REGIONAL CONDITIONS

In preparing for the future it is important to understand the present. The Regional Conditions Report describes current travel behavior and the existing conditions for all transportation modes, including roadway, transit, bicycle, pedestrian, and freight. A review of policy and a summary of directions for recommendations concludes this report.

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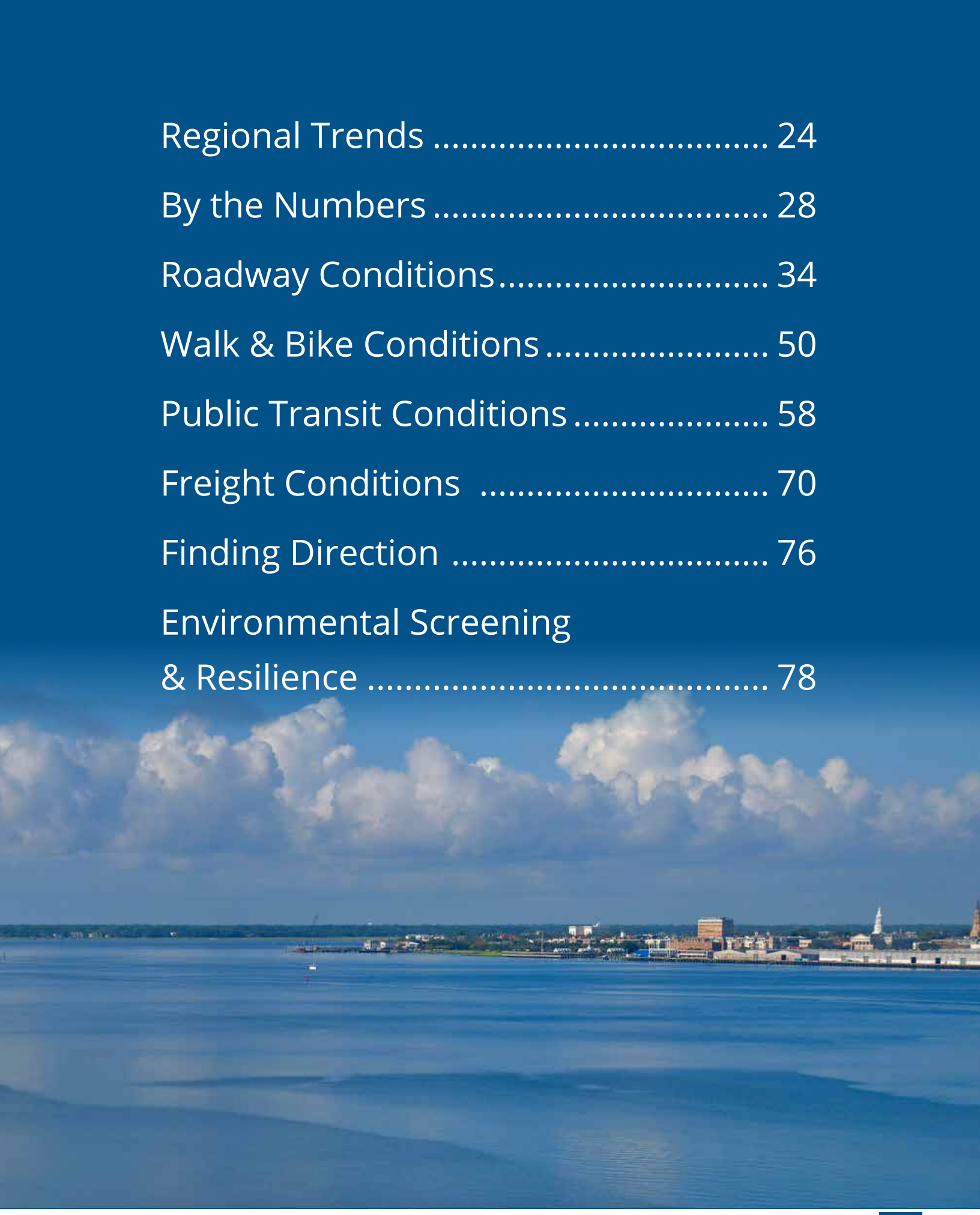
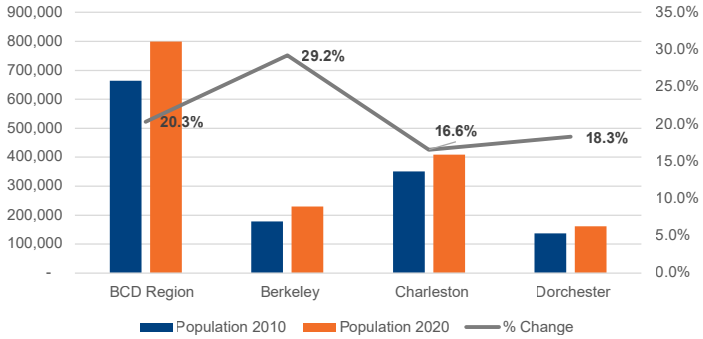


regional trends

Population Growth

The Berkeley-Charleston-Dorchester region of South Carolina has been growing rapidly for the past three decades. In the past decade, the region has grown twice the rate than that of the state and the CHATS planning area has absorbed a significant proportion of that growth. As of 2020, there were approximately 800,000 full-time residents in the region. While Charleston County had the greatest absolute change (+58,026 residents), Berkeley County had the highest growth proportionately.

Figure 2-1: Region Population Growth, 2010-2020

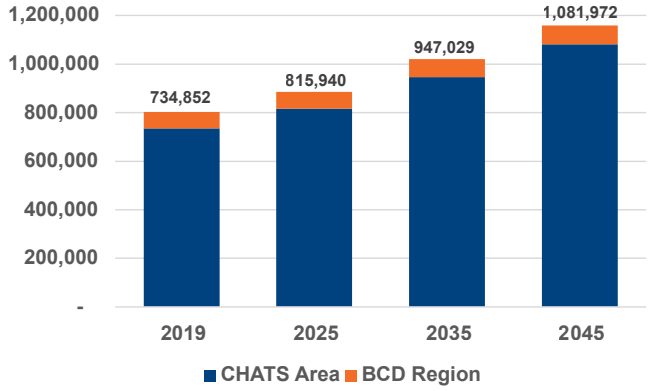


BCDCOG maintains a regional Travel Demand Model (TDM) which serves as a tool in the long-range transportation planning process. The model uses a set of existing and forecast year(s) socio-economic, and roadway network data to project changes in future traffic volume and travel times. Future year socio-economic data assumptions are developed to be consistent with local land use and development plans, utilizing census data, land use characteristics, economic factors, land capacity and land availability measurements in their computation. The model is updated and expanded in its capabilities every five years at a minimum, however the region has been known to grow faster than forecasted.

Forecasted Population Growth

Approximately 92% of the regional population resides within the CHATS urban planning boundary. Between 2019 and 2045, the urban population is forecasted to grow by roughly 47% to just over 1 million residents. As seen in **Map 2-1**, a larger portion of the forecasted growth is expected to occur in Berkeley County.

Figure 2-2: Forecasted Population Growth, 2019-2045

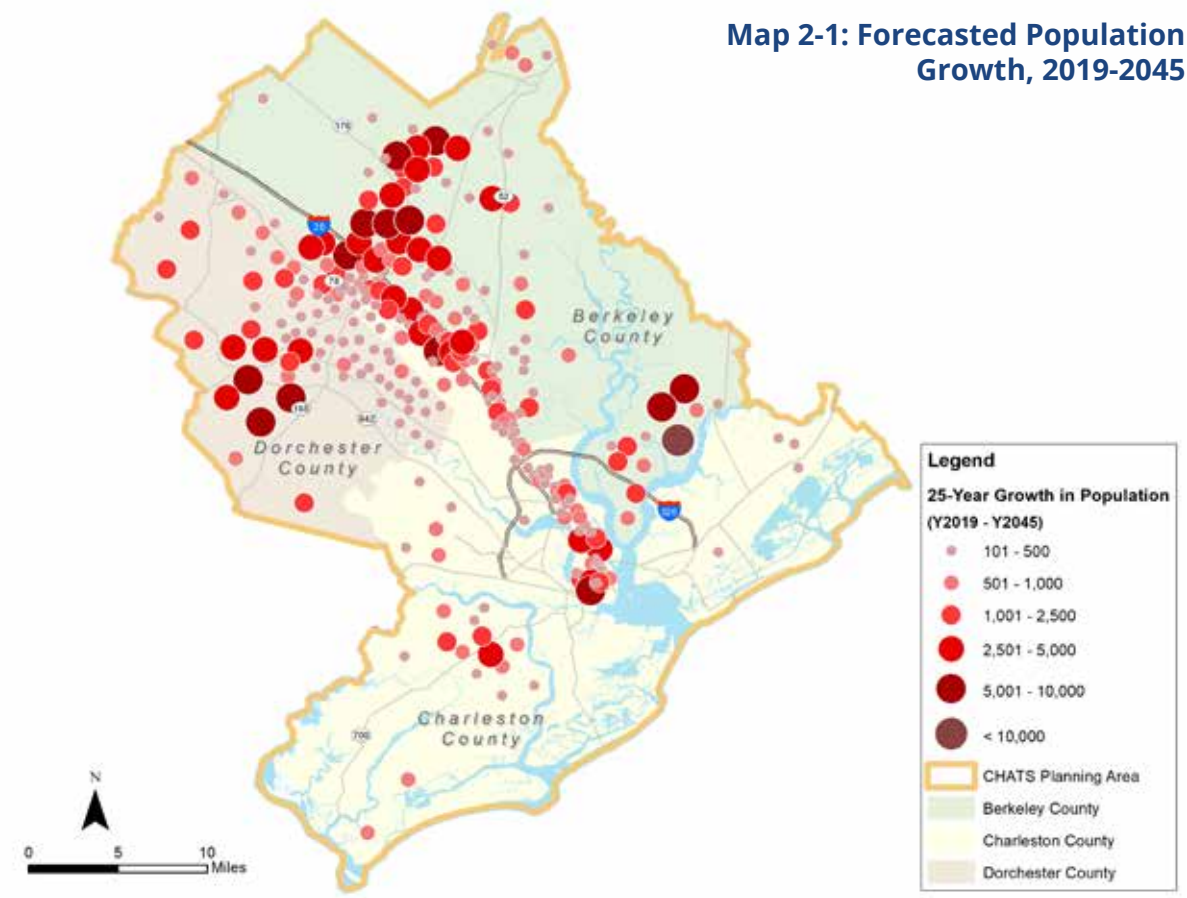


The regional population growth has been fueled by several factors, not the least of which is the regional success with economic development efforts. Since closing of the Charleston Naval Base in the mid-1990s, the region's economy has diversified and industries across various sectors have geographically invested across the region. **Map 2-2** illustrates those area where employment opportunities are forecasted to grow in the next twenty years for a total employment increase of 173,500 jobs just within the CHATS planning area.

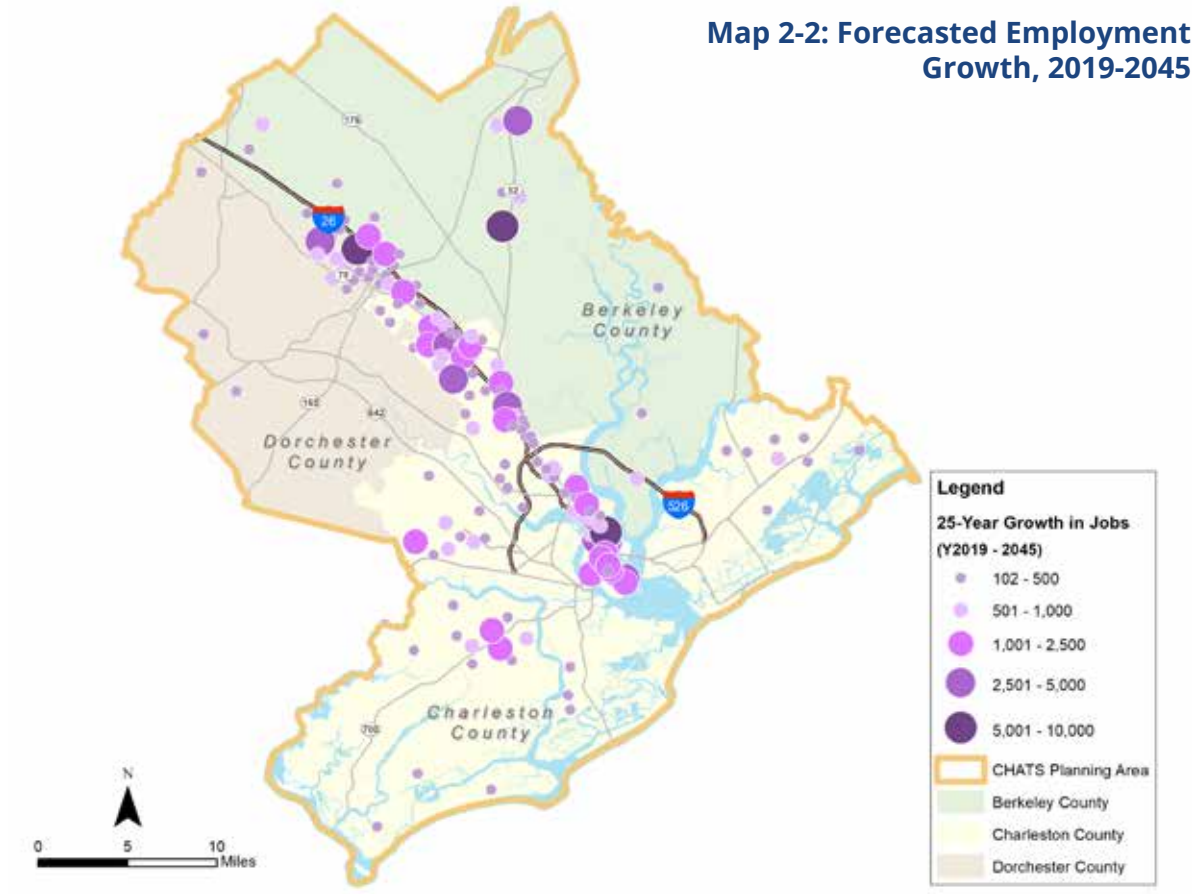
As see in the forecasts, local population growth has generated demand for more residential, non-residential and industrial land uses within the CHATS borders. Major planned developments approved in the past 20 years are reaching build-out capacity while new projects are springing up across the CHATS planning area. As a result, the CHATS planning area itself was expanded after the 2020 census to include areas west of Summerville. Recent and long-standing employers in the region continue to cluster along the interstates and primary road corridors such as I-26. Ongoing development will increase demand on the region's already stressed transportation network.

Residential

Map 2-1: Forecasted Population Growth, 2019-2045



Map 2-2: Forecasted Employment Growth, 2019-2045



Photo/Boeing

The region's urbanization has spread to previously rural areas of all three counties, particularly Berkeley and Dorchester. Some of this growth is associated with the establishment and expansion of new employment opportunities, however most is driven by lower cost of land where developers can market more affordable housing and communities. Within older urbanized areas, growth is being accommodated with more intense residential development types such as townhomes and multi-family complexes. A majority of local jurisdictions recognize the efficiency of these residential development types in terms of land absorption. Higher density residential development also supports alternate modes of mobility that can increase the efficiency of the region's transportation systems.

Employment Centers

Employment uses within the CHATS planning area also continue to expand. These uses are diverse across industry sectors, including medical, military support, and manufacturing and distribution, as well as in the intensity and scale of facilities. Principal regional employers such as MUSC, Roper St Francis, Joint Base Charleston, and Boeing are located in the heart of CHATS planning area. In the past decade, however, major employers and employment centers have been established on the periphery of the CHATS planning area. These facilities, such as Volvo and Redwoods Materials at the Camp Hall along I-26, as well as the Wal-Mart distribution center outside Ridgeville just off I-26 will eventually provide employment for over 4,000 people. However, these industries not only not only bring jobs to rural residents, but also drive alternative commuting patterns and encourage residential developments at the periphery of the urbanized area.

Transit-Oriented Development

A major component of developing the region's (and state's) first bus rapid transit (BRT) line is the concurrent planning for Transit Oriented Development (TOD) around the system's transit stations. Along the 21-mile Lowcountry Rapid Transit (LCRT) corridor, the region is planning for and establishing policies and codes that will foster transit supportive development patterns at each of the LCRT station areas. These development patterns are critical to generating strong ridership, positive economic impacts, equitable development, and achieving regional growth management goals.

Transit-oriented development is a concentration of development that integrates, complements, and prioritizes the use of public transit for daily urban mobility needs. It creates walkable community centers with a mix of commercial, residential, office and entertainment around or near a transit station. These more compact developments attract residents who look to reside where they have convenient access to public transportation, while commercial and employment uses look to locate within TODs where they can serve new residents

Illustrative TOD Station Area Design Concept (Shipwatch Square Station Area).

Source: Neck Area Master Plan, BCDCOG 2014 and LCRT Transit Oriented Development (TOD) Strategy Report and Policy Toolkit, BCDCOG 2022

and residents of the neighborhoods surrounding the transit stations. Focusing growth around transit stations capitalizes on public investments in transit and provides many benefits including:

- Absorption of regional growth that reduces demand on the regional road network.
- Increased ridership and associated revenue gains for transit systems
- Opportunities for the provision of affordable housing
- Incorporation of public and private sector investment
- Revitalization of surrounding neighborhoods
- Improved safety for pedestrians and cyclists through non-motorized infrastructure

From 2020-2022, BCDCOG and LCRT staff engaged with both public and private sector partners including local government staff, community and neighborhood groups, local advocacy groups, and members of the business, development, housing, and transportation communities to developed the *Lowcountry Rapid Transit: Transit Oriented Development (TOD) Strategy Report and Policy Toolkit.* This report provides guidance for local governments, the private sector, community groups, and other stakeholders to support the implementation of TOD in the LCRT corridor over time. Recommended TOD policy tools and strategies can also be leveraged to shape development patterns in other high growth corridors and nodes in the region that are envisioned to be more transit supportive.

The region is committed to realize the long-term TOD vision along the LCRT corridor and work continues with local, regional, and state. The region's Travel Demand Model's long-term or future land use scenario forecasts assume TOD growth and development along the LCRT high capacity transit corridor.

Without appropriate planning, the region expects gentrification of existing neighborhoods along I-26 will continue. There are concerns that affordability challenges in the future LCRT Corridor will continue by increasing market demand along the line. However, the introduction of this premium transit system can also help lower household transportation costs by giving residents more transportation choices, reducing commute times and connecting people to more jobs. With a strategic policy framework in place, transit-oriented development at station areas along the LCRT corridor can and should be a part of the solution to the region's affordability crisis.

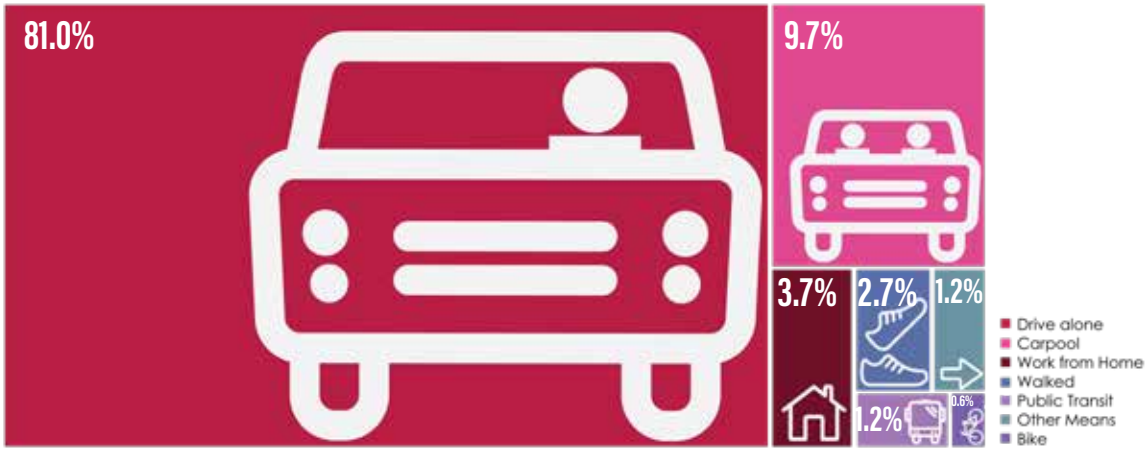
transportation trends
by the numbers

There are numerous data sources that provide insight into travel patterns and trends in the CHATS planning area. This section of the report highlights what the data says about transportation in the CHATS area.

How do we move? Data from the Census' American Community Survey (ACS) paints a picture of travel in the region. In general, the CHATS planning area is very car dependent. In 2020 roughly 81% of commuters drove alone to work (up from 78% in 2000 and compared to 75% of commuters at the national level in 2020). The proportion of commuters driving Single-Occupancy-Vehicles (SOV) has remained fairly stable over the last decade, while commuting preferences in the region are changing across other modes. From 2010 to 2020 the percent of commuters who carpooled, used public transportation, and walked and bicycled to work all decreased, while the proportion of regional commuters who worked at home or telecommuted more than doubled.

Figure 2-3: Means of Transportation to Work 2010 and 2020 Comparison

Means of Transportation to Work 2010



Means of Transportation to Work 2020

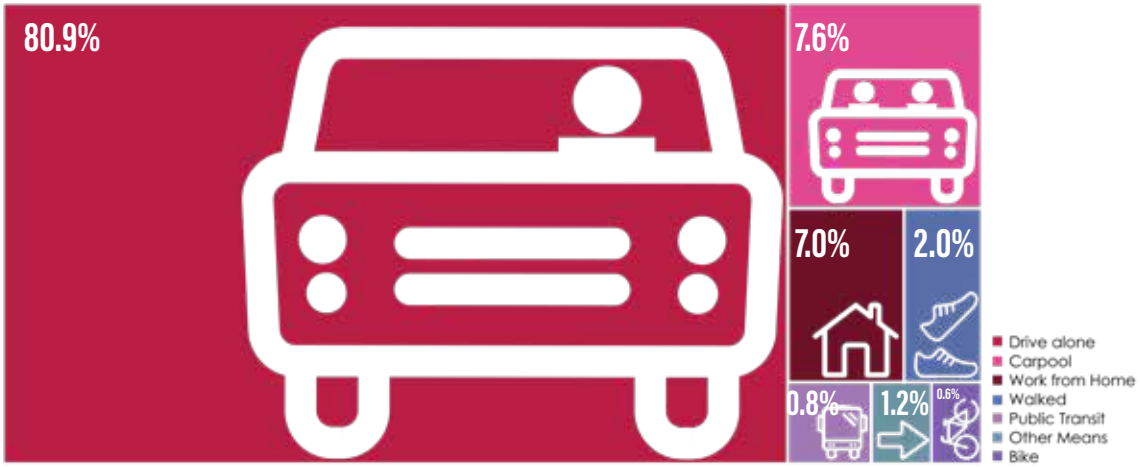
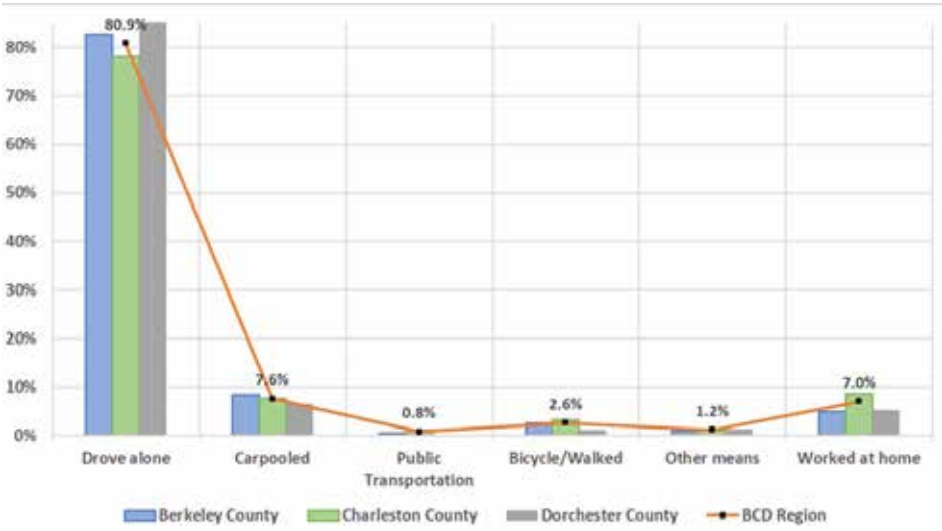


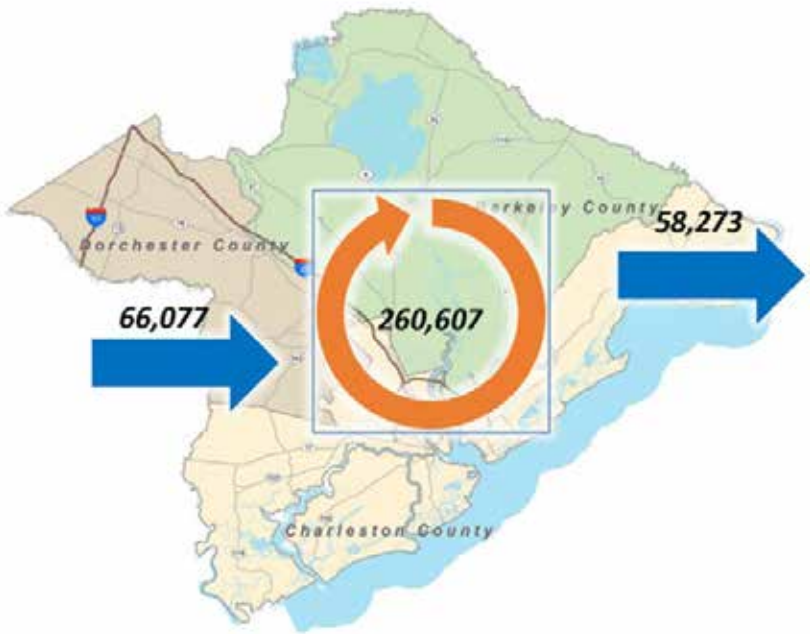
Figure 2-4: Means of Transportation to Work BCD Regional Comparison, 2010-2020



When the 2020 regional commuter patterns are broken down by county, both Dorchester and Berkeley County labor forces are more car dependent than that of Charleston County. It is encouraging to see that Berkeley County had the highest percent of commuters carpooling (8.4%).

Figure 2-5: Commuter Inflows and Outflows, 2021

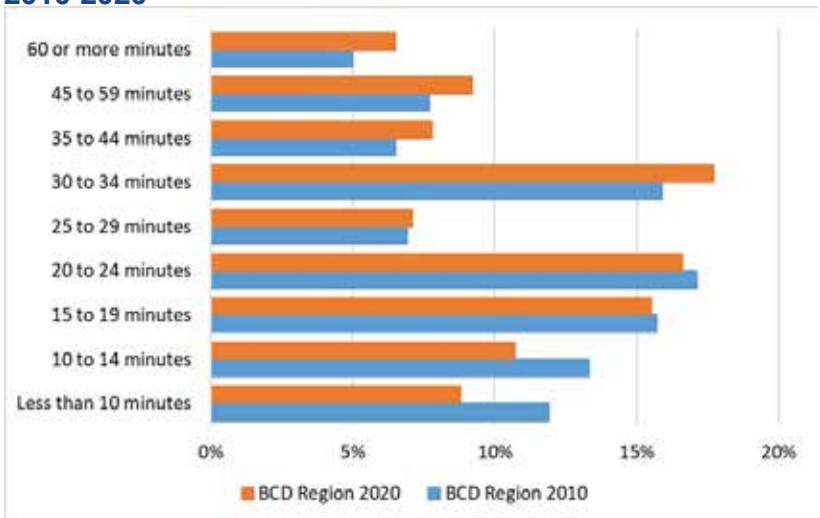
A significant percent of BCD residents, roughly 80%, stay within the three-county region for work, while the percent of workers who commute into (20%) and out of (18%) the region are fairly evenly distributed.



