Appendix F

Energy Use Assessment

MEMO

Date: **April 16, 2018**

To: **Steve Abbs, Davidon Homes**

From: **Michael Keinath, Ramboll**

Subject: **ENERGY USE ASSESSMENT FOR CEQA ANALYSIS DANVILLE, CALIFORNIA**

Dear Mr. Abbs:

At the request of Davidon Homes, Ramboll US Corporation (Ramboll) calculated the estimated energy use for the construction and operation of the Magee Preserve residential development project in Danville, California (the "Project").

The Project will be comprised of 69 new single family homes, including 7 adjoining casitas,[1] on land that is currently used for cattle grazing. Sixty-six of the single family homes will be constructed on the large portion of the proposed Project site primarily south of Diablo Road. Three of the single family homes will be constructed on the small portion of the proposed Project to the west of the main portion along McCauley Road.

Ramboll followed the methodology described below to estimate the fuel use from the construction and operation of the Project. Results of this analysis are also presented below, and calculations are shown in the subsequent tables at the end of this report.

SUMMARY OF RESULTS

Energy use was estimated for construction and operation of the Project. This included diesel fuel, gasoline, natural gas, and electricity. The total diesel fuel use estimated for the Project is 146,264 gallons during construction and 362 gallons per year during operation, and the total gasoline fuel use estimated for the Project is 17,025 gallons during construction and 47,929 gallons per year during operation. Natural gas consumption is estimated to be 24,971 therms per year and electricity consumption is estimated to be 136 MWh per year.

METHODOLOGY

Ramboll estimated energy consumption for both construction and operation of the Project. This includes: 1) diesel fuel use for construction off-road equipment; 2) diesel and gasoline fuel use for construction on-road vehicles; 3) diesel and gasoline fuel use from vehicle trips generated by the Project; 4) operational natural gas usage; and 5) operational electricity consumption. The methodology for the estimation of this energy consumption is presented below.

Construction Energy

Ramboll estimated diesel fuel usage from construction off-road equipment using the construction schedule, construction equipment list, and other characteristics shown in **Table 1**. Equipment

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[1] Seven casitas will be constructed as part of the proposed Project. For the operational energy use analysis, it was assumed that ten additional casitas, for a total of 17, would be constructed by the home owners.

horsepower and load factor were assumed using default data from the California Emission Estimator Model version 2016.3.1 (CalEEMod®).[2] CalEEMod® is a statewide program designed to calculate air pollutant emissions for development projects in California using land use data. CalEEMod® utilizes appropriate default data that can be used if site-specific information is not available. Average brake-specific fuel consumption and diesel fuel properties (heating value and density) from United States Environmental Protection Agency (USEPA) AP-42 (Section 3.4) were used to obtain a fuel per horsepower-hour factor. These factors and other calculations are shown in **Table 2**.

Fuel use associated with construction vehicle trips generated by the Project was also estimated; trips include construction worker trips, haul trucks trips for material import, and vendor trips for construction material deliveries. Fuel use from these vehicles traveling to the Project was based on the projected number of trips the Project will generate (CalEEMod™ default values), default average trip distance by land use in CalEEMod™ and fuel efficiencies estimated in the California Air Resources Board's (ARB) EMFAC2014 model. Construction on-road vehicle fuel consumption calculations are shown in **Tables 3 – 6**. Total construction fuel use is shown in **Table 7**.

Operational Energy

Energy use consumed by the homes and their residents at full build-out was also estimated; this energy use consists of natural gas use and electricity consumption, as well as fuel used for vehicle trips associated with the Project. Ramboll estimated the natural gas consumption using default energy intensities by building type from CalEEMod™ and corrected for the most recent 2016 Title 24 standards. The Title 24 adjustments are shown in **Table 8**.

Additionally, the Project will include electric vehicle (EV) charging stations in the homes. Electricity use from the charging of EVs was calculated and is outlined in **Table 9**. Additionally, the Project Sponsor has indicated that all residences will be zero net electricity homes, in accordance with the proposed California Energy Commission's (CEC) 2019 Title 24 standards.[3] Because these homes will generate as much clean renewable electricity as they consume over the course of a year, electricity use for these homes was assumed to be zero over the course of the year; natural gas emissions were assumed to be in accordance with 2016 Title 24, as a conservative assumption. These calculations are shown in **Table 9**.

