METROPOLITAN BRANCH TRAIL PHASE II

AIR QUALITY TECHNICAL REPORT

Prepared by:
KB Environmental Sciences, Inc.

Prepared for:
RK&K

DRAFT

November 30, 2016

1. INTRODUCTION

The Metropolitan Branch Trail (MBT) is a proposed 8-mile multi-use trail that will ultimately extend from the Silver Spring Metro Station in Maryland to Union Station in the District of Columbia, generally following the path of the Washington Metropolitan Area Transit Authority (WMATA) Metro Red Line, connecting with a number of regional trails. Currently the southern segment from McCormack Drive/Bates Road to Union Station is nearly complete. Notably, the Metropolitan Branch Trail Phase II project (i.e., the Proposed Project) is associated with the development of the northern section of the trail from McCormack Drive/Bates Road north to the Maryland border. One of the elements of the Proposed Project entails converting existing traffic lanes to trail use; therefore, an analysis was conducted to evaluate the potential for local air quality impacts at affected intersections within the study area.

Following this introduction, Section 2 of this Technical Report discusses the regulatory context for the air quality analysis. Section 3 presents ambient air monitoring levels in the vicinity of the project. Section 4 details the project-level intersection (i.e., hot-spot) analysis methodology and results. Finally, Section 5 summarizes the key findings of the air quality analysis.

2. REGULATORY CONTEXT

Pursuant to the requirements of the Clean Air Act (CAA), the United States Environmental Protection Agency (EPA) establishes, enforces, and periodically reviews the National Ambient Air Quality Standards (NAAQS). The NAAQS safeguard public health (primary standards) and environmental welfare (secondary standards) against the detrimental effects of outdoor air pollution. There are NAAQS for six common air pollutants, referred to as criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), which includes particulate matter with a diameter of 10 microns or less (PM_{10}) and a diameter of 2.5 microns or less ($PM_{2.5}$), and sulfur dioxide (SO_2). Two of these pollutants are not of concern for transportation air quality analysis: Pb and SO_2. And notably, two of these pollutants are considered regional pollutants – O_3 and NO_2 – therefore they are not addressable at the project level. Thus, CO and PM levels are analyzed as the accepted indicator of vehicle-generated air emissions for a specific project.

The EPA designates areas as either meeting (i.e., attainment) or not meeting (i.e., nonattainment) the NAAQS. An area with measured pollutant concentrations which are lower than the NAAQS is designated as an attainment area; an area with pollutant concentration which exceed the NAAQS is designated as a nonattainment area. An area is designated as unclassifiable when there is lack of sufficient data to form the basis of an attainment status determination. Once a nonattainment area meets the NAAQS and additional re-designation requirements in the CAA, the EPA designates the area to be maintenance. O_3 nonattainment areas are further classified as extreme, severe, moderate, or marginal. The CAA requires states to develop a plan to attain and maintain the primary and secondary NAAQS for each area designated nonattainment for a NAAQS. These plans are known as State Implementation Plans (SIPs).

The Proposed Project is located in the District of Columbia which lies within a nonattainment area for O_3 and a maintenance area for $PM_{2.5}$ (as of November 2014) and CO (as of January 1996).

The National Capital Region Transportation Planning Board (NCRTPB) and the Metropolitan Washington Council of Governments (MWCOG) along with the District Department of Transportation (DDOT) perform regional transportation and air quality planning. Section 176(c) of the CAA limits federal assistance on activities that do not conform to the objectives of the SIP for air quality. To meet the requirements of the CAA, the EPA promulgated what is known as the Transportation Conformity Rule (40 CFR Part 51). The responsibility of determining whether a transportation (i.e., roadway-related) plan, program, or individual project that is approved, permitted, or funded by a federal agency conforms to an approved SIP. Transportation conformity determination falls upon the Federal Highway Administration (FHWA) with assistance from the transportation department for the state in which the project is located.