Travel Times to Work

According to 2020 ACS data the average travel time to work for regional commuters is 26.6 minutes, which is fairly on par with both South Carolina and national travel time averages of 25.1 minutes and 26.9 minutes respectively. However, this regional average has tre nded up over the last decade, increasing by 2.2 minutes on average. Roughly 60% of residents living in the tri-county region commute less than 30-minutes to work. In general, short commutes of under 10-minutes decreased between 2010 and 2020, while longer trips of 30-minutes or more have trended upward.

Figure 2-6: Travel Time to Work in BCD Region, 2010-2020



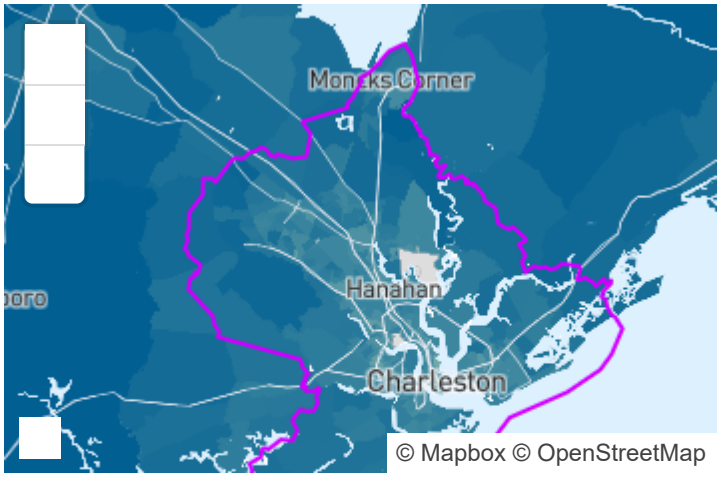
How much does it cost?

In 2019, residents in the CHATS (MPO) Planning Area were spending an average of just over $14,000 per household annually on transportation costs. Transportation costs are considered affordable if they are 15% of less of a household income. Transportation costs for the Charleston-North Charleston-Summerville Metropolitan Statistical Area represent approximately 22% of the 2019 median income ($78,927).

Annual driving mileage has increased across the country, including within the CHATS planning area. The estimated annual miles put on vehicles in the region is 19,400 per household. This vehicle usage impacts greenhouse gas emissions, spurring climate change that is of particular concern to our coastal region.

Figure 2-7: Housing + Transportation Costs

Map of Transportation Costs % Income



Location Efficiency Metrics

Places that are compact, close to jobs and services, with a variety of transportation choices, allow people to spend less time, energy, and money on transportation.

1% — Percent of location efficient neighborhoods

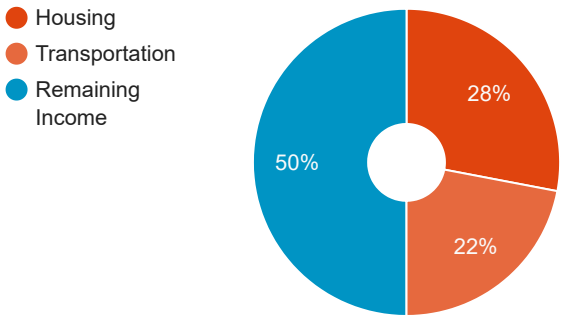
Neighborhood Characteristic Scores (1-10)

As compared to neighborhoods in all 955 U.S. regions in the Index

Job Access	AllTransit Performance Score	Compact Neighborhood
4.9	1.8	3.2
Moderate access to jobs	Car-dependent with very limited or no access to public transportation	Low density and limited walkability

Average Housing + Transportation Costs % Income

Factoring in both housing *and* transportation costs provides a more comprehensive way of thinking about the cost of housing and true affordability.



Transportation Costs

In dispersed areas, people need to own more vehicles and rely upon driving them farther distances which also drives up the cost of living.

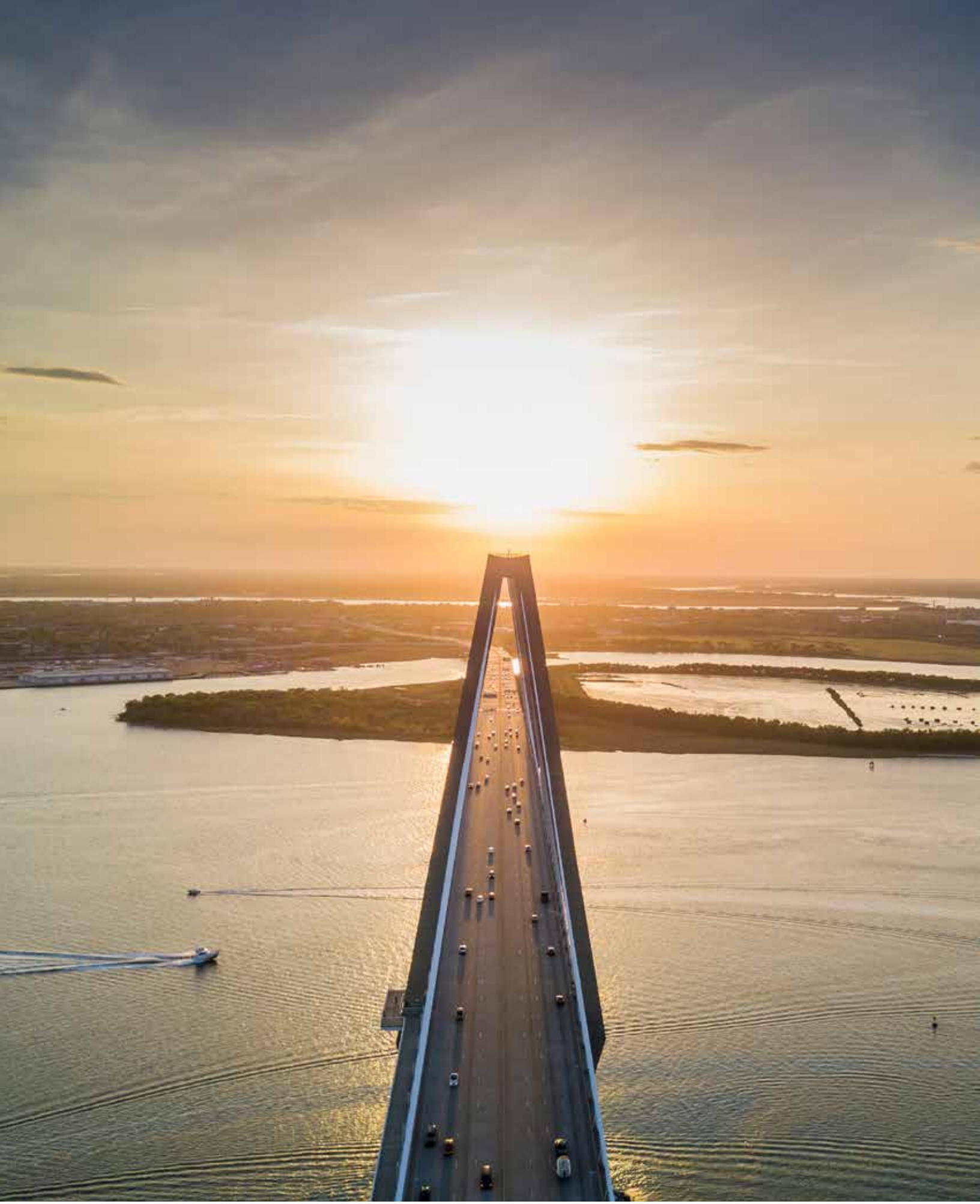
$14,052 — Annual Transportation Costs

1.87 — Autos Per Household

19,400 — Average Household VMT

1%	37	8.04 Tonnes
Transit Ridership % of Workers	Annual Transit Trips	Annual Greenhouse Gas per Household

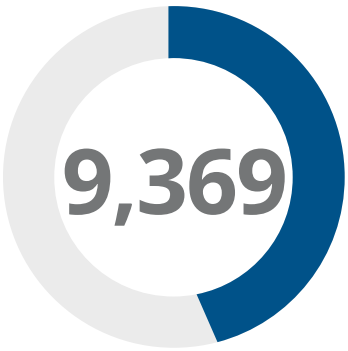
Infographics from Center for Neighborhood Technology, H + T Fact Sheet



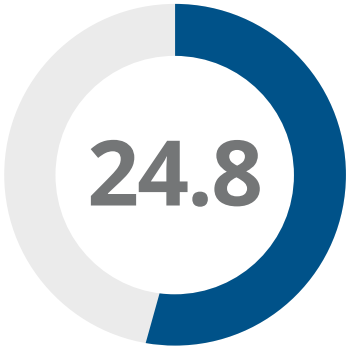
how does the nation see us?

There are a few readily available data sources that people and businesses use to understand transportation in a region. These sources, which admittedly have some limitations, are nevertheless the face of the region as people and businesses decide to relocate. The following graphics provide a snapshot of what the world sees when it uses commonly accessed information to learn about the CHATS planning area's transportation system. (Texas A&M Transportation Institute (TTI) 2019 Annual Urban Mobility Scorecard)

Figure 2-8: Cost of Congestion



Annual Excess Fuel Consumed (1000 gallons)"



Hours of travel delay (Millions)

Congestion cost (Millions)

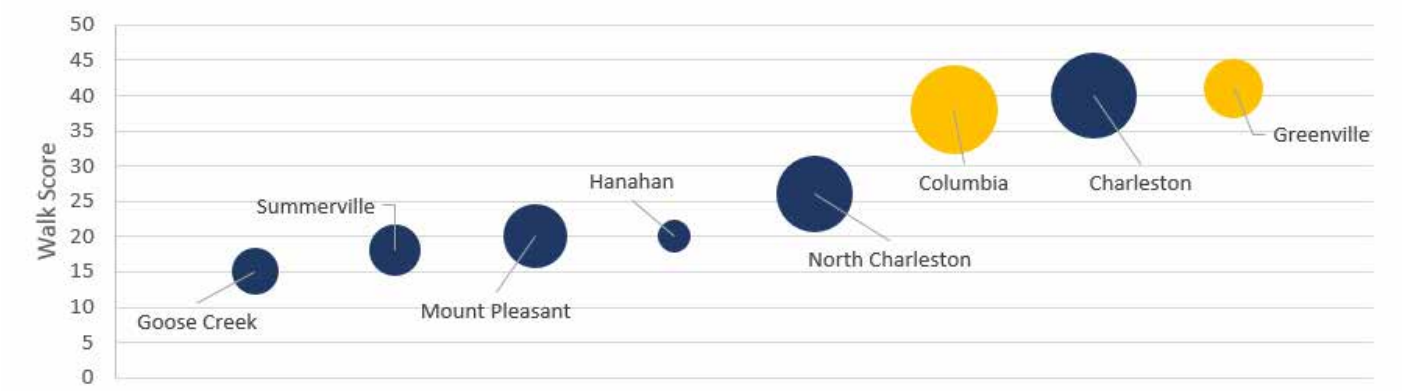
Travel Time Index

Cost of Congestion: The CHATS metro region is in the "middle-of-the-pack" compared to similarly sized peer regions in excess fuel consumption, travel delay, and congestion cost. However, the region's travel time index, which is a measure of reliability of the system, is worse than many of its peers. (Texas A&M Transportation Institute (TTI) 2019 Annual Urban Mobility Scorecard)

Commuter Stress Index (2019): Congested conditions in the region can lead to commuter stress. Charleston has a higher stress index than the majority of its peers, at 1.31. The Columbia, SC metro outperforms our region with a commuter stress index of only 1.17, one of the best in the peer group of medium-sized cities as defined by the TTI annual congestion report.

Getting to Work: Commuting in the metro area varies greatly depending on where you are going and how you are getting there. Data from the real estate website *trulia.com* show that more centrally located destinations, such as North Charleston, are located within a relatively short driving commute from most other urbanized places in the region. With the exception of Downtown Charleston, most locations are nearly inaccessible within an hour of travel on public transit.

Figure 2-9: Municipality Walk Score Comparison



Walk Score: The City of Charleston has the highest "Walk Score" (a measure of proximity of various origins and destinations) in the region, with Goose Creek lagging behind other municipalities. Charleston barely beats out its peer city of Columbia, but is outperformed by Greenville, perhaps due to that city's more compact size – a key factor in the destination-drive Walk Score methodology. In this chart, the size of the bubble represents the city's population.

Figure 2-10: Getting to Work

Note: The travel time is indicated by the color box in the matrix. Green indicates shorter travel times and red indicates longer travel times.

roadway conditions

Arterial roadways serve as the prime movers of people and goods in the CHATS planning area, carrying the majority of the transportation system users on any given day. Twelve (12) of the most important highway corridors were selected for analysis (see **Map 2-3**) based on travel data, such as traffic counts and congestion times as well as regional stakeholder input. These corridors are crucial for congestion management in the CHATS area, and will be explored along with other corridors in the Congestion Management Process (CMP).

Purpose

Understand congestion, crash, and other contributing factors.

Map 2-3: Corridors Critical to Regional Mobility

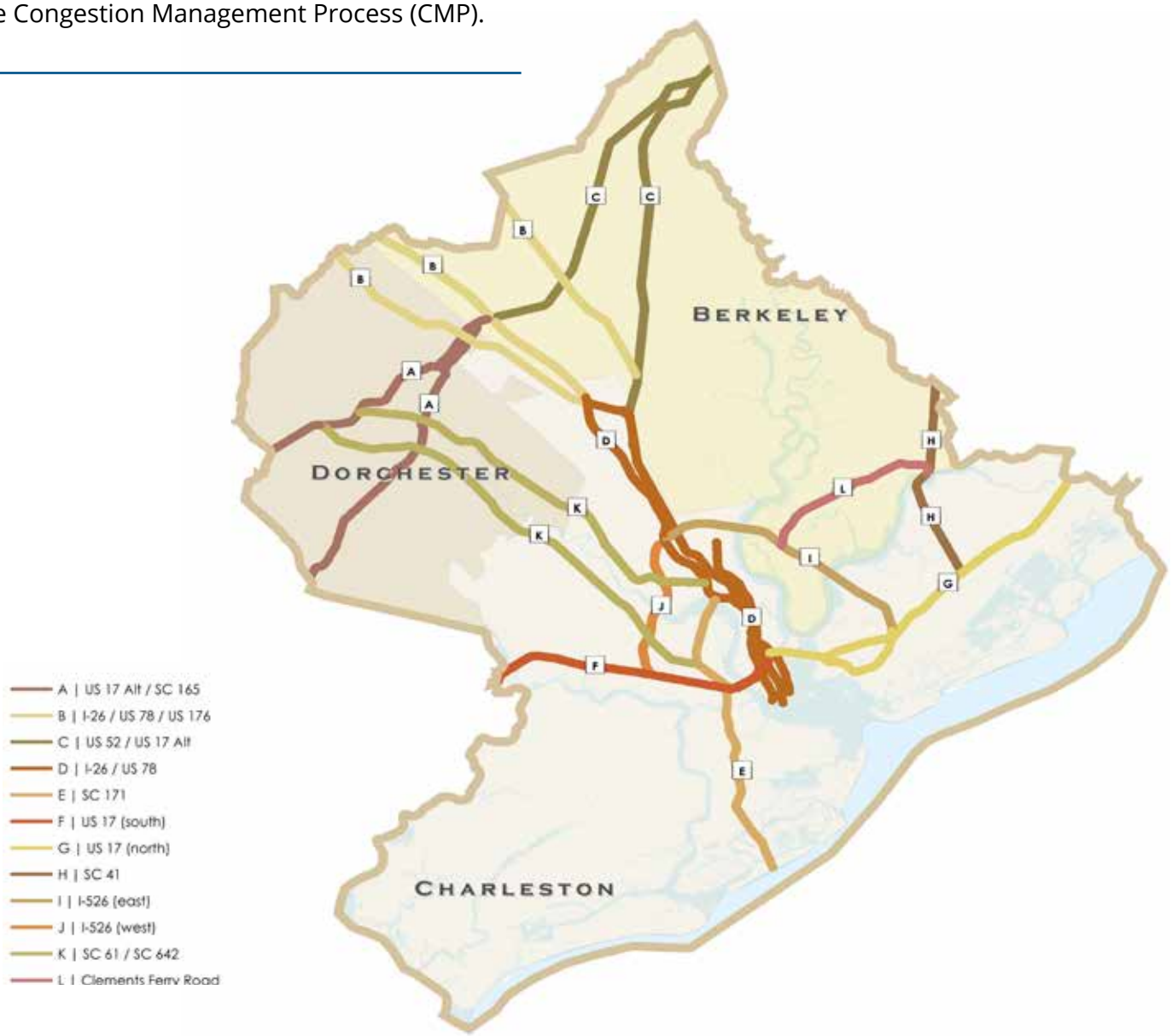


Figure 2-11: Peak-Hour Travel

Using data about travel times gathered through satellite, GPS, and cellular carriers, the typical time it takes to traverse the 12 study corridors, both in the off-peak hours and in the peak hours, was calculated to better understand the effects that congestion is having on mobility in the CHATS planning area. The chart below shows not only the additional increase in absolute time that it takes to traverse a corridor during the peak hours, but also the percentage difference between the typical peak and off-peak travel times. Some corridors saw very little difference between peak and off-peak travel times (e.g. I-26 / US 78 / US 176) while others, including I-526 (East) and US 17 (South), have close to a 25% increase in typical travel times during peak hours.

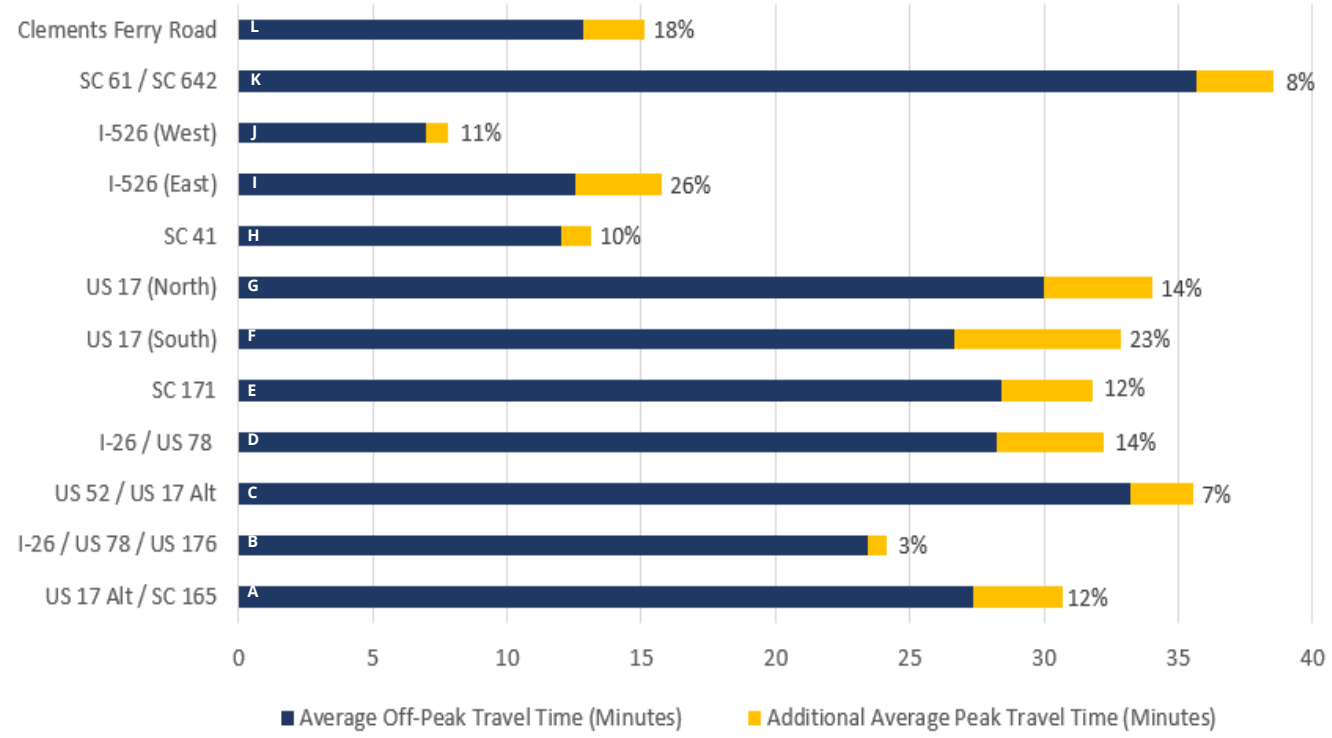
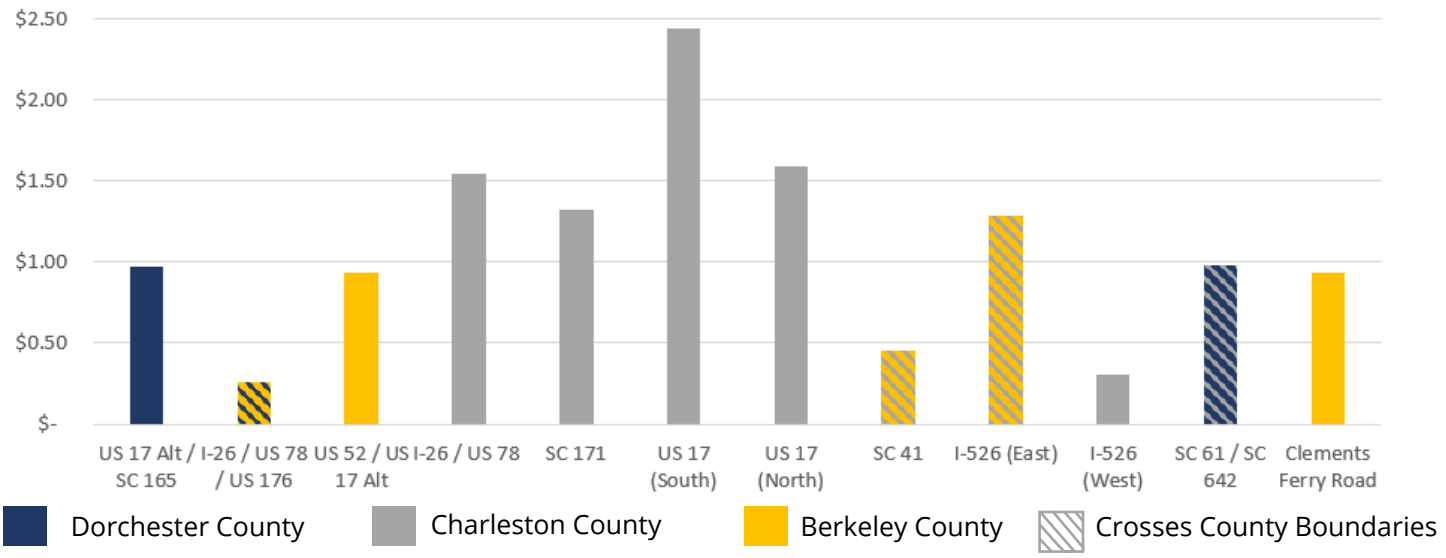


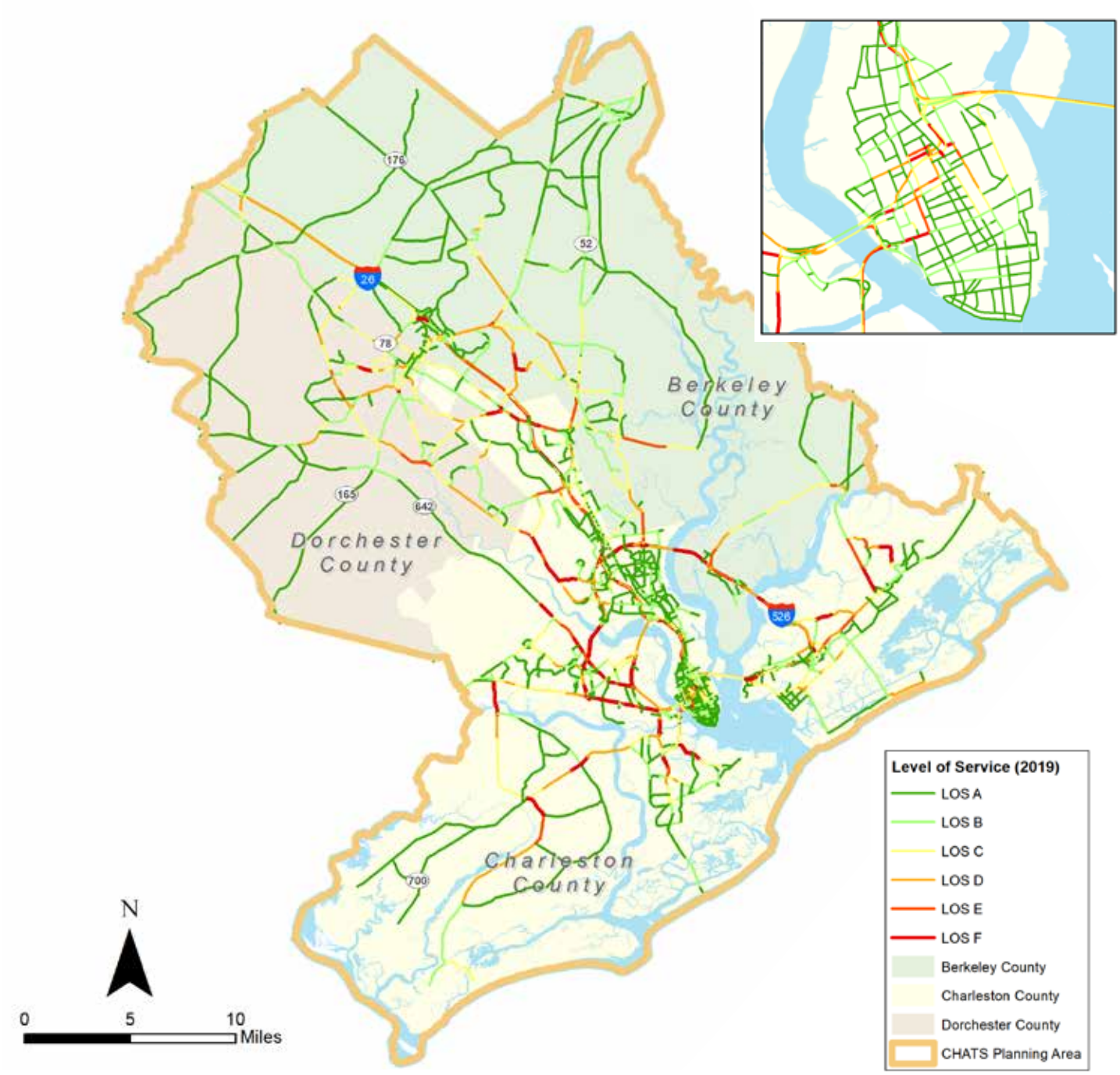
Figure 2-12: Cost of Congestion County Comparison

For every trip along a corridor during congested conditions, the extra time spent driving is associated with a cost to the driver. The average wage rates for each county were used to determine the cost of time. (Note: for corridors that cross county boundaries, indicated by hatched bars, the additional time was split between the counties to generally determine overall cost). In Charleston County, where the wage rate is relatively high, the average cost of congestion traversing an entire corridor is over $1.00 per trip in several corridors.



Level of service (LOS) is a qualitative measure used to relate the quality of traffic service. Volume-to-Capacity Ratio (V/C) is a measure that reflects mobility and quality of travel by comparing roadway demand (vehicle volumes) with roadway supply (carrying capacity). Using the calculated V/C, a level for service rating is applied. The LOS rating describes how traffic flows, where an A is free flow, B is reasonably free flow, C is stable flow, D is approaching unstable flow, E is unstable flow signifying the roadway is operating at capacity, and F is forced or breakdown flow. **Map 2-4** and **Map 2-5** below provide the Level of Service rating of roadways in the CHATS planning area.

