APPENDIX J:

Air Quality Analysis

Air Quality

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Western Land Area
Environmental Assessment

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1 Introduction

This appendix presents the overall data, assumptions, approach, and methodology for preparing criteria pollutant and pollutant precursor project-related motor vehicle traffic emissions inventories for the future years 2020 and 2025 for the three Proposed Action Alternatives (e.g., Current Market, Medium Density, and High Density) for the Western Land Area (WLA) development at Washington Dulles International Airport (IAD). Additionally, project-related construction emissions inventories were also prepared for construction years 2020 through 2025 for the three alternatives.

The emissions inventories were prepared for carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter less than 10 micrometers in diameter (coarse or PM_{10}), and particulate matter less than 2.5 micrometers in diameter (fine or $PM_{2.5}$).

2 Construction Activities

For this assessment, construction-related emissions are primarily associated with the exhaust from heavy equipment (i.e., backhoes, bulldozers, graders, etc.), delivery trucks (i.e., cement trucks, dump trucks, etc.) and construction worker vehicles getting to and from the airport construction site(s); dust from site preparation, land clearing, material handling, equipment movement on unpaved areas, and demolition activities; and fugitive emissions from the storage/transfer of raw materials. These emissions are temporary in nature and generally confined to the construction site and the access/egress roadways.

To calculate short-term emissions resulting from construction activities, an estimate of daily equipment requirements was prepared for each general construction activity using the Airport Construction Emissions Inventory Tool (ACEIT).[1] Project-specific details were used in the ACEIT to estimate construction activities and equipment/vehicles activity data (e.g., equipment mixes/times). Because the default emission factors used by ACEIT are outdated and do not reflect the latest EPA's Motor Vehicle Emission Simulator (i.e., MOVES/NONROAD)[2] model, only activity data was extracted from ACEIT. Up-to-date emission factors were then developed using the MOVES, which includes both on-road vehicles and off-road construction equipment. Consistent

[1] TRB, ACRP Report 102, Guidance for Estimating Airport Construction Emissions, http://www.trb.org/ACRP/Blurbs/170234.aspx

[2] MOVES2014a is the latest version of MOVES/NONRAOD. Additional information is available at https://www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves.

with the planning and development timeframes for the proposed project, **Table 1** presents the year(s) and the construction activities associated with the proposed projects.

Table 1
Construction Schedule for Proposed Projects at WLA

Year	Construction Activities
2020-2025	• Site Clearing • Construction of Retail, Warehouse Distribution, Data Center, and Light Industrial-use Buildings • Pavement of Internal Roadways • Pavement of Surface Parking Lot

Source: HNTB Corporation, 2017.

2.1 On-Road Vehicles

For on-road vehicles, the anticipated vehicle-miles-traveled (VMT) were estimated to determine annual emissions. In deriving the VMT (**Table 2**), the following was assumed:

- VMT by material delivery and dirt haul trucks was based on a travel distance of 40-mile roundtrip.
- In deriving the VMT for laborers/commuters, it was assumed that a passenger car/truck composite vehicle would commute 30-mile roundtrip per laborer.

Table 2
Construction Equipment Annual VMT

Vehicles	MOVES On-road	Miles Travelled
Laborers/Commuters	Passenger Car/Truck	804,960
Material Delivery & Dirt Haul Trucks	Single Unit Short-haul Truck	61,920
Tractor Trailers	Combination Short-haul Truck	41,280

The following equation was used to obtain annual emission rates for on-road vehicles:

Emissions (tons/year) for on-road vehicles = Emission Factor (g/mile) x vehicle miles travelled per day x days/year x (1 pound/453.59 grams) x (1 ton/2,000 pounds)

Emission factors associated with the MOVES model are presented in **Table 3** for laborers/commuters, material delivery/dirt haul trucks, and tractor trailers.

Table 3
On-Road Vehicle Emission Factors (grams/mile)

Vehicles	MOVES On-road	Pollutant	2020	2021	2022	2023	2024	2025
Laborers/ Commuters	Passenger Car/Truck	CO	7.1	6.6	6.2	5.8	5.4	5.0
		VOC	0.7	0.6	0.6	0.6	0.5	0.5
		NO_x	0.4	0.3	0.3	0.3	0.2	0.2
		SO_2	0.003	0.003	0.003	0.003	0.003	0.003
		PM_{10}	0.08	0.08	0.08	0.07	0.07	0.07
		$PM_{2.5}$	0.03	0.03	0.03	0.03	0.02	0.02
Material Delivery & Dirt Haul Trucks	Single Unit Short-haul Truck	CO	1.8	1.7	1.6	1.5	1.5	1.4
		VOC	0.5	0.4	0.4	0.4	0.3	0.3
		NO_x	2.6	2.3	2.1	1.9	1.7	1.6
		SO_2	0.01	0.01	0.01	0.01	0.01	0.01
		PM_{10}	0.3	0.3	0.3	0.3	0.3	0.3
		$PM_{2.5}$	0.1	0.1	0.1	0.1	0.1	0.1
Tractor Trailers	Combination Short-haul Truck	CO	2.5	2.3	2.2	2.1	2.0	1.9
		VOC	0.5	0.4	0.4	0.3	0.3	0.3
		NO_x	4.5	3.9	3.4	3.1	2.8	2.5
		SO_2	0.02	0.02	0.02	0.02	0.02	0.02
		PM_{10}	0.5	0.5	0.5	0.4	0.4	0.4
		$PM_{2.5}$	0.2	0.2	0.2	0.1	0.1	0.1

Source: MOVES 2014a.
Notes: CO – Carbon Monoxide, NO_x – nitrogen oxides, SO_2 – sulfur dioxide, $PM_{10/2.5}$ – particulate matter, and VOC – volatile organic compounds.

