# Vulcan Landing Way Pier Dredging and Maintenance Supporting Air Quality and Greenhouse Gas Emissions Assumptions and Calculations

## **Air Emission Calculation Methodology**

Regulatory models used to estimate air quality impacts included:

- California Air Resources Board (CARB) EMFAC¹ emissions inventory model.
   EMFAC is the latest emission inventory model that calculates emission inventories and emission rates for motor vehicles operating on roads in California. This model reflects CARB's current understanding of how vehicles travel and how much they emit. EMFAC can be used to show how California motor vehicle emissions have changed over time and are projected to change in the future.
- CARB OFFROAD<sup>2</sup> emission factors derived from CalEEMod Version 2022.1 User Guide Appendix G. OFFROAD is the latest emission inventory model that calculates emission inventories and emission rates for off-road equipment such as loaders, excavators, and off-road haul trucks operating in California. This model reflects CARB's current understanding of how equipment operates and how much they emit. OFFROAD can be used to show how California off-road equipment emissions have changed over time and are projected to change in the future.
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
   Harborcraft, Dredge, and Barge Emission Factors Calculator<sup>3</sup>, which estimates
   emission rates for harbor craft engines based on CARB emission estimation
   databases.

The air quality analysis includes a review of criteria pollutant emissions such as carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOC) also referred

https://www.caleemod.com/documents/user-guide/01\_User%20Guide.pdf

https://www.airquality.org/Residents/CEQA-Land-Use-Planning/CEQA-Guidance-Tools

<sup>&</sup>lt;sup>1</sup> California Air Resources Board (CARB). *EMFAC2021 User's Guide*. January 15, 2021. https://ww2.arb.ca.gov/our-work/programs/msei/emfac2021-model-and-documentation

<sup>&</sup>lt;sup>2</sup> California Air Pollution Control Officers Association (CAPCOA). California Emissions Estimator Model User Guide Version 2022.1. April 2022.

<sup>&</sup>lt;sup>3</sup> Sacramento Metropolitan Air Quality Management District (SMAQMD). Harborcraft, Dredge, and Barge Emission Factors. July 2017.

to as reactive organic gases (ROG), particulate matter less than 10 micrometers (coarse or PM10), particulate matter less than 2.5 micrometers (fine or PM2.5). Greenhouse gas (GHG) emissions were also estimated in terms of metric tons of CO<sub>2</sub> equivalents (CO<sub>2</sub>e).

### **Construction Emissions Assumptions**

Work would be conducted during the month of September to accommodate the multiple environmental work windows of species that could occur in the area. Typical construction activities would occur between 8:00 a.m. to 5:00 p.m. Monday through Friday. No noise generating construction would occur on Saturdays, Sundays, or federal holidays.

The dredging activity is expected to require the following equipment:

- Crane barge and associated clam shell bucket for removing sediment
- Tugboats for crane barge positioning and dump cycle runs
- Support barges, including flat deck barges, utilizing anchors and/or spuds
- Support vessels for moving barges
- Small support vessels for crew transportation
- On-barge forklift for materials movement

**Table 1** provides details for the proposed use of construction equipment. Maintenance dredging would be conducted during the month of September on an as-needed basis up to one episode per 10-year permit period. Therefore, construction equipment needed for one episode would be 50 percent of the days listed in **Table 1**.

**Table 1. Estimated Equipment Requirements** 

<b>Equipment Type</b>	Quantity	Horsepower	Operating Hours per Day	Days
Crane Barge	1	330	10	6
Tug Boat 1	1	600	4.5	6
Tug Boat 2	1	1200	12	6
Support Barges	2	15	6	6
Support Vessels	1	60	10	6
Small Support	1	50	2	6
Vessels				
Crane	1	20	2	6
Forklift	1	250	2	2

**Table 2** provides pickup and delivery round trips and trip lengths for each construction episode.

Table 2. Pickup and Delivery Trip Requirements

Source	Round Trips	Round Trip Miles per Trip
Heavy Equipment Mobilization/	4	120
Demobilization		
Export/Disposal	4	84
Solid Waste Disposal	2	140

#### **Construction Emissions Results**

**Table 3** provides the estimated average daily construction combustion emissions and **Table 4** provides the estimated annual construction GHG emissions.