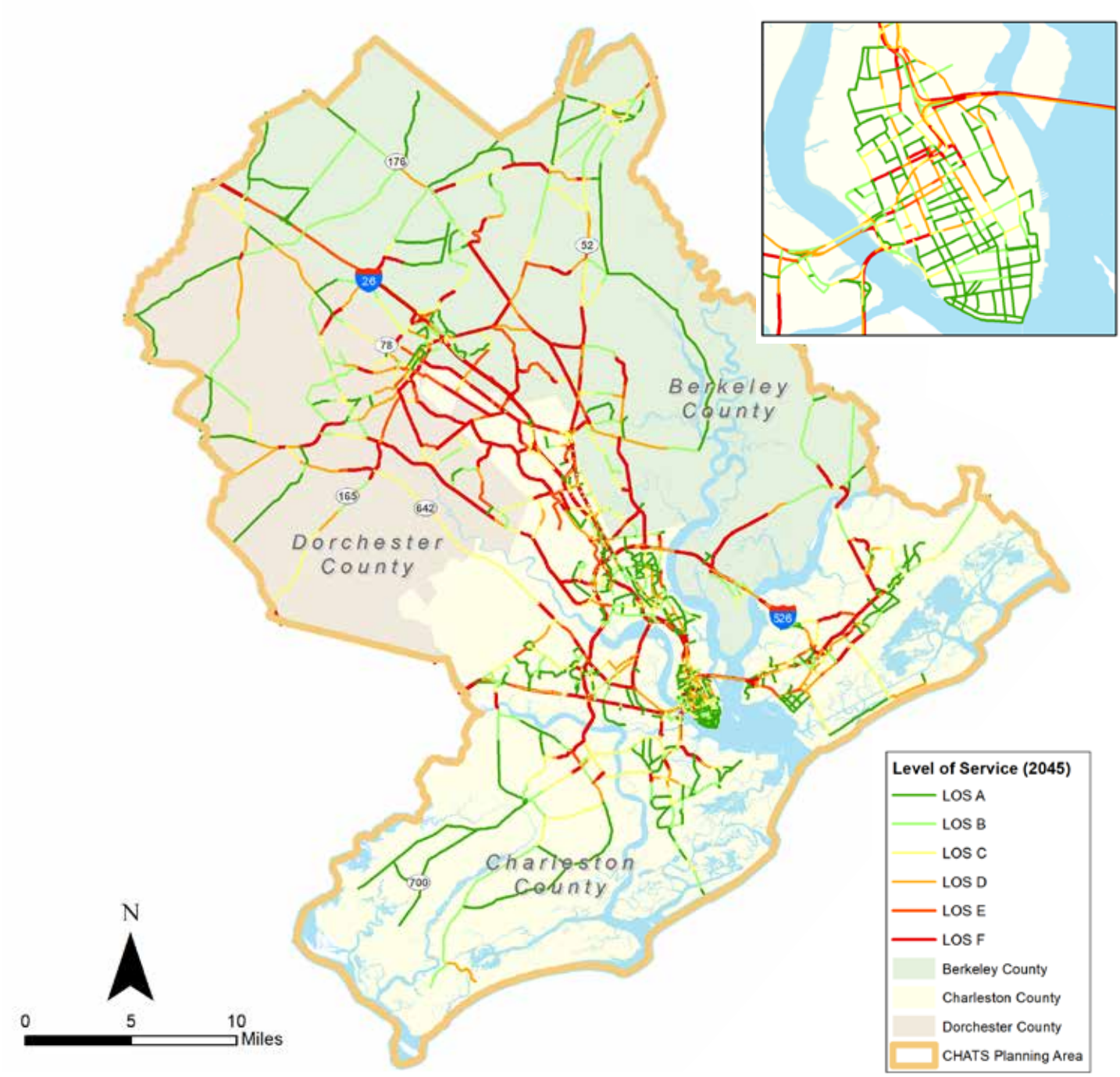
Map 2-4: 2019 Level of Service (LOS) Rating based on Volume-to-Capacity Ratio



Under current conditions, shown in **Map 2-4**, the worst performing facilities operating at failing or near failing conditions are located along the region's major thoroughfares which are important to regional mobility.

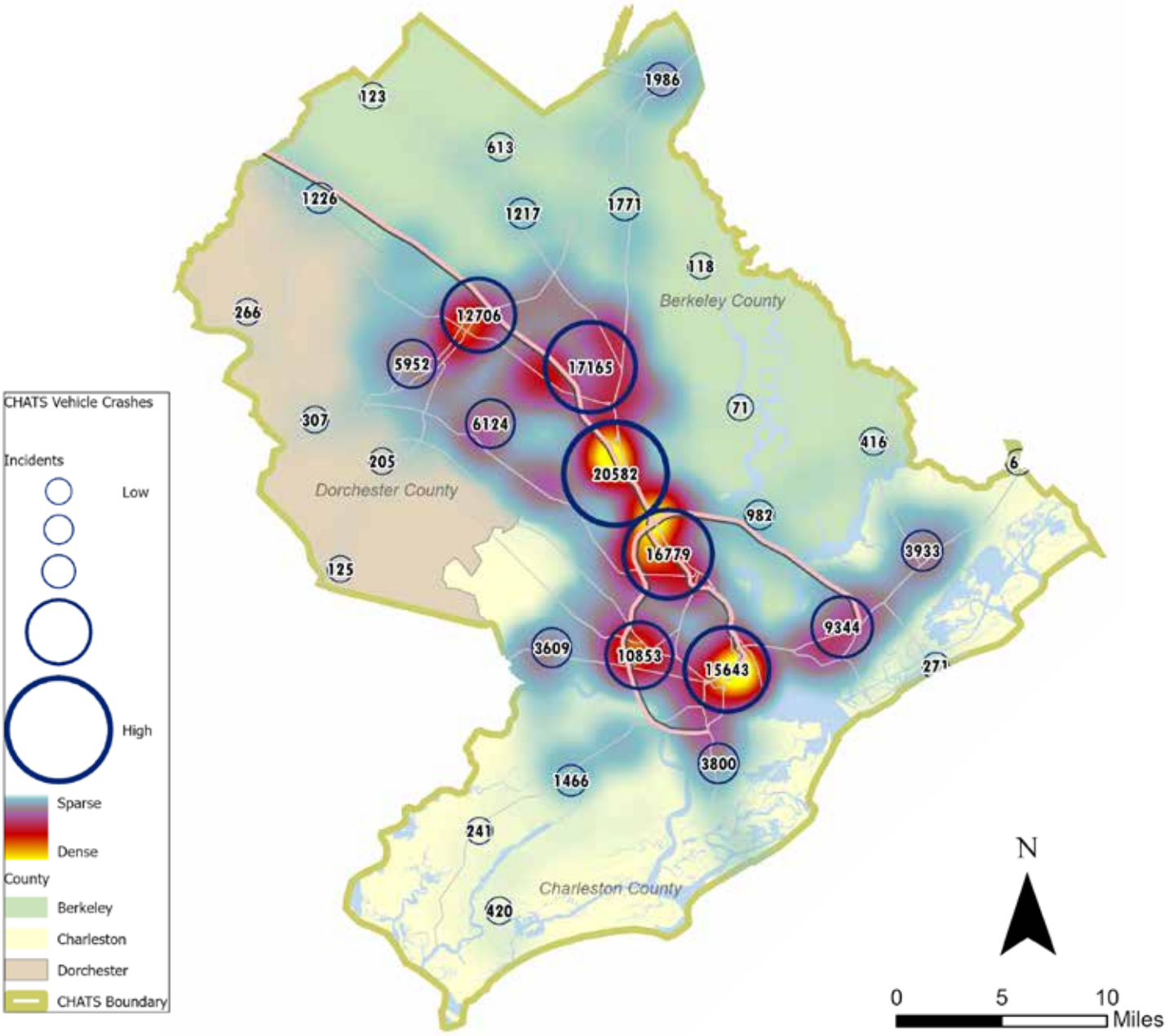
Map 2-5 below, shows the forecasted roadway LOS experienced if there was an increase in demand for travel in our area resulting from population and jobs growth through 2045 and no additional investment is made in the region's transportation network beyond those projects currently funded or committed for implementation through 2045. Most regional corridors will be overcapacity or will fail.

Map 2-5: Motor Vehicle Level of Service (LOS), 2045



Map 2-6 illustrates vehicular crash clusters from data collected between 2016-2021. This dataset when evaluated in conjunction with the existing vehicle level of service provides insight into the cause of congestion at certain locations. Crash clusters often correlate with areas of high congestion and may be a source of non-recurring congestion.

Map 2-6: Crash Clusters and Congestion



The Planning Time Index (PTI) is a congestion measure that represents or looks at the amount of time a traveler should reserve for a trip to ensure on-time arrival to their destination at least 95% of the time. **Map 2-7**, provides the Peak period PTI for the region's primary and secondary highways. A PTI of 1.5 means that, for a 20 minute trip in light or near free-flow traffic, the total travel time that should be planned for the trip is 30 minutes. A region may elect to define what is an acceptable PTI threshold based on local context and the overall mobility goals of the area. For general planning purposes corridors with PTIs of 2 or more were flagged as congested for further evaluation.

Table 2-1 on the following page provides the top roadway segments with the highest PTI indexes of 2 or more in the CHATS planning area:

Map 2-7: Peak Period Planning Time Index (PTI), 2019

Table 2-1: Corridors with Highest PTI Ranked

Roadway	From	To	PTI_ Peak
Ladson Rd	US-78	Miles Jamison Rd	3.59
I-526	US-17 N	Savannah Highway	3.39
Mallard	Orangeburg Rd	US-78	3.20
Riverland Dr	Maybank Rd	Camp Rd	2.93
Glenn McConnell Blvd	Bees Ferry Rd	Paul Cantrell Blvd	2.89
SC-61 Connector	Savannah Highway	Wesley Dr	2.76
James Island Expwy	Folly Rd Approach		2.73
I-26	Ashley Phosphate Rd	College Park Rd	2.67
I-26	Dorchester Rd	I-526	2.67
Dorchester Rd	Ladson Rd	Michaux Parkway	2.58
Coming St	Cannon St	Calhoun St	2.49
Cross County Rd	Ashley Phosphate Rd	Bayhawke Cir	2.42
Cooper Store Rd	US-176	Queenie Rd	2.37
Houston Northcutt Blvd	US-17	Harbor Pointe Dr	2.30
Spring St	King St	Septima Clark Parkway	2.29
Brigade St	Meeting St	Morrison Dr	2.28
Rifle Range Rd	IOP Connector	Venning Rd	2.23
Camp Rd	Folly Rd	Riverland Dr	2.20
Cannon St	King St	Septima Clark Parkway	2.20
East Battery St	Broad St	Market St	2.14
Jedburg Rd	Drop Off Dr	Arabian Dr	2.13
Central Ave	W. Carolina Ave	Briarwood Ln	2.11
Midland Prkwy	Ladson Rd	Bentons Lodge Rd	2.10
Miles Jamison Rd	Ladson Rd	Judith Dr	2.09
Wesley Dr	SC-61	Folly Rd Blvd	2.09
College Park Rd	US-78	Crowfield Blvd	2.06
US-17	Colemand Blvd	I-526	2.05
US-17	I-26	Spring St	2.06
Ashley Phosphate Rd	Rivers Ave	Dorchester Rd	2.01

Congestion Management Process

Metropolitan Planning Organizations (MPOs) in Transportation management Areas (TMAs) are required by federal law to develop and maintain a Congestion Management Process (CMP). Federal guidance states that the intent of the Process is to **"address congestion management through a process that provides safe and effectively integrated management and operation of the multimodal transportation system"**.

The CMP is intended to be a "living document" that identifies strategies for addressing recurring and non-recurring congestion and work in tandem with the LRTP. The CMP includes strategies that may be leveraged across the region, while the LRTP identifies finite projects that incorporate the strategies and guides them forward into project development based on reasonably forecasted project costs. As the MPO for the Charleston region, CHATS is responsible for CMP development and implementation. The CHATS CMP is being developed concurrently with the LRTP and documented as a standalone report. This section is intended to provide a brief overview of the Process.

Federal Eight-Step Congestion Management Process

In April 2011, FHWA released the *Congestion Management Process: A Guidebook* document which provides additional detail and guidance to MPOs in the development and application of the Process. This document includes an 8-step process that summarizes the key components of the Process. These steps are illustrated in Figure X and summarized below, and were used to guide the development of the CHATS CMP.

Step 1: Develop Regional Objectives

Objectives for the CMP were created in concert with the LRTP principles and goals and guided the development of the CMP performance measures.

Step 2: Define the Regional CMP Network

While not required, the CHATS CMP looks beyond the MPO boundaries to include the entirety of the Berkley-Charleston-Dorchester Council of Governments' planning area. Within the three member counties, the roadway network includes all routes classified as major collector and above.

Step 3: Develop Multimodal Performance Measures

Building on the goals and objectives of the CMP, the multimodal performance measures include those that are federally required, as well as other measures that were identified as key through the planning process. While not an exhaustive list, examples of additional performance measures include percent of routes with Intelligent Transportation System (ITS) capabilities and average clearance time for crashes.

Step 4: Collect Data and Monitor System Performance

The CHATS CMP leveraged multiple data sources; however, the primary source was Iteris' *ClearGuide*. Similar data sources will be procured and made available to CHATS by SCDOT for continued monitoring of the regional CMP network.

Step 5: Analyze Congestion Problems and Needs

Iteris' *ClearGuide* data tool was utilized to screen the CMP network for congestion problems. Metrics calculated and reviewed in the analysis process included:

- Average Planning Time Index (PTI)
- Morning peak period (7:00 to 9:00 A.M) Recurrent Delay and evening peak period (4:00 to 6:00 P.M) Recurrent Delay
- Total Weekday Delay

These metrics were used to identify congested corridors within the

Step 6: Identify and Assess Strategies

The CMP identified a series of strategies intended to improve the performance of the congested network. Strategies were organized into seven overarching categories:

- Transit and Transit Oriented Development (TOD) & Land Use
- Micromobilty
- Intelligent Transportation Systems
- Transportation Systems Management & Operations (TSMO)
- Capacity Improvement
- Freight
- Transportation Demand Management

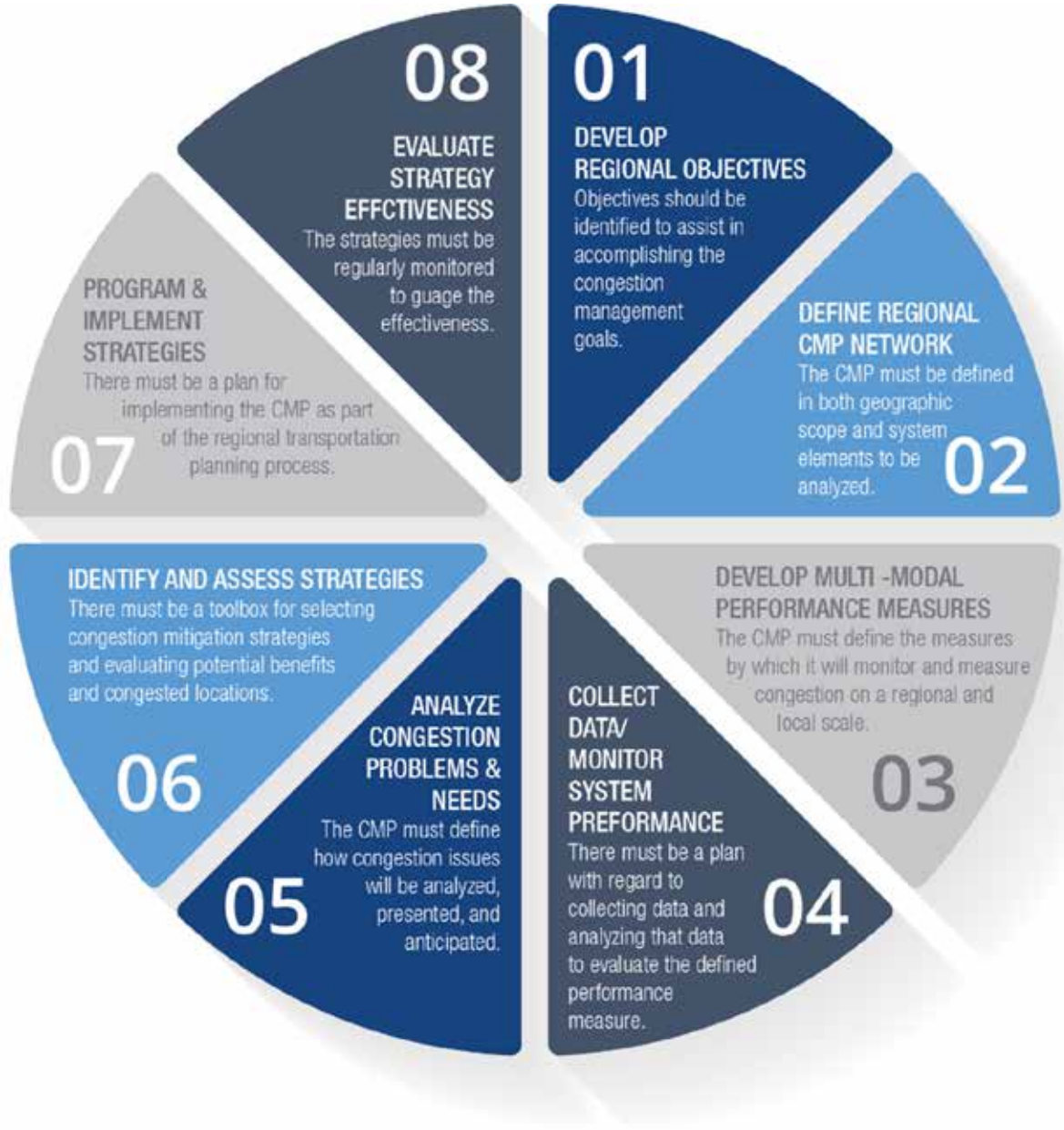
Step 7: Program and Implement Strategies

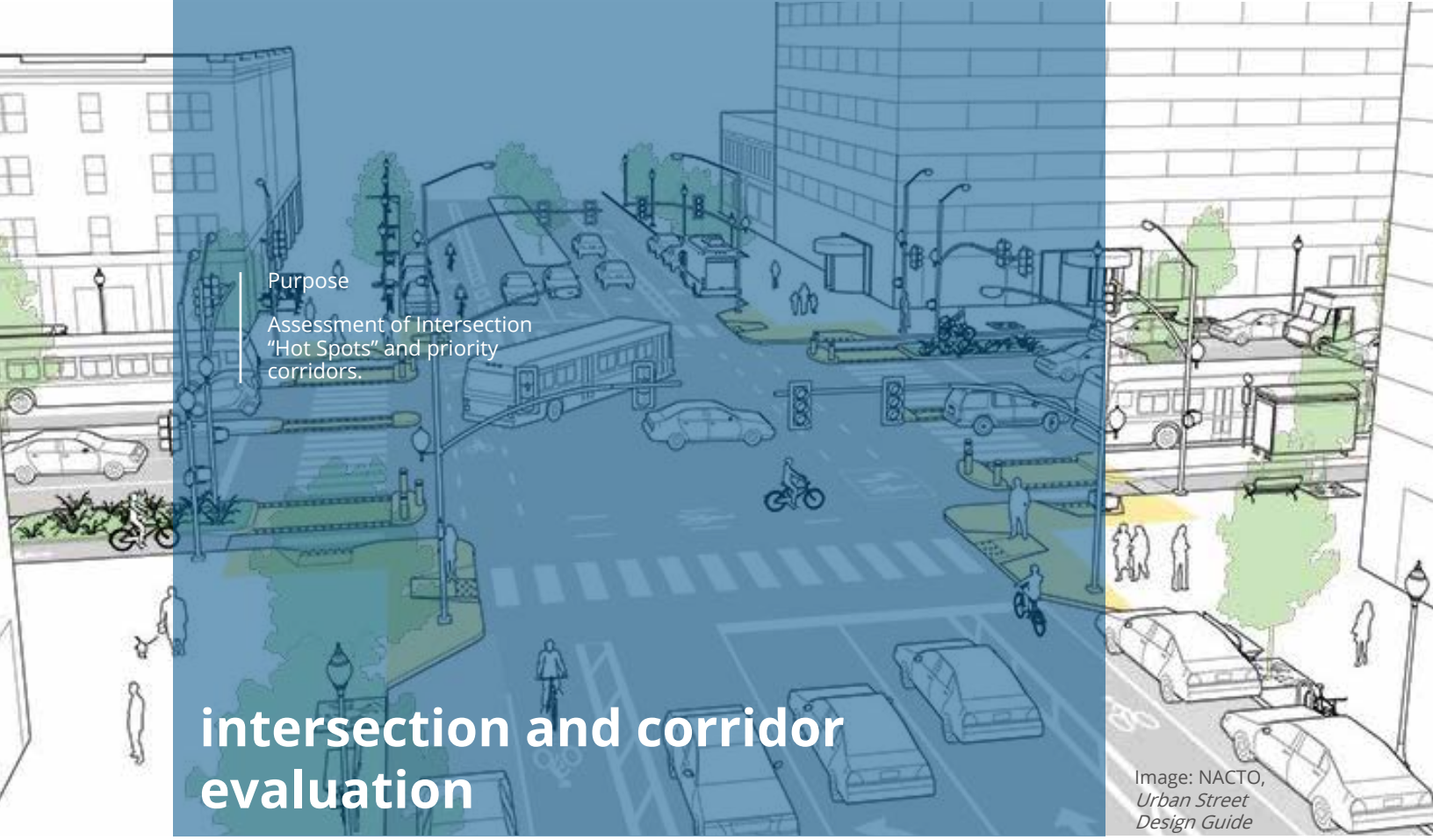
The programming and implementation of CMP strategies is intended to occur on a continual basis throughout the planning and project development cycle. CHATS and BCDCOG staff will continue to work with member jurisdictions and SCDOT to integrate congestion-minimizing strategies into projects from the planning phase through the design and implementation of projects.

Step 8: Evaluate Strategy Effectiveness

Evaluating the effectiveness of CMP strategies post-implementation will allow CHATS staff to understand where improvements can be implemented, as well as make progress on the achievement of performance measures. The CMP will rely on two primary means of evaluation: (1) trends in the overall effectiveness of strategy implementation system-wide. This monitoring will rely on data already collected or planned to be collected in support of the performance measures; and (2) effectiveness of strategies at the project level. As projects are implemented, CHATS staff will work with relevant member jurisdictions and SCDOT to conduct a series of before-and-after case studies evaluating the effectiveness of congestion reduction strategies.

Figure 2-13: Congestion Management Process Eight-Step Process





Purpose

Assessment of Intersection "Hot Spots" and priority corridors.

intersection and corridor evaluation

Image: NACTO, *Urban Street Design Guide*

Traditional regional and long-range transportation plans were typically focused on broad-brush, very long-term and usually very costly recommendations that addressed basic capacity shortfalls, usually through roadway expansions. Today, however, these plans also consider or examine more localized or location-specific problem areas, sometimes called "bottlenecks" or "Hot Spots", in an effort to address transportation issues through more low-cost, quick-to-implement improvements or mitigation strategies that improve mobility.

The CHATS Long-Range Transportation Plan process realizes the benefits that can be gained from studying specific problem areas throughout the planning area. These benefits include developing better cost estimates, more detailed design solutions at key locations, and creating more interest and activity in the public realm. The need for this type of assessment is supported indirectly by recent federal emphases on developing practical, innovative solutions that yield measurable performance improvements.

HOT SPOTS

Hot Spot locations were reviewed and described both in terms of typical congestion as well as physical characteristics for all modes of travel (their "completeness"). Pedestrian, bicycle, street crossing, transit, and safety (crash) characteristics were noted as needing improvement, adequate, or already good.

CORRIDORS

Corridors were assessed using a multi-modal level-of-service model that provides letter grade (shown in summaries) and numerical scores that allow a "before-and-after" understanding of recommendations and their impacts.

Hot Spot and corridor locations were identified in prior long term planning efforts and maintained in this LRTP by considering traffic, crash, and public input data gathered during the planning process. Eight Hot Spot and five corridor locations were studied using the approach shown on the previous page. Of these, eight Hot Spots and three corridor segments were conceptually redesigned in the Roadway Recommendations chapter.

P	B	C	T	S

KEY: P=Pedestrian Treatments; B=Bicycle Treatments; C=Crossing Treatments; T=Transit Provisions; S=Safety
white square=not applicable; green=good/preserve; yellow=adequate; red=improvements needed

01	US 17 ALT/MAIN & MYERS

P	B	C	T	S

A recent realignment of this intersection installed sidewalks and better turning provisions. However, all approaches are still congested , particularly the southbound movement. No bicycle facilities, and sidewalks abut the back of curb. Aesthetics, lighting, shade, and crossing treatments are all areas of improvement, as are any relief measures to improve traffic flow.

02	LONG POINT & US 17 NORTH

P	B	C	T	S

Unusual in that the intersection lacks a “hard” commercial corner, residential and institution (church) uses predominate. One missing crosswalk, discontinuous sidewalks, and abundance of pavement to accommodate relatively modest volumes (as evidenced by low levels of congestion) create a forbidding environment to cross over 110’ on foot, although high-level lighting and pedestrian signals are present. There are no amenities at the transit stops 400’ to the east.

03	MAYBANK HWY & MAIN/BOHICKET

P	B	C	T	S

In a rural area with a small pocket of development, this area has a potential for a neighborhood-scale commercial node spurred by growth in the region. A significant skew and driveway encroachment from highway-oriented retail/service land uses degrade the design. Inconsistent crossing treatments, sweeping right turns, and sporadic sidewalk treatments leave room for improvements. Posted at 45 mph, congestion on Maybank Highway suggests the need for capacity and traffic flow improvements. This area aslo functions as a link stop for the Tri County Link’ green and blue lines.

04 FOLLY & SOL LEGARE

P	B	C	T	S

This intersection is primarily hampered by an offset leg (Tern's Nest Road) to the north and east of the Sol Legare intersection. Congestion is related to seasonal flows. While there are no sidewalks present, a bicycle lane does traverse both sides of Folly Road. The nearest bus stop is a half-mile away. Grocery store, multi-family, and single-family residences line the corners, as does a power substation in the southeast quadrant. This area quickly launches into marshland before accessing Folly Beach.

05 US 78 & LADSON

P	B	C	T	S

Long pedestrian crossings could be mitigated by "pork chop" islands to connect the sidewalk that abuts the travelway now. There is currently no median refuge, although the driveways would support creating them. There are no bicycle treatments, and transit service stops just short of this location. Mid-day and PM peak period congestion is typical, particular Ladson Road.

06 REMOUNT & NORTH RHETT

P	B	C	T	S

With a park occupying the northwest quadrant and a grocery store in the southwest corner, this location has the potential to be a mixed-use enclave. CARTA transit (Route 13) is here, but is minimally provided-for on the west leg of the intersection, and with a bench on the NE corner. Sidewalks are discontinuous and abut the roadway, but pedestrian signals are present. Lighting and sweeping right-turn radii present potential safety concerns. Better and more consistent streetscaping would be an asset. This location is on an Evacuation Route.

07 COSGROVE & AZALEA

P	B	C	T	S

This intersection is immediately off of the I-26 exit and traffic merging into Cosgrove to turn west on Azalea have little time to cross 4 lanes of traffic. This movement becomes near impossible when the left turn lane queues during peak times, with extreme cases leading to stacked traffic up the off-ramp to the interstate. Free flow turns and lack of bicycle and pedestrian amenities creates dangerous conditions non-motorized travel. Four bus stops are located within a quarter mile of this intersection.

08	BETSY KERRISON & SEA ISLAND

P	B	C	T	S

Bohicket Road and River Road are two of the main thoroughfares crossing Johns Island and meet at Betsy Kerrison Parkway, connecting Seabrook and Kiawah Islands back to the mainland. Both Bohicket and River are primarily two-lane scenic byways that connect a number of communities on the island. Due to development on the islands, these smaller roads are facing increased traffic and congestion. To prevent changing the character of those two corridors, the proposed Sea Island Parkway would be constructed through the middle, becoming the spine of Johns Island and easing the congestion from the byways. This intersection would be where Sea Island connects back to these three roads.

