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) EMFAC[1] 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[2] 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[3], 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_x), volatile organic compounds (VOC) also referred

[1] 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

[2] California Air Pollution Control Officers Association (CAPCOA). *California Emissions Estimator Model User Guide Version 2022.1*. April 2022. https://www.caleemod.com/documents/user-guide/01_User%20Guide.pdf

[3] Sacramento Metropolitan Air Quality Management District (SMAQMD). Harborcraft, Dredge, and Barge Emission Factors. July 2017. https://www.airquality.org/Residents/CEQA-Land-Use-Planning/CEQA-Guidance-Tools

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_2 equivalents (CO_2e).

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

Equipment Type	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 Vessels	1	50	2	6
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/ Demobilization	4	120
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	NOx	PM10	PM2.5
Offroad Mobile Equipment and Harborcraft	5.19	89.99	39.34	1.13	1.03
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_2e
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 Daily Emissions (pounds/day)					Annual Emissions (tons/year)					Annual Emissions (metric tons/year)
	ROG	CO	CO2e	PM_{10}	$PM_{2.5}$	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	CO2e
Offroad Mobile Equipment Emissions	5.19	89.99	39.34	1.13	1.03	0.02	0.27	0.12	0.00	0.00	39
Onroad Vehicle Emissions	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

						Emission Factor (g/hp-hour)								Average Daily Emissions (lbs/day)					Annual Emissions (tons/year)					Annual Emissions (Metric tons/year)
Equipment Type	Quantity	Horsepower	Hours Per Day	Load Factor	Days	ROG	NOx	PM_{10}	$PM_{2.5}$	CO	CO_2	CH_4	N2O	ROG	NOx	PM_{10}	$PM_{2.5}$	CO	ROG	NOx	PM_{10}	$PM_{2.5}$	CO	CO2e
Dredge (Crane Barge)	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
Support Barge	2	15	6	0.45	6	0.6446	4.3913	0.3982	0.3594	4.8927	786.1184	0.0319	0.0064	0.1151	0.7842	0.0711	0.0642	0.8737	0.0003	0.0024	0.0002	0.0002	0.0026	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	1	50	2	0.45	6	1.9570	5.3460	0.3144	0.2838	5.2593	591.0446	0.0240	0.0048	0.1941	0.5304	0.0312	0.0282	0.5218	0.0006	0.0016	0.0001	0.0001	0.0016	0.1602
Crane	1	20	2	0.29	6	1.2350	4.8640	0.3820	0.3510	5.7220	586.6070	0.0240	0.0050	0.0316	0.1244	0.0098	0.0090	0.1463	0.0001	0.0004	0.0000	0.0000	0.0004	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	1.7625	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
														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 Emissions (pounds/day)					Annual Emissions (tons/year)					Annual Emissions (metric tons/year)
Vehicle Type	Total Episode Round Trips	Average RT VMT	Total Project VMT	ROG	CO	NOx	CO_2	CH_4	N_2O	PM_{10}	$PM_{2.5}$	ROG	CO	NOx	PM_{10}	$PM_{2.5}$	ROG	CO	NOx	$PM_{2.5}$	PM_{10}	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

Vessel/Engine Information						Emission Rates (lb/hr; estimates for each row are totals over the number of engines listed in column J for that row)										Emission Rates for a Single Engine (g/bhp-hr)									
Vessel Name	Vessel Type	Engine Model Year	Engine Rated Power (hp)	Engine Load Factor	Number of engines	PM_{10}	$PM_{2.5}$	NOx	ROG	CO	SO_2	CO_2	CH_4	N_2O	CO_2e	PM_{10}	$PM_{2.5}$	NOx	ROG	CO	SO_2	CO_2	CH_4	N_2O	CO_2e
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
Support Vessel	Work 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
Small Support	Work 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