4. PHYSICAL ENVIRONMENT

Section 4 discusses the physical environment including potential impacts related to noise, air quality, farmlands, infrastructure and utilities, visual resources, hazardous materials, and floodplains and floodways. Each section presents the affected environment, as well as the potential impacts to the environment as a result of the proposed improvements.

4.1 NOISE

This section summarizes the traffic noise assessment performed for the project. Details are documented in the project's *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009), incorporated by reference and available on the North Carolina Turnpike Authority (NCTA) Web site (www.ncturnpike.org/projects/monroe). The analysis was performed in accordance with the *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (Title 23 of the Code of Federal Regulation [CFR] Part 772).

4.1.1 CHARACTERISTICS OF NOISE

Noise is defined as unwanted sound. Truck and automobile noise is usually comprised of noises from engine exhaust, the drive train, and tire/roadway interaction.

The magnitude of noise is usually described by a common unit of reference called the "decibel" (dB). The A-weighted decibel scale is used almost exclusively when measuring vehicle noise because it places an emphasis on the frequency range to which the human ear is most sensitive (1,000-6,000 Hertz). Sound levels that are measured using the A-weighted decibel scale are written as dBA.

Examples of typical noise levels include 110 dBA for a car horn at a distance of 3 feet, 75 dBA for a blender at 3 feet, 55 dBA for a conversation at 10 feet, and 45 dBA for background noise conditions in a rural or suburban area.

Noise Sources

Background noise levels in a rural or suburban environment are typically about 45 dBA. A car horn produces about 110 dBA at a 3-foot distance.

The criteria that the Federal Highway Administration (FHWA), NCTA, and North Carolina Department of Transportation (NCDOT) use to determine noise impacts are based upon hourly average noise levels [Leq(h)]. In other words, the fluctuating sound levels of traffic noise are represented in terms of a steady noise level having the same energy content.

4.1.2 NOISE ABATEMENT CRITERIA

Noise Abatement Criteria

FHWA Noise Abatement Criteria are found in 23 CFR 772.

The FHWA has established Noise Abatement Criteria (NAC) and procedures to be used in the planning and design of highways. The FHWA NAC is presented in **Table 4-1**. As shown in the table, the NAC are divided into Activity Categories depending upon different sensitivities to noise. Most land uses within and adjacent to the Detailed Study Alternatives (DSAs) are in Activity Categories B and C, and include residences, schools, churches, and businesses. There are no Category A land uses located near the DSAs.

TABLE 4-1: FHWA Noise Abatement Criteria

Activity Category	Leq (hour)	Description of Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (exterior)	Developed lands, properties, or activities not included in Categories A and B above.
D	--	Undeveloped lands.
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: *Procedures for Abatement of Highway Traffic Noise and Construction Noise* (Title 23 CFR Part 772).

Noise mitigation measures must be considered when future noise levels either approach or exceed the NAC levels, or if there are substantial increases over existing noise levels. The definitions of approach and substantial increase are left up to each state. NCDOT defines approach as within 1 decibel of the NAC. NCDOT's definitions for "substantial increases" are presented in **Table 4-2**. The NCTA follows NCDOT's policies, guidance, and procedures regarding noise.

TABLE 4-2: NCDOT Definition of Substantial Increase in Noise Levels

Existing Average Noise Level dBA Leq [hour]	Increase (in dBA) from Existing Noise Levels to Future Noise Levels Defined as a Substantial Increase
≥55	10 or more
54	11 or more
53	12 or more
52	13 or more
51	14 or more
≤50	15 or more

Source: *Traffic Noise Abatement Policy* (NCDOT, 2004).

Title 23 CFR 772.11(a) states, "*In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit.*"

4.1.3 EXISTING NOISE ENVIRONMENT

Noise level measurements were conducted in the project study area to determine the typical existing background (i.e., ambient) noise levels and to provide a basis for assessing the impacts of future traffic noise levels. A sound-level meter was used to measure existing traffic and background noise at 17 representative locations on July 30 and 31, 2008.

The measurement locations are shown in **Figure 4-1a-c** and included seven measurements adjacent to area roadways and ten locations in areas away from direct traffic noise sources. Noise measurement sites were selected to represent noise-sensitive land uses in communities within the vicinity of the DSAs. All noise measurement sites were located in Union County.

Table 4-3 presents the measurement results. At locations where traffic noise did not dominate the noise environment, the existing noise levels ranged from approximately 40 dBA Leq to 55 dBA Leq. In the seven locations near roadways, noise levels ranged from approximately 52 dBA Leq to 65 dBA Leq.

TABLE 4-3: Existing Noise Level Measurements

Site Number	Location	Description	Measured Average Noise Level (dBA Leq)
1	Stallings Elementary School (Stallings Rd)	50 feet from road – measurement of traffic noise on Stallings Road	58.9
2	West of Rocky River Rd/Indian Trail Rd Intersection	50 feet from road – measurement of traffic noise on Unionville-Indian Trail Road	59.1
3	Secrest Shortcut Rd near Dusty Hollow Rd (Avondale Park neighborhood)	50 feet from road – measurement of traffic noise on Secrest Shortcut Road	61.0
4	Northeast side of Forest Park Rd/Pine Tree Dr intersection (Forest Park neighborhood)	Measurement of background noise levels away from traffic	54.6
5	Blackberry Ln (off of Stevens Mill Rd) (Eaglecrest/Blackberry Ridge neighborhoods)	Measurement of background noise levels away from traffic	48.8
6	Shadowy Retreat Dr (Fairhaven neighborhood)	Measurement of background noise levels away from traffic.	52.9
7	North end of Oakland Ave (Acorn Woods/Gold Hill neighborhoods)	Measurement of background noise levels away from traffic	43.9
8	Southwind Trail Dr, 5 lots in from Secrest Shortcut Rd (northern end of Arbor Glen neighborhood)	Measurement of background noise levels away from traffic	53.2
9	Parking area off Saratoga Blvd west of Belmont Stakes Ave (Bonterra neighborhood)	Measurement of background noise levels away from traffic	39.8
10	Suburban Dr (Suburban Estates neighborhood)	Measurement of background noise levels away from traffic	45.0
11	Willis Long Rd/Winchester Rd intersection	50 feet from road – measurement of traffic noise on Willis Long Road	54.6
12	Stump Lake Rd off Deese Rd (Ridge View neighborhood)	Measurement of background noise levels away from traffic	45.7
13	East of Olive Branch Rd/Bentwood Ln intersection (Lakeside/Lakeshores neighborhoods)	50 feet from road – measurement of traffic noise on Olive Branch Road	59.9
14	McIntyre Rd near athletic stadium; College Park/Wingate University area	Measurement of background noise levels away from traffic	49.5
15	Ansonville Rd near Lilies Way (Glencroft neighborhood)	50 feet from road – measurement of traffic noise on Ansonville Road	52.4
16	US 74 near Marshville (near the East Campus Church)	50 feet from road – measurement of traffic noise on US 74	65.3
17	Sardis Elementary School (off Sardis Church Rd)	Measurement of background noise levels away from traffic	49.5

Source: *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009).

4.1.4 NOISE IMPACT ANALYSIS METHODOLOGY

The FHWA Traffic Noise Model® (TNM), Version 2.5, was used to predict future traffic noise levels for this project. TNM calculates noise levels at modeled locations using inputs including projected year 2035 peak-hour traffic volumes; vehicle mix (percentages of cars, medium trucks, and heavy trucks); speed; roadway lengths and gradients; distances between sources, barriers, and receptors; and shielding provided by intervening terrain, barriers, and structures.

This analysis used a two-step approach to estimate noise levels. The first step used TNM to develop noise contours and to identify the sensitive receptors (e.g., houses, schools, churches, parks, etc.) potentially impacted by traffic noise from the proposed DSAs. The noise contours do not account for shielding provided by intervening terrain, barriers, or structures. The noise contours are a conservative estimate of noise levels used for preliminary identification of receptors potentially impacted by future traffic noise.

In the second step, TNM was used to perform more detailed analyses in areas (called "Barrier Evaluation Areas") where approximately three or more receptors were identified as being potentially impacted based upon the results of the first step. Based upon the detailed TNM analyses and the *Traffic Noise Abatement Policy* (NCDOT, 2004), noise barriers were evaluated, where appropriate, to determine if they would be feasible and reasonable. Determinations of feasibility and reasonableness presented in this Draft EIS are preliminary and subject to change based upon final design, building permits issued as of the Date of Public Knowledge, and completion of the public involvement process. For additional information on the criteria for determining whether barriers are feasible and reasonable, see **Section 4.1.6** (*Noise Barriers*).

4.1.5 TRAFFIC NOISE IMPACTS

4.1.5.1 Noise Contours

In the first step of the analysis process, TNM was used to develop year 2035 noise contours along the mainlines of the DSAs. The 2035 noise contours provide the basis for a preliminary identification of potentially impacted receptors. **Table 4-4** shows the maximum extent of the 71 dBA Leq and 66 dBA Leq 2035 traffic noise contours for the various segments of the DSAs. Maps are included in **Appendix D** showing the 2035 noise contours and the receptors within the contours.

The 66 dBA Leq and 71 dBA Leq noise contours correspond to the levels that approach the NAC for Activity Categories B and C, respectively (**Table 4-1**). Distances to these 2035 noise contour lines are measured from the Monroe Bypass/Connector centerline. The noise contours are based upon the highest projected 2035 peak hour traffic volumes for each segment for each DSA. This information should assist local authorities in exercising land use control over the remaining undeveloped lands adjacent to the roadway within the local jurisdictions.

Table 4-5 lists the numbers of receptors in each Activity Category predicted to be impacted by noise, based upon the 2035 traffic noise contours. Impacted receptors are receptors expected to experience traffic noise impacts either by approaching or exceeding the FHWA NAC based upon the 71 dBA Leq (for Category C) and 66 dBA Leq (for Category B) traffic noise contours, or by a substantial increase in exterior noise levels. Impacted receptors do not include those properties that would be relocated by the project.

TABLE 4-4: 2035 Traffic Noise Contours

Mainline Segment	Maximum Contour Distances (feet from Centerline)		Applicable DSAs
	71 dBA Leq	66 dBA Leq	
I-485 to Stallings Rd	225	340	A,B,A1,B1,A2,B2,A3,B3
	265	395	C,D,C1,D1,C2,D2,C3,D3
Stallings Rd to Indian Trail-Fairview Rd	250	360	A,B,A1,B1,A2,B2,A3,B3
	250	355	C,D,C1,D1,C2,D2,C3,D3
Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	250	360	A,B,A1,B1,A2,B2,A3,B3
	250	365	C,D,C1,D1,C2,D2,C3,D3
Unionville-Indian Trail Rd to Rocky River Rd	250	365	All DSAs
Rocky River Rd to US 601	245	350	All DSAs
US 601 to NC 200 (Morgan Mill Rd)	190	320	All DSAs
NC 200 (Morgan Mill Rd) to Austin Chaney Rd	180	285	All DSAs
Austin Chaney Rd to Forest Hills School Rd	160	260	A,B,A1,B1,A2,B2,A3,B3
	160	265	C,D,C1,D1,C2,D2,C3,D3
Forest Hills School Rd to US 74 between the towns of Wingate and Marshville	150	250	All DSAs

Source: *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009).

