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9 NEPA Affected Environment

9.1 Introduction

This section describes the existing environmental conditions within the project study area and identifies sensitive features and constraints for both the natural, physical and human environment. The existing conditions and constraints will provide a baseline for the comparison of impacts of the proposed project and will help to guide refinements of an LPA.

9.2 Task Description

The consultant has gathered and analyzed data on the existing conditions along the corridor for the following resources:

- Communities, community facilities and land use
- Cultural resources
- Visual and aesthetic resources
- Natural resources, vegetation and threatened and endangered species
- Farmlands
- Water quality, hydrology and floodplains
- Coastal zone
- Noise and vibration
- Air quality
- Hazardous materials
- Energy
- Safety and security

9.3 Study Area and Analysis Area

The study area for the LCRT was defined by using a half-mile buffer around the Recommended Alternative from the i-26*ALT* study, as illustrated on Figure 1.1. The northern termini of the study area near Summerville, was expanded beyond the half-mile buffer to ensure future consideration of alignment options that could connect to key destinations. At the southern termini of the study area, near the Charleston Peninsula, the study extends to Broad Street. For discussion purposes, the study area has been defined by segments as follows:

- **Segment 1:** North Main Street & Richardson Avenue to US 78 & 165 (Berlin G Myers Parkway): This segment is assumed to operate in mixed traffic with one-way service circulating Summerville Square and in curb-side lanes to Berlin G Myers.
- **Segment 2:** US 78 (Berlin G Myers Parkway to Otranto Road): This segment is assumed to operate in an at-grade semi-exclusive guideway with cross traffic and curb-side lanes.
- **Segment 3:** US 52 (Otranto Road to Carner Avenue): This segment is assumed to operate in an at-grade semi-exclusive guideway in the median with cross traffic.
- **Segment 4:** US 52 (Carner Avenue to Mt. Pleasant Street): This segment is assumed to be a semi-exclusive dedicated guideway.
- **Segment 5:** US 52 (Mt. Pleasant Street to Line Street): This segment assumes curb-side mixed traffic operations.

This section of the document summarizes the resource conditions that exist for the project study area today (at the time the analysis was conducted). The analysis area may vary within each section relative to the resource – the analysis area could range from the footprint of the study area only (wetlands, community facilities) to the Lowcountry region as a whole (air quality, energy).

9.4 Land Use, Zoning and Economic Development

This section summarizes the information found in Chapter 3. Please refer to said chapter for a more detailed explanation of land use.

9.4.1 Existing Land Use and Zoning

The following provides a general qualitative description of the various land use patterns along the corridor and within the study area. A quantitative description (at the parcel level) of the corridor land use is presented in Appendix B of the Land Use/Economic Development Report.

9.4.1.1 Summerville (Segments 1 and 2)

A retail and mixed-use area is located along North Main Street near downtown Summerville and E 5th N Street from Berlin G Myers Parkway north. Going east toward I-26 on North Main Street from E 5th N Street, this stretch of the study area is characterized by big box retailers and smaller out-lot developments. The study area continues east along US 17 ALT crossing over I-26 to the Nexton development, a 4,000 acre development planned for a variety of uses, including 6,500 homes and a mixture of retail, commercial, and office space.

The southeast area is characterized by scattered mature commercial use (retail and light industrial), large undeveloped areas, and some residential neighborhoods. These neighborhoods are predominantly single family, with an increasing number of multi-family units approaching Berlin G Myers Parkway and Summerville.

Development decreases around the area of the US 78 and I-26 interchange. Some commercial and light industrial uses are present along US 78, but a significant amount of forested, undeveloped land and wetlands characterize this stretch. The area across from the Coastal Carolina Fairgrounds/Exchange Park contains a significant amount of industrial development.

9.4.1.2 North Charleston (Segments 2, 3, and 4)

One of the most active and intense portions of the study area is further southeast towards North Charleston. The area contains the Trident Medical Center, CSU, and a large number of medical office and other related facilities. This area also has one of the highest concentrations of multi-family residential developments in the corridor, which are supported by a large number of retail stores. This portion of the study area also includes a major public open space/recreational amenity, the North Charleston Wannamaker County Park.

Further south, near the Otranto Road intersection, the study area is primarily commercial with residential uses behind the commercial development. More intense commercial uses exist to the west, ultimately giving way to the Charleston International Airport, Boeing, and Joint Base Charleston, located just west of the study area. The area surrounding the intersection of Ashley Phosphate Road and Rivers Avenue is a major activity area with Trident Technical College, the

Northwoods Mall, and additional large scale retailers. A significant amount of multi-family housing exists west of the corridor just north of Northwoods Mall. Commercial and retail uses exist along the western edge of the study area, along Montague Avenue and International Boulevard near the Charleston Area Convention Center.

Mature commercial (generally retail) uses continue to be the dominant land use along US 78 (Rivers Avenue). Along the east side of the study area and along the Cooper River are the Charleston Naval Complex and related industrial uses. Residential areas are predominantly single family with occasional concentrations of multi-family housing. On the east and north of McMillan Avenue are a significant number of garden apartments and two-family residences.

9.4.1.3 Charleston (Segments 4 and 5)

Further south along the corridor, land use begins to change to industrial with some residential scattered on the east and west sides of the study area. The Port of Charleston lies just outside of the corridor to the east. The area along Meeting Street and south of the I-26 is characterized by newly developed multi-story mixed-use, along with development on the west side of the street. These developments include multi-family residential, first floor retail, hotel, and office uses. The Upper King Street retail/commercial corridor runs one block to the west. The area west of King Street is predominantly single family residential, with some multi-family residential and scattered retail. To the east of Meeting Street is a mixture of single family and multi-family residential.

Downtown Charleston is characterized by a large proportion of older and historic structures. Additional information on historic and cultural resources is provided in Section 9.7. The area north of Calhoun Street at the western edge of the study area can be characterized as a medical district with MUSC, MUSC Health Center, and Roper Hospital. South of the medical district and Calhoun Street, the pattern is predominantly urban single family detached housing with some scattered multi-family housing, retail and institutional uses. Heading east along Calhoun, the predominance of multi-family housing and commercial development increases as the corridor heads past the College of Charleston and turns north on Meeting Street.

9.4.2 Economic Development

South Carolina as a whole has experienced a period of economic strength since the 2008 Great Recession. The Charleston MSA has been a leading driver of this positive momentum, with growth generally exceeding the national economy. Area Development Online[1], a site selection organization, ranked South Carolina second in their Top States for Doing Business and Yelp[2] ranked Charleston number one for small business growth in 2018. The region's strong job creation has resulted in similar population growth, with 28 people moving to the region each day. Continuing a decade of improvements, South Carolina's unemployment rate in November 2018 was 3.3 percent versus the national rate of 3.7 percent[3]. In 2018, total employment in

[1] Lee and Associates. 2018. Quarterly Reports.

[2] Charleston Metro Chamber of Commerce and Charleston Regional Development Alliance. 2018.

[3] Federal Reserve Bank of Richmond. 2018. Beige Book and Monthly Updates.

Charleston grew 2.2 percent versus a national rate of 1.7 percent. Additionally, Charleston continued to lead metropolitan areas in the state with an unemployment rate of 2.8 percent.

While the national rate of growth has slowed in the past two years, South Carolina; by contrast, has experienced real personal income (RPI) growth for five consecutive years and eight of the past ten years overall. In a related measure, Charleston's median family income increased a healthy 8.3 percent year-over-year in November 2018, outpacing the state's two largest MSAs and reinforcing the gains made in real income over the past decade[3].

The service, government, and advanced industry sectors continue to play an increasing role in Charleston's development. Tourism provided $4.2 billion of economic impact, according to the Charleston Metro Chamber of Commerce. The government sector, led by Joint Base Charleston and the Charleston Naval Complex, is estimated to bring $4 billion in direct investment and $2.3 billion in indirect investment to the MSA while employing approximately 22,000 according to the HUD OPDR. According to the University of South Carolina, the outlook for 2019 onward is generally positive. It is anticipated that growth will be moderate (due to tariffs, rising interest rates and changes in the global economy), but will remain steady with job growth at or above two percent, and an unemployment rate below 3.5 percent[4].

9.4.3 Affordable Housing

According to the U.S. Census Bureau, the median household income (MHI) in occupied housing and median owner-occupied home value for the tri-county area is about $57,755 and $205,167 respectively.[5] Specific to the study area, the census tract data show the MHI in occupied housing and median owner-occupied home value is about $46,312 and $159,150 respectively. The average home value in the study area (across census tracts) is about $239,869, which is over $80,000 higher than the median estimate. The median home price may not provide an accurate assessment of the housing cost burden faced by many households because of the value dispersion. The city of Charleston acknowledges it is facing a housing affordability crisis.[6] Roughly 26 percent (about 13,141) of the households in owner-occupied housing pay over 30 percent of their income on housing related costs. For renters, over 51.5 percent (about 14,426) of households are housing cost-burdened.

Census data in the study area and region report similar estimates, showing that disproportionally, when compared to owners, renters are spending over half their income on housing costs. This supports the trend that renting is becoming more prevalent as mortgages become harder to obtain and people seek greater mobility. The weighted average of housing cost burden data show 42 percent of households in the study area are paying over 30 percent of MHI in housing. The weighted average for the tri-county area is 34 percent, which indicates the housing affordability crisis is more prominent in the study area.

Additionally, the HUD data for the study area provide additional evidence regarding the housing affordability crisis in the study area, where reportedly 43 percent of households are burdened by

[4] University of South Carolina. 2019. South Carolina Economic Outlook.

[5] Average of the three counties from U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.

[6] City of Charleston. 2018. Lowline Affordable Housing Development Project. Procurement Division.

housing costs. The HUD data for the study area also show that the majority of affordable housing units are within the cities of Charleston and North Charleston, where the project study area serves. However, the overall inventory shows public housing and housing choice voucher units total only 6,307, which represents just over 2 percent of the 274,408 occupied housing units with the tri-county area.[7]

The city of Charleston passed a referendum in 2017 to issue a $20 million bond for affordable housing. TOD planning related to the LCRT project could be coordinated with this bond program and some of the other programs discussed to produce affordable housing units in mixed income projects in the corridor.

Within each county, individual departments, such as the Charleston County Community Development Department, work to fund affordable housing and community revitalization projects. Existing regional programs and incentives include HUD grants: the CDBG, HOME, and Housing Opportunities for Persons w/AIDS (HOPWA) grants promote the development and rehabilitation of housing for lower income families and individuals.[8]

MU-WH zoning districts MU-1/WH and MU-2/WH require that 20 percent of housing units in proposed developments are made available to individuals making 80 percent (rental) or 120 percent (owner-occupied) of the area median income or that the majority of the ground floor is dedicated to non-residential uses. Affordable housing units are protected for 25 years. A fee in lieu option is available for developer to opt out of constructing subsidized units directly under their development.

9.4.4 Next Steps

With forecasted population and employment growth, the regional real estate market is poised for continued expansion. The study area has seen a significant share of the region's new development over the past five years and is well positioned to see similar results going forward. Investment in transit infrastructure and services in the corridor should provide additional leverage for future development and promote the design of interconnected and multimodal complete streets.

In order to reduce transportation cost burden (in addition to housing cost), TOD planning related to the LCRT could be coordinated with the affordable housing bond program and other initiatives to produce affordable housing units in mixed income projects in the corridor. Additionally, study area ordinance should be reviewed to consider expanding the MU-WH district zoning to generate employment opportunities within the study area to alleviate the transportation and housing cost burden.

9.5 Socioeconomics, Community Features, and Environmental Justice

This section presents social, cultural, economic, environmental justice (EJ), and limited English proficiency (LEP) conditions in the study area and associated region. The information is summarized from the community characterization report (CCR), which provides detailed

[7] United States Department of Housing and Urban Development. 2018. Continuum of Care- Public Housing Agency Crosswalk. https://www.hudexchange.info/resources/documents/FY-2018-CoC-PHA-Crosswalk-Report.pdf [Accessed December 17, 2018]

[8] City of Charleston. 2018. Housing and Community Development. https://www.charleston-sc.gov/DocumentCenter/Index/42.

information regarding regional and study area history, local planning initiatives, the local transportation network, and socioeconomic and environmental justice factors (see Appendix E). The CCR will help inform the community impact assessment (CIA), an evaluation of effects of the project on communities and their qualities of life.

9.5.1 Federal Actions and Guidance

The CCR and CIA follow FTA guidance on evaluating social and economic impacts, including effects to minority and low-income populations, collectively referred to as EJ populations (FTA 2016, 2018). According to FTA, an agency of the United States Department of Transportation (USDOT), transit projects often result in both positive and negative social and economic impacts and may influence community character and development trends. The CCR and CIA employ methodologies presented by the FHWA in *Community Impact Assessment: A Quick Reference for Transportation* (FHWA 2018).

FTA's consideration of EJ is founded on Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (FTA 2012). EO 12898 directs each federal agency to make EJ part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on EJ populations. USDOT Order 5610.2(a), *Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (USDOT Order) also informs how FTA addresses EJ. The USDOT Order establishes policy to integrate EJ principles into USDOT planning, programming, rulemaking, and policy formation. In considering EJ, the CCR and CIA specifically follow FTA's *Environmental Justice Policy Guidance for Federal Transit Administration Recipients* (FTA C 4703.1).

As with other federal agencies, FTA follows the President's Council on Environmental Quality (CEQ) guidance (CEQ Guidance) for applying EO 12898 under NEPA. CEQ Guidance directs identification of minority populations when either the minority population of the affected area exceeds 50 percent or the minority population percentage of the study area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997). CEQ defines minority populations as people who identify themselves as Asian or Pacific Islander, American Indian or Alaskan Native, Black (not of Hispanic origin), or Hispanic. Due to including one of these minorities, those indicating two or more races are also considered minorities. As the study area minority population comprised 48.3 percent of the total population according to the 2017 ACS, minority populations were identified as those exceeding the 50-percent threshold within study area segments and associated USCB block groups.

CEQ Guidance further specifies that low-income populations are to be identified using the annual statistical poverty threshold from the USCB Current Population Reports Series P-60 on Income and Poverty. The USCB-provided 2017 poverty threshold for individuals under age 65 was $12,752, and the official poverty rate for the United States (U.S.) as a whole in 2017 was 12.3 percent (USCB 2018). Low-income populations with poverty rates above the U.S. poverty rate of 12.3 percent were identified among study area segments and USCB census tracts using the 2017 ACS, and those with poverty rates above the CCR study area rate of 23.7 are noted as

having a higher chance for disproportional environmental and human health effects from the project.

Pursuant to Title VI of the Civil Rights Act of 1964 (42 USC § 2000d et seq.), U.S. Department of Justice (USDOJ) Guidance to Federal Financial Assistance Recipients Regarding Title VI Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons [DOJ LEP Guidance; Federal Register 67(117):41455-41472, June 18, 2002], and EO 13166 [Federal Register 65(159):50121-50122, August 16, 2000], the LEP population was assessed for the study area region and the immediate CCR study area. DOJ LEP Guidance advises recipients of DOJ funds to provide "written translations of vital documents for each eligible LEP language group that constitutes five percent or 1,000, whichever is less, of the population of persons eligible to be served or likely to be affected or encountered" [Federal Register 67(117):41463-41464, June 18, 2002]. This is referred to herein as the DOJ LEP threshold. Eligible LEP language groups are those whose members self-report speaking English less than very well.

9.5.2 Study Area Description and Data Representation

The CCR study area, which at this point in the analysis overlaps the study area as described in Chapter 9.3, encompasses approximately 38 square miles situated in southwestern Berkeley County, central Charleston County, and southeastern Dorchester County and overlaps the incorporated boundaries of six municipalities (Figure 9.5.1). The municipalities consist of the cities of Goose Creek and Hanahan in Berkeley County; the town of Lincolnville and the cities of Charleston and North Charleston in or largely in Charleston County; and the town of Summerville largely in Dorchester County. Unincorporated named areas, such as the community of Ladson, as well as many named subdivided neighborhoods also overlap the CCR study area (Figure 9.5.2). Insights regarding development trends and community character in the CCR study area were gained through background research, study of historical maps and aerial photography, direct field observations, and conversations with community members and project stakeholders.

The CCR study area overlaps 31 whole USCB block groups and 70 partial USCB block groups contained within 50 USCB census tracts (Table 9.5.1). USCB data were compiled for the block groups to present demographic and economic factors and identify EJ and LEP populations residing in the CCR study area. Depending on availability and comparability, USCB data were derived from the 2010 decennial census (2010 Census); the most current, complete datasets of the 2013 – 2017 5-year estimates of the American Community Survey (2017 ACS); and for counties and municipalities, the 2017 estimates of the USCB Population Estimates Program (2017 PEP) and 2010 and 2017 data provided in USCB QuickFacts. These data were obtained utilizing USCB American FactFinder, TIGER Products, Population and Housing Unit Estimates, and USCB QuickFacts (USCB 2019a, 2019b, 2019c). The CCR study area is described in the five segments as presented in Chapter 9.3, from north to south, for ease of analysis and presentation.

Table 9.5.1 USCB Census Tracts and Block Groups in the Study Area

Study area segment (total BGs)	Block group				
1 (12)	CT 31.06 BG 1	CT 106.04 BG 1	CT 107 BG 1	CT 207.10 BG 2	
	CT 106.03 BG 1	CT 106.04 BG 2	CT 107 BG 2	CT 207.13 BG 1	
	CT 106.03 BG 2	CT 106.06 BG 1	CT 107 BG 3	CT 207.14 BG 2	
2 (24)	CT 31.06 BG 1	CT 31.14 BG 1	CT 207.10 BG 2	CT 207.15 BG 2	CT 207.21 BG 1
	CT 31.06 BG 2	CT 31.15 BG 1	CT 207.13 BG 1	CT 207.16 BG 1	CT 208.09 BG 1
	CT 31.06 BG 3	CT 31.15 BG 2	CT 207.14 BG 1	CT 207.16 BG 2	CT 208.10 BG 1
	CT 31.07 BG 3	CT 31.15 BG 3	CT 207.14 BG 2	CT 207.16 BG 3	CT 209.04 BG 1
	CT 31.13 BG 1	CT 107 BG 3	CT 207.14 BG 3	CT 207.17 BG 3	
3 (40)	CT 31.04 BG 1	CT 31.14 BG 3	CT 34 BG 3	CT 38 BG 2	CT 55 BG 2
	CT 31.04 BG 2	CT 31.15 BG 1	CT 35 BG 3	CT 40 BG 1	CT 209.01 BG 2
	CT 31.05 BG 1	CT 31.15 BG 3	CT 36 BG 2	CT 40 BG 2	CT 209.03 BG 1
	CT 31.05 BG 2	CT 33 BG 1	CT 36 BG 3	CT 40 BG 3	CT 209.03 BG 2
	CT 31.11 BG 1	CT 33 BG 2	CT 37 BG 1	CT 43 BG 1	CT 209.04 BG 1
	CT 31.13 BG 2	CT 33 BG 3	CT 37 BG 2	CT 43 BG 4	CT 209.04 BG 2
	CT 31.14 BG 1	CT 33 BG 4	CT 37 BG 3	CT 44 BG 2	CT 209.04 BG 3
	CT 31.14 BG 2	CT 34 BG 2	CT 38 BG 1	CT 55 BG 1	CT 210 BG 3
4 (12)	CT 16 BG 1	CT 43 BG 2	CT 44 BG 1	CT 54 BG 2	
	CT 16 BG 2	CT 43 BG 3	CT 44 BG 2	CT 54 BG 3	
	CT 43 BG 1	CT 43 BG 4	CT 54 BG 1	CT 55 BG 1	
5 (31)	CT 1 BG 1	CT 6 BG 1	CT 11 BG 1	CT 44 BG 1	CT 53 BG 3
	CT 1 BG 3	CT 7 BG 1	CT 11 BG 2	CT 51 BG 1	CT 54 BG 2
	CT 2 BG 1	CT 7 BG 2	CT 11 BG 3	CT 51 BG 2	CT 54 BG 3
	CT 4 BG 1	CT 9 BG 1	CT 15 BG 1	CT 52 BG 1	
	CT 4 BG 2	CT 9 BG 2	CT 15 BG 2	CT 52 BG 2	
	CT 5 BG 1	CT 10 BG 1	CT 16 BG 1	CT 53 BG 1	
	CT 5 BG 2	CT 10 BG 2	CT 16 BG 2	CT 53 BG 2	

Sources: 2017 ACS
Abbreviations: BG = Block Group, CT = Census Tract

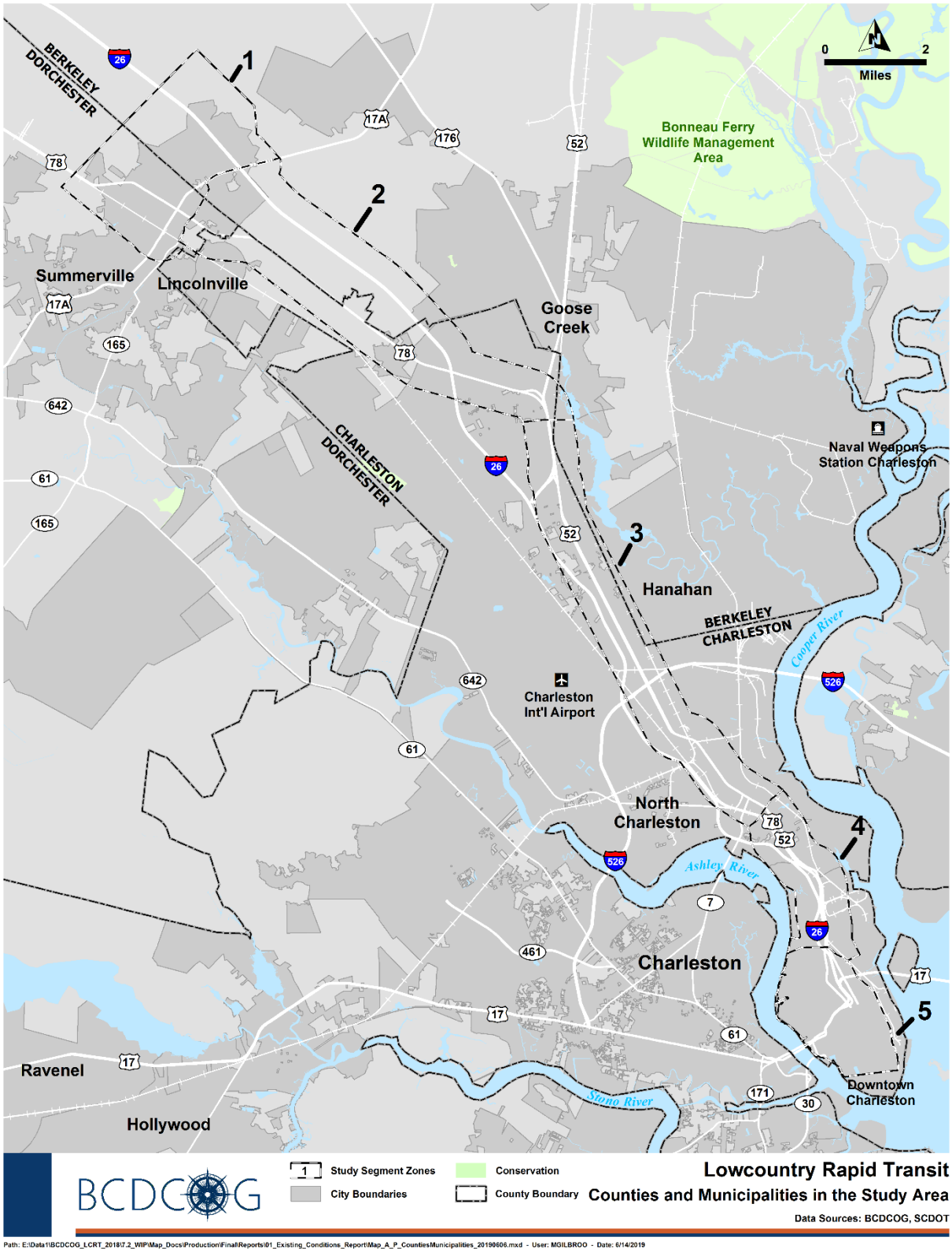

Figure 9.5.1 Counties and Municipalities in the Study Area

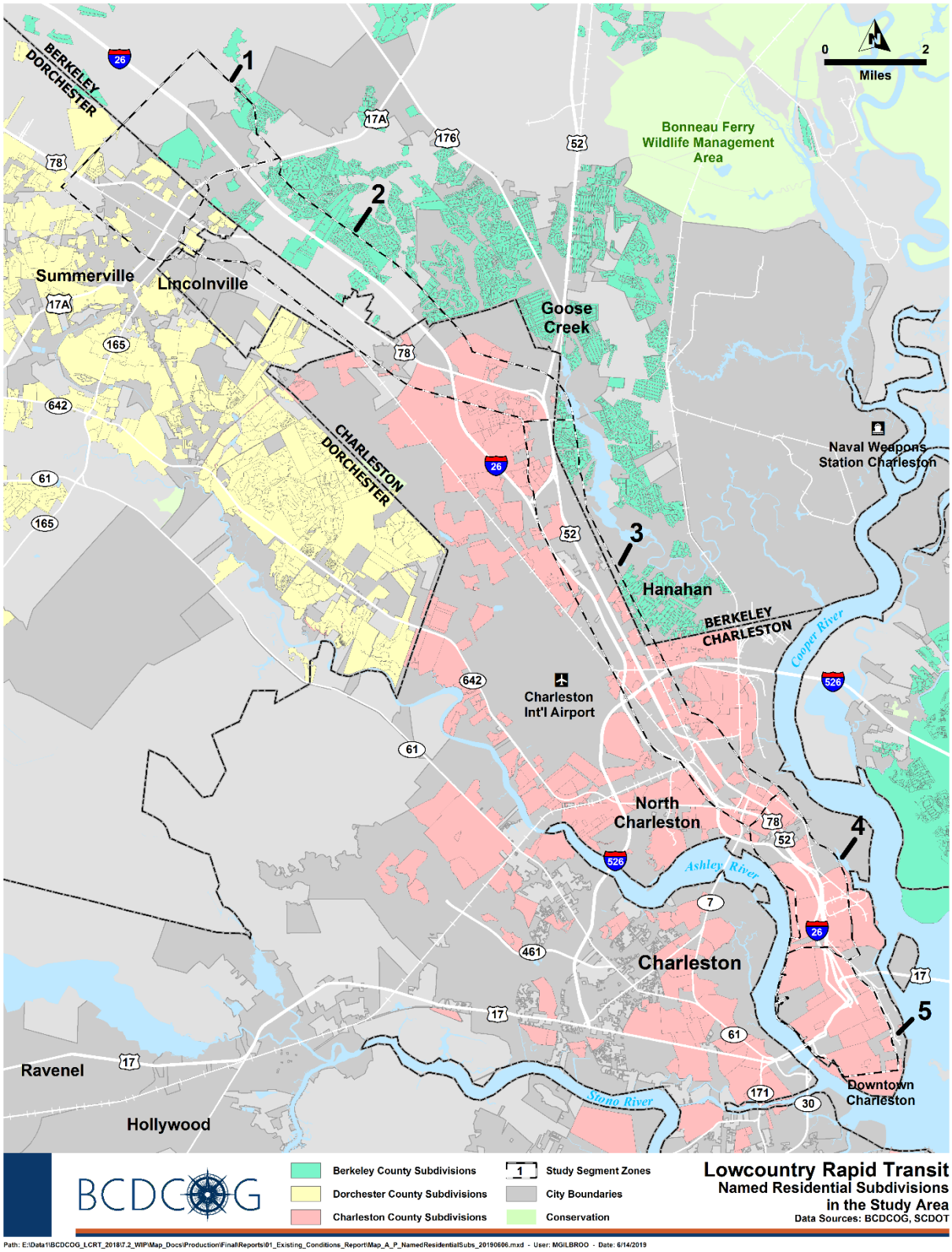

Figure 9.5.2 Named Residential Subdivisions in the Study Area

9.5.3 Study Area Socioeconomics

This section summarizes details pertaining to development trends, major community features, and demographics and economics in the study area. Study area trends compared with those of the region are presented first, followed by a brief discussion of each segment of the study area. Table 9.5.2 provides study area factors compared with the region and those of its five segments. Demographic factors related to transit needs, in particular, are presented in Chapter 2.

According to the 2017 ACS, approximately 85,324 people currently reside in the study area, and the study area experienced a rate of increase from 2010 that was similar to the state. The median age across the study area was younger than the counties in the study area region and the state. Minorities constituted 48.3 percent of people in the study area, with African American and Hispanic ranking as the two most numerous minority groups. Across the study area, the highest educational attainment of most people 25 years old and older was a high school diploma or equivalency. Of the people who have completed college degrees, those with bachelor's degrees are the most numerous.

The median home value in the study area was higher than the state and Berkeley County, and median gross rent was higher than the state median but lower than the county medians. Median household income and the average per capita income rate in the study area were both lower than in the state and county. Approximately 7.0 percent of the civilian workforce was unemployed, slightly lower than the state and higher than the county in the same period. Poverty rates for all people averaged 23.7 percent across the study area, higher than the state, counties, and study area municipalities. The Spanish-speaking LEP population was the only LEP population to meet the DOJ LEP threshold across the study area.

Table 9.5.2 Regional, Study Area, and Segment Trends

Geography	% of study area pop.	% pop. change, 2010 to 2017	People per square mile	Median age	% of study area housing units	Median house value	Median gross rent	% of study area work-force	Unem-ploymen t rate	% minority	Poverty rate, all people	Spanish LEP	
												Pop.	%
South Carolina	—	8.6	167	39.0	—	$148,600	$836	—	7.2	32.7	16.6	90,311	2.0
Berkeley County	—	22.5	198	35.8	—	$164,900	$1,014	—	6.4	32.9	12.8	3,905	2.0
Charleston County	—	14.6	438	37.2	—	$273,100	$1,084	—	5.3	32.2	15.3	6,253	1.7
Dorchester County	—	14.6	273	36.2	—	$177,500	$1,003	—	6.2	32.1	11.8	1,906	1.3
Study Area	—	8.7	2,239	32.2	—	$172,250	$982	—	7.0	48.3	23.7	2,383	3.0
Segment 1	9.2	6.9	853	36.2	8.5	$192,250	$1,121	8.4	6.8	42.2	11.7	109	1.5
Segment 2	26.3	15.4	2642	36.3	24.3	$164,150	$1,040	29.0	6.2	40.1	13.9	392	1.9
Segment 3	27.6	10.3	1,828	32.2	29.1	$111,150	$882	29.9	7.4	58.9	27.3	1,731	8.0
Segment 4	5.9	10.5	1,220	36.4	6.1	$101,150	$838	4.5	11.4	85.4	35.0	18	0.4
Segment 5	31.0	2.6	7,556	28.5	32.0	$450,950	$1,274	28.2	6.8	40.6	31.5	133	0.5

Source: 2017 ACS; 2017 QuickFacts
— indicates not applicable; Pop. = Population

9.5.3.1 Segment 1

Segment 1 physically constitutes 24.1 percent of the study area and is largely composed of portions of Berkeley and Dorchester counties but also includes a small area within Charleston County. Incorporated limits of the town of Summerville, including several subdivisions and neighborhoods, as well as unincorporated portions of Berkeley and Dorchester counties whose residents utilize services in Summerville comprise the majority of Segment 1, as shown on Figure 9.5.1 and Figure 9.5.2. Major community features are concentrated in and around Summerville and include schools, churches, parks, emergency facilities, and retail shops, as shown on Figure 9.5.3. Twelve whole or partial USCB block groups within eight census tracts are encompassed by Segment 1, and the primary USCB data compiled for these are provided for Segment 1 as a whole in Table 9.5.2.

Summerville has grown from an eighteenth-century health resort that attracted seasonal residents to a thriving commercial and retail center supporting many area residents (town of Summerville 2019). A historic district featuring historical homes and churches surrounds the central commercial district in downtown Summerville. Numerous churches, ranging from those dating to the late 1880s to the more contemporary, are located in Summerville. Alston Middle School and Alston-Bailey Elementary School, both located in Segment 1, have served residents of Summerville for many years. The Alston campus was originally the African-American high school in Summerville, but when schools integrated, the campus began serving middle school students of any race (stakeholder discussion, January 30, 2019).

Since the 1980s, several areas surrounding Summerville developed into residential subdivisions with retail offerings that together convey a distinctly suburban character (stakeholder discussion, January 30, 2019). The Oakbrook area, which surrounds the intersection of Dorchester Road and Bacons Bridge Road to the west of Segment 1, was the first area to develop near central Summerville. Oakbrook originally provided housing and shopping for people associated with Joint Base Charleston, southward along Dorchester Road, and this remains a major activity area near Segment 1. In more recent years, growth has accelerated, particularly as people have moved to the area for employment and sought more affordable costs of living. These new developments are currently posing traffic challenges in Segment 1, particularly along roadways that intersect I-26 eastward from central Summerville.

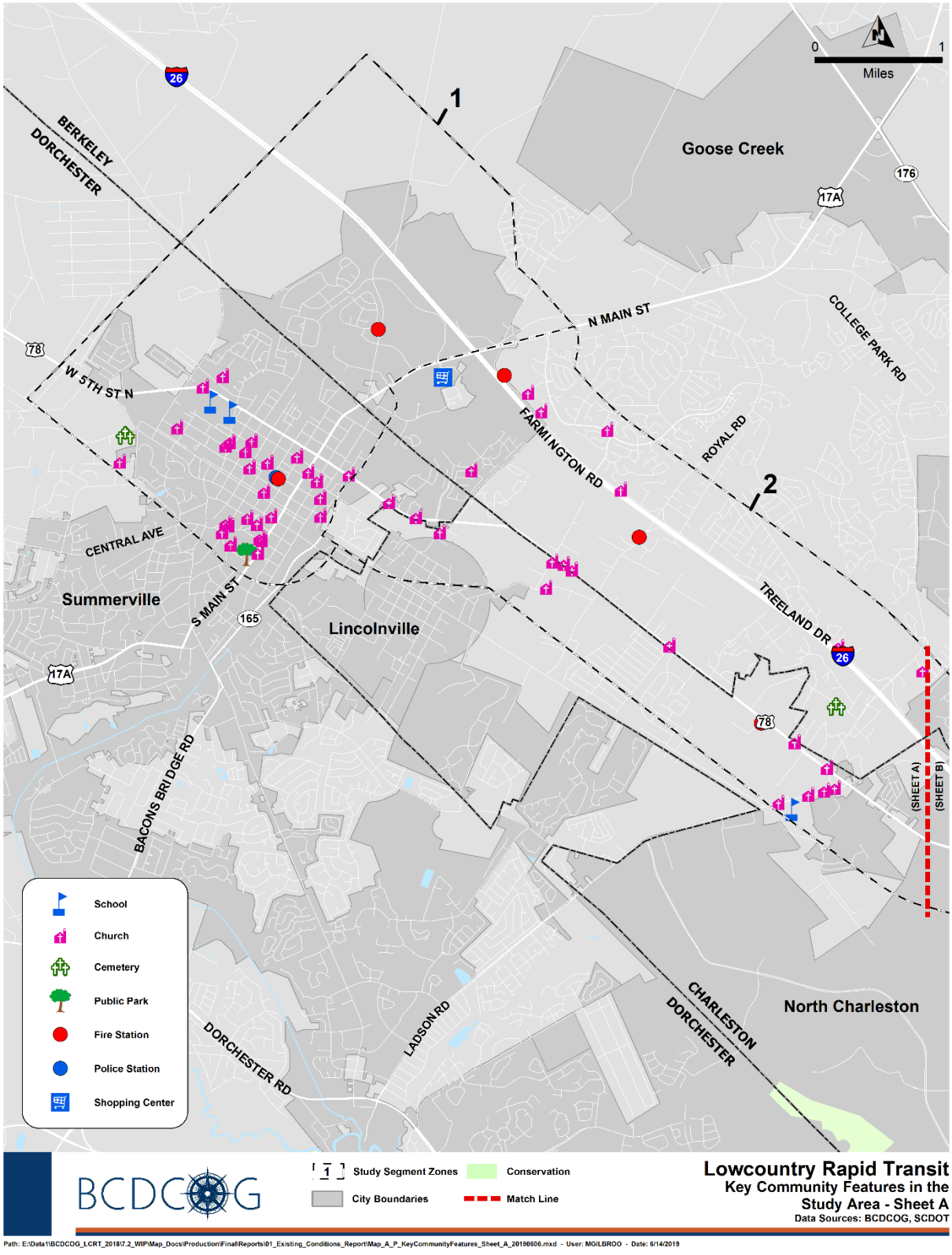

Figure 9.5.3 Key Community Features in the Study Area (Sheet A)

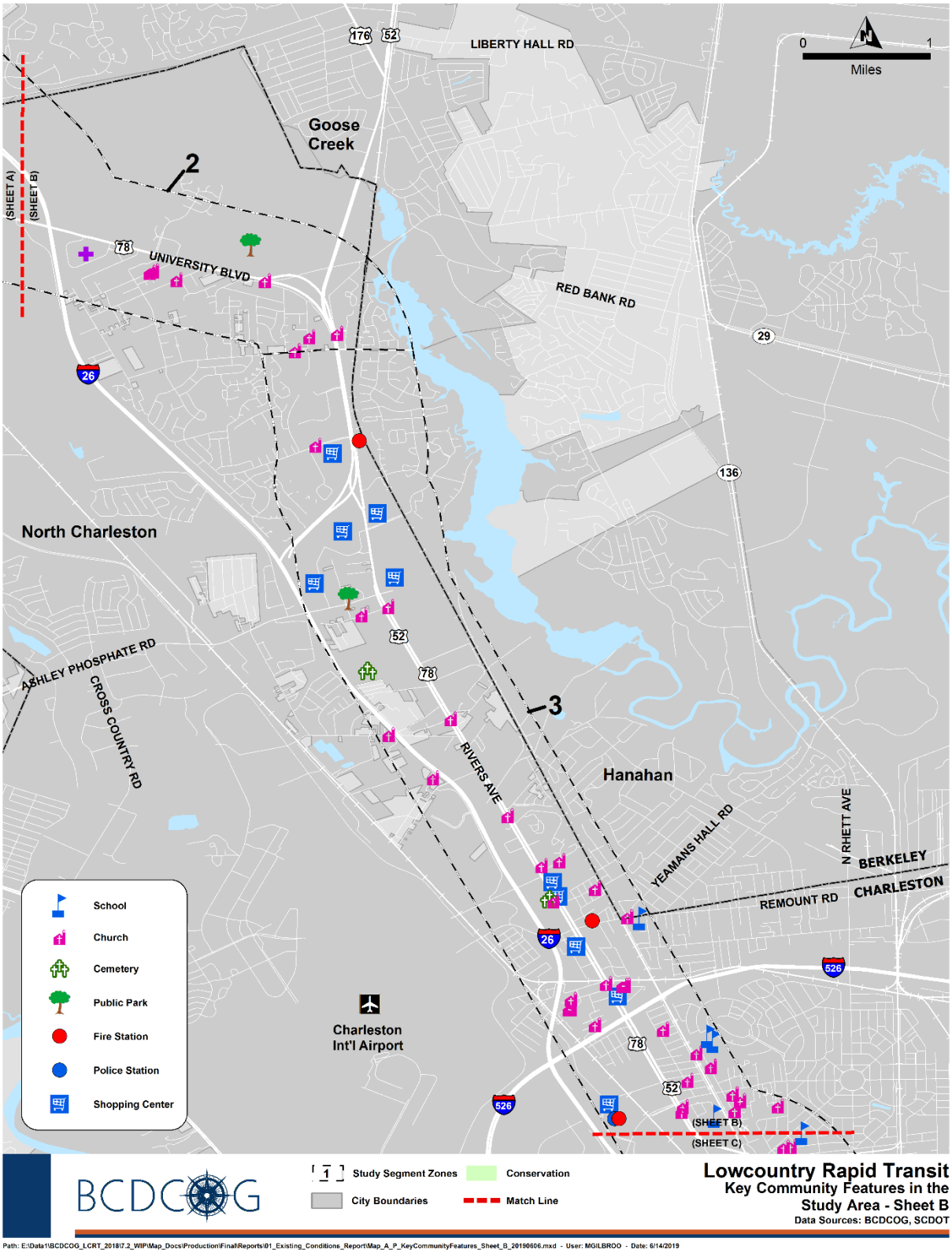

Figure 9.5.4 Key Community Features in the Study Area (Sheet B)