P	B	C	T	S

KEY: P=Pedestrian Treatments; B=Bicycle Treatments; C=Crossing Treatments; T=Transit Provisions; S=Safety
white square=not applicable; green=good/preserve; yellow=adequate; red=improvements needed

COMMONPLACE HOT SPOT ISSUES

- Crossing provisions lacked well-maintained or high-visibility crosswalks
- Design, such as skewness, hampers the flow of turning vehicles and contributes to congestion
- Transit service often ends just short of the Hot Spot; where there was service, stops were often located "near-side" to the intersection often without furniture or shelter to riders
- Basic sidewalk and bicycle provisions were missing, particularly for on-road cycling
- Streetscaping was inconsistent, missing, or poorly maintained
- Lighting, when present, was high-level and ineffective for pedestrians
- Delineation of public-private spaces, maintenance of adjacent land uses, and a lack of unique characteristics that create a sense of place may contribute to poorly perceived security

01 CORRIDOR: SC 165 (BACONS BRIDGE ROAD)

Note: Level of Service grades (A-F) are assigned based on LOS of each mode along route.

Northbound
Auto: B
Ped: E
Bike: D
Bus: F

Southbound
Auto: B
Ped: E
Bike: D
Bus: F

DORCHESTER TO LIVE OAK

A sidepath (east side) between Dorchester and Ridge falls short of the Sawmill Branch Trail access. No fixed-route transit service. The Dorchester intersection features dual left-turn bays to accommodate heavy turns.

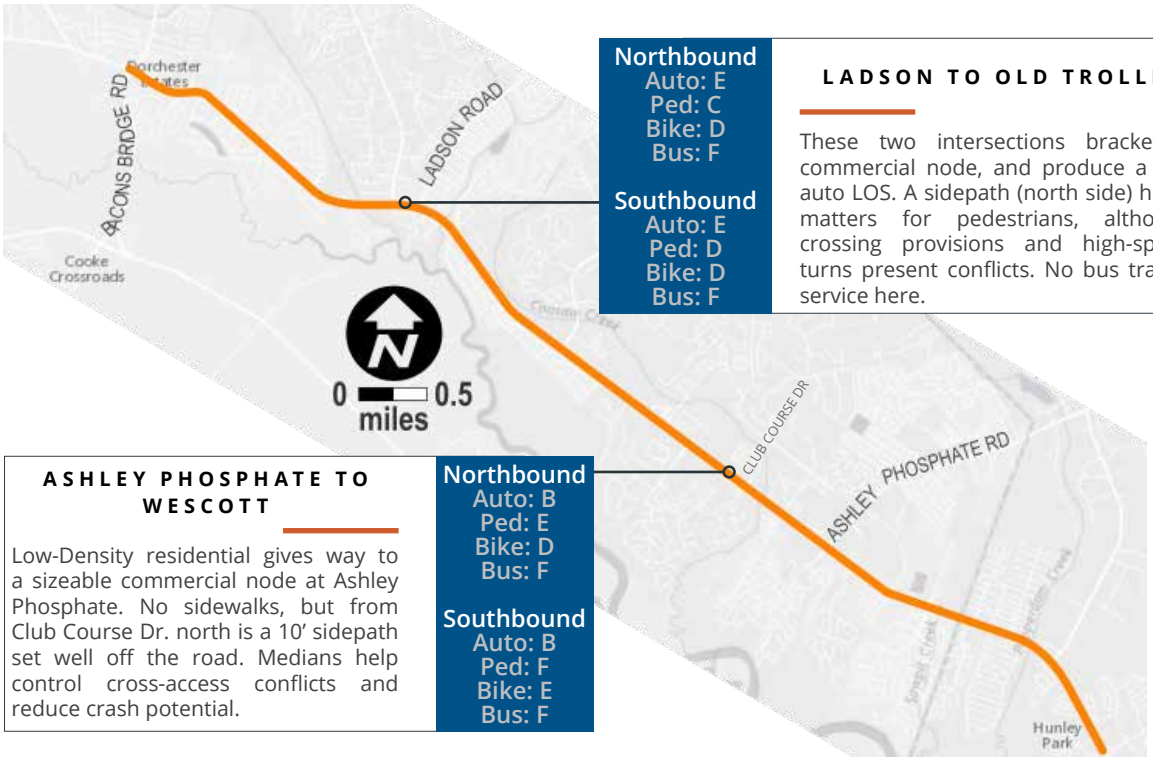
Northbound
Auto: B
Ped: E
Bike: D
Bus: F

Southbound
Auto: B
Ped: E
Bike: D
Bus: F

BEECH HILL TO DORCHESTER

Construction work will widen the road, assumed to be five lanes. No sidewalk yet exists, but the reconstruction may be addressing this shortcoming. Minor queuing is typical on the west and south legs of the Dorchester intersection in peak periods.

02 CORRIDOR: SC 642 (DORCHESTER ROAD)



Northbound
Auto: E
Ped: C
Bike: D
Bus: F

Southbound
Auto: E
Ped: D
Bike: D
Bus: F

LADSON TO OLD TROLLEY

These two intersections bracket a commercial node, and produce a low auto LOS. A sidepath (north side) helps matters for pedestrians, although crossing provisions and high-speed turns present conflicts. No bus transit service here.

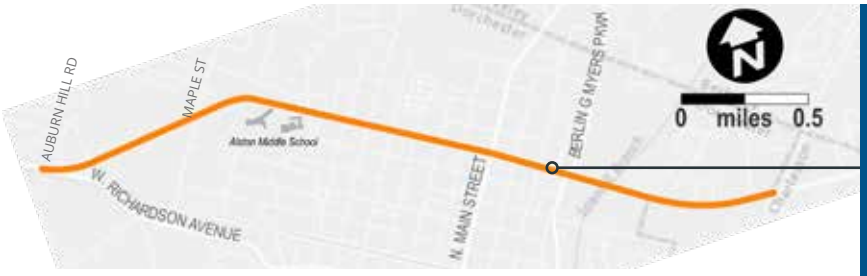
ASHLEY PHOSPHATE TO WESCOTT

Low-Density residential gives way to a sizeable commercial node at Ashley Phosphate. No sidewalks, but from Club Course Dr. north is a 10' sidepath set well off the road. Medians help control cross-access conflicts and reduce crash potential.

Northbound
Auto: B
Ped: E
Bike: D
Bus: F

Southbound
Auto: B
Ped: F
Bike: E
Bus: F

03 CORRIDOR: US 78 (5TH STREET)



Westbound
Auto: D-F
Ped: E
Bike: D
Bus: F

Eastbound
Auto: D-F
Ped: F
Bike: E
Bus: F

DOWNTOWN SUMMERVILLE

This small town main street sees congested conditions from mid-day through the PM peak period from Myers to Cedar. Sidewalk is very rare, and there are no bike provisions (although the Sawmill Branch Trail is nearby). Business driveways are sometimes poorly defined; intersections at Auburn Hills and Maple could be improved.

04 CORRIDOR: RIVERS AVENUE

Although there is a bike lane on Rivers Avenue, traffic volumes and speeds encourage use of the sidewalk.

Westbound
Auto: D
Ped: C
Bike: B
Bus: E

Eastbound
Auto: D
Ped: C
Bike: B
Bus: E

COSGROVE TO DURANT

The highway-directed land uses have many driveways and present the greatest (access management) challenge in the corridor. With bike lanes, sidewalks, and transit on 20 to 30-minute headways, Rivers Avenue is the most "complete" of the corridors. However, design (e.g., railroad), safety, and aesthetic challenges remain to improve viability.

05 CORRIDOR: US 52 (GOOSE CREEK BOULEVARD)

OLD MT. HOLLY TO OLD FORT

Some congestion from US 176 to the south occurs now. Access management will play a vital role as the corridor develops further, with several unsignalized crossings set. No bike/ped facilities are present, but the sidepath (and transit service) that stops just south could be extended with acquiring additional right-of-way.

Northbound
Auto: A
Ped: F
Bike: E
Bus: F

Southbound
Auto: A
Ped: F
Bike: E
Bus: F

roadway directions

The Project Team was challenged with coordinating this information, past plans (including the adopted LRTP), and identifying the remaining shortfalls in capacity and performance identified through forecasts of simulated future travel needs. Some, although not all, of the specifics are shown at right ("Roadways: What We Heard"), with more general directions that need to be considered in the development of the recommendations discussed in the following paragraphs.

It's About Traffic and Congestion, Sort of

While there are many newcomers to the region arriving every day, more participants in outreach efforts have lived in the BCD Region for 10, 15, or 20 years. These people have seen enormous change, and particularly lengthening trips and longer periods of traffic congestion. A number of people voiced a concern about the pace, location, design, or other aspects of a successful economy and wanted policies to reflect the need to better manage new development, or at least make it pay for a larger share of the infrastructure that supports it.

Everyone (and Place) has Their Limit

Although there is still room for roadway capacity improvements, the additional infrastructure is increasingly expensive to plan, design, build, and maintain. Technology, transit, and active modes of travel will have to bear an increasing share of the responsibility to move people and goods in a place that values its historic and natural resources. Twenty-four travel lanes across various corridors connect the northwest edges of the CHATS planning area to the Charleston central business district. Adding more travel lanes may help segments of the corridor, but that capacity still has to "funnel" down to lower-capacity streets.

Feeding the Beast

Perhaps the most significant barrier to overcome is that of creating stable financing adequate to build and maintain a transportation system with a capacity that meets the demand. The Team heard many times that new improvements are overwhelmed or obsolete by the time they are constructed, implying that higher-capacity designs should have been pursued initially.

Roadways: What We Heard

- **Summerville**
  Several commenters highlighted issues on downtown streets and major arterials to the west of town (e.g., Orangeburg Road, Dorchester Road).
- **Charleston/North Charleston**
  The areas around Montague Avenue, I-526/I-26 interchange, Savannah Highway, Sam Rittenburg Blvd., and other major highways were focal points for many commenters, particularly specific intersections from a capacity standpoint.
- **Mt. Pleasant/Sullivan's Island**
  There were fewer comments here, and focused on fewer areas, such as intersections with the Isle of Palms Connector and SC Hwy 41. There were more biking, walking, and transit destinations on the islands and beaches, but connections to them were noted as being important facilities and services to improve.
- **James Island/Folly Beach/Kiawah**
  Maybank Highway, River Road, and Bohicket Road intersections and, to some extent, roadway capacity were noted as areas to improve.
- If there was an **over-arching theme** to many of the comments received at the project symposia and other venues, it is that the capacity of the roadways has been reached and that congestion is rapidly worsening, threatening the economy, freight movements, and emergency response times. Workshop participants noted that managing capacity and elevating complete streets as their top priorities.

walk & bike conditions

Purpose

Integration of concerns identified in the recent WalkBike BCD Plan.

Walking, bicycling, and other low-speed forms of transportation are critical elements of the region's transportation network. As the counties and municipalities within the CHATS boundary continue to experience rapid population and employment growth, the region has a unique opportunity to build high-quality micromobility infrastructure as part of new development and to make use of available federal funding to retrofit existing neighborhoods.

Small block sizes in the region's historic, densely-gridded neighborhoods provide a model for how to create future walkable developments. This grid, a remnant of the area's pre-motor vehicle planning, has been replicated in some of the area's newer developments such as I'On in Mount Pleasant and Oak Terrace Preserve in North Charleston.

Neighborhoods built around golf courses with pathways such as Crowfield Plantation and the Hamlets in Goose Creek, Legend Oaks in Dorchester County, and the Daniel Island Club area offer an alternative design with strong interconnectivity. However, these neighborhoods may lack the nearby mixed land uses to encourage walking and biking trips in lieu of using a vehicle.

Map 2-4: Existing Pedestrian & Bicycle Facilities

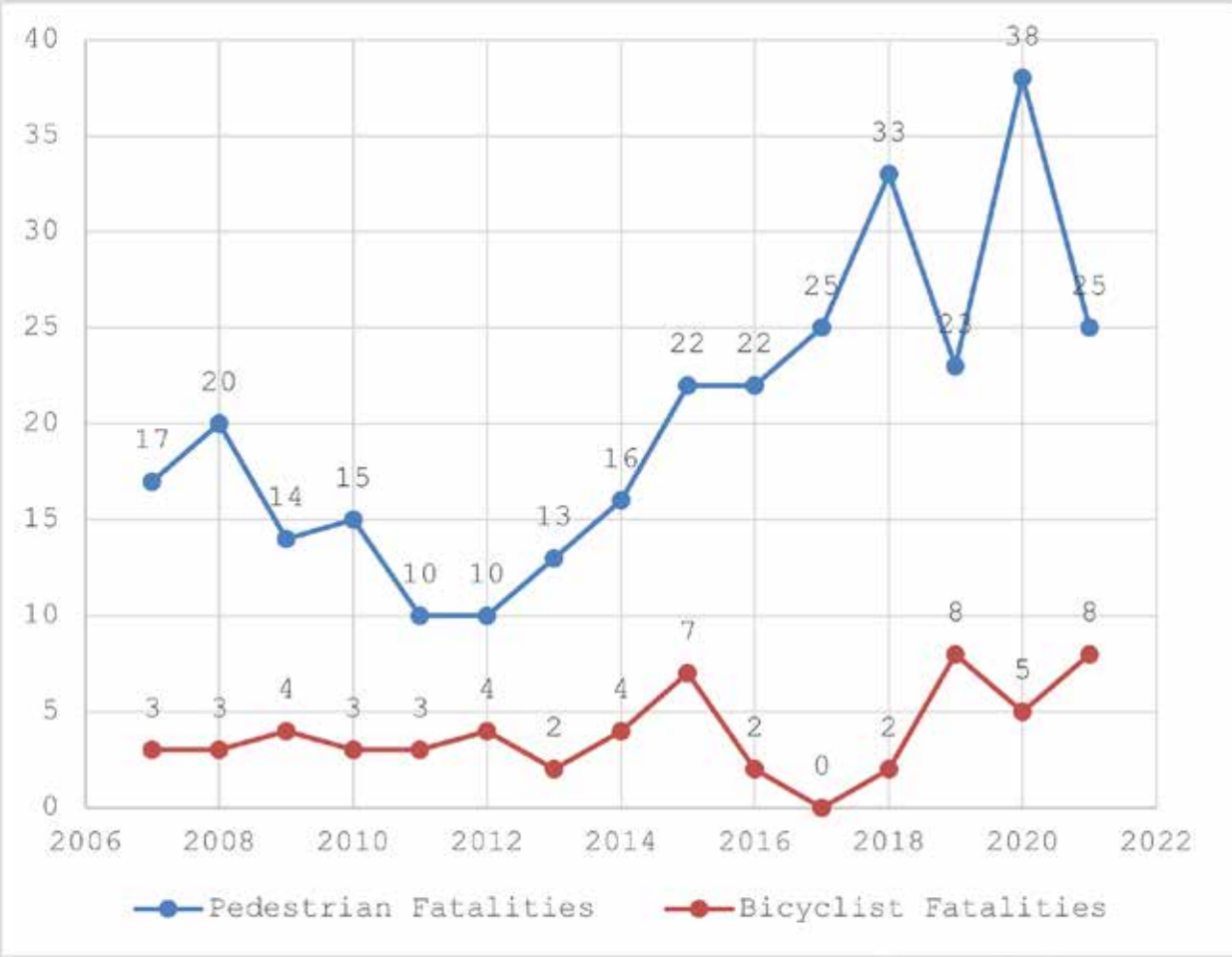
...fatalities are not simply statistics, but represent the deaths of neighbors, workers, family members, and residents in the region.

bicycle and pedestrian crashes

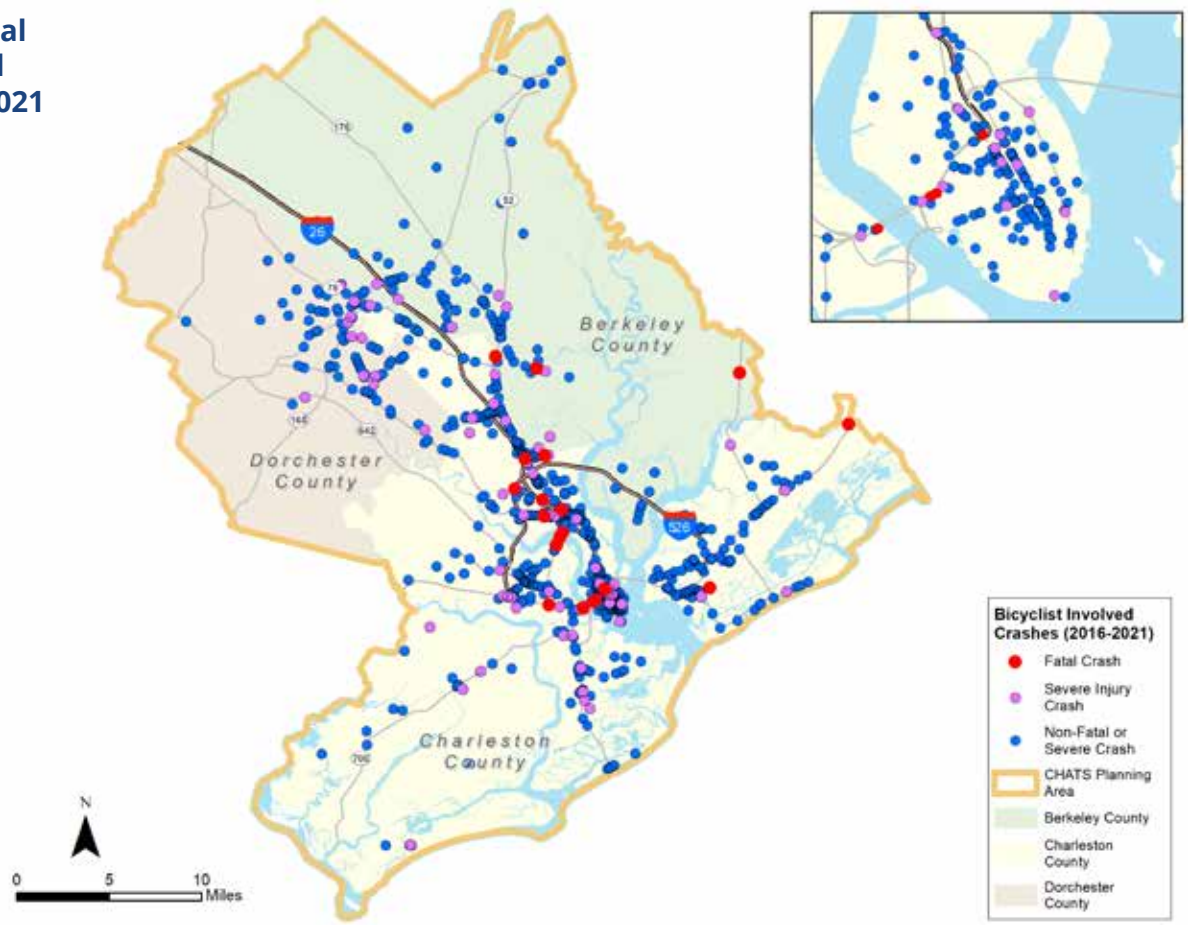
According to the most recently available data from the National Highway Traffic Safety Administration (NHTSA FIRST), South Carolina had the **second highest rate** of pedestrian fatalities per 100,000 population and the **fourth highest rate** of bicyclist fatalities per 100,000 population between 2019 and 2021. Within South Carolina, the number of pedestrian fatalities in 2021 was 284% higher than a decade prior (190 fatalities compared to 123 fatalities), and the number of bicyclist fatalities increased 230% over the same time period (46 fatalities compared to 26%).

As shown in **Figure 2-14**, this statewide trend of increasing pedestrian and bicyclist fatalities is also evident in Berkeley, Charleston, and Dorchester counties. These fatalities are not simply statistics. They represent the deaths of neighbors, co-workers, family members, and residents in the region. Their stories are embedded in the data of this plan and emphasize the need to invest in safer streets.

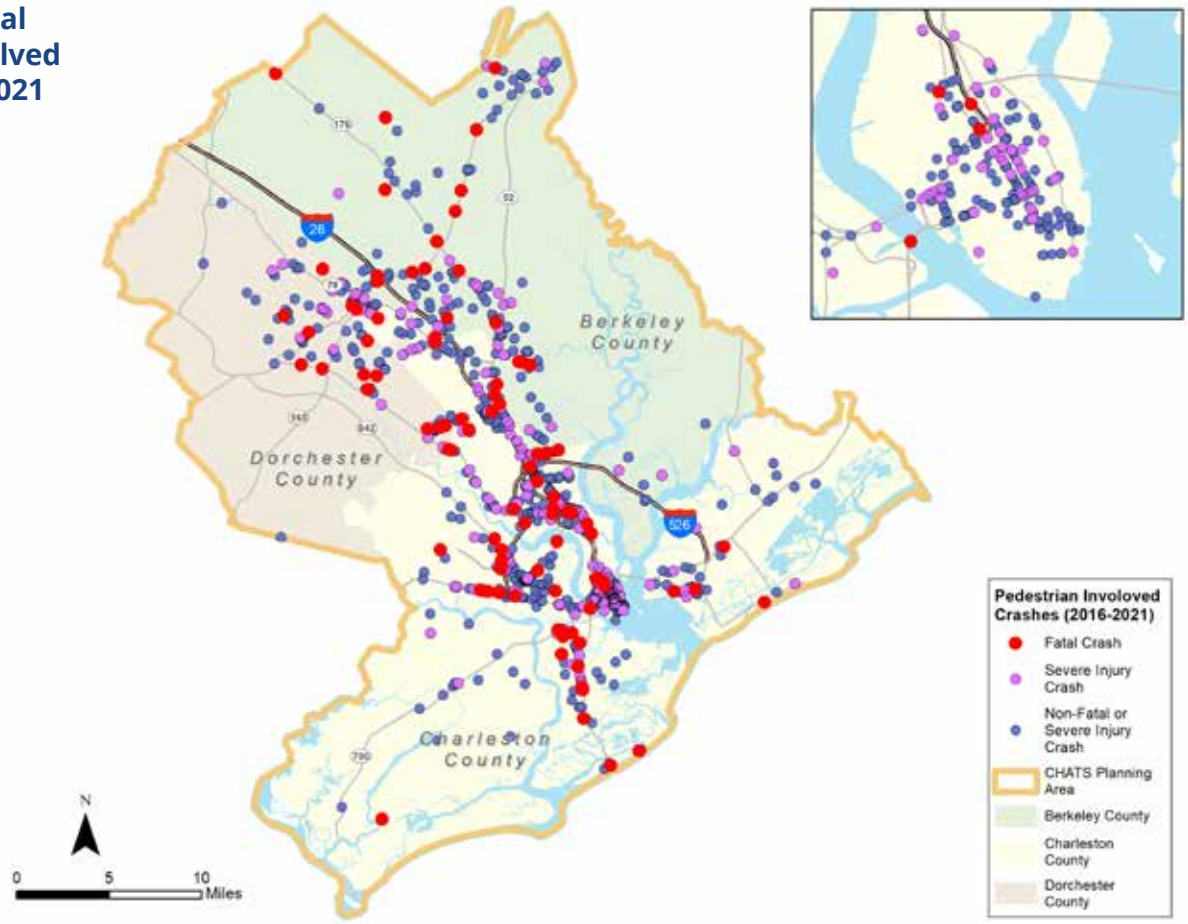
Figure 2-14: Pedestrian & Bicyclist Fatalities for Berkeley, Charleston, & Dorchester Counties (NHTSA FIRST, 2007-2021)



Map 2-5: Regional Bicycle Involved Crashes, 2016-2021



Map 2-6: Regional Pedestrian Involved Crashes, 2016-2021

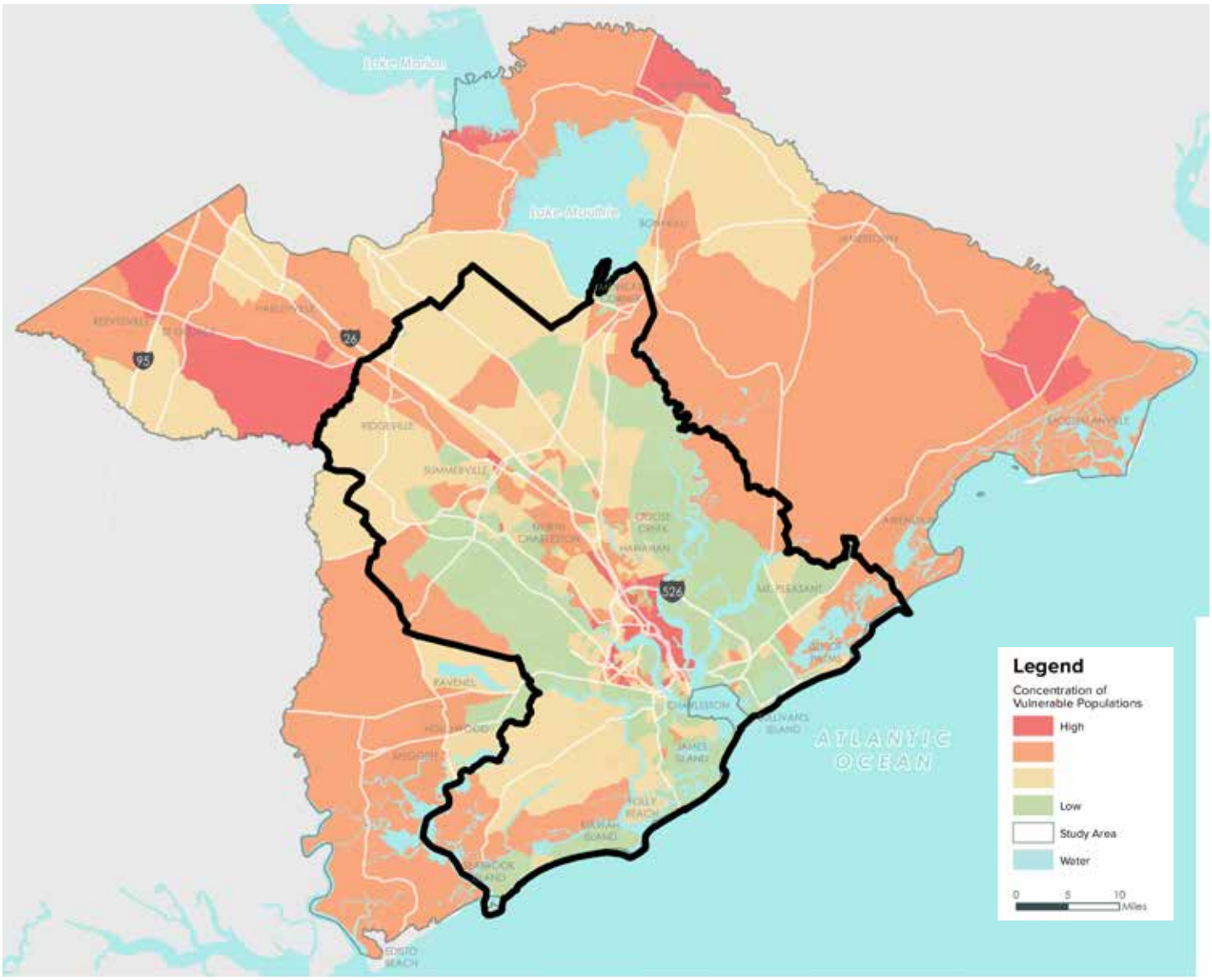


barriers and challenges

Recent growth and development patterns within the CHATS boundary have typically failed to support walking and bicycling. Major arterials, such as I-26 and US-17, bisect neighborhoods with high-speed traffic and present roadblocks to pedestrian and bicyclist mobility even when the neighborhoods themselves are walkable/bikeable.. Bridges without adequate walking and bicycling infrastructure, such as the SC-7 Bridge (NorthBridge), Burnet R. Maybank Memorial Bridge, General William C. Westmoreland Bridge, Don N. Holt Bridge, and James B. Edwards Bridgeoften disconnect entire communities from one another.

Map 2-7 illustrates an equity analysis of Census Tracts within the CHATS boundary using six socioeconomic factors: children, older adults, non-white populations, low-income households, personal motor vehicle access, and linguistic isolation. The Census Tracts with the most vulnerable populations were found to be concentrated in downtown Charleston, West Ashley, Summerville, North Charleston, and near I-26.

