 eqv	1.11404119	CO2 eqv	2.87358027

Scenario Year: 2018

All model years in the range 1974 to 2018

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00502881	CO	0.00923234
NOx	0.00047300	NOx	0.00979416
ROG	0.00057178	ROG	0.00139856
SOx	0.00001071	SOx	0.00002749
PM10	0.00009494	PM10	0.00040110
PM2.5	0.00006234	PM2.5	0.00031792
CO2	1.10562643	CO2	2.84646835
CH4	0.00005003	CH4	0.00006203
N2O	0.00002026	N2O	0.00009650
CO2 eqv	1.11295662	CO2 eqv	2.87768473

Scenario Year: 2019

All model years in the range 1975 to 2019

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00471820	CO	0.00857192
NOx	0.00043716	NOx	0.00900205
ROG	0.00054654	ROG	0.00130563
SOx	0.00001072	SOx	0.00002706
PM10	0.00009523	PM10	0.00037393
PM2.5	0.00006259	PM2.5	0.00029276
CO2	1.10496100	CO2	2.85060182
CH4	0.00004743	CH4	0.00005619
N2O	0.00001920	N2O	0.00008741
CO2 eqv	1.11191031	CO2 eqv	2.87887960

Scenario Year: 2020

All model years in the range 1976 to 2020

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00444247	CO	0.00799617
NOx	0.00040506	NOx	0.00831802
ROG	0.00052463	ROG	0.00122382
SOx	0.00001073	SOx	0.00002733
PM10	0.00009550	PM10	0.00035054
PM2.5	0.00006279	PM2.5	0.00027128
CO2	1.10456157	CO2	2.85148109
CH4	0.00004495	CH4	0.00005330
N2O	0.00001820	N2O	0.00008291
CO2 eqv	1.11114749	CO2 eqv	2.87830219

Scenario Year: 2021

All model years in the range 1977 to 2021

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00421218	CO	0.00748303
NOx	0.00037757	NOx	0.00773500
ROG	0.00050573	ROG	0.00115568
SOx	0.00001073	SOx	0.00002755
PM10	0.00009640	PM10	0.00033125
PM2.5	0.00006364	PM2.5	0.00025331
CO2	1.11009559	CO2	2.86434187
CH4	0.00004322	CH4	0.00004905
N2O	0.00001750	N2O	0.00007630
CO2 eqv	1.11642895	CO2 eqv	2.88902454

Scenario Year: 2022

All model years in the range 1978 to 2022

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00397866	CO	0.00699290
NOx	0.00035150	NOx	0.00722470
ROG	0.00048658	ROG	0.00108569
SOx	0.00001072	SOx	0.00002774
PM10	0.00009661	PM10	0.00031501
PM2.5	0.00006389	PM2.5	0.00023906
CO2	1.11019931	CO2	2.87006769
CH4	0.00004121	CH4	0.00004557
N2O	0.00001669	N2O	0.00007088
CO2 eqv	1.11623782	CO2 eqv	2.89299807



Scenario Year: **2023**

All model years in the range 1979 to 2023

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00377527	CO	0.00658123
NOx	0.00032851	NOx	0.00679147
ROG	0.00046900	ROG	0.00102852
SOx	0.00001070	SOx	0.00002790
PM10	0.00009676	PM10	0.00030109
PM2.5	0.00006405	PM2.5	0.00022582
CO2	1.11023373	CO2	2.87466338
CH4	0.00003951	CH4	0.00004218
N2O	0.00001600	N2O	0.00006561
CO2 eqv	1.11602249	CO2 eqv	2.89588881

Scenario Year: **2024**

All model years in the range 1980 to 2024

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00358611	CO	0.00625076
NOx	0.00030721	NOx	0.00647083
ROG	0.00045136	ROG	0.00096578
SOx	0.00001080	SOx	0.00002807
PM10	0.00009676	PM10	0.00029407
PM2.5	0.00006410	PM2.5	0.00021880
CO2	1.11061572	CO2	2.88010717
CH4	0.00003781	CH4	0.00004019
N2O	0.00001531	N2O	0.00006251
CO2 eqv	1.11615549	CO2 eqv	2.90033043