Table 3. Average Daily Construction Combustion Emissions (lbs./day)

Source	ROG	CO	N0x	PM10	PM2.5
Offroad Mobile Equipment and	5.19	89.99	39.34	1.13	1.03
Harborcraft					
Onroad Vehicles	0.00	0.30	0.59	0.05	0.03
Total	5.19	90.29	39.93	1.18	1.06

Table 4. Annual Construction GHG Emissions (metric tons/year)

Source	CO <sub>2</sub> e
Offroad Mobile Equipment and Harborcraft	39
Onroad Vehicles	2
Total	41

## **Attachments**

- Construction Emissions Summary Offroad Mobile (1 page)
- Equipment Emissions Onroad (1 page)
- Motor Vehicle Emissions (1 page)
- Harborcraft, Dredge, and Barge Emission Factors Model Output (1 page)

# **Vulcan Landing Construction Emissions Summary**

	Average D	aily Emissio	ns (pounds/	day)		Annual En	Annual Emissions (metric tons/year)				
	ROG	CO	C02e	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	N0x	PM <sub>10</sub>	PM <sub>2.5</sub>	CO2e
Offroad											
Mobile											
Equipment											
<b>Emissions</b>	5.19	89.99	39.34	1.13	1.03	0.02	0.27	0.12	0.00	0.00	39
Onroad											
Vehicle											
<b>Emissions</b>	0.00	0.30	0.59	0.05	0.03	0	0	0	0	0	2
TOTAL	5.19	90.29	39.93	1.18	1.06	0.02	0.27	0.12	0	0	41

## Offroad Mobile Equipment Combustion Emissions - Vulcan Landing

						Emissio	on Factor (	g/hp-hour)						Averag	e Daily Em	issions (I	bs/day)		Annual	Annual Emissions (tons/year)						
Equipment Type	Quantity	Horsepower	Hours Per Day	Load Factor	Days	ROG	ROG NOX PM <sub>10</sub> PM <sub>25</sub> CO CO <sub>2</sub> CH <sub>4</sub> N2O RO									PM <sub>10</sub>	PM <sub>2.5</sub>	CO	ROG	NOx	PM <sub>10</sub>	PM <sub>2.5</sub>	CO	CO2e		
Dredge (Crane	1	330	10	0.45	6	0.0500	0.2600	0.0100	0.0100	2.6000	786.1184	0.0319	0.0064	0.1637	0.8512	0.0327	0.0327	8.5120	0.0005	0.0026	0.0001	0.0001	0.0255	7.0299		
Barge) Support Barge	2	15	6	0.45	6	0.6446	4.3913	0.3982	0.3594	4.8927	786.1184	0.0319	0.0064	0.1037	0.7842	0.0327	0.0327	0.8737	0.0003	0.0026	0.0001	0.0001	0.0255	0.3834		
Support Vessel	1	60	10	0.45	6	0.9124	5.7494	0.3456	0.3102	4.3268	591.0446	0.0240	0.0048	0.5431	3.4223	0.2057	0.1846	2.5755	0.0016	0.0103	0.0006	0.0006	0.0077	0.9610		
Small Support																										
Vessel Crane	1 1	50 20	2	0.45 0.29	6	1.9570 1.2350	5.3460 4.8640	0.3144 0.3820	0.2838 0.3510	5.2593 5.7220	591.0446 586.6070	0.0240 0.0240	0.0048	0.1941 0.0316	0.5304 0.1244	0.0312	0.0282	0.5218 0.1463	0.0006	0.0016 0.0004	0.0001	0.0001	0.0016	0.1602 0.0410		
Forklift	1	250	2	0.2	2	0.1910	1.5800	0.0600	0.0550	1.2080	528.2440	0.0210	0.0040	0.0140	0.1161	0.0044	0.0040	0.0888	0.0000	0.0001	0.0000	0.0000	0.0001	0.0353		
Tugboat 1	1	600	4.5	0.5	6	0.5922 4.1608 0.0899 0.0811 4.1740 591.0446 0.0240 0.0048 1									12.3834	0.2676	0.2414	12.4230	0.0053	0.0372	0.0008	0.0007	0.0373	4.8049		
Tugboat 2	1	1200	12	0.5	6	0.1490	1.3310	0.0321	0.0290	4.0852	591.0446	0.0240	0.0048	2.3659	21.1272	0.5093	0.4609	64.8461	0.0071	0.0634	0.0015	0.0014	0.1945	25.6263		
			L			_								5.19	39.34	1.13	1.03	89.99	0.02	0.12	0.00	0.00	0.27			