The Proposed Project is subject to the Transportation Conformity Rule because it is a roadway/highway project in a nonattainment area and because it requires federal approval. Under provisions of the CAA, it must be demonstrated that the current Transportation Improvement Program (TIP) and Constrained Long Range Transportation Plan (CLRP), conform to the objectives of the SIP for air quality. The Proposed Project (TIP ID # 5942) is included in the current TIP (i.e., the Transportation Improvement Program for the National Capital Region FY 2015-2020)[1] and the CLRP (i.e., the 2015 Amendment to Financially Constrained Long Range Transportation Plan for the National Capital Region)[2] which were approved October 15, 2014 (and amended in October 21, 2015), and determined to conform to the intent of the SIP.

Therefore, a CO project-level intersection analysis was performed to determine whether the Proposed Project would cause or contribute to violations of the 1-hour and 8-hour CO NAAQS. DDOT confirmed in a meeting on September 22, 2016 that this air quality assessment would include a CO hot-spot analysis, and that a $PM_{2.5}$ analysis would not be conducted because the Proposed Project is not a "project of local air quality concern" in accordance with 40CFR93.123(b)(1) and would not generate a significant change in diesel vehicles.

3. AMBIENT AIR MONITORING

The Department of Energy and Environment (DOEE) Ambient Air Quality Monitoring operates five stations based on population density and distribution in the District of Columbia. The closest CO and $PM_{2.5}$ monitoring stations to the Proposed Project is the 2500 1st Street Northwest (NW) site. The two closest stations that measure O_3 are 2500 1st Street NW and 301 Van Buren Street NW. The background concentration should be obtained from a representative background monitoring site not affected by the intersection of interest and since Van Buren Street is one of the intersections analyzed in this project this station is not included. **Table 1** includes the ambient air pollutant levels monitored at 2500 1st Street NW for the years 2013 through 2015. The ambient concentrations of CO are well below the NAAQS for all years. The ambient concentrations of $PM_{2.5}$ are also below the NAAQS for all years. Of note, the O_3 levels are above

[1] National Capital Region Transportation Planning Board, Transportation Improvement Program (TIP), http://old.mwcog.org/clrp/projects/tip/fy1520.asp.

[2] National Capital Region Transportation Planning Board, Constrained Long-Range Transportation Plan (CLRP), http://old.mwcog.org/clrp/resources/KeyDocs_2015.asp.

the NAAQS - within the range of the definition of marginal nonattainment[3] - but show a decreasing trend. Even though O_3 is a regional pollutant therefore they are not addressable at the project level the background levels are shown here for completeness because the District of Columbia lies within a nonattainment area for O_3.

Table 1. Ambient Air Monitoring Data

Monitoring Station	Site ID	Pollutant	Averaging Period	NAAQS	2013	2014	2015
2500 1st Street, NW Washington, DC	110010043	CO [ppm]	1 hour[1]	35	2.1	1.6	1.7
			8 hour[1]	9	1.2	1.5	1.5
		O_3 [ppm]	8 hour[2]	0.070	0.079	0.074	0.069
		$PM_{2.5}$ [$\mu g/m^3$]	1 year[3]	12.0	11.6	9.9	10.0
			24 hours[4]	35	26	21	25

Source: EPA, AirData – Data Download, accessed 25 September 2016; and https://www.epa.gov/outdoor-air-quality-data/monitor-values-report.
Note: NAAQS = National Ambient Air Quality Standards, ppm = parts per million, and $\mu g/m^3$ = micrograms per cubic meter of air.
[1] Not to be exceeded more than once per year.
[2] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 consecutive years.
[3] Annual mean, averaged over 3 years.
[4] 98th percentile, averaged over 3 years.

4. INTERSECTION ANALYSIS METHODOLOGY AND RESULTS

An intersection analysis was conducted to evaluate the potential for local air quality impacts at intersections within the study area. The air quality intersection analysis was conducted in accordance with the criteria established by the EPA's *Project-Level Conformity and Hot-Spot Analyses*[4], as well as FHWA's *Carbon Monoxide Categorical Hot-Spot Finding*[5].