Scenario Year: **2025**

All model years in the range 1981 to 2025

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00342738	CO	0.00595363
NOx	0.00028846	NOx	0.00615945
ROG	0.00043545	ROG	0.00092178
SOx	0.00001070	SOx	0.00002761
PM10	0.00009679	PM10	0.00028425
PM2.5	0.00006418	PM2.5	0.00020958
CO2	1.11078571	CO2	2.88143570
CH4	0.00003641	CH4	0.00003765
N2O	0.00001474	N2O	0.00005857
CO2 eqv	1.11611985	CO2 eqv	2.90038172

Scenario Year: **2026**

All model years in the range 1982 to 2026

Passenger Vehicles (pounds/mile)		Delivery Trucks (pounds/mile)	
CO	0.00328779	CO	0.00569435
NOx	0.00027141	NOx	0.00589869
ROG	0.00042052	ROG	0.00088403
SOx	0.00001076	SOx	0.00002716
PM10	0.00009687	PM10	0.00027657
PM2.5	0.00006415	PM2.5	0.00020187
CO2	1.11105829	CO2	2.88298299
CH4	0.00003518	CH4	0.00003581
N2O	0.00001424	N2O	0.00005570
CO2 eqv	1.11621250	CO2 eqv	2.90100126

Notes:

SCAQMD 2008

HHD-DSL composite includes tire & brake wear

Onroad N₂O per Annex 3, Table A-99



**Table G-18 Highest (Most Conservative) EMFAC2007 (version 2.3)
Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks**

Projects in the SCAQMD (Scenario Years 2007 - 2026)
Derived from Peak Emissions Inventory (**Winter, Annual, Summer**)

**Vehicle Class:
Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)**

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model and extracting the **Heavy-Heavy-Duty Diesel Truck (HHDT)** Emission Factors.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle/emission categories listed in the tables below, by use of the following equation:

$$\text{Emissions (pounds per day)} = N \times TL \times EF$$

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

The **HHDT-DSL** vehicle/emission category accounts for all emissions from heavy-heavy-duty diesel trucks, including start, running and idling exhaust. In addition, ROG emission factors account for diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors account for tire and brake wear.

The **HHDT-DSL, Exh** vehicle/emission category includes only the exhaust portion of PM10 & PM2.5 emissions from heavy-heavy-duty diesel trucks.

Scenario Year: **2007**

All model years in the range 1965 to 2007

HHDT-DSL (pounds/mile)	
CO	0.01446237
NOx	0.04718166
ROG	0.00372949
SOx	0.00003962
PM10	0.00230900
PM2.5	0.00204018
CO2	4.22184493
CH4	0.00016312
N2O	0.00015353
CO2 eqv	4.27286406

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00216752
PM2.5	0.00199491

Scenario Year: **2008**

All model years in the range 1965 to 2008

HHDT-DSL (pounds/mile)	
CO	0.01361368
NOx	0.04458017
ROG	0.00351579
SOx	0.00004136
PM10	0.00215635
PM2.5	0.00189990
CO2	4.21067145
CH4	0.00016269
N2O	0.00015312
CO2 eqv	4.26155554

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00201296
PM2.5	0.00185303

Scenario Year: **2009**

All model years in the range 1965 to 2009

HHDT-DSL (pounds/mile)	
CO	0.01282236
NOx	0.04184591
ROG	0.00329320
SOx	0.00004013
PM10	0.00199572
PM2.5	0.00175227
CO2	4.21080792
CH4	0.00015249
N2O	0.00014352
CO2 eqv	4.25850077

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00185393
PM2.5	0.00170680

Scenario Year: **2010**

All model years in the range 1966 to 2010

HHDT-DSL (pounds/mile)	
CO	0.01195456
NOx	0.03822102
ROG	0.00304157
SOx	0.00004131
PM10	0.00183062
PM2.5	0.00160083
CO2	4.21120578
CH4	0.00014201
N2O	0.00013366
CO2 eqv	4.25562112

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00168861
PM2.5	0.00155435



Scenario Year: 2011

All model years in the range 1967 to 2011

HHDT-DSL (pounds/mile)	
CO	0.01112463
NOx	0.03455809
ROG	0.00279543
SOx	0.00003972
PM10	0.00166087
PM2.5	0.00144489
CO2	4.22045680
CH4	0.00012910
N2O	0.00012150
CO2 eqv	4.26083358