2.2 Off-Road Construction Equipment

EPA's NONROAD 2008 model is used to estimate off-road equipment emissions and is embedded within the latest version of MOVES. **Table 4** presents the off-road equipment included in the analysis along with the corresponding category description used within MOVES, and the usage factors and horsepower (hp) that was assigned to each type of construction equipment. Emissions factors (grams/hp-hour) for each equipment type were applied to the anticipated work output (hp-hours) of expected equipment use. ACEIT was used to estimate construction activities and equipment activity data (e.g., equipment fleet/operating times). A usage factor accounting for the percentage of daily operation was also included in the estimates. That is, a usage factor of 0.75 equates to 6 hours of operation.

Table 4
Construction Equipment Information

Equipment	MOVES Description	Usage Factor	Horsepower
40 Ton Crane	Cranes	0.48	300
90 Ton Crane	Cranes	0.48	300
Auger Drill	Bore/Drill Rigs	0.29	175
Backhoe	Tractors/Loaders/Backhoes	0.55	100
Bob Cat	Tractors/Loaders/Backhoes	0.55	75
Bulldozer	Crawler Tractor/Dozers	0.45	175
Chain Saws	Chain Saws < 6 HP (Commercial)	0.15	11
Compacting Equipment	Rollers	0.37	100
Concrete Pump	Other Construction Equipment	0.29	11
Concrete Ready Mix Trucks	Other General Industrial Equipment	0.42	600
Flat Bed or Dump Trucks	Other General Industrial Equipment	0.42	600
Fork Truck	Other General Industrial Equipment	0.42	100
Front Loader	Tractors/Loaders/Backhoes	0.55	100
Grout Mixer for Mortar	Cement & Mortar Mixers	0.13	600
High Lift Fork Truck	Rough Terrain Forklifts	0.32	100
Line Painting Truck/Sprayer	Other General Industrial Equipment	0.42	600
Log Chipper	Other Lawn & Garden Equipment	0.21	100
Man Lift	Aerial Lifts	0.18	75
Masonry Saw	Concrete/Industrial Saws	0.28	40
Mulcher	Other Lawn & Garden Equipment	0.21	100
Paving Machine	Paving Equipment	0.30	175
Roller	Rollers	0.37	100
Seed Truck Spreader	Other General Industrial Equipment	0.42	600
Small Dozer	Crawler Tractor/Dozers	0.45	175
Survey Crew Trucks	Other General Industrial Equipment	0.42	600
Ten Wheelers	Other General Industrial Equipment	0.42	600
Tool Truck	Other General Industrial Equipment	0.42	600
Tractor	Other General Industrial Equipment	0.42	100
Trowel Machine	Surfacing Equipment	0.27	600

Source: MOVES2014a.
Note: EPA's NONROAD2008 model is used to estimated off-road construction equipment emissions and is embedded within the latest version of MOVES2014a.

Because the age of the equipment is entirely dependent on the preferences of the contractor, a conservative estimate of average equipment age was applied. For example, although newer Tier III and IV equipment less than six years old may be used, the construction emissions inventory utilized Tier I and II equipment for a portion of the fleet.

The following equations were used to obtain emission estimates for off-road construction equipment:

Construction Equipment Emissions (tons/year) = Emission Factor (grams/hp-hour) x Horsepower (hp) x hours per year x Usage Factor x (1 pound/453.59 grams) x (1 ton/2,000 pounds)

Tables 5 through **10** present the construction equipment emission factors (grams per hp-hour) for 2020 through 2025, respectively.

Table 5
2020 Construction Equipment Emission Factors (g/mile)

Description	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
40 Ton Crane	0.4	1.4	<0.01	0.1	0.1	0.2
90 Ton Crane	0.4	1.4	<0.01	0.1	0.1	0.2
Auger Drill	1.0	3.2	<0.01	0.2	0.2	0.3
Backhoe	2.9	3.0	<0.01	0.4	0.4	0.6
Bob Cat	2.9	3.0	<0.01	0.4	0.4	0.6
Bulldozer	0.5	1.2	<0.01	0.1	0.1	0.2
Chain Saws (gasoline)	213	2.4	<0.01	7.4	6.8	71.4
Compacting Equipment	0.7	1.5	<0.01	0.1	0.1	0.2
Concrete Pump	0.9	2.1	<0.01	0.1	0.1	0.2
Concrete Ready Mix Trucks	0.5	1.5	<0.01	0.1	0.1	0.2
Flat Bed or Dump Trucks	0.5	1.5	<0.01	0.1	0.1	0.2
Fork Truck	0.5	1.5	<0.01	0.1	0.1	0.2
Front Loader	2.9	3.0	<0.01	0.4	0.4	0.6
Grout Mixer for Mortar	1.9	3.8	<0.01	0.3	0.3	0.4
High Lift	1.0	1.6	<0.01	0.1	0.1	0.2
Line Painting Truck/Sprayer	0.5	1.5	<0.01	0.1	0.1	0.2
Log Chipper	1.9	4.0	<0.01	0.3	0.3	0.4
Man Lift	4.2	4.6	<0.01	0.6	0.6	0.9
Masonry Saw	1.2	2.6	<0.01	0.2	0.1	0.2
Mulcher	1.9	4.0	<0.01	0.3	0.3	0.4
Paving Machine	0.9	1.8	<0.01	0.1	0.1	0.2
Roller	0.7	1.5	<0.01	0.1	0.1	0.2
Seed Truck Spreader	0.5	1.5	<0.01	0.1	0.1	0.2
Small Dozer	0.5	1.2	<0.01	0.1	0.1	0.2
Survey Crew Trucks	0.5	1.5	<0.01	0.1	0.1	0.2
Ten Wheelers	0.5	1.5	<0.01	0.1	0.1	0.2
Tool Truck	0.5	1.5	<0.01	0.1	0.1	0.2
Tractor	0.5	1.5	<0.01	0.1	0.1	0.2
Trowel Machine	1.3	2.7	<0.01	0.2	0.2	0.2

Source: MOVES2014a.