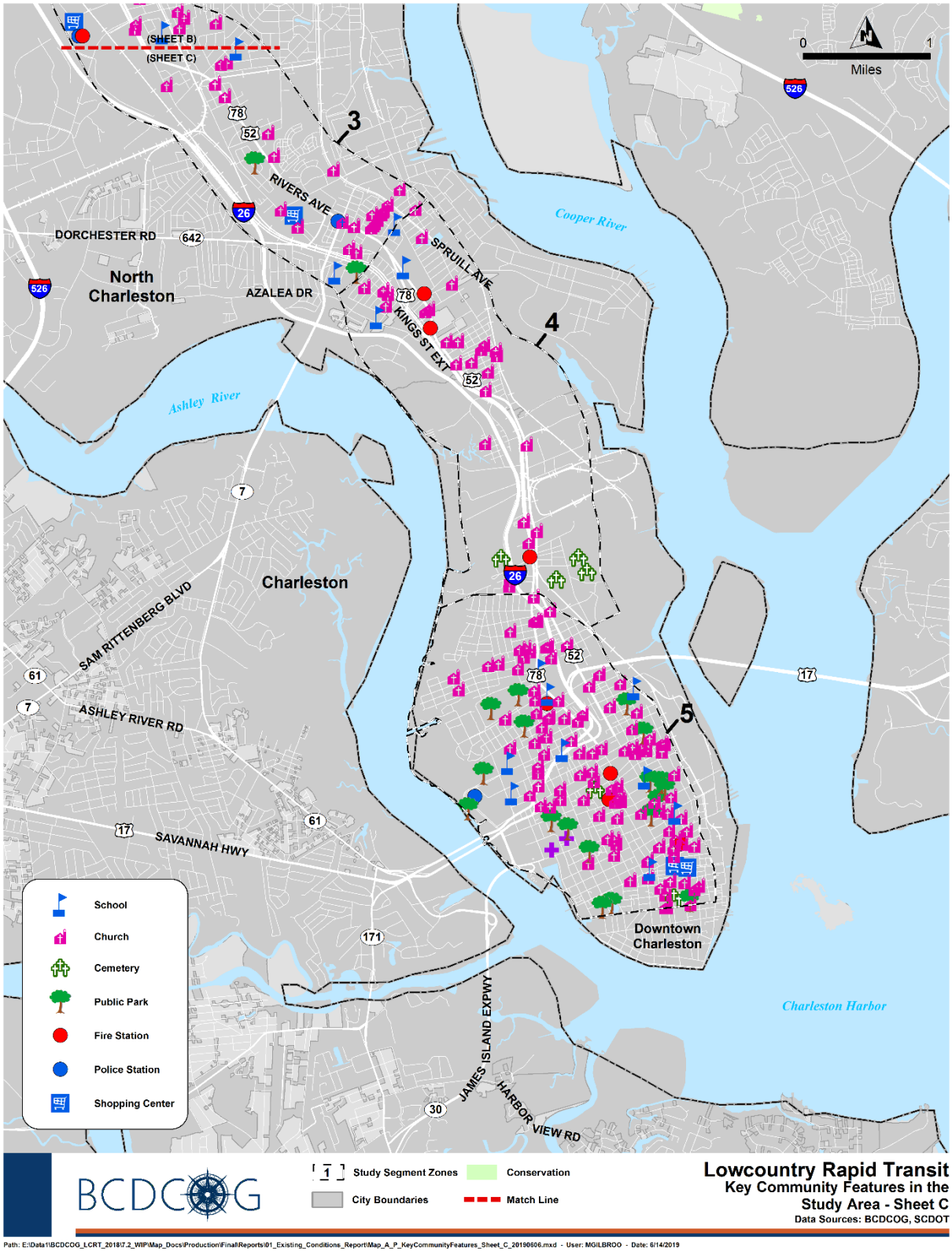

Figure 9.5.5 Key Community Features in the Study Area (Sheet C)

9.5.3.2 Segment 2

Segment 2 physically occupies 22.2 percent of the study area and is composed of Berkeley and Charleston counties and a small portion of Dorchester County. Much of Segment 2 is unincorporated portions of Berkeley and Charleston counties known as Ladson, but portions of the town of Lincolnville and the cities of Goose Greek, Hanahan, and North Charleston, including several subdivisions and neighborhoods, are within Segment 2, as shown on Figure 9.5.1 and Figure 9.5.2. Major community features, including schools, churches, community centers, parks, and emergency facilities, concentrate in the central portion of Segment 2, generally surrounding north-south traversing US 78 and I-26, as shown on Figure 9.5.3 and Figure 9.5.4. Twenty-four whole or partial USCB block groups within 16 census tracts are encompassed by Segment 2, and the major USCB data compiled for these are provided for Segment 2 as a whole in Table 9.5.2.

Approximately one-third of the 1.2-square mile town of Lincolnville is encompassed within Segment 2 (USCB 2019b). Many of its original African-American settlers were members of Ebenezer AME Church (South Carolina Department of Parks, Recreation, and Tourism 2019). In recent years, Lincolnville has experienced sustained, albeit relatively slow population growth, perhaps as a result of its proximity to Summerville, which borders Lincolnville to the north, west, and south. Segment 2 also encompasses a small, extreme western portion of the city of Goose Creek, which serves as an important bedroom community to Charleston.

While Lincolnville and Goose Creek occupy small portions, Segment 2 is primarily a transportation corridor with major highways and I-26 traversing north to south in the central portion of the segment. Churches in Segment 2 range from the more established, such as Philadelphia Baptist Church and Trinity Missionary Baptist Church, to newer churches congregating in commercial facilities, such as Journey Church and Faith Goose Creek. A portion of North Charleston Wannamaker Park is within Segment 2. The park features playgrounds, mutli-use pathways, picnic areas, disc golf, a dog park, and other amenities within its 1,015 acre site north of the convergence of US 78 and US 52 (Charleston County Parks 2019).

Ladson Elementary School, along Ladson Road, west of US 78, serves over 900 students in Segment 2 (Charleston County School District 2019). Trident Medical Center is located at the intersection of I-26 and US 78. The center is a 313-bed facility with a 24-hour emergency room and a Level II Trauma Center (Trident Health System 2019). CSU, across US 78 from Trident Medical Center, was established in 1965 and currently offers 18 undergraduate degrees and one doctoral degree to its 3,600 students (CSU 2019).

9.5.3.3 Segment 3

Segment 3 physically constitutes 33.8 percent of the study area and is composed of portions of Charleston County and a small portion of Berkeley County. The city of North Charleston comprises the majority of Segment 3, and extreme western portions of the city of Hanahan are also within Segment 3, as shown on Figure 9.5.1. Several named subdivisions and neighborhoods are encompassed by Segment 3, as shown on Figure 9.5.2. Major community features concentrate in the central portion of Segment 3, particularly surrounding US 78/US 52 (Rivers Avenue), as I-26 skirts the western edge of Segment 3. The features include schools,

churches, community centers, parks, and emergency facilities, as shown on Figure 9.5.4 and Figure 9.5.5. Forty whole or partial USCB block groups within 20 census tracts are encompassed by Segment 3, and pertinent USCB data compiled for these are provided for Segment 3 as a whole in Table 9.5.2.

In the nineteenth and twentieth centuries, Segment 3 and North Charleston, generally, were characterized by major industry. Phosphate mining and lumbering were actively pursued, and the U.S. Navy operated major shipbuilding and repair facilities on the Cooper River (City of North Charleston 2019). Thriving working class neighborhoods developed in response, but the 1996 closure of the Charleston Naval Yard led many people to relocate out of Segment 3. Economic opportunities in Segment 3 suffered as a result, and poverty rates generally rose for area residents (EPA and LAMC 2018).

Today, Segment 3 is characterized by commercial areas along Rivers Avenue, where many shopping centers, such as Northwoods Mall, are set off the roadway and framed by large parking areas. Parks and community centers, along with numerous churches, are primarily located within established residential areas. The churches vary from long-established churches, such as St. Peters AME Church and Mt. Moriah Baptist Church, to more recent ones, such as Kingdom Hall-Jehovah's Witness. Educational facilities within Segment 3 include Trident Technical College, a two-year college offering over 150 programs to its 15,000 students (Trident Technical College 2019). Numerous middle schools and elementary schools are also located within Segment 3, as well as more non-traditional learning opportunities, such as offered at Charleston School of the Arts and Academic Magnet High School.

In recent years, growth in Segment 3 has accelerated, and many newer housing developments have been built, such as Mixson, Hope's Point, Oak Terrace Preserve, and Horizon Village (AECOM 2010). Mixson is a mixed-use, walkable neighborhood being built in Park Circle. Hope's Point is located in a private borough near the Liberty Hill neighborhood. Oak Terrace Preserve, located at the northern boundary of Liberty Hill and Howard Heights, is a sustainable redevelopment project that began selling in 2006. Horizon Village is a Hope VI redevelopment located north of the Chicora/Cherokee neighborhood and serving households with average incomes. The Manor and Barony Place Apartments are newer multifamily options in North Charleston.

9.5.3.4 Segment 4

Segment 4 occupies 10.7 percent of the study area and is completely within Charleston County. The city of Charleston comprises the majority of Segment 4, and extreme southern North Charleston composes the northern portion of the segment, as shown on Figure 9.5.1. Many subdivisions and neighborhoods are encompassed by Segment 4, as shown on Figure 9.5.2. Major community features include schools, churches, cemeteries, community centers, and emergency facilities, as shown on Figure 9.5.5. Twelve whole or partial USCB block groups within five census tracts are encompassed by Segment 4, and the major USCB data compiled for these are provided for Segment 4 as a whole in Table 9.5.2.

Similar to Segment 3, Segment 4 initially developed through the influence of industry, especially associated with the Charleston Naval Yard, and many working class neighborhoods were

formed in response. As a result of these early development trends, Segment 4 is presently characterized by well-established residential, commercial, and industrial land uses. Many long-term residential neighborhoods, such as Five Mile and Union Heights, are located within this segment, while new development has been quite limited in this segment. The churches in Segment 4 are primarily community-oriented churches located within established neighborhoods, and often several churches are located in close proximity to each other. Segment 4 includes Magnolia and St. Lawrence cemeteries, both founded in the 1800s (Magnolia Cemetery 2019). Morris Street Baptist Church, an 1865-founded African-American church located in Segment 5, maintains a cemetery near the Ashley River in Segment 4 (Morris Street Baptist Church 2019). Educational facilities in Segment 4 include Chicora Elementary School and Military Magnet Academy, and two community centers serve area residents in Segment 4.

9.5.3.5 Segment 5

Segment 5 physically constitutes 3.5 percent of the study area and is completely composed of portions of Charleston County and the city of Charleston, as shown on Figure 9.5.1. Several named subdivisions and neighborhoods are encompassed by Segment 5, as shown on Figure 9.5.2. Primarily within downtown Charleston, Segment 5 is characterized by many historical buildings, schools, parks, emergency facilities, and hospitals, as shown on Figure 9.5.5. Thirty-one whole or partial USCB block groups within 16 census tracts are encompassed by Segment 5, and the relevant USCB data compiled for these are provided for Segment 5 as a whole in Table 9.5.2.

Founded and settled by English colonists in 1670, Charleston developed into a wealthy city supported by its busy seaport and many plantations by the mid-eighteenth century (City of Charleston 2019). The city restructured its economy through trade and industry after the Civil War, and in the twentieth century, the Charleston Naval Base and the region's medical and tourist industry developed into major aspects of the local economy. Charleston remains one of the top tourist destinations in the U.S. today, as evidenced by its numerous restaurants, coffee shops, bars, historic hotels, inns, and retail stores. Many historical homes and other buildings are also extant in downtown Charleston, and together these features convey a unique sense of place. Many of the churches are historical, such as the Cathedral of St. John the Baptist, Cathedral of St. Luke and St. Paul, Emmanuel AME Church, French Huguenot Church, Grace Episcopal Church, and Morris Street Baptist Church. Other long-established churches are located throughout the downtown area. Educational institutions include Burke High School and Memminger Elementary School. College of Charleston, Medical University, Trident Technical College's downtown Palmer Campus, and The Citadel Military College are post-secondary schools in Segment 5.

Charleston has limited space for additional development, and any development that does occur in the historic downtown area must be approved by the Board of Architectural Review (BAR) (City of Charleston 2019). Within the historic districts, the BAR reviews all new construction, alterations, and renovations visible from the public right-of-way. The BAR also reviews all demolitions of historical buildings (i.e., 50 years of age or older) on any structures south of Mt. Pleasant Street, and any demolitions, regardless of age, within the Old and Historic District.

Downtown Charleston is interspersed with parks such as Colonial Park, Brittlebank Park, Hampton Park, and Stoney Field that provide many recreational opportunities. Activity centers include the Old City Market, Charleston Place, and the Charleston Visitor Center. Retail shops and restaurants are located along King Street and throughout the downtown area.

9.5.4 Study Area Environmental Justice and Limited English Proficiency

Based on the 2017 ACS, EJ populations were generally prominent in the study area and associated region (see Table 9.5.2). The city of Charleston, town of Lincolnville, and city of North Charleston all qualified as low-income populations based on the 2017 ACS, and Lincolnville and North Charleston additionally qualified as minority populations. Berkeley and Charleston counties in their entireties also qualified as low-income. However, in assessing EJ in the CCR study area, study area segments and USCB geographies were considered, rather than municipalities and counties, due to representing more detailed patterns particular to the study area, as presented in Figure 9.5.6 and Figure 9.5.7. This section summarizes these findings. Appendix D provides more detail, including the individual USCB geographies with qualifying EJ and LEP populations.

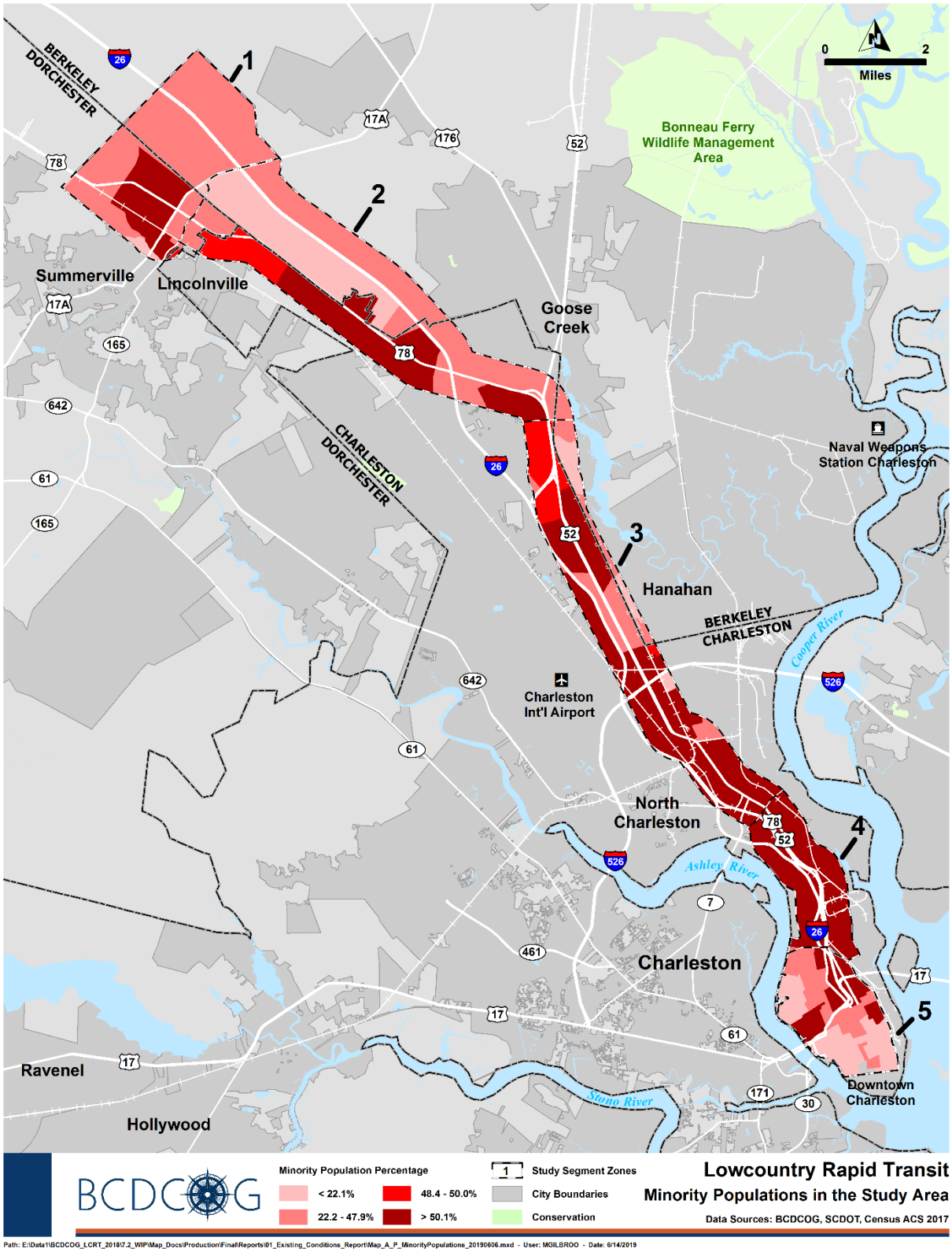

Figure 9.5.6 Minority Populations in the Study Area

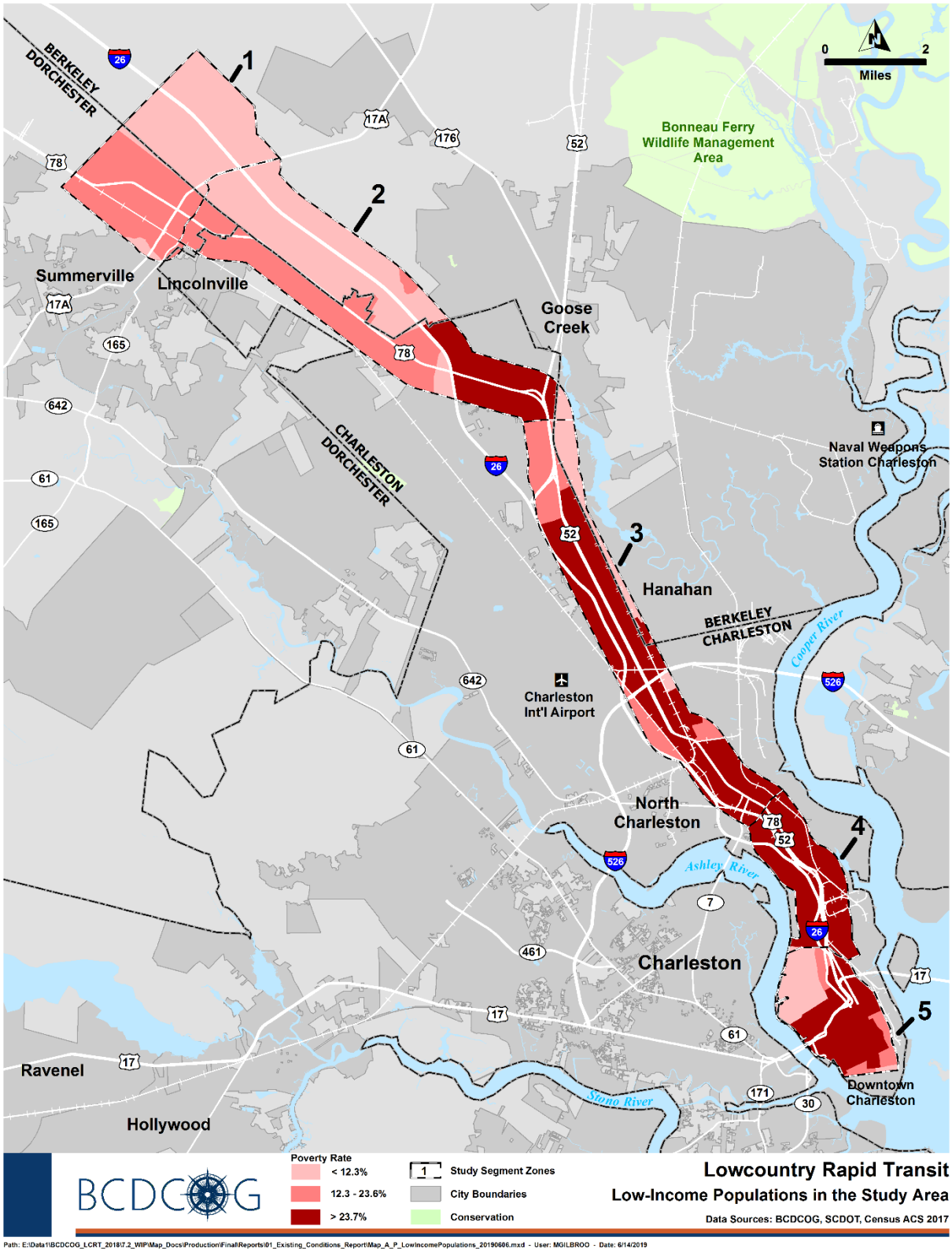

Figure 9.5.7 Low-Income Populations in the Study Area

9.5.4.1 Minority Populations

Two segments (Segment 3 and 4) and 39 individual USCB block groups within the study area have minority percentages that exceeded the 50-percent threshold, based on the 2017 ACS. Similar to the region, the prominent minority race or ethnicity across the study area was Black or African American, and Hispanic populations ranked as the second most numerous. Notably, Segments 3 and 4 qualified as minority populations, and these segments represented nearly 34 percent of the study area population.

9.5.4.2 Low-Income Populations

While no census tracts in the CCR study area had per capita income rates at or lower than the 2017 U.S. poverty threshold of $12,752, three segments (Segments 3, 4, and 5) and the 37 individual USCB census tracts had poverty rates that were higher than the official U.S. poverty rate of 12.3 percent, based on the 2017 ACS. Two of the segments (Segments 3 and 4) and 18 of the census tracts may have higher vulnerability, as these areas had low-income populations that exceeded the study area poverty rate of 23.7 percent and per capita income rates lower than the study area average of $25,824. Notably, Segments 3, 4, and 5 qualified as low-income populations, and these segments represented nearly 65 percent of the study area population.

9.5.4.3 Limited English Proficiency Populations

Based on 2017 ACS data, the CCR study area is home to a Spanish-speaking LEP population that met the DOJ LEP threshold, and the data indicate that this population is concentrated in Segment 3. These findings direct that translation services for all publicly offered project-related materials should be provided in Spanish to better inform LEP populations of the project.

9.5.4.4 Known Environmental Justice Neighborhoods

In 2005, seven African-American neighborhoods in Segments 3 and 4 organized the Lowcountry Alliance for Model Communities (LAMC) as a grassroots comprehensive planning effort (AECOM 2010). The neighborhoods consist of Accabee, Chicora/Cherokee (also called Charleston Heights), Five Mile, Howard Heights, Liberty Hill, Union Heights, and Windsor. As part of the environmental review process for a proposed port terminal expansion, the U.S. Army Corps of Engineers (USACE) determined that the populations of these neighborhoods met EJ criteria, and LAMC representatives demonstrated that each neighborhood has borne a disproportionate share of negative environmental effects in the local area.

The locations and associated USCB block groups of Accabee, Chicora/Cherokee, Five Mile, Howard Heights, Liberty Hill, Union Heights, and Windsor are provided in Table 9.5.5. Rosemont, located in Segment 4 and also included in Table 9.5.5, is another African-American community of concern for LAMC. While this neighborhood was not included in the 2010 study by AECOM discussed below, impacts to Rosemont from surrounding development and road construction are similar to that described for the others (HDR observations, February 1, 2019). Collectively, these eight neighborhoods are referred to herein as the LAMC neighborhoods.

Table 9.5.3 Known Environmental Justice Neighborhoods in the Study Area

Neighborhood	Study area segment	USCB block group	Location
Accabee	3, 4	CT 44 BG 2	Bounded by Accabee Road, CSX/NS railroad tracks on the north and east, Misroon Street on the south, and St. Simmons Drive on the west, adjacent to and southwest of Chicora/Cherokee
Chicora/Cherokee	3, 4	CT 43 BG 1 CT 43 BG 2 CT 43 BG 3 CT 43 BG 4 CT 55 BG 1 CT 55 BG 2	Bounded by Reynolds and Spruill avenues on the north, Avenue D and Bainbridge Avenue on the east, Burton Lane on the south, and CSX/NS railroad tracks on the west, adjacent to and northeast of Accabee
Five Mile	4	CT 43 BG 3 CT 43 BG 4	Bounded by Burton Lane on the north, Spruill Avenue on the east, Hampton Avenue on the south, and Meeting Street on the west, adjacent to the south of Chicora/Cherokee
Howard Heights	4	CT 43 BG 3 CT 54 BG 1	Bounded by Shipyard Creek on the north, CSX railroad tracks on the east, and Spruill Avenue on the west, adjacent to and west of Windsor
Liberty Hill	3	CT 33 BG 4	Located along East Montague Avenue between Mixson and Gaynor avenues and generally does not extend southward of Rowan Drive or northward of Spell Lane
Rosemont	4	CT 44 BG 1 CT 44 BG 2	Bounded by NS railyard to the north, King Street Extension on the east, Hagood Street on the south, and the Ashley River on the west, isolated from other residential areas
Union Heights	4	CT 54 BG 1	Bounded by Arbutus Avenue on the north, Spruill Avenue on the east, the convergence of Spruill Avenue and Meeting Street on the south, Meeting Street on the west, adjacent to and south of Windsor
Windsor	4	CT 43 BG 4 CT 54 BG 1	Bounded by Hampton Avenue on the north, Spruill Avenue on the east, Arbutus Avenue on the south, and Meeting Street on the west, adjacent to and north of Union Heights

The Union Heights area was initially settled after the Civil War by people previously enslaved on nearby plantations (EPA and LAMC 2018). In the 1940s and 1950s, many residential areas were being constructed or newly expanded upon around the Charleston Naval Complex, including Chicora/Cherokee, Five Mile, Howard Heights, Rosemont, Union Heights, and Windsor (AECOM 2010; USGS 2019). Union Heights and nearby areas developed into thriving working class neighborhoods with many commercial offerings for residents by the mid-twentieth century (EPA and LAMC 2018). However, urban renewal was underway by the 1970s, and new roadways began to impact LAMC neighborhoods. These changes caused people to fall into poverty and the buildings and infrastructure, into decline. When the naval operations ceased in 1996, many middle class families relocated to more northern portions of North Charleston, and investments and associated economic opportunities in the LAMC neighborhoods suffered.

Many individual properties in LAMC neighborhoods are considered heirs' property, meaning ownership is associated with a common relative from whom existing owners inherited the

property (HDR stakeholder discussion, January 29, 2019). The residents of these neighborhoods also identify with regional Gullah/Geechee traditions, which emerged from cultural practices of enslaved Africans on Antebellum-period plantations in the broad region (NPS 2005). Many Gullah/Geechee people in these neighborhoods maintain subsistence fishing practices on the Ashley and Cooper rivers.

In addition to low-income rates and high rates of foreclosure, the LAMC neighborhoods face many challenges related to barriers to connectivity and incompatible industrial land uses surrounding these neighborhoods (AECOM 2010). Railroad tracks traverse through LAMC neighborhoods and hinder access to surrounding areas while affecting noise levels and air quality. Portions of I-26 bisect the neighborhoods and affect character and aesthetics. Industrial development has also occurred in LAMC neighborhoods. While some operations are defunct and left behind brownfield sites, other businesses continue to operate in proximity to these residential areas.

Altogether, the various impacts to the LAMC neighborhoods limit economic opportunities, and the lack of connectivity between residential areas hinders familial and community relations (AECOM 2010; HDR stakeholder discussion, January 29, 2019, and observations, February 1, 2019). The existing impacts also suggest that the neighborhoods may be more vulnerable to future impacts and, in particular, the compounding nature of cumulative changes to the area.

9.5.5 Next Steps

As the community characterization study proceeds, HDR may refine the CCR study area to consist of the natural community divisions that have developed over time through shared cultural histories, ethnicities, economic strategies, and central concerns or interests of community participants. Entire settlements, such as whole ethnic communities or neighborhoods, will be delineated wherever possible to account for changes in community cohesion that may result from the project.

Following CIA Guidance, HDR will further seek to characterize transient populations in the CCR study area and other groups of people who share common characteristics or interests that nurture a sense of unity among the group that are not spatial in nature. Such interests could include religion, culture and ethnicity, class status, shared use of bus or commuter routes, or harvest and consumption of natural resources for personal and family sustenance. HDR will also enhance its consideration of known EJ neighborhoods and may identify additional EJ populations and neighborhoods as the study proceeds. Direct observations, conversations with people who reside in or utilize the study area, and coordination with relevant organizations serving the study area and/or associated populations will help inform CCR refinement. HDR will also make appropriate re-evaluations of the CCR study area and associated human communities based on changes to the set of alternatives being considered.

The CCR will serve as a baseline for the NEPA process and will be used to develop the CIA, an evaluation of effects of the project on communities and their qualities of life. Like the CCR, the CIA will be developed in part through direct observations, conversations with study area residents and stakeholders, and coordination with relevant organizations serving the study area and/or associated populations. The consideration and documentation of environmental and

socioeconomic effects is a critical part of NEPA, and findings from the CCR and CIA will be incorporated into the NEPA document developed for the project.

9.6 Land Acquisitions and Relocations

Federal and state laws require that property owners be paid fair market value for their land and improvements, and that they be assisted in finding replacement business sites or dwellings. Relocations result from right-of-way acquisitions that require the use of a property occupied by a residence or business. Partial acquisitions occur when only a portion of an existing land use is required and as such may not result in relocation. Full acquisitions occur when a complete parcel is required and may result in either a residential or business relocation. The study area for land acquisition and relocations will be the estimated limits of construction for the proposed alignment and the associated stations and facilities.

Under the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970 (Uniform Act), as amended, all federal agencies are required to meet certain standards for the fair and equitable treatment of persons displaced by federally-supported actions. Relocation assistance will follow the guidelines set forth in Title 49, Part 24 of the Code of Federal Regulations (49 CFR Part 24). BCDCOG intends to follow the intent of the Uniform Act regardless of project funding sources.

9.7 Cultural Resources

This section discusses cultural resources (historic architectural and archaeological resources) within the study area. Cultural resources are properties and places that illustrate aspects of prehistory or history or have long-standing cultural associations with established communities and/or social groups. Cultural resources can include archaeological sites, structures, buildings, and groups of any of these resources, among others.

Historic properties are cultural resources listed or eligible for listing in the National Register of Historic Places (NRHP). To be eligible for listing in the NRHP, cultural resources must typically be at least 50 years of age, possess historic integrity, and embody at least one of four criteria, per 36 CFR § 60:

A. Association with events that have made a significant contribution to the broad patterns of our history.
B. Association with the lives of persons significant in our past.
C. Embodiment of the distinctive characteristics of a type, period, or method of construction; representative of the work of a master; possessing high artistic values; or representative of a significant and distinguishable entity whose components may lack individual distinction.
D. Cultural resources that have yielded, or may be likely to yield, information important to prehistory or history.

With the expectation of federal funding or federal permitting decisions, the proposed project is being evaluated in accordance with the National Historic Preservation Act of 1966 (NHPA), as amended (54 USC § 300101 et seq.). Additionally, Section 106 of the NHPA and 36 CFR Part 800 require that federal agencies (FTA) consider the impact of federal undertakings on historic

properties. For the purposes of this document, BCDCOG conducted background research and a brief field reconnaissance of the study area. The findings of this initial study are documented in the cultural resources technical report in Appendix F.

9.7.1 Background Research and Analysis

Archaeologists and GIS specialists gathered information on the history and development of the study area from a variety of sources. The locations of known historic properties and archaeological sites were retrieved from ArchSite, the online database of cultural resources information maintained by the South Carolina Department of Archives and History (SCDAH) and the University of South Carolina's South Carolina Institute of Archaeology and Anthropology (SCIAA). Reports of previous cultural resources investigations were also reviewed. These were identified through ArchSite or through the study consultant's library. Investigators reviewed historic maps, plats, and aerial photographs of the study area on file at the city of Charleston's GIS Department, the Charleston County Public Library's South Carolina Room, the South Carolina Historical Society, the SCDAH, and other online repositories in the state. Investigators attempted to gather more detailed information concerning past land use by reviewing indices of city businesses and other primary resources, and also reviewed secondary sources concerning the historic development of Charleston.

Historic maps, plats, and aerial photographs were georectified using GIS software to place these representations of past land use and the built environment on photographs or maps of the modern landscape. In this fashion, the locations of former buildings, structures, and other facilities can be projected within the study area. The locations of known historic properties and archaeological sites were assembled in a GIS database and projected over the study area. The locations of cemeteries, historic churches (those present prior to 1900), and historic public facilities like orphanages, asylums, and hospitals also were noted and placed in the GIS database. Cemeteries often are not historic properties (they require special consideration for NRHP eligibility) but are protected under South Carolina statutes. Church yards and the yards of public facilities also are likely to contain burials. The locations of these kinds of facilities and the known historic properties and archaeological sites were then inspected to provide information about potential effects associated within the proposed study area.

9.7.2 Historical Architectural Resources

Historic architectural resources generally include historic buildings, structures, objects, or districts over 50 years in age. No architectural survey investigations were completed as part of the architectural evaluation. Instead, a background literature review and a brief vehicular architectural reconnaissance investigation were conducted within the study area. The findings of this initial study are documented in the cultural resources technical report in Appendix F.

In the study area, 155 architectural resources are eligible for, listed on, or unevaluated for the NRHP. For the purposes of project planning, resources that are unevaluated for the NRHP will be definitively evaluated for the NRHP if they are within the Area of Potential Effect (APE) of the eventual preferred alternative. These include 80 domestic (e.g., house, plantation, tenement) properties, 17 religious (e.g., church, funeral home) properties, 19 institutional (e.g., hospital, school) properties, 17 commercial/industrial (e.g., factory, office building) properties, 17 military (e.g., barracks, fortification) properties, and five public (e.g., park, tavern) properties. These 155

architectural resources should be avoided when selecting the preferred alignment. If they cannot be avoided, appropriate mitigation strategies should be developed. Table 9.7.1 provides a summary of each historic architectural resource. Figures 9.7.1 through 9.7.4 present the locations of all historic resources (both architectural and archaeological) within the study area.

The majority of the historic architectural resources are located in the southern portion of the study area, in Charleston (Segment 5). Only one of the historic architectural resources is located in Berkeley County, and three are located in Dorchester County.

