

Appendix B

Air Quality and Greenhouse Gas Modeling

MPWMD Potential Acquisition of Monterey Water Supply and District Boundary Adjustment

Criteria Air Pollutant Emissions Calculations

Number of Daily Vehicle Trips	62
Maximum Daily VMT	1014

Pollutant	Emission Factor Type	Emission Factor	Daily Emissions (grams/day)	Daily Emissions (lbs/day)
ROG	RUNEX	0.041275223 grams/mile	41.85	0.0922
	IDLEX ¹	0 grams/vehicle/day	0.00	0.0000
	STREX	0.490113042 grams/trip	30.39	0.0669
	HOTSOAK	0.237161457 grams/trip	14.70	0.0324
	RUNLOSS	0.865214339 grams/trip	53.64	0.1182
	RESTLOSS	0.387310273 grams/vehicle/day	12.01	0.0264
	DIURN	0.473624501 grams/vehicle/day	14.68	0.0323
TOTAL				0.3685
NO _x	RUNEX	0.152815038 grams/mile	154.95	0.3413
	IDLEX ¹	0 grams/vehicle/day	0.00	0.0000
	STREX	0.329095635 grams/trip	20.40	0.0449
TOTAL				0.3863
CO	RUNEX	1.620705972 grams/mile	1643.40	3.6198
	IDLEX ¹	0 grams/vehicle/day	0.00	0.0000
	STREX	2.825834995 grams/trip	175.20	0.3859
TOTAL				4.0057
SO _x	RUNEX	0.003440971 grams/mile	3.49	0.0077
	IDLEX ¹	0 grams/vehicle/day	0.00	0.0000
	STREX	0.000688433 grams/trip	0.04	0.0001
TOTAL				0.0078
PM ₁₀	RUNEX	0.00283291 grams/mile	2.87	0.0063
	IDLEX ¹	0 grams/vehicle/day	0.00	0.0000
	STREX	0.002924334 grams/trip	0.18	0.0004
	PMTW	0.008000002 grams/mile	8.11	0.0179
	PMBW	0.036750011 grams/mile	37.26	0.0821
TOTAL				0.1067
PM _{2.5}	RUNEX	0.00260495 grams/mile	2.64	0.0058
	IDLEX ¹	0 grams/vehicle/day	0.00	0.0000
	STREX	0.002689121 grams/trip	0.17	0.0004
	PMTW	0.002000001 grams/mile	2.03	0.0045
	PMBW	0.015750005 grams/mile	15.97	0.0352
TOTAL				0.0458

Notes

VMT = vehicle miles traveled; ROG = reactive organic gases; NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM₁₀ = particulate matter measuring no more than 10 microns in diameter; PM_{2.5} = particulate matter measuring no more than 2.5 microns in diameter; RUNEX = Running Exhaust Emissions; IDLEX = Idle Exhaust Emissions (calculated only for heavy-duty trucks; STREX = Start Exhaust Tailpipe Emissions; HOTSOAK = Hot Soak Evaporative Hydrocarbon Emissions; RUNLOSS = Running Loss Evaporative Hydrocarbon Emissions; RESTLOSS = Resting Evaporative Losses; DIURN = Diurnal Evaporative Hydrocarbon Emissions; PMTW = Tire Wear Particulate Matter Emissions; PMBW = Brake Wear Particulate Matter Emissions

¹ According to the CARB EMFAC 2017 Volume 1 - User's Guide (2018), idle exhaust is calculated only for heavy-duty trucks because this process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods.

Emissions factor source: California Air Resources Board EMFAC2017 Web Database v. 1.0.2 Emission Rates for Monterey County for year 2020 for gasoline-fueled LDT1 vehicles.