TABLE 4-5: Impacted Receptors by Detailed Study Alternative Based on 2035 Traffic Noise Contours

DSA	Number of Impacted Receptors		
	Category B[1]	Category C[2]	Total
A	120	10	130
B	118	9	127
C	123	29	152
D	122	28	150
A1	127	11	138
B1	125	10	135
C1	130	30	160
D1	129	29	158
A2	110	10	120
B2	108	9	117
C2	113	29	142
D2	112	28	140
A3	117	11	128
B3	115	10	125
C3	120	31	151
D3	119	29	148

Source: *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009).
[1] Category B receptors include residences and churches.
[2] Category C receptors include businesses.

The numbers of impacted receptors range from 108 impacted Category B receptors for DSA B2, to 130 impacted Category B receptors for DSA C1. Category B receptors in the project area are mostly residential, with one church (Forest Hills Baptist Church) and one school (Stallings

Elementary School). The impacts to Category B receptors are primarily substantial increase impacts.

The numbers of Category C (business) impacts range from nine to eleven for DSAs that use DSA Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, and B3) to 28 to 31 for DSAs that use DSA Segment 2 (DSAs C, D, C1, D1, C2, D2, C3, and D3). The higher numbers of business impacts for DSAs using DSA Segment 2 occur along existing US 74.

4.1.5.2 Potential Noise Impacts to Churches, Schools, and Other Special Uses

There is one church (Forest Hills Baptist Church) and one public school (Stallings Elementary School) located within the 2035 traffic noise contours for the project. These are discussed below. The proposed Matthews Sportsplex in the southwest quadrant of the I-485/US 74 interchange also is located near the DSA corridor boundaries, but is not included in the discussion below. Traffic noise at this proposed park would be dominated by traffic noise on I-485 south of US 74 and by traffic noise on US 74 west of I-485. These are areas where the proposed project would contribute little traffic. The proposed DSAs would not cause an increase in traffic noise levels along these roadway segments.

Forest Hills Baptist Church. This church is located adjacent to DSA Segment 22A (DSAs A, C, A1, C1, A2, C2, A3, and C3) at the intersection of Willis Long Road (SR 1509) and Winchester Road, and is represented by Receptor F04 (**Appendix D** [Figure D-6]). A barrier for this church and adjacent residences was found to be not reasonable. Year 2035 noise levels are projected to be 67 dBA Leq at the side of the church facing the proposed project. There is a church parking lot between the building and the proposed right of way for these DSAs, which is not an area of frequent outdoor use sensitive to noise.

The interior NAC of 52 dBA Leq would not be exceeded in the church structure (**Table 4-1**). Light frame buildings can achieve at least 20 dBA of exterior to interior noise reduction, and masonry buildings can achieve 25-35 dBA of exterior to interior noise reduction (*Highway Traffic Noise Analysis and Abatement: Policy and Guidance*, FHWA, June 1995). With an exterior noise level of 67 dBA Leq, interior noise levels due to traffic noise would be expected to be more than 47 dBA Leq (67 dBA Leq minus 20 dBA of reduction).

Stallings Elementary School. This school is located adjacent to DSA Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, and B3) at the intersection of Stallings Road (SR 1365) and Stevens Mill Road (SR 1524), and is represented by Receptor B08 (**Appendix D** [Figure D-2]). Year 2035 noise levels are projected to be 58 dBA Leq at the side of the school facing the proposed project, which would not be considered an impact based on FHWA criteria; therefore, noise mitigation was not required. There is a school parking lot, which is not an area of frequent outdoor use sensitive to noise, located between the building and the proposed right of way for these DSAs. Playgrounds and recreational fields associated with the school are located behind the school, away from the proposed project, and would be shielded from project-generated traffic noise by the school building.

4.1.5.3 Construction Noise

The major construction elements of this project are expected to be earth removal, hauling, grading, and paving. General construction noise impacts (such as temporary speech interference

for passersby and those individuals living or working near the project) can be expected, particularly from paving operations and from the earth-moving equipment during grading operations. Overall, construction noise impacts are expected to be minimal and temporary. Furthermore, the shielding provided by surrounding wooded areas, hills, structures, and other natural and man-made features are considered sufficient to moderate the effects of intrusive construction noise.

4.1.6 NOISE ABATEMENT MEASURES

If traffic noise impacts are predicted, examination and evaluation of alternative noise abatement measures for reducing or eliminating the noise impacts must be considered. Types of abatement measures include highway alignment selection, traffic management measures, vegetative buffers, property acquisition, or noise barriers. Due to design constraints, access and space requirements, and cost considerations, noise barriers were found to be the only feasible and reasonable method of abatement.

Noise Barriers. Solid barriers reduce noise levels by blocking the sound path between the noise source and noise-sensitive areas. This measure is most often used on high-speed, limited access facilities where noise levels are high and there is adequate space for continuous barriers.

For a noise barrier to provide sufficient noise reduction it must be high enough and long enough to shield the receptor (e.g., house, church, park, school, etc.) from substantial sections of the roadway. The barrier must also be feasible to construct as well as reasonable. The *Traffic Noise Abatement Policy* (NCDOT, 2004) provides guidance on determining the feasibility and reasonableness of providing noise barriers, as discussed below.

Feasibility of barrier construction considers potential safety and/or drainage problems, whether a barrier can be built upon the site topography, and whether other noise sources are present within the area. Noise reductions of 10 dBA or less are usually attainable, and the barrier should achieve at least 5 dBA of noise reduction for front-row receptors.

Reasonableness factors include the following: barrier cost, support for the barrier from directly adjacent receptors, the degree of noise impact, and required noise barrier height. A reasonable barrier must be cost effective and not more than 25 feet high. The NCDOT and NCTA consider a cost-effective barrier as one that costs no more than $35,000 per benefited receptor (a site having 5 dBA or more noise reduction), plus an incremental increase of $500 per average decibel increase in the predicted exterior noise levels of the impacted receptors in the area. The cost of the noise barrier used in these calculations is $15.00 per square foot. Also, in general, noise barriers are not considered reasonable for businesses or isolated residences. Barriers were optimized during barrier design to achieve the maximum noise benefit for the least cost.

Date of Public Knowledge.

The Date of Public Knowledge of the location of the proposed project is the approval date of the ROD. After the Date of Public Knowledge, the federal/state governments are no longer responsible for providing noise-abatement measures for new development when building permits are issued within the noise impact area of a proposed highway project. For development occurring after this date, local governing bodies are responsible for ensuring that noise-compatible designs are utilized along the proposed route.

Barrier Evaluation Areas. The noise-sensitive sites predicted to be impacted directly (i.e., experience noise levels that approach or exceed FHWA NAC or show a substantial increase over existing levels) that were not considered isolated sites were further evaluated in terms of the feasibility and reasonableness of providing noise barriers.

Ten Barrier Evaluation Areas were modeled in detail in TNM to determine if barriers would be feasible and reasonable in these locations. **Figure 4-1a-c** shows the locations of these Barrier Evaluation Areas. The detailed analysis of potential noise barriers within these areas incorporated existing natural terrain and design features such as fill/cut sections. Barrier heights of up to a maximum of 25 feet were evaluated for the receptors impacted by each DSA at each location.

As a result of the analyses performed for the ten areas mentioned above, three locations were identified where noise barriers were preliminarily determined to be feasible and reasonable. The three preliminary noise barriers are shown on **Figure 4-1a-c** and listed in **Table 4-6**.

TABLE 4-6: Preliminary Feasible and Reasonable Noise Barriers

Description	Preliminary Barriers[1]		
	N4-1	N7-2	N9-1
DSA Segment	18A and 2	31	40
DSAs	All DSAs	All DSAs	A, B, C, D, A1, B1, C1, D1
Description	Eastbound side of mainline. East of Indian Trail-Fairview Rd, west of Secrest Shortcut Rd, near the Acorn Woods neighborhood.	Eastbound side of mainline. East of Roanoke Church Rd, west of Fowler Rd, near the Avondale Park neighborhood.	Westbound side of mainline. East of Ansonville Rd, near the Glencroft neighborhood.
Average dBA Reduction for Benefited Receptors	7	9	6
Number of Benefited Receptors	16	18	17
Barrier Length (Ft)	1,522	2,593	2,343
Barrier Height (Ft)	16	16	16/14[2]
Approximate Barrier Cost[3]	$365,280	$622,320	$543,930
Cost Per Benefited Receptor Allowable Cost Per Benefited Receptor	$22,830 $45,500	$34,573 $46,000	$31,996 $38,294

Source: *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009).

[1] The determination of feasibility and reasonableness is preliminary and subject to change based on final design, building permits issues as of the Date of Public Knowledge, and the completion of the public involvement process.

[2] Barrier height varies as indicated. For example, "16/14" means that barrier has a 16-foot section and a 14-foot section.

[3] Based on $15.00 per square foot.

The barriers are located adjacent to the following neighborhoods: Acorn Woods/Gold Hill, Avondale Park, and Glencroft. Barrier lengths range between 1,522 feet and 2,593 feet, while barrier heights range between 14 feet and 16 feet. Costs for barriers identified in **Table 4-6** are between $365,280 and $622,320 and costs per benefited receptor are between $22,830 and $34,573.

The determination of feasibility and reasonableness of noise barriers is preliminary and subject to change based upon final design, building permits issued as of the Date of Public Knowledge, and the completion of the public involvement process. The majority of property owners of

receptors directly adjacent to the barrier (the front-row receptors) must support the construction of the noise abatement measure (*Traffic Noise Abatement Policy*, NCDOT, 2004).

A Design Noise Study will be prepared during final design of the Preferred Alternative. The Design Noise Study will include an update of the noise analysis based upon updated traffic forecasts and the final design.

A summary of the preliminary feasible and reasonable barriers included in each DSA is presented in **Table 4-7**.

TABLE 4-7: Summary of Noise Barriers by Detailed Study Alternative

DSA	Total Number of Feasible and Reasonable Noise Barriers*	Number of Benefited Receptors	Length of Barriers (ft)	Cost of Noise Barriers ($)
A	3	51	6,458	1,531,530
B	3	51	6,458	1,531,530
C	3	51	6,458	1,531,530
D	3	51	6,458	1,531,530
A1	3	51	6,458	1,531,530
B1	3	51	6,458	1,531,530
C1	3	51	6,458	1,531,530
D1	3	51	6,458	1,531,530
A2	2	34	4,115	987,600
B2	2	34	4,115	987,600
C2	2	34	4,115	987,600
D2	2	34	4,115	987,600
A3	2	34	4,115	987,600
B3	2	34	4,115	987,600
C3	2	34	4,115	987,600
D3	2	34	4,115	987,600

Source: *Final Traffic Noise Technical Memorandum* (PBS&J, March 2009).
* The determination of feasibility and reasonableness is preliminary and subject to change based on final design, building permits issued as of the Date of Public Knowledge, and the public involvement process.

4.2 AIR QUALITY

This section summarizes the air quality assessment performed for the project. Air pollutants evaluated include those with a National Ambient Air Quality Standard (NAAQS), mobile source air toxics (MSAT), and potential air quality impacts from construction activities. Details are documented in the project's *Final Air Quality Technical Memorandum* (PBS&J, February 2009), incorporated by reference and available on the NCTA Web site (www.ncturnpike.org/projects/monroe).