Traffic data for the project analysis was developed from multiple sources including MBT Blair Road Traffic Study, the 2010 Highway Performance Monitoring System (HPMS) data, and the Highway Capacity Model (HCM) Signalized Intersection Capacity Analysis reports[6]. For CO, intersections that are at Level-of-Service (LOS) D, E, or F or that will deteriorate to LOS D, E, or F due to increased traffic volumes related to the Proposed Project are of concern. **Table 2** lists the three intersections agreed upon by DDOT for the air quality modeling analysis (See **Figure 1**), as these were determined to deteriorate in LOS due to increased traffic volumes as well as traffic delay with the Proposed Project. The AM peak period is the worst-case scenario and therefore is used in the analysis for the existing (2016) and two future No Build and Build years of 2020 and 2040.

[3] EPA, Green Book 8-Hr Ozone (2008) Nonattainment Areas/State/County Report, http://www3.epa.gov/airquality/greenbook/hnca.html#6163 and the Green Book Designations, https://www.epa.gov/green-book/ozone-designation-and-classification-information. A marginal nonattainment area for NAAQS 2008 8-hour ozone standard is designated as an area that has a design value of 0.076 ppm up to but not including 0.086 ppm.

[4] EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections, November 1992 [EPA-454-R-92-005], https://www3.epa.gov/scram001/guidance/guide/coguide.pdf; Using MOVES2014 in Project-Level Carbon Monoxide Analyses, http://www3.epa.gov/otaq/stateresources/transconf/documents/420b15028.pdf, March 2015 [EPA-420-B-15-028]; and Transportation Conformity Guidance for 2008 Ozone Nonattainment Area, http://www3.epa.gov/otaq/stateresources/transconf/regs/420b12045.pdf July 2012 [EPA-420-B-12-045].

[5] FHWA, Carbon Monoxide Categorical Hot-Spot Finding, https://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/cmcf/.

[6] Traffic Study, WRA, March 2016.

Table 2. Modeled Intersections					
Pollutant	**2016 Existing**	**2020 No Build**	**2020 Build**	**2040 No Build**	**2040 Build**
Blair Road NW at Aspen Street NW	B	B	C	C	E
Blair Road NW at Van Buren Street NW	B	B	B	C	C
Blair Road NW at Kansas Avenue NW	D	D	D	F	F

Source: Traffic Study, RK&K 2016.
Note: Intersections were modeled for the AM peak period as this is worst-case scenario. Non-shaded values represent the intersections agreed upon by DDOT for the air quality modeling analysis in the meeting held on September 22, 2016. For the existing 2016 year, only the intersection of Blair Road NW at Kansas Avenue NW was analyzed per DDOT guidance.

Figure 1. Modeled Intersections

Emission factors for CO were calculated using EPA's MOVES2014 for four scenarios at three intersections and the existing condition at Blair Road NW and Kansas Avenue NW. Guidelines and information needed for the air quality modeling analysis were provided by: EPA's *Using MOVES2014 in Project-Level Carbon Monoxide Analysis* (March 2015), *Appendix W to 40 CFR Part 51* (November 2005), *1992 Guidelines for Modeling Carbon Monoxide from Roadway Intersections* (November 1991), *MOVES Input Data files for the District of Columbia* (provided by DDOT, 2016)[7], *Highway Capacity Manual* (2010), and *Synchro Report MBT* (2016).

All runs were modeled as project scale with geographical bounds for the District of Columbia. The intersections were divided into links to be used in MOVES2014 based on: approach (decelerating from cruising speed to stop at the intersection); departure (accelerating away from the intersection to cruising speed); free flow through the intersection (constant cruising speed); and, queue (idling). A maximum link length of 0.2 miles (300 meters) or the distance to the next intersection was used for free flow links, whichever was shorter. The geometry of the intersection was used for all links. **Figures 2 through 4** provide details of the three intersections modeled.