Fuel use associated with vehicle trips generated by the Project operation was also calculated. This was based on the projected number of trips the Project will generate (obtained from the Traffic Study), average trip distance by land use in CalEEMod™ and fuel efficiencies estimated in the California Air Resources Board's (ARB) EMFAC2014 model. These calculations account for the reductions in fuel use associated with the assumed increase in EVs as a result of the EV charging stations included in the Project. Project on-road vehicle fuel consumption calculations are shown in **Tables 10 – 11**.

RESULTS

A summary of overall fuel consumption from both construction and operation is shown in **Table 12**. The total fuel use for construction is estimated to be 146,264 gallons of diesel and 17,025 gallons of gasoline for construction off-road equipment and on-road vehicles. The total diesel fuel use from Project-generated operational traffic is 362 gallons per year and the total gasoline use is 47,929

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[2] California Air Pollution Control Officers Association (CAPCOA). 2016. California Emissions Estimator Model. Available at: http://www.CalEEMod.com/.

[3] California Energy Commission (CEC). 2017. Presentation - Proposed 2019 Building Energy Efficiency Standards ZNE Strategy. August 24. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/17-BSTD-01/TN220876_20170824T105443_82217_ZNE_Strategy_Presentation.pdf

gallons per year. Natural gas consumption and electricity consumption are expected to be 24,971 therms per year and 136 MWh per year, respectively.

To put these values into context, California's 30 million vehicles[4] consumed more than 15.1 billion gallons of gasoline[5] and more than 4.2 billion gallons of diesel[6] in 2015, making California the second largest consumer of gasoline in the world. Californians consumed 4,126 million therms of natural gas in 2015.[7] Of this total, residential uses in Contra Costa County consumed 156 million therms of natural gas.[8]

In 2016, 290,567 GWh of electricity were consumed in California, of which Contra Costa County residences consumed approximately 2,800 GWh.[9] Total in-state generation, not including small-scale solar installations, was 198,227 GWh, and energy imports accounted for 32% of the state-wide power mix.[10]

STANDARDS OF SIGNIFICANCE

While no quantitative thresholds related to energy are included in CEQA Guidelines Appendix G, Part I of Appendix F of the CEQA Guidelines states as follows:

"The goal of conserving energy implies the wise and efficient use of energy. The means of achieving this goal include:

1. decreasing overall per capita energy consumption,
2. decreasing reliance on natural gas and oil, and
3. increasing reliance on renewable energy resources."

Appendix F states that an Environmental Impact Report (EIR) should discuss the general energy impacts of a project, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. The avoidance of inefficient, wasteful, and unnecessary consumption of energy will be the standard of significance used for this project.

Proposed amendments to the CEQA Guidelines would add significance thresholds for energy impacts; if these proposed thresholds are adopted, Appendix G would recommend that an agency consider, in assessing whether a project's energy impacts are significant, the following factors:

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[4] California Energy Commission. 2016. Summary of California Vehicle and Transportation Energy. Available online at: http://www.energy.ca.gov/almanac/transportation_data/summary.html#vehicles. Accessed October 3, 2017.

[5] California Energy Commission. 2017. California Gasoline Data, Facts, and Statistics. Available online at: http://www.energy.ca.gov/almanac/transportation_data/gasoline/. Accessed October 3, 2017.

[6] California Energy Commission. 2017. California Diesel Fuel Data, Facts, and Statistics. Available online at: http://www.energy.ca.gov/almanac/transportation_data/diesel.html. Accessed October 3, 2017.

[7] A British Thermal Unit (BTU) is the amount of energy needed to raise the temperature of one pound of water by one degree Fahrenheit. A kBTU is 1,000 BTUs. A MMBtu is 1,000,000 BTUs. A therm is 100,000 BTUs.

[8] California Energy Commission. 2016. Energy Consumption Data Management Service. Gas Consumption by County. Available online at: http://www.ecdms.energy.ca.gov/gasbycounty.aspx. Accessed October 3, 2017.

[9] California Energy Commission. 2016. Energy Consumption Data Management Service. Electricity Consumption by County. Available online at: http://www.ecdms.energy.ca.gov/elecbycounty.aspx Accessed October 3, 2017.

[10] California Energy Commission. 2016. Total Electricity System Power. Available online at: http://www.energy.ca.gov/almanac/electricity_data/total_system_power.html. Accessed October 3, 2017.

- whether the project would result in the wasteful, inefficient or unnecessary consumption of fuel or energy; and
- whether the project would incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features.