4.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS AND EXISTING CONDITIONS

The Federal Clean Air Act of 1970, as amended (42 USC 7401), was enacted for the purposes of protecting and enhancing the quality of the nation's air resources to benefit public health, welfare, and productivity.

Criteria Pollutants

The USEPA has established NAAQS for six criteria pollutants:

- *Carbon monoxide (CO)*
- *Nitrogen dioxide (NO_2)*
- *Ozone (O_3)*
- *Lead (Pb)*
- *Particulate matter (PM)*
- *Sulfur dioxide (SO_2)*

The US Environmental Protection Agency (USEPA) has established primary and secondary NAAQS for six criteria air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), particulate matter (PM), and sulfur dioxide (SO_2). **Table 4-8** lists the NAAQS. The primary standards are set at a limit intended to "protect the public health with an adequate margin of safety," and the secondary standards are set at a limit intended to "protect the public welfare from known or anticipated adverse effects (effects to aesthetics, crops, architecture, etc.)" (Federal Clean Air Act 1990; Section 109, 42 USC 7409). The primary standards are established with a margin of safety, considering long-term exposures for the most sensitive groups in the general population (i.e., children, senior citizens, and people with breathing difficulties).

TABLE 4-8: National Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	Standard[5]	Standard Type
Carbon Monoxide	8-hour Average [1]	9 ppm	Primary
	1-hour Average [1]	35 ppm	Primary
Nitrogen Dioxide	Annual Arithmetic Mean	0.053 ppm	Primary and Secondary
Ozone	1-hour Average [8]	0.12 ppm	Primary and Secondary
	8-hour Average (1997 Standard) [6]	0.08 ppm	Primary and Secondary
	8-hour Average (2008 standard) [7]	0.075 ppm	Primary and Secondary
Lead	Quarterly Average	1.5 µg/m^3	Primary and Secondary
	Rolling 3-month Average [4]	0.15 µg/m^3 [2]	Primary and Secondary
Particulate Matter <10 micrometers (PM10)	24-hour Average [3]	150 µg/m^3	Primary and Secondary
Particulate Matter <2.5 micrometers (PM2.5)	Annual Arithmetic Mean [4]	15 µg/m^3	Primary and Secondary
	24-hour Average [5]	35 µg/m^3	Primary and Secondary
Sulfur Dioxide	Annual Arithmetic Mean	0.03 ppm	Primary
	24-hour Average [1]	0.14 ppm	Primary
	3-hour Average [1]	0.50 ppm	Secondary

Source: USEPA Web site: www.epa.gov/air/criteria.html

[1] The 1-hour average only applies to areas participating in an Early Action Compact. The Charlotte (NC)–Gastonia (NC)–Rock Hill (SC) air quality region is not an Early Action Compact area.

[2] Not to be exceeded more than once per year.

[3] Final rule signed October 15, 2008.

[4] Not to be exceeded more than once per year on average over 3 years.

[5] To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.

[6] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3 (effective December 17, 2006).

[7] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

[8] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm. (b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as USEPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

Pollutants that have a NAAQS are called criteria pollutants. An area that exceeds the NAAQS for one or more criteria pollutants is said to be in "non-attainment" of the NAAQS enforced under the Clean Air Act. The designation of an area is determined on a pollutant-by-pollutant basis. The USEPA classifies areas as either in attainment or non-attainment. Non-attainment areas for ozone, carbon monoxide, and some particulate matter are further classified based upon the degree of exceedance(s) over the NAAQS (e.g., marginal, moderate, serious, severe, and extreme). Attainment areas are categorized as either "in attainment" or as a "maintenance area for attainment", which means that the urban area has exceeded NAAQS levels for one or more pollutants in the past. Efforts in these maintenance areas must be made in order to maintain the status quo and not exceed the NAAQS (USEPA Web site: www.epa.gov/oar/oaqps/greenbk).

The Charlotte-Gastonia-Rock Hill air quality region is in attainment for nitrogen dioxide, lead, particulate matter, and sulfur dioxide. Additional detailed information regarding these criteria air pollutants can be found in the *Air Quality Technical Memorandum for the Monroe Connector Bypass* (PBS&J, February 2009).

The region is in maintenance for carbon monoxide and non-attainment for ozone, as described below.

Carbon Monoxide. Carbon monoxide is a colorless, odorless gas resulting from incomplete fuel combustion from both mobile and stationary sources and is the most commonly occurring air pollutant. Transportation accounts for the majority of carbon monoxide emissions (*2000 Ambient Air Quality Report*, North Carolina Department of Environment and Natural Resources Division of Air Quality [NCDENR-DAQ], 2002).

Except for Mecklenburg County, all other areas within the Charlotte-Gastonia-Rock Hill air quality region are designated as attainment for carbon monoxide. Mecklenburg County is a maintenance area for carbon monoxide (USEPA Web site: www.epa.gov/oar/oaqps/greenbk).

Ozone. Ozone (O_3) is the main component of smog. Since ozone is formed by chemical interactions with sunlight, ozone concentrations are generally higher during the daytime and in late spring through early fall (*2000 Ambient Air Quality Report*, NCDENR-DAQ, 2002).

On June 15, 2004, the Charlotte-Gastonia-Rock Hill air quality region was designated as a moderate non-attainment area for the 1997 8-hour ozone NAAQS (USEPA Web site: www.epa.gov/oar/oaqps/greenbk). The region includes the following counties in North Carolina: Mecklenburg, Gaston, Lincoln, Cabarrus, Rowan, Union, and the southern portion of Iredell. The urbanized area of eastern York County, South Carolina, also is included.

Compliance with the 1997 ozone standard is required by June 15, 2010. The State Implementation Plan (SIP) for ozone for this region submitted to USEPA by the NCDENR-DAQ projects that the 8-hour ozone standard will be met by this time (*State of the Environment Report 2008*, Mecklenburg County Land Use & Environmental Services).

4.2.2 TRANSPORTATION CONFORMITY

Background. Section 176(c) of the Clean Air Act Amendments (42 USC 7506(c)) requires that transportation plans, programs, and projects conform to the intent of the SIP. Conformity requirements apply to transportation plans, programs, and projects funded or approved by the

FHWA or the Federal Transit Administration (FTA) in areas that do not meet, or previously have not met, NAAQS for ozone, carbon monoxide, particulate matter, or nitrogen dioxide (*Fact Sheets on Highway Provisions*, FHWA Web site: www.fhwa.dot.gov/safetealu/factsheets/conformity.htm).

Transportation Conformity

The Clean Air Act Amendments require that transportation plans, programs, and projects conform to the intent of the state air quality implementation plan.

In North Carolina, the NCDENR-DAQ develops the SIP, which is the document that describes how North Carolina will maintain or achieve compliance with the NAAQS in non-attainment and maintenance areas.

USEPA has issued regulations implementing the transportation conformity requirements (40 CFR Part 93). The transportation conformity regulations are intended to ensure that a state does not undertake federally funded or approved transportation plans, programs, or projects that are inconsistent with the State's obligation to meet and maintain the NAAQS.

Under the transportation conformity regulations, a transportation conformity determination is required every time a Metropolitan Planning Organization (MPO) approves an update or amendment to its long range transportation plan (LRTP) and transportation improvement program (TIP). Under federal law, an MPO must **"update"** its LRTP and TIP at least once every four years. In addition, an MPO may choose to **"amend"** the LRTP and TIP more frequently. Typically, there are multiple amendments within each four-year update cycle. A **regional conformity determination** is needed for each update and amendment to an LRTP and TIP. The regional conformity determination is based on a region-wide analysis of projected emissions from all existing facilities and projects in the LRTP and TIP.

In addition to the regional conformity determination for LRTPs and TIPs, FHWA also must make a **project-level conformity determination**. For all pollutants, a project-level conformity determination can be made only if the project is included in a conforming LRTP and TIP. In addition, for carbon monoxide (CO) and particulate matter (PM), a project-level conformity finding requires a localized conformity analysis, known as a "hot-spot" analysis.

Regional Conformity Analysis. To demonstrate conformity at the regional level, an MPO in a non-attainment or maintenance area must show that expected emissions from their LRTP and TIP are within the mobile vehicle emission budgets in the applicable SIP. If there is no approved SIP, the MPO must apply an "interim emissions test" – which requires, in essence, a finding that emissions will be no greater with the proposed improvements in the LRTP/TIP than they would be without those improvements.

Project-Level ("Hot-Spot") Conformity Analysis. As noted above, all projects in non-attainment and maintenance areas must come from a conforming LRTP and TIP. In addition, in CO and PM non-attainment and maintenance areas, localized (or microscale) analysis may be necessary to determine project-level transportation conformity for federally funded or approved highway and transit projects. These projects must come from a currently conforming transportation plan/program. This type of analysis is sometimes referred to as "hot-spot analysis" (Transportation Conformity, FHWA Web site: www.fhwa.dot.gov/environment/conformity/con_broc.htm). For this project, the only hot-spot analysis required is for CO in Mecklenburg County, since Mecklenburg County is a CO maintenance area.

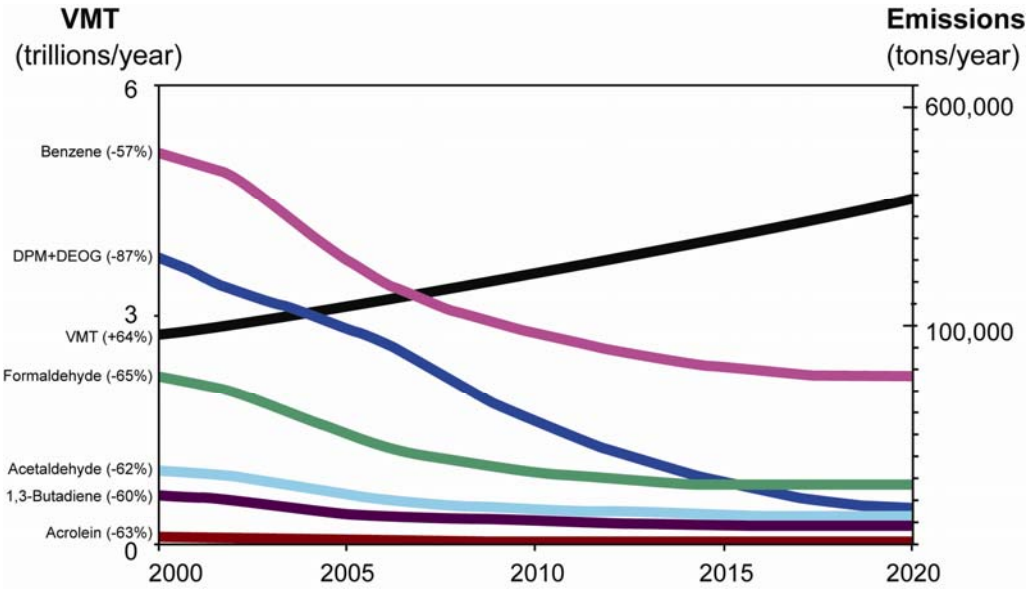
4.2.3 MOBILE SOURCE AIR TOXICS

In addition to the criteria air pollutants for which there are NAAQS, USEPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The USEPA is the lead federal agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The USEPA issued a Final Rule on *Controlling Emissions of Hazardous Air Pollutants from Mobile Sources* (66 CFR 17229) (March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. In its rule, USEPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, national low emission vehicle (NLEV) standards, Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, FHWA projects that even with a 64 percent increase in Vehicle Miles Traveled (VMT), these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent, as shown in **Exhibit 4-1**.