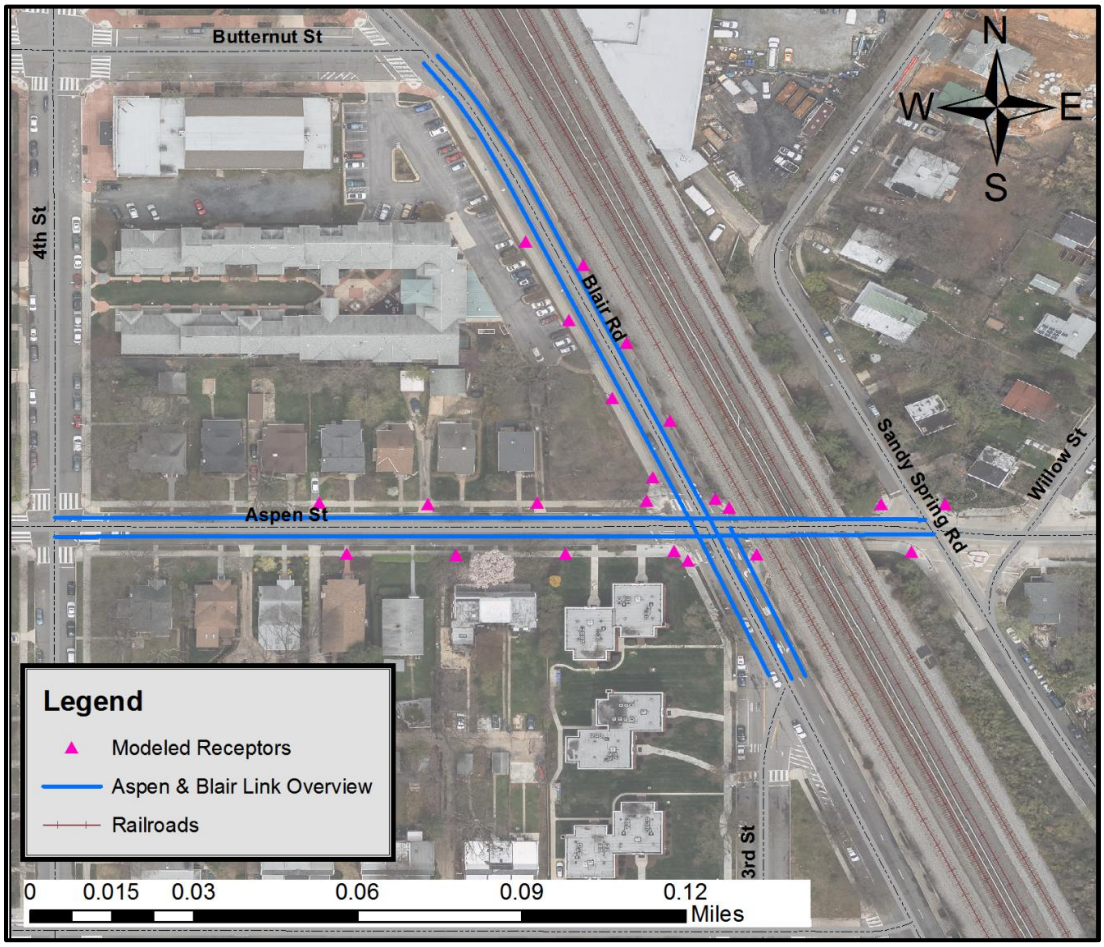

Figure 2. Blair Road NW at Aspen Street NW

[7] DDOT in collaboration with the Metropolitan Washington Council of Governments (MWCOG) provided the MOVES2014 input data files for the District of Columbia for the years analyzed.

