

Appendix 2

Air Quality Calculations

Lake Gregory Project

Emission Calculation Assumptions

General Assumptions

- 1) Work occurs 5 days a week, 7 am to 3:30 pm, excepting major holidays (average 22/23 days/month).

Onroad Equipment Emission Calculations Assumptions

- 1) CARB EMFAC model emission factors for the South Coast Air Basin provided on SCAQMD's CEQA Website are using the three vehicles classes they list (passenger, delivery, and heavy-heavy duty truck)
- 2) Heavy haul trip estimates are based on raw material import/export trips of 10 cubic yards per truck load
- 3) Trip distance assumptions: 30 miles/round trip for construction workers, crew trucks and other delivery sized vehicles, and 20 miles per trip for water trucks (for road dust calculations only), 40 miles/round trip for equipment fueling trucks, 0.1 miles for dam site dump trucks moving stockpiled fill to the dam face within the 2-acre site, and bulk material and waste trucks trip distances were calculated based on the assumed haul routes for each.

Offroad Equipment Emission Calculation Assumptions

- 1) CARB OFFROAD model emission factors for the SCAQMD CEQA website were used, and load factors revised per latest CARB guidance
- 2) Gasoline equipment emission factors are estimated based on the rate in g/hp-hr provided in the Gasoline Equipment Emission Factor Rates table for EPA/ARB compliant four-cycle engines.

Fugitive Dust Emission Calculations Assumptions

- 1) Fugitive dust emissions are estimated using AP-42 and SCAQMD CEQA Handbook.
- 2) Unpaved travel distance assumes workers park on street (no unpaved travel) and other vehicles transit unpaved areas as necessary.
- 3) Total area to be disturbed is 10 acres.

Greenhouse Gas Emission Calculations Assumptions

- 1) GHG emissions are estimated based on guideline and emission factors provided by The Climate Registry General Reporting Protocol
- 2) For diesel-fueled equipment, fuel consumption rate of 0.38 lbs/bhp-hr and density of 6.8 lbs/gallon are used.
- 3) For gasoline-fueled equipment, fuel consumption rate of 0.47 lbs/bhp-hr and density of 6.0 lbs/gallon are used.

Lake Gregory Project

Construction Schedule and Equipment/Vehicle Use Assumptions

Phase	Duration (work days)	Employees	Quantity
1 Site Preparation; Road and Utilities Relocation	25	20	
2 Materials Import, Borrow Site Excavation	80	14	70000 cu yd
3 Buttress Construction and Rock Slope Protection Placement	100	20	70000 cu yd
4 Site Reclamation and Street Improvements	40	14	

Phase	Month/Weeks							
	1	2	3	4	5	6	7	8
1	XXXX	X						
2		XXX	XXXX	XXXX	XXXX	X		
3		XX	XXXX	XXXX	XXXX	XXXX	XX	
4						XXX	XXXX	X
Days	March 23	April 20	May 22	June 23	July 22	July 23	August 23	September 23

Onroad Equipment Use

Phase	Onroad Equipment	Type	Veh. Type	Total VMT/Trip	Unpaved VMT/Trip	Trips/Day	Total Trips	Total		Unpaved		Paved		Sediment Haul Site Notes	
								VMT/Day	Total VMT	VMT/Day	Total VMT	VMT/Day	Total VMT		
1	Site Preparation; Road and Utilities Relocation	Employee Vehicle	Onroad	Passenger	30	0	20	500	600	15,000	0	0	600	15,000	
	Crew Trucks	Onroad	Delivery	30	0.1	1	20	30	600	0	2	30	598		
	Tree Waste Haul Trucks	Onroad	HHDT	24	0.1	2	20	48	480	0	2	48	478		
	Equipment Delivery	Onroad	HHDT	30	0.1	10	20	300	600	1	2	299	598		
2	Materials Import, Borrow Site Excavation	Employee Vehicle	Onroad	Passenger	30	0	14	1,120	420	33,600	0	0	420	33,600	
	Crew Trucks	Onroad	Delivery	30	0.1	1	80	30	2,400	0	8	30	2,392		
	Tree Waste Haul Trucks	Onroad	HHDT	26.8	0.4	2	20	54	536	1	8	53	528	Ponderosa East	
	Tree Waste Haul Trucks	Onroad	HHDT	27.15	0.75	2	20	54	543	2	15	53	528	Ponderosa West	
	Haul Trucks	Onroad	HHDT	20	0.1	100	2,000	2,000	40,000	10	200	1,990	39,800	Papoose Dam	
	Haul Trucks	Onroad	HHDT	4.4	0.1	150	1,000	660	4,400	15	100	645	4,300	Thousand Pines	
	Haul Trucks	Onroad	HHDT	42	0.1	60	2,000	2,520	84,000	6	200	2,514	83,800	Redlands	
	Haul Trucks	Onroad	HHDT	2.8	0.4	150	2,000	420	5,600	60	800	360	4,800	Ponderosa East	
	Haul Trucks	Onroad	HHDT	3.15	0.75	150	2,000	473	6,300	113	1,500	360	4,800	Ponderosa West	
3	Buttress Construction and Rock Slope Protection Placement	Employee Vehicle	Onroad	Passenger	30	0	20	2,000	600	60,000	0	0	600	60,000	
	Crew Trucks	Onroad	Delivery	30	0.1	1	65	30	1,950	0	7	30	1,944		
	Haul Trucks	Onroad	HHDT	24	0.1	8	120	192	2,880	1	12	191	2,868		
	Dump Trucks	Onroad	HHDT	0.1	0.1	140	7,000	14	700	14	700	0	0		
4	Site Reclamation and Street Improvements	Employee Vehicle	Onroad	Passenger	30	0	14	560	420	16,800	0	0	420	16,800	
	Crew Trucks	Onroad	Delivery	30	0.1	1	30	30	900	0	3	30	897		
	Equipment Removal	Onroad	HHDT	30	0.1	4	20	120	600	0	2	120	598		
	Hydroseeding	Onroad	Delivery	30	0.1	1	10	30	300	0	1	30	299		
	Haul Trucks	Onroad	HHDT	30	0.1	2	80	60	2,400	0	8	60	2,392		
n/a	Daily Support	Fuel Truck	Onroad	Delivery	40	1	1	150	40	6,000	1	150	39	5,850	
	Water Truck	Offroad	N/A	20	20	2	195	40	3,900	40	3,900	0	0		

Passenger	125,400		0	125,400
Delivery	12,150		171	11,980
HHDT	149,039		7,449	145,490

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Construction Schedule and Equipment/Vehicle Use Assumptions