Table 9.7.1 Historic Architectural Resources

County	Segment	Resource Number	Name	NRHP Status
Berkeley	2	0281	Otranto Plantation	Listed
		276 0002	Otranto Plantation House	Listed
Charleston	3	1511.00-04	John C. Calhoun Homes and Office	Eligible (demolished)
		1519	George Legare Homes Rebuilt	Eligible
		1526	Ben Tillman School	Eligible
		1527	Ben Tillman Homes	Eligible
		4251	Morningside Elementary - 1999 Singley Lane	Eligible
		4254	Six Mile Elementary - 3008-3012 Chicora Ave.	Eligible
		6384	Atlantic Coast Line Charleston Station - 4565 Gaynor Ave.	Eligible
		7806	Bethune Elementary School	Eligible
		M-17	USMC Barracks CNC	Eligible
	3 & 4	4306	1985 Joppa Street	Eligible
	4	1189	Cold War PE	Unevaluated
		1663	GARCO Employee Housing - 3008-3012 Chicora Ave.	Eligible
		1664	GARCO Employee Housing	Eligible
		1665		Eligible
		4286	2000 Meeting Street	Eligible
		4309	2028 Irving Avenue	Eligible
			Standard Oil Company Buildings - 1600 Meeting Street (3)	Eligible
	4 & 5	1842	Five Mile Viaduct	Eligible
	5	0001	Aiken, Gov. William, House - 48 Elizabeth St.	Listed

County	Segment	Resource Number	Name	NRHP Status
		0005	James Nicholson House - 172 Rutledge Ave.	Listed
		0013	Thomas Bennett House - 69 Barre St.	Listed
		0014	Bethel Methodist Church -57 Pitt St.	Listed
		0015	William Blalock House - 18 Bull St.	Landmark
		0016	Florence Crittenton Home - 19 St. Margaret St.	Listed
		0028	Central Baptist Church - 26 Radcliffe St.	Listed
		0032	Cigar Factory	Listed
		0033	Circular Congregational Church and Parish House - 150 Meeting St.	Landmark
		0034	Citizens and Southern National Bank of South Carolina - 50 Broad St.	Listed
		0037	College of Charleston Bldg.	Landmark
		0038	Dock Street Theatre - 135 Church St.	Listed
		0045	Farmers' and Exchange Bank - 14 E. Bay St.	Landmark
		0049	Fireproof Building - 100 Meeting St.	Landmark
		0063	Hibernian Hall - 105 Meeting St.	Landmark
		0068	Kahal Kadosh Beth Elohim Synagogue - 90 Hasell St.	Landmark
		0073	Lowndes Grove	Listed
		0074	Jonathan Lucas House - 286 Calhoun St.	Listed
		0076	McCrady's Tavern and Long Room - 153 E. Bay St.	Listed
		0080*	Joseph Manigault House - 350 Meeting St.	Landmark
		0081	Market Hall and Sheds - 188 Meeting St	Landmark
		0089	Old Bethel Methodist Church - 222 Calhoun St.	Listed
		0090*	SC State Arsenal (Citadel) - 2 Tobacco St. (Marion Sq.)	Listed
		0093	Old Marine Hospital - 20 Franklin St.	Landmark
		0094	Old Slave Mart - 6 Chalmers St.	Listed
		0099*	Powder Magazine - 79 Cumberland St.	Landmark
		0100	Presqui'ile - 2 Amherst St.	Listed

County	Segment	Resource Number	Name	NRHP Status
		0102	Robert Barnwell Rhett House - 6 Thomas St.	Landmark
		0103	William Robb House - 12 Bee St.	Listed
		0104	Florence Crittenton Home - 19 St. Margaret St.	Listed
		0109	Rutledge, Gov. John, House - 116 Broad St.	Landmark
		0112	St. Mary's Roman Catholic Church - 93 Hasell St.	Listed
		0114	St. Philip's Episcopal Church - 146 Church St.	Landmark
		0122	Josiah Smith Tennent House - 729 E. Bay St	Listed
		0124	South Carolina National Bank of Charleston - 16 Broad St.	Listed
		0133	Unitarian Church - 6 Archdale St.	Landmark
		0134	Porter Military Academy Bldg. - 175--181 Ashley Ave.	Listed
		0138	Denmark Vesey House - 56 Bull St.	Landmark
		1509	c. 1846 Residence - 6 Ambrose Alley	Contributes to Listed District
		2063	308 St. Philips Street	Contributes to Eligible District
		2064	306 St. Philips Street	Contributes to Eligible District
		2065	Catherine Sigwald House - 74 Fishburne Street	Eligible
		2066	72 Fishburne Street	Contributes to Eligible District
		2067	68 Fishburne Street	Contributes to Eligible District
		2103	Huguenot Church - 136 Church St.	Landmark
		2109	James Sparrow House - 65 Cannon St.	Listed
		2249	541 Rutledge Ave.	Eligible
		2562	Hampton Park	Eligible
		2568.00	540 Rutledge Ave. (house)	Eligible
		2568.01	540 Rutledge Ave. (outbuilding)	Eligible
		2624	90 Fishburne Street	Eligible

County	Segment	Resource Number	Name	NRHP Status
		2704	Citadel Summerall Chapel - Jenkins Ave.	Eligible
		2715	Greek Orthodox Church of the Holy Trinity - 30 Race Street	Eligible
		2810	Colin McKissick Grant Home	Eligible
		2826	Citadel Howie Carillon - Jenkins Ave.	Eligible
		2888	Charleston Fire Department Engine No. 8 Building	Eligible
		2904	St. Barnabas Evangelical Lutheran Church - 45 Moultrie St.	Eligible
		4209	Greek Orthodox Church of the Holy Trinity - 30 Race Street	Listed
		4251	Morningside Elementary - 1999 Singley Lane	Eligible
		4254	Six Mile Elementary - 3008-3012 Chicora Ave.	Eligible
		4255	Chicora Graded School	Eligible
		4256	Columbus Street Elementary - 63 Columbus St.	Eligible
		4257	East Bay Elementary - 805 Morrison Dr.	Eligible
		4258	Courtenay Elementary - 382 Meeting St.	Eligible
		4259	Buist Elementary - 103 Calhoun St.	Potentially eligible
		4260	Memminger Elementary - 20 Beaufain St.	Eligible (demolished)
		4286	2000 Meeting Street	Eligible
		4309	2028 Irving Avenue	Eligible
		5646	154 Cannon Street	Contributes to eligible district
		5648	150 Cannon Street	Contributes to eligible district
		5657	152 Cannon Street	Contributes to eligible district
		5858	Halsey Blvd.	Eligible
		5859	c. 1920 Residence - 66 Barre St.	Eligible
		5859	c. 1920 Residence - 66 Barre St.	Eligible
		6384	Atlantic Coast Line Charleston Station - 4565 Gaynor Ave.	Eligible

County	Segment	Resource Number	Name	NRHP Status
		6453	John McAlister Inc. Funeral Home - 150 Wentworth Street	Eligible
		6453.01	John McAlister Inc. Funeral Home, outbuilding - 150 Wentworth Street	Contributes to Listed District
			10 Dingle Street	Contributes to Eligible District
			107 America Street	Contributes to Eligible District
			135 Ashley Avenue	Contributes to Listed District
			16 Orrs Court	Unevaluated
			18th C. Commecial/Residential Bldg. - 308 King Street	Contributes to Listed District
			19 Dingle Street	Contributes to Eligible District
			19th C. Residence (a) - 89 1/2 Wentworth Street	Contributes to Listed District
			19th C. Residence (b) - 15 Coming Street	Contributes to Listed District
			38 Bull Street	Contributes to Listed District
			47 Chapel Street	Contributes to Listed District
			561 Rutledge Avenue	Contributes to Eligible District
			58 1/2 Broad Street	Contributes to Listed District
			6 John Street	Contributes to Eligible District
			65 Hanover Street	Contributes to Eligible District
			66 South Street	Contributes to Eligible District
			70 Logan Street	Contributes to Listed District
			76 Drake Street	Contributes to Eligible District
			81 Columbus Street	Contributes to Eligible District

County	Segment	Resource Number	Name	NRHP Status
			9 Henrietta Street	Contributes to Listed District
			99 Alexander Street	Contributes to Listed District
			c. 1920s Commercial Bldg. - 210 Rutledge Avenue	Contributes to Eligible District
			Carlton Arms - 61 Vanderhorst Street	Eligible
			Charleston City Railway Car House	Listed
			Contributing Element of CHS Naval Hospital District (10)	Contributing to NRHP Listed District
			Doughty House - 71 Anson Street	Eligible
			Faber House; Hametic Hotel - 635 East Bay Street	Eligible
			Florence A. Clyde House - 191 Smith Street	Contributes to Eligible District
			Glover-Sottile House - 81 Rutledge Street	Eligible
			Isaac Jenkins Mikell House - 94 Rutledge Avenue	Listed
			Jackson Street Freedman's Cottages	Listed
			McMakin-Bicaise House - 109 Rutledge Avenue	Contributes to Listed District
			Mid 19th C. Residence - 185 Coming Street	Contributes to Eligible District
			Mid-19th C. Residence - 180 Broad Street	Contributes to Listed District
			Mishaw Rifle Guard's Hall - 262 Ashley Avenue	Eligible
			North Tracy Street	Eligible
			People's Office Building - 18-22 Broad Street	Contributes to Listed District
			Residential Bldgs - 18 Duncan Street	Contributes to Listed District
			Rutledge Avenue Baptist Church - 554 Rutledge Avenue	Eligible
			Sixth Naval District Training Aids Library	Listed
			Thompson-Bonneau House - 10 Percy Street	Eligible

County	Segment	Resource Number	Name	NRHP Status
			Zion-Olivet Presbyterian Church - 134 Cannon Street	Eligible
Dorchester	1	1278	Summerville National Guard Armory - 301 N. Hickory Street	Eligible
		1291	Kapstone Lumber Mill Administration Building	Eligible
		496 0561	Dorchester County Hospital - 500 North Main Street	Eligible

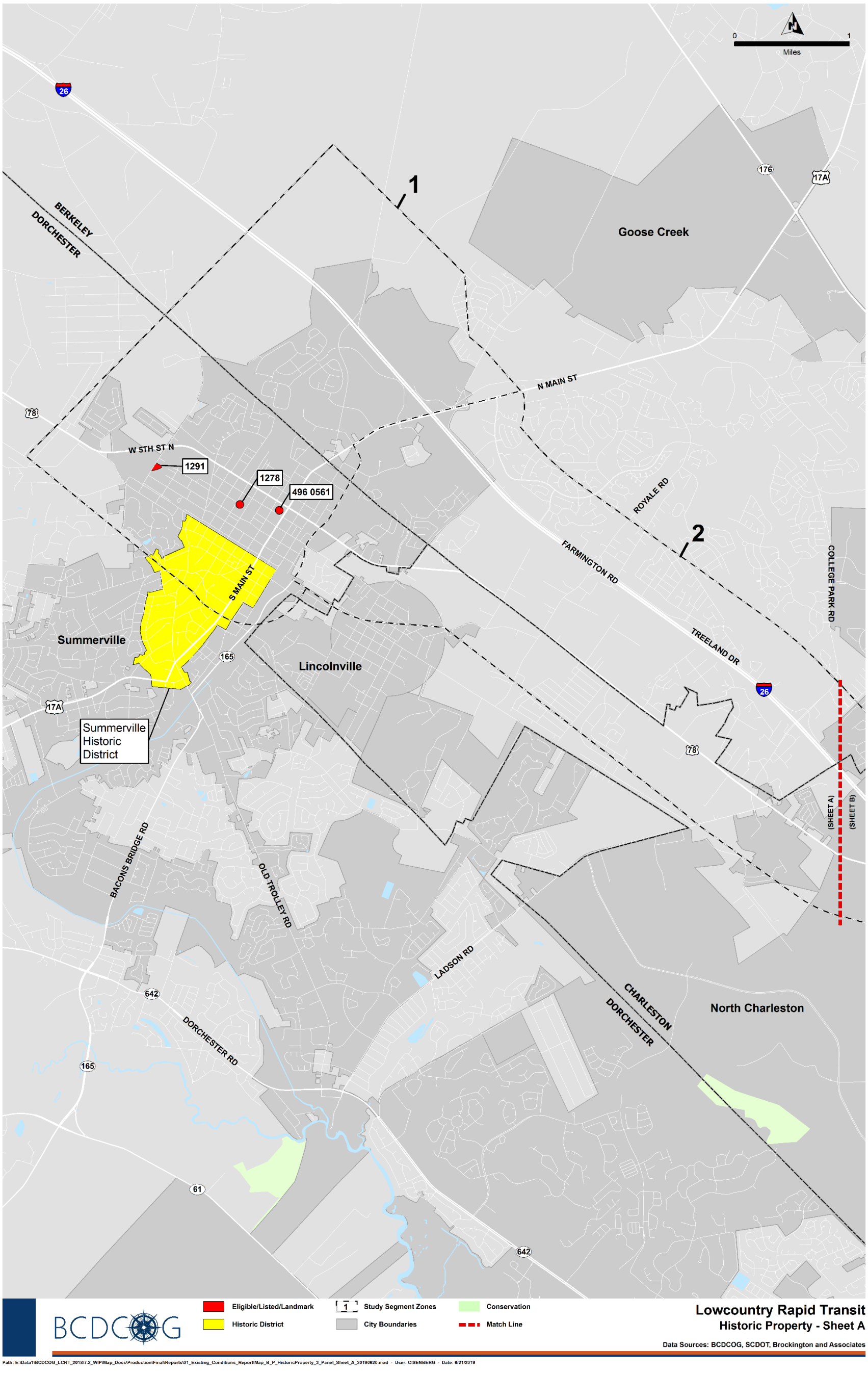

Figure 9.7.1 Historic Resources in the Study Area (Sheet A)

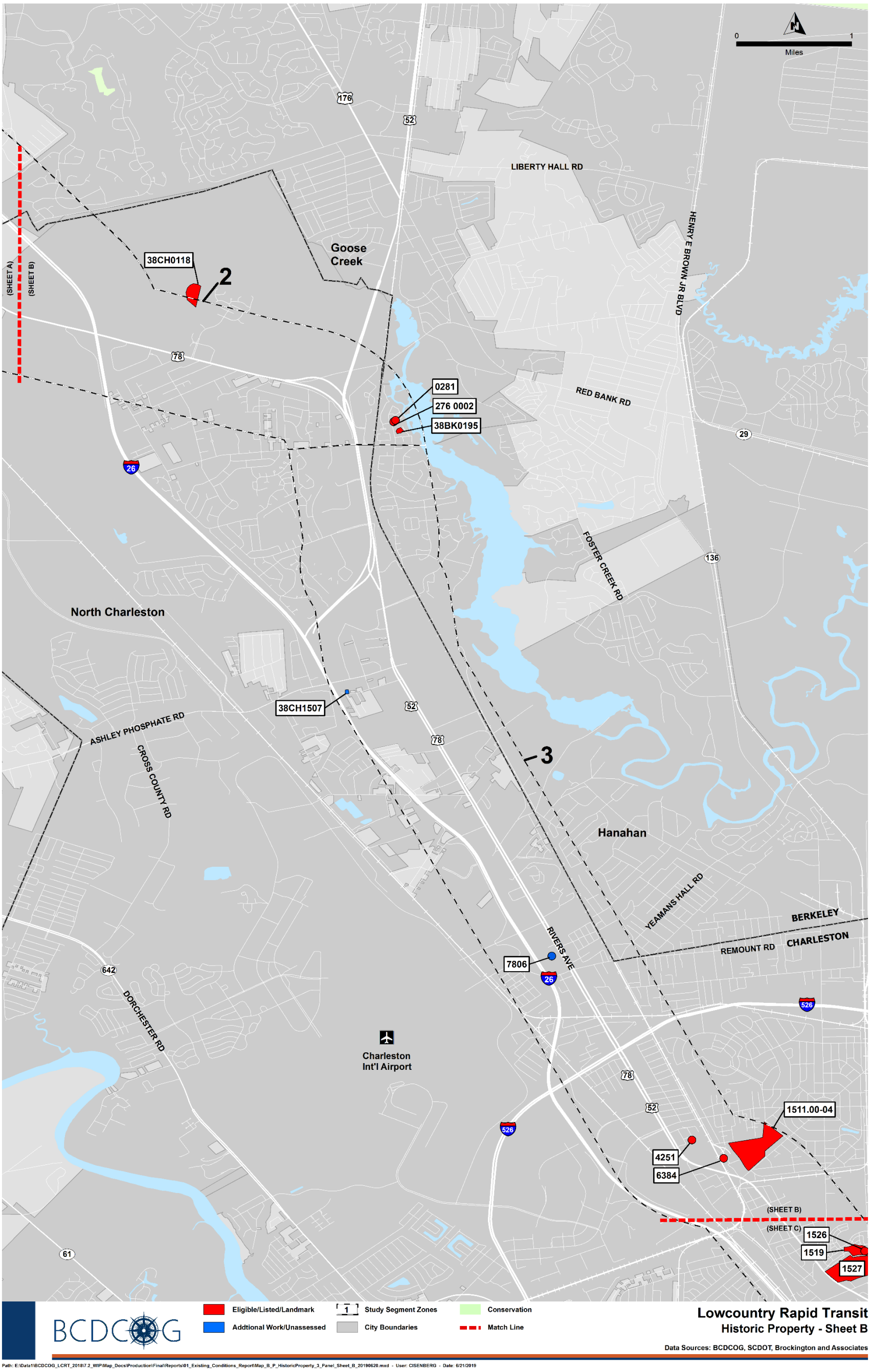

Figure 9.7.2 Historic Resources in the Study Area (Sheet B)

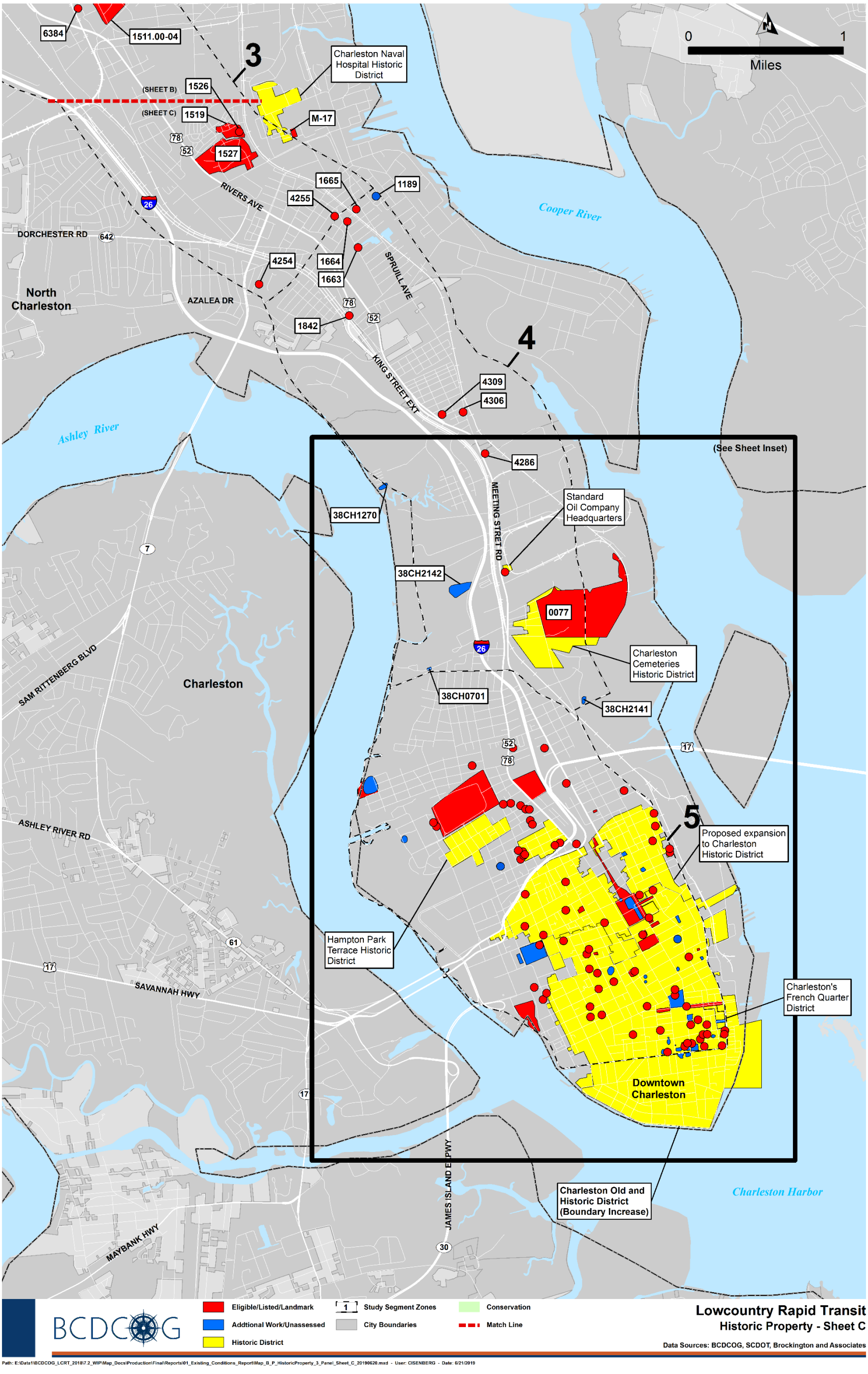

Figure 9.7.3 Historic Resources in the Study Area (Sheet C)

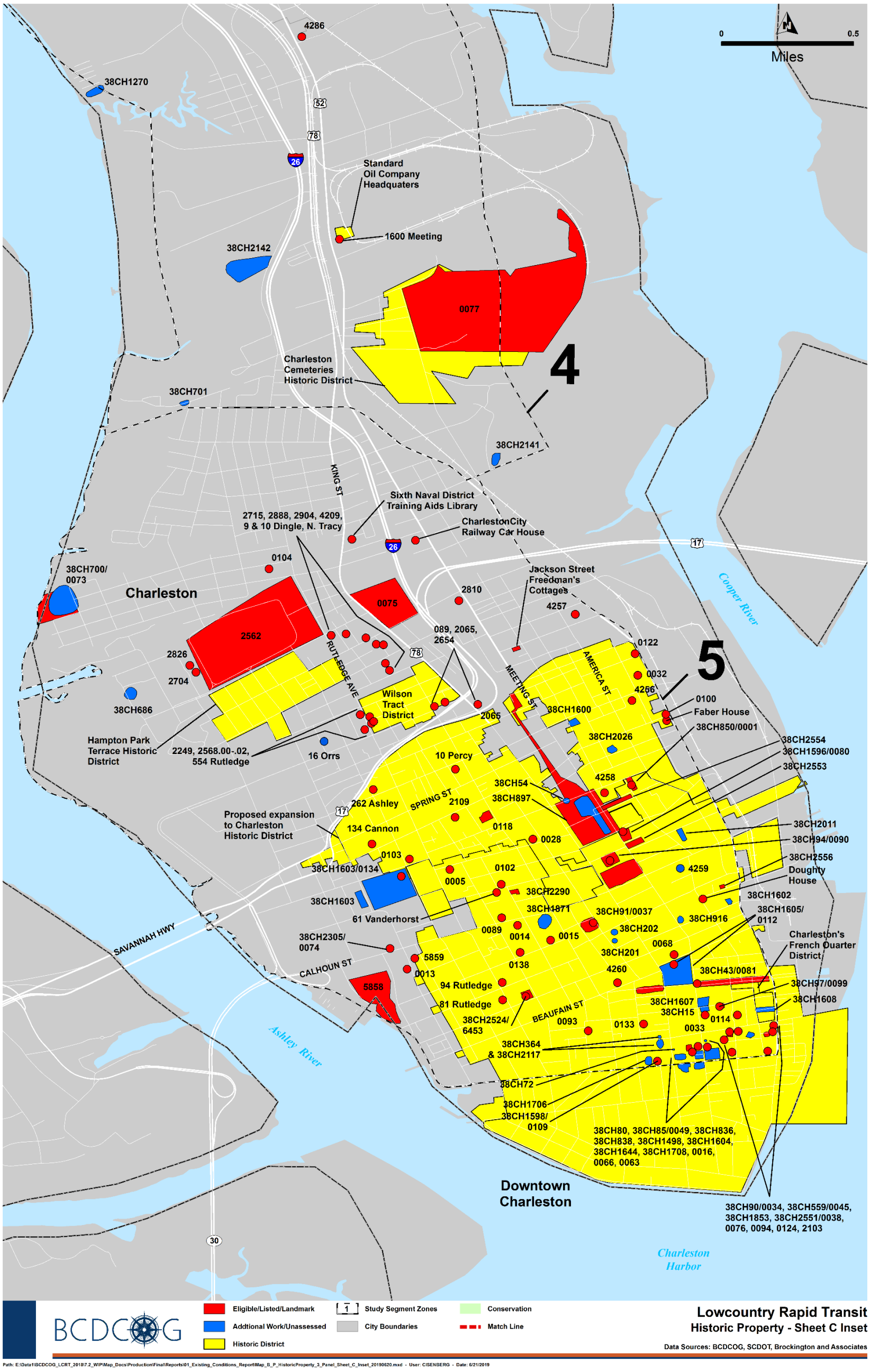

Figure 9.7.4 Historic Resources in the Study Area (Sheet C Inset)

9.7.3 Cemeteries and Historic Districts

There are six cemeteries recorded as historic architectural resources and 11 historic districts that have been previously identified within the study area. Figures 9.7.1 through 9.7.4 present the locations of these resources. Table 9.7.2 provides a summary of these resources.

Table 9.7.2 Cemeteries and Historic Districts

Resource Type	County	Segment	Resource Number	Name	NRHP Status
Cemetery	Berkeley	2		Jones Cemetery	Not Eligible
			496-0719	Mt. Zion Church Cemetery	Not Eligible
	Charleston	5	0077	Magnolia Cemetery	Listed
			0118	Coming Street Cemetery	Listed
			2874	Brotherly Cemetery	Contributes to Listed District
	Dorchester	1	496-0596	Brownsville Cemetery	Not Eligible
Historic District	Charleston	4		Charleston Naval Hospital Historic District	Listed
				Standard Oil Company Headquarters	Listed
		4 & 5		Charleston Cemeteries Historic District	Listed
		5		Charleston Old and Historic District (boundary increase)	Listed
				Charleston's French Quarter District	Listed
				Hampton Park Terrace Historic District	Listed
				Proposed expansion to Charleston Historic District	Determined Eligible/Owner Objection
				William Aiken House and Associated Railroad Structures	Landmark
			0075	William Enston Home	Listed
				Wilson Tract District	Eligible
	Dorchester	1		Summerville Historic District	Listed

The total number of cemeteries in the study area is difficult to assess. Most of the cemeteries have not been recorded as cultural resources, nor have they been appropriately mapped or documented by government agencies. At present, there are nine cemeteries recorded as cultural resources in the study area. Three of the cemeteries are recorded as archaeological sites and are discussed in the archaeological sites section below. Three cemeteries are recorded as above-ground resources (Jones Cemetery, Mt. Zion Church Cemetery [496-0719], and Brownsville Cemetery [496-0596]) and are not eligible for the NRHP; however, cemeteries are protected from disturbance and desecration under South Carolina state law (South Carolina Code of Laws 16-17-590 and 16-17-600). There are three NRHP-listed cemeteries in the study area, including Brotherly Cemetery, Coming Street Cemetery, and Magnolia Cemetery.

Background research indicates 11 NRHP eligible or listed historic areas/districts, as listed in Table 9.7.2. These include one historic district in Segment 1 (Summerville Historic District) and 10 historic districts in Segments 4 and 5 (Charleston Cemeteries Historic District, Charleston Naval Hospital Historic District, Charleston Old and Historic District [Boundary Increase], Charleston's French Quarter District, Hampton Park Terrace Historic District, Proposed Expansion to Charleston Historic District, Standard Oil Company Headquarters, William Aiken House and Associated Railroad Structures, William Enston Home, and the Wilson Tract District).

9.7.4 Archaeological Sites

No subsurface investigations were completed as part of the archaeological evaluation. Instead, a background literature review and brief vehicular and pedestrian archaeological reconnaissance investigation were conducted in the study area. The summary of the archaeological investigations to date are documented in the cultural resources technical report in Appendix F.

Within the study area, 54 archaeological sites are eligible for, listed on, or unevaluated for the NRHP. Additionally, three archaeological sites in the study area are cemeteries determined not eligible for the NRHP (Sites 38CH1507, 38CH1889, and 38CH2142). However, cemeteries are protected from disturbance and desecration under South Carolina state law (South Carolina Code of Laws 16-17-590 and 16-17-600). These 57 sites should be avoided when selecting the preferred alignment. If they cannot be avoided, appropriate mitigation strategies should be developed. Table 9.7.3 provides a summary of each archaeological site. Figures 9.7.1 through 9.7.4 present the locations of these resources.

Table 9.7.3 Archaeological Sites

County	Segment	Resource Number	Name	NRHP Status
Berkeley	2	38BK0195	Otranto Indigo Vat	Eligible
Charleston	2	38CH0118	The Elms Plantation	Eligible
	3	38CH1507	Sims Cemetery	Not Eligible (cemetery)
	5	38CH0015	Meeting Street shell midden	Unevaluated

County	Segment	Resource Number	Name	NRHP Status
		38CH0043	Market Hall & Sheds	Eligible
		38CH0054	Best Friend Tracks	Unevaluated
		38CH0072	Quaker Meeting House	Unevaluated
		38CH0080	Blake tenements	Eligible
		38CH0085	Fireproof building	Eligible
		38CH0090	Citizens & Southern Bank	Eligible
		38CH0091	College of Charleston	Eligible
		38CH0094	Old Citadel	Eligible
		38CH0097	Powder Magazine	Eligible
		38CH0201	28 St. Philips St.	Unevaluated
		38CH0202	53 George St.	Unevaluated
		38CH0364	Roddis House	Unevaluated
		38CH0559	McCrady's Longroom	Eligible
		38CH0686	Cartwright	Potentially Eligible
		38CH0700	Pendarvis	Potentially Eligible
		38CH0701	Garden site	Potentially Eligible
		38CH0836	Historic Charleston Foundation well	Potentially Eligible
		38CH0838	Charleston Courthouse Annex	Potentially Eligible
		38CH0850	William Aiken House	Eligible
		38CH0897	VRTC site	Potentially Eligible (destroyed)
		38CH0916	66 Society St.	Potentially Eligible
		38CH1270	Dolphin Cove	Unevaluated (destroyed)
		38CH1498	Charleston Courthouse	Potentially Eligible
		38CH1562	Saks Fifth Avenue	Eligible
		38CH1586	Marion Square	Eligible
		38CH1596	Joseph Manigault houses	Landmark
		38CH1598	John Rutledge House	Potentially Eligible
		38CH1600	70 Nassau St.	Potentially Eligible
		38CH1602	40 Society	Potentially Eligible

County	Segment	Resource Number	Name	NRHP Status
		38CH1603	President St.	Potentially Eligible
		38CH1604	Beef Market	Potentially Eligible
		38CH1605	Charleston Place	Potentially Eligible
		38CH1607	First Trident	Potentially Eligible
		38CH1608	Lodge Alley	Potentially Eligible
		38CH1644	Hollings Judicial Center Annex	Potentially Eligible
		38CH1706	Old St. Andrews Society Hall	Additional Work
		38CH1708	Charleston Judicial Center	Potentially Eligible
		38CH1853	6 Chalmers St.	Potentially Eligible
		38CH1871	Bishop England High School	Potentially Eligible (destroyed)
		38CH1889	City of Charleston Potter's Field	Not Eligible (cemetery)
		38CH2011	29 Charlotte St.	Potentially Eligible
		38CH2026	46 Reid St. cemetery	Potentially Eligible (cemetery)
		38CH2117	93 Queen St.	Potentially Eligible
		38CH2141	Unidentified powder magazine	Potentially Eligible
		38CH2142	Monrovia Cemetery	Not Eligible (cemetery)
		38CH2290	82 Pitt Street	Eligible
		38CH2305	Calhoun III	Unevaluated
		38CH2524	Christopher G. Memminger homesite	Eligible
		38CH2551	Dock Street Theatre	Eligible
		38CH2553	Wragg Square	Eligible
		38CH2554	Wragg Mall	Eligible
		38CH2556	48 Laurens Street	Eligible

Nearly all of the archaeological sites are located in Charleston (Segment 5). The remaining three archaeological sites are located in the northern and central portions of the study area (Segments 2 and 3).

9.7.5 Potentially Sensitive Areas in the Study Area

The study area contains numerous historic properties and other sensitive cultural resources that should be considered during the design, construction, and implementation of the proposed project. These include archaeological sites, cemeteries, and above-ground resources associated with agricultural, domestic, industrial, military, and religious activities, dating from as early as the late seventeenth to the mid-twentieth century. Based on archival research and GIS analyses, there are an estimated 267 sensitive areas classified into three general categories, including 187 cemeteries, 63 archaeological sites, and 11 above-ground resources (excluding cemeteries). Table 9.7.4 lists potentially sensitive areas in the study area by type (cemetery, archaeological, above-ground), class (agricultural, cemetery, industrial, medical/public, religious, and residential), and segment. Consideration of these resources is necessary under various federal, state, and city ordinances, regulations, statutes, and policies. The locations of these potentially sensitive areas are presented in Figures 9.7.5 through 9.7.8. Recommendations for preventing or limiting adverse effects to historic properties or other sensitive resources are presented at the end of this discussion and in the cultural resources technical report in Appendix F.

Table 9.7.4 Potentially Sensitive Cultural Resource Areas in the Study Area

Type	Class	Segment	Label	Name
Cemetery	Cemetery	1	41	Brownsville Cemetery (496-0596)
			170	Oak Grove Cemetery
		2	47	Cemetery
			49	Cemetery
			61	Cherry Hill Cemetery
			119	Hanover Circle Cemetery
			140	Jones Cemetery
			164	Mt. Zion Baptist Church Cemetery (496-0719)
		3	46	Carolina Memorial Gardens
			48	Cemetery
			135	Jerusalem Baptist Church Cemetery or Racker Hill Cemetery
			136	Jerusalem Baptist Church Cemetery
			169	Oak Grove Cemetery
			230	St. Peters Church Cemetery
			250	Union Baptist Church Cemetery
		4	27	Brith Shalom Cemetery
			29	Beth Elohim Cemetery
			30	Bethany Lutheran Cemetery
			37	Brith Shalom Beth Israel Cemetery

Type	Class	Segment	Label	Name
			38	Brotherly Association Burial Ground
			40	Brown Fellowship Society Cemetery
			42	Calhoun AME Church Cemetery
			51	Cemetery
			52	Cemetery
			53	Cemetery
			60	Morris Street Baptist Church Cemetery
			64	Christian Benevolent Society Cemetery
			72	Citadel Square Baptist Church Cemetery
			89	Disher Farm Cemetery
			99	Family Cemetery
			101	Francis Brown Methodist Church Cemetery
			103	Friendly & Charitable Association Cemetery
			104	Friendly Union Society Cemetery
			105	Friendly Union Society Burial Ground
			113	Gertrude Heyward Cemetery
			115	Grave of Isaac Huger, Jr.
			117	Greek Orthodox Cemetery
			120	Happoldt Farm Cemetery
			123	Heriot Street Sepulchre
			124	Heyward Cemetery
			125	Heyward Cemetery
			130	Humane & Friendly Society Cemetery
			141	Kahal Kadosh Beth Elohim Cemetery
			151	Magnolia Cemetery
			153	McCrady's Farm Cemetery
			156	Mickey Funeral Home Cemetery
			157	Monrovia Union Cemetery
			158	Monrovia Union Cemetery East Section
			166	New Emanuel AME Church of Charleston
			167	New Morris Brown AME Church Cemetery
			172	Old Bethel Church Congregation Cemetery

Type	Class	Segment	Label	Name
			174	Old Morris Brown AME Church Cemetery
			195	Ravenel Farm Cemetery
			198	Reserve Fellowship Society Cemetery
			199	Rikdersville Jewish Cemetery
			220	St. Lawrence Catholic Cemetery
			240	The Baptist Church of Charleston Cemetery
			242	Trinity AME Church Cemetery #1
			243	Trinity AME Church Cemetery #2
			248	Union Baptist Church Cemetery
			249	Union Baptist Church Cemetery
			253	Unity & Friendship Society Burial Ground
			267	Zion Presbyterian Church Cemetery
		4 & 5	108	Geiger Farm Cemetery
		5	11	2nd Presbyterian Church & Graveyard
			12	38CH699/1648 Public Cemetery (Cannonsborough)
			28	Bersheba Cemetery (Colored)
			33	Bethel M. E. Church Burying Ground
			39	Brown Fellowship (Negro Burying Ground)
			50	Cemetery
			56	Central Church Cemetery for AA Members
			60	Charleston Orphan House
			63	Christ AME Church Cemetery
			70	Circular Congregational Church Cemetery
			71	Citadel Square Baptist Church Cemetery
			82	Colored Burial Ground
			88	Cumberland & Bethel Methodist Church Cemetery
			97	Ephrath Cemetery (Negro Burying Ground)
			111	German Lutheran Burial Ground
			121	Harby Cemetery
			122	Hebren Cemetery (Beth Elohim)
			129	Huguenot Church Grave Yard

Type	Class	Segment	Label	Name
			142	Keigley's Cemetery
			143	Landgrave West's Vault and Tomb
			145	Local Union Society #52
			147	Lutheran African American Burial Ground
			154	McPhelah (Negro Burying Ground)
			155	Memorial Baptist Church Cemetery (Colored)
			161	Morris Street Baptist Church/Burial Ground
			165	Nergo Burial Ground
			176	Old Presbyterian (Westminster Presbyterian) Grave Yard
			182	Payne's Farm Cemetery
			187	Public Cemetery
			188	Public Cemetery
			189	Public Cemetery/Charleston Medical College
			190	Public Cemetery/County Jail
			191	Public Cemetery/Jenkins Colored Orphanage
			192	Public Cemetery/Roper Hospital
			193	Quake Church Yard
			194	R. C. Cathedral of St Johns
			200	Rose's Farm Cemetery
			215	St. James Methodist Church
			216	St. John's Luther Church, Unitarian Church
			218	St. John’s Burial Association
			225	St. Mary's R. C. Church
			226	St. Patrick's Church
			227	St. Paul’s Episcopal Church
			229	St. Peter's/St. Michael's Calvary & Baptist
			231	St. Philip's Episcopal Church Cemetery
			233	St. Stephen's Episcopal Church Cemetery
			236	Stranger's and Negro Burying Ground
			244	Trinity Colored

Type	Class	Segment	Label	Name
			245	Trinity M.E. Church/Grave Yard
			252	Union Soldier Prisoner of War Camp
			258	Wentworth St. Lutheran Church Cemetery
	Religious	1	9	1st Baptist Church (Colored)
			10	1st Church of God
			31	Bethany M.E. Church
			32	Bethel A.M.E.
			66	Church of Epiphany
			67	Church of God
			83	Colored Church
			98	Episcopal Church
			217	St. John's The Evangelist R. C. Church
			222	St. Luke’s Church
			234	St. Stephen's Reformed Episcopal Church (Colored)
			237	Summerville Baptist Church
			239	Summerville Presbyterian Church
			259	Wesley M.E. Church
		2	128	Huguenot Church at Goose Creek ruins
			148	Lydia Church
		5	15	A.M.E. Church
			17	African American Church
			24	Baptist Church
			25	Baptist Church Negro
			34	Big Zion Presbyterian Church (Colored)
			43	Calvary Baptist Church (Colored)
			44	Calvary Episcopal Church (Colored)
			45	Cannon St. Baptist Church
			54	Centenary (Colored) Methodist Church
			55	Central Baptist Church (Colored)
			59	Morris St. A.M.E. Church
			68	Church of the Holy Communion
			69	Church of the Immaculate Conception

Type	Class	Segment	Label	Name
			81	Colored Baptist Church
			86	Community Chapel Star Gospel Mission
			93	Ebenezer M.E. Church (Colored)
			96	Emanuel A.M.E. Church
			100	First Christian Church
			110	German Evangelical Church
			112	German Lutheran Church
			114	Grace Episcopal Church
			116	Greater St. Luke AME Church
			137	Jewish Synagogue
			138	Jewish Temple
			144	Line Street Baptist Church
			162	Mt. Herman Church
			163	Mt. Zion A.M.E. Church
			171	Old Bethel Church
			177	Olivet Presbyterian Church (Colored)
			18	American St. Baptist Church
			183	Plymouth Congregational Church
			196	Reformed Episcopal Church (Colored)
			197	Reformed Methodist Church
			203	Salem Baptist Church
			212	Spring Street M.E. Church
			213	St. Barnadas Evangelical Lutheran Church
			219	St. Joseph's R. C. Church
			221	St. Luke’s A.M.E. Church
			223	St. Luke’s Episcopal Church
			224	St. Mark’s P. E. Church
			228	St. Pete's A. E. Church
			232	St. Phillip’s AME Church
			247	Union Baptist Church (Colored)
			257	Wallingford Presbyterian Church (Colored)
			260	Wesley M.E. Church
			262	Westminster Presbyterian Church

Type	Class	Segment	Label	Name
			266	Zion Baptist Church (Colored)
	Medical/Public	1	19	Arthur B. Lee Hospital
			90	Dorchester County Hospital
		5	65	Church Home Orphanage
			73	City Alms House
			74	City Hospital
			75	City Orphan Asylum
			84	Colored Hospital & Training School for Nurses
			85	Colored Mission
			214	St. Francis Xavier's Infirmary
Archaeological	Industrial	1	106	FRRY Brick Plant
			146	Lumber Yard
			204	Salsbury Brick Works
			238	Summerville Ice & Fuel Plant
		3	184	Precooling Plant (Ice Plant)
			265	Wulbern Fertilizer Works
		4	20	Ashepoo Fertilizer Company
			22	Atlantic Fertilizer Works
			59	Charleston Lead Works
			62	Chicora Fertilizer Works
			131	Imperial Fertilizer Works
			132	Interstate Chemical Corporation
			150	MacMurphy Co./Wando Fertilizer Works
			152	McCabe Fertilizer Company
			168	North State Lumber Company
			205	Schutzenplatz
			235	Stono Fertilizer Works
			246	Tuxbury Lumber Company
			254	VA-Carolina Chem Co./Standard Fert Works
		5	16	Adam's Dispensary & Bottling Works
			21	Atlantic Coast Line R. R. Depot