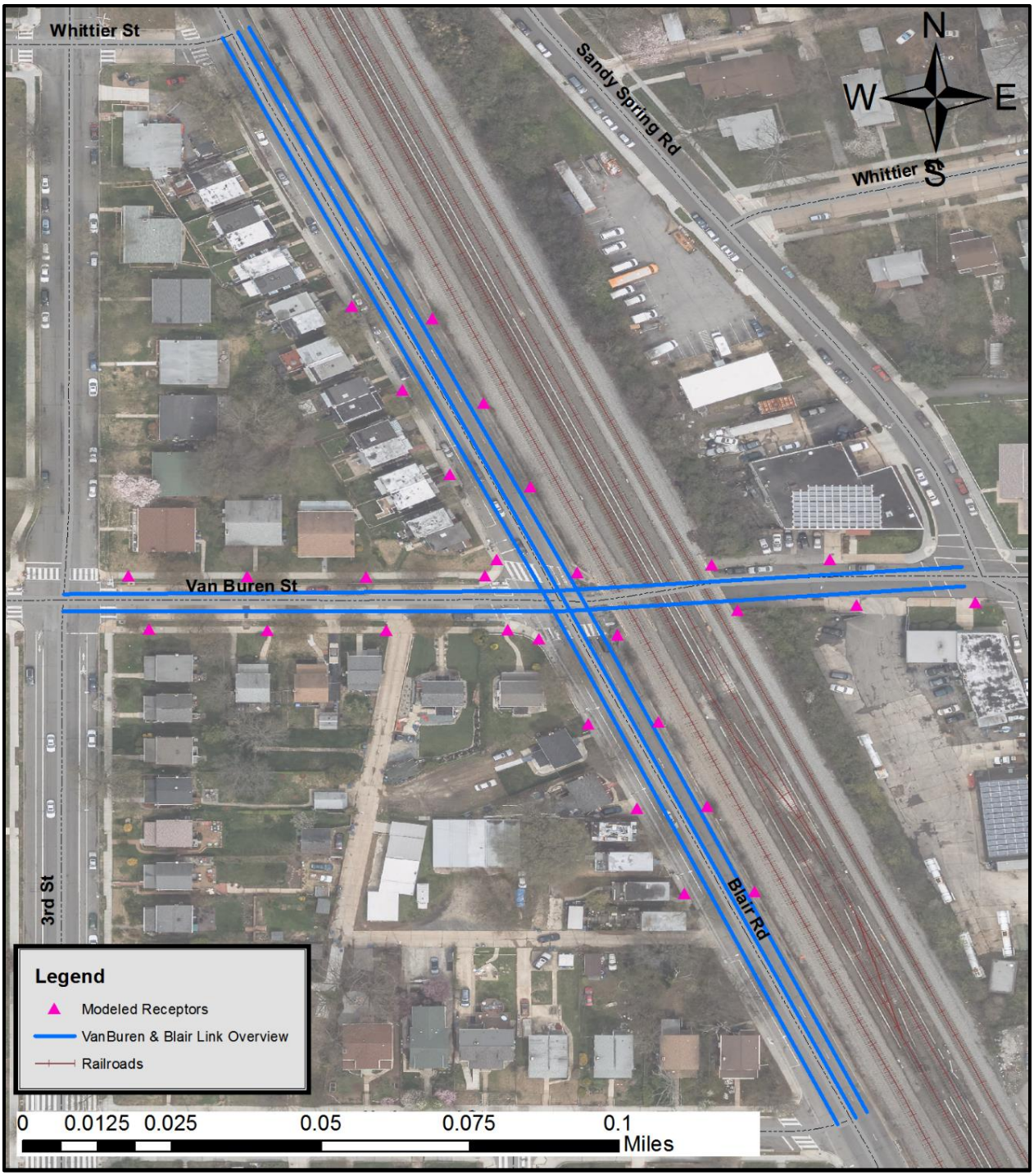

Figure 3. Blair Road NW at Van Buren Street NW

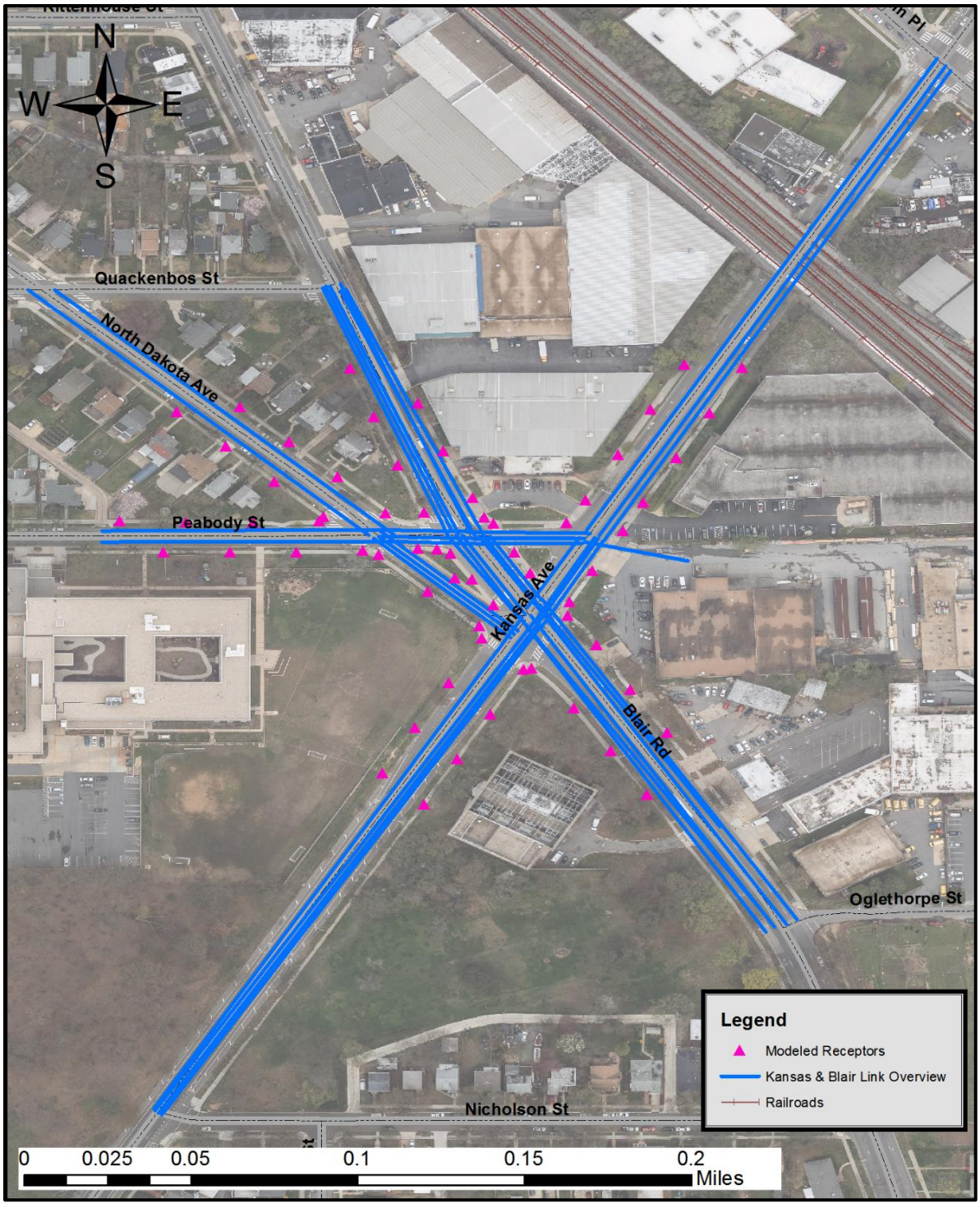

Figure 4. Kansas Avenue NW at Blair Road NW

All links were modeled as urban unrestricted access (i.e., arterials, connectors, and local streets). Speed limits were provided in the Synchro report, typically 30 miles per hour (mph) for through movements (25 mph for a few select roads), 15 mph for left turns and 9 mph for right turns. All queue links were given a constant speed of zero mph.