	Equipment Type	Horsepower	Number	Hours / Day	# Days
Phase	<i>Site Preparation; Road and Utilities Relocation</i>				
1	Hydraulic Crane (50 ton)	173	2	8	5
	Bulldozer	305	2	8	20
	Grader	220	2	8	20
	Backhoe Loader	129	2	4	20
	Whole Tree Chipper	500	1	4	20
	Chainsaws	6	4	8	20
	Water Trucks	457	1	8	20
	Paving Machine	121	1	8	20
	Dump Trucks	ND*	3	8	20
	<i>Materials Import, Borrow Site Excavation</i>				
2	Haul Trucks	ND*	15	8	80
	Tree Haul Trucks	ND*	1	8	20
	Whole Tree Chipper	500	1	8	20
	Chainsaws	6	4	8	20
	Excavator	188	1	8	80
	Bulldozer	305	1	8	80
	Backhoe Loader	129	1	8	80
	Grader	220	1	8	65
	Water Truck	457	1	8	80
	<i>Buttress Construction and Rock Slope Protection Placement</i>				
3	Backhoe Loader	129	1	8	65
	Bulldozer	305	1	8	65
	Grader	220	1	8	65
	Sheepsfoot / Roller / Tamper	240	1	8	65
	Water Trucks	457	1	8	65
	Excavator	188	1	8	40
	Hydraulic Crane (50 ton)	173	2	8	5
	Grout Pump	43	1	8	30
	Haul Trucks	ND*	2	8	15
	Dump Trucks	ND*	3	8	65
	<i>Site Reclamation and Street Improvements</i>				
4	Paving Machine	121	1	8	5
	Compressor	100	1	8	30
	Water Truck	457	1	8	30
	Grader	220	1	8	10
	Roller/Compactor	150	1	8	5
	Hydroseeding Truck	ND*	1	8	10
	Service Truck	ND*	2	8	30

* - ND* means no data necessary for these equipment items that have their emissions calculated using on-road engine emission factors.

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Construction - Mitigated Emissions Summary

Maximum Daily Emissions (lbs/day)

Phase 2 and Phase 3, During Excavation of Ponderosa West Borrow Site

	VOC	CO	NOx	SOx	PM10	PM2.5
Onroad Vehicles	6.04	29.87	63.12	0.14	3.21	2.65
Offroad Equipment	29.23	107.16	72.86	0.13	3.16	2.91
Fugitive Dust	---	---	---	---	273.72	36.46
Total	35.27	137.03	135.98	0.27	280.10	42.03
SCAQMD Significance Thresholds	75	550	100	150	150	55
<i>Exceeds Thresholds?</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>

Total Emissions (tons)

	VOC	CO	NOx	SOx	PM10	PM2.5
Onroad Vehicles	0.17	0.94	1.48	0.00	0.08	0.06
Offroad Equipment	0.74	2.74	2.61	0.00	0.11	0.10
Fugitive Dust	---	---	---	---	6.60	1.02
Total	0.91	3.67	4.09	0.01	6.79	1.19

Total GHG Emissions (Tons)

	CO2	N2O	CH4	CO2e
Onroad Vehicles	356.82	0.00	0.00	357.37
Offroad Equipment	545.66	0.03	0.01	550.61
Total	902.48	0.03	0.02	907.98
Amortized Emissions (50 Year Project Life)				18.16
SCAQMD Significance Thresholds				10,000
<i>Exceeds Thresholds?</i>				<i>No</i>

Mitigated Maximum Daily Emissions (lbs/day)

Excavation, Placement of Enbankment, Loading & Hauling

	VOC	CO	NOx	SOx	PM10	PM2.5
Onroad Vehicles	6.04	29.87	63.12	0.14	3.21	2.65
Offroad Equipment	24.96	107.16	65.83	0.13	3.23	2.97
Fugitive Dust	---	---	---	---	115.73	20.51
Total	31.01	137.03	128.95	0.27	122.18	26.14
SCAQMD Significance Thresholds	75	550	100	150	150	55
<i>Exceeds Thresholds?</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>No</i>

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Construction- Onroad Vehicles Emission Calculations

Assumption:

1. CARB EMFAC model emission factors from SCAQMD CEQA website (2016 fleet average)

Onroad Emission Factors - 2016 (lbs/mile)

	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	0.00063	0.00576	0.00056	0.00001	0.00009	0.00006
Delivery	0.00162	0.01081	0.01173	0.00003	0.00047	0.00038
Heavy-Heavy Duty	0.00161	0.00705	0.01887	0.00004	0.00094	0.00078

Daily Emissions

Site Preparation; Road and Utilities Relocation

Vehicle Type	Daily VMT	Daily Emissions (lbs/day)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	600	0.38	3.45	0.33	0.01	0.06	0.04
Delivery	30	0.05	0.32	0.35	0.00	0.01	0.01
Heavy-Heavy Duty	348	0.56	2.45	6.57	0.01	0.33	0.27
Totals		0.99	6.23	7.25	0.02	0.40	0.32

Materials Import, Borrow Site Excavation

Vehicle Type	Daily VMT	Daily Emissions (lbs/day)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	420	0.27	2.42	0.23	0.00	0.04	0.03
Delivery	30	0.05	0.32	0.35	0.00	0.01	0.01
Heavy-Heavy Duty	4,520	7.28	31.85	85.31	0.18	4.27	3.55
Totals		7.59	34.59	85.89	0.18	4.32	3.58

Buttress Construction and Rock Slope Protection Placement

Vehicle Type	Daily VMT	Daily Emissions (lbs/day)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	600	0.38	3.45	0.33	0.01	0.06	0.04
Delivery	30	0.05	0.32	0.35	0.00	0.01	0.01
Heavy-Heavy Duty	206	0.33	1.45	3.89	0.01	0.19	0.16
Totals		0.76	5.23	4.57	0.02	0.26	0.21

Site Reclamation and Street Improvements

Vehicle Type	Daily VMT	Daily Emissions (lbs/day)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	420	0.27	2.42	0.23	0.00	0.04	0.03
Delivery	60	0.10	0.65	0.70	0.00	0.03	0.02
Heavy-Heavy Duty	180	0.29	1.27	3.40	0.01	0.17	0.14
Totals		0.65	4.33	4.33	0.01	0.24	0.19

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Construction- Onroad Vehicles Emission Calculations

Daily Support

Vehicle Type	Daily VMT	Daily Emissions (lbs/day)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	--	--	--	--	--	--	--
Delivery	40	0.06	0.43	0.47	0.00	0.02	0.02
Heavy-Heavy Duty	--	--	--	--	--	--	--
Totals		0.06	0.43	0.47	0.00	0.02	0.02

Maximum Overlap (Phase 2 during Ponderosa Exc./Hauling and Phase 3)

Vehicle Type	Daily VMT	Maximum Daily Emissions (lbs/day)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	1,020	0.65	5.87	0.57	0.01	0.10	0.06
Delivery	100	0.16	1.08	1.17	0.00	0.05	0.04
Heavy-Heavy Duty	3,252	5.24	22.91	61.38	0.13	3.07	2.55
Totals		6.04	29.87	63.12	0.14	3.21	2.65

Total Emissions

Site Preparation; Road and Utilities Relocation

Vehicle Type	Total VMT	Total Emissions (lbs)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	15,000	9.49	86.37	8.35	0.16	1.41	0.92
Delivery	600	0.97	6.48	7.04	0.02	0.28	0.23
Heavy-Heavy Duty	1,080	1.74	7.61	20.38	0.04	1.02	0.85
Totals		12.20	100.46	35.77	0.22	2.71	1.99

Materials Import, Borrow Site Excavation

Vehicle Type	Total VMT	Total Emissions (lbs)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	33,600	21.25	193.47	18.70	0.36	3.16	2.06
Delivery	2,400	3.88	25.93	28.15	0.07	1.12	0.91
Heavy-Heavy Duty	141,379	227.67	996.16	2,668.35	5.59	133.53	110.90
Totals		252.80	1,215.56	2,715.20	6.01	137.80	113.87