Table 6
2021 Construction Equipment Emission Factors (g/mile)

Description	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
40 Ton Crane	0.3	1.2	<0.01	0.1	0.1	0.2
90 Ton Crane	0.3	1.2	<0.01	0.1	0.1	0.2
Auger Drill	0.9	3.0	<0.01	0.2	0.1	0.3
Backhoe	2.6	2.8	<0.01	0.4	0.4	0.5
Bob Cat	2.6	2.8	<0.01	0.4	0.4	0.5
Bulldozer	0.4	1.1	<0.01	0.0	0.0	0.2
Chain Saws (gasoline)	213	2.4	<0.01	7.4	6.8	71.4
Compacting Equipment	0.6	1.3	<0.01	0.1	0.1	0.2
Concrete Pump	0.8	1.9	<0.01	0.1	0.1	0.2
Concrete Ready-Mix Trucks	0.5	1.3	<0.01	0.1	0.1	0.2
Flat Bed or Dump Trucks	0.5	1.3	<0.01	0.1	0.1	0.2
Fork Truck	0.5	1.3	<0.01	0.1	0.1	0.2
Front Loader	2.6	2.8	<0.01	0.4	0.4	0.5
Grout Mixer for Mortar	1.8	3.6	<0.01	0.3	0.2	0.4
High Lift	0.9	1.4	<0.01	0.1	0.1	0.2
Line Painting Truck/Sprayer	0.5	1.3	<0.01	0.1	0.1	0.2
Log Chipper	1.8	3.9	<0.01	0.3	0.3	0.4
Man Lift	3.9	4.4	<0.01	0.5	0.5	0.9
Masonry Saw	1.1	2.5	<0.01	0.1	0.1	0.2
Mulcher	1.8	3.9	<0.01	0.3	0.3	0.4
Paving Machine	0.8	1.6	<0.01	0.1	0.1	0.2
Roller	0.6	1.3	<0.01	0.1	0.1	0.2
Seed Truck Spreader	0.5	1.3	<0.01	0.1	0.1	0.2
Small Dozer	0.4	1.1	<0.01	0.0	0.0	0.2
Survey Crew Trucks	0.5	1.3	<0.01	0.1	0.1	0.2
Ten Wheelers	0.5	1.3	<0.01	0.1	0.1	0.2
Tool Truck	0.5	1.3	<0.01	0.1	0.1	0.2
Tractor	0.5	1.3	<0.01	0.1	0.1	0.2
Trowel Machine	1.1	2.5	<0.01	0.2	0.1	0.2

Source: MOVES2014a.

Table 7
2022 Construction Equipment Emission Factors (g/mile) -

Description	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
40 Ton Crane	0.3	1.0	<0.01	0.04	0.04	0.2
90 Ton Crane	0.3	1.0	<0.01	0.04	0.04	0.2
Auger Drill	0.8	2.8	<0.01	0.1	0.1	0.3
Backhoe	2.4	2.5	<0.01	0.4	0.3	0.5
Bob Cat	2.4	2.5	<0.01	0.4	0.3	0.5
Bulldozer	0.3	0.9	<0.01	0.04	0.04	0.2
Chain Saws (gasoline)	213	2.4	<0.01	7.4	6.8	71.5
Compacting Equipment	0.5	1.2	<0.01	0.1	0.1	0.2
Concrete Pump	0.8	1.7	<0.01	0.1	0.1	0.2
Concrete Ready-Mix Trucks	0.4	1.2	<0.01	0.1	0.1	0.2
Flat Bed or Dump Trucks	0.4	1.2	<0.01	0.1	0.1	0.2
Fork Truck	0.4	1.2	<0.01	0.1	0.1	0.2
Front Loader	2.4	2.5	<0.01	0.4	0.3	0.5
Grout Mixer for Mortar	1.7	3.4	<0.01	0.2	0.2	0.4
High Lift	0.7	1.2	<0.01	0.1	0.1	0.2
Line Painting Truck/Sprayer	0.4	1.2	<0.01	0.1	0.1	0.2
Log Chipper	1.7	3.8	<0.01	0.3	0.3	0.4
Man Lift	3.6	4.2	<0.01	0.5	0.5	0.8
Masonry Saw	1.0	2.4	<0.01	0.1	0.1	0.2
Mulcher	1.7	3.8	<0.01	0.3	0.3	0.4
Paving Machine	0.7	1.5	<0.01	0.1	0.1	0.2
Roller	0.5	1.2	<0.01	0.1	0.1	0.2
Seed Truck Spreader	0.4	1.2	<0.01	0.1	0.1	0.2
Small Dozer	0.3	0.9	<0.01	0.04	0.04	0.2
Survey Crew Trucks	0.4	1.2	<0.01	0.1	0.1	0.2
Ten Wheelers	0.4	1.2	<0.01	0.1	0.1	0.2
Tool Truck	0.4	1.2	<0.01	0.1	0.1	0.2
Tractor	0.4	1.2	<0.01	0.1	0.1	0.2
Trowel Machine	1.0	2.3	<0.01	0.1	0.1	0.2

Source: MOVES2014a.

Table 8
2023 Construction Equipment Emission Factors (g/mile)