For purposes of this analysis, impacts to energy resources will be considered to be significant if the project would result in the wasteful, inefficient or unnecessary consumption of fuel or energy, and conversely if the project would not incorporate renewable energy or energy efficiency measures into building design, equipment use, transportation or other project features.

DISCUSSION

The Project avoids or reduces inefficient, wasteful, and unnecessary consumption of energy in part through siting; it is located within the boundaries of the Town of Danville and adjacent to other residential development, thereby reducing per capita vehicle miles traveled compared to residential development outside urbanized areas. In addition, many Project design features that reduce energy consumption will be required by law.[11] All homes in this development will be constructed as zero net electricity homes, which will generate as much clean renewable electricity as they consume over the course of a year, greatly reducing grid-powered electricity use from the Project. Finally, the Project includes two non-required elements that will reduce transportation energy use. The first is a 3,800-foot publicly accessible trail. Second, as noted above, each home will be equipped with an electric vehicle charging station to encourage the use of electric vehicles, thus reducing diesel and gasoline fuel use. Based on these Project features, the Project avoids or reduces inefficient, wasteful, and unnecessary consumption of energy, and therefore is considered to have a Less than Significant impact.

CLOSING

If you have any questions about these analyses, please feel free to contact me at 415.796.1934 or mkeinath@ramboll.com. Thank you for the opportunity to assist you with this matter.

Attachments:

Tables

[11] California Energy Commission. 2016 Building Energy Efficiency Standards, Frequently Asked Questions. Available at: http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf. Accessed October 4, 2017.

TABLES

Table 1
Construction Schedule and Off-Road Equipment List
Davidon Magee Preserve
Danville, California

Phase	Sub-Phase	Construction Start[1]	Construction End[1]	Equipment[1]	Quantity[1]	Usage Hours per Day[2]	Total Usage Days	Total Usage Hours per Equipment
Site Preparation	Demolition	1/1/2019	1/9/2019	Rubber Tired Dozers	2	8.0	7	112
				Excavators	3	8.0	7	168
				Concrete/Industrial Saws	1	8.0	7	56
	Site Preparation	1/10/2019	1/21/2019	Tractors/Loaders/Backhoes	4	8.0	8	256
				Rubber Tired Dozers	3	8.0	8	192
	Grading	1/22/2019	5/6/2019	Rubber Tired Dozers	1	8.0	75	600
				Excavators	2	8.0	75	1,200
				Graders	1	8.0	75	600
				Tractors/Loaders/Backhoes	2	8.0	75	1,200
				Scrapers	2	8.0	75	1,200
	Trenching	5/7/2019	8/19/2019	Excavators	2	8.0	75	1,200
				Tractors/Loaders/Backhoes	4	8.0	75	2,400
	Paving	8/20/2019	9/9/2019	Pavers	2	8.0	15	240
				Rollers	2	8.0	15	240
				Paving Equipment	2	8.0	15	240
	Landscaping	9/10/2019	11/10/2019	Tractors/Loaders/Backhoes	2	8.0	44	704
Model Home Construction	Building Construction	10/9/2019	6/20/2020	Tractors/Loaders/Backhoes	3	7.0	183	3,843
				Generator Sets	1	8.0	183	1,464
				Welders	1	8.0	183	1,464
				Cranes	1	7.0	183	1,281
				Forklifts	3	8.0	183	4,392
	Architectural Coating	6/21/2020	7/9/2020	Air Compressors	1	6.0	14	84
Home Production	Building Construction	10/9/2019	8/1/2022	Welders	1	8.0	734	5,872
				Cranes	1	7.0	734	5,138
				Forklifts	3	8.0	734	17,616
				Tractors/Loaders/Backhoes	3	7.0	734	15,414
				Generator Sets	1	8.0	734	5,872
	Architectural Coating	8/2/2022	10/9/2022	Air Compressors	1	6.0	49	294

Notes:
1. Construction schedule and equipment list provided by Project Sponsor.
2. Usage hours per day are based on CalEEMod® defaults.