Buttress Construction and Rock Slope Protection Placement

Vehicle Type	Total VMT	Total Emissions (lbs)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	60,000	37.95	345.48	33.39	0.64	5.63	3.68
Delivery	1,950	3.15	21.07	22.87	0.05	0.91	0.74
Heavy-Heavy Duty	3,580	5.77	25.22	67.57	0.14	3.38	2.81
Totals		46.87	391.78	123.83	0.84	9.93	7.23

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Construction- Onroad Vehicles Emission Calculations

Site Reclamation and Street Improvements

Vehicle Type	Total VMT	Total Emissions (lbs)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	16,800	10.63	96.73	9.35	0.18	1.58	1.03
Delivery	1,200	1.94	12.97	14.07	0.03	0.56	0.45
Heavy-Heavy Duty	3,000	4.83	21.14	56.62	0.12	2.83	2.35

Totals	17.40	130.84	80.05	0.33	4.97	3.84
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Daily Support

Vehicle Type	Total VMT	Total Emissions (lbs)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	--	--	--	--	--	--	--
Delivery	6,000	9.69	64.83	70.37	0.17	2.80	2.27
Heavy-Heavy Duty	--	--	--	--	--	--	--

Totals	9.69	64.83	70.37	0.17	2.80	2.27
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Total Emissions

Vehicle Type	Total VMT	Total Emissions (lbs)					
	Total	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	125,400	79.32	722.05	69.79	1.34	11.78	7.69
Delivery	12,150	19.62	131.29	142.51	0.34	5.66	4.60
Heavy-Heavy Duty	145,490	234.29	1,025.13	2,745.94	5.75	137.41	114.13

Totals	333.24	1,878.47	2,958.24	7.43	154.85	126.42
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Construction- Offroad Equipment Unmitigated Emission Calculations

Assumptions:

1. CARB OFFROAD model emission factors from SCAQMD CEQA website (2016 fleet average), with CARB load factor corrections from OFFROAD2011
2. Gasoline equipment emission factors are estimated based on the rate in g/hp-hr provided in the Gasoline Equipment Emission Factor Rates table for EPA/ARB compliant four-cycle engines.

Offroad Emission Factors - 2016 (pounds/hour)

	Primary Offroad Equipment	HP	Number	Off-road Emission Factor (lbs/hr)					Hrs/day	Days
				ROG	CO	NOx	SOx	PM		
Site Preparation; Road and Utilities Relocation	Hydraulic Crane (50 ton)	173	2	0.0572	0.3158	0.4027	0.0006	0.0231	8	5
	Bulldozer	305	2	0.1098	0.3474	0.9022	0.0013	0.0342	8	20
	Grader	220	2	0.0824	0.3524	0.6477	0.0011	0.0270	8	20
	Backhoe Loader	129	2	0.0378	0.2567	0.2574	0.0005	0.0173	4	20
	Whole Tree Chipper	500	1	0.1494	0.5027	1.2837	0.0024	0.0432	4	20
	Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20
	Water Trucks	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	20
	Paving Machine	121	1	0.0780	0.3320	0.4738	0.0005	0.0395	8	20
Materials Import, Borrow Site Excavation	Whole Tree Chipper	500	1	0.1494	0.5027	1.2837	0.0024	0.0432	8	20
	Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20
	Excavator	188	1	0.0658	0.4055	0.4525	0.0009	0.0226	8	80
	Bulldozer	305	1	0.1098	0.3474	0.9022	0.0013	0.0342	8	80
	Backhoe Loader	129	1	0.0378	0.2567	0.2574	0.0005	0.0173	8	80
	Grader	220	1	0.0824	0.3524	0.6477	0.0011	0.0270	8	65
	Water Truck	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	80
Buttress Construction and Rock Slope Protection Placement	Backhoe Loader	129	1	0.0378	0.2567	0.2574	0.0005	0.0173	8	65
	Bulldozer	305	1	0.1098	0.3474	0.9022	0.0013	0.0342	8	65
	Grader	220	1	0.0824	0.3524	0.6477	0.0011	0.0270	8	65
	Sheepsfoot / Roller / Tamper	240	1	0.0694	0.2548	0.6464	0.0011	0.0231	8	65
	Water Trucks	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	65
	Excavator	188	1	0.0658	0.4055	0.4525	0.0009	0.0226	8	40
	Hydraulic Crane (50 ton)	173	2	0.0572	0.3158	0.4027	0.0006	0.0231	8	5
	Grout Pump	43	1	0.0422	0.1522	0.1688	0.0003	0.0115	8	30
Site Reclamation and Street Improvements	Paving Machine	121	1	0.0780	0.3320	0.4738	0.0005	0.0395	8	5
	Compressor	100	1	0.0424	0.1934	0.2279	0.0003	0.0190	8	30
	Water Truck	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	30
	Grader	220	1	0.0824	0.3524	0.6477	0.0011	0.0270	8	10
	Roller/Compactor	150	1	0.0616	0.3440	0.4447	0.0007	0.0283	8	5

Site Preparation; Road and Utilities Relocation

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Hydraulic Crane (50 ton)	173	2	0.0572	0.3158	0.4027	0.0006	0.0231	8	5	0.92	5.05	6.44	0.01	0.37	4.58	25.27	32.21	0.05	1.85
Bulldozer	305	2	0.1098	0.3474	0.9022	0.0013	0.0342	8	20	1.76	5.56	14.43	0.02	0.55	35.14	111.17	288.69	0.43	10.93
Grader	220	2	0.0824	0.3524	0.6477	0.0011	0.0270	8	20	1.32	5.64	10.36	0.02	0.43	26.37	112.76	207.27	0.37	8.65
Backhoe Loader	129	2	0.0378	0.2567	0.2574	0.0005	0.0173	4	20	0.30	2.05	2.06	0.00	0.14	6.05	41.07	41.19	0.07	2.77
Whole Tree Chipper	500	1	0.1494	0.5027	1.2837	0.0024	0.0432	4	20	0.60	2.01	5.13	0.01	0.17	11.95	40.22	102.70	0.20	3.45
Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20	19.64	67.25	0.81	0.00	0.11	392.80	1,345.02	16.25	0.03	2.12
Water Trucks	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	20	0.93	2.89	6.33	0.01	0.22	18.55	57.89	126.53	0.27	4.49
Paving Machine	121	1	0.0780	0.3320	0.4738	0.0005	0.0395	8	20	0.62	2.66	3.79	0.00	0.32	12.48	53.12	75.81	0.09	6.31
										26.08	93.12	49.37	0.08	2.31	507.92	1,786.51	890.66	1.50	40.58

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Construction- Offroad Equipment Unmitigated Emission Calculations

Materials Import, Borrow Site Excavation

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Whole Tree Chipper	500	1	0.1494	0.5027	1.2837	0.0024	0.0432	8	20	1.19	4.02	10.27	0.02	0.35	23.90	80.44	205.40	0.39	6.91
Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20	19.64	67.25	0.81	0.00	0.11	392.80	1,345.02	16.25	0.03	2.12
Excavator	188	1	0.0658	0.4055	0.4525	0.0009	0.0226	8	80	0.53	3.24	3.62	0.01	0.18	42.08	259.54	289.62	0.58	14.45
Bulldozer	305	1	0.1098	0.3474	0.9022	0.0013	0.0342	8	80	0.88	2.78	7.22	0.01	0.27	70.27	222.34	577.38	0.86	21.86