Description	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
40 Ton Crane	0.2	0.9	<0.01	0.04	0.04	0.2
90 Ton Crane	0.2	0.9	<0.01	0.04	0.04	0.2
Auger Drill	0.7	2.6	<0.01	0.1	0.1	0.2
Backhoe	2.2	2.3	<0.01	0.3	0.3	0.4
Bob Cat	2.2	2.3	<0.01	0.3	0.3	0.4
Bulldozer	0.3	0.8	<0.01	0.04	0.04	0.2
Chain Saws (gasoline)	213	2.4	<0.01	7.4	6.8	71.5
Compacting Equipment	0.4	1.1	<0.01	0.04	0.04	0.2
Concrete Pump	0.7	1.5	<0.01	0.1	0.1	0.2
Concrete Ready-Mix Trucks	0.3	1.0	<0.01	0.05	0.05	0.2
Flat Bed or Dump Trucks	0.3	1.0	<0.01	0.05	0.05	0.2
Fork Truck	0.3	1.0	<0.01	0.05	0.05	0.2
Front Loader	2.2	2.3	<0.01	0.3	0.3	0.4
Grout Mixer for Mortar	1.6	3.2	<0.01	0.2	0.2	0.4
High Lift	0.6	1.1	<0.01	0.1	0.1	0.2
High Lift Fork Truck	0.6	1.1	<0.01	0.1	0.1	0.2
Line Painting Truck/Sprayer	0.3	1.0	<0.01	0.05	0.05	0.2
Log Chipper	1.7	3.7	<0.01	0.3	0.2	0.4
Man Lift	3.4	4.1	<0.01	0.4	0.4	0.7
Masonry Saw	0.9	2.3	<0.01	0.1	0.1	0.2
Mulcher	1.7	3.7	<0.01	0.3	0.2	0.4
Paving Machine	0.6	1.4	<0.01	0.1	0.1	0.2
Roller	0.4	1.1	<0.01	0.0	0.0	0.2
Seed Truck Spreader	0.3	1.0	<0.01	0.05	0.05	0.2
Small Dozer	0.3	0.8	<0.01	0.03	0.03	0.2
Survey Crew Trucks	0.3	1.0	<0.01	0.05	0.05	0.2
Ten Wheelers	0.3	1.0	<0.01	0.05	0.05	0.2
Tool Truck	0.3	1.0	<0.01	0.05	0.05	0.2
Tractor	0.3	1.0	<0.01	0.05	0.05	0.2
Trowel Machine	0.9	2.2	<0.01	0.1	0.1	0.2

Source: MOVES2014a.

Table 9
2024 Construction Equipment Emission Factors (g/mile)

Description	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
40 Ton Crane	0.2	0.8	<0.01	0.03	0.03	0.2
90 Ton Crane	0.2	0.8	<0.01	0.03	0.03	0.2
Auger Drill	0.7	2.4	<0.01	0.1	0.1	0.2
Backhoe	2.0	2.1	<0.01	0.3	0.3	0.4
Bob Cat	2.0	2.1	<0.01	0.3	0.3	0.4
Bulldozer	0.3	0.8	<0.01	0.04	0.04	0.2
Chain Saws (gasoline)	213	2.4	<0.01	7.4	6.8	71.5
Compacting Equipment	0.4	1.0	<0.01	0.04	0.04	0.2
Concrete Pump	0.6	1.4	<0.01	0.1	0.1	0.2
Concrete Ready-Mix Trucks	0.3	0.9	<0.01	0.04	0.04	0.2
Flat Bed or Dump Trucks	0.3	0.9	<0.01	0.04	0.04	0.2
Fork Truck	0.3	0.9	<0.01	0.04	0.04	0.2
Front Loader	2.0	2.1	<0.01	0.3	0.3	0.4
Grout Mixer for Mortar	1.6	3.0	<0.01	0.2	0.2	0.4
High Lift	0.5	0.9	<0.01	0.1	0.1	0.2
Line Painting Truck/Sprayer	0.3	0.9	<0.01	0.0	0.0	0.2
Log Chipper	1.6	3.6	<0.01	0.2	0.2	0.4
Man Lift	3.1	3.9	<0.01	0.4	0.4	0.7
Masonry Saw	0.8	2.2	<0.01	0.1	0.1	0.2
Mulcher	1.6	3.6	<0.01	0.2	0.2	0.4
Paving Machine	0.6	1.2	<0.01	0.1	0.1	0.2
Roller	0.4	1.0	<0.01	0.05	0.05	0.2
Seed Truck Spreader	0.3	0.9	<0.01	0.05	0.05	0.2
Small Dozer	0.3	0.8	<0.01	0.03	0.03	0.2
Survey Crew Trucks	0.3	0.9	<0.01	0.05	0.05	0.2
Ten Wheelers	0.3	0.9	<0.01	0.05	0.05	0.2
Tool Truck	0.3	0.9	<0.01	0.05	0.05	0.2
Tractor	0.3	0.9	<0.01	0.05	0.05	0.2
Trowel Machine	0.9	2.0	<0.01	0.1	0.1	0.2

Source: MOVES2014a.

Table 10
2025 Construction Equipment Emission Factors (g/mile)

Description	CO	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
40 Ton Crane	0.2	0.7	<0.01	0.03	0.03	0.2
90 Ton Crane	0.2	0.7	<0.01	0.03	0.03	0.2
Auger Drill	0.6	2.2	<0.01	0.1	0.1	0.2
Backhoe	1.8	1.9	<0.01	0.3	0.2	0.4
Bob Cat	1.8	1.9	<0.01	0.3	0.2	0.4
Bulldozer	0.2	0.7	<0.01	0.02	0.02	0.2
Chain Saws (gasoline)	213	2.4	<0.01	7.4	6.8	71.5
Compacting Equipment	0.4	0.9	<0.01	0.04	0.04	0.2
Concrete Pump	0.5	1.2	<0.01	0.1	0.1	0.2
Concrete Ready-Mix Trucks	0.3	0.8	<0.01	0.03	0.03	0.2
Flat Bed or Dump Trucks	0.3	0.8	<0.01	0.03	0.03	0.2
Fork Truck	0.3	0.8	<0.01	0.03	0.03	0.2
Front Loader	1.8	1.9	<0.01	0.3	0.2	0.4
Grout Mixer for Mortar	1.5	2.9	<0.01	0.2	0.2	0.3
High Lift	0.5	0.8	<0.01	0.04	0.04	0.2
Line Painting Truck/Sprayer	0.3	0.8	<0.01	0.03	0.03	0.2
Log Chipper	1.5	3.5	<0.01	0.2	0.2	0.3
Man Lift	2.9	3.8	<0.01	0.4	0.4	0.6
Masonry Saw	0.7	2.1	<0.01	0.1	0.1	0.2
Mulcher	1.5	3.5	<0.01	0.2	0.2	0.3
Paving Machine	0.5	1.2	<0.01	0.1	0.1	0.2
Roller	0.4	0.9	<0.01	0.04	0.04	0.2
Seed Truck Spreader	0.3	0.8	<0.01	0.03	0.03	0.2
Small Dozer	0.2	0.7	<0.01	0.02	0.02	0.2
Survey Crew Trucks	0.3	0.8	<0.01	0.03	0.03	0.2
Ten Wheelers	0.3	0.8	<0.01	0.03	0.03	0.2
Tool Truck	0.3	0.8	<0.01	0.03	0.03	0.2
Tractor	0.3	0.8	<0.01	0.03	0.03	0.2
Trowel Machine	0.8	1.9	<0.01	0.1	0.1	0.2

Source: MOVES2014a.