Type	Class	Segment	Label	Name
			23	B. I Simmons Saw Mill, Wood & Lumber Yard
			35	Blohme Milling Co.
			36	Bradley Mill
			57	Charleston Bagging Manufacturing Co.
			58	Charleston Door Sash & Lumber Co.
			80	Collin's Wood Yard
			87	Consumers Ice Co. Ice Factory
			92	E. L. Halsey Saw Mill
			107	G. Rohoe & Co. Grist Mill
			109	Geo. D. Hacker & Sons Sash, Door, & Blind Fac.
			118	H. A. Meyer - Wood Yard
			133	Iron Gasometer
			134	Iron Gasometer
			139	JM Connelley's Undertaking-Coffin Fac/Green House
			149	Lynch's Wood Yard
			178	P. Chappeau -Dairy
			179	Paints and Oils
			180	Palmer Mfg Co. Barrel Factory
			181	Palmetto Soap Mfg Co.
			202	Royal Bag and Yarn Mfg Co.
			207	Southern Cotton Oil Co's Atlantic Refinery
			208	Southern Railroad Yard
			209	Southern Railroad Yard
			210	Southern Railroad Yard
			211	Southern Railroad Yard
			241	The JNO F. Riley Foundry & Machine Works
			255	Vacant Saw Mill
			256	Vesta Mills
			261	West Point Rice Mill
			263	Wetherhorn & Fischer

Type	Class	Segment	Label	Name
	Public	3	14	6 Mile House
		4	13	5 Mile House (burned 1800s)
			91	Dover's Tavern/Quarter House
	Military		76	Civil War Earthworks
			77	Civil War Fortification
			78	Civil War Fortification
			79	Civil War Fortification
		5	1	1746 Fortifications
			2	1780 Fortifications
			3	1789 Fortifications
			4	1812 Fort
			5	1812 Fortifications
			6	1812 Fortifications
			7	1812 Fortifications
			8	1812 Fortifications
			26	Battery Gadberry
			127	Hornwork
			173	Old City Wall
Above-Ground	Residential	3	126	Highland Park
			175	Old North Charleston southwest
		4	201	Rosemont
			206	Silver Hill
			251	Union Heights
		4 & 5	186	Proposed Peninsula City District
		5	185	Proposed Extension of Old and Historic District
	Rice	2	94	Elms Plantation Rice Field
			95	Elms/Crowfield Plantation Rice Field
			264	Woodstock Plantation Rice Field
		3	102	Fraser's Plantation Rice Field

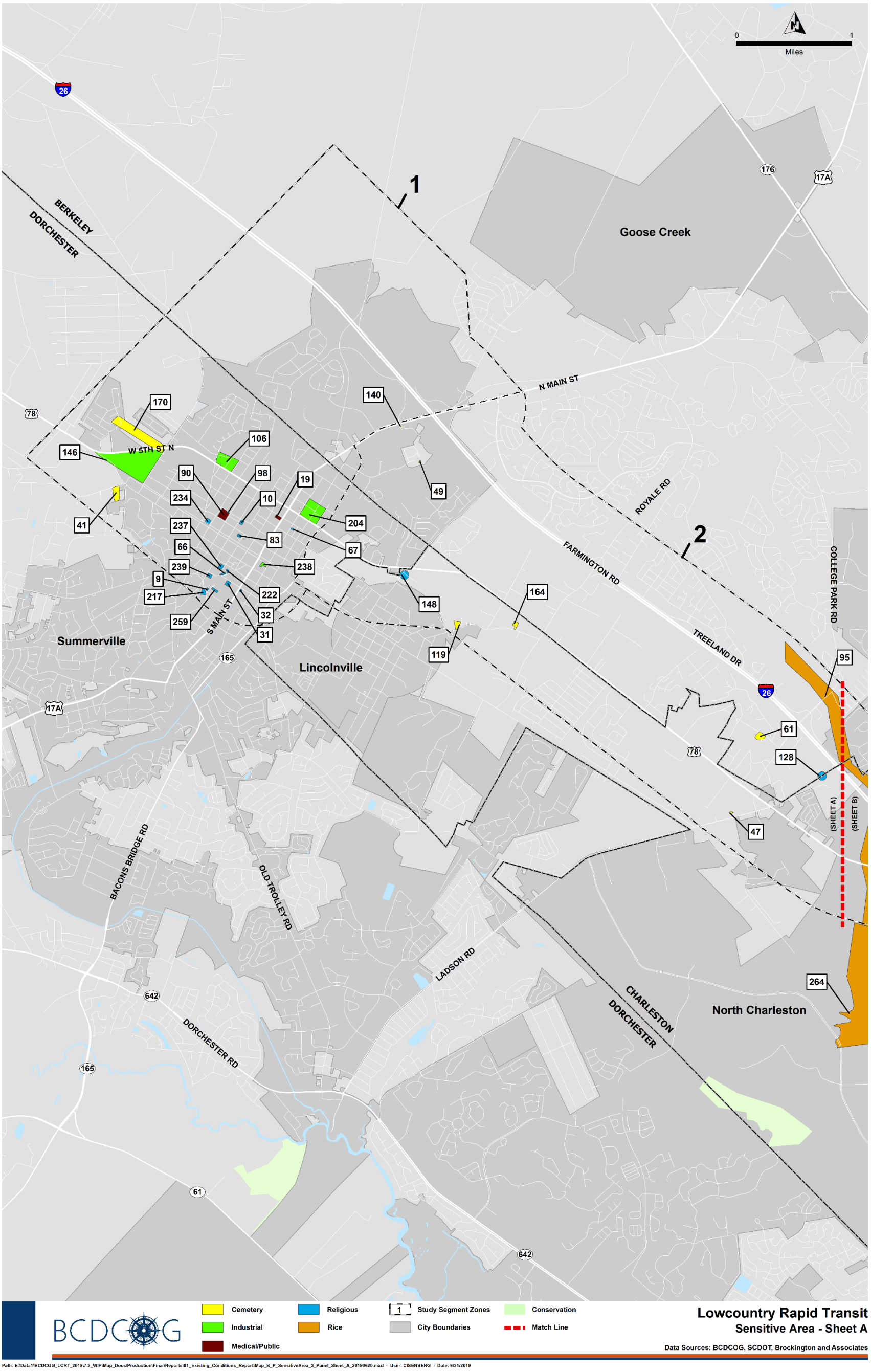

Figure 9.7.5 Potentially Sensitive Cultural Resource Areas in the Study Area (Sheet A)

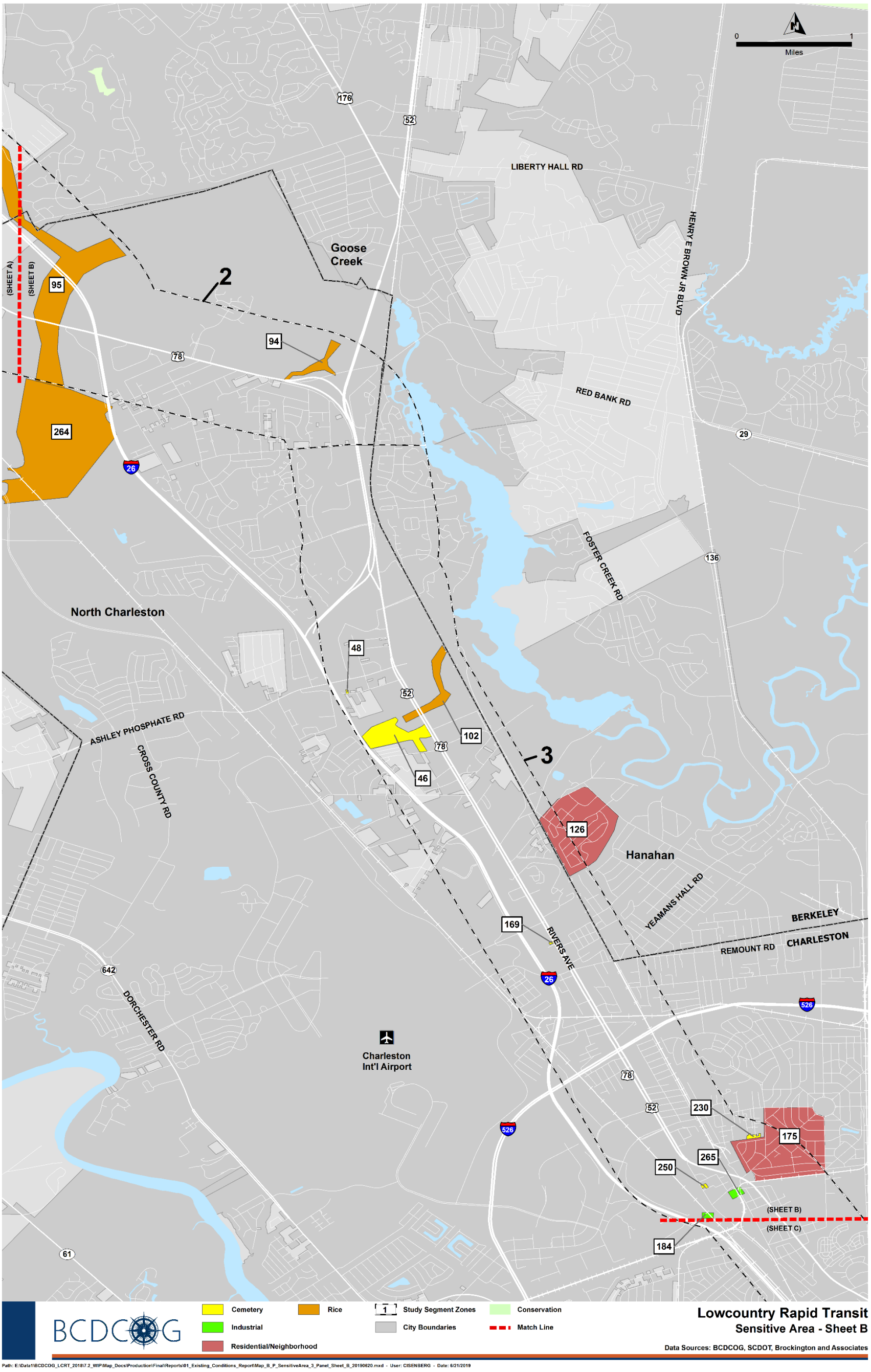

Figure 9.7.6 Potentially Sensitive Cultural Resource Areas in the Study Area (Sheet B)

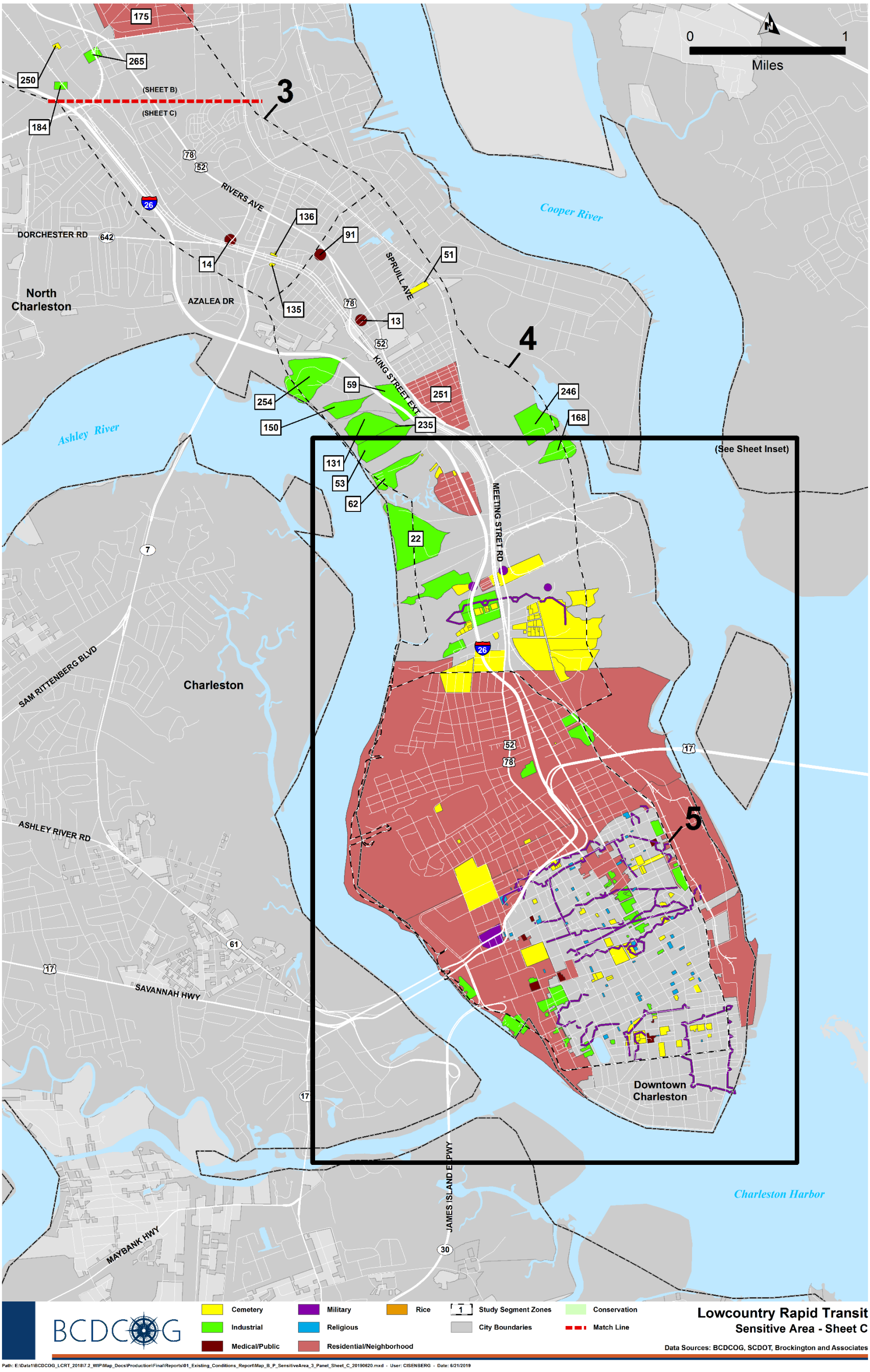

Figure 9.7.7 Potentially Sensitive Cultural Resource Areas in the Study Area (Sheet C)

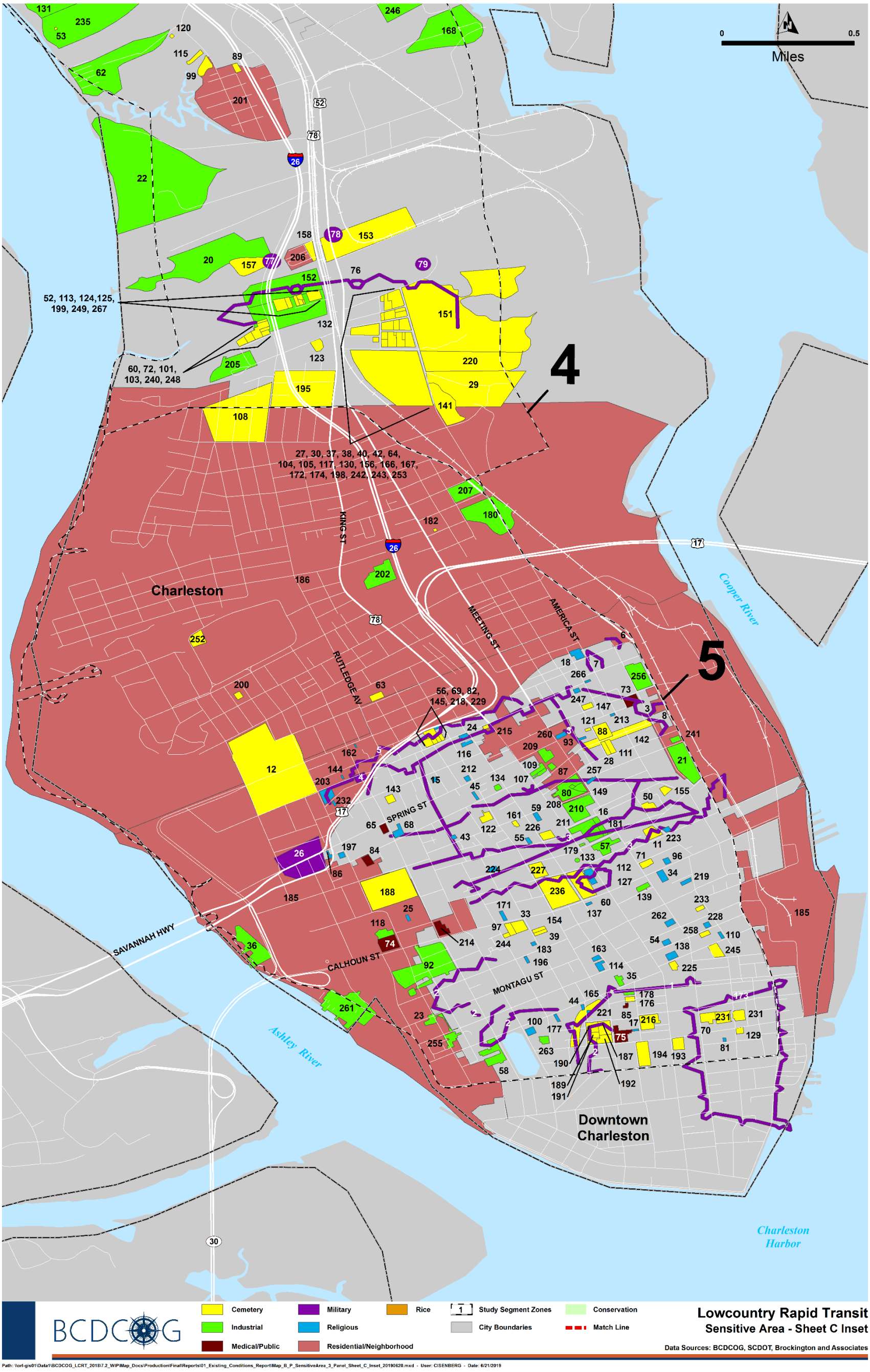

Figure 9.7.8 Potentially Sensitive Cultural Resource Areas in the Study Area (Sheet C Inset)

9.7.6 Recommendations

The reconfiguration of roads, intersections, and other infrastructure in the study area may have an adverse effect on historic properties. Construction activities may disturb subsurface deposits and new infrastructure may lead to adverse audio, vibratory, and visual effects to historic properties. The alteration of the upper few feet of soils and sediments at an archaeological site may disrupt or destroy archaeological deposits or features that may contain important information about the past. Similarly, ground disturbing activities within or near former cemeteries may encounter human remains, either dislocated or within intact graves. Appropriate procedures will be necessary to ensure that such encounters do not desecrate these burials.

In so far as possible, ground-disturbing and noise/vibration-generating activities associated with proposed improvements should be designed to avoid known historic properties, archaeological sites, and extant or former cemeteries. Appropriate distances between historic properties (primarily buildings and structures) and such activities should prevent or limit adverse effects. The nature of individual buildings/structures, the kinds of activities anticipated at a locale, and the nature of the soils/sediments in the general area all may determine what the appropriate distance may be. Similarly, open areas in the portions of the study area that are not recently made land (areas built up by means of fill deposits) should be avoided as well. These areas are more likely to contain important archaeological deposits. However, intact deposits or features may be present on almost any lot within the study area. The public rights-of-way and streets are the least likely areas to contain intact archaeological deposits and features given their use as conduits for various below ground infrastructure and the modifications that are necessary to create modern roads. Should above-ground elements of the proposed project require placement near individual historic properties, the appearance of these facilities should conform as much as possible to the kinds of facades and buildings/structures present at the selected locale. This will limit or prevent visual intrusions. Landscaping and false structures covering elements may prevent adverse effects as well.

Even with site selections for project elements that avoid or limit historic properties or areas of higher archaeological potential, there still may be effects to yet undiscovered resources. Additional investigation, both archival and archaeological (to include remote sensing and more traditional archaeological approaches), may be needed to assess the potential risk of adverse effects at specific locales.

Moving forward, upon the selection of the preferred alternative for the project, an intensive cultural resources survey will be necessary for the archaeological and architectural APEs. Survey methods and determination of the archaeological and architectural APEs will be finalized during consultations with the FTA and SHPO.

9.8 Section 4(f) and 6(f) Resources

This section presents an evaluation of the potential use of lands protected under Section 4(f) of the USDOT Act of 1966 (49 U.S.C. 303 and implemented for the FHWA and FTA by joint regulation at 23 CFR Part 774), as well as Section 6(f) of the U.S. Land and Water Conservation Fund Act of 1965 (36 CFR 59). Section 4(f) generally prohibits the use of land of significant

publicly owned parks, recreation areas, wildlife and waterfowl refuges, and land of a publicly or privately owned historic site for transportation projects unless the FTA determines that there is no feasible and prudent avoidance alternative and that all possible planning to minimize harm has occurred. The key features of Section 4(f) are described below:

- Section 4(f) applies only to agencies within the USDOT, including FTA.
- Section 4(f) applies only to publicly owned parks, recreation areas, and wildlife and waterfowl refuges. Similar resources that are privately owned yet open to the public are not considered Section 4(f) resources.
- Section 4(f) also applies to historic sites listed on or eligible for listing on the NRHP, regardless of whether the site is in public or private ownership.
- Section 4(f) applies to all archeological sites listed on or eligible for inclusion on the NRHP, including those discovered during construction. The exception to this is when the FTA, in consultation with the South Carolina State Historic Preservation Office (SHPO), determines that the archaeological resource is important chiefly because of what can be learned by data recovery and has minimal value to preservation in place.
- Section 4(f) applies to protected resources when a “use” occurs. This “use” can be permanent, such as the permanent acquisition of a property, or temporary, such as the use of the property for construction staging purposes. Section 4(f) also applies when a “constructive use” occurs, such as when the noise, vibration, air quality, or visual impacts of a project are so great that the use of the property is substantially impaired, even though it is not physically affected by the project.
- The use of Section 4(f) property can also be determined to be *de minimis* by FTA. For publicly owned public parks, recreation areas, and wildlife and waterfowl refuges, a *de minimis* impact is one that will not adversely affect the activities, features, or attributes of the property. For historic sites, a *de minimis* impact means that FTA has determined (in accordance with 36 CFR Part 800) that either no historic property is affected by the project or that the project will have "no adverse effect" on the historic property. A *de minimis* impact determination does not require analysis to determine if avoidance alternatives are feasible and prudent, but consideration of avoidance, minimization, mitigation, or enhancement measures should occur. There are certain minimum coordination steps that are also necessary.

State and local governments often obtain grants through the Land and Water Conservation Fund (LWCF) to acquire or make improvements to parks and recreation areas. Section 6(f) of this act prohibits the conversion of property acquired or developed with these grants to a non-recreational purpose without the approval of the Department of the Interior's National Park Service (NPS). Section 6(f) directs the U.S. Department of Interior (DOI) to assure that replacement lands of equal value, location, and usefulness are provided as conditions to such conversions. Consequently, where conversions of Section 6(f) lands are proposed for transportation projects, replacement lands will be necessary.

All properties within the study area were evaluated to determine if Section 4(f) and/or Section 6(f) resources were present. Based on database reviews, there are no known publicly owned wildlife or waterfowl refuges located within the study area. In addition, there are no known parks and recreation areas in the study area that received Section 6(f) funds from the LWCF. Figures 9.8.1 through 9.8.3 present the locations of parks, trails, school playgrounds, and fairgrounds that are potential Section 4(f) resources in the study area.

9.9 Visual and Aesthetic Resources

Visual resources are those physical features that make up the visual landscape, including land, water, vegetation, and man-made elements. These elements are the stimuli upon which visual experiences are based. Substantial visual and aesthetic resources within the project area include historic structures, parklands, and undeveloped open space/natural areas. Potential sensitive visual receptors include areas or users affected by changes in the visual and aesthetic character of the study area.

NEPA and CEQ regulations address visual impacts under the heading of aesthetics. These regulations identify aesthetics as one of the elements or factors in the human environment that must be considered in determining the effects of a project. Further, 23 USC 109(h) cites “aesthetic values” as a matter that must be fully considered in developing a project.

The proposed project may include design elements including pavement markings, bus shelters, and signage. The most visible aspect of the project would include the stations and dedicated bus lanes. It is a project goal to work with the local community in development of the aesthetic design for BRT stations. Another project goal is for the system to be appropriate to its time, fit well within the contexts of the communities it serves, and have a predictable, consistent design that stitches through the whole system, while being sensitive to visual and aesthetic resources along the route.

9.9.1 Historic Resources

Historic structures and historic districts are identified in Tables 9.7.1 and 9.7.2, and illustrated on Figures 9.7.1 through 9.7.4, in the Cultural Resources section (Section 9.7). The findings of the initial cultural resources study are documented in the cultural resources technical report in Appendix F.

Again, a total of 155 historic architectural resources have been previously identified within the study area. The majority of the historic architectural resources are located in the southern portion of the study area, in Segment 5 (Charleston). Only one of the historic architectural resources is located in Berkeley County, and three are located in Dorchester County.

There are three previously identified NRHP-listed cemeteries and 11 historic districts within the study area. The three NRHP-listed cemeteries are all located in the Segment 5 (Charleston). Historic districts include one in Segment 1 (Summerville) and 10 in Segments 4 and 5 (North Charleston and Charleston).

Standard Oil Company headquarters

9.9.2 Parklands and Undeveloped Open Spaces/Natural Areas

There are a number of parklands and undeveloped open spaces/natural areas in the study area. These resources are also discussed in Section 9.8 (Section 4(f) and 6(f) Resources) and are illustrated on Figures 9.8.1 through 9.8.3 within Section 9.8. Two of these are in Segment 1 (Summerville), four are in Segments 2 and 3 (North Charleston), and 15 are in Segment 5 (Charleston). Generally, the majority of the undeveloped open space and natural areas are in the northern portion of the study area, in the vicinity of Summerville, Lincolnville, and Ladson.

9.9.3 Next Steps

Moving forward, project planners and designers will work to avoid or minimize visual impacts to the resources discussed above that are located in the vicinity of the eventual preferred alternative. While the BRT system will have a predictable, consistent design that stitches through the whole system, it should also be sensitive to visual and aesthetic resources along the route. Continued consultation with the SHPO, local conservation groups, and local communities with ties to these resources will be an important part of this process.

Sawmill Branch Trail

Wragg Mall

9.10 Hazardous and Contaminated Materials

Hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA), 42 U.S. Code (USC) § 6901 et seq., are defined as “a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may; (A) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or; (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of or otherwise managed.” (42 USC § 6903) Hazardous waste/material sites are regulated by RCRA, as amended; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended; and the Superfund Amendments and Reauthorization Act of 1986 (SARA).

9.10.1 Environmental Records Review

A hazardous materials screening covering the proposed study area was conducted in January 2019. A search of federal and state environmental databases to identify sites with recognized environmental conditions was conducted. In general, the study area parametersconsisted of a half-mile offset from the outermost alignment; note that at this stage in project planning and design, multiple alignment options are being considered at the northern and southern terminuses of the LCRT. This half-mile offset generally coincides with search radii specified in ASTM E1527-13 “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.” The screening did not include field review or owner interviews.

Given the length of the study area, multiple alignment options, and long history of industrial and commercial property usage, a total of 5,592 listings were identified within the study area during the database search. For the purpose of this preliminary hazardous materials screening, an opinion of potential risk to the project was assigned for each database searched and the number of listings per database was tabulated. Note that some sites are listed in multiple databases and thus, may be counted more than once in Table 9.10.1. Databases were divided into high, medium, and low risk based largely on known contamination and regulatory status. Listings are considered to be high risk if they have confirmed contamination (non-underground storage tank (UST) sites), are in active correction action, or have engineering or institutional controls in place, as these conditions may restrict activities at each site. Listings are considered to be medium risk if they have known contamination from USTs or spills. Listings are considered to be low risk if the database provides no evidence of contamination. The results of the database search are summarized in Table 9.10.1. A complete copy of the report with detailed maps is included in Appendix G

Table 9.10.1 Summary of Environmental Database Search

Database	Description	Listings in Database Search
High Risk Databases		
NPL	**National Priority List:** The NPL is a subset of SEMS and identifies over 1,200 sites for priority cleanup under the Superfund program. NPL sites may encompass relatively large areas.	2
SEMS	**Superfund Enterprise Management System:** The Superfund Enterprise Management System (SEMS) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of USEPA's Superfund program across the United States. The list was formerly known as CERCLIS, renamed to SEMS by the USEPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of CERCLA. This dataset also contains sites which are either proposed to or on the NPL and the sites which are in the screening and assessment phase for possible inclusion on the NPL.	15
CORRACTS	**Corrective Action Report:** CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.	4
US ENG CONTROLS	**Engineering Controls Sites List:** A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.	3
US INST CONTROLS	**Sites with Institutional Controls:** listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.	2
SC SHWS	**Site Assessment Section Project List:** state hazardous waste sites (SWHS) records are the states' equivalent to SEMS. These sites may or may not already be listed on the federal SEMS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.	120
ROD	**Record of Decision:** ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.	2
LEAD SMELTERS	**Lead Smelter Sites:** A listing of former lead smelter site locations.	1
US BROWNFIELDS	**Listing of Brownfields Sites:** Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off undeveloped, open land and both improves and protects the environment. The Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by USEPA brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on targeted brownfields assessments performed by USEPA Regions.	25

Database	Description	Listings in Database Search
SC BROWNFIELDS	**Brownfields Sites Listing:** The brownfields component of the voluntary cleanup program (VCP) allows a non-responsible party to acquire a contaminated property with state superfund liability protection for existing contamination by agreeing to perform an environmental assessment and/or remediation.	83
SC VCP	**Voluntary Cleanup Program:** Sites participating in the VCP. Once staff and a non-responsible party have agreed upon an approved scope of work for a site investigation and/or remediation, the party enters into a voluntary cleanup contract. Staff oversees the cleanup efforts to ensure that activities are performed to our satisfaction. Upon completion of the negotiated work in the voluntary cleanup contract, the non-responsible party receives state Superfund liability protection.	86
Medium Risk Databases		
NFRAP	**No Further Remedial Action Planned**	12
RCRA TSDF	**RCRA - Treatment, Storage and Disposal:** RCRAInfo is USEPA's comprehensive information system, providing access to data supporting the RCRA and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by RCRA. Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. Treatment, storage, and disposal facilities (TSDFs) treat, store, or dispose of the waste.	6
SC LUST	**Leaking Underground Storage Tank (LUST) List:** When a release occurs from an underground storage tank, the owner and/or operator of the tank is required to report the release to South Carolina Department of Health and Environmental Control (SCDHEC). This database contains a listing of releases from underground storage tanks.	277
SC RCR	**Registry of Conditional Remedies:** The Bureau of Land and Waste Management established this registry to help monitor and maintain sites that have conditional remedies. A conditional remedy is an environmental remedy that includes certain qualifications. These qualifications are divided into two major categories: remedies requiring land use controls (LUCs) and conditional no further actions.	90
SC AUL	**Land Use Controls:** LUCs encompass institutional controls, such as those involved in real estate interests, governmental permitting, zoning, public advisories, deed notices, and other legal restrictions. The term also includes restrictions on access, whether achieved by means of engineered barriers (e.g., fence or concrete pad) or by human means (e.g., the presence of security guards). Additionally, the term includes both affirmative measures to achieve the desired restrictions (e.g., night lighting of an area) and prohibitive directives (e.g., restrictions on certain types of wells for the duration of the corrective action). Considered altogether, the LUCs for a facility will provide a tool for how the property should be used in order to maintain the level of protectiveness that one or more corrective actions were designed to achieve.	32
SC ALLSITES	**Site Assessment & Remediation Public Record Database:** The purpose of this SCDHEC database is two-fold. First, it will provide to communities another form of notice of cleanup activity, allowing them to have more information about assessment and cleanup activities in their area and in the state. Second, it can assist those seeking to redevelop brownfield properties within South Carolina.	75

Database	Description	Listings in Database Search
SC SPILLS	**Spill List:** Spills and releases of petroleum and hazardous chemicals reported to the SCDHEC Division of Emergency Response.	103
2020 COR ACTION	**2020 Corrective Action Program List:** The USEPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations	2
SC GWCI	**Groundwater Contamination Inventory:** An inventory of all groundwater contamination cases in the state.	135
SC UIC	**Underground Injection Wells Listing:** A listing of underground injection well locations used for remediation.	18
SC RGA HWS	**Recovered Government Archive State Hazardous Waste Facilities List:** The Recovered Government Archive State Hazardous Waste (RGA HWS) database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from records formerly available from SCDHEC.	117
SC RGA LUST	**Recovered Government Archive Leaking Underground Storage Tank:** The Recovered Government Archive Leaking Underground Storage Tank (RGA LUST) database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from records formerly available from the SCDHEC.	648

Databases deemed to contain low risk sites (i.e., sites with no known contamination) were not included in Table 9.10-1 because they are not believed to pose a material risk to the study area; however, additional information on low risk sites can be found in Appendix G.

9.10.2 Historic Use Information

The objective of reviewing historical use information is to develop a history of previous land uses in the vicinity of the study area. Historical sources were reviewed that were reasonably ascertainable and likely to provide useful information, as defined by the ASTM standard. This information was used to assess the previous land uses for potential hazardous materials impacts that may affect the study area.

9.10.2.1 Fire Insurance Maps

A Sanborn Fire Insurance Map search was conducted and returned 720 maps for the study area. Given the preliminary nature of planning and design of the corridor, Sanborn Maps were not reviewed for this screening. Once an alignment is finalized, and if specific sites of potential concern are identified during other screening activities, a targeted review of specific Sanborn Fire Insurance Maps may be warranted.

9.10.2.2 City Directory Information

A city directory search was conducted. The city directories may be useful in identifying sites that had operated as retail petroleum service stations, dry cleaners, or other facilities that may pose an environmental risk to the study area. Given the preliminary stage of planning and multiple alignment options, city directory review was limited to the central portion of the study area along Rivers Avenue (Segments 2 and 3). City directories from the years 1968, 1971, 1976, 1981, 1986, 1992, 1995, 2000, 2005, 2010, and 2014 were reviewed. The city directories are included as Appendix H.

Properties located along Rivers Avenue in the vicinity of the study area have been a mixture of commercial and residential. The city directory lists occupant name and street address (in parentheses, where available). Table 9.10.2 includes a list of nearby businesses that had the potential to store or use hazardous waste onsite.

Table 9.10.2 Businesses with the Potential to Store or Use Hazardous Waste Onsite

Business	Address (Rivers Ave)
Scotchman Store	8860
Town & Country Dry Cleaning and Laundry	8780
Amerada Hess Corporation	8740
BP Exploration & Oil Inc./Circle K Stores Inc.	8700
Stokes Cycle Center Inc./Stokes Automotive Inc./Charleston Mitsubishi/Stokes Kia	8650 & 8640
Penske Auto Centers Inc.	8571
Racetrack Gasoline	8560
Ilderton Conversion Charleston LLC	8550
Clarke William Motors Inc./James Hyundai Inc./Charleston Lincoln Mercury/Mamas Used Car Outlet/HHNCSC LLC	8485 & 8475
Racetrack Petroleum Inc./Raceway Gas Station	8480
Fiat of North Charleston	8355
Grease Monkey/South Lubes Inc./Heartland Automotive Services Inc.	8336
Hendrick Automotive Group/North Charleston Automotive Co.	8333
Midas Muffler and Brake Shop/Midas Auto Systems Experts/JJH Automotive LLC	8330
Hendrick Automotive Group	8261
Southern Coatings Paint and Decorating/Full Spectrum Paints Coatings	8232
Reed Gene Chevrolet/Marathon Chevrolet N. Charleston/COC Auto LLC/Saturn Retail North Carolina	8199
E-Z Serve Convenience Stores/Swifty Serve Corp./Lil Cricket Food Stores Inc./GPM Southeast LLC	8120
Kuppenheimer Manufacturing Co.	7800
Five Towers Service Station	

Business	Address (Rivers Ave)
Judy's Garage/George's Marine Welding	7641
Michelin Tire Corp./Mill Transportation and Warehousing	7606
Jiffy Lube/Carolina Petroleum Products/South Lubes Inc.	7601
Gunter's Esso/Exxon Station	7565
Reed Gene Enterprises/Lexus of Charleston	7519
Reed Gene Toyota Inc./Gene Reed Toyota Service	7501
Charleston Lincoln Mercury Inc.	7436
Reed Gene Suzuki Inc./Gene Reed Motors Inc.	7331
North Charleston Marine Sales & Service/Charleston Vinyl Top & Trim	7323
Ryan's Garage	7085
Ray's Garage	7001
Clark's Paint and Body Shop Auto Repair	7003

9.10.2.3 Historical Aerial Photographs

Historical aerial photographs are valuable to review features of the study area and surrounding properties over a long period of time. A historical aerial search was conducted and aerials were reviewed for the following years: 1938/1939, 1953/1954, 1961, 1968, 1971, 1979, 1983, 1989/1990, 1994/1995, 2009, 2011, and 2017.

Aerial photography review indicated dense development in the vicinity of the southern terminus (Segment 5) as early as 1938. Shipping terminals and bulk storage tanks are visible south and east of the study area. Development decreases north/northwest of Charleston in the vicinity of the Cosgrove Bridge, as properties north of the bridge appear to be largely wooded or agricultural (Segments 3 and 4). By 1953, the Charleston Air Force Base is visible northwest of Ashley Phosphate Road. Throughout the dates of aerials reviewed, residential and commercial developments continue to increase northwest of Charleston toward the northern terminus of the study area.

9.10.2.4 Historical Topographic Maps

A historical topographic map search was conducted in January 2019, to provide an overview of the area relative to potential previous land uses and serve to verify observations made through other historical source data. Historical USGS 7.5-minute series topographic maps (Appendix I) for the years 1919, 1920, 1941, 1943, 1944, 1948, 1957, 1958, 1971, 1979, 1983, 1988, 1989, 1990, 1994, 1998, and 2014 were utilized.

As early as 1919, downtown Charleston is shown as being densely populated with buildings. Shipping docks are prevalent along the Cooper River on the eastern side of Charleston. Little development extends north of Magnolia Cemetery, except at shipping terminals along the Ashley and Cooper Rivers. By 1948, bulk tank farms and other development are visible north of

Magnolia Cemetery (Segment 4); Highway 17 is visible entering Charleston from the east across Drum Island (Segment 5). By 1958, development extends from Charleston to North Charleston. Several bulk tank farms are visible east of North Charleston, along the Cooper River. As early as 1958, a significant portion of land south of the Charleston Air Force base is identified as “Strip Mine.”