Backhoe Loader	129	1	0.0378	0.2567	0.2574	0.0005	0.0173	8	80	0.30	2.05	2.06	0.00	0.14	24.21	164.30	164.75	0.30	11.08
Grader	220	1	0.0824	0.3524	0.6477	0.0011	0.0270	8	65	0.66	2.82	5.18	0.01	0.22	42.86	183.24	336.82	0.60	14.06
Water Truck	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	80	0.93	2.89	6.33	0.01	0.22	74.20	231.54	506.13	1.08	17.97
										24.13	85.06	35.49	0.07	1.48	670.33	2,486.41	2,096.36	3.83	88.44

Buttress Construction and Rock Slope Protection Placement

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Backhoe Loader	129	1	0.0378	0.2567	0.2574	0.0005	0.0173	8	65	0.30	2.05	2.06	0.00	0.14	19.67	133.49	133.86	0.24	9.00
Bulldozer	305	1	0.1098	0.3474	0.9022	0.0013	0.0342	8	65	0.88	2.78	7.22	0.01	0.27	57.09	180.65	469.12	0.70	17.76
Grader	220	1	0.0824	0.3524	0.6477	0.0011	0.0270	8	65	0.66	2.82	5.18	0.01	0.22	42.86	183.24	336.82	0.60	14.06
Sheepsfoot / Roller / Tamper	240	1	0.0694	0.2548	0.6464	0.0011	0.0231	8	65	0.56	2.04	5.17	0.01	0.18	36.08	132.49	336.11	0.57	12.01
Water Trucks	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	65	0.93	2.89	6.33	0.01	0.22	60.29	188.13	411.23	0.88	14.60
Excavator	188	1	0.0658	0.4055	0.4525	0.0009	0.0226	8	40	0.53	3.24	3.62	0.01	0.18	21.04	129.77	144.81	0.29	7.23
Hydraulic Crane (50 ton)	173	2	0.0572	0.3158	0.4027	0.0006	0.0231	8	5	0.92	5.05	6.44	0.01	0.37	4.58	25.27	32.21	0.05	1.85
Grout Pump	43	1	0.0422	0.1522	0.1688	0.0003	0.0115	8	30	0.34	1.22	1.35	0.00	0.09	10.13	36.54	40.50	0.06	2.76
										5.10	22.10	37.37	0.06	1.68	251.75	1,009.58	1,904.67	3.39	79.27

Site Reclamation and Street Improvements

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Paving Machine	121	1	0.0780	0.3320	0.4738	0.0005	0.0395	8	5	0.62	2.66	3.79	0.00	0.32	3.12	13.28	18.95	0.02	1.58
Compressor	100	1	0.0424	0.1934	0.2279	0.0003	0.0190	8	30	0.34	1.55	1.82	0.00	0.15	10.18	46.43	54.70	0.08	4.56
Water Truck	457	1	0.1159	0.3618	0.7908	0.0017	0.0281	8	30	0.93	2.89	6.33	0.01	0.22	27.82	86.83	189.80	0.41	6.74
Grader	220	1	0.0824	0.3524	0.6477	0.0011	0.0270	8	10	0.66	2.82	5.18	0.01	0.22	6.59	28.19	51.82	0.09	2.16
Roller/Compactor	150	1	0.0616	0.3440	0.4447	0.0007	0.0283	8	5	0.49	2.75	3.56	0.01	0.23	2.47	13.76	17.79	0.03	1.13
										3.04	12.67	20.68	0.03	1.14	50.19	188.49	333.06	0.62	16.18

Total Emissions (lbs)				
ROG	CO	NOx	SOx	PM
1,480.19	5,471.00	5,224.75	9.35	224.47

Maximum Overlap (Phase 2 and Phase 3)

Daily Emissions (lbs/day)				
ROG	CO	NOx	SOx	PM
29.23	107.16	72.86	0.13	3.16

Lake Gregory Project

Construction- Offroad Equipment Mitigated Emission Calculations

Assumptions:

1. CARB OFFROAD model emission factors from latest version of OFFROAD (Tier 3 fleet average >50 hp)
2. Gasoline equipment emission factors are estimated based on the rate in g/hp-hr provided in the Gasoline Equipment Emission Factor Rates table for EPA/ARB compliant four-cycle engines.

Offroad Emission Factors - 2016 (pounds/hour) - Tier 3 Weighted average for equipment larger than 50 hp

	Primary Offroad Equipment	HP	Number	Off-road Emission Factor (lbs/hr)					Hrs/day	Days
				ROG	CO	NOx	SOx	PM		
Site Preparation; Road and Utilities Relocation	Hydraulic Crane (50 ton)	173	2	0.0165	0.3158	0.2704	0.0006	0.0158	8	5
	Bulldozer	305	2	0.0486	0.3474	0.7165	0.0013	0.0320	8	20
	Grader	220	2	0.0411	0.3524	0.4987	0.0011	0.0223	8	20
	Backhoe Loader	129	2	0.0190	0.2567	0.2618	0.0005	0.0157	4	20
	Whole Tree Chipper	500	1	0.0722	0.5027	1.1246	0.0024	0.0444	4	20
	Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20
	Water Trucks	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	20
	Paving Machine	121	1	0.0146	0.3320	0.2697	0.0005	0.0149	8	20
Materials Import, Borrow Site Excavation	Whole Tree Chipper	500	1	0.0722	0.5027	1.1246	0.0024	0.0444	8	20
	Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20
	Excavator	188	1	0.0276	0.4055	0.3946	0.0009	0.0175	8	80
	Bulldozer	305	1	0.0486	0.3474	0.7165	0.0013	0.0320	8	80
	Backhoe Loader	129	1	0.0190	0.2567	0.2618	0.0005	0.0157	8	80
	Grader	220	1	0.0411	0.3524	0.4987	0.0011	0.0223	8	65
Buttress Construction and Rock Slope Protection Placement	Water Truck	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	80
	Backhoe Loader	129	1	0.0190	0.2567	0.2618	0.0005	0.0157	8	65
	Bulldozer	305	1	0.0486	0.3474	0.7165	0.0013	0.0320	8	65
	Grader	220	1	0.0411	0.3524	0.4987	0.0011	0.0223	8	65
	Sheepsfoot / Roller / Tamper	240	1	0.0240	0.2548	0.4767	0.0011	0.0199	8	65
	Water Trucks	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	65
	Excavator	188	1	0.0276	0.4055	0.3946	0.0009	0.0175	8	40
	Hydraulic Crane (50 ton)	173	2	0.0165	0.3158	0.2704	0.0006	0.0158	8	5
Site Reclamation and Street Improvements	Grout Pump	43	1	0.0422	0.1522	0.1688	0.0003	0.0115	8	30
	Paving Machine	121	1	0.0146	0.3320	0.2697	0.0005	0.0149	8	5
	Compressor	100	1	0.0134	0.1934	0.2628	0.0003	0.0161	8	30
	Water Truck	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	30
	Grader	220	1	0.0411	0.3524	0.4987	0.0011	0.0223	8	10
Roller/Compactor	150	1	0.0155	0.3440	0.2985	0.0007	0.0169	8	5	