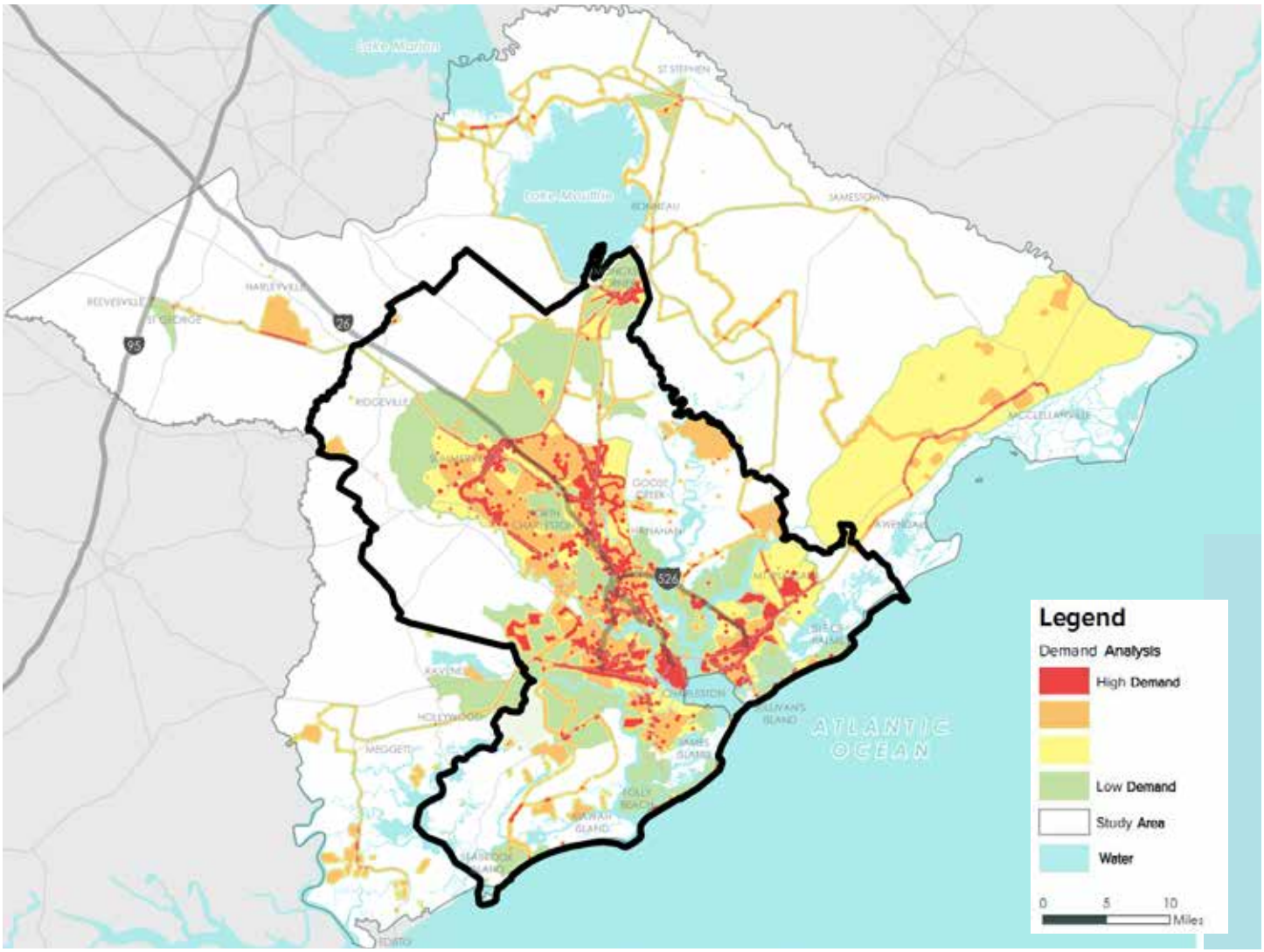
Map 2-7: Regional Equity Analysis (2017)



demand

Map 2-8 illustrates a demand analysis of areas within the CHATS boundary based on proximity to activity centers for working, learning, recreating, living, and accessing transit. Areas with the highest potential demand for walking and bicycling trips are concentrated around central business districts and densely populated neighborhoods in Charleston, North Charleston, Mount Pleasant, and Moncks Corner.

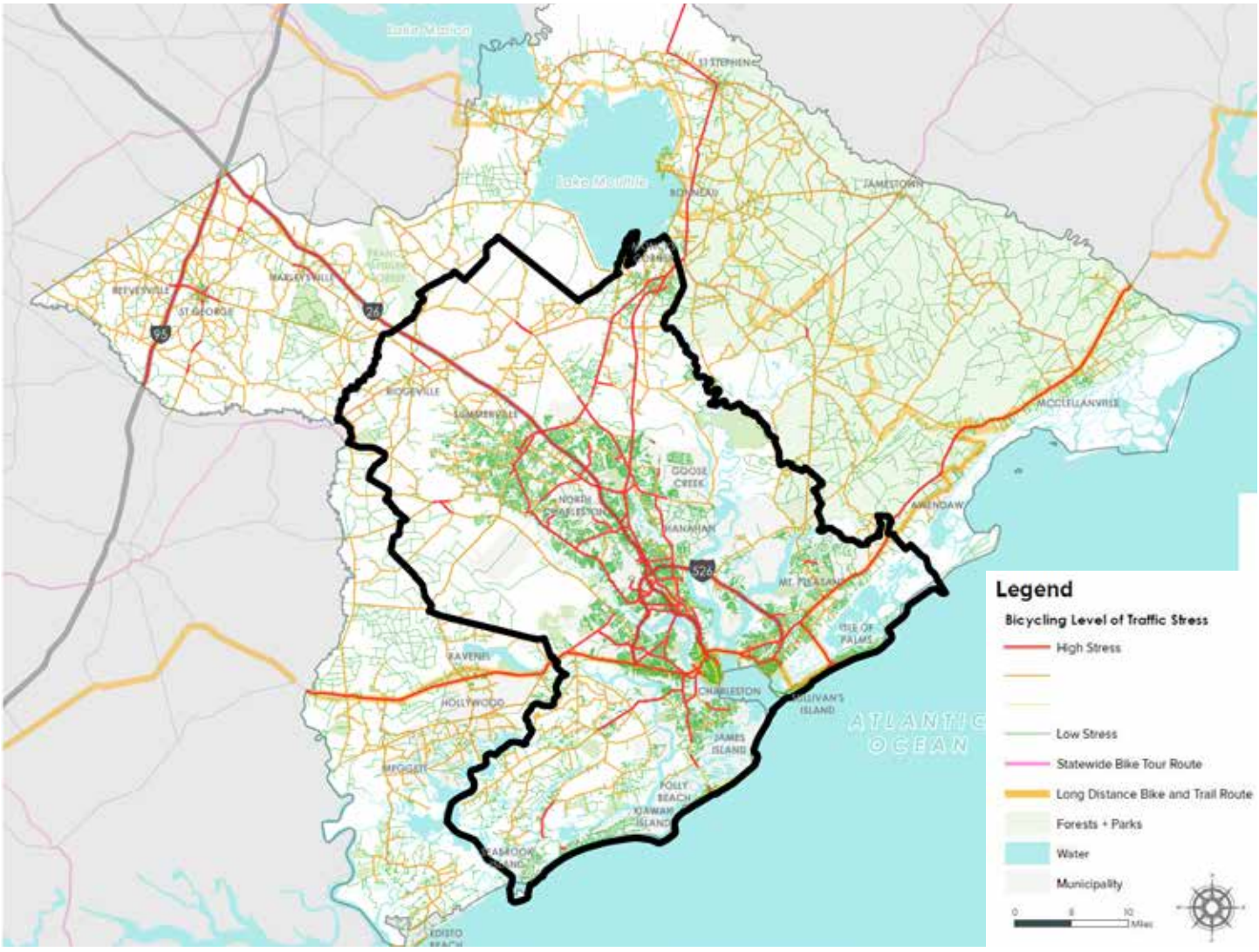
Map 2-8: Regional Walking & Bicycling Demand Analysis (2017)



stress

Map 2-9 illustrates a "bicycling level of traffic stress" analysis of areas within the CHATS planning area based on the presence and type of existing bikeways and pathways, as well as the classification of adjacent travel lanes and their posted speed limits. The results provide a useful snapshot of the quality of the existing bicycling environment. Residential streets with two lanes and lower speeds offer more comfortable, lower stress environments, particularly when designed with bike lanes or wider shoulders.. Off-street shared-use paths that are separated from motor vehicle traffic offer the lowest stress environments. Using these parameters, approximately 70% of roads within the CHATS boundary are considered low stress for bicycling. The remaining 30% are high stress and primarily constitute major thoroughfares that connect people to employment centers, educational institutions, and commercial districts.

Map 2-9: Regional Bicyclist Level of Traffic Stress Analysis (2017)



sharing the ride

Bikesharing systems support the use of cycling in dense areas where shorter trips can just as efficiently, or more efficiently, be accomplished without the use of a vehicle. In 2022, Lime took over operations from Gotcha Group of the bikeshare system on the City of Charleston's peninsula. The new bike share system has over 40 existing stations (see **Figure 2-15**). There are no other bikeshare or low-speed shared mobility systems within the CHATS planning area

Figure 2-15: Lime Bikeshare (Lime, 2023)

bicycle & pedestrian directions

BCDCOG last updated its regional bicycle and pedestrian plan, *Walk Bike BCD*, in 2017. Themes from the plan include:

We're Doing this for Our Health

Accessibility to walking and bicycling facilities helps to discourage single-occupancy vehicle trips and encourages physical activity. Walking helps to control weight, and therefore, helps to positively influence a wide range of health conditions including diabetes, hypertension, and heart disease.

Safety is Paramount

Pedestrian- and bicyclist-involved collisions have historically been concentrated in densely-populated areas, around older populations, and places with high tourist traffic. Counties within the CHATS planning area have experienced some of the highest rates of pedestrian and bicyclist fatalities in the state. Participants in the WalkBike BCD planning process were provided a list of potential safety countermeasures to prioritize. From that list, pathways, decreasing speed limits on certain roads, and making intersections safer to cross by foot and by bicycle were the preferred strategies to make the roads safer for pedestrians and bicyclists.

Infrastructure Needs

Only 20% of respondents during the WalkBike BCD's plan development indicated that bicycling in the region was a "safe, practical, and convenient way to get from one place to another". Walking did not fare much better at 30% of respondents. To address this, 90% of respondents agreed that tax dollars should include pedestrian and bicycle amenities, allocating almost 70% of funds to sidewalks, bikeways, and closing gaps in the regional pathway network. .

public transit conditions

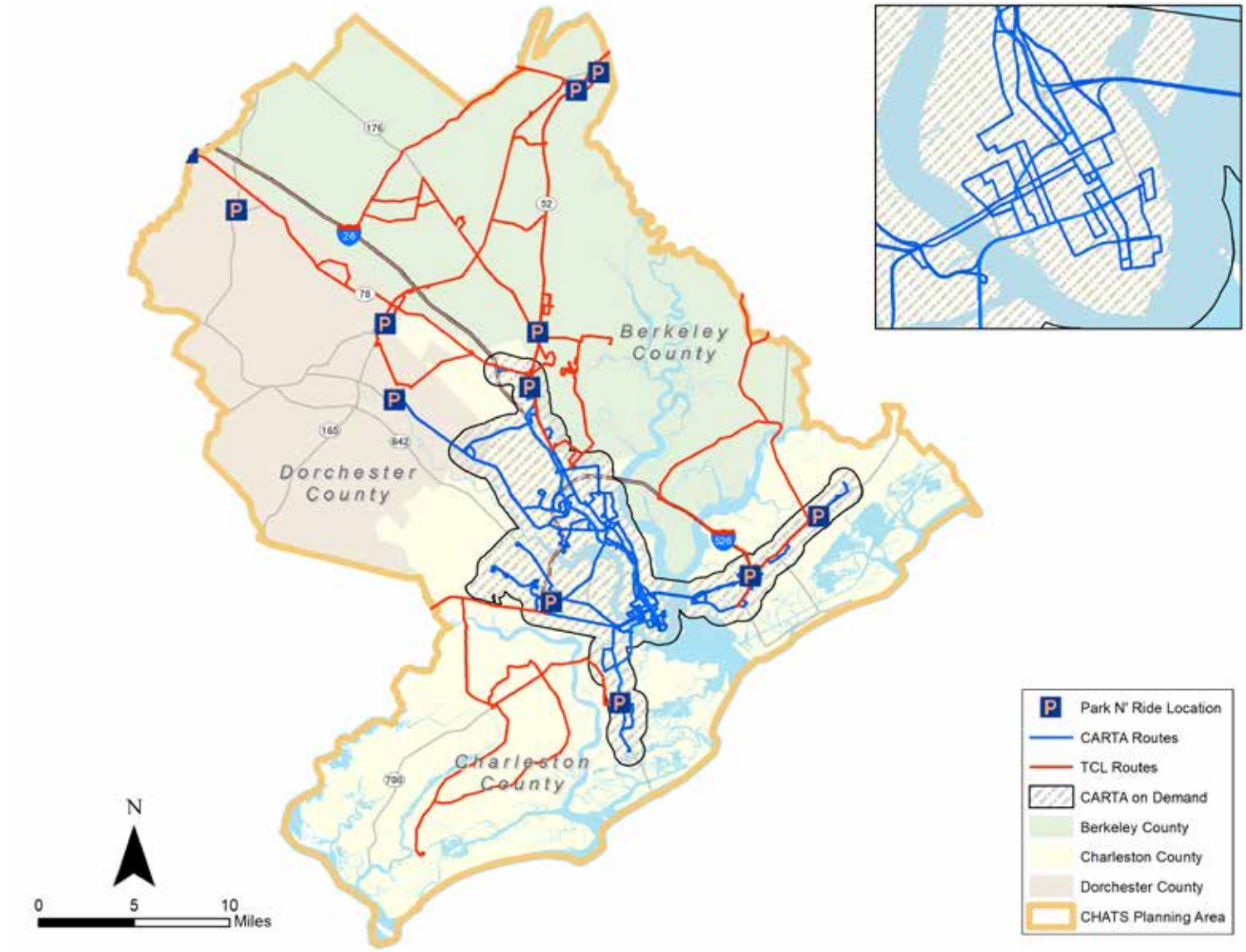
Public transportation in the CHATS planning area is operated by two fixed-route bus services and human service providers within the three counties. The following summary includes findings from outreach to transit operators as well as a technical review of past performance data and current operating services.

Fixed services are provided by two agencies: the Charleston Area Regional Transportation Authority (CARTA) and the Berkeley-Charleston-Dorchester Rural Transportation Management Association (RTMA, d.b.a. TriCounty Link). CARTA primarily serves the urban core of the planning area with fixed route, commuter bus, and paratransit services, while TriCounty Link (TCL) primarily serves the rural areas with deviated fixed route and commuter services. **Map 2-10** illustrates the CARTA and TCL route networks within the CHATS planning area.

Purpose

Brief review of primary transit services and performance.

Map 2-10: Public Transit Service



CARTA services

The CHATS Planning Area is served by two public transportation systems. Charleston Area Regional Transportation Authority (CARTA) is the region's urban public transportation provider that provides transit service in downtown Charleston and surrounding areas. The Berkeley, Charleston, Dorchester Rural Transportation Management Authority (BCD-RTMA), more commonly known as TriCounty Link (TCL), is the region's rural public transportation provider that makes connections to CARTA services in the urban area. All CARTA and TCL vehicles conform with Americans with Disabilities Act (ADA) accessibility requirements by including amenities such as ramps, lifts, and securement systems for mobility devices. CARTA and TCL have an agreement that enables riders to transfer between the two systems at no cost. Working together, CARTA and TCL ensure accessible and affordable transportation access throughout the rural and metropolitan areas of the tri-county region. Map X shows CARTA and TriCounty Link routes along with their respective service areas.

CARTA operates fixed-route bus service and ADA complementary demand-response paratransit service throughout the Charleston-North Charleston urbanized area. CARTA's fixed-route bus service includes 17 local routes, three (3) limited stop express bus routes, and the Downtown Area Shuttle (DASH) which is a free shuttle circulator

system in the Historic Charleston Peninsula area of downtown Charleston. CARTA's demand-response services include Tel-a-Ride, which is the system's primary paratransit offering, as well as CARTA OnDemand, a partnership with rideshare companies Uber and Lyft that is open to seniors 55-years of age or older and registered Tel-A-Ride customers. The service area for both Tel-a-Ride and CARTA OnDemand includes any location within ¾ of a mile of CARTA's fixed route services. CARTA also operates seven (7) park and ride facilities that are free of charge for commuters using the express route system. CARTA operates 365 days a year, with local routes generally running from approximately 5:15 AM to 8:30 PM and frequencies ranging from 15 to 105 minutes. The service area covers a total of 9 municipalities in the Charleston-North Charleston Urbanized Area, primarily in Charleston County.

TriCounty Link services

TriCounty Link (TCL) serves the areas of Berkeley, Charleston and Dorchester Counties that lie outside of the CARTA service area. Although TCL is primarily considered a rural system, some portions of the service area fall within the US Census designated urbanized area boundaries, most notably in the Towns of Moncks Corner and Summerville and the City of Goose Creek. TCL operates ten regular local routes, four commuter routes, and a demand-response service known as "Link-to-Lunch." TCL's fixed-route system operates as a "flag-stop" service in which customers can summon the vehicle for pickup between designated stops along the route. TCL does not have an independent paratransit service but does

provide ADA paratransit service in conjunction with the fixed-route system by deviating up to ¾ of a mile off the established routes for eligible customers.

Ridership & Performance

Data available from the National Transit Database (NTD) and the American Community Survey (ACS) provides insight into how the CARTA and TriCounty Link systems have performed and been utilized in recent years and over time. Service can be analyzed in terms of both consumption and supply, with consumption statistics expressing the usage of the system by the public and supply statistics expressing the amount of service that was provided by the agency.

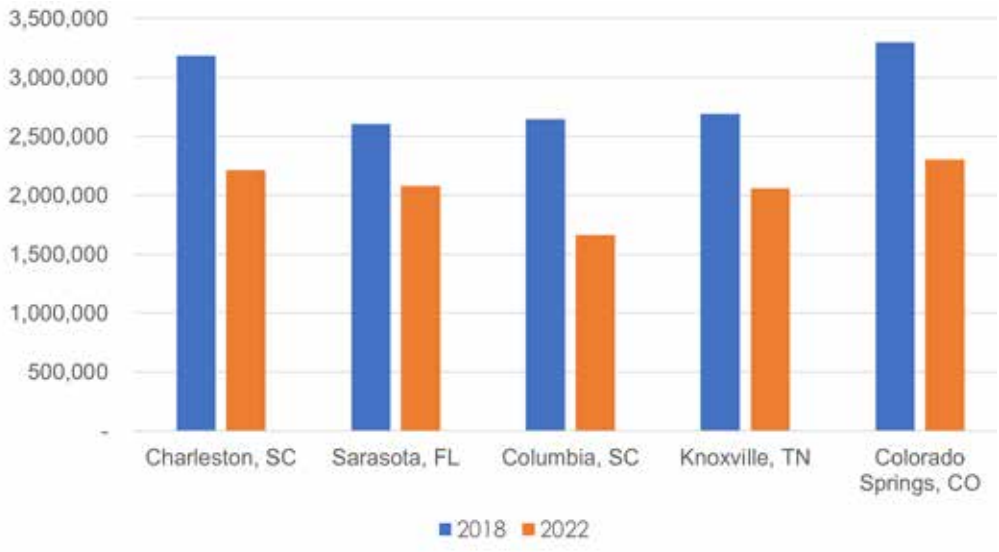
According to ACS 5-Year estimate datasets, public transportation in the urbanized area of Charleston accounts for only a small percentage of workplace commuting and the share of individuals reporting to use public transportation for commuting has decreased since 2015. ACS data shows that on average from 2015-2021, one-percent (1%) of the working population aged 16 and over in the Charleston-North Charleston metropolitan statistical area (MSA) used public transportation to get to work (see **Table 2-2**).

Table 2-2: Transit Ridership for Working Population 16 Years and Older, Charleston MSA, 2015-2021

Year	2015	2016	2017	2018	2019	2020	2021
Regional Working Population	332,831	345,940	357,767	367,113	377,693	385,291	387,485
Transit Commuters	4,656	4,229	3,880	3,143	2,982	3,029	2,823
% Transit Commuters	1.4%	1.2%	1.1%	0.9%	0.8%	0.8%	0.7%

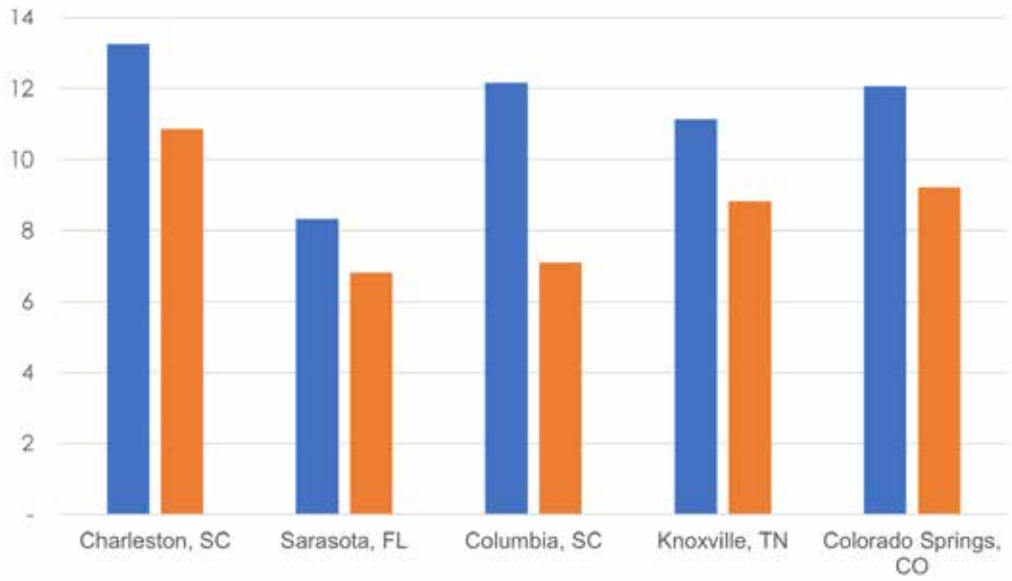
Transit ridership is reported in the NTD as unlinked passenger trips (UPT), or the number of individual trips taken by all passengers annually. In 2022, CARTA served 2.2 million unlinked passenger trips. This is a 30.6% decline from 2018; which is primarily due to the impact of the COVID-19 pandemic. CARTA is not alone in experiencing falling ridership numbers over this period—NTD data shows that peer systems serving urbanized areas with similarly sized populations have also exhibited significant decreases in transit ridership from 2015 to 2021 as shown in **Figure 2-16**.

Figure 2-16: Transit Ridership, 2018-2022



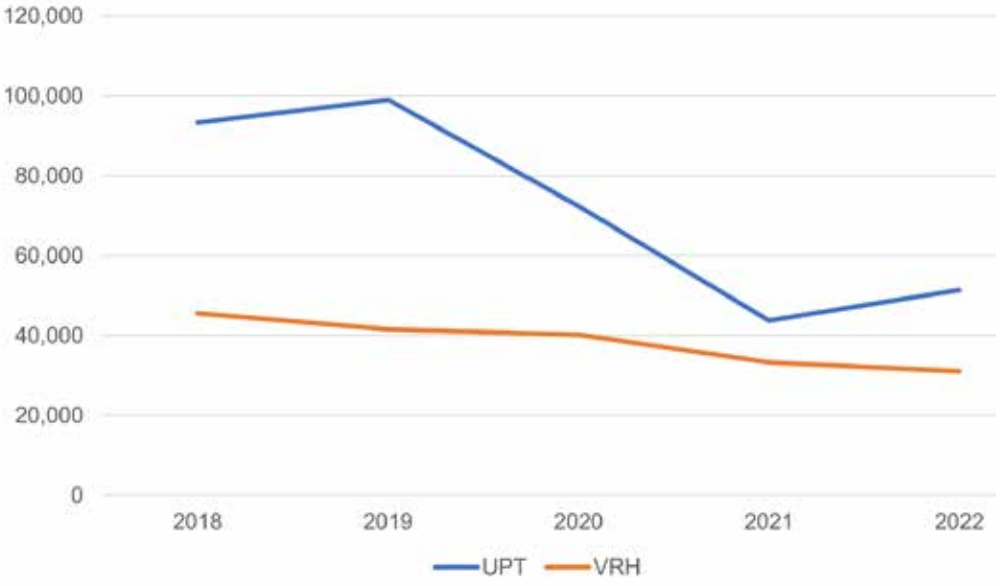
Service productivity is measured by riders per hour or the ratio of the number of passengers the transit system served per revenue hour of service provided. In 2018, CARTA served 13.3 passengers per hour, which was the highes among the peer systems. In 2022, riders per hour declined to 10.9 riders per hour; however, CARTA continued to be higher than its peers.

Figure 2-17: Transit Riders Per Hour, 2018-2022



TCL's ridership has also decreased since 2018. In 2022, TCL served 51,412 passenger trips, a 48% decrease from the 93,241 trips provided in 2018. The amount of service provided, expressed as revenue hours, declined 25% between from 2018 to 2022, also due to pandemic-related declines in ridership and driver shortages. In 2018, TCL carried 2.1 passengers per hour compared to 1.65 passengers per hour in 2022. It is important to note that this includes transit services in both the urbanized and rural areas.

Figure 2-18: TCL Unlinked Passenger Trips and Vehicle Revenue Hours, 2018 - 2022



Recent Transit Developments

The following table details major developments pertaining to the CARTA and TCL systems that took place since the last LRTP update:

2019

Opening of North Charleston Intermodal Facility

A state-of-the-art 4,000-square-foot intermodal facility was opened to serve as a hub for train service from Amtrak, local transit service from CARTA, and regional bus service from Southeastern Stages. The facility includes meeting space and a historic display room dedicated to the Liberty Hill community, the location of the former North Charleston Amtrak station. CARTA funded 80% of the $14.5 million project through FTA grant awards, with the City of North Charleston and Charleston County contributing local matching funds.

2020

Impact of COVID-19 Pandemic

The COVID-19 pandemic negatively impacted transit agencies across the country by causing massive declines in ridership and revenue. At the same time, agencies took on significant new expenses related to COVID-19 prevention measures. CARTA and TCL were both vulnerable to these impacts and the systems were forced to reduce frequency and, in some cases, suspend services. The systems have since shown indications of recovery, but both agencies are still working towards restoring service and ridership back to pre-pandemic levels.

2021

CARTA Launches *CARTA OnDemand* Program

CARTA partnered with Transportation Network Companies (TNCs) Uber and UZURV to provide subsidized demand-response rideshare services to seniors and paratransit customers. UZURV has since been replaced by Lyft.

Hospitality of the Peninsula (HOP) Service

CARTA launched the Hospitality on Peninsula (HOP) route in Spring 2018 to assist hospitality industry workers in getting to jobs on the downtown peninsula. The HOP service was intended to offer hospitality workers an alternative to the difficult and expensive task of parking in downtown Charleston's Central Business District. The service was indefinitely suspended in May of 2021 due to the City's policy changes to parking in the peninsula due to Covid and the loss of the leased parking area due to development. CARTA is designing a new Park & Ride on the peninsula, and construction is planned for 2025. HOP service is anticipated to return when the Park & Ride is complete.

Increased Route Frequency

CARTA doubled the frequency on two of the system's local fixed-routes. *Route 31 – Folly Road* provides access between the downtown Charleston peninsula and the Town of James Island. The frequency of Route 31 changed from every one and one-half hours (the lowest frequency on the system at the time) to every forty-five minutes in February 2021. *Route 32 – North Bridge* traverses the North Bridge, a half-mile segment of S.C. Highway 7 that crosses the Ashley River to connect the cities of Charleston and North Charleston. The frequency of Route 32 also doubled, going from one hour to every 30 minutes in October 2021.

Beach Reach Shuttle

CARTA launched a seasonal park-and-ride service to provide an alternative to car travel to the beach. The service is intended to reduce beach traffic and provide a beach transport option to residents with no automobile access on weekends and holidays during the summer months. The service was relaunched in 2022 and 2023.