Fugitive dust emissions for PM and VOC were calculated and included in the total construction emissions. A fugitive dust PM_{10} emission factor of 1.2 tons per acre disturbed per month during construction activity was used, assuming that fugitive dust is generated throughout the construction period such that 25 percent of the project area would be disturbed per construction month and 10 percent of the project area would be disturbed per year. Based on EPA's AP-42, $PM_{2.5}$ emissions were assumed to be 10 percent of PM_{10} emissions. Erosion control measures and water programs are typically taken into account to minimize fugitive dust and particulate emissions at construction sites. For this analysis, a dust control efficiency of 75 percent due to daily watering and other measures (limiting vehicle speed, stockpile control) was assumed.

Evaporative VOC emissions associated with the application of hot mix asphalt on areas requiring paving were estimated using raw materials quantities listed in the projected construction schedule, as well as an emission factor of 0.053 tons of VOC per acre of asphalt material laid, following methodology outlined by the National Association of Clean Air Agencies (NACAA, formerly STAPPA-ALAPCO).

2.3 Estimated Construction Emissions

The year 2020 through 2025 criteria and precursor emissions estimates to occur with implementation of three Proposed Action Alternatives (e.g., Current Market, Medium Density, and High Density) are presented in **Tables 11 through 13**. As shown, emissions would vary by alternative. The greatest annual emissions of CO, NO_x, SO_2, PM and VOC are estimated to occur in the year 2020 with the High Density Alternative.

Table 11
Current Market Alternative Construction Emissions (tons/year)

Year	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	VOC
2020	36	57	0.1	81	12	10
2021	33	50	0.1	81	11	9
2022	29	45	0.1	80	11	9
2023	26	40	0.1	80	10	8
2024	24	35	0.1	79	10	8
2025	22	32	0.1	79	10	8

Source: KBE, 2017
Note: Emissions modelled using MOVES2014a. Results subject to rounding.

Table 12
Medium-Density Alternative Construction Emissions (tons/year)

Year	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	VOC
2020	41	66	0.1	81	13	11
2021	37	59	0.1	80	12	11
2022	33	52	0.1	80	11	10
2023	30	46	0.1	79	11	10
2024	27	41	0.1	79	10	9
2025	24	37	0.1	78	10	9

Source: KBE, 2017.
Note: Emissions modelled using MOVES2014a. Results subject to rounding.

Table 13
High-Density Alternative Construction Emissions (tons/year)

Year	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$	VOC
2020	51	86	0.2	94	15	14
2021	46	76	0.2	94	14	13
2022	41	68	0.1	93	14	13
2023	37	60	0.1	92	13	12
2024	33	53	0.1	91	12	12
2025	30	48	0.1	91	12	11

Source: KBE, 2017
Note: Emissions modelled using MOVES2014a. Results subject to rounding.

3 Project-Related Traffic

Traffic-related air emissions associated with the development of the WLA can be attributed to the daily operation of motor vehicles (e.g., passenger cars, truck, and buses). Air emissions from traffic depends on several factors including: i.) the volume of vehicles, ii.) the types of vehicles, iii.) motor vehicle emission rates, iv.) and travel speed and distance. The WLA is located between IAD and Route 606 (a.k.a., Old Ox Road). Route 606 would provide the main access to the WLA.

3.1 Roadway Segments

Traffic-related air emissions were estimated from potential traffic volume increases along Route 606 associated with the development of the WLA. Six segments along Route 606 are used to represent the variability of traffic along this road. **Table 14** shows the segments used in the air quality analysis.

Table 14
Roadway Segment Lengths

Segment	Description	Miles Travelled
1	North of Freeport/Trade Center to Dulles Greenway	2.2
2	Between Freeport/Trade Center and Beaver Meadow	0.3
3	Between Beaver Meadow and Overland Road	0.2
4	Between Overland Road and School Road	0.2
5	Between School Road and Pebble Run	0.2
6	South of Pebble Run to John S. Mosby Hwy	2.6
	Total:	**5.8**

Source: KBE, 2017.

3.2 Vehicle Types

Types of motor vehicles (e.g., cars, trucks, and buses) were obtained from the Virginia Department of Transportation (VDOT) Traffic Engineering Division 2016 Annual Average Daily Traffic Volume Estimates by Section of Route for Loudoun County. **Table 15** shows the vehicle distribution types used in this analysis.

Table 15
Vehicle Type Distribution

Description	MOVES Vehicle Type	Vehicle Distribution (%)
Motorcycles, Passenger Cars and Vans	Motorcycles, Passenger Cars/Trucks	93.06
Busses	Transit Bus	1.70
2-Axle Single Unit Trucks (not including pickups and vans)	Light Commercial Truck	1.72
3-Axle Single Unit Trucks	Short-haul Single Unit Truck	1.68
Trucks with Single Trailer	Combination Short-haul Single Unit Truck	1.84

Source: VDOT, 2016.

3.3 Traffic Volumes

Traffic volumes were developed for future No Action and Proposed Action years (i.e., 2020 and 2025). Traffic volumes associated with the 2020 and 2025 No Action years represent traffic volumes without the proposed project. Traffic volumes associated with the 2020 and 2025 Proposed Action years represents traffic volumes with the proposed improvements. Maximum peak one hour traffic volumes were assumed for six hours of each day per year. **Table 16** provides the estimated traffic volumes.