MOVES2014 was run for CO emissions from running exhaust and crankcase running exhaust. CO emissions were calculated from vehicles traveling along the roadway (approach, departure, and free flow links) and idling (queue links) at the intersection. MOVES was utilized to calculate emission factors for each scenario (i.e., 2016 existing [Blair and Kansas only], 2020 No Build/Build, and 2040 No Build/Build) at all three intersections.

EPA's CAL3QHC[8] dispersion model was used to predict CO vehicular emissions at receptor locations for the worst-case roadway intersections identified above. The CAL3QHC dispersion model is an EPA approved micro-scale atmospheric dispersion model that combines roadway design and operational parameters, motor vehicle emission factors and meteorological conditions to predict concentrations at specified receptor locations along roadways, interchanges, or intersections. The CAL3QHC dispersion model utilizes the emission factors from MOVES2014 to predict the CO concentrations at air quality receptors. The dispersion modeling analysis was prepared for the 2016 existing, the 2020 No Build/Build, and the 2040 No Build/Build scenarios.

For the CO analysis, the following worst-case meteorological conditions and input parameters to CAL3QHC were used:

- Stability Class: D (neutral atmosphere)
- Wind Speed: 1 meter per second (m/s)
- Wind Directions: 360° in 1° increments
- Mixing Height: 1,000 meters (m)
- Surface Roughness: 108 centimeters (cm) for single family residential
- Saturation Flow Rate: Based on Synchro reports in vehicles per hour (veh/hr)

CO concentrations were estimated for a 1-hour averaging period and adjusted to an 8-hour averaging period based on a persistence factor of 0.7.[9] Receptors were placed at the nearest locations where the general public would have access and where the maximum concentrations are expected to occur. Specifically, receptors were placed approximately three meters from each of the traveled roadways which comprise the intersection or on the center of the sidewalk. Receptors were located at the corners of each of the three intersections and at distances of 25, 50, and 75 meters from the intersection corner along both the approach and departure lanes at the intersection. These distances were adjusted accordingly to avoid commercial driveways. A receptor height of 1.8 meters was used in the analysis as it is the typical breathing height of a person. Links included free flow lanes (approach and departure), and queue lanes, for the appropriate number of lanes and turning movements. Data such as approach traffic volumes, signal timing cycle, and queue delay, were based on the project traffic study Synchro reports.

[8] EPA, User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentration near Roadway Intersections (Revised), September 1995, [EPA-454/R-92-006], https://www3.epa.gov/scram001/userg/regmod/cal3qhcug.pdf.
[9] EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections, November 1992 [EPA-454-R-92-005], https://www3.epa.gov/scram001/guidance/guide/coguide.pdf.

Emissions factors were obtained from the MOVES2014 model and were based upon model input parameters provided by DDOT and project specific data. MOVES2014 emission factors were developed based on specific information (e.g., vehicle/fuel mix, fuel specifications, inspection/maintenance program, meteorological data) related to the District of Columbia.

Background concentrations representing other local sources were determined based on nearby ambient air monitoring stations data (see **Table 1**). The nearest monitoring station that collects data for CO is located at 2500 1st Street NW, approximately 2.8 miles southwest of the southernmost intersection (Blair Road NW and Kansas Avenue NW). Background monitoring data was adjusted for the future by multiplying the existing CO background by the ratio of the future CO emission factors to the existing CO emission factors and multiplying by the ratio of future to current traffic volumes, per EPA guidance for the future 1-hour background concentrations.[10] The future 8-hour CO concentrations were adjusted to an 8-hour averaging period based on a persistence factor of 0.7. The 2015 report CO background concentrations and the adjusted 2020 and 2040 CO background concentrations are presented in **Table 3**. Of note, a 2015 background was used for 2016 modeling since complete 2016 background data were not yet available at the time of this report.