9.10.3 Next Steps

Moving forward, project planners will work to avoid or minimize impacts to hazardous and contaminated materials located in the vicinity of the eventual preferred alternative. Prior to construction, further investigation in the form of a complete Phase I Environmental Site Assessment and further investigations should occur for any areas outside the existing right-of-way to evaluate the potential for contamination. Contaminated soil unearthed during construction could require treatment and disposal and may not be suitable for backfilling operations. In addition, it could be necessary to notify contractors about contaminated sites if worker exposure to hazardous conditions is anticipated. Coordination with South Carolina Department of Health and Environmental Control (SCDHEC) would then be required to determine appropriate treatment and/or removal actions.

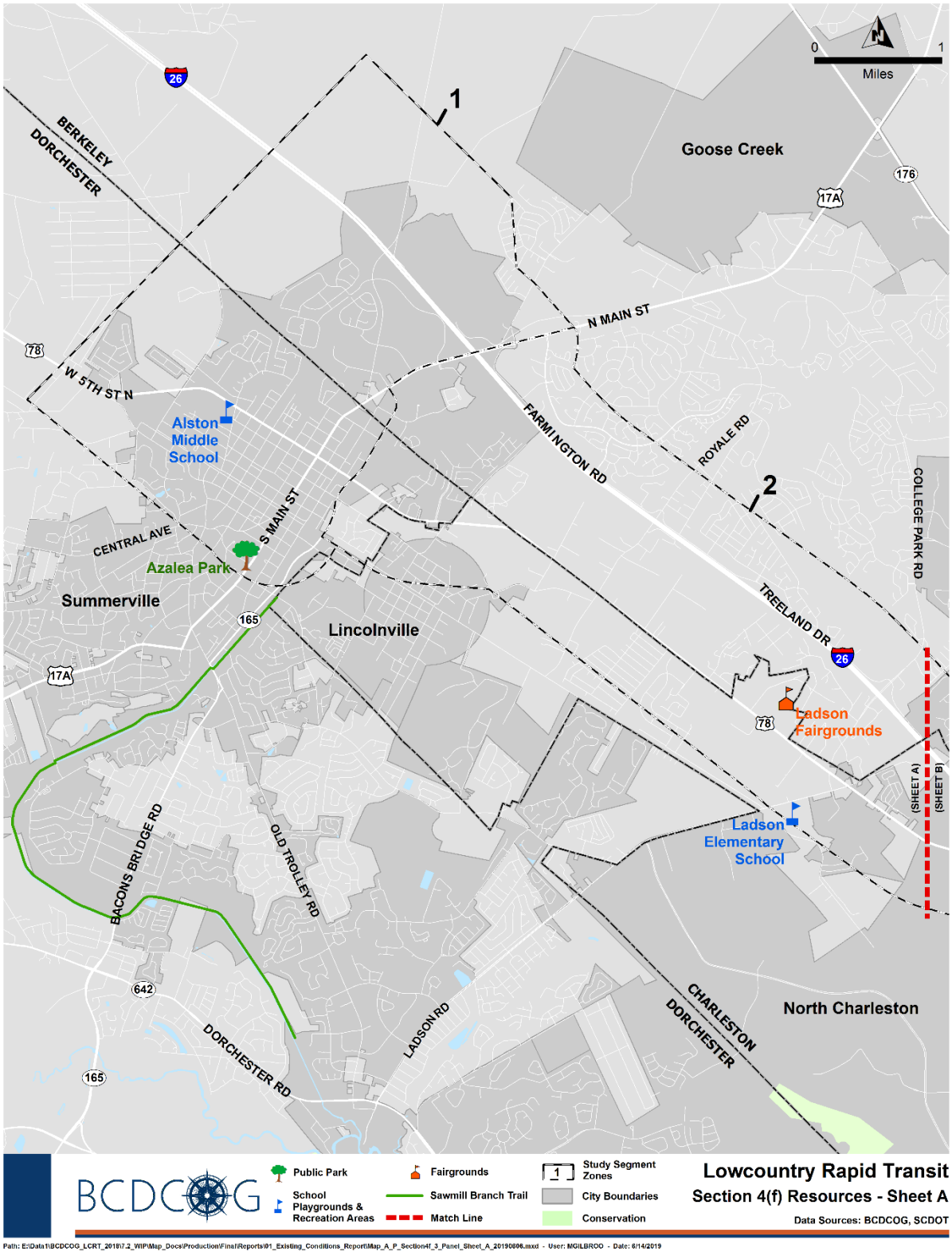

Figure 9.8.1 Locations of parks, trails, school playgrounds, and fairgrounds that are potential Section 4(f) resources in the study area (Sheet A)

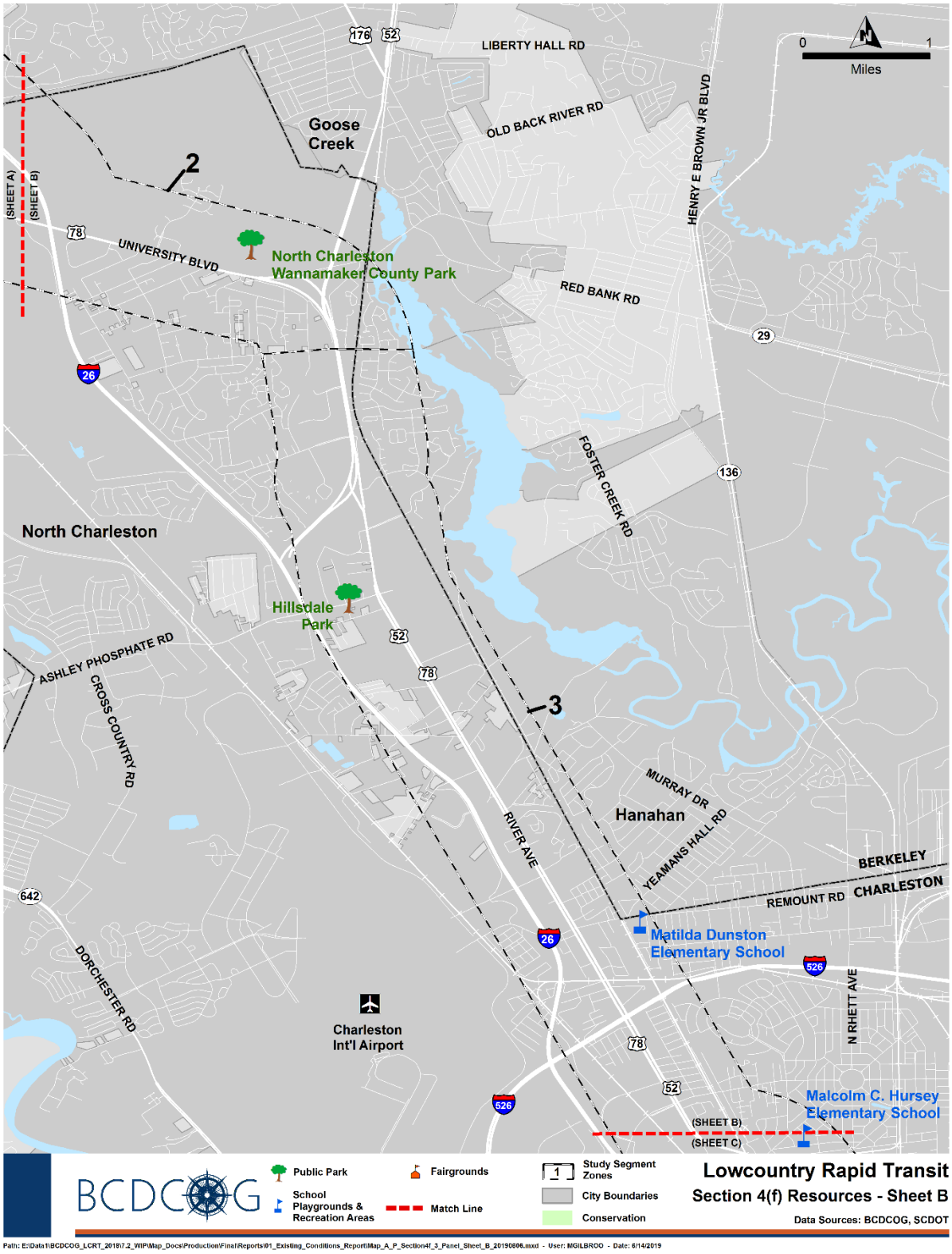

Figure 9.8.2 Locations of parks, trails, school playgrounds, and fairgrounds that are potential Section 4(f) resources in the study area (Sheet B)

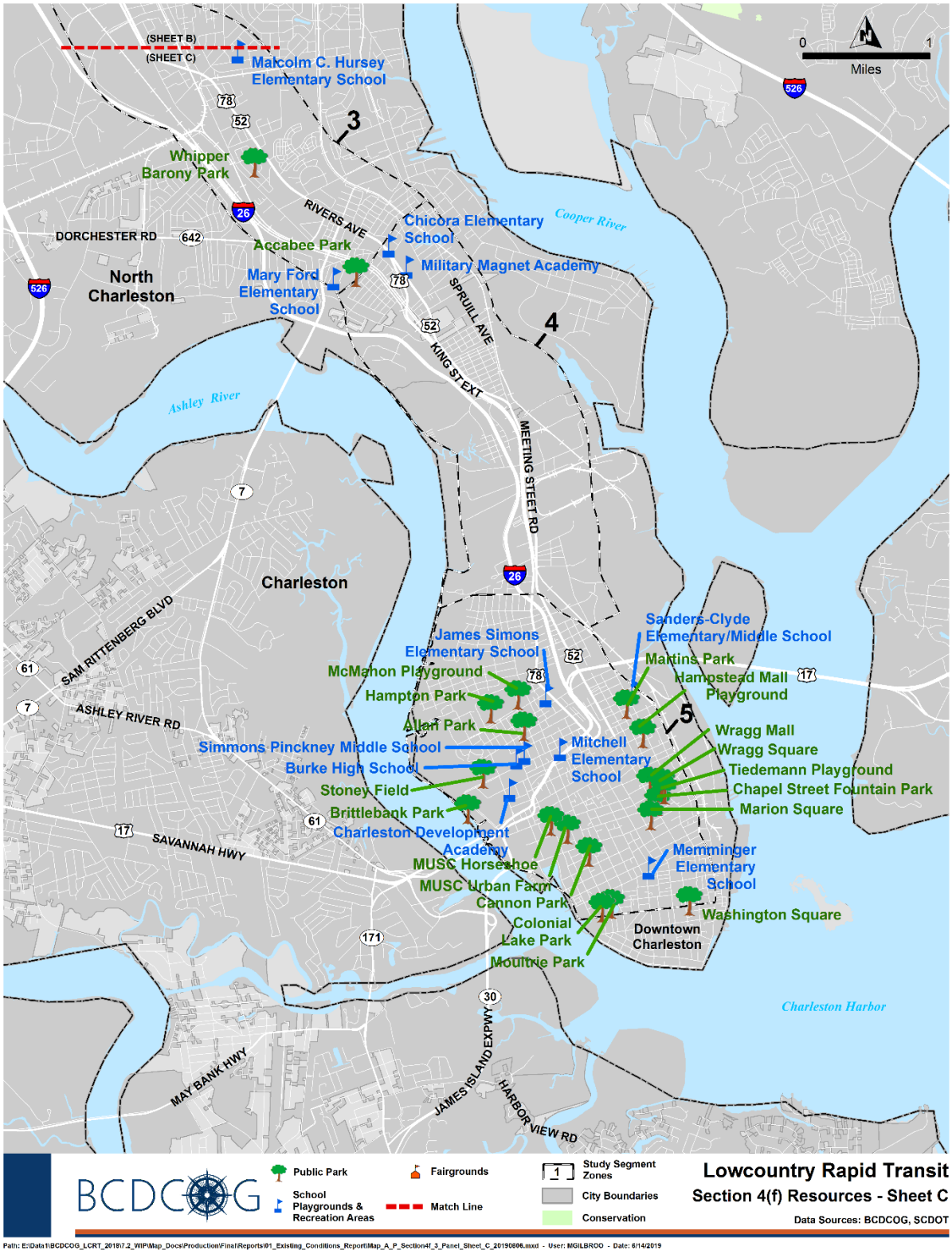

Figure 9.8.3 Locations of parks, trails, school playgrounds, and fairgrounds that are potential Section 4(f) resources in the study area (Sheet C)

9.10.4 Parks and Trails

There are a number of publicly owned parks and one trail in the study area. Table 9.8.1 summarizes these resources. Two of these are in Segment 1 (Summerville), one is in Segment 2 (North Charleston), three are in Segment 3 (North Charleston), and the majority/remainder are in Segment 5 (Charleston). Since these resources are publicly owned parks and trails, they are afforded protection under Section 4(f). Marion Square (Site 38CH1586), Wragg Square (Site 38CH2553), and Wragg Mall (Site 38CH2554) are eligible for listing on the NRHP as archaeological sites. As such, Section 4(f) is applicable to these resources as both publicly owned parks and as significant historic resources.

Table 9.8.3 Publicly Owned Parks and Trails

Segment	City/Town	Name	Notes
1	Summerville	Azalea Park	
1	Summerville	Sawmill Branch Trail	
2	North Charleston	North Charleston Wannamaker County Park	
3	North Charleston	Hillsdale Park	
	North Charleston	Whipper Barony Park	
	North Charleston	Accabee Park	
5	Charleston	Hampton Park	
	Charleston	Stoney Field	
	Charleston	McMahon Playground	
	Charleston	Brittlebank Park	
	Charleston	Allen Park	
	Charleston	Martins Park	
	Charleston	Mall Playground	
	Charleston	Wragg Mall	Site 38CH2554; NRHP eligible
	Charleston	Wragg Square	Site 38CH2553; NRHP eligible
	Charleston	Tiedemann Playground	
	Charleston	Marion Square	Site 38CH1586; NRHP eligible
	Charleston	MUSC Horseshoe	
	Charleston	Cannon Park	
	Charleston	Washington Park	
	Charleston	Colonial Lake	

9.10.5 School Playgrounds/Recreation Areas

Several schools with associated playgrounds/recreation areas are located within the study area. Table 9.8.2 summarizes these resources. One of these is in Segment 1 (Summerville), one is in Segment 2 (Ladson), three are in Segment 3 (North Charleston), two are in Segment 4 (North Charleston), and six are in Segment 5 (Charleston). While the primary purpose of publicly owned school playgrounds is generally for structured physical education classes and recreation for the students, these properties may also serve significant public recreational purposes and therefore be subject to Section 4(f) requirements. If the playground is open to the general public (during non-school hours and not just to students of the school) for organized recreational purposes such as ballgames and other sporting events, it may be considered open to the public. Publicly owned school playgrounds, running tracks, ball fields, etc. also provide substantial walk-on recreational opportunities for the surrounding community that may qualify as Section 4(f) properties.

Table 9.8.4 Schools

Segment	City/Town	Name
1	Summerville	Alston Middle School
2	Ladson	Ladson Elementary School
3	North Charleston	Matilda Dunston Elementary School
	North Charleston	Malcolm C. Hursey Elementary School
	North Charleston	Mary Ford Elementary School
4	North Charleston	Chicora Elementary School
	North Charleston	Military Magnet Academy
5	Charleston	James Simons Elementary School
	Charleston	Sanders-Clyde Elementary/Middle School
	Charleston	Mitchell Elementary School
	Charleston	Burke High School
	Charleston	Charleston Development Academy
	Charleston	Memminger Elementary School

9.10.6 Fairgrounds

There is one fairground (the Ladson Fair Grounds/Exchange Park/Coastal Carolina Fair in Segment 2 - Ladson) located within the study area. Publicly owned fairgrounds that function primarily for commercial purposes by hosting state or county fairs, horse races, or other commercial ventures are not considered Section 4(f) properties. When fairgrounds are open to the public and function primarily for public recreation other than an annual fair, Section 4(f) applies to those portions of the land determined significant for park or recreational purposes. The general non-annual fair use of this property is not considered to be for park or recreation purposes; therefore, this property does not qualify as a Section 4(f) property.

9.10.7 Historic Properties

While Section 4(f) applies to resources listed and eligible for listing on the NRHP, for the purposes of this document, and to establish a worst-case scenario, resources currently identified as potentially eligible and also unevaluated are being treated as if they are NRHP-eligible. Historic resources are identified in Tables 9.7.1 through 9.7.3 and illustrated on Figures 9.7.1 through 9.7.4, located in the Cultural Resources section (Chapter 9.7).

As noted in Chapter 9.7, a total of 155 historic architectural resources have been previously identified within the study area. The majority of the historic architectural resources are located in the southern portion of the study area, in Segment 5 (Charleston). Only one of the historic architectural resources is located in Berkeley County, and three are located in Dorchester County.

There are three previously identified NRHP-listed cemeteries and 11 historic districts within the study area. The three NRHP-listed cemeteries are all located in the Charleston area (Segment 5). Historic districts include one historic district in Segment 1 (Summerville Historic District) and 10 historic districts in Segments 4 and 5 (Charleston Cemeteries Historic District, Charleston Naval Hospital Historic District, Charleston Old and Historic District [Boundary Increase], Charleston's French Quarter District, Hampton Park Terrace Historic District, Proposed Expansion to Charleston Historic District, Standard Oil Company Headquarters, William Aiken House and Associated Railroad Structures, William Enston Home, and the Wilson Tract District).

Magnolia Cemetery

Within the study area, 54 archaeological sites are eligible for, listed on, or unevaluated for the NRHP. Nearly all of the historic archaeological sites are located in Segment 5 (Charleston). The remaining three archaeological sites are located in the northern and central portions of the study area (Segments 2 and 3).

9.10.8 Next Steps

Moving forward, project planners will work to avoid or minimize impacts to Section 4(f) resources located in the vicinity of the eventual preferred alternative. Continued consultation with the SHPO, local conservation groups, and local communities with ties to these resources will be an important part of this process.

9.11 Air Quality

The Clean Air Act and Amendments of 1990 (CAAA) and the Final Transportation Conformity Rule 40 Code of Federal Regulation (CFR) Parts 51 and 93 direct the EPA to implement environmental policies and regulations that will ensure acceptable levels of air quality. The EPA has established the National Ambient Air Quality Standards (NAAQS) in accordance with the requirements of the CAAA and requirements of the Conformity Rule. The CAAA identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including

protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Attainment of the NAAQS is required by the CAAA.

The EPA has set NAAQS for six principal pollutants, which are called criteria air pollutants. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m3). Table 9.11.1 summarizes the primary and secondary standards.

Table 9.11.1 Primary and Secondary Air Quality Standards

Pollutant		Primary/secondary	Averaging time	Level	Form
Carbon monoxide (CO)		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		Primary/secondary	Rolling 3 month average	0.15 ug/m^3	Not to be exceeded
Nitrogen oxide (NO_2)		Primary	1 hour	100 pbb	98th percentile of 1-hour daily maximum concentrations averaged over 3 years
		Primary/secondary	1 year	53 pbb	Annual mean
Ozone (O_3)		Primary/secondary	8 hours	0.07 ppm	Annual 4th highest daily maximum 8-hour concentration averaged over 3 years
Particulate matter(PM)	$PM_{2.5}$	Primary	1 year	12.0 ug/m^3	Annual mean averaged over 3 years
		Secondary	1 year	15.0 ug/m^3	Annual mean averaged over 3 years
		Primary/secondary	24 hours	35 ug/m^3	98th percentile averaged over 3 years
	PM_{10}	Primary/secondary	24 hours	150 ug/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2)		Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations averaged over 3 years
		Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

9.11.1 Conformity of Regional Transportation Plans and TIP

Ozone is typically not a concern at the project level because it is an area-wide pollutant. As such, it is analyzed as part of a State Implementation Plan (SIP). States are required to develop SIPs that explain how they will meet the requirements of the CAA. The SIP is a plan for implementation, maintenance, and enforcement of the NAAQS, and includes emission limitations and control measures to attain the standards. Since this project is anticipated being federally funded, EPA's conformity regulations apply to this project. The LCRT is included in the CHATS 2040 LRTP. Because Charleston and Berkeley Counties are currently in attainment of all federal air quality standards, conformity analysis is not required for projects in these local plans.

9.11.2 Climate Change and Greenhouse Gases

Gases in the atmosphere can contribute to the greenhouse effect both directly and indirectly. Direct effects occur when the gas itself absorbs radiation. Indirect effects occur when gas influences the lifetime or formation of other gases that affect the radiative balance of the earth. There are both naturally-occurring and man-made (anthropogenic) greenhouse gas (GHG) emissions. Major anthropogenic GHG pollutants include ozone (O_3), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other anthropogenic pollutants in the atmosphere (carbon monoxide (CO), nitrogen oxide (NO_2), volatile organic compounds (VOCs), and aerosols) may also influence radiation exchanges in the atmosphere and participate in formation of the GHG. CO_2 emissions constitute around 80 percent of all GHG. Transportation is one of the major contributors to CO_2 emission production. Transportation sources generate varying amounts of O_3 and its precursors; nitrogen oxides (NO_x) and hydrocarbons (HC) (specifically VOCs), particulate matter (PM) and/or CO emissions, all of which are concerns for human and environmental health.

9.11.3 Affected Environment

This section describes existing conditions in the region for air quality. The study area for air quality is defined as the Berkeley, Charleston, Dorchester (BCD) region. To monitor air quality and attainment status, EPA and SCDHEC maintain a network of monitoring stations that sample ambient air pollutant concentrations and provide data to assess the impact of control strategies. Monitoring data from these stations are stored in EPA's Air Quality Index (AQI) database. The active monitors nearest to the project corridor are located at:

- Station 45-015-1002 located on South Live Oak Drive in Moncks Corner (Ozone)
- Station 45-015-0002 located on River Oak Drive in Goose Creek (Ozone)
- Station 45-0119-0046 located on Bulls Island Road in Awendaw (Ozone, NO2, SO2, BC, Continuous PM2.5, and meteorological conditions).

The AQI was created to enhance the public's understanding of air pollution. This uniform air quality index is used by state and local agencies for reporting on daily air quality to the public. The AQI provides general information to the public about air quality and associated health effects.

An AQI value between 0 and 50 is considered "good" and air pollution poses little or no risk. Values between 51 and 100 are considered "moderate" and air quality is acceptable though there may be a moderate health concern for a very small number of people. AQI values between 101 and 150 are considered "unhealthy for sensitive groups." The general public is not likely to be affected when the AQI is in this range. AQI values greater than 150 considered "unhealthy." The AQI summaries for Berkeley and Charleston Counties are presented in Table 9.11.2.[9]

[9] https://aqs.epa.gov/aqsweb/airdata/download_files.html#Annual

Table 9.11.2 Air Quality Index for Study Area

	Number of days								
County*	Available data	Median AQI	Good	Moderate	CO	Ozone	SO2	PM2.5	PM10
Berkeley	217	31	208	9	0	217	0	0	0
Charleston	264	37	233	31	0	148	0	113	0

*No data listed for Dorchester County

As of 2016, the BCD region is in attainment with all air quality standards in the CAAA.

9.11.4 Recommendations

The BCDCOG has agreed to enter a statewide partnership to proactively address air quality issues before they become a problem. In South Carolina, 45 of the 46 counties are participating in an Early Action Plan, in partnership with the SCDHEC Bureau of Air Quality (BAQ). The Early Action Plan determines what actions must be taken at the state and local level to ensure compliance with recently adopted federal regulations regarding ozone emissions. Berkeley, Charleston, and Dorchester counties have no mandated requirements, but have developed plans for voluntary activities and actions, to maintain current conditions and prepare them for any future problems which may emerge.[10]

Air toxics analysis is a continuing area of research. 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 outcomes as a result of lifetime Mobile Source Air Toxic (MSAT) exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA. The FHWA has developed interim guidance on how to evaluate MSAT in NEPA documents. Based on this guidance, transit projects have a low potential for MSAT effects and would only require a qualitative assessment of emissions. This qualitative assessment should compare, in narrative form, the expected effect of the project on traffic volumes, vehicle mix, or routing of traffic and the associated changes in MSAT for the project alternatives, including no-build, based on vehicle miles traveled, vehicle mix, and speed. It should also discuss national trend data projecting substantial overall reductions in emissions due to stricter engine and fuel regulations issued by EPA.[11]

[10] https://bcdcog.com/air-quality/

[11] https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/index.cfm

9.12 Noise and Vibration

9.12.1 Regulatory Context

The noise and vibration analyses for the LCRT were prepared in accordance with FTA's noise and vibration guidance manual, Transit Noise and Vibration Impact Assessment (FTA 2018). The manual includes noise and vibration assessment methods and impact thresholds. Operation of the project will not be subject to state or local noise regulations. Construction contractors will have to comply with local construction noise limits, if they exist.

9.12.1.1 Noise

Noise is typically defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, speech, or recreation. Sound is what we hear when fluctuations in air pressure occur above and below the standard atmospheric pressure. Three variables define characteristics of noise: level (or amplitude), frequency, and time pattern.

Sound pressure level is expressed in decibels (dB) on a logarithmic scale. Typical sound levels generally fall between 20 and 120 dB, similar to the range of human hearing. A 3 dB change in sound level is widely considered to be barely noticeable in outdoor environments, and a 10 dB change in sound level is perceived as a doubling (or halving) of the loudness.

The frequency of sound is the rate at which fluctuations in air pressure occur and is expressed in cycles per second, or hertz (Hz). Most sounds consist of a broad range of sound frequencies. The average human ear does not perceive all frequencies equally. Therefore, the A-weighted decibel (dBA) scale was developed to approximate the way the human ear responds to sound levels; it mathematically applies less weight to frequencies we do not hear well and applies more weight to frequencies we do hear well. Typical A-weighted noise levels for various types of sound sources are summarized in Figure 9.12.1.

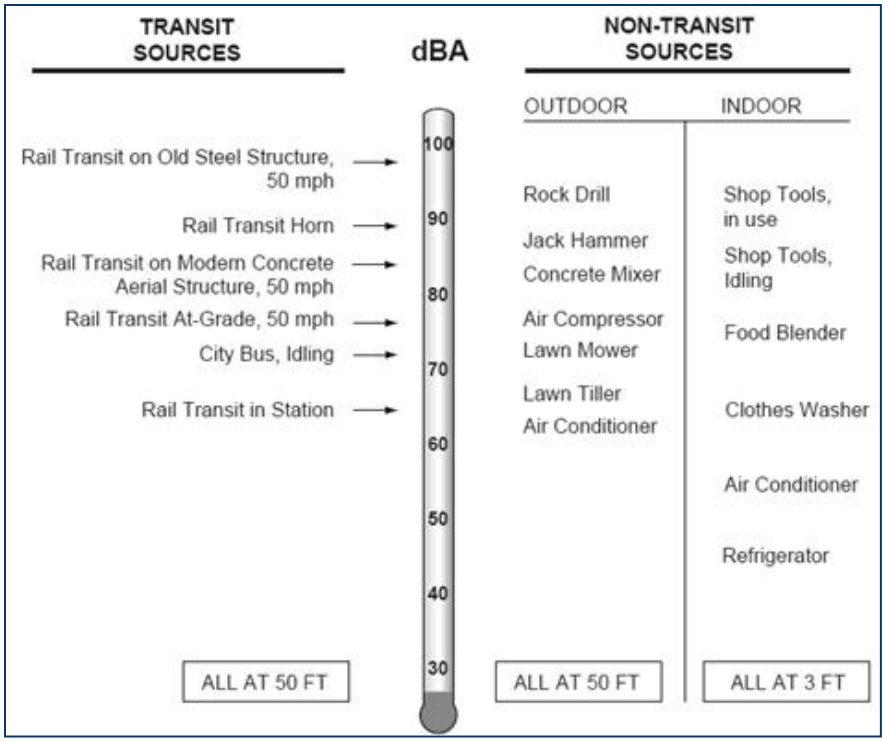

Figure 9.12.1 Typical Noise Levels

Source: FTA 2018.

As stated in the FTA guidance manual (FTA 2018), human reaction to environmental noise depends on the number of noise events, how long they last, and whether they occur during the daytime or nighttime. While the maximum noise level provides information about the amplitude of noise generated by a source, it does not provide any information about how long the noise event lasted. The sound exposure level (SEL) is a noise metric that takes into account both how loud a noise source is and how long the event occurs. The SEL of a noise event is a building block used to determine cumulative noise exposure over a one-hour or 24-hour long period.

Analysts use two primary noise measurement descriptors to assess noise impacts from transit projects. They are the equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}). The L_{eq} is often used to describe sound levels that vary over time, typically for a one-hour period. Using 24 consecutive one-hour L_{eq} values, it is possible to calculate daily cumulative noise exposure. The L_{dn} is a 24-hour cumulative A-weighted noise level that includes all noise that occurs throughout a 24 hour period, with a 10 dBA penalty on noise that occurs during nighttime hours (between 10 PM and 7 AM) where sleep interference might be an issue. The 10 dBA penalty makes the L_{dn} useful when assessing noise in residential areas or other land uses where overnight sleep occurs.

9.12.1.1.1 FTA Transit Noise Criteria

The FTA noise impact criteria are based on well-documented studies regarding community response to noise. These thresholds are based on the land use of the noise-sensitive receptor and existing noise level. The L_{dn} is used to assess transit-related noise for residential areas and

land uses where overnight sleep occurs (Land Use Category 2), and the one-hour L_{eq} [$L_{eq(h)}$] is used to assess impact at locations with daytime and/or evening use (Land Use Category 1 or 3), as shown in Table 9.12.1.

Table 9.12.1 FTA Noise Land Use Categories

Land use category	Noise metric (dBA)	Description of land use category
1	Outdoor $L_{eq(h)}$	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq(h)}$	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

Source: FTA 2018.
Notes: Outdoor $L_{eq(h)}$ uses the noisiest hour of transit-related activity during hours of noise sensitivity

The FTA noise impact criteria are defined by two curves that allow a varying amount of project noise based on the existing noise level, as shown in Figure 9.12.2. Below the lower curve, a project is considered to have no impact because the introduction of the project noise would result in an insignificant increase in noise level and number of people highly annoyed. The two degrees of noise impact defined by the FTA criteria are defined as follows:

- **Severe Impact**: In the severe impact range, a large percentage of people would be highly annoyed by the project noise. Noise mitigation will normally be specified for severe impact areas unless it is not feasible or reasonable (meaning there is no practical method of mitigating the impact or mitigation measures are cost-prohibitive).
- **Moderate Impact**: In the moderate impact range, changes in the cumulative noise level are noticeable, but may not be sufficient to cause strong, adverse reactions from the community. In this range, other project-specific factors are considered to determine the magnitude of the impact and the need for mitigation. Other factors include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost-effectiveness of mitigating noise to more acceptable levels.

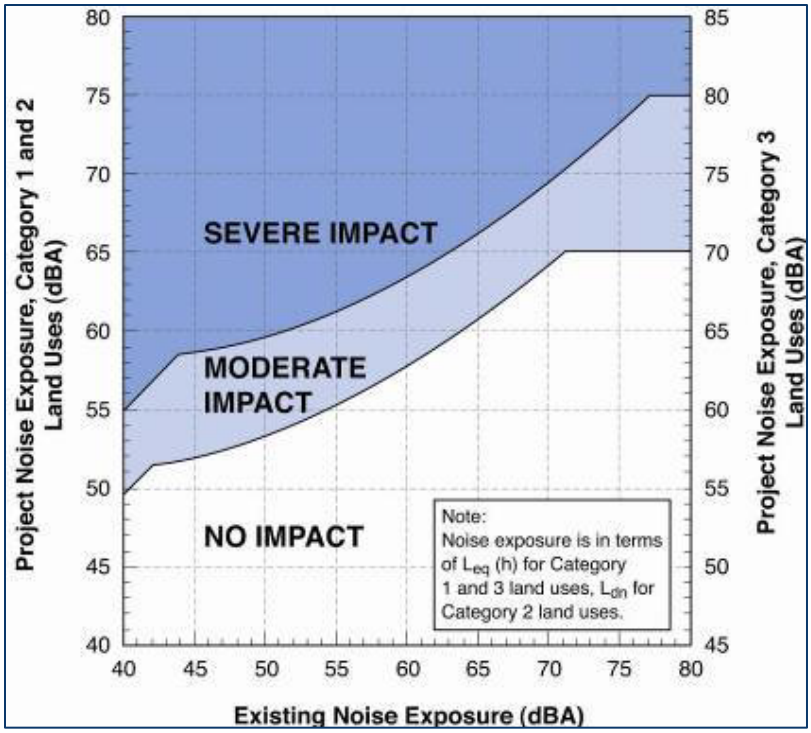

Figure 9.12.2 FTA Noise Impact Criteria

Source: FTA 2018

9.12.1.1.2 FTA Construction Noise Criteria

FTA's guidance manual does not provide standardized criteria for construction noise impacts. However, the manual suggests that the guidelines in Figure 9.12.2 are reasonable criteria for assessment. These construction noise criteria are intended to be compared with the combined $L_{eq(h)}$ of the two noisiest pieces of construction equipment during one hour.

Table 9.12.2 FTA Construction Noise Criteria

Land use	Daytime noise limit (dBA)	Nighttime noise limit (dBA)
Residential	90	80
Commercial and industrial	100	100

Source: FTA 2018.
Note: Noise limit is the combined $L_{eq(h)}$ of the two noisiest pieces of construction equipment during one hour.

9.12.1.2 Vibration

Ground-borne vibration (GBV) consists of rapidly fluctuating motions of the ground transmitted into a receptor (building) from a vibration source, such as transit trains. FTA uses vibration velocity to describe vibration levels for transit projects.

The root mean square (RMS) amplitude of a motion over a one-second period is commonly used to predict human response to vibration. The vibration velocity level is expressed in terms of vibration decibels (VdB), which is decibels relative to a reference quantity of one-micro-inch

per second. The level of vibration represents how much the ground is moving. The background vibration level in residential areas is usually 50 VdB or lower—well below the threshold of perception for humans, which is around 65 VdB. Annoyance begins to occur for frequent transit events at vibration levels over 70 VdB.

Vibration frequency is also expressed in Hz, and the human response to vibration generally falls between 6 and 200 Hz. Human response to vibration is a function of the average motion over a period of time, such as one second. Human response to vibration also roughly correlates to the number of vibration events during the day. The more events that occur, the more sensitive humans are to vibration. Figure 9.12.3 illustrates common vibration sources and associated human and structural responses to GBV.

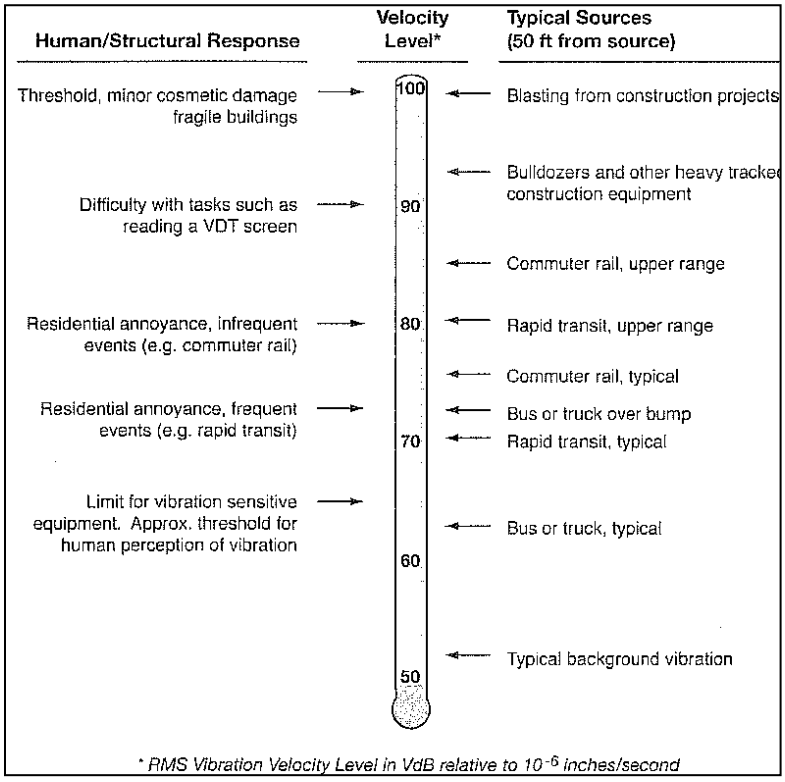

Figure 9.12.3 Typical Vibration Levels

Source: FTA 2018

9.12.1.2.1 FTA Transit Vibration Criteria

FTA identifies separate criteria for both GBV and ground-borne noise (GBN). GBN is often masked by airborne noise; therefore, GBN criteria are primarily applied to subway operations in which airborne noise is negligible. FTA differentiates vibration-sensitive land uses into three distinct categories—similar but not identical to the noise-sensitive land use categories, as shown in Table 9.12.3. The vibration thresholds vary based on the land use and the frequency of the vibration events. The proposed LCRT would include approximately 116 bus pass-by events depending on the weekday, subjecting the study area to the frequent event thresholds.

Table 9.12.3 FTA Vibration Impact Criteria

Land use category	Frequent events[a]	Occasional events[b]	Infrequent events[c]
	GBV impact level (VdB re 1 micro-inch/second)		
Category 1[d] (highly sensitive, where vibration would interfere with operations)	65	65	65
Category 2 (where overnight sleep occurs)	72	75	80
Category 3 (institutional with primarily daytime use)	75	78	83
GBN impact level (dBA re 20 micropascals)			
Category 2 (where overnight sleep occurs)	35	38	43
Category 3 (institutional with primarily daytime use)	40	43	48

Source: FTA 2018.

[a] Frequent events is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall in this category.

[b] Occasional events is defined as between 30 and 70 vibration events of the same source per day. Most commuter rail trunk lines have this many operations.

[c] Infrequent events is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.

[d] The Category 1 criteria limits are based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Vibration-sensitive equipment is generally not sensitive to GBN.

9.12.1.2.2 FTA Construction Vibration Criteria

Vibration attributable to construction activities is usually temporary. Thus, the principal concern for construction vibration is potential damage to structures. Table 9.12.4 lists damage criteria that can be applied to protect sensitive or fragile structures. These criteria can be used to identify locations that should be considered more carefully during the LCRT's final design phases.

Table 9.12.4 FTA Vibration Damage Criteria

Building category	Peak particle velocity (inch/second)	RMS velocity (VdB)
I. Reinforced-concrete, steel, or timber (no plaster)	0.50	102
II. Engineered concrete and masonry (no plaster)	0.30	98
III. Non-engineered timber and masonry buildings	0.20	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: FTA 2018

Note: RMS velocity is provided as a reference to the general magnitude of vibration, compared with the operational vibration impact thresholds; assumes a crest factor of 4 (12 VdB).

9.12.2 Affected Environment

9.12.2.1 Noise

Existing conditions were evaluated in accordance with FTA guidelines (2018). A noise screening assessment was performed to determine if noise-sensitive land uses were close enough to the proposed LCRT corridor to justify further evaluation of project-related noise.

This section discusses noise-sensitive land use in the study area and presents noise measurement results.

9.12.2.1.1 Noise Screening Assessment

The noise screening distance for a BRT project without intervening buildings is 200 feet and 100 feet for obstructed views, and any noise-sensitive land uses within this distance from the proposed roadway centerline were evaluated in the general noise assessment. Noise screening contours were overlaid upon digital aerial photographs using GIS technology. The project team evaluated land use data in GIS shape files and determined if any parcels within the FTA noise screening distances can be classified in any of the three noise-sensitive land use categories listed above. Using GIS, the project team counted the number of noise-sensitive parcels, sorted by FTA land use category. This section presents screening results organized by study area segment. Where a segment contains more than one alignment alternative, each alternative is discussed separately.