Table 16
Peak Hour Volumes

Road Segment	Distance (Miles)	Description	Vehicle Distribution	Volume	Maximum Traffic Volume								
					Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	100.00%	Daily Peak One Hour	1,951	2,295	2,812	2,570	2,609	2,717	3,324	3,387	3,602
				Annual	4,272,790	5,025,547	6,158,672	5,627,429	5,714,456	5,949,364	7,278,985	7,418,431	7,888,861
		Motorcycles, Passenger Cars and Vans	93.06%		3,976,178	4,676,679	5,731,144	5,236,779	5,317,765	5,536,366	6,773,686	6,903,452	7,341,225
		Busses	1.70%		72,450	85,213	104,427	95,419	96,895	100,878	123,423	125,787	133,764
		2-Axle Single Unit Trucks (not including pickups and vans)	1.72%		73,661	86,638	106,173	97,014	98,515	102,564	125,486	127,890	136,000
		3-Axle Single Unit Trucks	1.68%		71,617	84,234	103,226	94,322	95,781	99,718	122,004	124,342	132,226
		Trucks with Single Trailer	1.84%		78,733	92,604	113,484	103,695	105,298	109,627	134,127	136,697	145,365
2	0.33	Between Freeport/Trade Center and Beaver Meadow	100.00%	Daily Peak One Hour	1,813	2,168	2,710	2,427	2,471	2,587	3,209	3,269	3,471
				Annual	3,970,470	4,747,002	5,934,971	5,314,147	5,411,703	5,665,838	7,027,369	7,159,150	7,601,231
		Motorcycles, Passenger Cars and Vans	93.06%		3,694,845	4,417,471	5,522,972	4,945,245	5,036,029	5,272,522	6,539,537	6,662,170	7,073,562
		Busses	1.70%		67,324	80,490	100,634	90,107	91,761	96,070	119,156	121,391	128,887
		2-Axle Single Unit Trucks (not including pickups and vans)	1.72%		68,449	81,836	102,316	91,613	93,295	97,676	121,149	123,421	131,042
		3-Axle Single Unit Trucks	1.68%		66,550	79,565	99,477	89,071	90,706	94,966	117,787	119,996	127,405
		Trucks with Single Trailer	1.84%		73,162	87,471	109,362	97,922	99,720	104,402	129,491	131,919	140,065
3	0.18	Between Beaver Meadow and Overland	100.00%	Daily Peak One Hour	1,895	2,237	2,789	2,495	2,536	2,652	3,242	3,296	3,498
				Annual	4,150,050	4,899,218	6,107,088	5,464,509	5,553,775	5,807,432	7,099,881	7,218,386	7,660,599
		Motorcycles, Passenger Cars and Vans	93.06%		3,861,958	4,559,120	5,683,141	5,085,169	5,168,239	5,404,287	6,607,016	6,717,294	7,128,809
		Busses	1.70%		70,368	83,071	103,552	92,657	94,170	98,471	120,386	122,395	129,894
		2-Axle Single Unit Trucks (not including pickups and vans)	1.72%		71,545	84,460	105,283	94,206	95,745	100,117	122,399	124,442	132,065
		3-Axle Single Unit Trucks	1.68%		69,560	82,117	102,362	91,592	93,088	97,339	119,002	120,989	128,401
		Trucks with Single Trailer	1.84%		76,472	90,276	112,533	100,693	102,337	107,012	130,827	133,011	141,159
4	0.21	Between Overland and School Rd	100.00%	Daily Peak One Hour	871	1,043	1,307	2,384	2,433	2,562	3,196	3,261	3,486
				Annual	1,906,395	2,283,681	2,862,362	5,221,170	5,329,107	5,610,465	6,999,424	7,140,938	7,634,968
		Motorcycles, Passenger Cars and Vans	93.06%		1,774,055	2,125,151	2,663,661	4,858,723	4,959,167	5,220,993	6,513,532	6,645,222	7,104,957
		Busses	1.70%		32,325	38,722	48,534	88,530	90,361	95,131	118,683	121,082	129,459
		2-Axle Single Unit Trucks (not including pickups and vans)	1.72%		32,865	39,370	49,346	90,011	91,871	96,722	120,667	123,107	131,623
		3-Axle Single Unit Trucks	1.68%		31,953	38,277	47,977	87,513	89,322	94,038	117,318	119,690	127,971
		Trucks with Single Trailer	1.84%		35,128	42,081	52,744	96,209	98,198	103,382	128,976	131,584	140,687
5	0.17	Between School Rd and Pebble Run	100.00%	Daily Peak One Hour	871	1,043	1,307	2,379	2,426	2,551	3,171	3,235	3,453
				Annual	1,906,395	2,283,681	2,862,362	5,210,212	5,313,168	5,586,557	6,943,854	7,085,081	7,561,058
		Motorcycles, Passenger Cars and Vans	93.06%		1,774,055	2,125,151	2,663,661	4,848,525	4,944,334	5,198,745	6,461,820	6,593,243	7,036,178
		Busses	1.70%		32,325	38,722	48,534	88,345	90,090	94,726	117,740	120,135	128,206
		2-Axle Single Unit Trucks (not including pickups and vans)	1.72%		32,865	39,370	49,346	89,822	91,597	96,310	119,709	122,144	130,349
		3-Axle Single Unit Trucks	1.68%		31,953	38,277	47,977	87,329	89,055	93,637	116,387	118,754	126,732