More information on emission factors can be found in the EMFAC2017 Volume I - User's Guide (2018) available at:
<https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide-final.pdf>

MPWMD Potential Acquisition of Monterey Water Supply and District Boundary Adjustment
Greenhouse Gas Emissions Calculations

Number of Annual Vehicle Trips	7008
Maximum Annual VMT	177180

Greenhouse Gas	Emission Factor Type	Emission Factor		Annual Emissions (grams/year)	Annual Emissions (MT/year)	Annual Emissions (MT of CO ₂ e/year) ¹
CO ₂	RUNEX	347.7199622	grams/mile	61609022.91	61.6090	61.609
	IDLEX ²	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	69.56814807	grams/trip	487533.58	0.4875	0.488
	TOTAL				62.0966	62.097
CH ₄	RUNEX	0.009190677	grams/mile	1628.40	0.0016	0.046
	IDLEX ²	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.094267904	grams/trip	660.63	0.0007	0.018
	TOTAL				0.0023	0.064
N ₂ O	RUNEX	0.010901858	grams/mile	1931.59	0.0019	0.512
	IDLEX ²	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.033168688	grams/trip	232.45	0.0002	0.062
	TOTAL				0.0022	0.573
CO ₂ e	TOTAL				TOTAL	62.734

Notes
VMT = vehicle miles traveled; CO ₂ = carbon dioxide; CH ₄ = methane; N ₂ O = nitrous oxide; CO ₂ e = carbon dioxide equivalents; MT = metric tons; RUNEX = Running Exhaust Emissions; IDLEX = Idle Exhaust Emissions (calculated only for heavy-duty trucks; STREX = Start Exhaust Tailpipe Emissions
¹ Assumes a global warming potential of 28 for CH ₄ and 265 for N ₂ O.
² According to the CARB EMFAC 2017 Volume 1 - User's Guide (2018), idle exhaust is calculated only for heavy-duty trucks because this process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods.
Emissions factor source: California Air Resources Board EMFAC2017 Web Database v. 1.0.2 Emission Rates for Monterey County for year 2020 for gasoline-fueled LDT1 vehicles.
Global warming potentials for CH ₄ and N ₂ O source: Intergovernmental Panel for Climate Change (2015) Climate Change 2014 Synthesis Report.
More information on emission factors can be found in the EMFAC2017 Volume I - User's Guide (2018) available at: https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide-final.pdf

Source: EMFAC2017 (v1.0.2) Emission Rates

Region Type: County

Region: Monterey

Calendar Year: 2020

Season: Annual

Vehicle Classification: EMFAC2011 Categories

Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HOTSOAK and RUNLOSS, g/vehicle/day for IDLEX, RESTLOSS and DIURN

Calendar Year	2020
Vehicle Category	LDT1
Model Year	Aggregate
Speed	Aggregate
Fuel	Gasoline
Population	15883.36119
VMT	560231.4269
Trips	72353.65478
NOx_RUNEX	0.152815038
NOx_IDLEX	0
NOx_STREX	0.329095635
PM2.5_RUNEX	0.00260495
PM2.5_IDLEX	0
PM2.5_STREX	0.002689121
PM2.5_PMTW	0.002000001
PM2.5_PMBW	0.015750005
PM10_RUNEX	0.00283291
PM10_IDLEX	0
PM10_STREX	0.002924334
PM10_PMTW	0.008000002
PM10_PMBW	0.036750011
CO2_RUNEX	347.7199622
CO2_IDLEX	0
CO2_STREX	69.56814807
CH4_RUNEX	0.009190677
CH4_IDLEX	0
CH4_STREX	0.094267904
N2O_RUNEX	0.010901858
N2O_IDLEX	0
N2O_STREX	0.033168688
ROG_RUNEX	0.041275223
ROG_IDLEX	0
ROG_STREX	0.490113042
ROG_HOTSOAK	0.237161457
ROG_RUNLOSS	0.865214339
ROG_RESTLOSS	0.387310273

ROG_DIURN	0.473624501
TOG_RUNEX	0.060175125
TOG_IDLEX	0
TOG_STREX	0.536607339
TOG_HOTSOAK	0.237161457
TOG_RUNLOSS	0.865214339
TOG_RESTLOSS	0.387310273
TOG_DIURN	0.473624501
CO_RUNEX	1.620705972
CO_IDLEX	0
CO_STREX	2.825834995
SOx_RUNEX	0.003440971
SOx_IDLEX	0
SOx_STREX	0.000688433