Transit Design Guidelines

BCDCOG and CARTA adopted the Transit and Bus Stop Design Guidelines, which is a tool for facilitating the proper siting, design, installation, and maintenance of either existing or proposed bus stops on the CARTA and TCL systems. The Guidelines are intended to serve as a tool for anyone involved in the planning, design, construction, or maintenance of bus stops.

2022

LCRT Entry into Engineering

BCDCOG completed NEPA and project development for Lowcountry Rapid Transit, a planned Bus Rapid Transit (BRT) line from the Ladson Fairgrounds to the Medical District in the Charleston Peninsula. The project was rated and received approval from the FTA to enter the New Starts Engineering phase of the Capital Investment Grants (CIG) program, enabling the LCRT project to incur reimbursable costs, including Engineering activities and vehicle purchases. Engineering is scheduled to be complete and Full Funding Grant Agreement request is anticipated to occur in 2026.

Mobile Ticketing Launch

CARTA and TCL expanded fare payments options by partnering with Token Transit to enable customers to purchase transit tickets and board transit vehicles with a free app for mobile devices.

Climate Action Plan

CARTA released its first Climate Action Plan that set forth two goals: full-fleet electrification by 2045 and net-zero emissions agency-wide by 2050. The Climate Action Plan emerged from a 2018 CARTA resolution to convert its entire fixed-route fleet to battery-electric buses and is intended to provide the framework for a fully integrated strategic plan for achieving the two primary goals.[1]

Downtown Charleston Transit Study

In 2022, CARTA received Route Restoration planning funds to develop a plan to restore transit ridership in the Peninsula due to the pandemic. The Downtown Charleston Transit Study (DCTS) is identifying improvements to transit service in the near team, as well as improvements needed when the LCRT project starts revenue service in 2029. The plan includes recommendations for transit infrastructure as well as an assessment of dedicated bus lanes and their feasibility in the peninsula as future BRT corridors come online.

Transit directions

Public feedback regarding the transit system was obtained at a series of public pop-up events. Event attendees were asked to provide specific feedback on their experience using transit in the CHATS Planning area.

Many citizens thought that transit services were not a viable option for traveling around the Berkeley-Charleston-Dorchester region. This attitude was influenced by two key factors: the schedule and the connectivity of the routes. Comments related to the transit schedule were focused on limited hours that the system operates, with reduced service on weekends and the lack of service after 10 PM. Because the services only operate during certain parts of the day and week, many people did not feel that it was a reliable way to travel around the Charleston area.

Public feedback also revealed frustration that the routes were not reliable for trips to distant locations within the BCDCOG region. For instance, while the service is easy to use to get around downtown Charleston, many noted that it is difficult to get to other areas, such as Mount Pleasant, Folly Beach, or Summerville using the same system due to transfers and travel time. The public noted that the transit system feels very fragmented and localized, rather than an integrated regional system.

Transit: What We Heard

Much of the transit-related feedback expressed by community members mirrored the comments obtained for the 2040 LRTP. Common themes that resurfaced during renewed public outreach included:

- **Improved passenger amenities**
- **Greater route frequency**
- **Expanded commuter services, park-and-ride facilities, and express route**
- **Better regional access to major employment centers.**
- **Bus Rapid Transit (BRT) or Passenger Rail Service for the North (I-26) Corridor; US 17 Corridor is also a strong candidate for high-quality transit service**
- **More/Better service for the beaches**
- **Existing services often carry a poor image with choice riders, and are not competitive with auto travel currently in outlying communities**
- **Waterborne services, including access to port areas and medical facilities**
- **Increased development of park-and-ride lots and services, which aligns to the recent Park and Ride Study conducted by the BCDCOG**
- **Need to eliminate stigma associated with transit services**
- **Better information for, and marketing of, the current system and services is important**

Mobility Management

The Lowcountry Go Commuter Services Program (Lowcountry Go) is a mobility management program to help reduce peak-hour motor vehicle traffic congestion on I-26 and I-526 within the CHATS planning area. The program was launched by BCDCOG in 2018 in partnership with SCDOT and employers and stakeholders in the region, building on a series of studies on the potential effectiveness of transportation demand management strategies along I-26 and I-526 completed in 2013. The analysis found that a combination of carpool, vanpool, transit pass incentives, telecommuting, employee schedule changes, and micromobility infrastructure could reduce commute trips by up to 5% along the study corridor.

Lowcountry Go initiatives target implementation of the commuter- and employer-based strategies in **Table 2-3**.

Table 2-3: Transportation Demand Management Strategies (SCDOT)

Commuter-based	Employer-based	Operations
Carpool/ridematching Programs to encourage and match multiple workers with similar commutes to share trips to/from the workplace	**Telecommuting** Use of mobile telecommunications instead of physically commuting a place of work	**Managed lanes** (see Chapter 10 for more information) These references may not work in this document for now so leave out
Vanpool Programs that provide multiple workers (usually 4+) with similar commutes contract to use a van to share trips to/from the workplace	**Flexible work schedules** Work schedules allowing employees to arrive and depart work outside the peak periods	**Congestion pricing** *(see Chapter 10 for more information)*
Emergency ride home Programs to reimburse carpool and vanpool users for trips by taxi, TNC, or transit services that cannot be accommodated by the regular carpool or vanpool schedule	**Staggered work schedules** Work schedules to minimize the number of employees arriving or departing work at the same time	**Signal prioritization** *(see Chapter 6 for more information)*
Park-and-ride lots Designated space within a parking lot that allows single-occupancy motorists to transfer to transit, carpools, or vanpools	**Compressed work weeks** Work schedules allowing employees to work longer hours for fewer weekdays	**Fuel tax or mileage fees** Increased tax rate for gasoline and diesel or a new fee based on the number of miles driven by a motorist
Preferred parking for rideshare participants Designated parking spaces for carpool or vanpool vehicles at a workplace	**Transit pass incentives** Employer-provided passes that cover a portion or all of the cost of travel to/from the workplace via transit	**Micromobility infrastructure** *(see Chapter 8 for more information)*
Carshare Short-term vehicle rentals that typically charge users by the hour or mileage driven	**Parking cash-out** Incentive to accept an increased income in place of a free or subsidized parking space at work	**Education, Promotion, & Marketing**
Shuttles - Buses/vans that make short trips along a fixed route between major destinations		

Based on surveys of employees and employers over the years, challenges to implementation of transportation demand management strategies generally include:

- **Uphill Battle** - Almost all employees that work near I-26 and I-526 drive to work (90%) Although 68% of employees said they were open to switching to another mode, only 14% of drivers said they would be willing to switch from single-occupancy vehicles if you paid them. This was because employees found driving, even with peak-hour traffic congestion, is still more convenient than other available options at the time. That said, employees were most likely to listen to an economic argument for changing their commute patterns (20%) compared to societal benefits (17%) and environmental (9%).

- **Parking** - Driving single-occupant vehicles is currently more convenient than other available options because employees do not bear the full cost associated with parking. Almost all employees (98%) park on-site or at an adjacent property. But most employees did not realize their employer subsidized their parking costs. 82% of employees said that parking was free, but only 27% said that their employer paid for their parking. Employers indicated that the main reason they support transportation demand management strategies was to reduce demand for parking.

- **Employer Participation** - Although most employers indicated that more sustainable transportation options were important (82%), only 37% indicated that they offer any incentives to employees. Of the employers who do not offer incentives to their employees for using more sustainable transportation options, 39% indicated that their primary reason for not developing incentive programs was a lack of time. A majority of employers (62%) hoped that an outside group could provide incentives, promotion, and marketing.

- **Carpool/Vanpool** - 13% of employees said they were willing to try carpooling or vanpooling, and 32% said incentives would make them more likely to use these modes. Among the 37% of employers that offered incentives for more sustainable transportation options, approximately three-quarters offered carpooling or vanpooling incentives. However, only 4% of employees took advantage of these incentives. Furthermore, 61% of employees said that no incentives would make them want to join a carpool or vanpool.

- **Workplace Policies** - Before the COVID pandemic, 24% of employees were willing to try telecommuting, and 38% of employees indicated that their employers offered some form of telecommuting. Flexible schedules were more common, with 46% of employees indicating that this was an option for them.

During the same year, Charleston County replicated the commuter survey design and collected responses from 175 Charleston County employees. Although 30% of respondents indicated that they would not be willing to try any transportation demand management strategies, 43% indicated a willingness to try transit and 37% were willing to try vanpooling. Almost four-fifths of respondents stated that they would be willing to log their trips in order to potentially win prizes.

Using the results from the 2013 corridor analysis and feedback from the two surveys, BCDCOG began development of a new mobility management program called “Lowcountry Go”. The program was intended to serve as a centralized system for employers and employees to access transportation demand management resources. In 2017, BCDCOG published the *Commuter Services Program Guide* which set out a marketing plan to promote available services, establish an incentive program designed to shift travel behavior, and to solicit buy-in from large employers in the region.

Ridematching & Carpooling

Starting in 2018, BCDCOG established an online ridematching service to help potential carpool users find other travelers with similar commute patterns. The platform was hosted by Ride Amigos. After matching, BCDCOG encouraged users to continue to log their trips into the online platform for a chance to win prize giveaways. BCDCOG has also promoted the program through efforts such as the "LowGoTober" marketing campaign that provided donated gift cards, park passes, bikeshare memberships, and event tickets through random prize drawings.

Employees at MUSC represented the largest share of logged trips through the online platform, regardless of mode, by a single employer, 10% of all trips logged by MUSC employees.

Vanpool Program

In 2020, BCDCOG published the *Rural Workforce Transportation Study* (2020) containing an evaluation of potential strategies for the rural workforce in Berkeley, Charleston, and Dorchester counties to be able to access job skills training and employment. Potential strategies included expanded TriCounty Link service (medium effectiveness), microtransit or ridehailing services (low effectiveness), carsharing (low effectiveness), and vanpooling (medium to high effectiveness). Based on this evaluation, the study recommended development of a pilot vanpool program with a long-term goal of a financially self-sustaining regional vanpool program.

BCDCOG launched an agency-led vanpool program in 2021. The purpose of the Lowcountry Go vanpool program is to deliver a high quality, affordable vanpooling service that will serve as a complement to CARTA and TriCounty Link services by linking people, jobs and communities in the most efficient manner possible. The program provides eligible groups of four or more commuters with a 7 or 15 passenger van to use to commute to and from work. BCDCOG promotes the program to large regional employers through hiring events, expos, and presentations.

Introductory Vanpool Costs

For the first six months after signing up, BCDCOG offers access to the vanpool program for $30 per person per month, including lease of the vehicle, insurance, maintenance, and fuel.

The Lowcountry Go Vanpool Program has helped several businesses provide affordable transportation to their employees. As an example, the Lighthouse for the Blind uses two vans to transport 11 employees to their office in Summerville. To support performance monitoring efforts, each vanpool is required to document their trips, including mileage and time stamps.

Emergency Ride Home Service

To help eliminate barriers to trying the carpool and vanpool services, BCDCOG offers an "Emergency Ride Home" service. If a regular carpool or vanpool user is unable to participate in their shared commute due to an illness, unscheduled overtime, or other unforeseen disruption to their schedule, BCDCOG will reimburse the user per trip to take a taxi, bus, or ridehailing service home. The service is available to users up to three trips per calendar year, and to request reimbursement, users must submit a completed form directly to BCDCOG's program manager.

Telecommuting

Employee and employer openness to telecommute changed drastically following the COVID pandemic in early 2020. Before the COVID pandemic, working from home was only practiced by 4% of U.S. workers and only 7% of U.S. employers made flexible workplace options available to most or all of their employees (Global Workplace Analytics). However, in 2017, the James B. Edwards Bridge along I-526 over the Wando River was closed or had reduced lanes for three months. Over half (51%) of respondents to a survey conducted by the Charleston Regional Development Alliance (CRDA) to gauge commuters willingness to shift travel patterns indicated that they changed their commute because of the bridge closure, and 58% favored working from home one or more days per week (CRDA, *Reboot the Commute*).

During the peak of the COVID pandemic in 2020, 69% of the U.S. workforce telecommuted. This shift helped employees save between $600 and $6,000 per year through reduced travel, parking, and food costs. It also helped save the equivalent of 11 workdays per year through eliminated travel times (Global Workplace Analytics).

As safety restrictions eased and employees were able to return to the workplace more safely, 82% of the U.S. workforce stated that they wanted to continue to telecommute at least some of the time, with 19% indicating that they want to work remotely every day. Among the national workforce that was currently telecommuting, 46% indicated that they would look for another job if their current employer eliminate telecommuting as an option, and over 33% of workers said that they would take a pay cut of up to 5% to be able to telecommute (Global Workplace Analytics).

Timeline of Travel Demand Management Activities

2011: BCDCOG began the Trident Rideshare mobility management program with Emergency Ride Home reimbursement

2012: BCDCOG's *Our Region, Our Plan* defined regional travel demand management goals

2013: SCDOT published the *Corridor Analysis for I-526 between North Charleston & West Ashley*

2015: BCDCOG published the *I-26 Regional Fixed Guideway Alternative Analysis*

2016 - Charleston County conducted a Smart Commuters online survey

2017: BCDCOG published the final report for the *Transportation Demand Management Employee & Employer Surveys* and the *Commuter Services Program Guide*

Feb. 2018: BCDCOG replaces the Trident Rideshare mobility management program with Lowcountry Go and launches a rideshare matching platform through Ride Amigos

May 2018: CRDA conducted a commuter survey about the shift in travel behavior resulting from a three-month closure of the Wando Bridge along I-526

Oct. 2018: BCDCOG conducted "LowGoTober" marketing campaign to encourage the use of the rideshare matching platform through gift card, park pass, bikeshare membership, and event ticket giveaways

Feb. 2019: BCDCOG conducted "Commuter Challenge" marketing campaign with gift basket giveaways

Apr. 2019: CRDA launched the "Reboot the Commute" marketing campaign

May 2019: Charleston County published an implementation plan for travel demand management strategies in its US-17 corridor study

2021: SCDOT published the *I-26 Corridor Management Plan* and included high-level transportation demand management recommendations

Fringe Benefits

To help support transportation demand management strategies, the Internal Revenue Service (IRS) offers employer tax incentives called "Fringe Benefits." As documented in the IRS' *Employer's Tax Guide to Fringe Benefits*, employers can promote ridesharing, transit, and bicycling commutes through tax incentives.

Table 2-4: Mobility Management Objectives

Objective	Strategy	Metric
Reduce single-occupancy vehicle trips along primary arterials such as I-26, I-526, and US-17	Continue to promote BCDCOG's vanpool program	Commute mode share, American Community Survey Number of individuals registered and participating in the program Number of miles or hours traveled Social media followers, likes, and shares for Lowcountry Go Number of employer and community events attended to promote the program Number of marketing materials requested and distributed Number of available vans Feedback from employer surveys
	Promote the use of park-and-ride lots	Number of park-and-ride lots Number of total park-and-ride lot parking spaces Commute mode share, American Community Survey
	Encourage major employers to implement carpooling programs	
	More competitively price parking fees in employment and tourist destinations	Parking turnover rate Commute mode share, American Community Survey
	Work with county and local municipalities to promote telecommuting opportunities	Commute mode share, American Community Survey
	Work with county and local municipalities to develop land use plans that site employment areas and residences for skilled works near one another	Travel time to work, American Community Survey

Purpose

Provide relevant direction and peer examples for improving freight transportation.

freight conditions

Charleston's economy has always been dependent on freight and trade, beginning with its founding as a colonial port city in 1670. The BCD Region's continued economic prosperity and competitiveness depends on the efficient and reliable movement of goods and people. Economic analysis found that millions of tons of freight worth billions of dollars traverse BCD Regional multimodal freight transportation infrastructure annually. This multimodal freight transportation network generates just over a third of the BCD economy (38 percent) and around one-fifth of the state economy (18 percent), based on the average direct, indirect, and induced impacts of the freight industry on the region's sales output, gross regional product (GRP), income, and jobs created. This economic impact translates into nearly 200,000 jobs and billions of dollars of income, GRP, and goods and services sold. Ensuring that the region's freight infrastructure can continue to accommodate the safe, efficient movement of freight now and into the future is critical for the local, state, and national economy.

Figure 2-19: Economic Impacts of BCD Freight Movement

Planning for the Network & Intermodal Facilities

In 2021, the BCDCOG developed and adopted the region's first Regional Freight Mobility Plan which provides a blueprint for developing a transportation network that is safe and efficient for the movement of goods *and* people, and supports economic growth while simultaneously minimizing the negative impacts associated with increased freight movement. The Plan takes an integrated land use-transportation planning approach to identifying the area's freight transportation needs, and provides a comprehensive, multimodal mix of infrastructure improvements, and policy and program recommendations to address these issues.

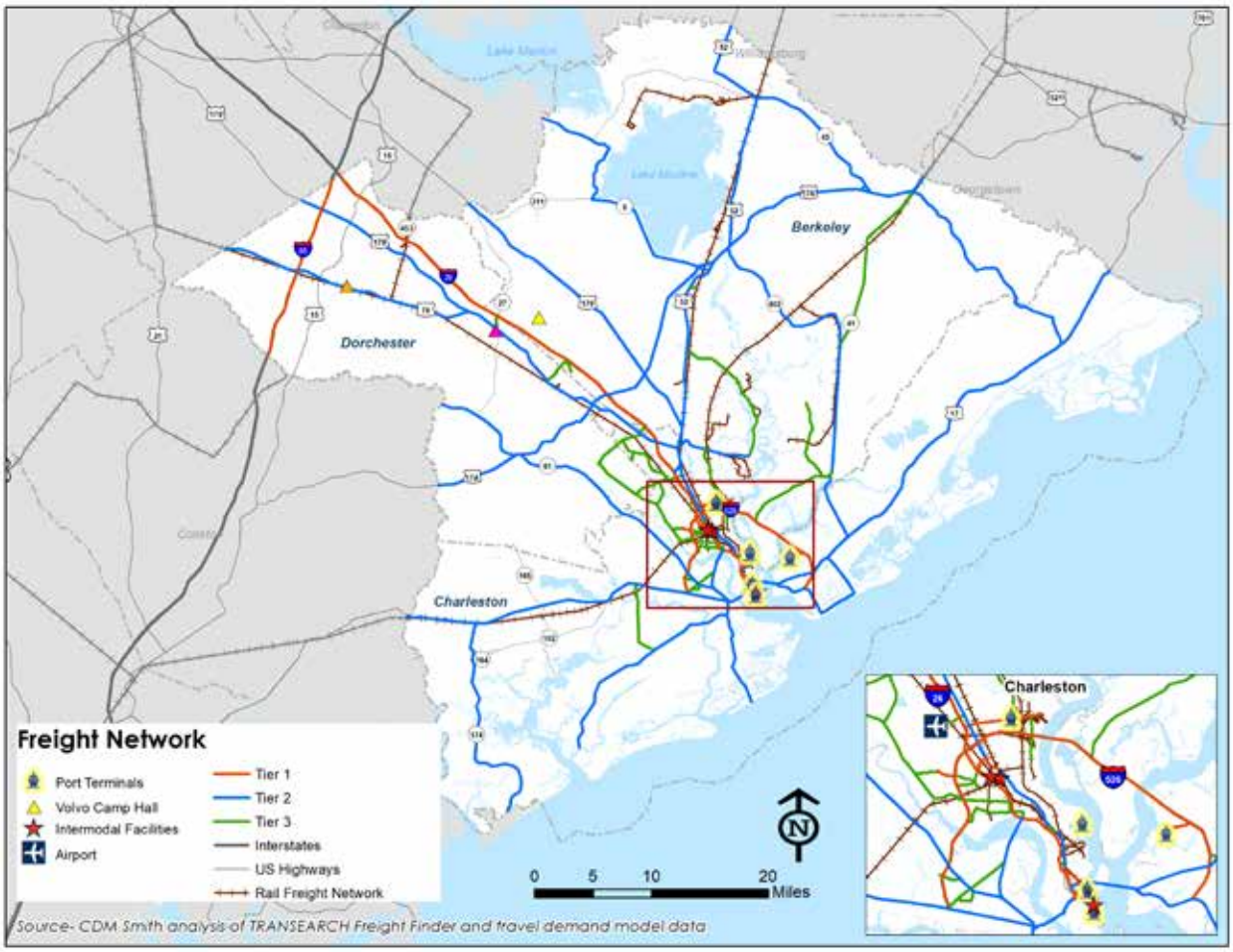
The freight transportation network in the BCD Region consists of a major seaport, an international airport, freight rail connections, and highway trade corridors. Together, this multimodal network ensures that freight continues to be a major part of the regional and statewide economy. The regional freight highway network is divided into three tiers to help with identifying freight needs and shaping recommendations. **Map 2-11** provides an overview of the regional freight system, and a description of each of the highway freight tiers are as follows:

TIER 1 – Interstate Highways and Nationally Designated Routes. These routes are nationally significant and are either designed for long-distance travel and trade (e.g., interstates) or are on another nationally designated freight network (e.g., National Highway System Intermodal Connectors).

TIER 2 – Non-Interstate South Carolina Freight Network and South Carolina Strategic Corridor Network. These facilities include routes that are strategically important to the state of South Carolina but are not part of the interstate highway system or other national networks.

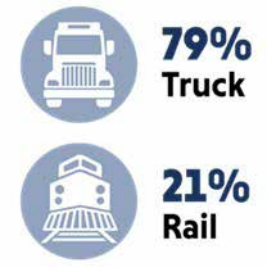
TIER 3 – Local Freight Routes. These roads provide critical last mile connections to key freight facilities or between freight-generating land uses and the rest of the state/national highway network.

Map 2-11: Regional Freight Network & Intermodal Facilities



Freight Flows

Existing Freight Flows



Nearly 113 million tons of freight valued at $249 billion moved along the region's freight infrastructure in 2016. The United States Army Corps of Engineers (USACE) Waterborne Commerce Statistics Center reports that 20 percent (23 million tons) of this freight funnels through the Port of Charleston. Identifying what kind of freight is moving through the region and what modes this freight depends on are both important factors in planning for future freight growth.

Truck freight is the dominant mode in the region, with 79 percent of freight tonnage moving through the region via trucks. Most of this truck freight is through-freight (61 percent, including freight originating in ports and intermodal facilities) meaning it does not come from or go to a location within the region, but simply passes through it. Through-freight usually travels along I-95 in Dorchester County, which acts as a bridge connecting interstate trade along the East Coast. Aside from I-95, regional truck tonnage moves mostly along I-26, connecting the region with the rest of South Carolina, especially the Columbia capital area, the Pee Dee region, and the Upstate region.

Rail freight makes up about 21 percent of freight movement in the BCD region. Unlike trucks, freight traversing BCD's railroads are not mostly through, but are instead directional trips that originate or terminate in the region (including at the Port and intermodal transfer facilities). Rail in the BCD region mostly serves the city of Charleston, port connections with Upstate and out-of-state markets, inbound coal from the Midwest, container shipping, and the regional energy supply chain. For both rail and truck freight, the top commodities originating or terminating in the region are Non-metallic Metals (by tonnage) and Transportation Equipment (by value). Regardless of mode, freight movement in the region shows the bridge-role played by the region's transport infrastructure between the rest of South Carolina, the U.S., and abroad.

Future Freight Flows

Future regional freight demand was forecasted for the year 2040 for both highway and rail freight in the Regional Freight Plan. Overall, the region should see total freight tonnage moving through the region to increase to over 210 million tons by 2040, an 88 percent increase from the 2016 value of 112 million. The value of the freight moving along the regional freight network is expected to

Figure 2-20: BCD Freight Movement Tonnage by Mode

grow from $248 billion to $567 billion in 2040, a 128 percent increase. By 2040, truck freight moved on the region's network is projected to increase to over 170 million tons, a 92 percent total increase (2.7 percent annually). Over half of the growth is in the same top five commodity groups that currently comprise most tons, with outbound volumes growing slightly faster than the other directions (inbound, intraregional, and through). The value of the freight moving along the highway network is expected to grow 134 percent, from $211 billion to $494 billion.

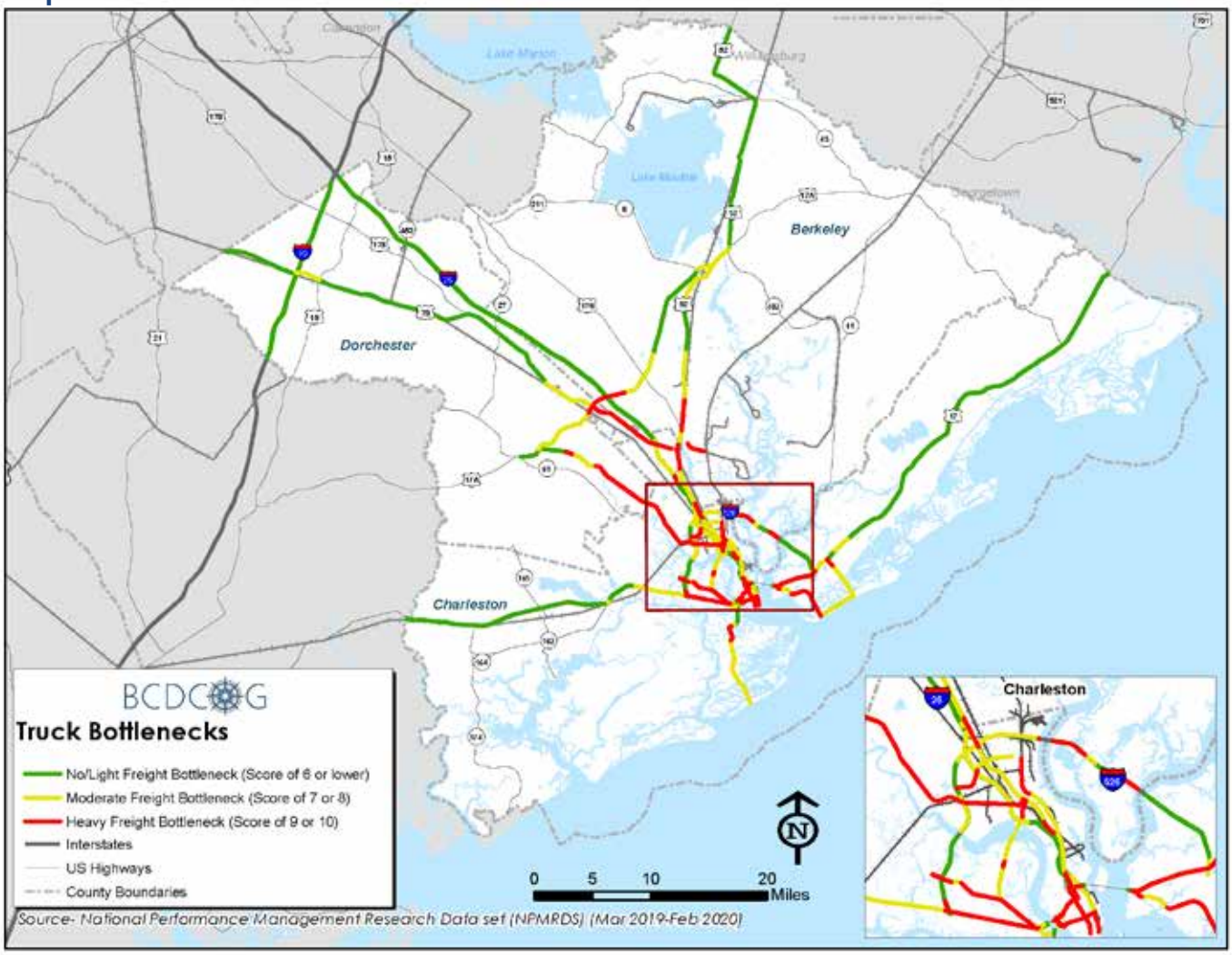
By 2040, rail freight on the tri-county railroad lines is projected to increase to almost 40 million tons, a 65 percent total increase, or 2.1 percent annually, with outbound volumes growing slightly faster than the other directions. About half of the absolute volume growth is in miscellaneous mixed shipments and chemicals; coal imports (from Kentucky, Indiana, and Pennsylvania) are not expected to grow. This is likely due to increased focus on renewable energy sources. The value of the freight moving along the highway network is expected to grow 100 percent, from $37 billion to nearly $74 billion.