Abbreviations:
CalEEMod®: California Emissions Estimator Model

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Table 2
Off-Road Construction Equipment Diesel Fuel Usage
Davidon Magee Preserve
Danville, CA

Calendar Year[1]	Phase	Sub-Phase[1]	Project Equipment[1]	HP[2]	LF[2]	Total Hours[1]	HP-Hour[3]	Fuel Usage[4] (gal)
2019	Site Preparation	Demolition	Rubber Tired Dozers	247	0.73	112	20,195	1,032
			Excavators	158	0.38	168	10,137	518
			Concrete/Industrial Saws	81	0.40	56	1,814	93
		Site Preparation	Tractors/Loaders/Backhoes	97	0.37	256	9,151	467
			Rubber Tired Dozers	247	0.40	192	18,970	969
		Grading	Rubber Tired Dozers	247	0.40	600	59,280	3,028
			Excavators	158	0.38	1,200	72,408	3,699
			Graders	187	0.41	600	46,002	2,350
			Tractors/Loaders/Backhoes	97	0.37	1,200	43,068	2,200
			Scrapers	367	0.48	1,200	211,392	10,799
		Trenching	Excavators	158	0.38	1,200	72,408	3,699
			Tractors/Loaders/Backhoes	97	0.37	2,400	85,787	4,382
		Paving	Pavers	130	0.42	240	13,104	669
			Rollers	80	0.38	240	7,296	373
			Paving Equipment	132	0.36	240	11,405	583
		Landscaping	Tractors/Loaders/Backhoes	97	0.37	704	25,164	1,285
	Model Home Construction	Building Construction	Tractors/Loaders/Backhoes	97	0.37	1,260	45,038	2,301
			Generator Sets	84	0.74	480	29,837	1,524
			Welders	46	0.45	480	9,936	508
			Cranes	231	0.29	420	28,136	1,437
			Forklifts	89	0.20	1,440	25,632	1,309
	Home Production	Building Construction	Welders	46	0.45	480	9,936	508
			Cranes	231	0.29	420	28,136	1,437
			Forklifts	89	0.20	1,440	25,632	1,309
			Tractors/Loaders/Backhoes	97	0.37	1,260	45,038	2,301
			Generator Sets	84	0.74	480	29,837	1,524
2020	Model Home Construction	Building Construction	Tractors/Loaders/Backhoes	97	0.37	2583	92,328	4,716
			Generator Sets	84	0.74	984	61,165	3,125
			Welders	46	0.45	984	20,369	1,041
			Cranes	231	0.29	861	57,678	2,946
			Forklifts	89	0.20	2,952	52,546	2,684
		Architectural Coating	Air Compressors	78	0.48	84	3,145	161
	Home Production	Building Construction	Welders	46	0.45	2,096	43,387	2,216
			Cranes	231	0.29	1,834	122,860	6,276
			Forklifts	89	0.20	6,288	111,926	5,718
			Tractors/Loaders/Backhoes	97	0.37	5,502	196,666	10,046
			Generator Sets	84	0.74	2,096	130,287	6,656
2021	Home Production	Building Construction	Welders	46	0.45	2,088	43,222	2,208
			Cranes	231	0.29	1,827	122,391	6,252
			Forklifts	89	0.20	6,264	111,499	5,696
			Tractors/Loaders/Backhoes	97	0.37	5,481	195,916	10,008
			Generator Sets	84	0.74	2,088	129,790	6,630
2022	Home Production	Building Construction	Welders	46	0.45	1,208	25,006	1,277
			Cranes	231	0.29	1,057	70,808	3,617
			Forklifts	89	0.20	3,624	64,507	3,295
			Tractors/Loaders/Backhoes	97	0.37	3,171	113,346	5,790
			Generator Sets	84	0.74	1,208	75,089	3,836
		Architectural Coating	Air Compressors	78	0.48	294	11,007	562
							Total	**145,061**

Notes:

1. Year, phase, and equipment list provided by Project Sponsor. Total hours based on construction schedule information in Table 1.
2. Load factor and horsepower are CalEEMod® defaults for the equipment type.
3. HP-Hour is the basis for the fuel calculation. HP-Hour is calculated using the following formula:
   HP-Hour = Total Hours x LF x HP
4. Off-road mobile source fuel usage is calculated using a fuel usage rate of 0.0512 gallons of diesel per horsepower (HP)-hour. This is calculated based on diesel

Abbreviations:

Gal: gallon
HP: horsepower
LF: load factor

References:

USEPA. 1996. AP-42. Section 3.4 Large Stationary Diesel And All Stationary Dual-fuel Engines. October. Available at: https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf.