Site Preparation; Road and Utilities Relocation

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Hydraulic Crane (50 ton)	173	2	0.0165	0.3158	0.2704	0.0006	0.0158	8	5	0.26	5.05	4.33	0.01	0.25	1.32	25.27	21.63	0.05	1.26
Bulldozer	305	2	0.0486	0.3474	0.7165	0.0013	0.0320	8	20	0.78	5.56	11.46	0.02	0.51	15.55	111.17	229.29	0.43	10.24
Grader	220	2	0.0411	0.3524	0.4987	0.0011	0.0223	8	20	0.66	5.64	7.98	0.02	0.36	13.15	112.76	159.58	0.37	7.12
Backhoe Loader	129	2	0.0190	0.2567	0.2618	0.0005	0.0157	4	20	0.15	2.05	2.09	0.00	0.13	3.04	41.07	41.88	0.07	2.51
Whole Tree Chipper	500	1	0.0722	0.5027	1.1246	0.0024	0.0444	4	20	0.29	2.01	4.50	0.01	0.18	5.78	40.22	89.97	0.20	3.55
Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20	19.64	67.25	0.81	0.00	0.11	392.80	1,345.02	16.25	0.03	2.12
Water Trucks	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	20	0.89	2.89	8.29	0.01	0.43	17.72	57.89	165.89	0.27	8.66
Paving Machine	121	1	0.0146	0.3320	0.2697	0.0005	0.0149	8	20	0.12	2.66	2.16	0.00	0.12	2.34	53.12	43.15	0.09	2.39
										22.78	93.12	41.63	0.08	2.08	451.69	1,786.51	767.64	1.50	37.86

Lake Gregory Project

Construction- Offroad Equipment Mitigated Emission Calculations

Materials Import, Borrow Site Excavation

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Whole Tree Chipper	500	1	0.0722	0.5027	1.1246	0.0024	0.0444	8	20	0.58	4.02	9.00	0.02	0.35	11.55	80.44	179.93	0.39	7.10
Chainsaws	6	4	0.6138	2.1016	0.0254	0.0000	0.0033	8	20	19.64	67.25	0.81	0.00	0.11	392.80	1,345.02	16.25	0.03	2.12
Excavator	188	1	0.0276	0.4055	0.3946	0.0009	0.0175	8	80	0.22	3.24	3.16	0.01	0.14	17.66	259.54	252.55	0.58	11.22
Bulldozer	305	1	0.0486	0.3474	0.7165	0.0013	0.0320	8	80	0.39	2.78	5.73	0.01	0.26	31.10	222.34	458.57	0.86	20.49
Backhoe Loader	129	1	0.0190	0.2567	0.2618	0.0005	0.0157	8	80	0.15	2.05	2.09	0.00	0.13	12.16	164.30	167.52	0.30	10.06
Grader	220	1	0.0411	0.3524	0.4987	0.0011	0.0223	8	65	0.33	2.82	3.99	0.01	0.18	21.37	183.24	259.32	0.60	11.57
Water Truck	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	80	0.89	2.89	8.29	0.01	0.43	70.88	231.54	663.57	1.08	34.64
										22.19	85.06	33.08	0.07	1.59	557.53	2,486.41	1,997.72	3.83	97.19

Buttress Construction and Rock Slope Protection Placement

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Backhoe Loader	129	1	0.0190	0.2567	0.2618	0.0005	0.0157	8	65	0.15	2.05	2.09	0.00	0.13	9.88	133.49	136.11	0.24	8.17
Bulldozer	305	1	0.0486	0.3474	0.7165	0.0013	0.0320	8	65	0.39	2.78	5.73	0.01	0.26	25.27	180.65	372.59	0.70	16.64
Grader	220	1	0.0411	0.3524	0.4987	0.0011	0.0223	8	65	0.33	2.82	3.99	0.01	0.18	21.37	183.24	259.32	0.60	11.57
Sheepsfoot / Roller / Tamper	240	1	0.0240	0.2548	0.4767	0.0011	0.0199	8	65	0.19	2.04	3.81	0.01	0.16	12.47	132.49	247.87	0.57	10.32
Water Trucks	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	65	0.89	2.89	8.29	0.01	0.43	57.59	188.13	539.15	0.88	28.14
Excavator	188	1	0.0276	0.4055	0.3946	0.0009	0.0175	8	40	0.22	3.24	3.16	0.01	0.14	8.83	129.77	126.27	0.29	5.61
Hydraulic Crane (50 ton)	173	2	0.0165	0.3158	0.2704	0.0006	0.0158	8	5	0.26	5.05	4.33	0.01	0.25	1.32	25.27	21.63	0.05	1.26
Grout Pump	43	1	0.0422	0.1522	0.1688	0.0003	0.0115	8	30	0.34	1.22	1.35	0.00	0.09	10.13	36.54	40.50	0.06	2.76
										2.77	22.10	32.76	0.06	1.64	146.86	1,009.58	1,743.45	3.39	84.50

Site Reclamation and Street Improvements

	HP	Number	Emission Factor (lbs/hour)					Hrs/day	Days	Daily Emissions (lbs/day)					Total Emissions (lbs)				
			ROG	CO	NOx	SOx	PM			ROG	CO	NOx	SOx	PM	ROG	CO	NOx	SOx	PM
Paving Machine	121	1	0.0146	0.3320	0.2697	0.0005	0.0149	8	5	0.12	2.66	2.16	0.00	0.12	0.58	13.28	10.79	0.02	0.60
Compressor	100	1	0.0134	0.1934	0.2628	0.0003	0.0161	8	30	0.11	1.55	2.10	0.00	0.13	3.23	46.43	63.07	0.08	3.88
Water Truck	457	1	0.1108	0.3618	1.0368	0.0017	0.0541	8	30	0.89	2.89	8.29	0.01	0.43	26.58	86.83	248.84	0.41	12.99
Grader	220	1	0.0411	0.3524	0.4987	0.0011	0.0223	8	10	0.33	2.82	3.99	0.01	0.18	3.29	28.19	39.90	0.09	1.78
Roller/Compactor	150	1	0.0155	0.3440	0.2985	0.0007	0.0169	8	5	0.12	2.75	2.39	0.01	0.14	0.62	13.76	11.94	0.03	0.68
										1.56	12.67	18.93	0.03	0.99	34.30	188.49	374.54	0.62	19.92

Total Emissions (lbs)				
ROG	CO	NOx	SOx	PM
1,190.37	5,471.00	4,883.34	9.35	239.46

Maximum Overlap (Phase 2 and Phase 3)

Daily Emissions (lbs/day)				
ROG	CO	NOx	SOx	PM
24.96	107.16	65.83	0.13	3.23

Lake Gregory Project

Construction - Fugitive Dust Unmitigated Emission Calculations

Assumptions:

1. Fugitive dust emissions are estimated using AP-42.
2. Equipment usage, amount of material handling, and VMT assumptions are presented under "Schedule & Equipment"
3. Mitigation level assumes minimum mitigation required for SCAQMD Rule 403 compliance.