MPWMD Potential Acquisition of Monterey Water Supply and District Boundary Adjustment

Last Updated: June 4, 2020

Populate one of the following tables (Leave the other blank):

Annual VMT	OR	Daily Vehicle Trips
Annual VMT: 177,180		Daily Vehicle Trips: Average Trip Distance:

Fleet Class	Fleet Mix	Fuel Economy (MPG)	
Light Duty Auto (LDA)	0.000000	Passenger Vehicles	24.0
Light Duty Truck 1 (LDT1)	1.000000	Light-Med Duty Trucks	17.4
Light Duty Truck 2 (LDT2)	0.000000	Heavy Trucks/Other	7.4
Medium Duty Vehicle (MDV)	0.000000	Motorcycles	43.9
Light Heavy Duty 1 (LHD1)	0.000000		
Light Heavy Duty 2 (LHD2)	0.000000		
Medium Heavy Duty (MHD)	0.000000		
Heavy Heavy Duty (HHD)	0.000000		
Other Bus (OBUS)	0.000000		
Urban Bus (UBUS)	0.000000		
School Bus (SBUS)	0.000000		
Motorhome (MH)	0.000000		
Motorcycle (MCY)	0.000000		

Fleet Mix

Vehicle Type	Percent	Fuel Type	Annual VMT:	Vehicle Trips: VMT	Fuel Consumption
			VMT		(Gallons)
Passenger Vehicles	0.00%	Gasoline	0	0.00	0.00
Light-Medium Duty Trucks	100.00%	Gasoline	177180	0.00	10182.76
Heavy Trucks/Other	0.00%	Diesel	0	0.00	0.00
Motorcycle	0.00%	Gasoline	0	0.00	0.00

Total Gasoline Consumption (gallons)	10182.76
Total Diesel Consumption (gallons)	0.00

MPWMD Potential Acquisition of Monterey Water Supply and District Boundary Adjustment

GHG Emission Reduction Measure - Teleworking

Number of Employees Teleworking	15
Number of Days per Week for Teleworking	2
Number of Annual Vehicle Trips	1560
Maximum Annual VMT ¹	33696

Greenhouse Gas	Emission Factor Type	Emission Factor	Annual Emissions (grams/year)	Annual Emissions (MT/year)	Annual Emissions (MT of CO ₂ e/year) ²
CO ₂	RUNEX	298.5998476 grams/mile	10061620.47	10.0616	10.062
	IDLEX ³	0 grams/vehicle/day	0.00	0.0000	0.000
	STREX	59.85430507 grams/trip	93372.72	0.0934	0.093
	TOTAL			10.1550	10.155
CH ₄	RUNEX	0.005093446 grams/mile	171.63	0.0002	0.005
	IDLEX ³	0 grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.073722737 grams/trip	115.01	0.0001	0.003
	TOTAL			0.0003	0.008
N ₂ O	RUNEX	0.006704133 grams/mile	225.90	0.0002	0.060
	IDLEX ³	0 grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.030307244 grams/trip	47.28	0.0000	0.013
	TOTAL			0.0003	0.072
CO ₂ e	TOTAL			10.235	10.235