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00151936
PM2.5	0.00139772

Scenario Year: 2012

All model years in the range 1968 to 2012

HHDT-DSL (pounds/mile)	
CO	0.01021519
NOx	0.03092379
ROG	0.00252764
SOx	0.00004042
PM10	0.00149566
PM2.5	0.00129354
CO2	4.21590774
CH4	0.00011651
N2O	0.00010966
CO2 eqv	4.25234923

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00135537
PM2.5	0.00124837

Scenario Year: 2013

All model years in the range 1969 to 2013

HHDT-DSL (pounds/mile)	
CO	0.00931790
NOx	0.02742935
ROG	0.00226308
SOx	0.00004086
PM10	0.00133697
PM2.5	0.00114629
CO2	4.21518556
CH4	0.00010441
N2O	0.00009827
CO2 eqv	4.24784287

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00119623
PM2.5	0.00109863

Scenario Year: 2014

All model years in the range 1970 to 2014

HHDT-DSL (pounds/mile)	
CO	0.00846435
NOx	0.02418049
ROG	0.00201594
SOx	0.00004092
PM10	0.00118458
PM2.5	0.00100582
CO2	4.21279345
CH4	0.00009261
N2O	0.00008716
CO2 eqv	4.24175938

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00104243
PM2.5	0.00096059

Scenario Year: 2015

All model years in the range 1971 to 2015

HHDT-DSL (pounds/mile)	
CO	0.00766891
NOx	0.02122678
ROG	0.00178608
SOx	0.00004082
PM10	0.00104715
PM2.5	0.00087977
CO2	4.20902225
CH4	0.00008369
N2O	0.00007877
CO2 eqv	4.23519770

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00090631
PM2.5	0.00083282

Scenario Year: 2016

All model years in the range 1972 to 2016

HHDT-DSL (pounds/mile)	
CO	0.00704604
NOx	0.01887374
ROG	0.00161035
SOx	0.00003952
PM10	0.00094448
PM2.5	0.00078443
CO2	4.21063031
CH4	0.00007508
N2O	0.00007067
CO2 eqv	4.23411393

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00080419
PM2.5	0.00073898



Scenario Year: 2017

All model years in the range 1973 to 2017

HHDT-DSL (pounds/mile)	
CO	0.00650533
NOx	0.01690387
ROG	0.00145203
SOx	0.00004033
PM10	0.00084894
PM2.5	0.00069721
CO2	4.20820129
CH4	0.00006722
N2O	0.00006327
CO2 eqv	4.22922648

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00070873
PM2.5	0.00065111

Scenario Year: 2018

All model years in the range 1974 to 2018

HHDT-DSL (pounds/mile)	
CO	0.00604721
NOx	0.01526414
ROG	0.00131697
SOx	0.00003934
PM10	0.00076808
PM2.5	0.00062383
CO2	4.20756838
CH4	0.00006182
N2O	0.00005818
CO2 eqv	4.22690378

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00062758
PM2.5	0.00057700

Scenario Year: 2019

All model years in the range 1975 to 2019

HHDT-DSL (pounds/mile)	
CO	0.00565433
NOx	0.01389113
ROG	0.00120235
SOx	0.00004032
PM10	0.00070198
PM2.5	0.00056085
CO2	4.20637830
CH4	0.00005499
N2O	0.00005175
CO2 eqv	4.22357577

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00056085
PM2.5	0.00051320

Scenario Year: 2020

All model years in the range 1976 to 2020

HHDT-DSL (pounds/mile)	
CO	0.00532242
NOx	0.01274755
ROG	0.00110621
SOx	0.00003957
PM10	0.00064574
PM2.5	0.00050904
CO2	4.20541416
CH4	0.00005216
N2O	0.00004909
CO2 eqv	4.22172889

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00050364
PM2.5	0.00046227

Scenario Year: 2021

All model years in the range 1977 to 2021

HHDT-DSL (pounds/mile)	
CO	0.00503726
NOx	0.01179977
ROG	0.00103095
SOx	0.00004033
PM10	0.00059437
PM2.5	0.00046287
CO2	4.21495573
CH4	0.00004734
N2O	0.00004455
CO2 eqv	4.22976181