EXHIBIT 4-1: VMT vs MSAT Emissions, 2000-2020



Source: FHWA Web site: www.fhwa.gov/environment/airtoxic/vmtmsat2020.htm
Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50%. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns. 1 short ton = 907,200,000 mg.

On February 9, 2007, and under the authority of CAA Section 202(1), USEPA signed a Final Rule, *Control of Hazardous Air Pollutants from Mobile Sources*, which sets standards to control MSATs from motor vehicles. Under this rule, USEPA is setting standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. The new standards are estimated to reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. Concurrently, total emissions of volatile organic compounds (VOC) will be reduced by over 1.1 million tons in 2030 as a result of adopting these standards.

4.2.4 LOCAL ORDINANCES

Union County does not have any ordinances related to air quality. Mecklenburg County has an Air Pollution Control Ordinance (MCAPCO). Sections of the ordinance applicable to transportation sources include:

- Article 1 – Permitting Provisions for Air Pollution Sources, Rules and Operating Regulations for Acid Rain Sources, Title V, and Toxic Air Pollutants
  - Section 1.5600 –Transportation Facility Procedures
- Article 2 – Air Pollution Control Regulations and Procedures
  - Section 2.2000 – Transportation Conformity
  - Section 2.0800 – Transportation Facilities

Transportation sources subject to permitting as a transportation facility are defined in the ordinance as airport facilities (excluding military airfield) and parking facilities.

Section 2.2000 of the ordinance, addressing transportation conformity, states in Subsection 2003(a) that "Conformity analyses, determinations, and redeterminations for transportation plans, transportation improvement programs, FHWA/FTA projects, and state or local regionally significant projects shall be made according to the requirements of 40 CFR 93.104 and shall comply with the applicable requirements of 40 CFR 93.119, 93.120, 93.124, 93.125, and 93.126."

The MCAPCO also has applicable general provisions for nuisance dust (Section 1.5108) and open burning (Section 1.5106).

4.2.5 AIR QUALITY IMPACTS

4.2.5.1 Criteria Pollutants and Transportation Conformity

Traffic exhaust is the center of concern when determining the air quality impacts of a new roadway facility or the improvement of an existing roadway facility. Transportation is a primary contributor to four of the six criteria pollutants: ozone (through emission of nitrogen oxides and hydrocarbons), carbon monoxide, particulate matter, and nitrogen dioxide (*Air Quality Planning for Transportation Officials*, FHWA Web site: www.fhwa.dot.gov/environment/aqplan/index.htm). The impacts resulting from highway construction can range from intensifying existing air pollution to improving the ambient air conditions.

Pollutants of Concern

Ozone and carbon monoxide are the criteria pollutants of concern in the project area, which is part of a moderate non-attainment region for ozone and a maintenance area for carbon monoxide.

The criteria pollutants of concern in the project area are ozone and carbon monoxide, since the Charlotte-Gastonia-Rock Hill air quality region (which includes Mecklenburg County and Union County) is a moderate non-attainment region for ozone, and Mecklenburg County is a maintenance area for carbon monoxide.

Since ozone takes several hours to form from hydrocarbons and nitrogen oxide, urban areas as a whole are regarded as sources of ozone precursors, not traffic on individual streets and highways. Therefore, compliance of an individual project with the ozone NAAQS is demonstrated if the project is included in a conforming transportation plan, which considers the urban area as a whole.

Carbon monoxide is a more stable atmospheric pollutant (meaning it does not react as quickly with other chemicals) that is emitted directly from tailpipes. Therefore, localized concentrations of carbon monoxide can occur, and these concentrations can be estimated through modeling. As discussed below, the compliance of a project with the carbon monoxide NAAQS, therefore, is considered at both the localized (or hot-spot) level, and at the transportation plan level.

Localized Carbon Monoxide Hot-Spot Analysis. In accordance with 40 CFR 93.116, an FHWA project must not cause or contribute to any new localized carbon monoxide violations, or increase the frequency or severity of any existing carbon monoxide violations in carbon monoxide non-attainment and maintenance areas. A quantitative hot-spot analysis is required in the following cases (40 CFR 93.123):

i) For projects in or affecting locations, areas, or categories of sites which are identified in the applicable implementation plan as sites of violation or possible violation.

ii) For projects affecting intersections that are at Level of Service D, E, or F, or those that will change to Level of Service D, E, or F because of increased traffic volumes related to the project.

iii) For any project affecting one or more of the top three intersections in the non-attainment or maintenance area with highest traffic volumes, as identified in the applicable implementation plan.

iv) For any project affecting one or more of the top three intersections in the non-attainment or maintenance area with the worst level of service, as identified in the applicable implementation plan.

The portions of the DSAs in Union County do not need to be considered for a carbon monoxide hot-spot analysis since Union County is classified as an attainment area for carbon monoxide.

The applicable implementation plan (i.e., SIP) does not contain a list of locations or intersections as noted in items i, iii, and iv above. However, there is a list of high-congestion locations in Mecklenburg County available from the Charlotte Department of Transportation (CDOT) (CDOT Web site: www.charmeck.org/departments/transportation/roads/home.htm). None of the listed intersections are located within the DSAs.

Each of the DSAs uses one of two DSA Segments at the western end of the project: DSA Segment 18A or DSA Segment 2 (**Figure 2-8a**). Both corridor segments extend a short distance into Mecklenburg County. Regarding item ii above, none of the DSAs would directly affect any intersections in Mecklenburg County. The nearest signalized intersection in Mecklenburg County is the US 74 (Independence Boulevard)/Matthews-Mint Hill Road intersection, located

approximately 4,200 feet west of the I-485 mainlines. Year 2035 traffic volumes on US 74 west of I-485 are projected to be lower with the proposed project than under the No-Build Alternative. Since traffic volumes at the US 74 (Independence Boulevard)/Matthews-Mint Hill Road intersection would be less under any of the DSAs, none would negatively impact the operation of this intersection.

Based upon the discussion above, it is concluded that the project would not cause or contribute to any new localized carbon monoxide violations or increase the frequency or severity of any existing carbon monoxide violations since none of the DSAs fit the previously mentioned criteria requiring a quantitative carbon monoxide hot-spot analysis. This conformity determination meets all of the applicable Clean Air Act Section 176(c) requirements for federally funded or approved transportation projects. Specifically, the requirements for CO hot-spot analysis are codified at 40 CFR 93.116 and 93.123. By meeting these regulatory requirements as well as other requirements in the conformity regulations, this conformity determination demonstrates compliance with the requirements of CAA Section 176(c)(1).

Conformity Determinations for LRTPs and TIPs in Metrolina Region. The Monroe Connector/Bypass project is located in the Charlotte-Gastonia-Rock Hill air quality region (Metrolina region). The Metrolina region includes four MPOs: the Gaston Urban Area MPO, the Mecklenburg-Union MPO (MUMPO), the Cabarrus-Rowan MPO in North Carolina, and the Rock Hill-Fort Mill MPO in South Carolina. The Monroe Connector/Bypass is located within the boundaries the MUMPO. Therefore, this section focuses primarily on the conformity status of the MUMPO area.

Each of the MPOs in the Metrolina region has its own LRTP and TIP, but air quality emissions analyses are completed for the region as a whole. Therefore, amendments and updates to the LRTPs and TIPs are often approved simultaneously (or close in time to one another) based on a single regional emissions analysis.

For the Monroe Connector/Bypass project, transportation conformity determinations are required for two pollutants: **ozone** and **carbon monoxide.** The conformity requirements apply to these pollutants because the Metrolina region as a whole is designated as a nonattainment area for the 1997 8-hour ozone standard and Mecklenburg County is designated as a maintenance area for carbon monoxide (**Section 4.2.1**).

Conformity Determinations for LRTPs. MUMPO currently has an approved LRTP with a horizon year of 2030, which was adopted on April 20, 2005. A conformity determination for this LRTP update was made on June 8, 2005, and FHWA and FTA issued the conformity finding (approval of the conformity determination) on June 30, 2005.[1] Since that time, there have been two amendments to the 2030 LRTP for MUMPO.

- Amendment 1 is dated September 16, 2005, with a FHWA/FTA conformity finding on October 1, 2005.
- Amendment 2, the latest conformity determination, is dated May 25, 2007, with a FHWA/FTA conformity finding on June 29, 2007.

[1] The June 8, 2005 conformity determination for the Metrolina Region is titled: *Conformity Analysis and Determination Report for the Cabarrus-Rowan MPO, the Gaston Urban Area MPO, and the Mecklenburg-Union MPO 2030 Long Range Transportation Plans and the FY 2007–2013 State Transportation Improvement Programs and for Non-MPO Areas of Lincoln County, Iredell County, Gaston County, and Union County Areas.* A copy of this determination is included in the project file.

MUMPO is required to complete an update to their LRTP within four years after the most recent update. Therefore, the next update for the MUMPO LRTP must be approved by May 3, 2009. MUMPO is currently conducting travel demand modeling and air quality analyses to demonstrate conformity. Because the region does not have an approved SIP, the conformity analyses for the 2030 MUMPO LRTP are based on the "interim emissions test" – which, as noted above, requires a demonstration that emissions with the proposed improvements will be no greater than emissions without those improvements. MUMPO is currently exploring a range of options for demonstrating conformity for the LRTP. These options include adjusting the mix of new projects included in the LRTP and alternative modeling methods to demonstrate conformity.

Conformity Determinations for TIPs. MUMPO currently has an approved TIP covering the years 2009 through 2015. The 2009–2015 TIP is a direct subset of the respective conforming 2030 LRTP. The FHWA and FTA approved a conformity determination for the MUMPO 2009-2015 TIP on July 11, 2008.[2] The current TIP is valid for four years. Therefore, an update to MUMPO's 2009-2015 TIP is required by 2012.

Potential for "Conformity Lapse Grace Period." As noted above, MPOs are required to update LRTPs and TIPs at least once every four years. MUMPO is currently working to complete their LRTP update by the applicable deadline. The update can be completed only if conformity findings are made by the deadline. If MUMPO is not able to demonstrate conformity by the applicable deadline, it will enter a status known as a "conformity lapse grace period" (CLGP). Specifically, MUMPO would enter a CLGP on May 3, 2009, if the required conformity findings are not made by that date. During a CLGP, the MPO would not be allowed to approve any amendments to the LRTP or TIP. However, the existing 2009-2015 TIP would remain in effect during the CLGP. Projects in a conforming TIP are allowed to proceed during the CLGP.

Potential for a "Conformity Lapse." The CLGP would last for one year. If a CLGP occurs and an update to the LRTP has not been approved by the end of that year, the region would enter a status known as a "conformity lapse." During a conformity lapse, no federal approvals may be granted and the use of federal funds is halted. The only projects that could proceed during this period are projects that are exempt from transportation conformity (e.g., road resurfacing, safety projects, bicycle and pedestrian facilities, etc), transportation control measures that are in an approved SIP, and project phases that were approved prior to the start of the lapse (for example, ongoing studies).

Implications for Monroe Connector/Bypass. Federal and state transportation and environmental agencies are working collaboratively in an effort to avoid a CLGP and a conformity lapse. If those events occur, they would not necessarily prevent NCTA from proceeding with ongoing work in the NEPA process, but they could delay FHWA's signing of the ROD. FHWA and NCTA will provide an updated summary of the region's conformity status in the Final EIS.