Notes
VMT = vehicle miles traveled; CO ₂ = carbon dioxide; CH ₄ = methane; N ₂ O = nitrous oxide; CO ₂ e = carbon dioxide equivalents; MT = metric tons; RUNEX = Running Exhaust Emissions; IDLEX = Idle Exhaust Emissions (calculated only for heavy-duty trucks; STREX = Start Exhaust Tailpipe Emissions
¹ Assumes a one-way commute distance of 10.8 miles, consistent with the default home-work distance value for Monterey County used in CalEEMod.
² Assumes a global warming potential of 28 for CH ₄ and 265 for N ₂ O.
³ According to the CARB EMFAC 2017 Volume 1 - User's Guide (2018), idle exhaust is calculated only for heavy-duty trucks because this process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods.
Emissions factor source: California Air Resources Board EMFAC2017 Web Database v. 1.0.2 Emission Rates for Monterey County for year 2020 for gasoline-fueled LDA vehicles.
Global warming potentials for CH ₄ and N ₂ O source: Intergovernmental Panel for Climate Change (2015) Climate Change 2014 Synthesis Report.
More information on emission factors can be found in the EMFAC2017 Volume I - User's Guide (2018) available at: https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide-final.pdf

MPWMD Potential Acquisition of Monterey Water Supply and District Boundary Adjustment

GHG Emission Reduction Measure - Subsidizing Transit Passes

Number of Employees with Transit Passes	6
Number of Days per Week using Transit	3
Number of Annual Vehicle Trips	936
Maximum Annual VMT ¹	20217.6

Greenhouse Gas	Emission Factor Type	Emission Factor	Annual Emissions (grams/year)	Annual Emissions (MT/year)	Annual Emissions (MT of CO ₂ e/year) ²
CO ₂	RUNEX	298.5998476 grams/mile	6036972.28	6.0370	6.037
	IDLEX ³	0 grams/vehicle/day	0.00	0.0000	0.000
	STREX	59.85430507 grams/trip	56023.63	0.0560	0.056
	TOTAL			6.0930	6.093
CH ₄	RUNEX	0.005093446 grams/mile	102.98	0.0001	0.003
	IDLEX ³	0 grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.073722737 grams/trip	69.00	0.0001	0.002
	TOTAL			0.0002	0.005
N ₂ O	RUNEX	0.006704133 grams/mile	135.54	0.0001	0.036
	IDLEX ³	0 grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.030307244 grams/trip	28.37	0.0000	0.008
	TOTAL			0.0002	0.043
CO ₂ e				TOTAL	6.141

Notes
VMT = vehicle miles traveled; CO ₂ = carbon dioxide; CH ₄ = methane; N ₂ O = nitrous oxide; CO ₂ e = carbon dioxide equivalents; MT = metric tons; RUNEX = Running Exhaust Emissions; IDLEX = Idle Exhaust Emissions (calculated only for heavy-duty trucks; STREX = Start Exhaust Tailpipe Emissions
¹ Assumes a one-way commute distance of 10.8 miles, consistent with the default home-work distance value for Monterey County used in CalEEMod.
² Assumes a global warming potential of 28 for CH ₄ and 265 for N ₂ O.
³ According to the CARB EMFAC 2017 Volume 1 - User's Guide (2018), idle exhaust is calculated only for heavy-duty trucks because this process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods.
Emissions factor source: California Air Resources Board EMFAC2017 Web Database v. 1.0.2 Emission Rates for Monterey County for year 2020 for gasoline-fueled LDA vehicles.
Global warming potentials for CH ₄ and N ₂ O source: Intergovernmental Panel for Climate Change (2015) Climate Change 2014 Synthesis Report.
More information on emission factors can be found in the EMFAC2017 Volume I - User's Guide (2018) available at: https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide-final.pdf

MPWMD Potential Acquisition of Monterey Water Supply and District Boundary Adjustment

GHG Emission Reduction Measure - EV Conversion Reduction

Number of Vehicles Converted	3
Number of Annual Vehicle Trips	2964
Maximum Annual VMT ¹	118560

Greenhouse Gas	Emission Factor Type	Emission Factor		Annual Emissions (grams/year)	Annual Emissions (MT/year)	Annual Emissions (MT of CO ₂ e/year) ²
CO ₂	RUNEX	298.5998476	grams/mile	35401997.94	35.4020	35.402
	IDLEX ³	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	59.85430507	grams/trip	177408.16	0.1774	0.177
	TOTAL				35.5794	35.579
CH ₄	RUNEX	0.005093446	grams/mile	603.88	0.0006	0.017
	IDLEX ³	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.073722737	grams/trip	218.51	0.0002	0.006
	TOTAL				0.0008	0.023
N ₂ O	RUNEX	0.006704133	grams/mile	794.84	0.0008	0.211
	IDLEX ³	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.030307244	grams/trip	89.83	0.0001	0.024
	TOTAL				0.0009	0.234
CO ₂ e	TOTAL					35.837