9.12.2.1.1.1 Segment 1

Segment 1: North Main Street & Richardson Avenue to US 78 & 165 (Berlin G Myers Parkway): This segment is assumed to operate in mixed traffic with one-way service circulating Summerville Square and in curb-side lanes to Berlin G Myers. There are three alignment alternatives in Segment 1. Table 9.12.5 presents the noise screening assessment results for each alignment alternative.

Table 9.12.5 Noise Screening Results for Segment 1

Segment 1	Primary Option	North Option 1	North Option 2	North Option 3
Land Use Category 1	0	0	0	0
Land Use Category 2	3	1	2	5
Land Use Category 3	1	2	2	3

9.12.2.1.1.2 Segment 2

Segment 2: US 78 (Berlin G Myers Parkway to Otranto Road): This segment is assumed to operate in an at-grade semi-exclusive guideway with cross traffic and curb-side lanes. Table 9.12.6 presents the noise screening assessment results for each alignment alternative.

Table 9.12.6 Noise Screening Results for Segment 2

Segment 2	Primary Option	North Option 1	North Option 2	North Option 3
Land Use Category 1	0	0	0	0
Land Use Category 2	87	40	0	0
Land Use Category 3	13	6	1	1

9.12.2.1.1.3 Segment 3

Segment 3: US 52 (Otranto Road to Carner Avenue): This segment is assumed to operate in an at-grade semi-exclusive guideway in the median with cross traffic. Table 9.12.7 presents the noise screening assessment results for this segment.

Table 9.12.7 Noise Screening Results for Segment 3

Segment 3	Noise-sensitive receivers
Land Use Category 1	2
Land Use Category 2	77
Land Use Category 3	19

9.12.2.1.1.4 Segment 4

Segment 4: US 52 (Carner Avenue to Mt. Pleasant Street): This segment is assumed to be a semi-exclusive dedicated guideway. Table 9.12.8 presents the noise screening assessment results for each alignment alternative.

Table 9.12.8 Noise Screening Results for Segment 4

Segment 4	Primary Option	South Option 1	South Option 2	South Option 3	South Option 4	South Option 5	South Option 6	South Option 7
Land Use Category 1	1	0	0	0	0	0	0	0
Land Use Category 2	74	0	0	0	1	0	0	1
Land Use Category 3	14	0	0	0	0	0	0	0

9.12.2.1.1.5 Segment 5

Segment 5: US 52 (Mt. Pleasant Street to Line Street): This segment assumes curb-side mixed traffic operations. There are seven alignment alternatives in Segment 5; however, some of the screening contours overlap due to the proximity of alignment alternatives to other alignment alternatives. Table 9.12.9 presents the noise screening assessment results for each alignment alternative

Table 9.12.9 Noise Screening Results for Segment 5

Segment 5	Primary Option	South Option 1	South Option 2	South Option 3	South Option 4	South Option 5	South Option 6	South Option 7
Land Use Category 1	0	3	3	1	1	2	0	0
Land Use Category 2	90	181	267	858	365	787	636	191
Land Use Category 3	11	31	33	12	24	16	14	8

Figures 9.12.4 through 9.12.6 present noise screening results for the study area.

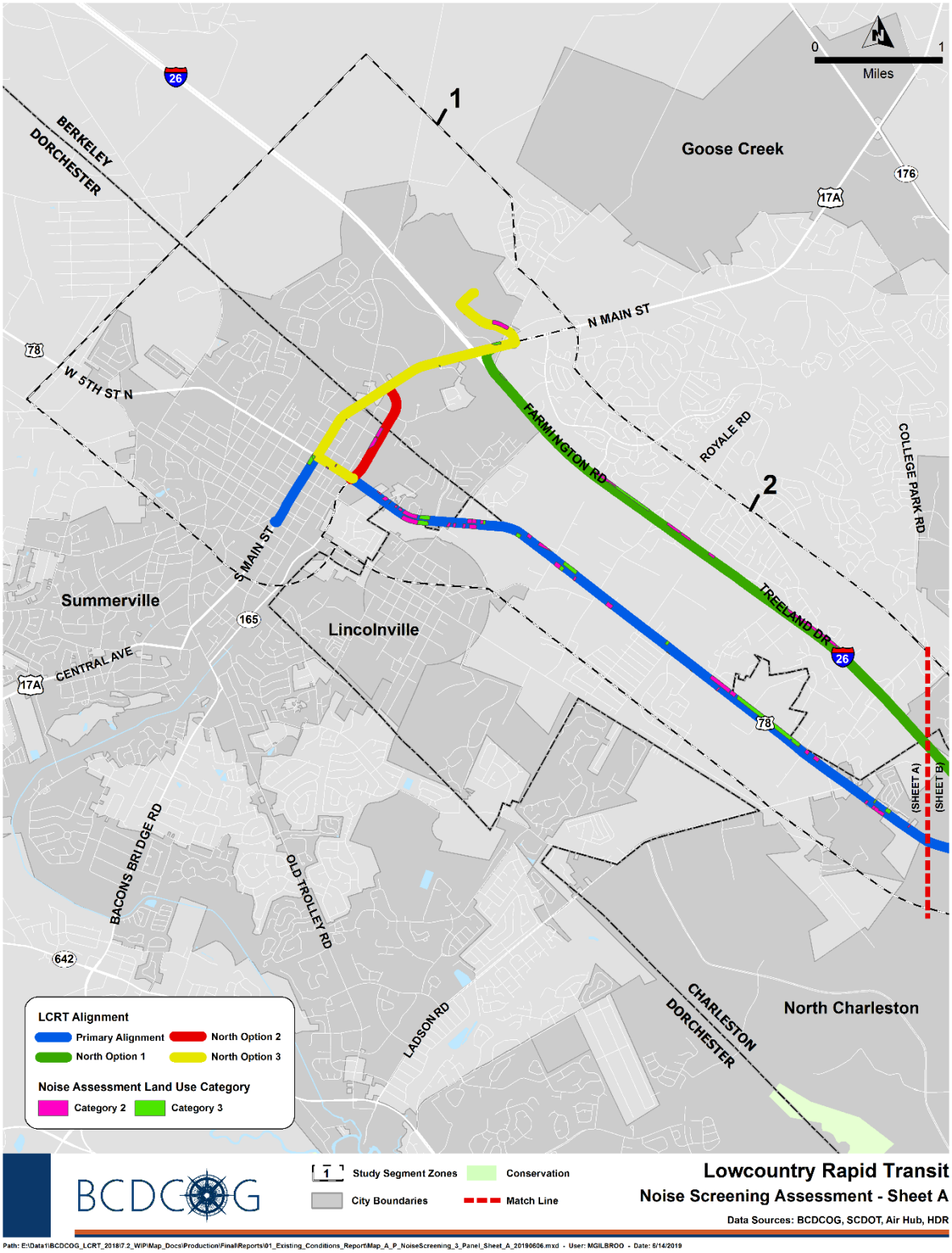

Figure 9.12.4 Noise Screening Assessment (Sheet A)

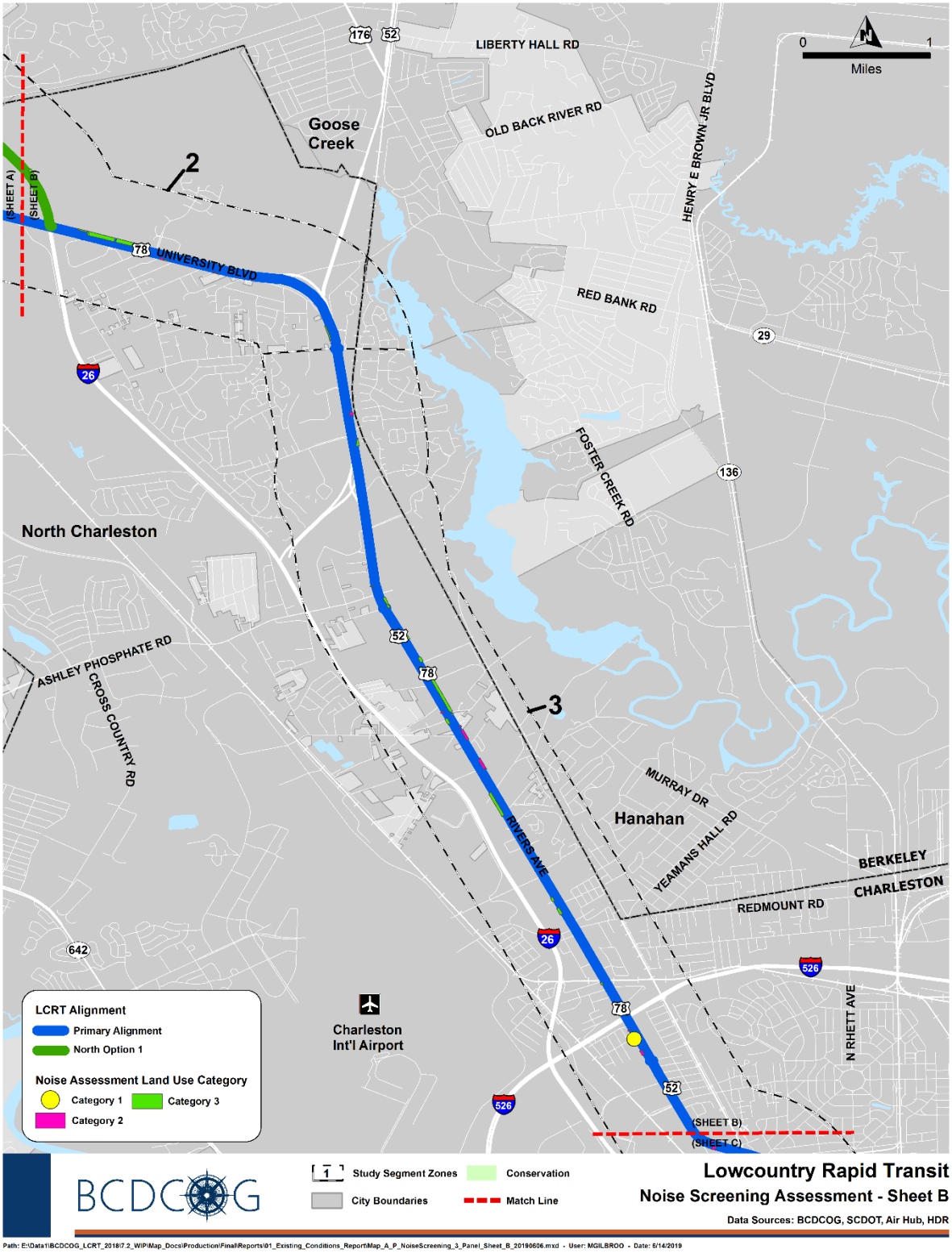

Figure 9.12.5 Noise Screening Assessment (Sheet B)

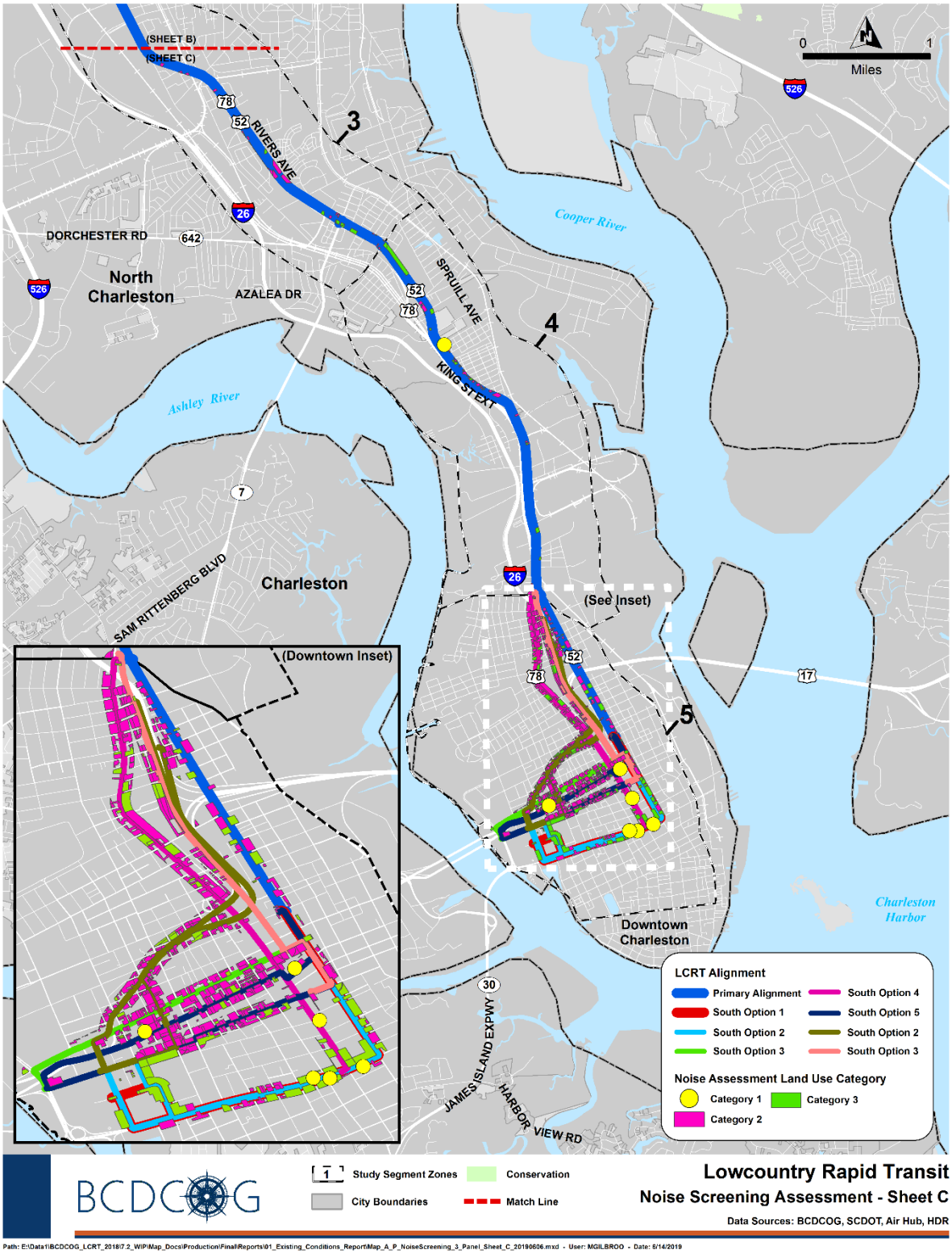

Figure 9.12.6 Noise Screening Assessment (Sheet C)

9.12.2.1.2 Existing Noise Conditions

Results of the noise screening assessments indicate the presence of noise-sensitive land uses with the FTA screening distances. Therefore, a General Noise Assessment will be performed in the next phase of the proposed LCRT, to assess the potential for noise impacts to occur if the project is constructed. To facilitate that impact assessment, existing noise levels will be measured throughout the project area. Table 9.12.10 summarizes the locations recommended for noise measurement.

Table 9.12.10 Recommended Noise Measurement Locations

Property address	Description	Dominant noise source
City of Charleston 642 Meeting St Charleston SC 29403	City government office offset approximately 20 feet from 20-30 mph, moderate traffic road, is situated at road grade.	Bus and pedestrian vehicular traffic on Meeting Street is dominant noise source. Traffic on highway 26 that is one block away at nearest point also contributes. Adjacent to this lot is a private school with potential for added noise during pick-up/drop-off hours.
2109 Thornlee Dr North Charleston SC 29405	Private residence located in residential area, bordered by other homes to the west and heavy five-lane traffic to the east. Situated at road grade approximately 90 feet from heavy traffic road.	Bus and pedestrian vehicular traffic on Rivers Ave/Highway 52 make up Dominant noise source. Commercial activities occurring on Rivers Avenue also contribute to overall sound scape. 3.5 miles north of this location is Charleston International Airport. Air traffic is thus also expected to be a noise source.
761 Meeting St Charleston SC 29403	Single story private residence in a residential area bordered by highway 26 to the west and heavy commercial area to the east. Situated at road grade approximately 50 feet from highway 26.	Dominant noise source is highway traffic from highway 26. Four-lane road cutting through urban business area with plenty of stop and go traffic, Morrison Drive is located 0.1 miles to the east which contributes to the overall sound scape also.
Providence A M E Church 2060 Jacksonville Rd North Charleston SC 29405	Church is located in center of residential block neighboring other homes. The overall block is bordered by two-lane roads with freely flowing traffic (no stop signs/lights), with no commercial area in vicinity. Building is at grade.	Area is relatively quiet, Dominant noise sources are from vehicular traffic on Meeting Street (300 feet west) and Carner Avenue (200 feet east). An industrial warehouse is located 800 feet Southeast, contribution from industrial equipment like forklifts is possible
2020 Emden St North Charleston SC 29406	Private residence located in a residential area, bordered by high traffic, six-lane Highway 52 to the West. General area has some commercial locations, sparsely spread about. Building is located approximately 230 feet from Highway 52 and at grade.	Dominant noise source is high speed, freely flowing traffic from Highway 52. Business areas are sparse and might be minor noise sources. Charleston International Airport is located 2.5 miles, suggesting periodic air traffic can be noise sources also.

Property address	Description	Dominant noise source
Summerville Church of the Nazarene 10825 Highway 78 Ladson SC 29483	Church is located in a suburban residential area with homes, low traffic roads and a limited number of commercial locations in the general vicinity. Building is 300 feet from E 5th N St and located at grade surrounded by yards on all sides.	Dominant noise sources are low speed traffic on three-lane E 5th N St. Nearest four-lane road is Highway 165 located 0.45 miles away from building, with stop and go traffic. This might also contribute to the sound scape of this location.
6311 Lucille Dr North Charleston SC 29406	Private residence located approximately 190 feet from six-lane highway 52 to the East. The west of this location is a neighborhood with rows of homes. A mobile home park is located to the southeast. Building is at grade.	Dominant noise source is traffic from highway 52, restaurants and businesses located on either wise of highway 52 in the vicinity of this location. Human activities at these locations can contribute as noise sources. Additionally, Charleston International Airport is located one mile to the west of this location. Aside from overhead air traffic, noise of aircrafts landing and taking off can also contribute to the soundscape at this location.
Value Place N Charleston Rivers LLC 4835 Rivers Ave North Charleston SC 29406	Hotel building located 140 feet from highway 52. Building is at grade and in the middle of parking lot.	Dominant noise source is traffic from highway 52, Additionally, Charleston International Airport is located 1.6 miles to the northwest of this location. Aside from overhead air traffic, noise of aircrafts landing and taking off can also contribute to the soundscape at this location. A rail line is 0.2 miles away and a railyard 0.25 away. Rail traffic noise and railyard operation noise are likely sources of noise also.
2026 Little Ave North Charleston SC 29405	Private residence located in a residential area neighboring other homes. The block is bordered by four-lane highway 52, which is approximately 110 feet from the building. Building is at grade.	Dominant noise sources are rail yard operations from a rail yard that is about 900 feet northwest of the building. A bus stop is 100 feet away, suggesting buses stopping and starting can contribute to the general soundscape. There is an off-ramp from highway 26 that terminates 700 feet to the northeast. High pitched squeals from vehicles braking can therefore be noise sources. Traffic travelling on Highway 52 is also a source
Mount Olive Missionary Baptist Church of N Chas 2416 Meeting Street Rd North Charleston SC 29405	Church is located on the corner of Meeting Street and Comstock Avenue, and is at grade. The general area is residential with some factories to the west.	A rail track passes 350 feet west of the building. Train pass byes will thus be dominant noise sources. Traffic travelling on four-lane Meeting Street will also be significant noise sources.
Carroll USPF VI Charleston III Springhouse Owner LP 7930 Saint Ives Rd North Charleston SC 29406	Apartment building in a vast park among other apartment buildings. This building is at grade and is approximately 30 feet from St Ives Road	Dominant noise is from traffic from highway 52 which lies about 523 feet from the building. Miller Motte Technical College is about 670 feet northwest. In and out traffic before and after class is likely to contribute to noise scape.

Property address	Description	Dominant noise source
10587 Highway 78 Ladson SC 29483	Private residence is 120 feet east of highway 78. Building is at grade.	General area is rural/residential with plenty of woods. Main noise sources are traffic from two-lane Highway 78. Neighboring this property is an auto shop, vehicles pulling in and out, and noise from operations of the auto shop will also contribute to the noise scape of this location.
3225 Rivers Ave North Charleston SC 29405	Private residence is 130 feet from Rivers Ave, with a surrounding fence. Building is at grade.	Dominant noise for this location comes from Rivers Avenue. Several bus stops are within 500 feet, thus frequent bus stopping, idling and starting is a noise source. 2 rail line lie between 0.2 and 0.25 miles Southwest of the building. Periodic rail traffic is thus a significant source as well.
Pilgrim Baptist Church 5371 Rivers Ave North Charleston SC 29406	Church is on the corner of Taylor St and Rivers Avenue. Building is at grade and fenced with a small yard to the west and parking lot to the north.	This location is about 50 feet away from six-lane Highway 52 and lies in a commercial area. A rail track passes at grade about 120 feet North of the building. The traffic from Highway 52 and rail traffic will be dominant noise sources. Charleston International Airport is approximately one mile to the west. Periodic air traffic is also a noise source, as is aircraft taking off and landing noise.
Intown Suites North Charleston Inc. 8082 Rivers Ave North Charleston SC 29406	Hotel building is located approximately 180 feet from highway 52. A lawn separates the highway from the parking lot of the building. Building is at grade.	This location is close to six-lane highway 52. Stop lights are present in the vicinity. Smooth flowing as well as stop and go traffic from this road will be dominant noise sources. Approximately 400 feet east of this building is a rail line, thus rail traffic will also be a significant noise source for this location.
CSU 9200 University Blvd North Charleston SC 29406	This location is a university, the campus of which is right on highway 78. Several buildings, parking lots and open space make up the campus.	Two main sources of noise for this location are highway 78 which is directly south and highway 26 which is directly east. The interchange for these highways is right on the southeast lot of campus, thus aside from constant speed traffic noise, deceleration and acceleration of vehicles are also noise sources.
561 Meeting St Charleston SC 29401	Private residence that is approximately 27 feet from Meeting Street. Building is at grade and is in an urban residential neighborhood.	The dominant sources of noise for this location are low speed traffic on Meeting Street(approximately 27 feet east of building) and high speed traffic on highway 26 (approximately 490 feet west of building).
2127 W Jimtown Dr North Charleston SC 29405	This location is a private residence located at the north bend of North Jimtown Drive. The building is approximately 40 feet from the N Jimton Drive and at grade.	Main noise sources for this location are traffic from highway 78, which is 260 north of the building. About 600 feet north are a group of auto shops, the operations of which can produce significant amounts of noise. 470 feet northeast is a rail track, and 1,400 feet northwest is a rail yard. Rail traffic and rail yard operation are also significant noise sources.

Property address	Description	Dominant noise source
8823 Antler Dr North Charleston SC 29406	This location is a private residence located on the north bend of Antler drive. The building is at grade, and an unobstructed line of sight exists between this location and highway 78.	This location is in a suburban residential area, with other residences in most directions. The only exception to this is highway 78 that is approximately 255 feet from it. The dominant noise source is thus traffic noise from highway 78. There may be minor contribution from living activities of neighbors.
CBSLC LLC 8915 University Blvd North Charleston SC 29406		
SE Combined Service of South Carolina Inc. 7113 Rivers Ave North Charleston SC 29406	This location is a cemetery and funeral home with plenty of open space. It is between highway 26 on the west and highway 52 on the east.	Dominant noise sources for this location are traffic from highway 52 and highway 26. Operations of commercial locations in the vicinity will act as a noise source also.
Charleston County School District 2950 Carner Ave North Charleston SC 29405	This location is a military academy that is 190 feet from Carner Avenue. The building is at grade.	The main noise sources for this location is traffic from four-lane highway 78 that is approximately 380 feet east of the location and Carner Avenue.
Town of Summerville 200 S Main St Summerville SC 29483-6010	This location is a multi-story administrative building that lies on the corner of W Richardson Avenue and S Main St. It is in a suburban, commercial/residential area.	The main noise sources for this location are traffic from W Richardson Avenue and S Main St. There are also two bus stops in the vicinity, which suggests stopping, idling and starting of bus traffic will also contribute to the noise scape.
303 Watergrass St Summerville SC 29486	This location is an undeveloped lot located 0.3 miles from highway 61/Beech Hill Road.	The general area of this location is undeveloped/rural/residential. Traffic of nearby roads like Beech Hill Road and Boonehill Road are the dominant noise sources.
Kingfisher Investments III LLC 151 Meeting St Ste 600 Charleston SC 29401-2233	This location is a multi-story office building. It is on the corner of Meeting Street and Horlbeck Alley.	This location is in a downtown - commercial area. Downtown traffic from Meeting Street and Horlbeck Alley will be the main noise sources.
New Beginnings Christian Church of the Lowcountry PO Box 1108 Ladson SC 29456-1108	This location is a church at the end of a long driveway, 300 feet from highway 78.	This location is in a suburban residential area, with neighborhoods and woods in all directions. The main source of noise for this location will be from vehicles travelling on highway 78. High speed traffic from highway 26 approximately 0.7 miles away will also be a significant source.
100 Magnolia St Ladson SC 29456-3506	This location is a private residence on the corner of Magnolia Street and highway 78. The building of this location is about 110 feet from the intersection of these streets.	The general area of this location is rural/residential. The dominant noise source for this location will be traffic travelling on two-lane highway 78.

Figure 9.12.7 illustrates the recommended noise measurement locations.

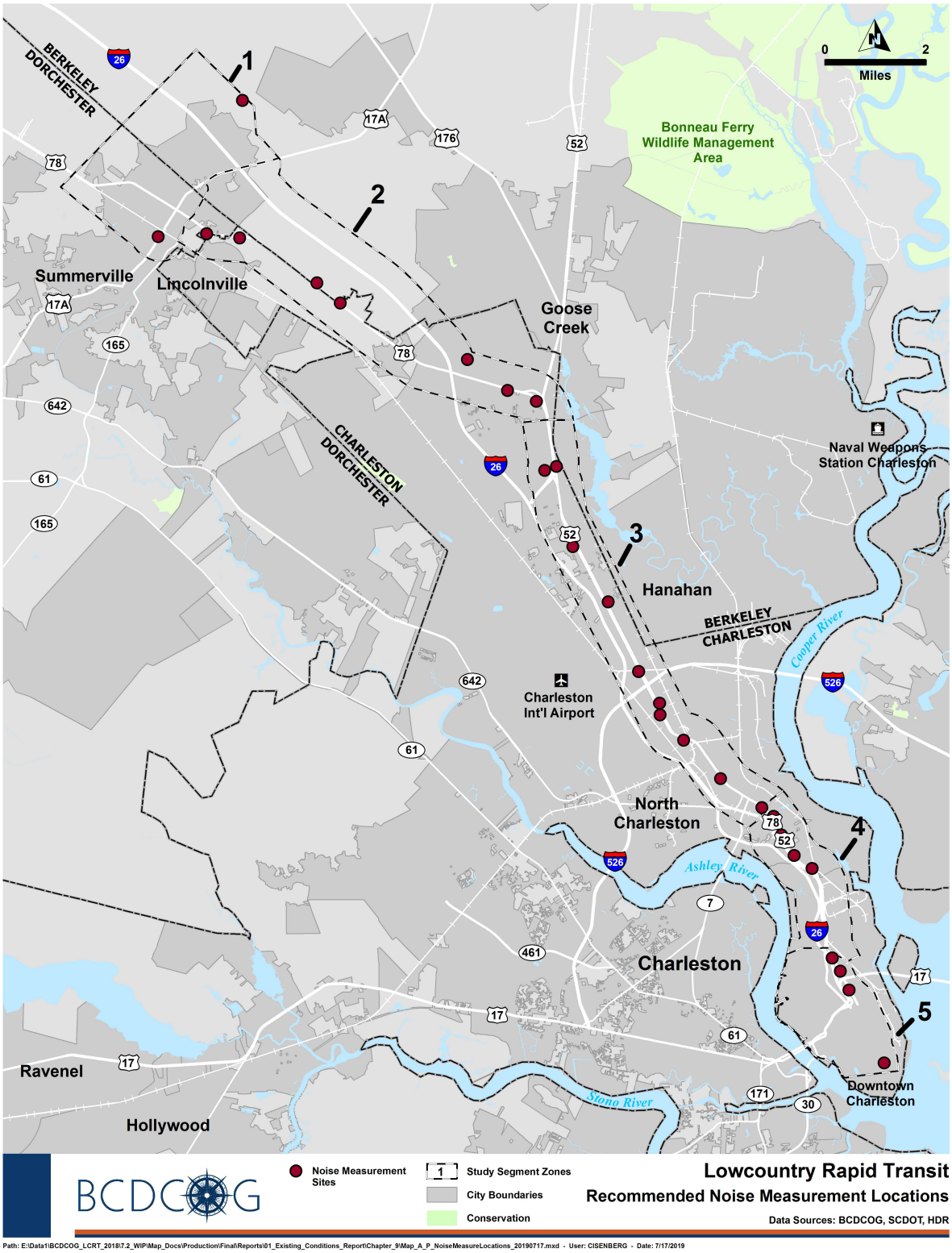

Figure 9.12.7 Recommended Noise Measurement Locations

9.12.2.2 Vibration

This section discusses vibration-sensitive land uses in the study area.

9.12.2.2.1 Vibration-Sensitive Land Use and Vibration Screening

The vibration screening distances for a BRT project are 100 feet for Category 1 receptors, 50 feet for Category 2 receptors, and 0 feet for Category 3 receptors. Using those distances, vibration screening contours were overlaid upon digital aerial photographs using GIS technology. The project team evaluated land use data in GIS shape files and determined if any parcels within the FTA vibration screening distances can be classified in any of the vibration-sensitive land use categories listed above. Using GIS, the project team counted the number of vibration-sensitive parcels, sorted by FTA land use category. The following sections discuss the results of the vibration screening assessment.

9.12.2.2.1.1 Segment 1

Segment 1: North Main Street & Richardson Avenue to US 78 & 165 (Berlin G Myers): This segment is assumed to operate in mixed traffic with one-way service circulating Summerville Square and in curb-side lanes to Berlin G Myers. There are three alignment alternatives in Segment 1. The table below presents vibration screening assessment results for each alignment alternative in this segment.

Table 9.12.11 Vibration Screening Results for Segment 1

Segment 1	Primary Option	North Option 1	North Option 2	North Option 3
Special Buildings	0	0	0	0
Land Use Category 1	0	0	0	0
Land Use Category 2	1	1	1	2
Land Use Category 3	0	0	0	0

9.12.2.2.1.2 Segment 2

Segment 2: US 78 (Berlin G Myers Parkway to Otranto Road): This segment is assumed to operate in an at-grade semi-exclusive guideway with cross traffic and curb-side lanes. Table 9.12.12 presents vibration screening assessment results for this segment.

Table 9.12.12 Vibration Screening Results for Segment 2

Segment 2	Vibration-sensitive Receivers
Special Buildings	0
Land Use Category 1	0
Land Use Category 2	43
Land Use Category 3	0

9.12.2.2.1.3 Segment 3

Segment 3: US 52 (Otranto Road to Carner Avenue): This segment is assumed to operate in an at-grade semi-exclusive guideway in the median with cross traffic. Table 9.12.13 presents vibration screening assessment results for this segment.

Table 9.12.13 Vibration Screening Results for Segment 3

Segment 3	Vibration-sensitive Receivers
Special Buildings	0
Land Use Category 1	0
Land Use Category 2	7
Land Use Category 3	0

9.12.2.2.1.4 Segment 4

Segment 4: US 52 (Carner Avenue to Mt. Pleasant Street): This segment is assumed to be a semi-exclusive dedicated guideway. Table 9.12.14 presents vibration screening assessment results for this segment.

Table 9.12.14 Vibration Screening Results for Segment 4

Segment 4	Vibration-sensitive Receivers
Special Buildings	0
Land Use Category 1	0
Land Use Category 2	13
Land Use Category 3	0

9.12.2.2.1.5 Segment 5

Segment 5-US 52 (Mt. Pleasant Street to Line Street): This segment assumes curb-side mixed traffic operations. There are seven alignment alternatives in Segment 5; however, some of the screening contours overlap due to the proximity of alignment alternatives to other alignment alternatives. Table 9.12.15 presents vibration screening assessment results for each alignment alternative in this segment.

Table 9.12.15 Vibration Screening Results for Segment 5

Segment 5	Primary Option	South Option 1	South Option 2	South Option 3	South Option 4	South Option 5	South Option 6	South Option 7
Special Buildings	0	6	6	2	1	3	0	0
Land Use Category 1	0	0	0	0	0	0	0	0
Land Use Category 2	45	112	197	527	173	508	260	61
Land Use Category 3	0	0	0	0	0	0	0	0

Figures 9.12.8 through 9.12.10 present the vibration screening results for the study area.

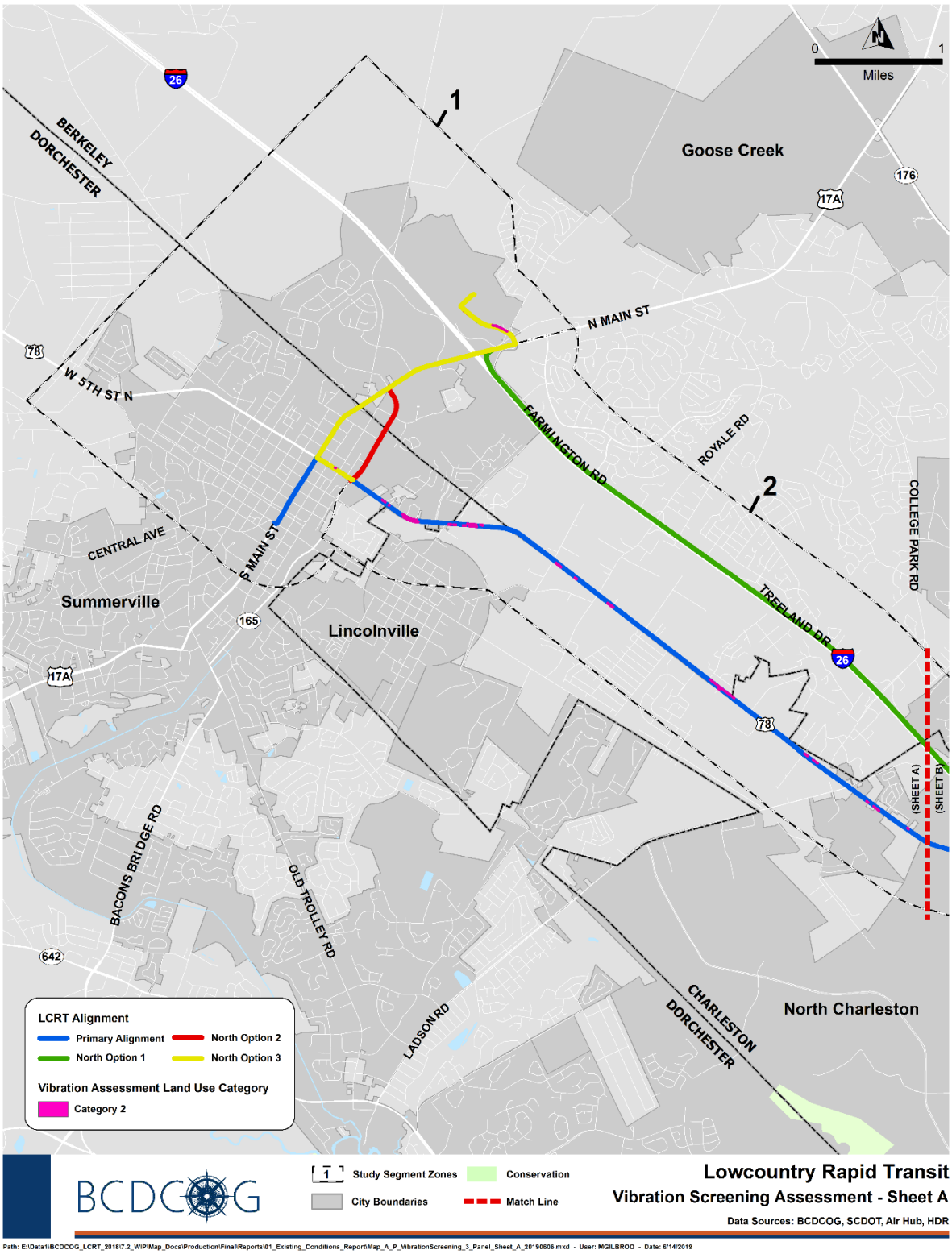

Figure 9.12.8 Vibration Screening Assessment (Sheet A)

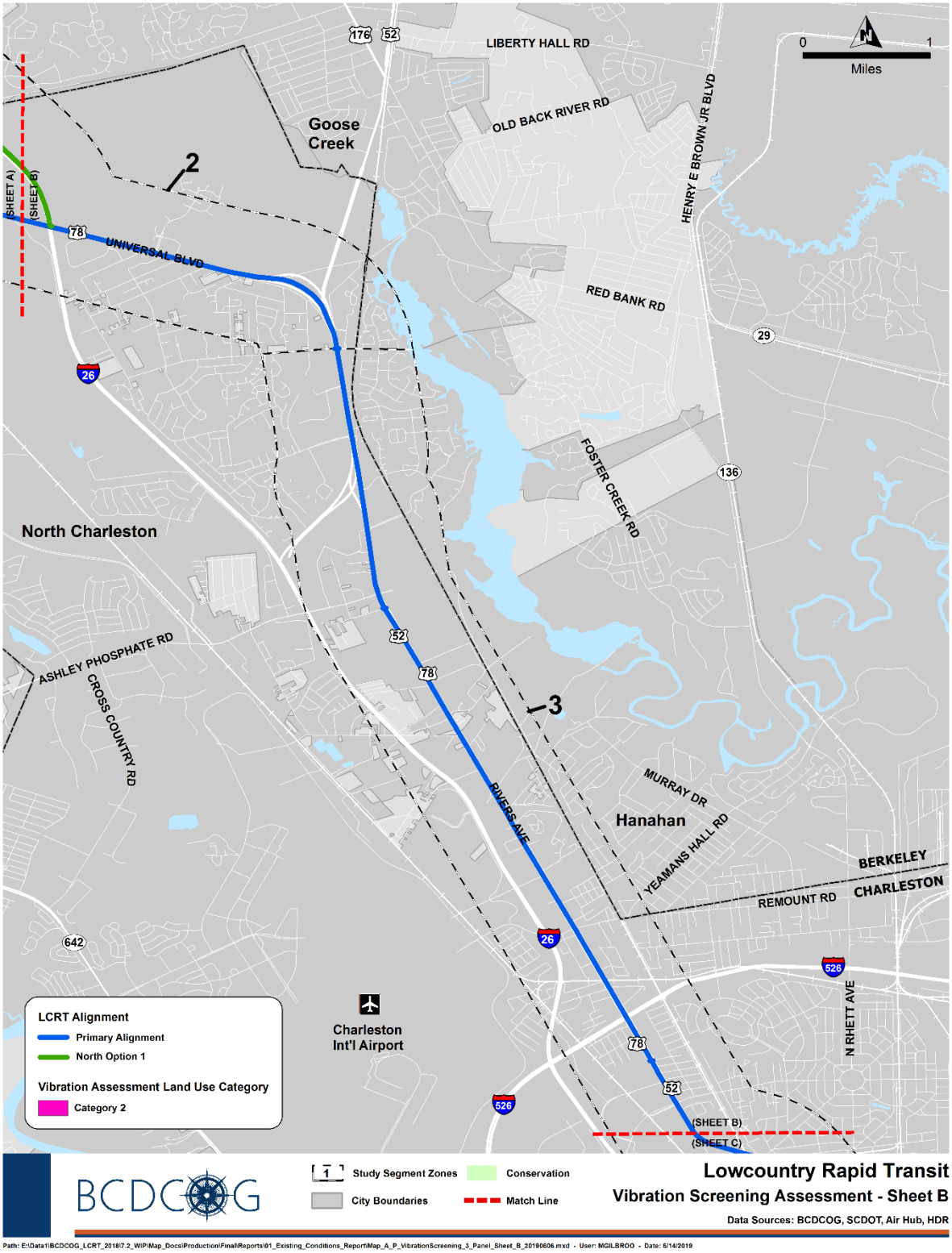

Figure 9.12.9 Vibration Screening Assessment (Sheet B)

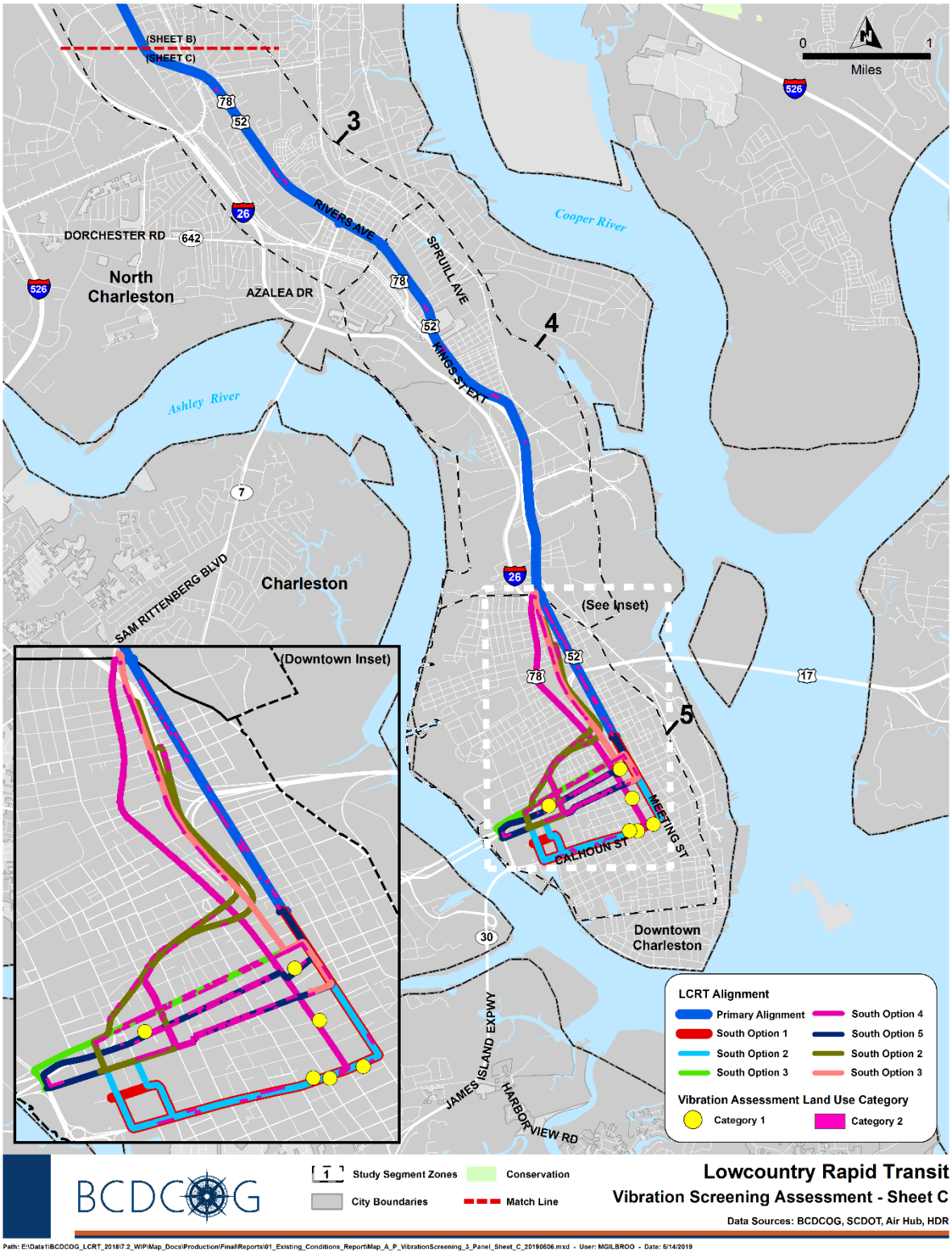

Figure 9.12.10 Vibration Screening Assessment (Sheet C)

Results of the vibration screening assessments indicate the presence of vibration-sensitive land uses with the FTA screening distances. Therefore, a General Vibration Assessment will be performed in the next phase of the project to assess the potential for vibration impacts to occur if the LCRT is constructed.