Status of SIP for Metrolina Region. The Clean Air Act requires North Carolina to submit a SIP by June 15, 2007, that describes how the state will attain the ozone standard by June 15, 2010, which is the statutory deadline for achieving attainment. The NCDENR-DAQ submitted a

[2] Conformity findings also are required for the so-called "donut area" of Union County, which is outside the MPO boundaries but is included within the ozone nonattainment area. Projects in the Union County donut area are included in NCDOT's 2009–2015 STIP and also have been found to conform. The USDOT made a Transportation Conformity Determination on the *2009–2015 STIP* on July 11, 2008.

proposed SIP for the ozone standard to USEPA on June 15, 2007. On November 17, 2008, USEPA sent a letter to NCDENR-DAQ stating that the proposed SIP did not demonstrate that the ozone standard would be achieved by the June 15, 2010 deadline. Therefore, USEPA recommended that North Carolina seek voluntary reclassification of its portion of the region from "moderate" to "serious" nonattainment status, which would extend the attainment deadline. USEPA noted that if North Carolina did not take this action, USEPA would disapprove the SIP (letter included in **Appendix A-6**).

On December 19, 2008, NCDENR-DAQ sent a letter to USEPA requesting that the previously submitted SIP be withdrawn and explained that NCDENR-DAQ intended to submit an updated SIP by November 2009, demonstrating attainment of the ozone standard by the June 15, 2010 deadline (letter included in **Appendix A-6**). The USEPA responded to NCDENR-DAQ in a letter dated January 9, 2009 stating that USEPA was making a "finding of failure to submit" a SIP (letter included in **Appendix A-6**). This action would be effective when published in the Federal Register.

USEPA's finding of "failure to submit" a SIP does not trigger any immediate consequences for this project. However, if NCDENR-DAQ does not submit a complete SIP within 24 months from publication of this finding in the Federal Register, then a penalty known as "highway sanctions" would apply in accordance with 40 CFR 52.31. Under highway sanctions, federal transportation funds to the region would be cut off until the required SIP submittal is made. While highway sanctions are possible, it is unlikely that they would occur. NCDENR-DAQ has stated that it intends to submit a revised SIP in November 2009 for USEPA approval. NCDENR-DAQ has also stated that, if the revised SIP is not approved, the State would seek reclassification of the region to "serious" nonattainment status, which would extend the attainment deadline and avoid the highway sanctions. So, even if the revised SIP is not approved, there are actions that the State can take to avoid highway sanctions.

In conclusion, the Metrolina region continues to face challenges in meeting the complex and stringent requirements of federal air quality laws. These requirements do not prevent ongoing studies from continuing, but they have the potential to delay federal approval of transportation projects in the region. To prevent such delays, federal and state air quality and transportation agencies are continuing to work together to resolve the air quality issues so that planned transportation projects can move forward.

Project-Level Conformity. The DSAs for the project are generally consistent with the project descriptions (freeway) and project lengths (approximately 20 miles total) included in the LRTP. The only inconsistency in the current LRTP is that the Monroe Bypass portion of the project (R-2559) is shown as a non-toll facility. The Monroe Connector/Bypass project is currently being studied only as a toll facility. Therefore, the updated LRTP and conformity determination will need to show the Monroe Bypass portion of the project as a toll facility. The selection of the No-Build Alternative would require the MUMPO LRTP to be updated to remove the proposed Monroe Connector and Monroe Bypass.

4.2.5.2 Mobile Source Air Toxics Impact Analysis

Recently, concerns for air toxics impacts have been more frequent on transportation projects during the National Environmental Policy Act (NEPA) process. Transportation agencies are increasingly expected by the public and other agencies to address mobile source air toxics (MSAT)

impacts in their environmental documents as the science emerges.

MSAT analysis is a continuing area of research where, while much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health impacts from MSATs are limited. These limitations impede FHWA's ability to evaluate how mobile source health risks should factor into project-level decision-making under NEPA.

Also, USEPA has not established regulatory concentration targets for the six relevant MSAT pollutants appropriate for use in the project development process. FHWA has several research projects underway to more clearly define potential risks from MSAT emissions associated with transportation projects. While this research is ongoing, FHWA requires each NEPA document to qualitatively address MSATs and their relationship to the specific highway project through a tiered approach (*Interim Guidance on Air Toxic Analysis in NEPA Documents* [FHWA, February 3, 2006] (FHWA Web site: www.fhwa.dot.gov/environment/airtoxic/020306guidmem.htm). The FHWA will continue to monitor the developing research in this emerging field. A qualitative analysis of MSATs for this project appears in its entirety in **Appendix E** and in the *Final Air Quality Technical Memorandum* (PBS&J, February 2009).

4.2.5.3 Construction Air Quality

Provided local ordinances for open burning and dust are followed, as described below, significant air quality impacts due to construction of the proposed project are not anticipated. The proposed project would be constructed in sections, limiting the overall construction activity occurring at any one location. There would also be emissions related to construction equipment and vehicles. However, these impacts related to construction would be temporary.

Open Burning. During construction of any of the DSAs, all materials resulting from clearing and grubbing, demolition or other operations will be removed from the project site, burned or otherwise disposed of by the contractor. Any burning will be accomplished in accordance with applicable laws, local ordinances, and regulations of the North Carolina SIP for air quality in compliance with 15A NCAC 02D.1903. For construction in Mecklenburg County, open burning (if allowed) will require a permit from the Mecklenburg County Land Use and Environmental Services Agency Department of Air Quality, in accordance with the MCAPCO Section 1.5106.

Dust. Also during construction, measures will be taken to reduce dust generated by construction when the control of dust is necessary for the protection and comfort of motorists and area residents. These dust-suppression measures may include watering unpaved work areas, temporary and permanent seeding and mulching, and covering stockpiled materials, and using covered haul trucks.

4.3 FARMLAND

4.3.1 FARMLAND PROTECTION POLICY ACT

The Farmland Protection Policy Act of 1981 (FPPA), 7 U.S.C. 4201, as amended, and its implementing regulations, 7 CFR Part 658, are intended to minimize the impact federal programs have on unnecessary and irreversible conversion of farmland to non-agricultural uses.

The FPPA requires all federal agencies to consider the impact of their activities on prime, unique, and local or statewide important farmland soils, as defined by the US Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS).

Prime Farmland

Land that has the best characteristics for producing food, feed, fiber, forage, oilseed, and other crops with minimum inputs of fuel, fertilizer, pesticides, and labor (FPPA).

Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and within allowable soil erosion tolerance or excessive soil erosion, as determined by NRCS.

Unique Farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, as determined by NRCS.

Local or Statewide Important Farmland is land other than prime or unique farmland that is determined to be important by the appropriate state, tribal, or unit of local government agency or agencies, with concurrence by the State Conservationist.

These definitions refer to areas where the soils are conducive to agricultural production, not just areas currently or historically used as farmland. According to the FPPA, prime farmland does not include land already in or committed to urban development or water storage.

4.3.2 PRIME AND IMPORTANT FARMLAND SOILS

NRCS has published soil surveys for Union County and Mecklenburg County. Soils within the DSA corridors considered by the NRCS to be prime or of statewide importance are listed in **Table 4-9** and shown in **Figure 4-2**. There are no farmland soils classified as unique or locally important within the vicinity of the DSAs.

TABLE 4-9: Prime and Important Farmland Soils in the Detailed Study Alternatives

Soil Symbol	Soil Name	Percent Slope	County
Prime Farmland Soils			
ApB	Appling Sandy Loam	2-8	Mecklenburg & Union
CeB2	Cecil Sandy Clay Loam - eroded	2-8	Mecklenburg
CeB2	Cecil Gravelly Sandy Clay Loam	2-8	Union
ChA	Chewlaca Silt Loam - frequently flooded	0-2	Union
CrB	Creedmoor Loam	2-8	Union
DaB	Davidson Sandy Clay Loam	2-8	Mecklenburg
EnB	Enon Sandy Loam	2-8	Mecklenburg
GaB2	Gaston Sandy Loam - eroded	2-8	Union
GeB2	Georgeville Silty Clay Loam - eroded	2-8	Mecklenburg
GfB2	Georgeville Silty Clam Loam - eroded	2-8	Union
HeB	Helena Sandy Loam	2-8	Mecklenburg
HeB	Helena Fine Sandy Loam	2-8	Union
MO	Monacan Soils	-	Mecklenburg
MeB	Mecklenburg Fine Sandy Loam	2-8	Mecklenburg
MeB2	Mecklenburg Sandy Clay Loam - eroded	2-8	Union
TbB2	Tatum Gravelly Silty Clay Loam - eroded	2-8	Union
VaB	Vance Sandy Loam	2-8	Mecklenburg

TABLE 4-9: Prime and Important Farmland Soils in the Detailed Study Alternatives

Soil Symbol	Soil Name	Percent Slope	County
Statewide Important Farmland Soils			
Bab	Badin Channery Silt Loam	2-8	Union
BaC	Badin Channery Silt Loam	8-15	Union
CoA	Colfax Sandy Loam	0-3	Union
DaD	Davidson Sandy Clay Loam	8-15	Mecklenburg
GaC2	Gaston Clay Loam - eroded	8-15	Union
GeD2	Georgeville Silty Clay Loam- eroded	8-15	Mecklenburg
IrA	Iredell Fine Sandy Loam	0-1	Mecklenburg
IrA	Iredell Loam	0-3	Union
IrB	Iredell Fine Sandy Loam	1-8	Mecklenburg
LgB	Lignum Gravelly Silt Loam	2-8	Mecklenburg
MeD	Mecklenburg Fine Sandy Loam	8-15	Mecklenburg
ScA	Secrest-Cid Complex	0-3	Union
TaC	Tatum Gravelly Silt Loam	2-8	Union
TbC2	Tatum Gravelly Silty Clay Loam	8-15	Union
WhB	White Store Loam	2-8	Union
ZnB	Zion Gravelly Loam	2-8	Union

Sources: Soils Survey of Union, North Carolina (NRCS, 1996); Soil Survey of Mecklenburg County, North Carolina (NRCS, June 1980); List of North Carolina Important Farmlands: USDA ftp site: ftp://ftp-fc.sc.egov.usda.gov/NC/NCweb/Programs/soilsurvey.
*Prime if protected from flooding or not frequently flooded during growing season.

4.3.3 EXISTING AGRICULTURE

4.3.3.1 Census Information

The North Carolina Employment Security Commission (NCESC) reported 1.1 percent agriculture-based employment in Union County for the 3rd quarter of 2007 (*Employment and Wages by Sector, 3rd Quarter 2007*, NCESC Web site: http://eslmi23.esc.state.nc.us/ew/). For Mecklenburg County, this percentage was slightly lower at 0.2 percent.

According to the *2002 Census of Agriculture* (USDA National Agricultural Statistics Service, June 2004, USDA Web site: www.nass.usda.gov/census/census02/volume1/nc/index2.htm), the number of farms between 1997 and 2002 increased from 1,142 to 1,224, and the average farm size decreased from 161 to 156 acres in Union County. For Mecklenburg County, the number of farms between 1997 and 2002 decreased from 377 to 300, while the average farm size decreased by one acre, from 86 to 85 acres.