Freight Challenges

Congestion and Freight Bottlenecks

An analysis of the freight network, looking at truck delay and daily Level of Service (LOS) on the freight network, identified extensive truck delays in the I-526 and Clements Ferry Road corridors, both of which provide truck access to the Wando Welch Terminal of the SC Ports Authority and nearby freight-related businesses. The interchange area of I-526 and Clements Ferry Road experiences truck delays of up to nearly 1,300 hours per day. Other segments experiencing significant truck delays include I-526 west of Clements Ferry Road to the

Map 2-12: Truck Bottlenecks



I-26 interchange, I-26 north of I-526, and Ashley Phosphate Road west of I-26. A complementary analysis was also conducted to identify highway freight bottlenecks using the FHWA National Performance Management Research Data Set (NPMRDS) vehicle probe data. The NPMRDS is a national data set of average travel times for use in analyzing highway system performance. I-26, I-526, SC 642, US 52, US 78, US 17, and several streets in downtown Charleston present significant bottlenecks for trucks. Locations of those bottlenecks are shown in **Map 2-12**.

Safety

Freight-related crashes occur less frequently than many other types of crashes, but result more frequently in fatalities or incapacitating injuries that are considered severe. Commercial vehicle-involved crash hotspots are mostly found along I-26 and parallel routes, like U.S. 78, that serve industrial land uses. There are also localized clusters of crashes along U.S.17 west of the Ashley, Palmetto Commerce Parkway, and U.S.17 Alt.

Safety is also a concern at rail-highway grade crossings. At-grade crossings present the greatest opportunity for people, automobiles, and trains to collide. Nationwide, 97 percent of all rail-related injuries and fatalities occur because of trespassing or other incidents at at-grade crossings. Utilizing Federal Rail Administration (FRA) grade grossing crash statistics from 2009-2019, a hot spot safety analysis of at-grade rail crossings in the region revealed a total of 53 at-grade crossings, which averages at 7 crashes per year region-wide. The top 5 rail crossings with the highest crash frequency are provided in **Table 2-5** and **Map 2-13** below.

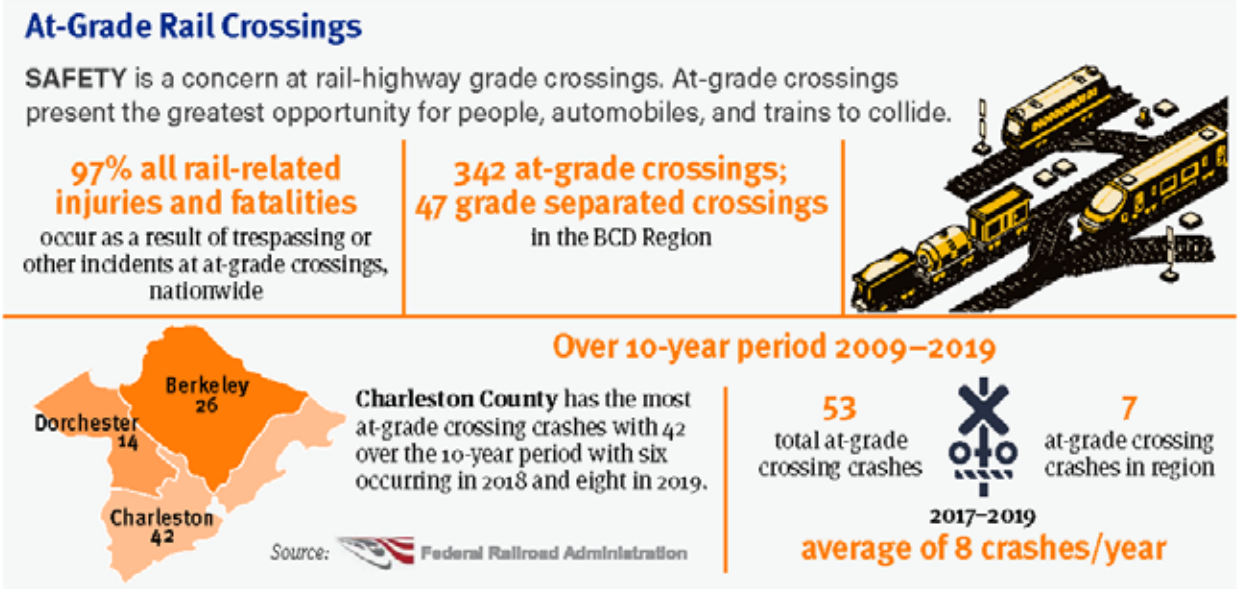


Table 2-5: High Crash At-Grade Rail Crossings

Rank	Railroad	Street Crossing	Near	County	Crossing ID	Total Crashes	Year of Last Crash
1	CSX	Red Bank Rd	US 52	Berkeley	631974A	8	2019
2	NS	Ashley Phosphate Rd	Southrail Road	Charleston	721448L	6	2019
3	CSX	E. Montague Ave	Gaynor Avenue	Charleston	631981K	3	2018
3	CSX	SC 165	Drayton Street	Charleston	632410U	3	2019
3	NS	North Main St	South Railroad Ave	Dorchester	721485N	3	2018

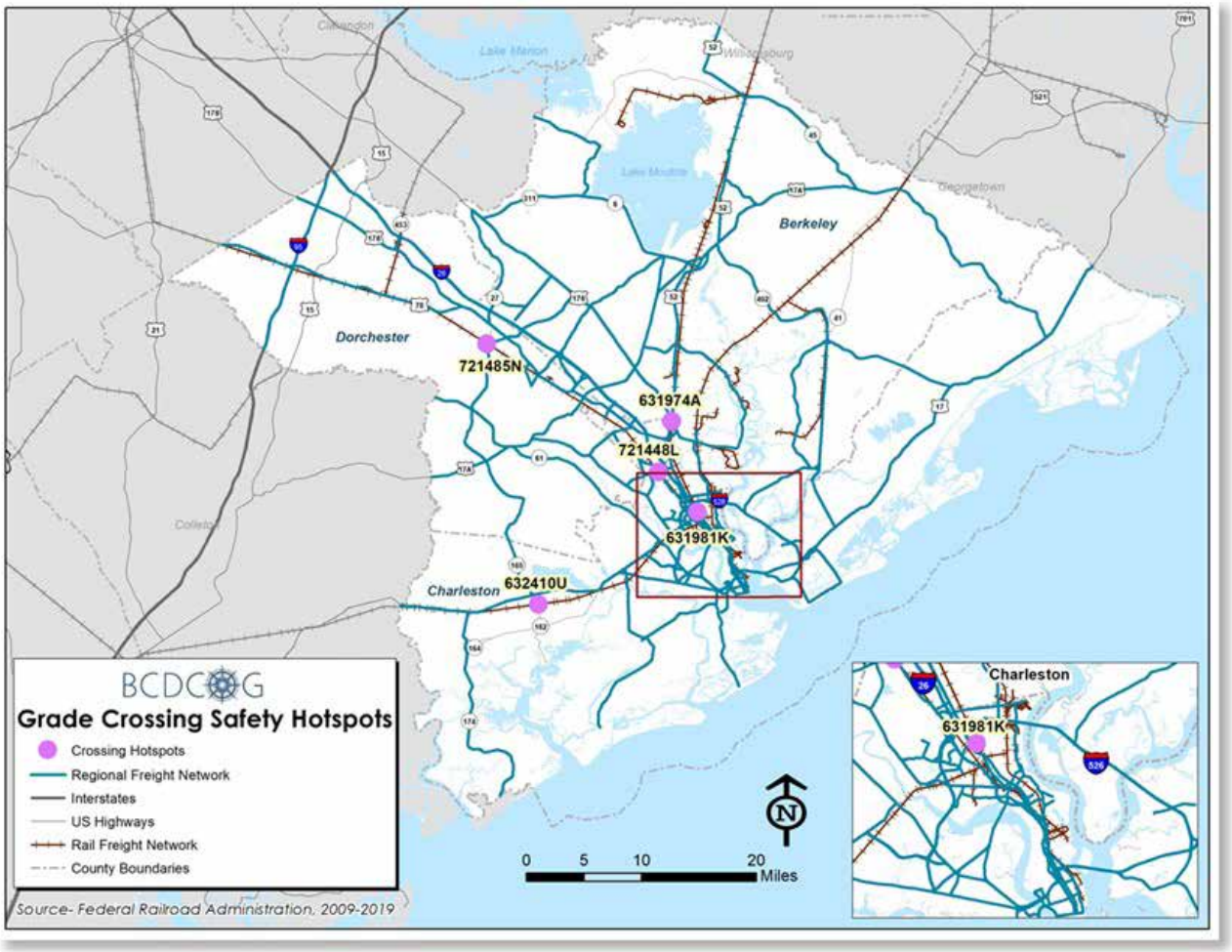
Note - data shown is from the BCD Regional Freight Plan and does not include incidents since 2019

Maintaining roadways and bridges in good condition was also highlighted under freight safety challenges. Poor pavement conditions reduce freight efficiency and contribute to increased wear and tear on trucks. Bridges and roadways in poor condition may require increased maintenance in the future, especially if truck traffic increases. Bridges that are restricted to less than the standard legal weight limit and those with low vertical clearance can impede commerce by forcing trucks to use alternate, less efficient routes. Some of these routings may be circuitous, adding cost and time to shipments.

Truck Parking

Truck drivers have two legal options for parking safely: public or private facilities. Public facilities can be rest areas, truck weigh stations, or truck rest stops. Private facilities usually include truck stops/fueling stations (sometimes with amenities like showers and food), lodging establishments or shopping centers. Of the truck parking identified in the region, about 81 percent is privately supplied and is located near I-95 in Dorchester County or along I-26 in Berkeley County. There is comparatively little supply near the Port of Charleston terminals or the major freight generators closer to the urban center of Charleston. Stakeholders indicated that this lack of truck parking near Port of Charleston is a major concern. The BCD Region is not immune to the nationwide truck parking shortage. Regional trends of a growing metro area, increasing land values, industrial expansions, and the Port of Charleston's cargo growth will continue contributing to ongoing truck parking shortages.

Map 2-13: Grade Crossing Safety Hotspots



finding direction

The complexity of the large and diverse CHATS MPO area demands a variety of recommendations for improvement. Themes that are repeated from analysis, public engagement, the Advisory Committee, and adopted plans/policies help provide a consistent framework for shaping these recommendations. The following is a summary of the key directions discussed in the preceding sections on freight, public transportation, auto/roadway, active modes, and cross-cutting policy matters, setting the stage for future recommendations.

Direction 1: Improve Connections in the Roadway Network

As the outlying areas of the CHATS planning area expand and attract new residential and commercial growth, more frequent connections - for all modes of travel - become increasingly important. A single road, regardless of its capacity or design, can accommodate trips entering and leaving from many points - only a network can distribute traffic effectively.

Direction 2: Increase Opportunities for Bicycle and Pedestrian Modes of Travel

Businesses, residents, and travelers are increasingly expecting to see more and better - especially off-road - bicycle and pedestrian networks. Currently, the CHATS planning area has sparse and fragmented pedestrian and bicycle accommodations, particularly outside of the core urban areas. Additional measures related to safe crossings are critical, emphasizing less-affluent communities where pedestrian crashes are more prevalent.

Direction 3: Enhance the Public Transportation System to Better Serve Existing Riders and Attract Choice Riders

Perhaps the most-cited theme was the need for more frequent public transportation as well as premium modes of travel, notably bus rapid transit and water-borne modes. The north/northwest corridors, downtown Charleston, town centers, and beaches were the most-often cited destinations for transit.

Direction 4: Draft and Adopt Policies that Directly Address the Goals of the LRTP

The rapid expansion into outlying areas will increase traffic pressure on smaller, secondary roads and the major arterials that they feed. Aligning transportation provision with decisions about the location, magnitude, and design of new private (and public) developments will be the single, most-important action to be taken by local governments and their private partners over the long haul. Policy recommendations can be found in the Implementation and Funding Chapter of this report.

Direction 5: Technology is an Increasing Share of the Answer

The superior ability of "smart" cities to be competitive in the upcoming decades is well-documented, and transportation is at the forefront of those decisions. Better signal progression integrated with routing logistics can improve both emergency response and transit - even freight - movements. Automated vehicle technology will further expand the utility of smart transportation infrastructure, extending into local delivery services, parking, and ridesharing across modes of travel.

Direction 6: Detailed Planning

None of the other recommendations - or even the long-range transportation plan in its entirety - creates a single-point solution for all the issues and challenges facing the dynamic CHATS planning area. Additional studies focusing on detailed corridor design, small area studies, and more frequent updates of land use and transportation plans will be necessary to keep pace with growth, and to provide citizens repeated opportunities to engage with professional staff and decision-makers about how best to meet those challenges.

Direction 7: Capacity = Capital

Ultimately, new roadway and transit capacity; bicycle and pedestrian infrastructure; expanded transit service and premium technologies; and designing new plans and programs all require an infusion of money. The LRTP identifies both costs and traditional revenue sources accessible to planners of today, but the size of the current, much less future, traffic concerns will necessitate the continued development of bond, tax, corporate contributions, and other financing sources to plan, design, build, and maintain/operate new services and expanded infrastructure.

Direction 8: Freight Mobility

Incorporating freight considerations into the periodic long-range transportation plan is important in a region that is a primary freight gateway, an activity that generates billions of dollars in economic benefits, thousands of jobs – and a lot of truck traffic. Every long-range transportation plan should have a project priority factor for freight from this plan onward. Technology will play an increasingly important role for freight moving forward, and should be coordinated with regional Congestion Management Process strategies and Intelligent Transportation Systems (ITS) plan recommendations.

Direction 9: Protecting Community Integrity

The CHATS planning area began as a place with great accessibility (initially by water and later by road and air), beautiful natural surroundings, and an attention to public design that has made it one of the most enviable places to live, work, and visit in the country. Protecting and building on that legacy now includes addressing threats posed by climate change, too-quick design values, and a tide of growth that is capable of drowning much that is good in the region. Transportation policies and decisions need to: contemplate these resources; support appropriate pace, quantity, and styles of development; and be driven by the community and its values. Increasing engagement with segments of the public and strengthening development and preservation policies are perhaps the most critical actions to ensure that a transportation system can be successful in meeting mobility, economic, and community goals.

Environmental Screening & resilience

During the regional transportation planning process, the array of factors discussed in the following pages are considered to ensure feasible recommendations. Often, transportation projects may have negative impacts on the natural environment. Because of the large amount of water features, such as lakes, rivers, swamps, and marshes, construction of new or wider roadways within the CHATS boundary can present environmental risks. Screening for negative environmental impacts early in the planning process can help to assess the severity of the impacts. Some projects may be eliminated during the process while others will continue through with additional mitigation measures designed to minimize impacts to the environment.

The project evaluation framework in Chapter 11 includes an environmental impact mitigation criterion. This criterion considers proximity to natural resources and the concentration of vulnerable populations to create a composite environmental impact score. If a project advances, detailed environmental assessments will be completed.

Resiliency is the ability to quickly recover from unanticipated disruptions to a transportation network. This definition, in relation to climate change, notes the region's need to better prepare for environmental hazards as they become more prevalent. The goal of resiliency is to invest in storm mitigation efforts in the present to save money on storm recovery in the future. These mitigation efforts vary widely and can include plans to decrease greenhouse gas emissions, improve flood management procedures, and increase citizen awareness of local natural hazards.

The concept of resilient cities has achieved considerable attention across the nation and worldwide. The 100 Resilient Cities organization defines urban resilience as: "...the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience" (Resilient Cities Network). A transportation plan has an important part to play in integrating these objectives into action through policies, infrastructure, and programmatic efforts across a broad array of public and private institutions.

The CHATS MPO's communities recognized the importance of resilience while updating the long-range transportation plan. Projects were partially scored on resiliency factors, such as access to evacuation routes, street connectivity, proximity of emergency shelters, and other emergency service infrastructure such as hospitals. Projects that improved the reliability or capacity of infrastructure and provided access to one of these locations received a higher score.

Individual cities within the CHATS planning area should be encouraged to participate in the 100 Resilient Cities and STAR Communities organizations. Additional information for 100 Resilient Cities (http://100resilientcities.org/) and STAR Communities (www.starcommunities.org/) is readily available – the CHATS MPO or BCDCOG can provide both guidance and financial support to their member jurisdictions to succeed within these two programs.

Health

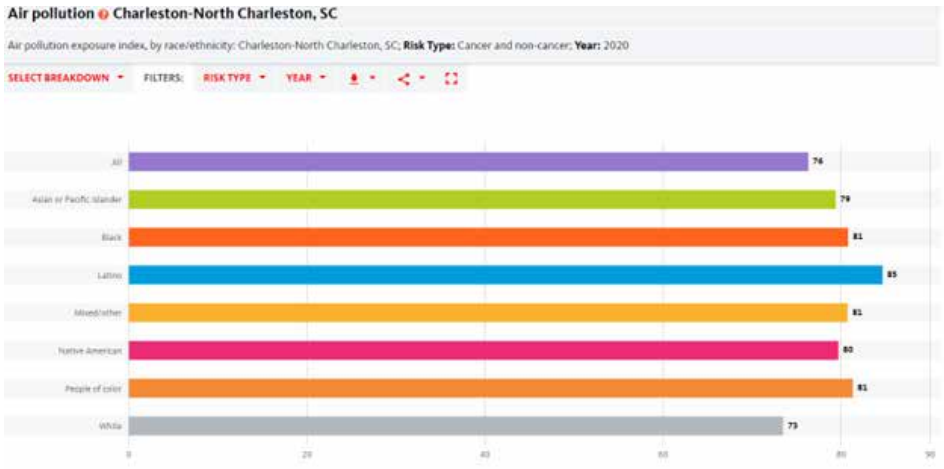
Because transportation touches many aspects of a person's life, adequate and reliable transportation services are fundamental to healthy communities. Transportation issues can affect a person's access to healthcare services. These issues may result in missed or delayed healthcare appointments, increased health expenditures, and overall poorer health outcomes. Developing affordable and appropriate transportation options, walkable and bikeable communities, and reducing the negative impacts of infrastructure on air quality, water quality, and outdoor noise can all help improve health outcomes.

Health Professional Shortages

The target ratio of underserved people to primary care clinicians is 3,000:1. Berkeley County (5,424:1), Charleston County (3,057:1), and Dorchester County (12,264:1) all do not meet this target ratio.

(University of South Carolina Institute for Families in Society, 2017)

Air Quality



Emissions from heavy-duty vehicles - such as diesel-powered trains, semi-trucks, and buses - expose people to toxic air pollutants (Particulate Matter, Ozone, Nitrogen Oxide, and Sulfur Dioxide). Evidence suggests that people living, working, or attending school near major roads have increased prevalence and severity of respiratory illnesses, neurological disorders, reproductive disorders, and developmental disorders (Jiang, et al, 2016). The United States controls air pollutants through the National Ambient Air Quality Standards (NAAQS) program and the Hazardous Air Pollutants (HAP) program. Although all three counties in our region are currently meeting EPA standards for particulate matter emissions (EPA), people living or working in North Charleston and downtown Charleston near I-26 and active railroads are estimated to be at a higher risk for chronic respiratory illnesses from diesel particulate matter (see **Map 2-14**) and experience a high prevalence of asthma and Chronic Obstructive Pulmonary Disease (COPD) compared to the rest of the country (see **Map 2-15** and **Map 2-16**).

According to PolicyLink and the University of Southern California Dornsife Equity Research Institute's National Equity Atlas, people of color in the Charleston-North Charleston metro area are disproportionately exposed to air pollution. As shown in the graph on the previous page, the average pollution exposure index for people of color in the Charleston metro area was higher than 81% of all Americans. Overall, the metro area ranks 27th out the nation's 150 largest metro areas for air pollution exposure.

Several ongoing local, regional, and state initiatives are working to address heavy-duty vehicle emissions with the CHATS boundary:

Grassroots Air Quality Monitoring

Currently, SCDHEC relies on two Ozone, two Nitrogen Oxide, three Particulate Matter, and one Sulfur Dioxide monitoring stations to measure toxic air pollutants within the CHATS boundary. In addition, the SC Ports Authority documents ongoing air monitoring efforts at each of its terminals on a quarterly basis, as well as conducting 6-year air emission inventories.

To help monitor heavy-duty vehicle emissions in the Charleston Neck Area's most affected neighborhoods, the Lowcountry Alliance for Model Communities (LAMC) partnered with the Charleston Community Research to Action Board (CCRAB), the University of Maryland, and the University of South Carolina to create the "Environmental Justice Radar". The initiative received approximately $500,000 in funding from the U.S. Environmental Protection Agency (EPA) to deploy fixed-site near-reference monitors and PurpleAir screening monitors in eight Environmental Justice communities.

SC Ports Electrification

In 2021, the EPA awarded the SC Ports Authority with $1.3 million in funding, from the Diesel Emissions Reduction Act (DERA), to help logistics companies replace eight diesel semi-trucks with new zero emission, battery-electric semi-trucks. This funding helps to continue the SC Ports Authority's Clean Truck Program. In addition, the SC Ports Authority received an additional $1.8 million in DERA funding to refurbish 12 rubber-tired gantry cranes at the Wando Welch Terminal with diesel-hybrid electric systems to minimize air pollution.

CARTA Fleet Transition

In 2022, CARTA developed the Battery Electric Bus Master Plan & Roadmap to transition its fixed-route bus fleet entirely to battery electric vehicles by FY 2040, including the necessary software, charging equipment, and workforce training needed to successfully implement the transition.

School Bus Fleet Transition

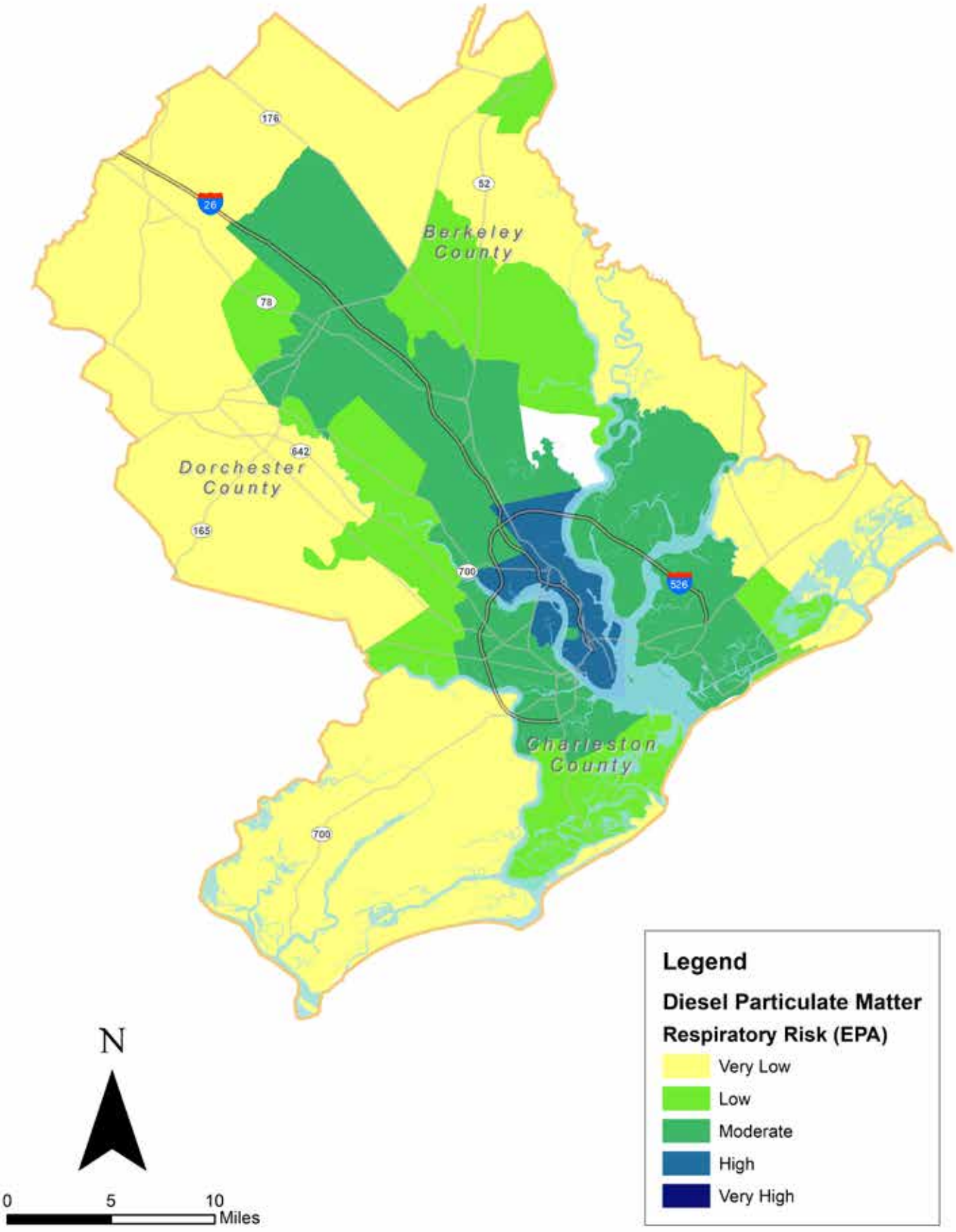
The EPA notes that replacing older diesel school buses can provide significant health benefits to children. Through the Volkswagen Environmental Mitigation Settlement, the South Carolina Department of Insurance awarded $34 million in funding to replace existing diesel school buses with 300 propane school buses and six electric buses. The South Carolina Department of Education's goal is to have 500 electric school buses in operation by 2027 (GovTech), and in 2023, they purchased an additional 160 electric school buses through EPA's Clean School Bus Program (Proterra).

Statewide Collaboration

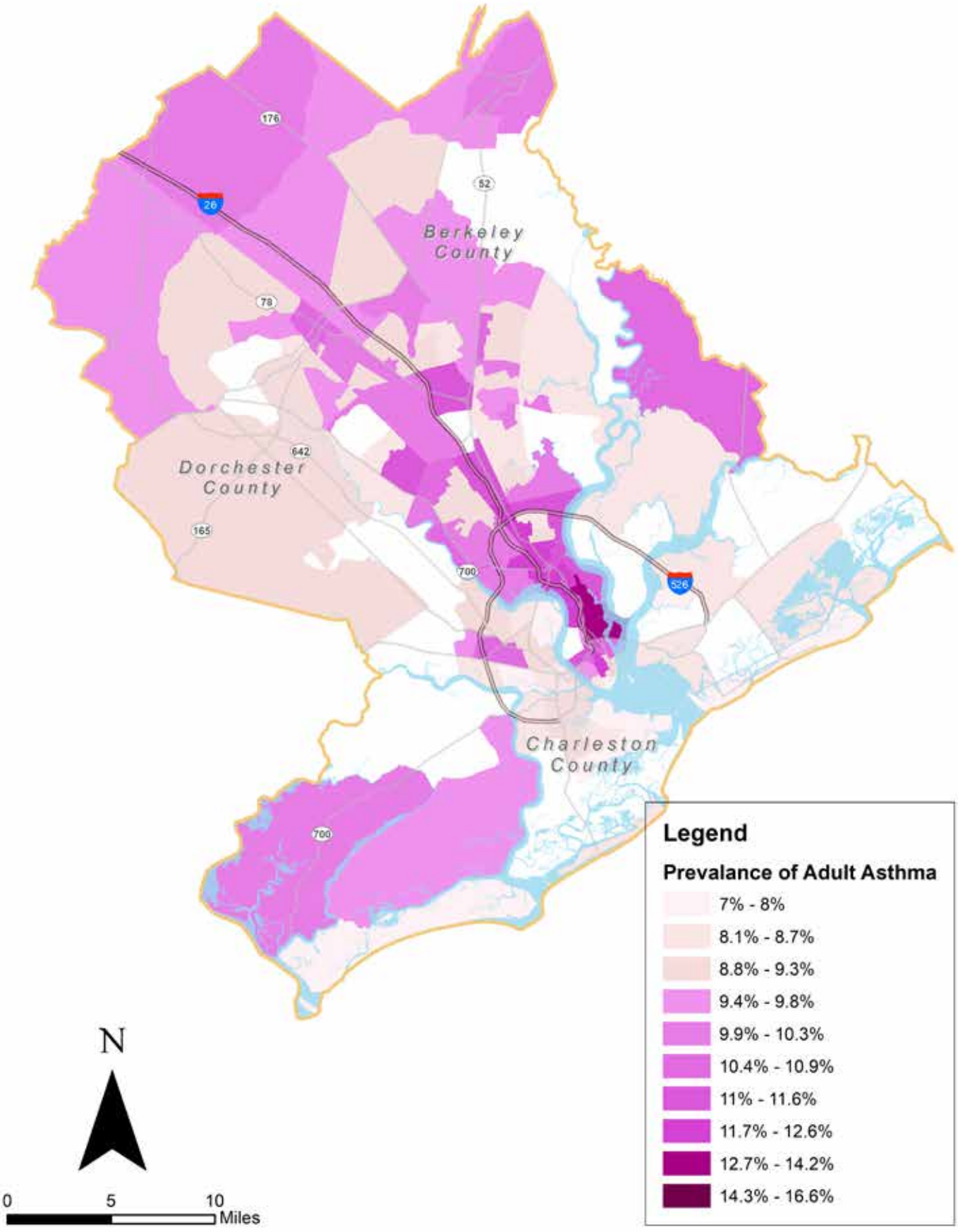
The Palmetto Air Quality Collaborative (PAQC) is a 4-year statewide initiative to develop innovative strategies to reduce air pollution and greenhouse gas emission. PAQC is co-led by the SC Office of Resilience and the SC DHEC. The collaborative will publish South Carolina's first statewide climate action plan in 2024.