Table 16
Peak Hour Volumes

Road Segment	Distance (Miles)	Description	Vehicle Distribution	Volume	Maximum Traffic Volume								
					Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
		Trucks with Single Trailer	1.84%		35,128	42,081	52,744	96,007	97,904	102,942	127,952	130,554	139,325
6	2.64	South of Pebble Run to John S. Mosby Hwy	100.00%	Daily Peak One Hour	1,863	2,220	2,766	2,514	2,561	2,685	3,323	3,387	3,605
				Annual	4,079,970	4,862,015	6,057,707	5,504,865	5,607,820	5,881,209	7,276,836	7,418,063	7,894,039
		Motorcycles, Passenger Cars and Vans	93.06%		3,796,743	4,524,499	5,637,187	5,122,723	5,218,532	5,472,942	6,771,686	6,903,109	7,346,044
		Busses	1.70%		69,180	82,441	102,715	93,341	95,087	99,722	123,386	125,781	133,852
		2-Axle Single Unit Trucks (not including pickups and vans)	1.72%		70,337	83,819	104,432	94,901	96,676	101,389	125,449	127,884	136,090
		3-Axle Single Unit Trucks	1.68%		68,385	81,493	101,534	92,268	93,994	98,576	121,968	124,335	132,313
		Trucks with Single Trailer	1.84%		75,180	89,591	111,623	101,436	103,333	108,371	134,088	136,690	145,461

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

3.4 Emission Factors

On-road vehicles emission factors (g/mile) for the given vehicle fleet (i.e., passenger cars and trucks, motorcycles, busses, light commercial truck, single unit short-haul trucks, combination short-haul trucks) were derived from MOVES2014a. MOVES model input parameters were selected based on guidance and data provided by the Metro Washington Council of Governments, Department of Transportation Planning. MOVES emission factors were developed based on specific information (i.e., vehicle/fuel mix, fuel specifications, inspection maintenance program, meteorology data, etc.) related to the Loudon County area. **Tables 17 through 19** show the emission factors used to estimate the traffic related emissions.

3.5 Estimated Traffic Emissions

Traffic related emissions were calculated by multiplying each vehicle type traffic volume by the appropriate emission factor and vehicle travel distance.

The following equation was used to obtain annual emission rates for motor vehicles:

Emissions (tons/year) for motor vehicles = Emission Factor (g/mile) x vehicle miles travelled per day x days/year x (1 pound/453.59 grams) x (1 ton/2,000 pounds)

Tables 20 through 25 show potential traffic related emissions.

Table 17
2016 Emission Factors

	Emission Rate (g/mile)								
Vehicle Description	**CO**	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO_2**	**CH_4**	**N_2O**
Motorcycles, Passenger Cars and Vans	7.34	0.62	0.01	0.03	0.02	0.54	368.60	0.01	0.0002
Busses	2.75	8.16	0.01	0.30	0.24	0.56	1448.41	0.03	0.0002
2-Axle Single Unit Trucks (not including pickups and vans)	3.07	1.43	0.01	0.09	0.07	0.26	590.80	0.02	0.0003
3-Axle Single Unit Trucks	1.96	5.16	0.01	0.44	0.36	0.62	839.51	0.03	0.0003
Trucks with Single Trailer	2.53	12.31	0.01	0.57	0.47	0.55	1623.85	0.02	0.0003

Source: MOVES2014a.

Table 18
2020 Emission Factors

Vehicle Description	Emission Rate (g/mile)								
	CO	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO_2**	**CH_4**	**N_2O**
Motorcycles, Passenger Cars and Vans	6.52	0.53	0.005	0.03	0.02	0.48	345.38	0.01	0.0002
Busses	2.27	4.76	0.009	0.18	0.14	0.35	1022.39	0.02	0.0002
2-Axle Single Unit Trucks (not including pickups and vans)	2.06	1.99	0.008	0.09	0.06	0.22	953.36	0.03	0.0004
3-Axle Single Unit Trucks	1.49	3.92	0.007	0.32	0.25	0.45	826.86	0.03	0.0004
Trucks with Single Trailer	1.87	8.98	0.014	0.41	0.33	0.41	1607.02	0.03	0.0003

Source: MOVES2014a.

Table 19
2025 Emission Factors

Vehicle Description	Emission Rate (g/mile)								
	CO	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO_2**	**CH_4**	**N_2O**
Motorcycles, Passenger Cars and Vans	5.50	0.42	0.002	0.02	0.01	0.40	315.68	0.01	0.0001
Busses	1.66	0.54	0.004	0.04	0.02	0.08	489.87	0.02	0.0003
2-Axle Single Unit Trucks (not including pickups and vans)	0.79	2.76	0.012	0.10	0.05	0.17	1406.57	0.04	0.0005
3-Axle Single Unit Trucks	0.90	2.36	0.007	0.18	0.12	0.25	811.06	0.04	0.0005
Trucks with Single Trailer	1.05	4.82	0.013	0.21	0.14	0.24	1586.00	0.03	0.0004

Source: MOVES2014a.

Table 20
Carbon Monoxide (CO) Emissions

Road Segment	Distance (Miles)	Description	CO Maximum Potential Emissions (tons)								
			Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	68.53	71.35	73.25	79.89	81.13	84.46	86.58	88.24	93.83
2	0.33	Between Freeport/Trade Center and Beaver Meadow	9.46	10.02	10.49	11.21	11.42	11.95	12.42	12.65	13.44
3	0.18	Between Beaver Meadow and Overland	5.46	5.70	5.96	6.36	6.47	6.76	6.93	7.04	7.47
4	0.21	Between Overland and School Rd	2.89	3.06	3.22	7.00	7.15	7.52	7.86	8.02	8.58
5	0.17	Between School Rd and Pebble Run	2.30	2.44	2.56	5.57	5.68	5.97	6.22	6.34	6.77
6	2.64	South of Pebble Run to John S. Mosby Hwy	77.19	81.42	84.99	92.19	93.91	98.49	102.10	104.08	110.76
		Total:	**166**	**174**	**180**	**202**	**206**	**215**	**222**	**226**	**241**