9.12.2.2.2 Existing Vibration Conditions

Existing vibration sources in the study area include traffic on local streets. The General Vibration Assessment does not evaluate increases over existing vibration levels. Therefore, existing vibration levels were not measured.

9.13 Energy

It has long been recognized that energy efficiency brings other benefits in addition to the reduction of energy consumption. Benefits of energy efficiency include things such as reduced climate change impact, reduced air pollution, improved health, improved indoor conditions, improved energy security, and reduction of price risk for energy consumers.[12] These are important considerations when evaluating the energy use of various transportation modes and the need to reduce reliance on transportation modes with high energy consumption.

South Carolina's overall energy consumption continues to be dominated by growth in the transportation sector. South Carolina's transportation sector was responsible for the second largest share of end-use energy consumption in 2013, and accounted for 28.5 percent of the State's energy usage at the point of consumption. "Transportation" includes energy usage in all air and ground-based vehicles fueling in the state. Automobiles are responsible for the majority of energy consumption in South Carolina's transportation sector. Total motor gasoline consumption increased by 2.4 percent in 2013. Some of the additional consumption was fuel ethanol, which increased by 2.9 percent; largely through gasoline-ethanol mixes, such as E10. With transportation being the largest petroleum consuming sector, motor gasoline is by far the most consumed petroleum product. The two petroleum products most regularly used in ground transportation arediesel and motor gasoline. They account for 88.0 percent of petroleum used in the state.[13]

9.13.1 Existing Environment

The LCRT study area consists of five segments based on the guideway assumptions of the project. These segments utilize the following corridors: US 17A/Main Street, SC165/Berlin G Myers Parkway, US 78, US 52/US78/Rivers Avenue, US 52/Meeting Street, US 78/King Street, & Calhoun Street. The existing roadway conditions for those main corridors is listed below.

- **US 17A/Main Street** ranges from a four to six-lane principal arterial between the US 17A & Richardson Avenue intersection and the US 17A & Sangaree Parkway/Brighton Park Boulevard intersection. It serves primarily residential and commercial land uses. The 2017 average SCDOT AADT is 35,475 vehicles per day (vpd). The posted speed limit is 30 miles per hour (mph) between Richardson Avenue and 5th Street, 35 mph between 5th Street and Berlin G Myers Parkway, and 45 mph between Berkeley Circle and

[12] https://en.wikipedia.org/wiki/Efficient_energy_use#Benefits

[13] Office of Regulatory Staff Energy Office, *South Carolina Energy Statistical Highlights,* October 2015.

Sangaree Parkway/Brighton Park Boulevard. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along US 17A ranges between 2 percent to 4 percent.

- **SC165/Berlin G Myers Parkway** is a four-lane minor arterial road between the SC 165 & US 78/5th Street intersection, and the SC 165 & US 17A which primarily serves commercial land uses. The 2017 average SCDOT AADT is 30,250 vpd. The posted speed limit is 45 mph. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along SC 165 ranges from 1 percent to 5 percent. US 78 is a two-lane principal arterial from the intersection at US 17A until the intersection at College Park Road, and serves primarily commercial and residential land uses. The 2017 SCDOT AADT is 15,000 vpd in section two and 39,950 vpd in section three. The posted speed limit is 35 mph between US17A and Berlin G Myers Parkway, 40 mph between Branch Creek Trail and South Pointe Boulevard, and 45 mph after South Pointe Boulevard. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along US 78 ranges from 4 percent to 6 percent.
- **US 52/US 78/Rivers Avenue** is an eight-lane divided principal arterial that primarily serves commercial and residential land uses. The 2017 average SCDOT AADT is 56,700 in section four, 45,600 vpd in section five, 32,200 vpd in section six, and 23,700 vpd in section seven. The posted speed limit is 45 mph between the merge of US 52 & US 78 near the Otranto Boulevard intersection and 35 mph between Otranto Boulevard and the split of US 52 and US 78 at the intersection with Carner Avenue. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along US 52/US78 ranges from 1 percent to 4 percent.
- **US 52/Meeting Street** ranges from a two to four-lane principal arterial which primarily serves commercial and residential land uses. The 2017 SCDOT AADT is 7,767 vpd in section eight and 18,900 vpd in section nine. The posted speed limit is 45 mph between Carner Avenue and Milford Street, 40 mph between Milford Street and Morrison Street, and 30 mph between Morrison Street and Calhoun Street. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along US 52/Meeting Street ranges between 2 percent to 9 percent.
- **US 78/King Street** is a two-lane minor arterial which primarily serves commercial and residential land uses. The 2017 SCDOT AADT is 9,300 vpd. The posted speed limit is 45 mph between Carner Avenue and Azalea Drive, 40 mph between Azalea Drive and Cypress Street, and 30 mph between Cypress Street and Calhoun Street. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along US 78/King Street ranges between 2 percent to 8 percent.
- **Calhoun Street** is a four-lane principal arterial which primarily serves commercial and residential land uses. The 2017 SCDOT AADT is 17,700 vpd and the posted speed limit is 25 mph. Based upon existing turning movement counts, the percentage of heavy vehicles in the study area along Calhoun Street ranges from 1 percent to 7 percent.

Current AADT volumes range from 7767 to 56,700[14] in the study area. The majority of the vehicles are two and four tire vehicles; buses, single unit 2- and 3-axle trucks, and tractor-trailers comprise the remaining vehicles.

The majority of intersections along the corridor are currently operating at a favorable LOS between A-D. Future conditions could worsen as continued growth leads to more vehicles using the corridor. Traffic congestion and the corresponding vehicle idling would result in a low degree of transportation-related energy-efficiency along the corridor. Detailed traffic information can be found in Chapter 8.

9.13.2 Existing Energy Consumption

The existing energy consumption for this study area ranges from approximately 890 million to 6.5 billion British thermal units (BTUs) per day (7,100 to 52,000 gallons of fuel). These calculations are based on an average annual passenger car mileage of 12,000 miles and an average in-use fuel economy of 24.1 miles per gallon (mpg) for passenger cars.[15] Annual fuel consumption along the study area would range from approximately 2.6 million to 19 million gallons. This analysis is based on the 22-mile mainline (US 78 and US 52) only, and therefore the probable fuel consumption will be slightly underestimated.[16] Regional population growth would be expected to continue and would generally lead to an increased demand in transportation needs. This growth would lead to increased vehicle use, increased traffic congestion, and decreased transportation-related energy efficiency in the project corridor and the region.

9.13.3 Potential Energy Reduction

Factors that could influence a reduction in energy consumption include the combination of improved transit operations, possible reductions in single occupancy vehicle passengers who switch to the improved transit system, and amenities being provided by the LCRT system (dedicated lanes/safety, real-time schedule information, accommodation of bicycles, etc.). This increased use of public transportation would result in decreased traffic congestion and vehicle idling, thereby increasing the transportation related energy efficiency within the project corridor for both public transportation and private vehicle use.

9.14 Safety and Security

CARTA, through its contractor Transdev, oversees the operation of transit services throughout the area. It also strives to maintain and improve the safety of commuter operations, reduce accidents and associated costs, and comply with federal and state regulations. In addition, CARTA works diligently to provide for the safety of motorists, bicyclists, and pedestrians while interacting with the transit services as they traverse common corridors.

[14] BCDCOG, Lowcountry Rapid Transit Existing Conditions Technical Report, January 2019

[15] EPA, Office of Transportation and Air Quality, EPA420-F-08-024, October 2008

[16] Fuel consumption per day was based on a 22-mile route divided by an average mpg of 24.1 and multiplied by AADT - annual fuel consumption multiplied the daily consumption by 365 - BTUs were then calculated by multiplying the gallons of fuel by 125,000 BTU per gallon - all numbers rounded

9.14.1 Existing Environment

Existing safety and security issues are described below as they relate to passengers and the communities surrounding the LCRT. There are no statistics regarding criminal activity around stops or on vehicles due to the rarity of these occurrences. However, statistics are compiled to track accidents with respect to transit operations. Table 9.14.1 includes accident statistics for the last five fiscal years.

Table 9.14.1 Accident Statistics for the Last Five Fiscal Years

Statistics	FY2015	FY2016	FY2017	FY2018	FY2019
Total miles	3,174,634	2,935,109	2,776,112	2,845,780	721,616
Total hours	224,607	209,274	202,056	207,417	54,460
Total passengers	4,887,032	4,055,835	3,589,047	3,113,766	770,280
Accidents					
Total revenue vehicle	151	194	179	118	42
Preventable street	34	44	55	36	19
Preventable yard	7	5	6	2	0
Total preventable	41	49	61	38	19
Accidents per 100,000 miles					
Total revenue vehicle	5.0	6.6	6.4	4.1	5.8
Preventable street	1.7	1.5	2.0	1.3	2.6
Total preventable	2.1	1.7	2.2	1.3	2.6

Source: CARTA, 2019

Crime statistics were obtained for Charleston and North Charleston via online research and are summarized in Table 9.14.2.

Table 9.14.2 Crime Statistics for Jurisdictions along the Corridor[17]

Jurisdiction	Incident rate*	Total incidents
City of Charleston	27.78	3747
City of North Charleston	66.59	7382
City of Summerville	37.55	1892
City of Hanahan	18.89	470

*Incident rate per 1,000

Increased criminal activity, passenger safety, and impeded emergency vehicle access are concerns of communities within the study area. Previous studies regarding safety before and after the introduction of transit systems are mixed, with some suggesting that stations are as safe as surrounding commercial activity centers or places where people congregate. Others

[17] https://www.neighborhoodscout.com

suggest that there is a direct correlation between increases in crime and proximity to transit. The majority of these crimes are non-violent acts, such as vandalism and theft.[18]

A summary of the existing public safety services by location is presented in Table 9.14.3 and illustrated on Figure 9.14.1. There are multiple fire stations, police stations, and hospitals in close proximity to the study corridor that provide emergency services to area residents.

Table 9.14.3 Police, Fire, and Emergency Service Locations by Jurisdiction

Station/public service	Location
North Charleston Fire Department	2500 City Hall Lane
Station 1	4830 Jenkins Avenue
Station 2	1791 Reynolds Avenue
Station 3	2014 Remount Road
Station 4	7270 Cross County Road
Station 5	6265 Dorchester Road
Station 6	8100 Rivers Avenue
Station 7	3690 Leeds Avenue
Station 8	2630 Meeting Street
Station 9	8303 Deerwood Drive
Station 10	7159 Stall Road
Station 11	9002 Dorchester Road
Station 12	9546 Palmetto Commerce Parkway
Charleston Fire Department/Station 9	1791 Reynolds Avenue
Station 2	262 Meeting Street
Station 3	264 Meeting Street
Station 6	5 Cannon Street
Station 8	370 Huger Street
Station 15	162 Coming Street
Summerville Fire Department	101 West Butternut Road
Station 1	300 West 2nd North Street
Station 2	161 Sheep Island Road
C&B Fire Department	1105 Yancey Street
Pine Ridge Fire Department	565 Myers Road
Caromi Fire Department	554 College Park Road
Goose Creek Fire Department	101 Button Hall Avenue

[18] https://sites.duke.edu/urbaneconomics/?p=1215

Station/public service	Location
Goose Creek Rural Fire Department	907 Red Bank Road
Hanahan Fire Department	5826 Campbell Street
Hanahan Police Department	1255 Yeamans Hall Road
Summerville Police Department	300 West 2nd North Street
Goose Creek Police Department	519 Goose Creek Boulevard
North Charleston Police Station	2500 City Hall Lane
North Charleston Police South	3401 Rivers Avenue
Charleston Police Department	180 Lockwood Boulevard
Trident Medical Center	9330 Medical Plaza Drive
St. Francis Hospital	2095 Henry Tecklenburg Drive
Roper Hospital	316 Calhoun Street
MUSC Medical Center	135 Rutledge Avenue

9.14.2 Safety and Security Benefits

New dedicated transit lanes, restriping of existing lanes for transit operations, and transit signal priority at intersections would lead to improved service that could entice some drivers to choose public transit for commuting. This could theoretically reduce the potential for traffic accidents. Average travel times and reduced travel delays along the corridor could be expected as a result of fewer vehicles using the roadway, which would provide improved access for emergency services.

The proposed transit route is part of an existing transportation corridor already used by buses and other vehicles, and is not anticipated to increase the number of crimes occurring on existing transit-owned properties or service corridors. Police presence and access to emergency services will continue to be available to area residents.

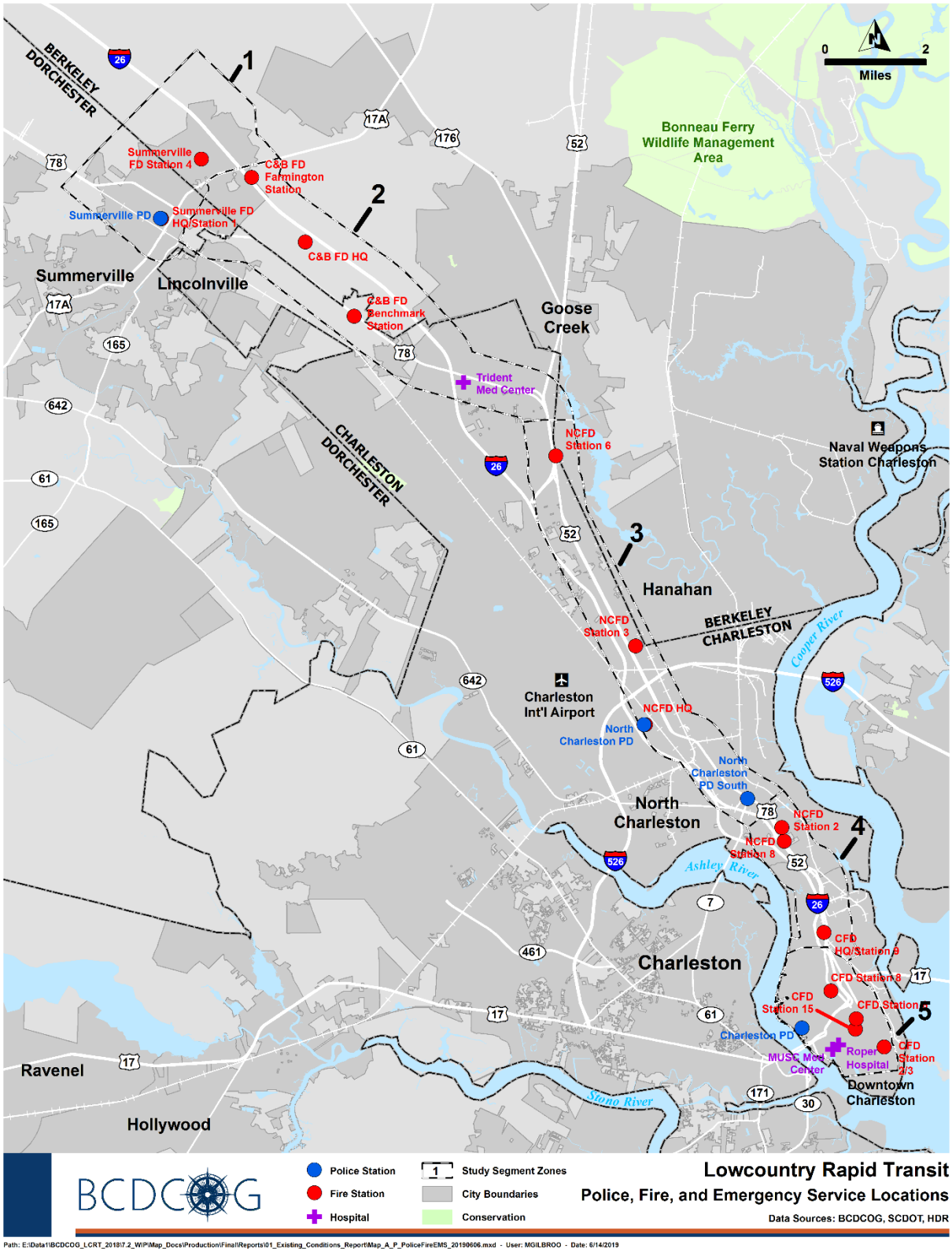

Figure 9.14.1 Police, Fire, and Emergency Service Locations

9.15 Geology and Soils

This section describes the existing geology, topography, and soils in the study area. The geology of an area includes bedrock materials, mineral deposits, soils, paleontological resources, and unique geological features. Topography is typically described with respect to the elevation, slope, aspect, and surface features found within a given area. Soils are the unconsolidated mineral or organic material on the immediate surface of the earth. Soil erosion potentially impacts soils, water resources, and air quality. The degree of erodibility is determined by physical factors such as drainage, permeability, texture, structure, and percent slope. Soil characteristics are an important consideration for the proposed project because soil properties could influence the suitability for construction and potential for erosion.

Local topography in the study area, as shown in the 2014 U.S. Geological Survey (USGS) 7.5-minute series topographic maps (Appendix I), is generally flat with a minimum elevation at sea level in downtown Charleston and gradually rising to approximately 80 feet above sea level in Summerville. The study area is located in the Coastal Plain Province of the Atlantic Plain Region.[19] The Coastal Plain Province is underlain by sedimentary deposits ranging in age from Upper Cretaceous (151 to 66 million years ago (MYA)) to Recent.[20] Most surficial materials consist of marine deposited sediments that were emplaced since the Cretaceous Period (151 to 66 MYA).

According to the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey data, 37.3 percent of the study area is classified as urban land.[21] This soil type is reserved for highly disturbed soils that have resulted from human activities, and have been altered over time through construction activities. The remaining 62.7 percent of the soils in the study area are primarily located in the northern and central portions of the study area (Segments 1-3) (Figure 9.15.1), and are listed in Table 9.15.1 along with slopes and drainage classifications. Soils that are very poorly drained make up 7.4 percent of the study area.

Table 9.15.1 Summary of Soil Types Within the Study Area

Name	Acres within study area	Percent of study area	Drainage classification
Aquic udifluvents (AU)	2.6	Less than 0.1%	Poorly drained
Blanton fine sand, 0-2% slopes (BlA)	19.1	0.1%	Moderately well drained
Blanton fine sand, 2-6% slopes (BlB)	6.2	0.0%	Moderately well drained
Bonneau fine sand, 0-2% slopes (BoA)	256.4	1.1%	Well drained
Bonneau fine sand, 2-6% slopes (BoB)	174.7	0.7%	Well drained
Bonneau loamy sand, 0-2% slopes (BoA)	97.5	0.4%	Well drained
Bonneau loamy sand, 2-6% slopes (BoB)	102.1	0.4%	Well drained
Borrow pits (Bp)	116.1	0.5%	Poorly drained

[19] Fenneman, N. M. (1938). Physiography of the Eastern United States. New York: McGraw-Hill

[20] Cooke, C. (1936) Geology of the Coastal Plain of South Carolina. Retrieved from https://pubs.usgs.gov/bul/0867/report.pdf

[21] USDA-NRCS. (2018). Web Soil Survey. Retrieved from http://websoilsurvey.nrcs.usda.gov/

Name	Acres within study area	Percent of study area	Drainage classification
Caroline fine sandy loam. 0-2% slopes (CoA)	27.3	0.1%	Well drained
Caroline find sandy loam, 2-6% slopes (CoB)	28.2	0.1%	Well drained
Charleston loamy fine sand (Ch)	8.1	0.0%	Moderately well drained
Chipley-Echaw complex (Ct)	40.1	0.2%	Somewhat poorly drained
Chipley loamy fine sand (Cm)	129.5	0.5%	Moderately well drained
Coxville fine sandy loam (Cu)	6.5	0.0%	Poorly drained
Craven fine sandy loam (Cr)	54.9	0.2%	Moderately well drained
Daleville silt loam (Da)	268.2	1.1%	Poorly drained
Dunbar and ardilla fine sandy loams, 0-2% slopes (DdA)	456.1	1.9%	Somewhat poorly drained
Duplin fine sandy loam, 0-2% slopes (DuA)	123.0	0.5%	Moderately well drained
Duplin fine sandy loam, 2-6% slopes (DuB)	363.0	1.5%	Moderately well drained
Edisto loamy fine sand (Ed)	55.7	0.2%	Somewhat poorly drained
Emporia loamy fine sand, 2-6% slopes (EpB)	69.8	0.3%	Well drained
Faceville fine sandy loam, 2-6% slopes (FvB)	9.5	0.0%	Moderately well drained
Foreston loamy fine sand, 0-2% slopes (FoA)	18.1	0.1%	Moderately well drained
Goldsboro loamy sand, 0-2% slopes (GoA)	1,566.2	6.4%	Moderately well drained
Grifton fine sandy loam, frequently flooded (Gr)	197.8	0.8%	Poorly drained
Haplaquents, loamy (Hp)	84.2	0.3%	Moderately well drained
Hockley loamy fine sand, 0-2% slopes (HoA)	811.7	3.3%	Moderately well drained
Hockley loamy fine sand, 2-6% slopes (HoB)	21.9	0.1%	Moderately well drained
Izagora silt loam, 0-2% slopes (IzA)	162.4	0.7%	Moderately well drained
Jedburg loam (Jd)	166.5	0.7%	Somewhat poorly drained
Lakeland sand, 0-6% slopes (LaB)	4.0	0.0%	Moderately well drained
Lenoir fine sandy loam (Le)	216.1	0.9%	Somewhat poorly drained
Leon fine sand, 0-2% slopes (Lo)	25.6	0.1%	Poorly drained
Lucy loamy sand, 0-6% slopes (LuB)	33.3	0.1%	Somewhat excessively drained
Lynchburg fine sandy loam, 0-2% slopes (Ly)	877.2	3.6%	Somewhat poorly drained
Lynchburg loamy sand, 0-2% slopes (Ln)	307.7	1.3%	Somewhat poorly drained
Meggett loam (Mg)	1,035.6	4.2%	Poorly drained
Mine pits and dumps (Mp)	25.0	0.1%	Moderately well drained
Myatt loam (My)	155.8	0.6%	Poorly drained
Nakina fine sandy loam (Na)	81.5	0.3%	Very poorly drained

Name	Acres within study area	Percent of study area	Drainage classification
Noboco loamy sand, 0-2% slopes (NoA)	55.7	0.2%	Well drained
Norfolk and dothan soils, 0-2% slopes (NdA)	183.5	0.8%	Well drained
Norfolk loamy sand, 0-2% slopes (NoA)	220.1	0.9%	Well drained
Norfolk loamy sand, 2-6% slopes (NoB)	169.6	0.7%	Well drained
Ocilla loamy fine sand (Oc)	770.4	3.2%	Somewhat poorly drained
Ocilla sand, 0-2% slopes (OcA)	377.3	1.5%	Somewhat poorly drained
Orangeburg loamy fine sand, 2-6% slopes (OrB)	41.5	0.2%	Well drained
Pamlico muck (Pa)	11.4	0.0%	Very poorly drained
Pantego fine sandy loam (Pe)	913.3	3.7%	Very poorly drained
Pantego sandy loam (Pa)	10.8	0.0%	Very poorly drained
Pelham sand (Pe)	50.8	0.2%	Poorly drained
Pickney loamy fine sand (Pk)	30.2	0.1%	Very poorly drained
Portsmouth fine sandy loam (Po)	316.0	1.3%	Very poorly drained
Quitman loamy sand (Qu)	295.4	1.2%	Somewhat poorly drained
Rains fine sandy loam, 0-2% slopes (Ra)	842.6	3.5%	Poorly drained
Rains sandy loam (Ra)	513.0	2.1%	Poorly drained
Rutlege loamy fine sand (Rg)	70.7	0.3%	Very poorly drained
Rutlege loamy fine sand, frequently flooded (Ru)	4.1	0.0%	Very poorly drained
Rutlege-Pamlico complex (Rp)	21.0	0.1%	Very poorly drained
Santee loam (Se)	353.0	1.4%	Very poorly drained
Scranton loamy fine sand (Sf)	172.8	0.7%	Somewhat poorly drained
Seabrook loamy fine sand (Sk)	2.9	0.0%	Somewhat poorly drained
Seagate sand (Se)	3.2	0.0%	Somewhat poorly drained
St. Johns fine sand (Sa)	2.9	0.0%	Poorly drained
Stono fine sandy loam (St)	48.5	0.2%	Very poorly drained
Udorthents (UD)	5.2	0.0%	Moderately well drained
Urban land (UR)	9,098.9	37.3%	Not rated
Water (W)	130.2	0.5%	Not rated
Wadmalaw fine sandy loam (Wa)	617.1	2.5%	Poorly drained
Wagram loamy fine sand, 0-6% slopes (WgB)	385.1	1.6%	Well drained
Wicksburg loamy fine sand, 0-6% slopes (WoB)	59.7	0.2%	Well drained
Yonges loamy fine sand (Yo)	418.7	1.7%	Poorly drained

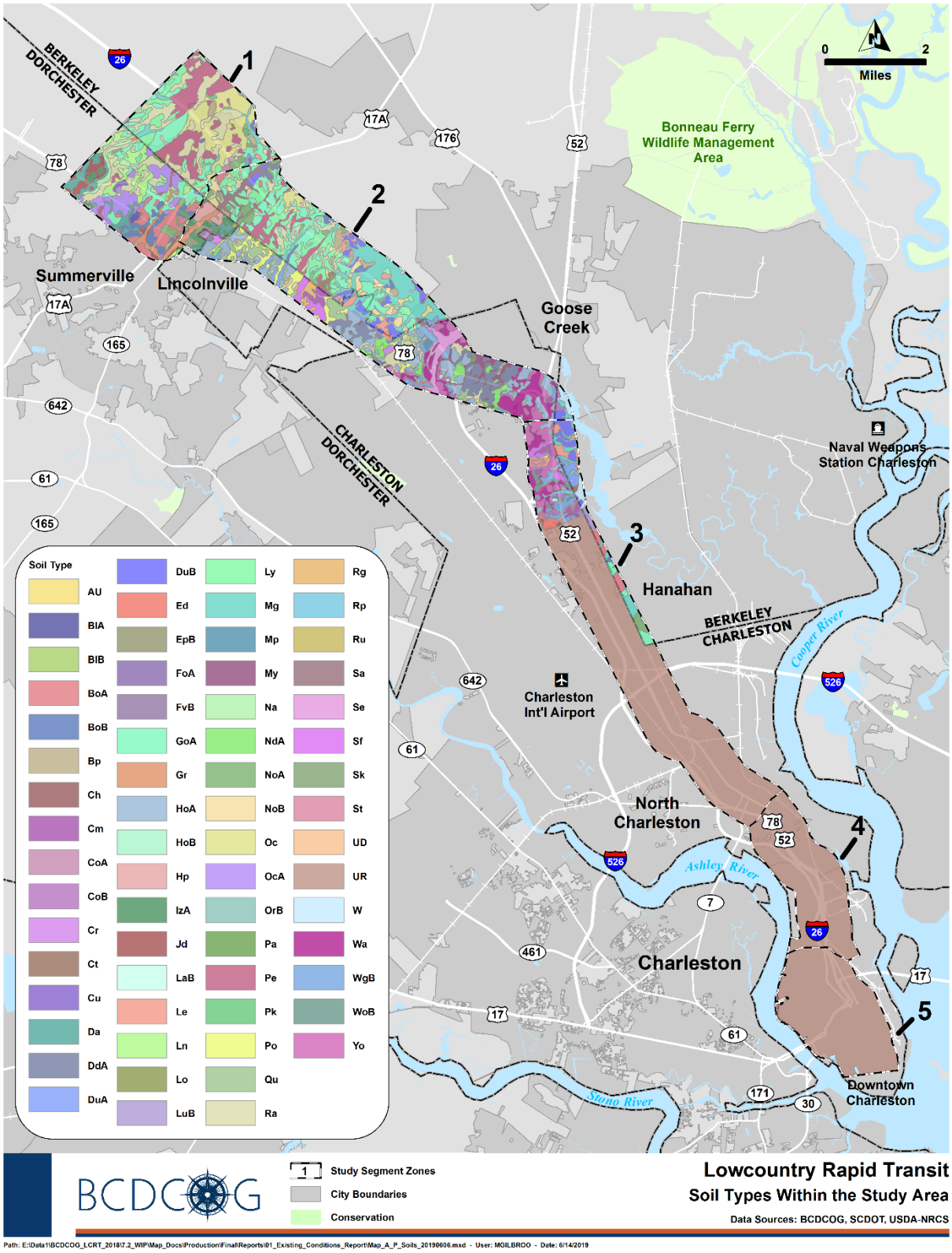

Figure 9.15.1 Soil Types Within the Study Area

9.15.1 Next Steps

Moving forward, project planners will work to avoid or minimize impacts to soils located in the vicinity of the eventual preferred alternative. Soils that are very poorly drained make up 7.4 percent of the study area, which may require soil correction (i.e., removal or replacement with stable soils or treatment in-place) for construction of pavement or stations. Soil erosion that could result from construction activities would be controlled through the use of appropriate environmental protection measures, including best management practices (BMPs) to prevent soil erosion.

9.16 Farmland Soils

Farmlands and prime, unique, and statewide important soils, as defined by the Farmland Protection Policy Act (FPPA) of 1981 (7 USC § 420 I, et. Seq.), are located within the study area.

A parcel containing prime farmlands, approximately 144.1 acres in size (Figure 9.16.1), is located in existing Segment 1 of the study area. The soil type analysis is as follows:

- 44.5 acres of Lynchburg loamy sand, 0 to 2 percent slopes (Ln) – Prime Farmland if drained
- 41.2 acres of Goldsboro loamy sand (GoA), 0 to 2 percent slopes – Prime Farmland
- 29.2 acres of Rains sandy loam (Ra) – Farmland of Statewide Importance
- 23.2 acres of Nakina fine sandy loam (Na) – Farmland of Statewide Importance
- 5.6 acres of Noboco loamy sand (NoA), 0 to 2 percent slopes – Prime Farmland
- 0.3 acre of Grifton fine sandy loam (Gr), frequently flooded – Not Prime Farmland.

Therefore, by definition, any areas within the study area that contain these soils are subject to the FPPA and an impact assessment is required if proposed alignments are in proximity to these areas. However, due to the location of the farmland, relative to the proposed location of the LCRT, this area is very unlikely to be considered within the proximity of the alignments.

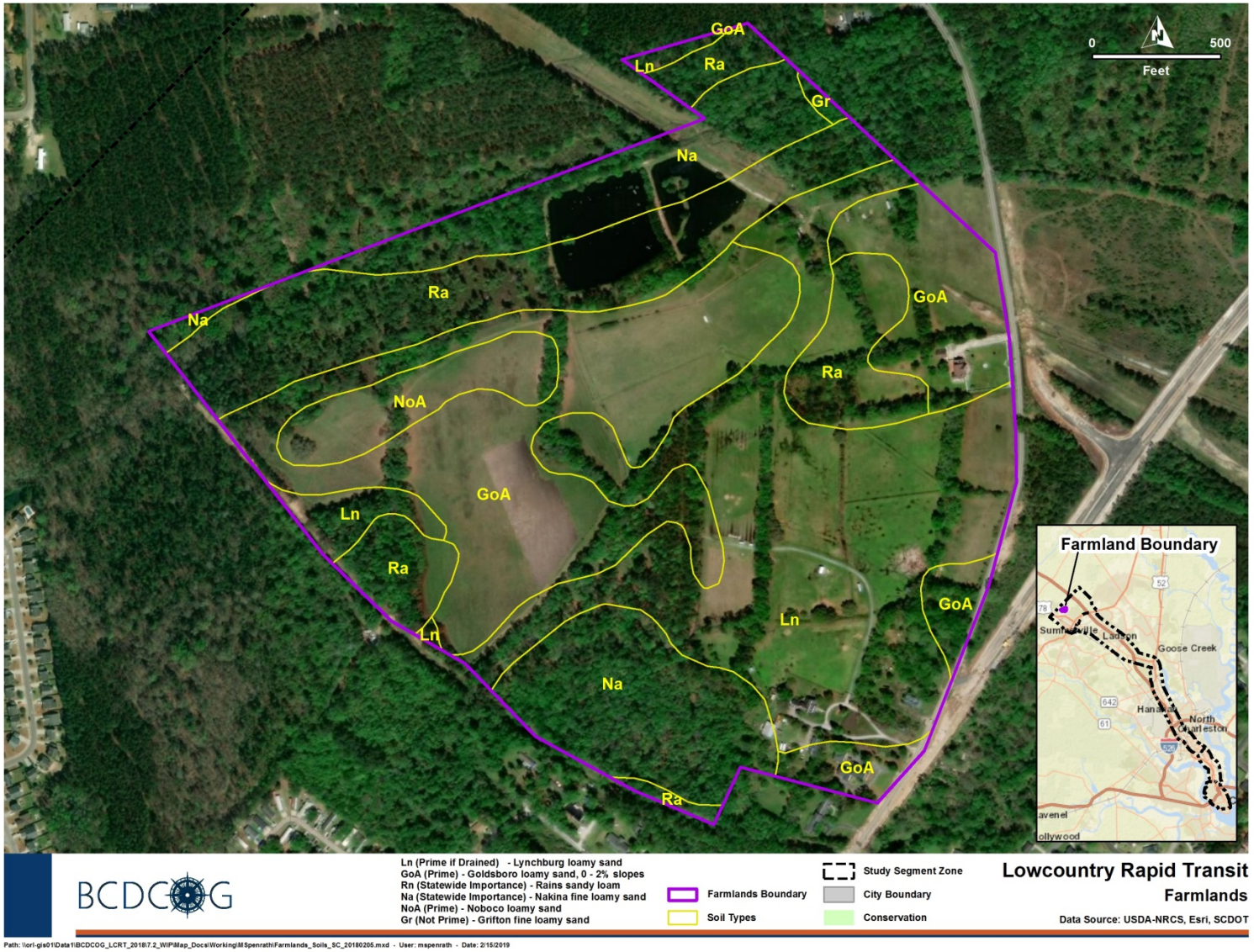

Figure 9.16.1 Farmlands in the LCRT Study Area

9.17 Hydrology, Water Quality, Floodplains, Surface Waters, and Wetlands

9.17.1 Hydrology of the Study Area

The USGS categorizes drainage areas by specific numbers, or hydrologic unit code (HUC). Large river basins are identified with a four-digit HUC (i.e. 0305). Sub-basins within that basin are given an eight-digit HUC that begins with the same four digits (i.e., 03050201). Ten-digit HUCs are also provided for watersheds within 8-digit HUCs (i.e., 03050201-06).