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00045411
PM2.5	0.00041729

Scenario Year: 2022

All model years in the range 1978 to 2022

HHDT-DSL (pounds/mile)	
CO	0.00478830
NOx	0.01098794
ROG	0.00096142
SOx	0.00004106
PM10	0.00055427
PM2.5	0.00042597
CO2	4.21520828
CH4	0.00004448
N2O	0.00004186
CO2 eqv	4.22911963

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00041399
PM2.5	0.00037807



Scenario Year: **2023**

All model years in the range 1979 to 2023

HHDT-DSL (pounds/mile)	
CO	0.00457902
NOx	0.01031407
ROG	0.00090210
SOx	0.00004009
PM10	0.00052122
PM2.5	0.00039592
CO2	4.21483461
CH4	0.00004176
N2O	0.00003931
CO2 eqv	4.22789696

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00037922
PM2.5	0.00034915

Scenario Year: **2024**

All model years in the range 1980 to 2024

HHDT-DSL (pounds/mile)	
CO	0.00444444
NOx	0.00974372
ROG	0.00084009
SOx	0.00003930
PM10	0.00050766
PM2.5	0.00038320
CO2	4.19552935
CH4	0.00003930
N2O	0.00003699
CO2 eqv	4.20782175

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00036682
PM2.5	0.00033735

Scenario Year: **2025**

All model years in the range 1981 to 2025

HHDT-DSL (pounds/mile)	
CO	0.00431086
NOx	0.00932573
ROG	0.00080206
SOx	0.00004018
PM10	0.00048541
PM2.5	0.00036326
CO2	4.19512979
CH4	0.00003697
N2O	0.00003479
CO2 eqv	4.20669226

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00034397
PM2.5	0.00031664

Scenario Year: **2026**

All model years in the range 1982 to 2026

HHDT-DSL (pounds/mile)	
CO	0.00420297
NOx	0.00898990
ROG	0.00077178
SOx	0.00003946
PM10	0.00046717
PM2.5	0.00034564
CO2	4.19349747
CH4	0.00003630
N2O	0.00003417
CO2 eqv	4.20485099

HHDT-DSL, Exh (pounds/mile)	
PM10	0.00032670
PM2.5	0.00029830

Notes:

SCAQMD 2008

HHDT-DSL composite includes tire & brake wear

Onroad N₂O per Annex 3, Table A-99

G-19 Dry Air Composition

Table G-19 Standard Composition of Dry Air

Principal Gas	Chemical Symbol	MW	Concentration	Fraction	MW
		g/mole	ppmv	percent	g/mole
Nitrogen	N ₂	28.014	780,805.00	78.080500	21.873471
Oxygen	O ₂	31.998	209,450.00	20.945000	6.701981
Argon	Ar	39.948	9,340.00	0.934000	0.373114
Carbon Dioxide	CO ₂	44.009	377.76	0.037776	0.016625
Neon	Ne	20.183	18.21	0.001821	0.000368
Helium	He	4.003	5.24	0.000524	0.000021
Methane	CH ₄	16.043	1.75	0.000175	0.000028
Krypton	Kr	83.800	1.14	0.000114	0.000096
Hydrogen	H ₂	2.016	0.50	0.000050	0.000001
Nitrous Oxide	N ₂ O	44.013	0.31	0.000031	0.000014
Xenon	Xe	131.300	0.09	0.000009	0.000012
Totals			1,000,000.00	100.000	28.966

Sources: UIG 2008, USEPA 2010, du Pont 1971, Jennings 1970

Notes:
 MW = molecular weight, g/mole
 ppmv = parts per million by volume (10⁻⁶)

USEPA GHG Inventory 2010

Universal Industrial Gases, Inc., <http://www.uigi.com/air.html>

Condensed Laboratory Handbook, E.I. du Pont de Nemours & Co., Inc., Wilmington, DE, 1971

Environmental Engineering – Analysis and Practice, B. H. Jennings, International Textbook Company, 1970

Carbon dioxide varies with uptake by removal mechanisms, 365 (IPCC) to 380 ppmv (UIG)