Table 3
Construction Truck Trips - Fuel Efficiency
Davidon Magee Preserve
Danville, California

Calendar Year	Vehicle Class	EMFAC2014 Outputs[2]		Diesel Fuel Efficiency[3] (miles/gallon)
		Diesel Fuel Consumption (1,000 gal/day)	VMT (miles/day)	
2019	HHDT	98.1	560,728	5.7
	MHDT	27.4	225,677	8.2
	HHDT/MHDT[1]	--	--	7.0
2020	HHDT	99.4	575,425	5.8
	MHDT	27.2	225,228	8.3
	HHDT/MHDT[1]	--	--	7.0
2021	HHDT	101.7	595,909	5.9
	MHDT	27.6	229,129	8.3
	HHDT/MHDT[1]	--	--	7.1
2022	HHDT	103.3	614,178	5.9
	MHDT	27.9	232,546	8.3
	HHDT/MHDT[1]	--	--	7.1

Notes:

1. Assumes 50% HHDT and 50% MHDT vehicles, consistent with assumptions in CalEEMod for hauling trucks.

2. EMFAC2014 was run for Contra Costa County for the constuction years 2019-2022. Data was aggregated over all vehicle model years and speed bins.

3. The fuel efficiency was calculated by dividing the VMT (miles/day) by the fuel consumption (gal/day).

Abbreviations:

gal: gallons
HHDT: Heavy Heavy Duty Trucks
MHDT: Medium Heavy Duty Trucks
VMT: vehicle miles traveled

Reference:

ARB. 2014. EMFAC2014 Web Database 1.0.7. Available at: https://www.arb.ca.gov/emfac/2014/

Table 4
Construction Worker Trips - Fuel Efficiency
Davidon Magee Preserve
Danville, California

Calendar Year	Vehicle Class	EMFAC2014 Outputs[2]		Gasoline Fuel Efficiency[3] (miles/gallon)
		Gasoline Fuel Consumption (1,000 gal/day)	VMT (miles/day)	
2019	LDA	484.1	13,706,383	28.3
	LDT1	42.8	1,019,900	23.9
	LDT2	218.9	4,626,053	21.1
	Worker Mix[1]	--	--	25.4
2020	LDA	475.6	13,873,675	29.2
	LDT1	40.8	1,000,865	24.5
	LDT2	213.8	4,655,122	21.8
	Worker Mix[1]	--	--	26.2
2021	LDA	465.6	14,006,558	30.1
	LDT1	38.9	986,241	25.3
	LDT2	207.9	4,687,319	22.5
	Worker Mix[1]	--	--	27.0
2022	LDA	453.9	14,084,407	31.0
	LDT1	37.1	973,388	26.2
	LDT2	201.7	4,714,986	23.4
	Worker Mix[1]	--	--	27.9

Notes:

1. Assumes 50% LDA, 25% LDT1, and 25% LDT2 vehicles, consistent with assumptions in CalEEMod for worker vehicles.
2. EMFAC2014 was run for Contra Costa County for the construction years 2019-2022. Data was aggregated over all vehicle model years and speed bins.
3. The fuel efficiency was calculated by dividing the VMT (miles/day) by the fuel consumption (gal/day).

Abbreviations:

gal: gallons
LDA: Light-Duty Automobiles
LDT: Light-Duty Trucks
VMT: vehicle miles traveled

Reference:

ARB. 2014. EMFAC2014 Web Database 1.0.7. Available at: https://www.arb.ca.gov/emfac/2014/

Table 5
On-Road Construction Trucks - Diesel Fuel Use
Davidon Magee Preserve
Danville, California

Year	Phase	Sub-Phase	Trip Type	Total One-Way Trips[1]	Total Distance[2] (miles)	Diesel Fuel Usage[3] (gal/yr)	Total Diesel Fuel Usage (gal/yr)
2019	Site Preparation	Demolition	Hauling	30	600	105	1,180
		Site Preparation	Hauling	15	300	52	
		Grading	Hauling	15	300	52	
		Trenching	Hauling	50	1,000	175	
		Paving	Hauling	200	4,000	700	
		Landscaping	Hauling	25	500	87	
	Model Home Construction	Building Construction	Vendor	1	7	1	
	Home Production	Building Construction	Vendor	7	51	7	
2020	Model Home Construction	Building Construction	Vendor	1	7	1	8
	Home Production	Building Construction	Vendor	7	51	7	
2021	Home Production	Building Construction	Vendor	7	51	7	7
2022	Home Production	Building Construction	Vendor	7	51	7	7

Notes:

1. Trip rates and distances provided by Project Sponsor for non-default phases (trenching, landscaping) and CalEEMod default values based on land use type and project phase for
2. Total distance is based on the default CalEEMod trip distance by trip type (20 miles/trip for hauling, 7.3 miles/trip for vendor).
3. Diesel fuel usage based on fuel consumption and VMT data from EMFAC2014 for Contra Costa County and total number of one-way trips. Emissions assume a 50%/50% split of MHDT and HHDT vehicles for vendor trips and 100% HHDT for hauling trips.