Emission Categories

- 1) Earthmoving
- 2) Road Dust Paved/Unpaved
- 3) Disturbed Area Windblown Emissions

1) Earthmoving

Emission Types

- A) Dozing
- B) Grading
- C) Material Loading/Handling

A) Dozing (AP-42 Section 11.9 for overburden)

$E = k \times (s)^{1.5} / (M)^{1.4}$ For PM10 and $k \times 5.7 \times (s)^{1.2} / (M)^{1.3}$ for PM2.5

E = lb/hr

k = Scaling Constant (0.75 for PM10 and 0.105 for PM2.5)

s = Silt Content (assumed to be 12%)

M = Moisture Content = 15% (based on SCAQMD moist and soil definition)

Emission Factor, lb/hr

PM10	PM2.5
0.70357	0.34927

Maximum Daily Dozer Use

	Hrs/day
Max Case	16

Total Dozer Use

	Hrs
Total Dozer Use	1,480

Dozer Emissions (Lbs/day)

	PM10	PM2.5
Max Case	11.26	5.59

Dozer Emissions (Tons)

	PM10	PM2.5
Total Dozer Use	0.52	0.26

Lake Gregory Project

Construction - Fugitive Dust Unmitigated Emission Calculations

B) Grading (AP-42 Section 11.9)

$$E = k \times 0.051 \times (S)_{2.0} \text{ for PM}_{10} \text{ and } k \times 0.040 \times (S)_{2.5} \text{ for PM}_{2.5}$$

$$E = \text{lb/VMT}$$

k = Scaling Constant (0.60 for PM₁₀ and 0.031 for PM_{2.5})

S = Mean Vehicle Speed assumed to be 3 mph

Assumes VMT = 3 x hours in use

Emission Factor, lb/VMT

PM10	PM2.5
0.27540	0.01933

Maximum Daily Grader VMT

	Hrs/day	VMT/day
Max Case	16	48

Total Grader VMT

	Hrs	VMT
Total Grader Use	1,440	4320

Emission Control

61%

Water dust suppression is assumed as a control measure.

Grading Emissions (Lbs/day)

	PM10	PM2.5
Max Case	5.16	0.36

Grading Emissions (Tons)

	PM10	PM2.5
Total Grader Use	0.23	0.02

C) Material Loading/Handling (AP-42, p. 13.2.4.3)

Assumptions:

1. This emission source covers the material handling of the stockpiled and used materials.
2. The worst case daily throughput is assumed to be 3,000 cu yds of wet soil total with two drops, or a total drop weight of 8,910 tons, annual is 140,000 cu yds with two drops (415,800 tons).

$$E = (k)(0.0032)[(U/5)^{1.3}]/[(M/2)^{1.4}]$$

$$E = \text{lb/ton}$$

k = Particle Size Constant (0.35 for PM₁₀ and 0.053 for PM_{2.5})

U = average wind speed = 25 MPH worst day, 8 MPH avg daytime (engineering assumption)

M = moisture content = 15% (SCAQMD moist)

	tons/period
Daily	8,910
Total	415,800

Emission Factors and Emissions

Emission Factors

PM10 Total	PM2.5 Total
0.00012	0.00002

PM10 Daily	PM2.5 Daily
0.00054	0.00008

Emissions (Lbs/day)

	PM10	PM2.5
Daily	4.82	0.73

Emissions (Tons/year)

	PM10	PM2.5
Total	0.05	0.01

Lake Gregory Project

Construction - Fugitive Dust Unmitigated Emission Calculations

2) Road Dust

Emission Types

A) Paved Road Dust

B) Unpaved Road Dust

A) Paved Road Dust

$$E = [k \times (sL)^{0.91} \times (W)^{1.02}] \times (1-P/4N)$$

E = lb/VMT

k = Constant (0.0022 for PM10 and 0.00054 for PM2.5)

sL = Silt Loading (assumed to be 0.2 g/m² for ADT between 500 and 5,000 from Table 13.2.1-2)

W = Average weight of vehicles in tons (calculated below)

P = Days of precipitation (15 assumed for annual calculation)

N = Days in period (365 for annual calculation)

Average Vehicle Weight Calculation

Assumptions

Passenger Vehicles = 2 tons average

Midsize "Delivery" Vehicles = 8 ton average

Heavy-Heavy Duty Trucks = 16.5 tons average (loaded 23 tons, unloaded 10 tons)

Daily Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
Worst Case	1,020	99	3,118	4,237	12.8

Total Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
Total Project	125,400	11,980	145,490	282,870	9.7

Daily Emission Factors (lb/VMT)

	PM10 Daily	PM2.5 Daily
Worst Case	0.00686	0.00168

Emissions (Lbs/day)

	PM10	PM2.5
Worst Case	29.05	7.13

Total Emission Factors (lb/VMT)

	PM10 Annual	PM2.5 Annual
Total Project	0.0051	0.0013

Emissions (Tons)

	PM10	PM2.5
Total Project	0.72	0.18

Lake Gregory Project

Construction - Fugitive Dust Unmitigated Emission Calculations

B) Unpaved Road Dust

$$E = (k)[(s/12)^{0.9}][[(W/3)^{0.45}][[(365-P)/365]$$

k = constant = 1.5 lb/VMT for PM10 and 0.15 lb/VMT for PM2.5

s = Silt Content (assumed to be 12%, SCAQMD 1993 Handbook value for mountain roads)

W = avg. vehicle weight = calculated below

P = Days of precipitation (40 assumed for annual calculation)

No correction for number of wet days due to assumption of working in dry season

Average Vehicle Weight Calculation

Assumptions:

Passenger Vehicles = 2 tons average

Midsize "Delivery" Vehicles = 8 ton average

Heavy-Heavy Duty Trucks = 16.5 tons average (loaded 23 tons, unloaded 10 tons)

Daily Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight (Tons)
Worst Case	0	1	174	175	16.4

Total Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight (Tons)
Total Project	0	171	7,449	7,620	16.3

Uncontrolled Emission Factors and Emissions

Daily Emission Factors (lb/VMT)

	PM10 Daily	PM2.5 Daily
Worst Case	3.23	0.32

Emissions (Lbs/day)

	PM10	PM2.5
Worst Case	565.39	56.54

Total Emission Factors (lb/VMT)

	PM10 Annual	PM2.5 Annual
Total Project	3.08	0.31

Emissions (Tons)

	PM10	PM2.5
Total Project	11.74	1.17

Emissions (Lbs/day)

	PM10	PM2.5
Worst Case	220.50	22.05

Emissions (Tons)

	PM10	PM2.5
Total Project	4.58	0.46

Watering (61%) is assumed as a necessary Rule 403 control measure

Emission Control
61%

Lake Gregory Project

Construction - Fugitive Dust Unmitigated Emission Calculations
Controlled Emissions (assumes 61% with watering)

3) Disturbed Area Windblown Emissions

Assumptions

1. Emission Factor is 0.38 tons/disturbed acres/year of Total Suspended Particulate (AP-42 Section 11.9).
2. PM10 and PM2.5 fractions of TSP are 0.489 and 0.102 respectively per CEIDARS factors from SCAQMD CEQA Website.
3. The disturbed area totals 10 acres.
4. Duration of disturbance is the eight month construction schedule.
5. Disturbed areas are controlled by water dust suppression of 61% control.
6. Restoration of disturbed acres creates no net emission increase of permanently disturbed acres

Disturbed Acres (acre-years)	Total Emissions (Tons)	
	PM10	PM2.5
6.7	0.49	0.10

Emissions (Lbs/day)	
PM10	PM2.5
2.95	0.60

* Disturbance area includes piles of earth fill.