Source 1: CARB Emission Factors Derived From Sacramento Metropolitan AQMD Harborcraft Calculator

Source 2: CARB Emission Factors Derived From CalEEMod Users Guide 08 Appendix G

Assumptions: 6 days of construction (two episodes per year); 2025 First Year of Construction

# **Motor Vehicle Combustion Emissions - Vulcan Landing**

				Emission	Factor (g	/mile)						Average	Daily Emi	ssions (po	ounds/day		Annual E	missions	Annual Emissions (metric tons/year)			
	Total Episode Round	Average	Total Proiect																			
Vehicle Type				ROG	CO	N0x	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	NOx	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	CO	N0x	PM <sub>2.5</sub>	PM <sub>10</sub>	CO2e
Dump Trucks (solid																						
waste)	2	140.0	280.0	0.02	0.51	1.47	1,654	0.064	0.264	0.13	0.05	0.00	0.05	0.15	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0
Dump Trucks																						
(export/disposal)	4	84.0	336.0	0.02	0.51	1.47	1,654	0.064	0.264	0.13	0.05	0.00	0.06	0.18	0.02	0.01	0.00	0.00	0.00	0.00	0.00	1
Haul Trucks																						
(mobilization/																						
demobilization)	4	120.0	480.0	0.02	1.06	1.50	1,507	0.117	0.244	0.13	0.06	0.00	0.19	0.26	0.02	0.01	0.00	0.00	0.00	0.00	0.00	1

Source: EMFAC 2021

Assumptions: 6 days of construction per episode; 2025 First Year of Construction

# **SMAQMD** Harborcraft, Dredge and Barge Emission Factor Calculator - Main Engine Emission Rates

**Calendar Year: 2025** Number of Entries: 5

			Emission Rates (lb/hr; estimates for each row are totals over the number of engines																						
Vessel/Engine Inform	nation					listed in column J for that row)										Emission Rates for a Single Engine (g/bhp-hr)									
		Engine	Engine	Engine																					
	Vessel	Model	Rated	Load	Number of																				
Vessel Name	Туре	Year	Power (hp)	Factor	engines	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	ROG	CO	<b>SO</b> <sub>2</sub>	CO <sub>2</sub>	CH <sub>4</sub>	$N_2O$	CO₂e	PM <sub>10</sub>	PM <sub>2.5</sub>	N0x	ROG	CO	SO <sub>2</sub>	CO <sub>2</sub>	CH <sub>4</sub>	$N_2O$	CO₂e
Support Barges	Barge	2008	15	0.45	1	0.006	0.005	0.065	0.010	0.073	0.000	11.698	0.000	0.000	11.739	0.398	0.359	4.391	0.645	4.893	0.007	786.118	0.032	0.006	788.8
	Work																								
Support Vessel	Boats	2008	60	0.45	1	0.021	0.018	0.342	0.054	0.258	0.000	35.182	0.001	0.000	35.303	0.346	0.310	5.749	0.912	4.327	0.006	591.045	0.024	0.005	593.1
	Work																								
Small Support	Boats	2008	50	0.45	1	0.016	0.014	0.265	0.097	0.261	0.000	29.318	0.001	0.000	29.419	0.314	0.284	5.346	1.957	5.259	0.006	591.045	0.024	0.005	593.1
Tugboat 1	Tug Boats	2015	600	0.50	1	0.059	0.054	2.752	0.392	2.761	0.004	390.909	0.016	0.003	392.251	0.090	0.081	4.161	0.592	4.174	0.006	591.045	0.024	0.005	593.1
Tugboat 2	Tug Boats	2017	1200	0.50	1	0.042	0.038	1.761	0.197	5.404	0.007	781.819	0.032	0.006	784.502	0.032	0.029	1.331	0.149	4.085	0.006	591.045	0.024	0.005	593.1