4.3.3.2 Agricultural Uses in the Detailed Study Alternatives

Based on field reviews, the primary agricultural use noted for the areas within the DSAs is pasture, which is dominated by grass and herb mixes. Approximately 39 to 48 percent of the land within the DSAs is estimated to be agriculturally maintained (*Monroe Connector/Bypass Natural Resources State Technical Report,* ESI, December 2008).

Union County has a voluntary farmland preservation program; however, there are no participating farm parcels within the DSAs. Mecklenburg County does not have a similar program.

4.3.4 FARMLAND IMPACTS

4.3.4.1 Prime and Important Farmland Soils

All proposed DSAs would involve the use of prime and statewide important farmland soils. The No-Build Alternative would not directly impact prime and important farmland soils. **Table 4-10** presents the acreages of prime and important farmland soils within the functional engineering design right of way for each DSA. The acreages were calculated using GIS by overlaying the functional design right of way on the soils GIS layer and subtracting out disturbed land already in urban development.

TABLE 4-10: Impacts to Prime and Important Farmland Soils

DSA	Total Acreage in DSA Right of Way	Prime Farmland Soils	Statewide Important Farmland Soils	Prime and Important Farmland Soils in DSA	
		Acres in Right of Way*		Total Acres	%
A	1,708	295	255	550	32.2
B	1,703	303	266	569	33.4
C	1,570	136	270	406	25.9
D	1,564	144	280	424	27.1
A1	1,655	322	233	555	33.5
B1	1,649	330	243	573	34.7
C1	1,516	163	247	410	27.0
D1	1,510	171	258	429	28.4
A2	1,478	291	235	526	35.6
B2	1,472	299	246	545	37.0
C2	1,339	132	250	382	28.5
D2	1,333	140	260	400	30.0
A3	1,424	318	213	531	37.3
B3	1,418	326	223	549	38.7
C3	1,286	159	227	386	30.0
D3	1,280	167	237	404	31.6

*Acreages are calculated for the functional engineering design right of way for each DSA. Areas of prime and statewide important soils already in urban development were not included in the totals.

DSA B1 has the most total acreage of prime and important farmland soils (573 acres), while DSA B3 has the highest percentage (38.7 percent). DSA C2 has the lowest total acreage (382 acres), while DSA C1 has the lowest percentage (27 percent).

4.3.4.2 Farmland Conversion Impact Ratings

In accordance with the FPPA and FHWA's *Guidelines for Implementing the Final Rule of the Farmland Protection Policy Act for Highway Projects*, a "Farmland Conversion Impact Rating for Corridor Type Projects" form was prepared. The NRCS forms are included in **Appendix F**.

The ratings on the NRCS forms are comprised of two parts. The Land Evaluation Criterion Value represents the relative value of the farmland to be converted on a scale from 0 to 100 points. The Corridor Assessment, which is rated on a scale of 0 to 160 points, evaluates farmland soils based upon its use in relation to the other land uses and resources in the immediate area. The two ratings are added together for a possible total rating of 260 points. Sites receiving a

total score of 160 points or more are given increasingly higher levels of consideration for protection (7 CFR 658.4).

Table 4-11 lists the total points for each DSA. The total point value for each DSA is less than 160 points. According to the FPPA, lands that receive a combined score of less than 160 points are not covered by the FPPA. Since the soils impacted by the DSAs do not meet the threshold of protection based on the evaluation under the FPPA, the impacts to prime and statewide important farmland is not considered under the FPPA.

TABLE 4-11: Farmland Impact Rating

DSA	Farmland Value		Total Points	
	Union	Mecklenburg	Union	Mecklenburg
A	81	80	147	146
B	81	80	147	146
C	81	82	147	148
D	80	82	146	148
A1	82	80	148	146
B1	81	80	148	147
C1	81	82	147	148
D1	81	82	146	147
A2	81	80	148	147
B2	81	80	147	146
C2	81	82	147	148
D2	81	82	147	148
A3	82	80	148	146
B3	82	80	148	146
C3	82	82	148	148
D3	82	82	147	147

Source: NRCS Farmland Conversion Impact Rating Forms (**Appendix F**).

4.3.4.3 Farm Relocations

The *Relocation Reports for the Monroe Connector/Bypass* (Carolina Land Acquisition, January 2009) note that all DSAs would include three farm relocations. Because much of eastern Union County is still rural, it is anticipated that there would be suitable replacement property available for farm relocation.

4.4 UTILITIES AND INFRASTRUCTURE

Information in this section is summarized from the *Draft Environmental Impact Statement for US 74 Improvements I-485 to US 601 (TIP Project R-3329)* (PBS&J, October 2003) and the *US 74 Monroe Bypass Environmental Assessment (TIP Project R-2559)* (JBM Engineers & Planners, March 1996). Utility information from the previous studies was verified and updated as appropriate through review of various Union County plans and reports, in addition to internet research. Additional information regarding water and sewer facilities is summarized from the *Union County, NC Wastewater Master Plan* (Camp Dresser & McKee, Inc., June 2006) and the *Union County Water Master Plan 2005 Update* (HDR, December 2005). These reports can be

obtained by contacting the NCTA via email at monroe@ncturnpike.org or by calling the NCTA at 919-571-3000. A separate utility impact report has not been prepared for this project.

4.4.1 EXISTING CONDITIONS

4.4.1.1 Electric Power

The project study area contains one major electric transmission line easement, which is maintained by Duke Energy Corporation. This easement runs north-south between Faith Church Road (SR 1518) and Sardis Church Road (SR 1516). The City of Monroe provides electric service to most of Monroe through seven distribution substations and 230 miles of line (City of Monroe Web site: www.monroenc.org/Energy Svcs/electric.htm). Union Power Cooperative and Duke Energy serve the smaller municipalities and unincorporated areas of Union County (Union County Partnership for Progress Web site: www.unioncpp.com/pdfs/infoguidepdfs/infrastructure.pdf).

4.4.1.2 Water and Sewer Facilities

Charlotte-Mecklenburg Utilities provides water and sewer service for homes and businesses in the Mecklenburg County portion of the project study area.

Union County provides water and sewer service to most of northwestern Union County, including the towns of Stallings, Indian Trail, Hemby Bridge, and Weddington, and the Village of Lake Park. Union County also provides water and sewer service to the City of Monroe's extra-territorial jurisdiction. The City of Monroe provides water and sewer service within their city limits. The East Union County Water Service Area is generally delineated as the area east of US 601 to the Anson County line and includes the eastern portion of the project study area. The East Union County Water Service Area is primarily rural and Union County only provides water to isolated pockets within the service area (*Union County Water Master Plan 2005 Update*, HDR, December 2005). Union County purchases water from Anson County for this area (up to an allocation of 2 million gallons per day [MGD]). The remaining properties are served by private wells.

It is projected that by the year 2050, two million people will depend on the Catawba River as source of drinking water. The Catawba River Water Treatment Plant (located in Van Wyck, SC) supplies water to the western portion of the project study area, and is jointly owned with the Lancaster County (SC) Water and Sewer District. The Catawba River Water Treatment Plant was expanded in 2004 to 36 MGD, which provides Union County with 18 MGD of permitted water treatment capacity. The plant can be expanded to 54 MGD, with 27 MGD for Union County (*Union County Water Master Plan 2005 Update*, HDR, December 2005). Union County's water system currently serves approximately 35,000 customers. Union County's *2008-2012 Capital Improvement Plan* shows the Public Works Department's Priority Project Numbers 8 and 9 as the Catawba River Water Treatment Plan Reservoir and Plant Expansions, respectively.

Over the past several years, high population growth coupled with other commercial and industrial growth has placed increasing demands on the Union County water system, particularly in the western part of the County. These demands have stressed the limits of available water treatment capacity as well as the hydraulics of moving this water through the distribution network to customers. Peak day water demands have repeatedly exceeded available

water treatment capacity. The County is already using some of Lancaster, South Carolina's allotted capacity from the Catawba River Water Treatment Plant to meet existing demand. This is not a viable option for the long-term and still leaves no additional capacity to allocate to new development.

Union County is currently working to find ways to provide additional water treatment capacity for existing and new development. In the meantime, the county adopted a Water Allocation Policy on October 20, 2008 to equitably distribute the estimated 1.9 MGD of capacity that will be available under revised water restrictions and schedules. Similarly, there is an adopted Sewer Allocation Policy.

Union County's wastewater system is comprised of five active wastewater treatment plants (WWTP), approximately 65 wastewater pumping stations, and over 500 miles of pipe with approximately 27,160 accounts. The five WWTPs have a combined rated treatment capacity of 8.1 MGD. The County has also purchased additional capacity at the City of Monroe WWTP (2.65 MGD) and Charlotte's McAlpine Creek WWTP (1 MGD with an additional 2 MGD reserved) (*Wastewater System Performance Summary - Fiscal Year 2007-2008*, Union County Department of Public Works, August 2008).

Two WWTPs are located within the project study area: the Crooked Creek WWTP and the City of Monroe WWTP. The Crooked Creek WWTP is located on the north side of Sardis Church Road (SR 1515), approximately 1.4 miles southwest of the proposed Unionville-Indian Trail Road interchange. It serves portions of Indian Trail, Lake Park, Hemby Bridge, and Stallings and is permitted to discharge up to 1.9 MGD of treated wastewater to the North Fork of Crooked Creek.

The City of Monroe WWTP is located on the north side of US 74 at 775 Treeway Drive, approximately 0.5 miles south of DSA Segment 36, and serves city residents. The City of Monroe WWTP also accepts wastewater from the towns of Wingate and Marshville, the area along US 74 east of Monroe, and Pilgrim's Pride (processing plant) through an inter-municipal agreement with Union County (*Union County, NC Wastewater Master Plan*, Camp Dresser & McKee, Inc., June 2006).

4.4.1.3 Natural Gas

Piedmont Natural Gas provides gas service to most of Union County and the City of Monroe serves Monroe and Wingate (Union County Partnership for Progress Web site: www.unioncpp.com/pdfs/infoguidepdfs/infrastructure.pdf).

The major natural gas line in the project study area is a four-inch pipe running from Monroe to Charlotte along US 74. The remaining lines servicing subdivisions in the project study area range from one to three inches. Two-inch gas lines run parallel to US 601, NC 200 and Olive Branch Road (SR 1006) in the project study area.

Piedmont Natural Gas – gas switching station in DSA Segment 31

The only major natural gas utility located within the corridor study area during field reviews is a Piedmont Natural Gas switching station located between Roanoke Church Road (SR 1505) and Fowler Road (SR 1502) (DSA Segment 31 – all DSAs) that consists of several above ground gas lines with shutoff valves.

4.4.1.4 Telecommunications

Local telephone services in the project study area are provided by Verizon and Windstream. Cable, digital phone, and high-speed internet services are provided by Time Warner Cable (Union County Partnership for Progress Web site: www.unioncpp.com/pdfs/infoguidepdfs/infrastructure.pdf). No major cell towers were identified during a preliminary field investigation of the DSA corridors.

4.4.1.5 Railroads

CSX Corporation owns and operates a main line freight-only railroad located near the southern boundary of the project study area on the western side of the project. The rail line parallels existing US 74, approximately halfway between US 74 and Old Monroe Road/Old Charlotte Highway (SR 1009). On the eastern portion of the project, all DSAs would cross the CSX railroad line before reconnecting with existing US 74, as shown in **Figures 2-10bb and 2-10cc**.