Abbreviations:

gal: gallon
HHDT: heavy heavy duty truck
MHDT: medium heavy duty truck
VMT: vehicle miles traveled
yr: year

Table 6
On-road Worker Construction Vehicles - Gasoline Fuel Use
Davidon Magee Preserve
Danville, California

Year	Phase	Sub-Phase	Workers[1] (trips/day)	Number of Days[2]	Total Trips[3]	VMT from Workers[4]	Gasoline Usage[5] (gallons)	Total Gasoline Usage (gallons)
2019	Site Preparation	Demolition	5	7	70	756	30	3,954
		Site Preparation	10	8	160	1,728	68	
		Grading	20	75	3,000	32,400	1,276	
		Trenching	10	75	1,500	16,200	638	
		Paving	15	15	450	4,860	191	
		Landscaping	10	44	880	9,504	374	
	Model Home Construction	Building Construction	4	60	480	5,184	204	
	Home Production	Building Construction	23	60	2,760	29,808	1,173	
2020	Model Home Construction	Architectural Coating	1	14	28	302	12	5,393
	Model Home Construction	Building Construction	4	123	984	10,627	406	
	Home Production	Building Construction	23	262	12,052	130,162	4,975	
2021	Home Production	Building Construction	23	261	12,006	129,665	4,801	4,801
2022	Home Production	Architectural Coating	5	49	490	5,292	190	2,877
	Home Production	Building Construction	23	151	6,946	75,017	2,688	

Notes:

1. Trip rates are default CalEEMod trip rates based on project phase type and land use types.
2. Number of days based on construction schedule.
3. Total trips is the total worker trips per calendar year. It is calculated as the product of number of days and 2 one-way trips per worker per day.
4. VMT from workers assumes the CalEEMod default trip distance of 10.8 miles/trip.
5. Gasoline usage calculated using the VMT and fuel effiencies.

Abbreviations:

VMT: vehicle miles traveled

Table 7
Construction Fuel Use by Year
Davidon Magee Preserve
Danville, California

Calendar Year	Fuel Usage[1]	
	Diesel (gallons)	Gasoline (gallons)
2019	51,484	3,954
2020	45,593	5,393
2021	30,801	4,801
2022	18,385	2,877
Total	**146,264**	**17,025**

Notes:
1. Total fuel usage consists of fuel for off-road construction equipment, on-road construction trucks, and construction worker vehicles.

Table 8
Title 24 Adjustments
Davidon Magee Preserve
Danville, CA

Reduction Calculation

Scenario	Land Use	Electricity (GWh)[1]		Lighting Electricity[2]	Natural Gas (million therms)[1]	
		Standard	% Reduction	% Reduction	Standard	% Reduction
2013	Single Family	1,133	11.7%	50%	62	21.1%
2016	Housing	1,001			49	

Adjusted Energy Intensity Factors

Scenario	Land Use SubType	Title 24 Electricity	Non-Title 24 Electricity	Lighting Electricity	Title 24 Natural Gas	Non-Title 24 Natural Gas
		kWhr/size/yr			kBTU/size/yr	
CalEEMod Defaults	Single Family	368.92	6680.41	1608.84	32797.58	3155
Adjusted	Housing	325.94		804.42	25874.52	

Notes:

1. The adjustment factors for Title 24 electricity and natural gas are from: California Energy Commission. Impact Analysis: 2016 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. June 2015.
2. The adjustment for lighting is based on the requirement that "All installed luminaires shall be high efficacy". High efficacy lighting can use over 75% less electricity than incandescent bulbs. Additional reductions in lighting electricity would come from sensors or occupancy controls required for certain building types. CEC, 2015.