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

Table 21
Nitrogen Oxide (NO_x) Emissions

Road Segment	Distance (Miles)	Description	NO_x Maximum Potential Emissions (tons)								
			Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	10.30	9.69	8.18	10.85	11.02	11.47	9.67	9.85	10.47
2	0.33	Between Freeport/Trade Center and Beaver Meadow	1.42	1.36	1.17	1.52	1.55	1.62	1.39	1.41	1.50
3	0.18	Between Beaver Meadow and Overland	0.82	0.77	0.67	0.86	0.88	0.92	0.77	0.79	0.83
4	0.21	Between Overland and School Rd	0.43	0.42	0.36	0.95	0.97	1.02	0.88	0.90	0.96
5	0.17	Between School Rd and Pebble Run	0.35	0.33	0.29	0.76	0.77	0.81	0.69	0.71	0.76
6	2.64	South of Pebble Run to John S. Mosby Hwy	11.60	11.06	9.49	12.52	12.75	13.37	11.40	11.62	12.36
		Total:	**25**	**24**	**20**	**27**	**28**	**29**	**25**	**25**	**27**

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

Table 22
Volatile Organic Compound (VOC) Emissions

Road Segment	Distance (Miles)	Description	VOC Maximum Potential Emissions (tons)								
			Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	5.26	5.42	5.45	6.07	6.16	6.41	6.44	6.56	6.98
2	0.33	Between Freeport/Trade Center and Beaver Meadow	0.73	0.76	0.78	0.85	0.87	0.91	0.92	0.94	1.00
3	0.18	Between Beaver Meadow and Overland	0.42	0.43	0.44	0.48	0.49	0.51	0.52	0.52	0.56
4	0.21	Between Overland and School Rd	0.22	0.23	0.24	0.53	0.54	0.57	0.59	0.60	0.64
5	0.17	Between School Rd and Pebble Run	0.18	0.19	0.19	0.42	0.43	0.45	0.46	0.47	0.50
6	2.64	South of Pebble Run to John S. Mosby Hwy	5.93	6.18	6.32	7.00	7.13	7.48	7.60	7.74	8.24
		Total:	**13**	**13**	**13**	**15**	**16**	**16**	**17**	**17**	**18**

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

Table 23
Particulate Matter equal to or less than 2.5 µm ($PM_{2.5}$) Emissions

Road Segment	Distance (Miles)	Description	$PM_{2.5}$ Maximum Potential Emissions (tons)								
			Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	0.37	0.33	0.25	0.37	0.38	0.39	0.29	0.30	0.32
2	0.33	Between Freeport/Trade Center and Beaver Meadow	0.05	0.05	0.04	0.05	0.05	0.06	0.04	0.04	0.05
3	0.18	Between Beaver Meadow and Overland	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.03
4	0.21	Between Overland and School Rd	0.02	0.01	0.01	0.03	0.03	0.04	0.03	0.03	0.03
5	0.17	Between School Rd and Pebble Run	0.01	0.01	0.01	0.03	0.03	0.03	0.02	0.02	0.02
6	2.64	South of Pebble Run to John S. Mosby Hwy	0.42	0.38	0.29	0.43	0.44	0.46	0.35	0.35	0.38
		Total:	**0.90**	**0.81**	**0.61**	**0.94**	**0.96**	**1.00**	**0.75**	**0.77**	**0.82**

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

Table 24
Particulate Matter equal to or less than 10 µm (PM_{10}) Emissions

Road Segment	Distance (Miles)	Description	PM_{10} Maximum Potential Emissions (tons)								
			Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	0.53	0.51	0.44	0.57	0.57	0.60	0.52	0.53	0.57
2	0.33	Between Freeport/Trade Center and Beaver Meadow	0.07	0.09	0.06	0.10	0.10	0.10	0.08	0.08	0.08
3	0.18	Between Beaver Meadow and Overland	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.05
4	0.21	Between Overland and School Rd	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05
5	0.17	Between School Rd and Pebble Run	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.04	0.04
6	2.64	South of Pebble Run to John S. Mosby Hwy	0.59	0.58	0.52	0.65	0.66	0.70	0.62	0.63	0.67
		Total:	**1.27**	**1.25**	**1.09**	**1.45**	**1.48**	**1.54**	**1.35**	**1.37**	**1.46**

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

Table 25
Sulfur Dioxide (SO_2) Emissions

Road Segment	Distance (Miles)	Description	SO_2 Maximum Potential Emissions (tons)								
			Existing Condition 2016	2020 No Action	2025 No Action	2020 Current Market	2020 Medium Density	2020 High Density	2025 Current Market	2025 Medium Density	2025 High Density
1	2.24	North of Freeport/Trade Center to Dulles Greenway	0.07	0.06	0.04	0.07	0.07	0.07	0.04	0.04	0.05
2	0.33	Between Freeport/Trade Center and Beaver Meadow	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	0.18	Between Beaver Meadow and Overland	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
4	0.21	Between Overland and School Rd	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
5	0.17	Between School Rd and Pebble Run	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
6	2.64	South of Pebble Run to John S. Mosby Hwy	0.08	0.07	0.04	0.08	0.08	0.08	0.05	0.05	0.06
		Total:	**0.18**	**0.15**	**0.09**	**0.17**	**0.18**	**0.18**	**0.11**	**0.11**	**0.12**

Source: KBE, 2017.
Note: Results for existing condition are provided for informational purposes.

4 Conclusions and Findings

Air emissions from project-related construction activities were estimated for future years 2020 through 2025, and air emissions from project-related traffic were estimated for future years 2020 and 2025. For each future year, three Action Alternatives were analyzed (i.e., Current Market Density, Medium Density, and High Density).

The analysis indicated that the greatest combined total emissions (e.g., construction and traffic-related emissions) are forecast to occur in the year 2020 for all three alternatives. None of the pollutants/precursors for which there are *de minimis* levels (NO_x, VOC and $PM_{2.5}$) would exceed the threshold levels in any year. As such, the General Conformity requirements of the CAA are not applicable and it can be presumed that the emissions would not cause or contribute to a violation of the NAAQS for NO_x, VOC or $PM_{2.5}$.