SCDHEC divides South Carolina into eight major river basins. The proposed study area exists entirely within the Edisto-Santee Basin.

9.17.1.1 Edisto-Santee Basin

The Edisto Basin extends across the Piedmont region of North Carolina and South Carolina. In South Carolina, the Edisto-Santee Basin encompasses approximately 23,600 square miles, and is roughly bounded by the cities of Anderson to the west, Camden to the east, and Beaufort to the south.

The basin is divided into twenty sub-basins. Of these, the study area is contained in its entirety in the Cooper Sub-Basin (HUC 03050201) which is approximately 808,800 acres. The Cooper Sub-Basin extends around Lake Moultrie, contains about half of the Francis Marion National Forest, and the entirety of the Charleston Peninsula as seen on Figure 9.17.1.

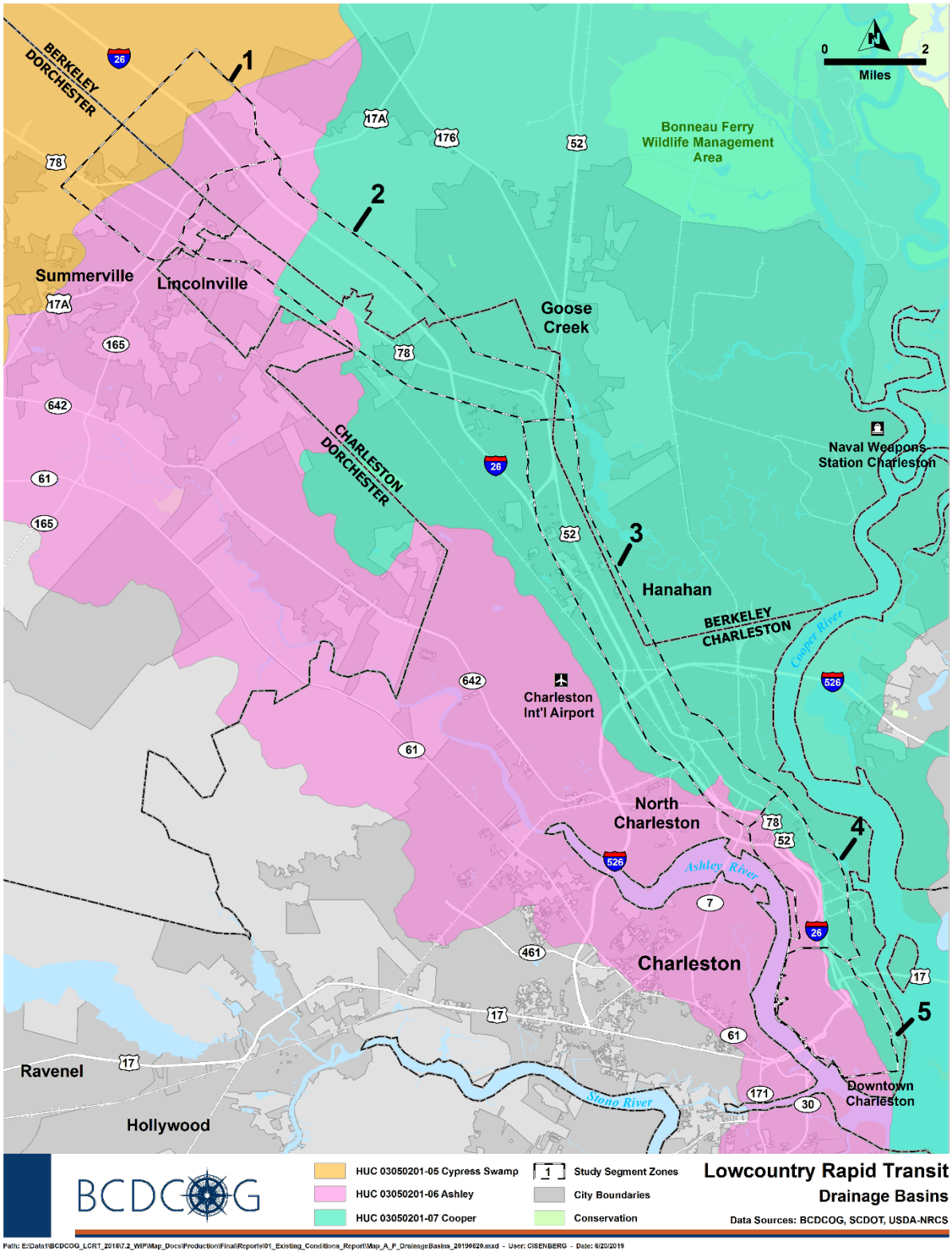

Figure 9.17.1 Drainage Basins

The sub basin is further divided into seven watersheds of which the study area stretches across three: Cypress Swamp (HUC 03050201-05), Ashley (HUC 03050201-06), and the Cooper (HUC 03050201-07).

Waters within the study area include freshwater, brackish, and saltwater depending on proximity to the coast.

9.17.2 Water Quality Surrounding the Study Area

SCDHEC develops a list of waterbodies that do not meet water quality standards and updates the list every two years. This list is a requirement of Section 303(d) of the Clean Water Act (CWA) and is commonly referred to as the 303(d) List.

The 303(d) List includes all water quality monitoring stations (WQMS) that are impaired and outlines the parameters that do not meet standards. A WQMS can be listed for one or more impairments. Table 9.17.1 lists the WQMS on the 2018 Draft 303(d) List found within one of the three watersheds within the study area. Note that not all of these impaired waters are necessarily within the study area itself but are potentially in the drainage areas.

The three watersheds in which the study area is contained ultimately drain into the Charleston Harbor by way of the Ashley and Cooper Rivers. Within these rivers, downstream of the study area, there are a total of approximately 31 SCDHEC WQMS with one monitoring site (Station CSTL-043) located within the study area.

A total maximum daily load (TMDL) is both a calculation of a pollutant entering a waterbody and a plan document. The calculation determines the amount of a single pollutant (e.g., bacteria, nutrients, metals) that can enter a waterbody on a daily basis and still meet water quality standards set forth by the state. The TMDL plan document includes this calculation along with source assessments, watershed and land use information, reductions and allocations information, implementation of the program and other relevant information, maps, figures, and pictures.

The goal of a TMDL is to identify potential pollution sources, calculate and quantify the reduction of those sources, and provide general implementation information needed in order to meet water quality standards and improve water quality. After the approval of the TMDL, an implementation plan can be developed to realize the goals of the written TMDL plan document. Implementation of a TMDL has the potential to reduce sources of pollution within a watershed and the potential to restore the full use of the waterbody.

TMDLs are calculated by adding all the sources for the pollutant causing the impairment. After a TMDL is calculated, the amount of pollutant entering the water is compared to the water quality standards for that waterbody. This total loading is then reduced to levels where water quality standards can be met. This reduced loading is then divided among all contributing sources.

According to the SCDHEC, one TMDL has been developed within the vicinity of the proposed project. Station CSTL-043 monitors fecal coliform bacteria for the TMDL associated with Dorchester Creek and Sawmill Branch Creek.

Table 9.17.1 Study Area Monitoring Stations on the 2018 Draft 303(d) List

Priority	Basin	Huc_12	County	Description	Station	Use*	Cause(s)
3	Santee	30502010503	Berkeley	Wassamassaw Swamp at US 176 CSTL-063	CSTL-063	REC	ECOLI
3	Santee	30502010601	Dorchester	Dorchester Creek at SC 165	CSTL-013	AL	DO
3	Santee	30502010601	Dorchester	Sawmill Branch Creek at SC 78 E of Summerville	CSTL-043	AL	DO
3	Santee	30502010602	Dorchester	Ashley River at SC 165 4.8 mi SSW of Summerville	CSTL-102	REC	ECOLI, ENTERO
3	Santee	30502010603	Dorchester	Eagle Creek at SC 642 5 mi SSE of Summerville	CSTL-099	REC	ENTERO
3	Santee	30502010604	Dorchester	Ashley River at Dorchester State Park	CSTL-560	FISH	HG
3	Santee	30502010604	Charleston	Ashley River at Magnolia Gardens	MD-049	AL	PH, TURBIDITY
3	Santee	30502010604	Charleston	Ashley River at Magnolia Gardens	MD-049	REC	ENTERO
3	Santee	30502010604	Charleston	Ashley River 1.8 mi NW of Runnymede Plantation	RT-032046	REC	ENTERO
3	Santee	30502010605	Charleston	Ashley River 1 - triangulate between tree line on island, peak of roof on rice building, and road	S AR1	REC	ENTERO
3	Santee	30502010605	Charleston	Brittlebank Park - end of floating dock facing SW	AR2	REC	ENTERO
1	Santee	30502010605	Charleston	James Island Creek 1 - south side, center of Harbor View Road Bridge	JIC1	REC	ENTERO
1	Santee	30502010605	Charleston	James Island Creek 2 - end of Oak Point Drive dock (private access)	JIC2	REC	ENTERO
3	Santee	30502010605	Charleston	Ashley River between Oldtown Creek and the Ashley River Memorial Bridge near midchannel	RO-09363	REC	ENTERO
3	Santee	30502010605	Charleston	James Island Creek N of White Hall Plantation	RT-052098	AL	DO
1	Santee	30502010605	Charleston	James Island Creek N of White Hall Plantation	RT-052098	REC	ENTERO
3	Santee	30502010605	Charleston	Orangegrove Creek SE of loop in Boardman Rd	RT-12020	REC	ENTERO

Priority	Basin	Huc_12	County	Description	Station	Use*	Cause(s)
3	Santee	30502010605	Charleston	Wappoo Cut Public Boat Landing - end of western floating dock at the Wappoo Cut Public Boat Ramp	WC1	REC	ENTERO
3	Santee	30502010701	Berkeley	Tail Race Canal at US 52 and 17A below Lake Moultrie -SC-033	CSTL-062	FISH	HG
3	Santee	30502010703	Berkeley	Foster Creek at Charleston Public Works water intake	MD-240	AL	DO
3	Santee	30502010704	Berkeley	Back River Reservoir in forebay equidistant from dam and shorelines	CSTL-124	AL	DO
3	Santee	30502010704	Berkeley	Cooper River @ Bushy Park	MD-042	FISH	HG
3	Santee	30502010704	Berkeley	Durham Creek at S-08-9 Bridge	MD-217	FISH	HG
3	Santee	30502010706	Berkeley	Goose Creek at S-08-136 Bridge	MD-039	REC	ENTERO
3	Santee	30502010706	Charleston	Goose Creek at US 52 N Chtn	MD-114	AL	DO
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 2.8 mi NW of Spillway near Otranto	RL-04390	AL	CHLA, DO, TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 2.3 mi S of Goose Creek Town Center	RL-01008	AL	DO
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 1.0 mi NW of spillway near W Shoreline	RL-03340	AL	CHLA, DO, TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 0.55 mi W of dam	RL-05412	AL	TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 2 mi N of spillway	RL-06434	AL	DO
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 0.6 mi NW of second powerline upstream of boat ramp, near W shore between two western embankments	RL-07017	AL	DO
3	Santee	30502010706	Berkeley	Goose Creek Reservoir midlake in line with Northbrook Blvd	RL-08065	AL	TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 0.1 mi NE of the John R. Bettis boat landing and 0.1 mi SE	RL-09081	AL	CHLA, TP
3	Santee	30502010706	Berkeley	Lake, Goose Creek Reservoir 1.95 mi W of Poppenheim Crossing	RI-10104	AL	CHLA, DO, TP

Priority	Basin	Huc_12	County	Description	Station	Use*	Cause(s)
3	Santee	30502010706	Berkeley	Lake, Goose Creek Reservoir 1.95 mi W of Poppenheim Crossing	RL-10104	REC	E COLI
3	Santee	30502010706	Berkeley	Lake, Goose Creek Reservoir 2.5 mi SW of Poppenheim Crossing	RL-10108	AL	CHLA, DO, TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir approximately 1.3 mi upstream from the dam. Site is located 100 yds south	RL-11118	AL	CHLA, PH, TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir approximately 250 yds NW of end of Hanahan Rd	RL-13132	AL	PH, TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 2.58 mi N of John R Bettis Landing	RL-15109	AL	CHLA, TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir 100 mi upstream of dam	ST-032	AL	TP
3	Santee	30502010706	Berkeley	Goose Creek Reservoir at second powerline upstream of boat ramp	ST-033	AL	TP
3	Santee	30502010707	Charleston	Clark Sound at Ocean View Flats	10A-16	SHELL FISH	FC
3	Santee	30502010707	Charleston	Fludd's Creek at Clark Sound	10A-16A	SHELL FISH	FC
3	Santee	30502010707	Charleston	Clark Sound, 550 yds E of Station 10A-16A	10A-16B	SHELL FISH	FC
3	Santee	30502010707	Charleston	Outfall of Morris Island discharge	10A-29	SHELL FISH	FC
3	Santee	30502010707	Charleston	Demetre Park (Sunrise Park) - end of Sunrise Park Dock facing NE towards the old village	of M Ch1	REC	ENTERO
1	Santee	30502010707	Charleston	Shem Creek at Bridge on US 17	MD-071	REC	ENTERO
3	Santee	30502010707	Charleston	Filbin Creek at Virginia Ave, North Charleston	MD-249	REC	ENTERO
3	Santee	30502010707	Charleston	Charleston Harbor 0.5 mi SE of mouth of Shem Creek	RO-036044	AL	CU
3	Santee	30502010707	Charleston	Charleston Harbor Cooper River side approximately 365 yds E of battery between shellfish sites	10b-05 And RO-12316	REC	ENTERO

Priority	Basin	Huc_12	County	Description	Station	Use*	Cause(s)
3	Santee	30502010707	Charleston	Unnamed tributary to Parrot Point Creek 0.8 mi S of Ft Johnson	RT-042072	AL	TURBIDITY
3	Santee	30502010707	Charleston	Clark Sound approximately 85 yds S of the end of Lighthouse Rd. Could be done off one of the docks to the E	RT-14088	AL	DO
3	Santee	30502010707	Charleston	Clark Sound approximately 85 yds S of the end of Lighthouse Rd. Could be done off one of the docks to the E	RT-14088	REC	ENTERO
1	Santee	30502010707	Charleston	Shem Creek 1 - SW end of floating dock at Shem Creek Park	SC1	REC	ENTERO
1	Santee	30502010707	Charleston	Shem Creek 2 - end of dock at Shem Creek public boat landing	SC2	REC	ENTERO
1	Santee	30502010707	Charleston	Shem Creek 3 - end of Sea Gull Drive dock (private access)	SC3	REC	ENTERO

*SCDHEC's water quality standards regulations, the designated uses:
REC - Contact recreation (swimming or primary and boating/wading or secondary),
AL - Aquatic life uses, which include fishing, the survival and propagation of a balanced indigenous aquatic community (fresh and marine) of fauna and flora, shellfish harvesting, crabbing,
FISH - Fish Consumption
SHELLFISH - Shellfish Harvesting

9.17.3 Floodplains

Floodplains are low-lying areas adjacent to rivers, streams, and other waterbodies that are susceptible to inundation during rain events. These areas provide important functions in the natural environment such as providing storage for flood waters, protecting the surrounding environment from erosion, and providing habitat for wildlife. Agencies are required to take actions that reduce the risk of impacts to floodplains and their associated floodway, or main channel of flow.

Floodplain and floodway protection is required under several federal, state, and local laws. Executive Order 11988 entitled “Floodplain Management,” requires federal agencies to avoid making modifications to or supporting development in floodplains wherever practical. Floodplains subject to inundation by the one-percent-annual-chance flood event are regulated by the Federal Emergency Management Agency (FEMA).

FEMA publishes maps depicting areas of regulated floodplains and floodways. The Flood Insurance Rate Map (FIRM) is the most common of these flood maps. FIRMs depict the boundaries of flood hazard areas and differentiates them by Zone.

Zone A floodplains are areas subject to inundation by the 1-percent-annual-chance flood event and are generally determined using approximate methodologies. Because detailed hydraulic

analyses have not been performed, Base Flood Elevations (BFEs) or flood depths are not available for Zone A floodplains.

Zone AE floodplains are areas subject to inundation by the 1-percent-annual-chance flood event and are determined by detailed methods. BFEs are available for Zone AE floodplains and are provided on FIRMs.

Zone VE floodplains are areas subject to inundation by the 1-percent-annual-chance flood event and are subject to additional hazards associated with storm waves. BFE are available for Zone VE floodplains and are provided on FIRMs.

Based upon a review of the floodplain mapping and a GIS analysis of the project study area, the proposed project crosses or encroaches on floodplains classified as A, AE, and VE as noted in Table 9.17.2. The extent of each floodplain can be found on Figure 9.17.2.

Table 9.17.2 Flood Zones in the Study Area

Flood zone	Area
A/AE	4,656 acres
VE	149 acres

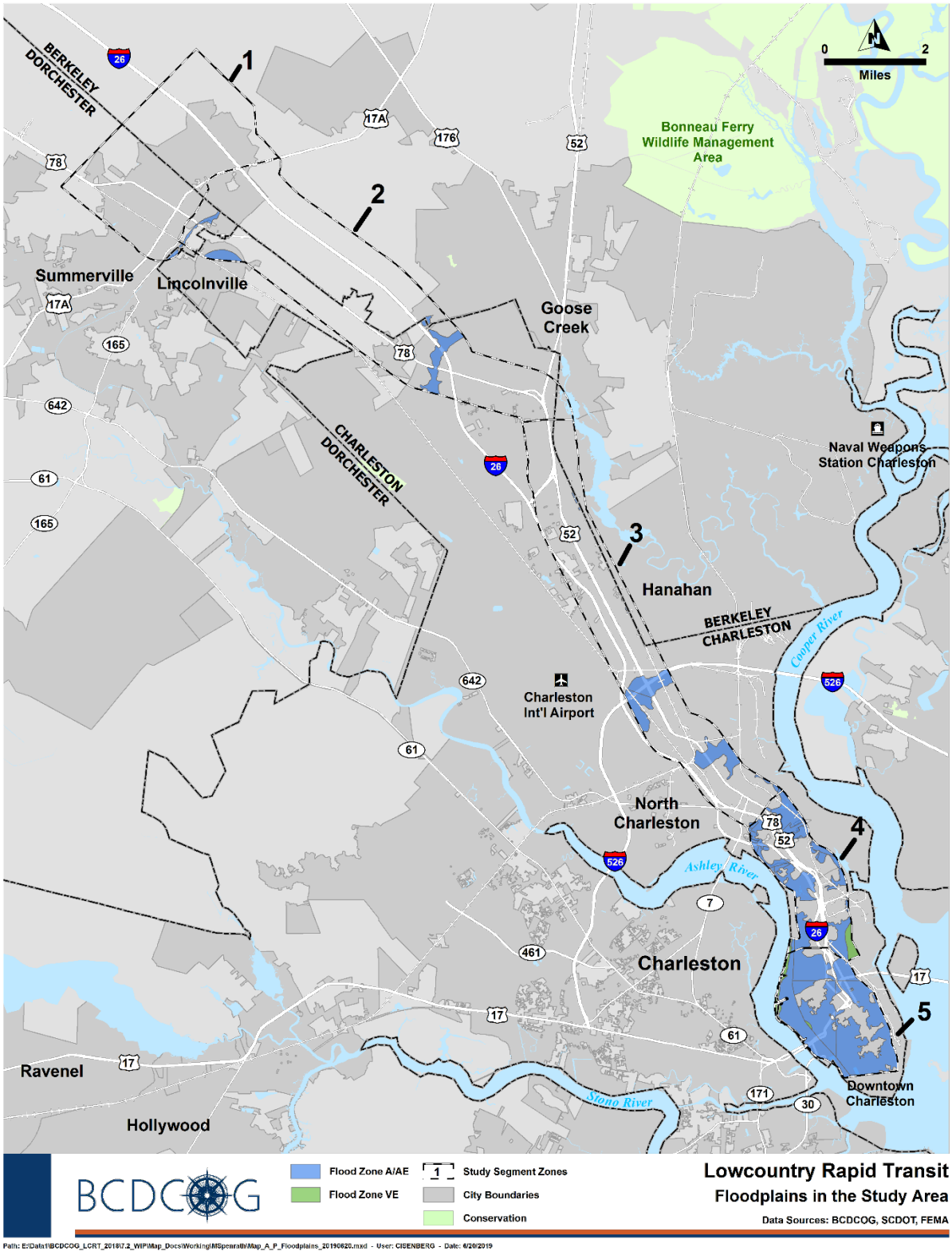

Figure 9.17.2 Floodplains in the Study Area

In accordance with Executive Order 11988, a hydraulic analysis must be conducted for an encroachment into a FEMA-regulated floodplain. The hydraulic analysis is used to determine if the project is likely to increase the risk of flooding within the floodplain. In order to meet the requirements of a “No-Rise” condition, FEMA requires projects which would encroach on regulated floodways and Zone AE floodplains to result in a change no greater than 0.1 feet from the established 100-year flood elevations. Furthermore, SCDOT requires all Zone A crossings to be analyzed for the 100-year flood to insure that the floodplain encroachment does not cause one (1) foot or more of backwater when compared to unrestricted or natural conditions. A preliminary hydraulic analysis will be performed for each encroachment of a FEMA-regulated floodplain and a detailed hydraulic analysis will be performed during final design.

Hydrologic studies have not yet been conducted at this stage of project development; however, a goal of the project would be to design in an effort to meet “No-Rise” requirements.

9.17.4 Surface Waters

Surface waters were identified and calculated using the National Hydrography Dataset (NHD). The NHD is maintained by the USGS and represents the water drainage network of the US with features such as rivers, streams, canals, lakes, ponds, coastline, dams, and stream gauges. The study area contains a total of 220 different streams, measuring approximately 53.7 miles in length. Some water features within the NHD are measured in acreage rather than linear feet or miles. These would include large rivers, ponds, and lakes. The NHD lists a total of 204 waterbodies spreading over 1,100 acres of the study area. The majority of the waters listed in the NHD are in Segment 1 and Segment 2. These waters range from freshwater in Segment 1 to saltwater in Segments 4 and 5. Segment 3 includes a mix of waters considered to be brackish.

Table 9.17.3 Surface Waters

Resource name	Amount of resource in project area	County
Chandler Bridge Creek	4,552 LF	Berkeley
Filbin Creek	6,217 LF	Charleston
McChune Branch	572 LF	Charleston
Newmarket Creek	2,096 LF	Charleston
Noisette Creek	4,812 LF	Charleston
Rumphs Hill Creek	7,835 LF	Dorchester/Berkeley
Sawmill Branch	17,177 LF	Dorchester/Berkeley
Spencer Branch	1,572 LF	Charleston
Stanley Branch	6,839 LF	Berkeley
Stroberfield Branch	9,765 LF	Charleston/Berkeley

Resource name	Amount of resource in project area	County
Turkey Creek	7,383 LF	Charleston/Berkeley
Bluehouse Swamp	654 ac.	Charleston
Colonial Lake	7.1 ac.	Charleston
Goose Creek Reservoir	573 ac.	Berkeley

9.17.5 Wetlands

Wetlands were identified through the National Wetland Inventory (NWI) which is maintained by US Fish and Wildlife Service (USFWS). Not including riverine, lakes, and ponds which were previously identified in the Surface Waters section, the NWI identifies four hundred and seventy four (474) distinct wetlands in the project area for a total of 2,586 acres. The majority of these wetlands are considered to be freshwater (2,188 acres) with the remaining 398 acres identified as estuarine and marine wetlands. Estuarine wetlands are primarily located in Segments 4 and 5. Refer to Figure 9.17.3 for a depiction of wetlands within the study area based on consultation of the NWI database.

The entirety of the project area falls within a coastal zone boundary and approximately 21 percent of the study area falls within the critical area. The critical line is commonly associated with coastal wetland regulations for SCDHEC and requires further regulation and permitting coordination to be carried out with SCDHEC-OCRM (Office of Coastal Resource Management). Please refer to Section 9.19 (Coastal Zone) for a more detailed description of the critical area within the coastal zone.

9.17.6 Next Steps

Wetlands within the study area will be delineated as a preliminary action prior to final project design. The placement of fill in wetlands should be carefully considered during project development and the refinement of alternatives. The project team should document all measures to avoid and/or minimize impacts to wetlands, in anticipation of a Department of the Army permit, under Section 404 of the Clean Water Act.

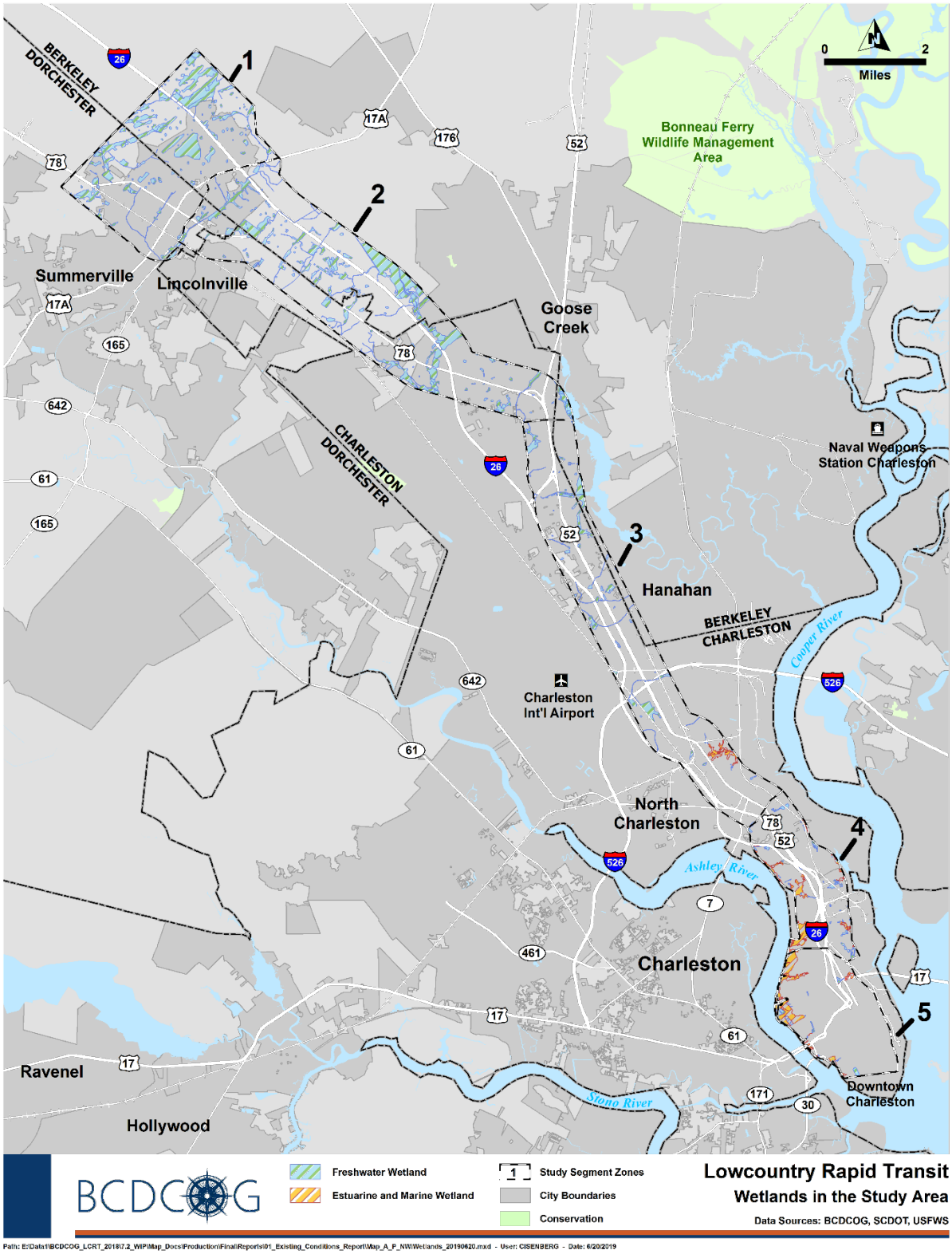

Figure 9.17.3 Wetlands in the Study Area

9.19 Coastal Zone

SCDHEC OCRM defines the coastal zone as “all coastal waters and submerged lands seaward to the State’s jurisdictional limits and all lands and waters in the counties of the State which contain any one or more of the critical areas. These counties are Beaufort, Berkeley, Charleston, Colleton, Dorchester, Horry, Jasper, and Georgetown”. The entire project area lies within the defined coastal zone, but Segments 4 and 5 are bordered by what is termed “critical area”, as defined by SCDHEC OCRM (Figure 9.1). Critical areas are defined as any of the following: “(1) coastal waters, (2) tidelands, (3) beach/dune systems, and (4) beaches”. In addition to salt marsh, segments 4 and 5 also border Charleston Harbor, the Ashley River, and the Cooper River.

BMPs would be used to minimize the potential for impacts to all critical areas within the project area. Full compliance with the Coastal Zone Management Act (CZMA) regulations, and any associated mitigation if identified, will be established during project design and prior to any ground disturbing activities. Any direct impact to critical area would require a joint permit from SCDHEC OCRM and the USACE. Any land disturbing activity that disturbs ½ acre or more, that is within a ½ mile of a receiving water body within the aforementioned coastal counties, also requires verification through the Coastal Zone Consistency (CZC) process. The CZC process is also administered by SCDHEC OCRM. In light of the extensive permit and/or mitigation requirements associated with impacting critical area, proposed alignments will consider the cost/benefit analysis of proposed impacts and proceed accordingly. Avoidance of all impacts to critical area is the most preferable course of action.

9.19.1 Next Steps

Any direct impact to critical area would require a joint permit from SCDHEC OCRM and the USACE. Any land disturbing activity that disturbs ½ acre or more, that is within a ½ mile of a receiving water body within the study area would also require verification through the Coastal Zone Consistency (CZC) process.

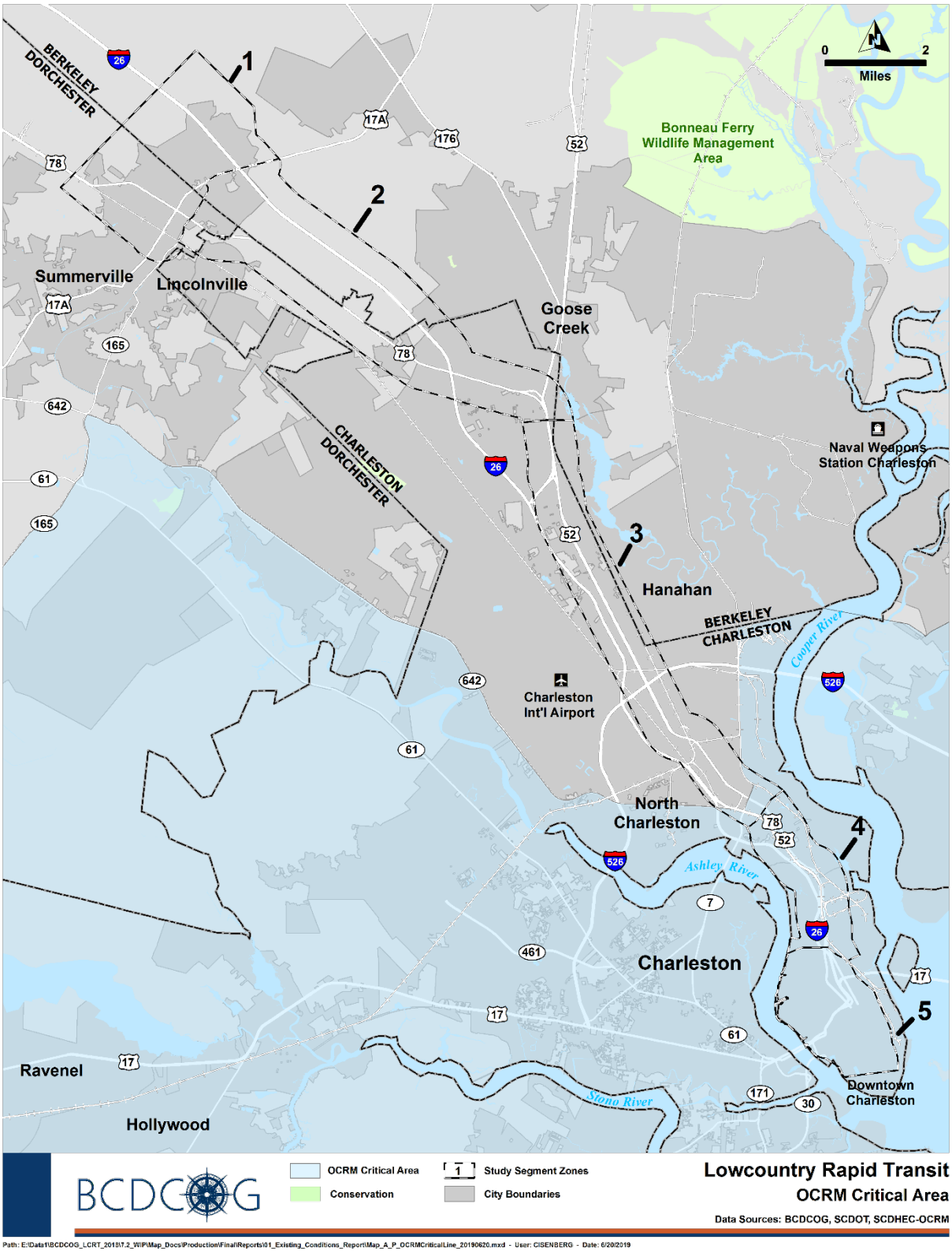

Figure 9.19.1 OCRM Critical Area

9.20 Conclusion and Next Steps

The information detailed in this chapter will provide the project team with the location and extent of the natural, cultural, and socioeconomic features within the study area and will guide the refinement of the project alternatives to avoid or minimize impacts to these resources. Resources are shown on the constraints maps in Appendix J.

The following resource considerations should be incorporated in the development of the project:

- The LCRT study area may be refined to reflect natural community divisions that have developed over time through shared cultural histories, ethnicities, economic strategies, and central concerns or interests of community participants. Direct observations, conversations with people who reside in or utilize the study area, and coordination with relevant organizations serving the study area and/or associated populations will help inform LCRT refinement.
- Known EJ neighborhoods and additional EJ populations and neighborhoods identified as the study proceeds warrant enhanced consideration as alternatives are refined.
- The reconfiguration of roads, intersections, and other infrastructure in the study area may have an adverse effect on historic properties. Construction activities may disturb subsurface deposits and new infrastructure may lead to adverse audio, vibratory, and visual effects to historic properties. The alteration of the upper few feet of soils and sediments at an archaeological site may disrupt or destroy archaeological deposits or features that may contain important information about the past. In so far as possible, ground-disturbing and noise/vibration-generating activities associated with proposed improvements should be designed to avoid known historic properties, archaeological sites, and extant or former cemeteries.
- There are numerous Section 4(f) properties within the study area, including parks, recreation areas, and historic sites that should be carefully considered during the refinement of alternatives. The project team should document all measures to avoid and/or minimize impacts to Section 4(f) properties and any avoidance alternatives that are determined to be feasible and prudent.
- It is a project goal to work with the local community in development of the aesthetic design for BRT stations. Another project goal is for the system to be appropriate to its time, fit well within the contexts of the communities it serves, have a predictable, consistent design that stitches through the whole system, and be sensitive to visual and aesthetic resources along the route.
- The National Wetlands Inventory (NWI) identifies freshwater (2,188 acres) and estuarine and marine wetlands (398 acres) in the LCRT study area. These wetlands will be delineated as a preliminary action prior to final project design. The placement of fill in wetlands should be carefully considered during project development and the refinement of alternatives. The project team should document all measures to avoid and/or minimize impacts to wetlands, in anticipation of a Department of the Army permit, under Section 404 of the Clean Water Act.

- In light of the extensive permit and/or mitigation requirements associated with impacting critical area, proposed alignments will consider the cost/benefit analysis of proposed impacts and proceed accordingly. Avoidance of all impacts to critical area is the most preferable course of action.

9.20.1 Next Steps

Next steps include development of a Class of Action checklist for the FTA to determine the applicable level of NEPA documentation for the project and the refinement of the purpose and need for the project.

As the NEPA process moves forward, these steps will be taken to consider and document potential impacts to resources in the project study area:

- The CCR will serve as a baseline for the development of the CIA, an evaluation of effects of the project on communities, and their qualities of life.
- Based on the estimated limits of construction for the proposed alignment and the associated stations and facilities, the number of acquisition and relocations will be quantified
- Upon the selection of the preferred alternative for the project, an intensive cultural resources survey will be necessary for the archaeological and architectural APEs. Survey methods and determination of the archaeological and architectural APEs will be finalized during consultations with the FTA and SHPO.
- Project planners will work to avoid or minimize impacts to Section 4(f) resources located in the vicinity of the preferred alternative. Continued consultation with the SHPO, local conservation groups, and local communities with ties to these resources will be an important part of this process.
- While the BRT system will have a predictable, consistent design that stitches through the whole system, it should also be sensitive to visual and aesthetic resources along the route. Continued consultation with the SHPO, local conservation groups, and local communities with ties to these resources will be an important part of this process.
- Prior to construction, further investigation in the form of a complete Phase I Environmental Site Assessment and further investigations should occur for any areas outside the existing right-of-way to evaluate the potential for contamination.
- Transit projects have a low potential for MSAT effects and would only require a qualitative assessment of emissions. This qualitative assessment should compare, in narrative form, the expected effect of the project on traffic volumes, vehicle mix, or routing of traffic and the associated changes in MSAT for the project alternatives, including no-build, based on vehicle miles traveled, vehicle mix, and speed.
- Results of the noise screening assessments indicate the presence of noise-sensitive land uses with the FTA screening distances. Therefore, a general noise assessment will be performed in the next phase of the proposed LCRT, to assess the potential for noise impacts to occur if the project is constructed.

- A habitat assessment will be conducted for the preferred alternative. As required, coordination would occur with USFWS for any potential affects to threatened or endangered species.
- Any direct impact to wetlands would require a permit from USACE under Section 404 of the CWA.
- Any direct impact to critical area would require a joint permit from SCDHEC OCRM and the USACE. Any land disturbing activity that disturbs one-half acre or more that is within a one-half mile of a receiving water body within the aforementioned coastal counties, also requires verification through the CZC process.

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