MBCP Emissions Factors		
	Carbon Intensity Factors (lb/MWh)	Emissions Factors (MT CO ₂ e/MWh)
CO ₂ e	2	0.00091

EV Usage			
Level 2 Charger	6.6	kW	Notes
4 Hour Charge	26.4	kWh	

Project Report - i-Tree Planting Calculator_{v2.1.0}

Location: Pacific Grove, California 93950

Electricity Emissions Factor: 2.00 pounds CO2 equivalent/MWh

Fuel Emissions Factor: 52.00 kilograms CO2 equivalent/MMBtu

Lifetime: 40 years

Tree Mortality: 10%



All amounts in the tables are for the full lifetime of the project.

Location		CO ₂ (Carbon Dioxide) Benefits			
Group Identifier	Tree Group Characteristics	CO ₂ (Carbon Dioxide) Avoided (pounds)	CO ₂ Avoided (\$)	CO ₂ Sequestered (pounds)	CO ₂ Sequestered (\$)
1	<ul style="list-style-type: none">• (1.0) Boxelder (Acer negundo) at 1.0 inch DBH (Diameter at Breast Height).• Planted 0-19 feet and north (0°) of buildings that were built post-1980 with heat and A/C.• Trees are in excellent condition and planted in partial sun.	742.9	\$17.28	7,299.9	\$169.77

Location		Energy Benefits			
Group Identifier	Tree Group Characteristics	Electricity Saved (kWh) (Kilowatt-Hours)	Electricity Saved (\$)	Fuel Saved (MMBtu) (Millions of British Thermal Units)	Fuel Saved (\$)
1	<ul style="list-style-type: none"> (1.0) Boxelder (Acer negundo) at 1.0 inch DBH (Diameter at Breast Height). Planted 0-19 feet and north (0°) of buildings that were built post-1980 with heat and A/C. Trees are in excellent condition and planted in partial sun. 	2,003.9	\$398.78	6.4	\$83.36

Location		Ecosystem Services			
Group Identifier	Tree Group Characteristics	Tree Biomass (short ton)	Rainfall Interception (gallons)	Runoff Avoided (gallons)	Runoff Avoided (\$)
1	<ul style="list-style-type: none"> (1.0) Boxelder (Acer negundo) at 1.0 inch DBH (Diameter at Breast Height). Planted 0-19 feet and north (0°) of buildings that were built post-1980 with heat and A/C. Trees are in excellent condition and planted in partial sun. 	1.9	32,141.4	7,064.1	\$63.12

Location		Air Benefits							
Group Identifier	Tree Group Characteristics	O ₃ (Ozone) Removed (pounds)	NO ₂ (Nitrogen Dioxide) Avoided (pounds)	NO ₂ (Nitrogen Dioxide) Removed (pounds)	SO ₂ (Sulfur Dioxide) Avoided (pounds)	SO ₂ (Sulfur Dioxide) Removed (pounds)	VOC (Volatile Organic Compound) Avoided (pounds)	PM _{2.5} (Particulate matter smaller than 2.5 micrometers in diameter) Avoided (pounds)	PM _{2.5} (Particulate matter smaller than 2.5 micrometers in diameter) Removed (pounds)
1	<ul style="list-style-type: none"> (1.0) Boxelder (Acer negundo) at 1.0 inch DBH (Diameter at Breast Height). Planted 0-19 feet and north (0°) of buildings that were built post-1980 with heat and A/C. Trees are in excellent condition and planted in partial sun. 	20.3	0.1	1.1	0.5	0.2	1.0	0.7	0.1





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