4.4.2 IMPACTS TO UTILITIES

All DSAs for the Monroe Connector/Bypass have the potential to impact water, sewer, gas, power, and telecommunications lines. All DSAs cross the high-voltage Duke Energy Corporation power line easement that runs between Faith Church Road (SR 1518) and Sardis Church Road (SR 1516). There are no electrical substations or towers located within the DSAs, but there may be vertical clearance issues associated with power lines in areas where the elevation of the proposed roadway is higher than the existing ground.

All DSAs would cross the two-inch gas lines running parallel to US 601, NC 200, and Olive Branch Road (SR 1006).

None of the DSAs would directly impact the aboveground Piedmont Natural gas switching station located within DSA Segment 31. The functional designs for all the DSAs are common in this area, and at their closest point, the estimated construction limits would be approximately 60 feet from the fenced-in area. The functional designs in this area would be in a fill section and impacts to the natural gas switching station are not anticipated.

No negative impacts to water or sewer service are anticipated with any of the DSAs. None of the DSAs would impact water or wastewater treatment facilities.

Utility coordination would be conducted during final design. All utility providers would be contacted and coordinated with to ensure that the proposed design and construction of the project would not substantially disrupt service.

4.5 VISUAL RESOURCES

4.5.1 VISUAL ENVIRONMENT

Visual features in the vicinity of the DSAs consist of a mixture of man-made and natural landscapes including new subdivisions, industrial developments, rural homes and farms,

agricultural fields, wooded uplands, streams, and wetlands. The topography is characterized by gently rolling hills with upland pastures and frequent forest-lined streams and swales.

The land surrounding the western end of the DSAs (west of US 601) is largely suburban and contains mostly residential uses and neighborhoods in and around the towns of Stallings, Indian Trail, Lake Park, Hemby Bridge, and Monroe. This portion of the project study area is experiencing growth, including new residential development and a shift toward a more suburban landscape. The land surrounding the DSAs east of US 601 is more rural and includes farms, pastures, forested areas, and scattered low-density residential development. Industrial and commercial uses are predominant along existing US 74.

4.5.2 VISUAL IMPACTS

People with views **from** the project and those with views **of** the project are addressed in this section, as both types of viewers have the potential to experience impacts. The views **from** the DSAs are comprised of areas that would be visible to travelers on the roadway, including views of the roadway right of way and beyond. Views **of** the DSAs were considered for residential areas and travelers on surrounding roadways.

There are no unique manmade or natural features with significant aesthetic value that exist in the vicinity of the DSAs. Aesthetic and topographic features such as open agricultural fields, pastures, rolling hills, forest-lined streams and woodland areas are present in the project study area. All of the DSAs have the potential to offer visually pleasing views of these topographic features from the proposed roadway. Visually pleasing aspects of the highway right of way will be further studied and developed in the final design phase with preparation of a landscaping plan.

Conversely, the DSAs have the potential to detract from existing views of rural and natural areas enjoyed by residents and users of property adjacent to the proposed roadway. Visual changes would be intermittent, with some residents subjected to a view of the roadway, and others shielded from the roadway by topography and vegetation. Portions of the DSAs, especially around Hemby Bridge, Wingate and the proposed interchanges at US 601 and NC 200, run through or very near existing residential developments and could have a range of visual impacts on residents. Some areas affected by the DSAs are urban or industrial and generally not scenic, so the degree of visual impact would be less. These areas are mostly found along existing US 74 near I-485, and along some of the major roads that would be served by interchanges.

As visual impacts can be subjective, a distinction was not made among alternatives with regard to the most or least visually impacting alternative. However, some general conclusions can be made regarding visual/aesthetic changes. Overall, the DSAs that have a higher number of neighborhoods exposed to the roadway (i.e., impact a greater number of neighborhoods with residential relocations) are expected to have a greater amount of visual impacts. In this case, all of the DSAs have similar numbers and types of relocation impacts to neighborhoods (**Section 3.2.2**). As such, visual impacts to neighborhoods are not expected to vary significantly among the DSA as a result of this project.

If a DSA that includes DSA Segment 2 (DSAs C, D, C1, D1, C2, D2, C3, D3) is selected as the Preferred Alternative, unique visual impacts could occur due to the potential elevation of an approximately one-mile section of elevated roadway that would run along the existing US 74

alignment, from just east of I-485 to just east of Stallings Road. A visualization of this elevated roadway can be found in **Appendix G**. Aesthetic treatments and structural alternatives for this elevated roadway would be identified and coordinated with local municipalities to minimize any visual impacts through this primarily commercial area.

4.6 HAZARDOUS MATERIALS

4.6.1 EXISTING CONDITIONS

Leaking Underground Storage Tanks

Old USTs at service stations can deteriorate and leak fuels, and are a common source of soil and/or groundwater contamination.

An assessment of the project study area was performed to identify the presence of potentially contaminated sites. The NCDOT Geotechnical Engineering Unit prepared a *GeoEnvironmental Impact Evaluation* in April 2008 to identify properties within the project study area that are or may be contaminated. This report is incorporated by reference, summarized below, and available on the NCTA Web site (www.ncturnpike.org/projects/monroe).

The North Carolina GIS database was used to identify known hazardous materials/waste sites within the vicinity of the proposed project. Several field studies were conducted along the project corridor. A search of appropriate state and federal environmental agencies' databases was performed to assist in evaluating sites identified during this survey.

Seventeen sites were identified that presently contain or formerly contained petroleum above ground storage tanks (AST) or underground storage tanks (UST). In addition, five other geoenvironmental concern areas were identified, including two junkyards, one auto repair service, and two farm USTs within the immediate vicinity of the DSAs. These sites are listed and described in **Table 4-12** and shown on **Figure 4-3.** The NCDOT Geotechnical Engineering Unit observed no additional contaminated properties during the field reconnaissance and regulatory agencies' records search.

TABLE 4-12: Known and Potentially Contaminated Sites in the Project Study Area

Site Number	Site Type and Facility ID Number	Location	UST Owner[1]	Other Information[2]	Anticipated Impact Severity
1	UST 0-014162	11103 East Independence Blvd, Matthews, NC 28105	Nisbet Oil Co	Matthews Shell – current gas station, 5 USTs in use	Low
2	UST 0-014847	11208 East Independence Blvd, Matthews, NC 28105	Exxon Mobil	Exxon #43524 – current gas station, 4 USTs in use, 1 UST closed in 1993, (GWI #10609, #19238, #21425)	Low
3	UST 0-026203	11229 East Independence Blvd, Matthews, NC 28105	Mansfield Oil Co	Fullwood Express – current gas station, 4 USTs in use	Low
4	UST 0-013704	11416 East Independence Blvd, Matthews, NC 28105	Kmart Corp	Former Kmart #7406, 1 UST was closed in 1998	Low
5	UST 0-036128	12033 East Independence Blvd, Matthews, NC 28105	Independence Real Estate Investors LLC	Office complex, 2 USTs currently in use	Low
6	UST 0-036128	12518 East Independence Blvd, Matthews, NC 28105	Independence Real Estate Investors LLC	Handy Pantry #156 – current gas station, 3 USTs in use	Low
7	Manuf. 0-026363	12701 East Independence Blvd, Matthews, NC 28105	McGee Corp	Manufacturing facility, 4 USTs closed in 1995 (GWI #12523)	Low

TABLE 4-12: Known and Potentially Contaminated Sites in the Project Study Area

Site Number	Site Type and Facility ID Number	Location	UST Owner[1]	Other Information[2]	Anticipated Impact Severity
8	Junkyard (site cleared since NCDOT report prepared)	13408 East Independence Blvd, Matthews, NC 28105	N/A	Don's Auto Parts, no evidence of any USTs, 2 ASTs and an oil water separator	Low
9	UST 0-009096	13025 East Independence Blvd, Matthews, NC 28105	LSAA, Inc BDA Sams Mart	Sams Mart #770, 4 USTs in use (GWI #18395)	Low
10	UST 0-008353	13024 East Independence Blvd, Matthews, NC 28105	Circle K Stores	Circle K #2705359 – current gas station, 5 USTs in use and 6 USTs closed in 1989 (GWI #22361)	Low
11	Junkyard	13415 US 74 Indian Trail, NC 28079	N/A	Junkyard and body shop	Low
12	Oil Change Facility	13519 US 74 Indian Trail, NC 28079	N/A	Pennzoil Outerbelt Lube Center	Low
13	Junkyard	7213 Secrest Shortcut Rd Indian Trail, NC 28079	N/A	Residence and junkyard	Low
14	UST 0-028050	4210 Rocky River Rd Monroe, NC 28110	Joel and Sylvia Clontz	1 UST closed in 1991	Low
15	Farm	1418 Roanoke Church Rd Monroe, NC 28110	N/A	Above ground fuel tanks, above ground chemical tanks, and pesticide storage sheds	Low
16	NCDOT Parcel # 972	2710 Concord Hwy Monroe, NC 28110	N/A	4 ASTs removed in 2002	None[3]
17	NCDOT Parcel # 926	Concord Hwy Monroe, NC 28110	N/A	1 UST and associated contaminated soil removed in 1999	None[3]
18	NCDOT Parcel # 905	734 Concord Hwy Monroe, NC 28110	N/A	1 UST and associated contaminated soil removed in 1999	None[3]
19	NCDOT Parcel # 235	2624 Morgan Mill Rd Monroe, NC 28110	N/A	1 UST and associated contaminated soil removed in 1999	None[3]
20	NCDOT Parcel # 902	2616 Morgan Mill Rd Monroe, NC 28110	N/A	1 UST and associated contaminated soil removed	None[3]
21	NCDOT Parcel # 912	US 74 Wingate, NC 28174	N/A	1 UST removed	Low
22	NCDOT Parcel # 906	US 74 Wingate, NC 28174	N/A	Former Mid-State Iron Works, Preliminary Site Assessment was conducted in 1999 and no USTs were identified within proposed right of way and construction easement areas	Low

Source: *GeoEnvironmental Impact Evaluation* (NCDOT Geotechnical Engineering Unit, April 2008).
[1]N/A if no UST owner reported. [2]GWI – groundwater incident. [3]A review of all available information finds there is nothing to indicate contamination would be a problem. It is possible that contaminants were handled on the property; however, all information indicates that contamination problems should not be expected.

4.6.2 IMPACTS FROM HAZARDOUS MATERIALS / WASTE SITES

The NCDOT Geotechnical Engineering Unit evaluated the sites listed in **Table 4-12** to determine the magnitude of anticipated impact if the project would directly affect the site. The NCDOT Geotechnical Engineering Unit rates sites as low, medium, or high, as defined below.

- Low – Little to no impacts to cost or schedule anticipated.
- Medium – Additional costs and time may be incurred due to the handling of contaminated materials, and a need for special construction techniques or products. There were no sites within the DSAs that received a "medium" impact rating.
- High – Costs and scheduling could overwhelm smaller projects and cause serious delays in larger projects. Liability may fall upon the NCTA to clean up contamination, which could require decades. These sites should be avoided to the extent possible. There were no sites within the DSAs that received a "high" impact rating.