Table 3. CO Background Data (ppm)

Year	Averaging Period	CO
2015	1-hour	1.7
	8-hour	1.5
2020	1-hour	1.4
	8-hour	1.0
2040	1-hour	0.5
	8-hour	0.4

Source: KB Environmental Sciences, Inc., 2016.
Note: Source of 2015 1-hour and 8-hour CO Concentration data https://www.epa.gov/outdoor-air-quality-data/monitor-values-report.

Table 4 presents the results of the intersection analysis for each scenario analyzed. The results include background concentrations as well as the effects of roadway traffic. As shown, the concentrations are well below the NAAQS. Additionally, for all three intersections the concentrations were approximately the same with the Proposed Project as compared to the No Build scenario. Thus, it was determined that the Proposed Project will not cause or contribute to adverse impacts of CO.

[10] EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections, November 1992 [EPA-454-R-92-005], https://www3.epa.gov/scram001/guidance/guide/coguide.pdf.

Table 4. CO Intersection Analysis Results (ppm)							
Intersection	**Averaging Period**	**NAAQS**	**2016 Existing**	**2020 No Build**	**2020 Build**	**2040 No Build**	**2040 Build**
Blair Road NW at Aspen Street NW	1-hour	35	-	1.4	1.4	0.5	0.5
	8-hour	9	-	1.0	1.0	0.4	0.4
Blair Road NW at Van Buren Street NW	1-hour	35	-	1.5	1.5	0.5	0.5
	8-hour	9	-	1.1	1.1	0.4	0.4
Blair Road NW at Kansas Avenue NW	1-hour	35	2.1	1.6	1.6	0.5	0.5
	8-hour	9	1.5	1.1	1.1	0.4	0.4

Source: KB Environmental Sciences, Inc., 2016.
Note: For the existing 2016 year, only the intersection of Blair Road NW at Kansas Avenue NW was analyzed per DDOT guidance.

5. SUMMARY

The Proposed Project is located in the District of Columbia which lies within a nonattainment area for O_3 and a maintenance area for $PM_{2.5}$ and CO. In order for FHWA to approve the development of the northern section of the trail, the Proposed Project must be included in the regional CAA conformity analysis. As stated in Section 2 of this report, the Proposed Project (TIP ID # 5942) is included in the current TIP and CLRP and conforms to the intent of the SIP.

A project-level intersection analysis was conducted to evaluate CO emissions at three intersections within the study area. A $PM_{2.5}$ analysis was not conducted because the Proposed Project is not a "project of local air quality concern", in accordance with 40CFR93.123(b)(1), and would not generate a significant change in diesel vehicles. As shown in **Table 5**, the concentrations of the CO project-level intersection analysis indicate that the Proposed Project will not cause or contribute to a violation of the NAAQS.

Table 5. Proposed Project CO Intersection Analysis Results (ppm)								
Intersection	**Averaging Period**	**NAAQS**	**2020 Build Concentrations**			**2040 Build Concentrations**		
			Background	**Modeled**	**Total**	**Background**	**Modeled**	**Total**
Blair Road NW at Aspen Street NW	1-hour	35	1.4	<0.1	1.4	0.5	<0.1	0.5
	8-hour	9	1.0	<0.1	1.0	0.4	<0.1	0.4
Blair Road NW at Van Buren St. NW	1-hour	35	1.4	0.1	1.5	0.5	<0.1	0.5
	8-hour	9	1.0	0.1	1.1	0.4	<0.1	0.4
Blair Road NW at Kansas Avenue NW	1-hour	35	1.4	0.2	1.6	0.5	<0.1	0.5
	8-hour	9	1.0	0.1	1.1	0.4	<0.1	0.4

Source: KB Environmental Sciences, Inc., 2016.