Maximum Overlap (Phase 2 and 3, during Phase 2 excavation)

	PM10	PM2.5
Dozing	11.26	5.59
Grading	5.16	0.36
Material Loading/Handling	4.82	0.73
Paved Road Dust	29.05	7.13
Unpaved Road Dust	220.50	22.05
Disturbed Area Windblown Emissions	2.95	0.60
Total	273.72	36.46

LST Maximum Overlap (Phases 3 and 4)

	PM10	PM2.5
Dozing	5.63	2.79
Grading	2.58	0.18
Material Loading/Handling	1.20	0.18
Paved Road Dust	0.00	0.00
Unpaved Road Dust	30.19	3.02
Disturbed Area Windblown Emissions	0.59	0.12
Total	40.19	6.30

Total Fugitive Emissions

	PM10	PM2.5
Dozing	0.52	0.26
Grading	0.23	0.02
Material Loading/Handling	0.05	0.01
Paved Road Dust	0.72	0.18
Unpaved Road Dust	4.58	0.46
Disturbed Area Windblown Emissions	0.49	0.10
Total	6.60	1.02

Lake Gregory Project

Construction - Fugitive Dust Mitigated Emission Calculations

Assumptions:

1. Fugitive dust emissions are estimated using AP-42.
2. Equipment usage, amount of material handling, and VMT assumptions are presented under "Schedule & Equipment"
3. Mitigation level assumes most effective feasible SCAQMD Rule 403 Table 1 and 2 control measures are applied.
4. Additional mitigation can occur for the following fugitive dust sources (unpaved roads, windblown emissions)

Emission Categories

- 1) Earthmoving
- 2) Road Dust Paved/Unpaved
- 3) Disturbed Area Windblown Emissions

1) Earthmoving

Emission Types

- A) Dozing
- B) Grading
- C) Scraper
- D) Material Loading/Handling

A) Dozing (AP-42 Section 11.9 for overburden)

$$E = k \times (s)^{1.5} / (M)^{1.4} \text{ For PM10 and } k \times 5.7 \times (s)^{1.2} / (M)^{1.3} \text{ for PM2.5}$$

E = lb/hr

k = Scaling Constant (0.75 for PM10 and 0.105 for PM2.5)

s = Silt Content (assumed to be 12%)

M = Moisture Content = 15% (based on SCAQMD moist and soil definition)

Emission Factor, lb/hr

PM10	PM2.5
0.70357	0.34927

Maximum Daily Dozer Use

	Hrs/day
Max Case	16

Total Dozer Use

	Hrs
Total Dozer Use	1,480

Dozer Emissions (Lbs/day)

	PM10	PM2.5
Max Case	11.26	5.59

Dozer Emissions (Tons)

	PM10	PM2.5
Total Dozer Use	0.521	0.258

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Construction - Fugitive Dust Mitigated Emission Calculations

B) Grading (AP-42 Section 11.9)

$$E = k \times 0.051 \times (S)^{2.0} \text{ for PM}_{10} \text{ and } k \times 0.040 \times (S)^{2.5} \text{ for PM}_{2.5}$$

$$E = \text{lb/VMT}$$

k = Scaling Constant (0.60 for PM₁₀ and 0.031 for PM_{2.5})

S = Mean Vehicle Speed assumed to be 3 mph

Assumes VMT = 3 x hours in use

Emission Factor, lb/VMT

PM10	PM2.5
0.27540	0.01933

Maximum Daily Grader VMT

	Hrs/day	VMT/day
Max Case	16	48

Total Grader VMT

	Hrs	VMT
Total Grader Use	1,440	4320

Emission Control
61%

Water dust suppression is assumed as a control measure.

Grading Emissions (Lbs/day)

	PM10	PM2.5
Max Case	5.16	0.36

Grading Emissions (Tons)

	PM10	PM2.5
Total Grader Use	0.23	0.02

C) Material Loading/Handling (AP-42, p. 13.2.4.3)

Assumptions:

1. This emission source covers the material handling of the stockpiled and used materials.

2. The worst case daily throughput is assumed to be 3,000 cu yds of wet soil total with two drops, or a total drop weight of 8,910 tons, annual is 140,000 cu yds with two drops (415,800 tons).

$$E = (k)(0.0032)[(U/5)^{1.3}]/[(M/2)^{1.4}]$$

$$E = \text{lb/ton}$$

k = Particle Size Constant (0.35 for PM₁₀ and 0.053 for PM_{2.5})

U = average wind speed = 25 MPH worst day, 8 MPH avg daytime (engineering assumption)

M = moisture content = 15% (SCAQMD moist)

	tons/period
Daily	8,910
Total	415,800

Emission Factors and Emissions

Emission Factors

PM10 Total	PM2.5 Total
0.00012	0.00002

PM10 Daily	PM2.5 Daily
0.00054	0.00008

Emissions (Lbs/day)

	PM10	PM2.5
Daily	4.82	0.73

Emissions (Tons/year)

	PM10	PM2.5
Total	0.05109	0.00774

Lake Gregory Project

Construction - Fugitive Dust Mitigated Emission Calculations Emissions (Lbs/day)

2) Road Dust

Emission Types

A) Paved Road Dust

B) Unpaved Road Dust

A) Paved Road Dust

$$E = [k \times (sL)^{0.91} \times (W)^{1.02}] \times (1-P/4N)$$

E = lb/VMT

k = Constant (0.0022 for PM10 and 0.00054 for PM2.5)

sL = Silt Loading (assumed to be 0.2 g/m² for ADT between 500 and 5,000 from Table 13.2.1-2)

W = Average weight of vehicles in tons (calculated below)

P = Days of precipitation (15 assumed for annual calculation)

N = Days in period (365 for annual calculation)

Average Vehicle Weight Calculation

Assumptions

Passenger Vehicles = 2 tons average

Midsize "Delivery" Vehicles = 8 ton average

Heavy-Heavy Duty Trucks = 16.5 tons average (loaded 23 tons, unloaded 10 tons)

Daily Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
Worst Case	1,020	99	3,118	4,237	12.8

Total Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
Total Project	125,400	11,980	145,490	282,870	9.7

Daily Emission Factors (lb/VMT)

	PM10 Daily	PM2.5 Daily
Worst Case	0.00686	0.00168

Emissions (Lbs/day)

	PM10	PM2.5
Worst Case	29.05	7.13

Total Emission Factors (lb/VMT)

	PM10 Annual	PM2.5 Annual
Total Project	0.0051	0.0013

Emissions (Tons)

	PM10	PM2.5
Total Project	0.72	0.18

Lake Gregory Project

Construction - Fugitive Dust Mitigated Emission Calculations

B) Unpaved Road Dust

$$E = (k)[(s/12)^{0.9}][[(W/3)^{0.45}][[(365-P)/365]$$

k = constant = 1.5 lb/VMT for PM10 and 0.15 lb/VMT for PM2.5

s = Silt Content (assumed to be 12%, SCAQMD 1993 Handbook value for mountain roads)

W = avg. vehicle weight = calculated below

P = Days of precipitation (40 assumed for annual calculation)

No correction for number of wet days due to assumption of working in dry season

Average Vehicle Weight Calculation

Assumptions:

Passenger Vehicles = 2 tons average

Midsize "Delivery" Vehicles = 8 ton average

Heavy-Heavy Duty Trucks = 16.5 tons average (loaded 23 tons, unloaded 10 tons)

Daily Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight (Tons)
Worst Case	0	1	174	175	16.4

Total Case VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight (Tons)
Total Project	0	171	7,449	7,620	16.3

Uncontrolled Emission Factors and Emissions

Daily Emission Factors (lb/VMT)

	PM10 Daily	PM2.5 Daily
Worst Case	3.23	0.32

Emissions (Lbs/day)

	PM10	PM2.5
Worst Case	565.39	56.54

Total Emission Factors (lb/VMT)

	PM10 Annual	PM2.5 Annual
Total Project	3.08	0.31

Emissions (Tons)

	PM10	PM2.5
Total Project	11.74	1.17

Controlled Emissions (assumes 61% with watering)

Emissions (Lbs/day)

	PM10	PM2.5
Worst Case	63.95	6.39

Watering (61%) and vehicle speed control to 10 mph (71%) are assumed as control measures.