Table 4-13 summarizes the impacts from potentially contaminated sites for each DSA. Those sites listed in **Table 4-12** with an anticipated type of impact of "none" were not included in **Table 4-13**. Because there is some uncertainty as to the exact locations of the sites, if the site was mapped as within the DSA corridor, it was assumed to be an impact. The DSAs' functional engineering designs were prepared to avoid known hazardous materials/waste sites to the extent possible. The No-Build Alternative would not impact any sites.

TABLE 4-13: Impact of Potentially Contaminated Sites on the Detailed Study Alternatives

Site Number*	Impact Severity	Detailed Study Alternative															
		A	B	C	D	A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D 3
Site 5: UST	Low	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Site 6: UST	Low			X	X			X	X			X	X			X	X
Site 7: Manuf.	Low	X	X			X	X			X	X			X	X		
Site 8: Junkyard	Low			X	X			X	X			X	X			X	X
Site 9: UST 0-009096	Low			X	X			X	X			X	X			X	X
Site 10: UST	Low			X	X			X	X			X	X			X	X
Site 11: Junkyard	Low			X	X			X	X			X	X			X	X
Site 12: Oil Change Facility	Low			X	X			X	X			X	X			X	X
Site 13: Junkyard	Low	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Site 14: UST	Low	X		X		X		X		X		X		X		X	
Site 15: Farm	Low	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Site 21: NCDOT Parcel # 912	Low	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Site 22: NCDOT Parcel # 906	Low	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Total Sites		7	6	12	11	7	6	12	11	7	6	12	11	7	6	12	11

Source: *GeoEnvironmental Impact Evaluation* (NCDOT Geotechnical Engineering Unit, April 2008).
*Sites 1 - 4 and 16 - 20 were not included in this table because no impacts are anticipated (Sites 1 - 4 are west of the project limits, Sites 16 -20 have been remediated).

Based upon the assessment described above, DSAs A, B , A1, B1, A2, B2, A3, and B3 would impact 6-7 sites, while DSAs C, D, C1, D1, C2, D2,C3, and D3 would impact 11-12 sites. Generally, the DSA corridor segments utilizing portions of US 74 had the highest numbers of potentially contaminated sites.

4.6.3 MITIGATION FOR HAZARDOUS MATERIALS / WASTE SITES

Once a Preferred Alternative is selected, a more detailed field reconnaissance will be conducted. Additional sites not recorded by regulatory agencies and not reasonably discernable during the project reconnaissance may occur. Soil and groundwater assessments will be conducted on each of the potentially contaminated properties within the Preferred Alternative before right-of-way acquisition in order that the degree and extent of contamination can be assessed.

4.7 FLOODPLAINS AND FLOODWAYS

4.7.1 BACKGROUND INFORMATION

Riverine floodplains are low-lying areas adjacent to stream channels that are prone to periodic flooding during heavy or prolonged rains. The 100-year floodplain is the area that has a one percent chance of flooding during any given year.

The floodway is the channel area that needs to be kept free of encroachment so the 100-year flood can be carried without increasing the level and extent of flood elevations. Streams for which detailed hydrological studies have not been conducted do not have defined floodways, so only the 100-year floodplain boundaries are estimated and mapped.

100-Year Floodplains and Floodways

The 100-year floodplain is the area that has a 1 percent chance of flooding during any given year.

The floodway is the channel area that needs to be kept free of encroachment so the 100-year flood can be carried without increasing the level and extent of flood elevations.

A floodplain evaluation was conducted for the project in accordance with Executive Order 11988 Floodplain Management and 23 CFR Part 650, Subpart A – Location and Hydraulic Design of Encroachments on Floodplains. Both Union County and Mecklenburg County are participants in the National Flood Insurance Program (NFIP) administered by the Federal Emergency Management Agency (FEMA). As part of the NFIP, FEMA determines floodway boundaries as a tool for floodplain management.

FEMA, in cooperation with federal, state and local governments, developed floodplain and floodway boundaries and Flood Insurance Rate Maps (FIRMs) for Union County in November 2008 and developed preliminary mapping for Mecklenburg County in October 2007 (North Carolina Floodplain Mapping Program www.ncfloodmaps.com/firm_indexes.htm).

4.7.2 FLOODPLAINS AND FLOODWAYS IN THE PROJECT STUDY AREA

Figure 4-4a-c shows the floodplains and floodways in the project study area. Named streams with defined floodplains in the project study area include, from west to east: North Fork Crooked Creek, South Fork Crooked Creek, Stewarts Creek, Lick Branch, Stumplick Branch, Richardson Creek, Rays Fork, Meadow Branch, and Negro Head Creek.

Defined floodways generally are located within or near municipal limits. Named streams with defined floodways in the study area include, from west to east: South Fork Crooked Creek, Stewarts Creek, and Richardson Creek.

4.7.3 MAJOR DRAINAGE STRUCTURES AND FLOODWAY / FLOODPLAIN IMPACTS

A preliminary hydraulics analysis was performed to identify the preliminary sizes and locations of major drainage structures along the DSAs that would be needed to adequately carry floodwaters. Major drainage structures are bridges, box culverts, or pipe culverts greater than 72 inches in diameter. The preliminary hydraulic analysis is presented in the *Preliminary Hydraulic Technical Memorandum* (PBS&J, December 2008), incorporated by reference and available on the NCTA Web site (www.ncturnpike.org/projects/monroe).

For all DSAs together, the preliminary hydraulics analysis identified a total of 56 crossings of streams and drainages for which bridges, box culverts, or pipe culverts greater than 72 inches in diameter would be required from a hydraulics standpoint. These are shown in **Figure 2-10a-cc**.

The major drainage structures and crossings were reviewed by the environmental resource and regulatory agencies at the Turnpike Environmental Agency Coordination Meeting on October 7, 2008 and at a bridging location field review on October 21, 2008. As a result of these meetings, the agencies agreed with several recommended bridge and culvert locations, and NCTA agreed to include bridges at several locations previously recommended for culverts in order to avoid or minimize stream and wetland impacts. The recommended bridge locations to avoid and minimize stream and wetland impacts are as follows and are shown in **Figure 2-10a-cc**:

- Crossing 3 on DSA Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, B3) – replace recommended culvert with twin 250 feet long bridge structures to avoid impacts to Stream S008a and Wetland W004.
- Crossing 5A on DSA Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, B3) – recommended 50-foot long bridge to avoid impacts to Stream S008B.
- Crossing 6 on DSA Segment 18A (DSAs A, B, A1, B1, A2, B2, A3, B3) – replace recommended culvert with twin 320 feet long bridges to avoid impacts to North Fork Richardson Creek and Wetland W005.
- Crossing 19 on DSA Segment 30 (DSAs B, D, B1, D1, B2, D2, B3, D3) – recommended twin 150 feet long bridges to avoid impacts to Stream S047.
- Crossing 20 on DSA Segment 30 (DSAs B, D, B1, D1, B2, D2, B3, D3) – recommended 75-foot bridge to avoid impacts to Stream S047.
- Crossing 21 on DSA Segment 22A (DSAs A, C, A1, C1, A2, C2, A3, C3) – recommended twin 110 feet long bridges to avoid impacts to Stream S047.
- Crossing 22A on DSA Segment 22A (DSAs A, C, A1, C1, A2, C2, A3, C3) – extended proposed bridge from 165 feet to 230 feet to clear Wetland W044 in addition to Stream S047.
- Crossing 30 on DSA Segments 34 and 36 (all DSAs) – recommended twin 240 feet long bridges to avoid impacts to Stream S082.

- Crossing 37 on DSA Segment 36 (DSAs A, B, C, D, A2, B2, C2, D2) – recommended twin 320 feet long bridges to avoid impacts to Stream S111.
- Crossing 38 on DSA Segment 36 (DSAs A, B, C, D, A2, B2, C2, D2) – recommended twin 280 feet long bridges to avoid impacts to Stream S112).
- Crossing 39 on DSA Segment 34 (DSAs A1, B1, C1, D1, A3, B3, C3, D3) – recommended bridge length (375 feet) would be maintained but possible lengthening to minimize impacts to Richardson Creek and surrounding streams would be investigated at a later time.
- Crossing 46 on DSA Segment 34 (DSAs A1, B1, C1, D1, A3, B3, C3, D3) – replace recommended culvert with twin 320 feet long bridges to avoid impacts to Stream S152 and Wetlands W163, W167, and W168.
- Crossing 47 on DSA Segment 36 (DSAs A, B, C, D, A2, B2, C2, D2) – replace culvert with twin 575 feet bridges to avoid impacts to Wetlands W170 and W167 and Stream S152.

Details about crossing locations, such as preliminary culvert size and length, approximate bridge length, floodplain width and floodway width are included in a table in **Appendix H**. Each crossing location was assigned a unique crossing ID, which is included in the table along with the applicable DSA Segment. The estimated bridge lengths do not attempt to span any existing floodplains or floodways at this time and were not modeled hydraulically, but are the minimum lengths necessary geometrically based on the proposed vertical alignment and the existing topography at the crossing location.

Table 4-14 summarizes the numbers of major drainage structures associated with each DSA.

TABLE 4-14: Summary of Major Drainage Structures and Floodway and Floodplain Crossings

DSA	Bridge Crossings over Streams	Major Culverts or Pipes (>72 inches in diameter)	Floodway Crossings	Floodplain Crossings
A	9	38	3	14
B	9	36	3	14
C	6	37	3	11
D	6	35	3	11
A1	8	36	2	13
B1	8	34	2	13
C1	5	35	2	10
D1	5	33	2	10
A2	9	38	3	14
B2	9	36	3	14
C2	6	37	3	11
D2	6	35	3	11
A3	8	36	2	13
B3	8	34	2	13
C3	5	35	2	10
D3	5	33	2	10

Source: *Preliminary Hydraulic Technical Memorandum* (PBS&J, December 2008).

As shown in **Table 4-14**, DSA A and DSA A2 would have the greatest number of major culverts and pipes (38), while DSAs D1 and D3 would have the least (33). DSAs A, B, A2 and B2 would have the most total combined crossings of floodways and floodplains (17) and DSAs C1, D1, C3 and D3 the least (12).

The DSAs for the project have been located in floodplains and/or floodways only in locations where existing residential and business development and other human and natural environment constraints have left no reasonable alternatives to the use of floodplains and/or floodways.

Once a Preferred Alternative is selected, a detailed hydrologic and hydraulic analysis will be performed for each crossing location to determine the actual size and configuration of each structure. Also, for all new location crossings on FEMA-regulated streams (streams where a floodway and/or floodplain has been identified), a Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) will be prepared and submitted to NC Floodplain Mapping Program or Mecklenburg County, as appropriate, for approval.

In NFIP flood hazard areas, the final hydraulic designs for the Preferred Alternative would be such that the floodway would carry the 100-year flood without a substantial increase in flood elevation. The effect of the project on floodwaters can be mitigated effectively through proper sizing and design of hydraulic structures (culverts, bridges, and channel stabilization).

A LOMR is FEMA's modification to an effective FIRM, or Flood Boundary and Floodway Map (FBFM), or both. LOMRs are generally based upon the implementation of physical measures affecting the hydrologic or hydraulic characteristics of a flooding source, and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations, or the Special Flood Hazard Area. The LOMR officially revises the FIRM or Flood Boundary and FBFM, and sometimes the Flood Insurance Study report, and when appropriate, includes a description of the modifications (FEMA Web site www.fema.gov/plan/prevent/floodplain/nfipkeywords/lomr.shtm).