Abbreviations:

GWh - gigawatt-hour
kWhr - kilowatt-hour
kBTU - thousand British thermal unit
yr - year

Table 9
Building Energy Use
Davidon Magee Preserve
Danville, CA

Land Use	Energy Source	Size Amount	Title 24 Electricity	Non-Title 24 Electricity	Lighting Electricity	Title 24 Natural Gas	Non-Title 24 Natural Gas
		Dwelling Unit, # Streetlights, % VMT	kWhr/yr			kBTU/yr	
Single Family Housing[1]	Net Zero Electricity	86	--	--	--	2,225,209	271,330
Electric Vehicle Charging[2]	Grid Energy	25%	--	121,162	--	--	--
		Total	**135,978**			**2,496,539**	

Notes:

1. All homes will be zero net electricity and are assumed to generate as much zero carbon electricity as they consume over the course of the year, thus generating zero net electricity emissions. The zero carbon electricity was conservatively assumed to not compensate for the increased electricity consumption due to electric vehicle charging.
2. Fuel economy of electric vehicle is 0.25 kWhr/mile. Electric vehicles travel 25% of annual VMT in previous table (484,648 miles). Fuel economy from US Department of Energy, 2013. Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: July 2017.

Abbreviations:

hr - hour
kBTU - thousand British thermal unit
kWhr - kilowatt-hour
W - watt
yr - year

Table 10
Operational Trips - Fuel Efficiency
Davidon Magee Preserve
Danville, California

Calendar Year	Fuel	Vehicle Class	EMFAC2014 Outputs[1]			Fuel Efficiency[2] (miles/gallon)
			Fleet Mix (%)	Fuel Consumption (1,000 gal/day)	VMT (miles/day)	
2023	Gas	LDA	72.5%	442.3	14,156,393	32.0
		LDT1	5.1%	35.5	964,757	27.2
		LDT2	22.4%	195.7	4,753,182	24.3
		Fleet Mix	--	--	--	30.0
	Diesel	LDA	94.8%	4.2	171,649	40.6
		LDT1	0.5%	0.0	632	31.6
		LDT2	4.7%	0.3	9,676	31.8
		Fleet Mix	--	--	--	40.2

Notes:

1. EMFAC2014 was run for Contra Costa County for the operational year 2023. Data was aggregated over all vehicle model years and speed bins. Fleet mix is based on the EMFAC2014 population distribution between LDA, LDT1 and LDT2.

2. The fuel efficiency was calculated by dividing the VMT (miles/day) by the fuel consumption (gal/day).

Abbreviations:

gal: gallons
LDA: light-duty automobile
LDT1: light-duty truck 1
LDT2: light-duty truck 2

Reference:

ARB. 2014. EMFAC2014 Web Database 1.0.7. Available at: https://www.arb.ca.gov/emfac/2014/

Table 11
Operational Vehicular Travel - Fuel Usage
Davidon Magee Preserve
Danville, CA

Year[1]	Total Annual VMT[2] (miles/yr)	Fuel Type	Portion of Fleet[3] (%)	VMT by Fuel Type (miles/yr)	Fleet Mix Efficiency[4] (miles/gal)	Fuel Usage (gal/yr)
2023	1,938,592	Gas	74%	1,439,405	30.0	47,929
		Diesel	1%	14,539	40.2	362
		Electric	25%	484,648	N/A	0

Notes:

1. Calculated for operational year 2023 only. Future years will likely use less fuel due to more efficient cars.
2. Total VMT is based on the trip generation from the traffic consultant and CalEEMod defaults for trip lengths.
3. Fleet distribution of gas to diesel vehicles is assumed to be similar to that of EMFAC2014 for LDA, LDT1 and LDT2 diesel and gas vehicles. Electric vehicles are assumed to be 25% of the fleet, as discussed in the Air Quality Technical Memo.
4. Fuel efficiency is based on fuel consumption and VMT data from EMFAC2014 for Contra Costa County and total VMT.

Abbreviations:

EV: electric vehicle
gal: gallon
LDA: light-duty automobile
LDT1: light-duty truck 1
LDT2: light-duty truck 2
VMT: vehicle miles traveled
yr: year

Table 12
Energy Use Summary[1]
Davidon Magee Preserve
Danville, CA

Construction		Building Energy Use		Vehicular Travel	
Diesel Fuel	**Gasoline**	**Electricity**	**Natural Gas**	**Diesel Fuel**	**Gasoline**
(gal)	(gal)	(MWh/year)	(therms/year)	(gal/year)	(gal/year)
146,264	17,025	136	24,971	362	47,929

Notes:
1. Energy use calculated in previous tables.

Abbreviations:
gal: gallons
MWH: Megawatt hours