Emissions (Tons)

	PM10	PM2.5
Total Project	1.33	0.13

Emission Control
89%

Lake Gregory Project

Construction - Fugitive Dust Mitigated Emission Calculations

3) Disturbed Area Windblown Emissions

Assumptions

1. Emission Factor is 0.38 tons/disturbed acres/year of Total Suspended Particulate (AP-42 Section 11.9).
2. PM10 and PM2.5 fractions of TSP are 0.489 and 0.102 respectively per CEIDARS factors from SCAQMD CEQA Website.
3. There are permanent and temporary disturbed acres that make up the total acre-years of disturbed area which totals 6 acres.
4. Duration of disturbance is the overall, with winter delay, 11 month construction schedule.
5. Disturbed areas and storage piles are controlled to 80 percent by a combination of water dust suppression, additional watering/covering of piles before declared wind events, and restoration as soon as possible to reduce the disturbed interval.
6. Restoration of disturbed acres creates no net emission increase of permanently disturbed acres

Disturbed Acres (acre-years)	Total Emissions (Tons)	
	PM10	PM2.5
6.7	0.25	0.05

Emissions (Lbs/day)	
PM10	PM2.5
1.51	0.31

* Disturbance area includes piles of earth fill.

Maximum Overlap (Buttress Construction, Reclamation)

	PM10	PM2.5
Dozing	11.26	5.59
Grading	5.16	0.36
Material Loading/Handling	4.82	0.73
Paved Road Dust	29.05	7.13
Unpaved Road Dust	63.95	6.39
Disturbed Area Windblown Emissions	1.51	0.31
Total	115.73	20.51

LST Maximum Overlap (Phases 3 and 4)

	PM10	PM2.5
Dozing	5.63	0.00
Grading	2.58	0.18
Material Loading/Handling	1.20	0.18
Paved Road Dust	0.00	0.00
Unpaved Road Dust	8.75	0.88
Disturbed Area Windblown Emissions	0.30	0.06
Total	18.47	1.30

Total Fugitive Emissions

	PM10	PM2.5
Dozing	0.52	0.26
Grading	0.23	0.02
Scraper	0.00	0.00
Material Loading/Handling	0.05	0.01
Paved Road Dust	0.72	0.18
Unpaved Road Dust	1.33	0.13
Disturbed Area Windblown Emissions	0.25	0.05
Total	3.11	0.64

Lake Gregory Project

Localized Emissions Calculations

Assumptions:

1. The LST onsite emissions are on the 2-acre Dam site construction area.
2. Localized emissions include all off-road equipment during the worst-case localized overlap (Phase 3 and 4).
3. Five percent of the on-road vehicle emissions occur within the LST project site area.
4. One day of grading and dozing occur on the LST project site area.
5. Unpaved road dust based 14 miles of dump truck travel and 10 miles of water truck travel on the two acre LST project site area.
6. One quarter of the maximum daily material handling emissions occur within the LST project site area.
7. The two acre LST project site area is all considered to be disturbed for wind erosion.
8. None of the paved road fugitive dust emissions occur on the LST project site area.

Maximum Daily Emissions (lbs/day)

Excavation, Placement of Enbankment, Loading & Hauling

	CO	NOx	PM10	PM2.5
Onroad Vehicles	0.50	3.16	0.16	0.13
Offroad Equipment	34.77	58.05	2.82	2.59
Fugitive Dust	---	---	40.19	6.30
Total	35.27	61.21	43.16	9.02
SCAQMD Significance Thresholds	1,463	200	22	6
<i>Exceeds Thresholds?</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>

Mitigated Maximum Daily Emissions (lbs/day)

Excavation, Placement of Enbankment, Loading & Hauling

	CO	NOx	PM10	PM2.5
Onroad Vehicles	0.50	3.16	0.16	0.13
Offroad Equipment	34.77	51.69	2.63	2.42
Fugitive Dust	---	---	18.47	1.30
Total	35.27	54.85	21.26	3.85
SCAQMD Significance Thresholds	1,463	200	22	6
<i>Exceeds Thresholds?</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>

Lake Gregory Project

Construction - Onroad Vehicles GHG Emission Calculations

Assumptions:

1. GHG emissions are estimated based on guideline and emission factors provided by The Climate Registry General Reporting Protocol (ver. 2.0 March 2013) and April 2014 updated emissions factors

EMFAC 2011 Fuel Consumption Rate in San Bernardino County (gallon/mile)

Passenger	Gasoline	0.047484
Delivery	Diesel	0.109966
Heavy-Heavy Duty	Diesel	0.169405

TCR Table 13.1 Carbon Dioxide Emission Factors for Transport Fuels (kg CO2/gallon)

	CO2
Motor Gasoline	8.78
Diesel	10.21

TCR Table 13.5 Emission Factors for Each Fuel and Vehicle Type (g/mile)

		CH4	N2O
Passenger*	Gasoline	0.0168	0.0051
Delivery	Diesel	0.0010	0.0015
Heavy-Heavy Duty	Diesel	0.0051	0.0048

*Passenger vehicles (Model Year 2010) are assumed to be half passenger cars and half light trucks (vans, pickup trucks, and SUVs).

Onroad Emission Factors - 2014 (pounds/mile)

	CO2	CH4	N2O
Passenger	0.91913	0.00004	0.00001
Delivery	2.47525	0.00001	0.00001
Heavy-Heavy Duty	3.81316	0.00001	0.00001

Total On-road GHG Emissions

	VMT	Total Emissions (tons)			
Vehicle Type	Total	CO2	CH4	N2O	CO2e
Passenger	125,400	57.63	0.00	0.00	57.90
Delivery	12,150	15.04	0.00	0.00	15.06
Heavy-Heavy Duty	149,039	284.15	0.00	0.00	284.42
Totals		356.82	0.00	0.00	357.37

Lake Gregory Project

Construction - Offroad Equipment GHG Emission Calculations

Assumptions:

1. GHG emissions are estimated based on guideline and emission factors provided by The Climate Registry General Reporting Protocol (ver. 2.0 March 2013) and April 2015 updated emissions factors
2. For diesel-fueled equipment, fuel consumption rate of 0.38 lbs/bhp-hr and density of 6.8 lbs/gallon are used.
3. For gasoline-fueled equipment, fuel consumption rate of 0.47 lbs/bhp-hr and density of 6.0 lbs/gallon are used.

TCR Table 13.1 Carbon Dioxide Emission Factors for Transport Fuels (kg CO₂/gallon)

	CO₂ (kg/gallon)
Motor Gasoline	8.78
Diesel	10.21

TCR Table 13.7 Methane and Nitrous Oxide Emission Factors for Non-Highway Vehicles

Construction	CH₄ (g/gallon)	N₂O (g/gallon)
Gasoline	0.50	0.22
Diesel	0.58	0.26

Total Offroad GHG Emissions

	Fuel Use (gallon)	Total Emissions (tons)			
		CO ₂	CH ₄	N ₂ O	CO ₂ e
Gasoline	602	6	0.00	0.00	6
Diesel	47,957	540	0.03	0.01	545
Totals	48,559	546	0.03	0.01	551