The forthcoming Climate Action plan will include objectives and strategies for ensuring consistency and improvement in the region's air quality. These potential strategies below will be measured for reducing the prevalence of respiratory diseases in the CHATS region:

Map 2-14: Diesel Particulate Matter Emissions (EPA, EnviroAtlas)



Map 2-15: Prevalence of Asthma (CDC, PLACES)



Map 2-16: Prevalence of Chronic Obstructive Pulmonary Disease (CDC, PLACES)

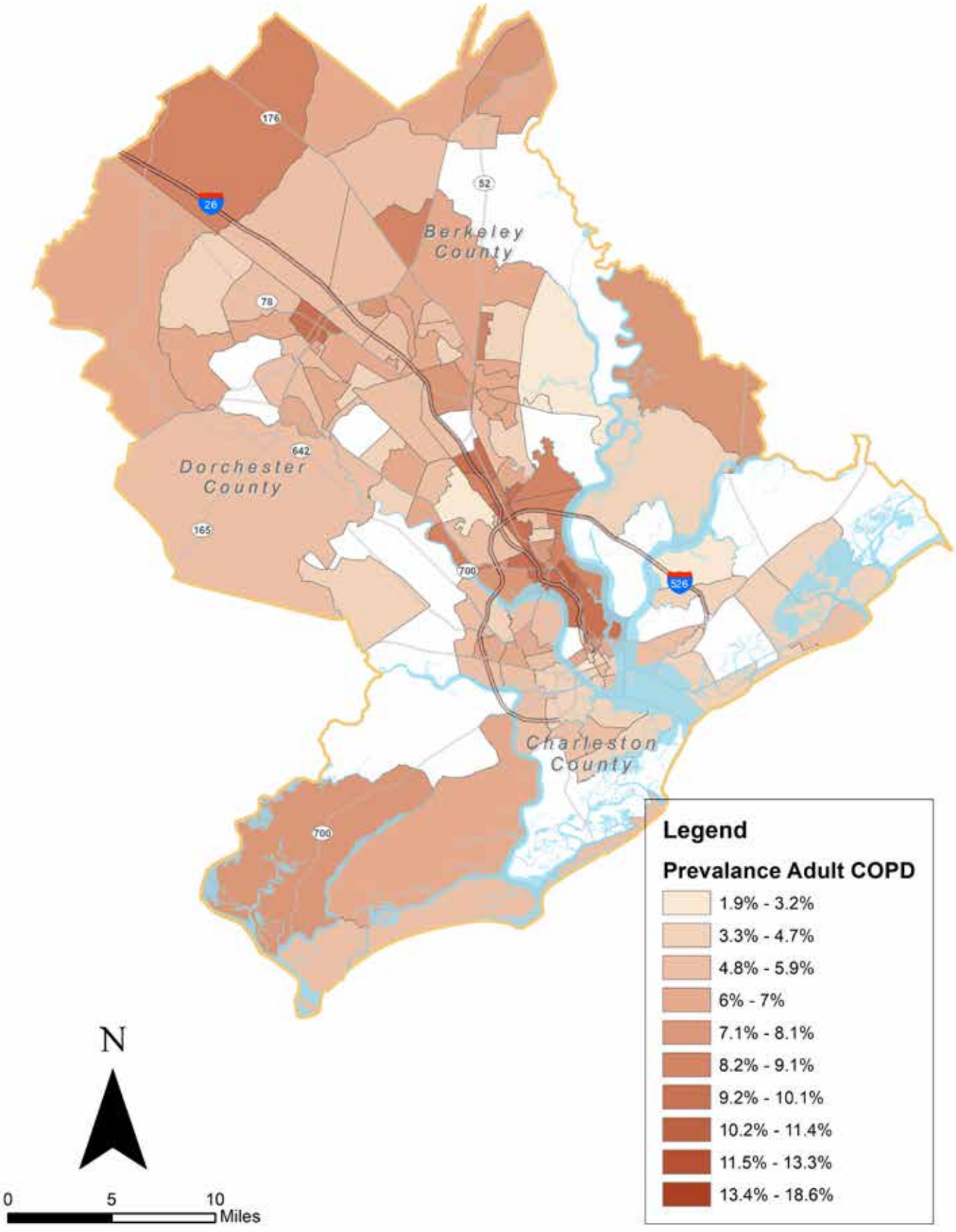


Figure X: Air Quality Objectives

- Reduce prevalence of respiratory diseases.
- Transition heavy-duty diesel truck fleets with older engines to cleaner engine technology with diesel particulate filters, NOx controls, and on-board diagnostics.
- Encourage SCDHEC to develop a heavy-duty vehicle inspection and maintenance program for all on-road non-gasoline heavy-duty vehicles operating in South Carolina over a specified gross weight rating threshold through the use of remote telematics to periodically download and transmit on-board diagnostic data and the issuing of compliance certificates.
- Transition from diesel to zero-emission fleets for heavy-duty municipal fleet vehicles, drayage vehicles, and freight trains operating on short line railroads.
- Transition from diesel, gasoline, and natural gas airport ground support equipment to electric equipment.
- Transition from diesel to battery electric fixed-route bus fleets.
- Transition from diesel to low- or zero-emission school bus fleets.
- Adopt genset locomotives for use in yard switching and branch lines.
- Identify opportunities to replace drayage truck trips with rail or tug barge movements.
- Expand pilot testing of pavement treatments that capture Nitrous Dioxide (NO2) emissions.
- Develop pilot roadside thick, tall vegetation barriers or solid barriers to reduce exposure to air pollution.
- Develop pilot neighborhood-level NO2 and PM sensor program for tracking criteria pollutants through the use of low-cost next-generation air monitoring sensors.
- Create no-idle zones and reduce idling by medium-duty tourism vehicles through "coaching" programs that share the benefits of air heaters, coolant heaters, waste-heat recovery systems, and battery/ auxiliary power systems.

Water Quality

Water quality standards project drinking water supplies, allow for recreational access to waterbodies, and improve survival and propagation outcomes for aquatic wildlife. The Clean Water Act gives states the responsibility to monitor and assess their waters and report the results to the EPA. All states are required to develop a list of waterbodies that do not meet water quality standards. The purpose of the lists is to identify impaired waters so that the source of impairment can be described and corrective actions can be implemented to improve water quality. Currently, there are over 200 impaired waterbodies in Berkeley, Charleston, and Dorchester counties (SC DHEC, 2020-2022). The transportation network contributes to the contamination of waterbodies through:

- Road construction and maintenance, including the creation of impervious surfaces that increase the velocity of stormwater runoff, lower groundwater recharge rates, and increase erosion
- Pollutants such as vehicle exhaust, oil and dirt
- Underground petroleum storage tanks that leak into groundwater
- Open water disposal of dredged materials

Mitigation practices include use of pervious surfaces, filtering of stormwater runoff, and maintenance of riparian buffers.

Noise Impacts

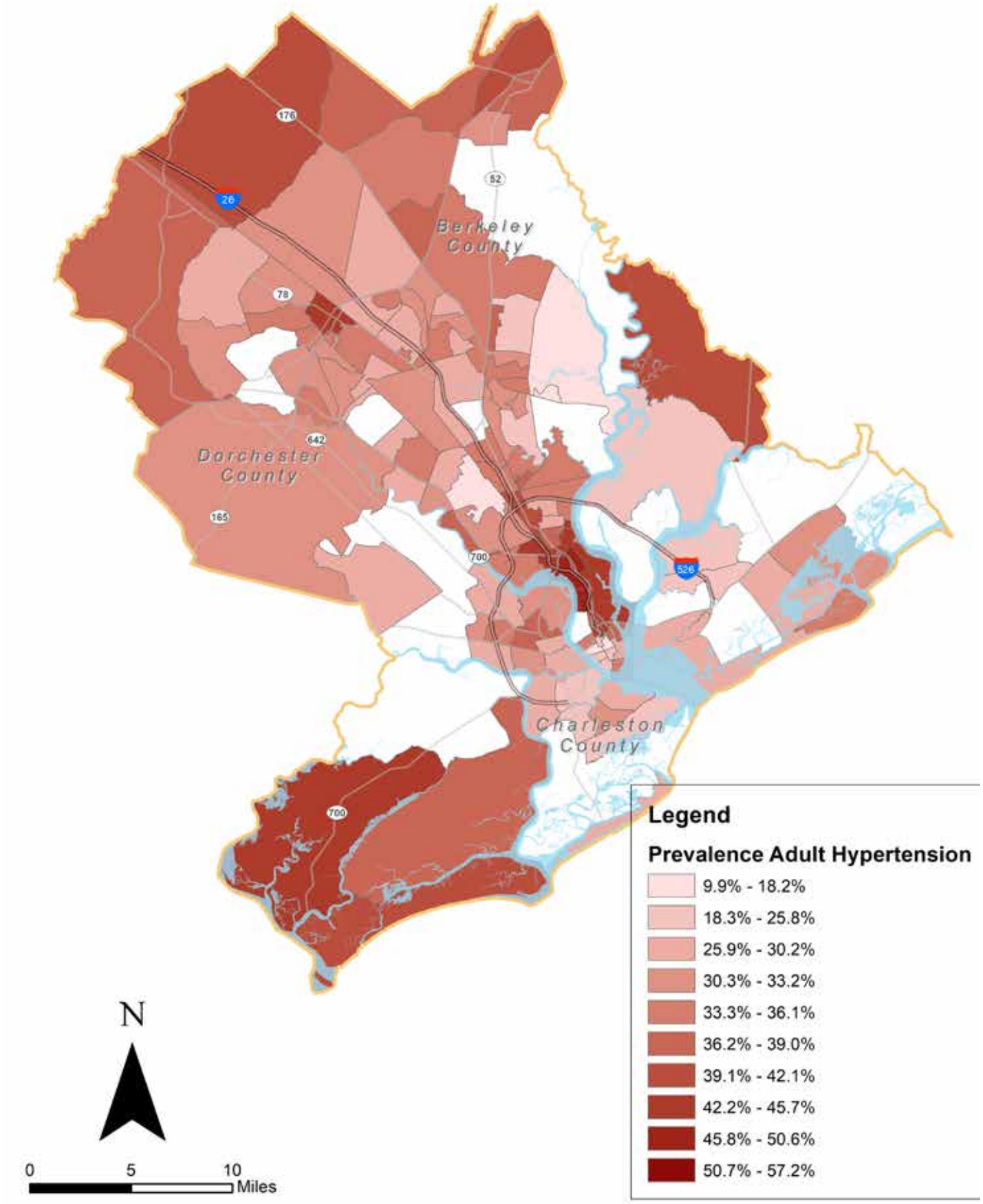
The transportation network can expose people to unwanted sound levels that are loud enough to be harmful to human health. Negative noise-related health impacts include hearing loss, tinnitus, sleep disturbance, decreased productivity, hypertension (see **Map 2-17**), and heart disease (see **Map 2-18**). Despite these negative impacts, noise is often excluded when analyzing the health effects of the transportation network or conducting health impact assessments. The EPA recommends 24-hour exposure limits of 55 dBA in residential areas and a second exposure limit of 70 dBA to prevent hearing loss (Hammer, et. al, 2014).

The Bureau of Transportation Statistics estimates noise exposure caused by different modes of transportation. In our region, air travel near the Charleston International Airport and the Charleston Executive Airport produces the loudest and farthest reaching noise impacts, with sound levels between 60 and 70 dBA into some residential areas (see **Map 2-19**). Similarly, interstates like I-26 and I-526 generate sound levels between 60 and 80 dBA for travelers in immediate proximity of the roadways. Other locations commonly associated with excess rail noise include at-grade crossings and rail yards, where shunting and coupling movements are performed, the braking of transit vehicles, garbage and street maintenance equipment, and construction equipment during roadway construction.

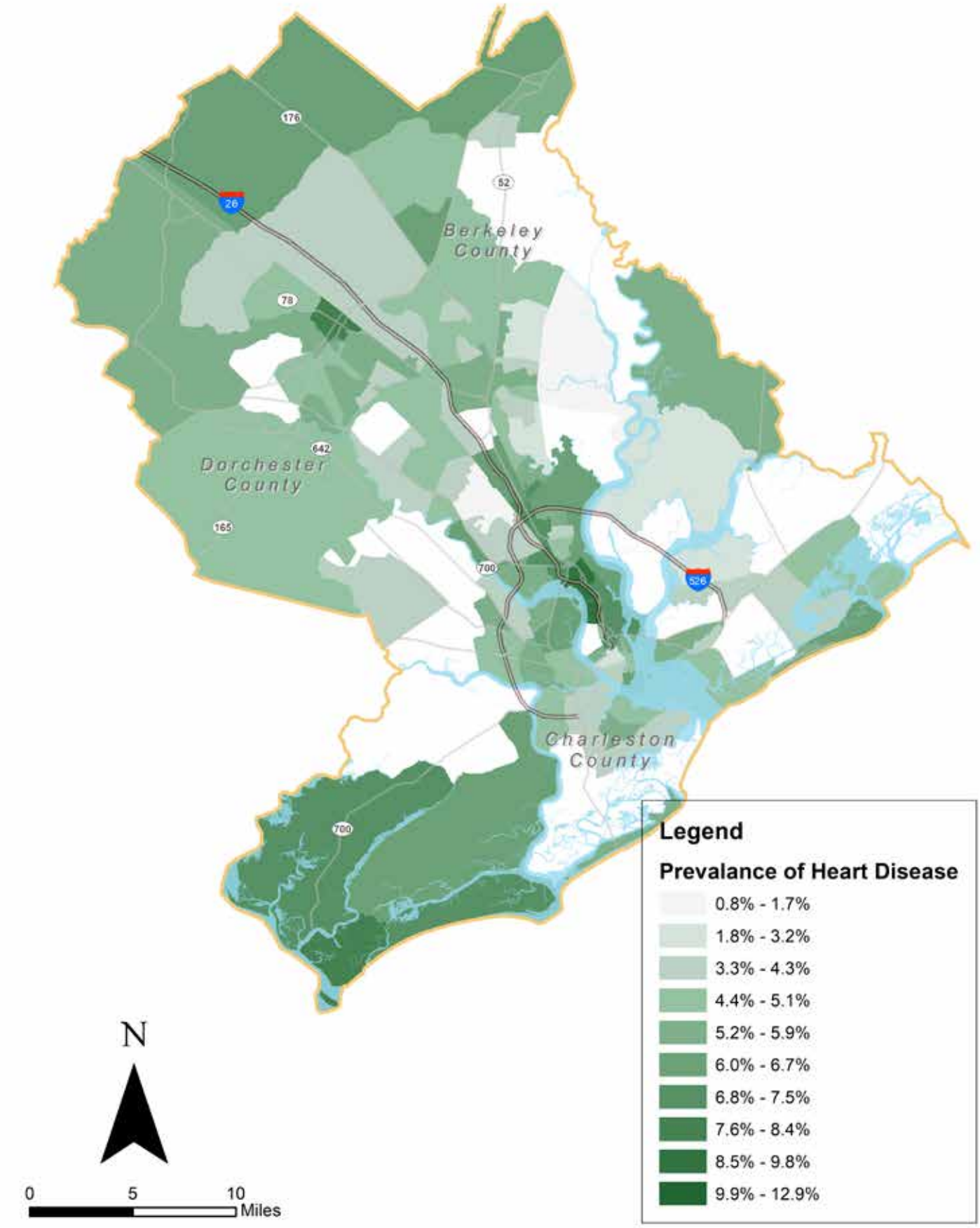
Figure X: Noise Impact Objectives

- Incorporation of noise-dampening pavement and solid concrete guardrails into major new elevated highway and interstate construction or resurfacing projects.
- Construction of noise barriers, such as earthen berms, during new collector road construction or residential development.
- Construction of noise barriers, such as sound walls and vegetative plantings, as retrofits to major existing at-grade highways and interstates.
- Restricting truck access to residential areas using the freight corridor tier system in BCDCOG's Regional Freight Plan.
- Mitigation funding for building noise insulation for planned new rail facilities.
- Designation of railroad "Quiet Zones" in which the locomotive engineer is not obligated to blow the horn when approaching an at-grade crossing following the implementation of additional safety countermeasures such as four-quadrant gates, medians on approaches plus crossing gates, and street closures. The designated quiet zones in Charleston (NS) and North Charleston (CSX) are two of only five within South Carolina.
- Tax rebate program to encourage maintenance of rail wheels or replacement with low-noise train wheels.
- Incorporation of noise-compatible land use planning, including buffer zones from airport runways, railyards, interstates, and environmentally-sensitive areas.
- Reduction of speed limit or implementation of traffic calming along collector roads.
- Transition from diesel-powered on-terminal equipment to electric equipment.
- Work with municipalities to incorporate noise contours from Joint Base Charleston's Air Installation Compatible Use Zones (AICUZ) Study (2019) into community plans, zoning ordinances, subdivision regulations, building codes, and other related documents.

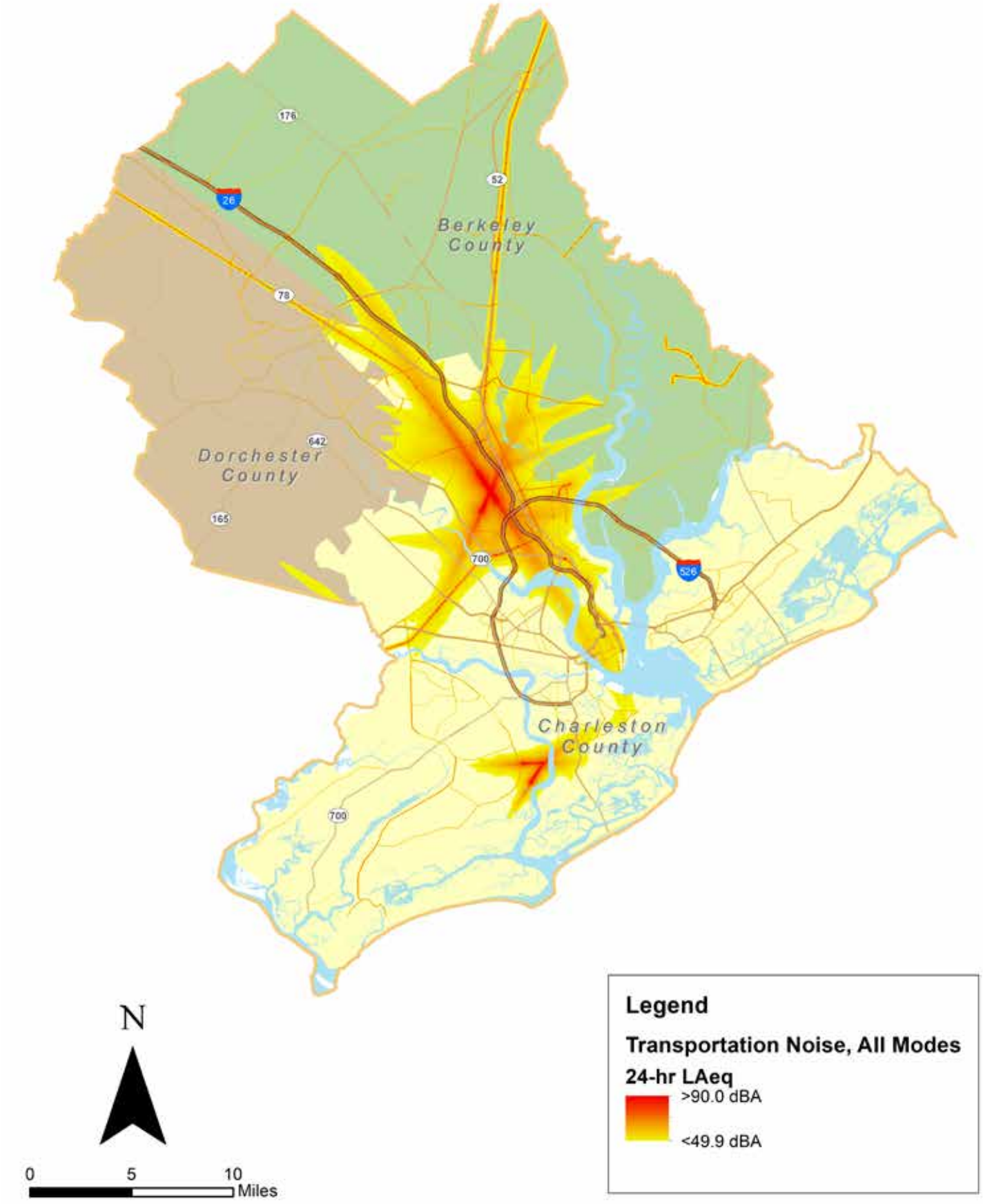
Map 2-17: Prevalence of Hypertension (CDC, PLACES)



Map 2-18: Prevalence of Heart Disease (CDC, PLACES)



Map 2-19: Estimated Transportation-related Noise, 2020 (BTS)



Physical Activity

Historically, we've designed much of our transportation network around commuting to work, but nationally commute trips only represent 25% of all non-home-based trips (NHTS, 2017). By broadening the idea of what types of trips the transportation network serves during the design process, we can find better ways to incorporate physical activity into road users' daily routines. This shift in thinking about the transportation network as an opportunity to promote public health can have real world impacts on the prevalence of co-morbidities associated with sedentary lifestyles such as obesity, diabetes, and cardiovascular disease (BMC Public Health).

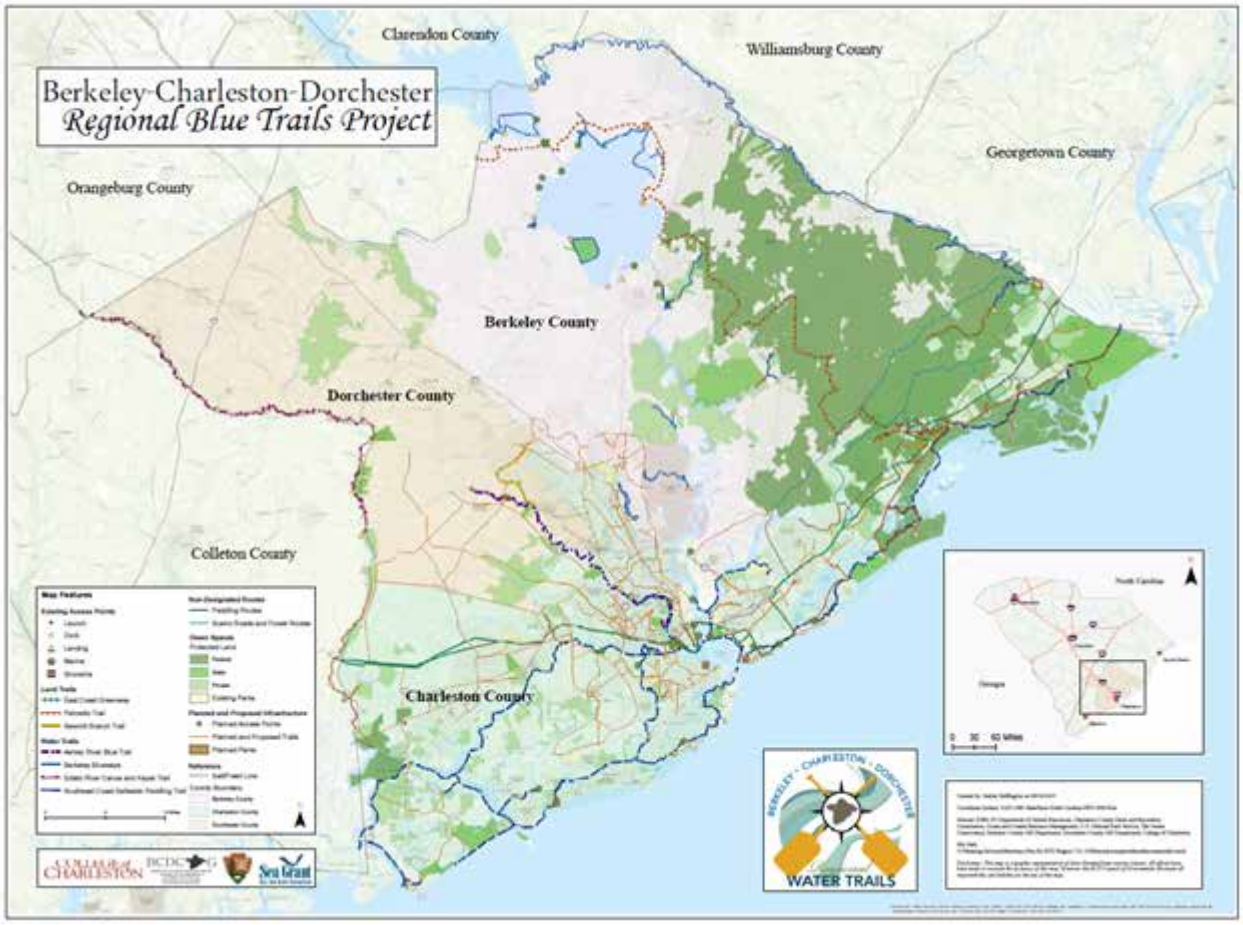
Table 2-6 shows the percent of residents in the region that do not currently engage in any leisure-time physical activity. Access to paths, recreational facilities, and street lighting have been shown to be a determinant of people's willingness to engage in physical activity (CDC).

Table 2-6: Physical Inactivity, by County (University of Wisconsin Population Health Institute)

Location	No Leisure-time Physical Activity	Access to Exercise Opportunities
Berkeley County	25%	68%
Charleston County	19%	90%
Dorchester County	24%	62%

Photo/Berkeley County Economic Development

Map 2-20: Blue Trails



In addition to building micromobility infrastructure, encouraging physical activity on the areas many waterways may be able to have an impact on health outcomes. In 2015, BCDCOG partnered with the College of Charleston, National Park Service, and the SC Sea Grant Consortium to map regional "blue trails", or recreational routes for canoeing, kayaking, and stand-up paddleboarding. These routes included the Ashley River Blue Trail, Berkeley Blueways, Edisto River Canoe & Kayak Trail, and the Southeast Coast Saltwater Paddling Trail (see the SC Department of Parks, Recreation, & Tourism's South Carolina Trails website for more routes).

Providing more opportunities for recreation and physical activities is generally voiced as a high-priority for residents during a comprehensive plan process. The strategies below can inform how jurisdictions' comprehensive plans can address the need for more physical activity within the land use and transportation elements:

Physical Activity Objectives

- Encourage compact design in land use planning.
- Increase the availability of free, publicly-accessible recreation facilities (parks, trails, sidewalks, paths, bikeways, community/ recreation centers, swimming pools, playgrounds, etc.).
- Reduce the number of preventable deaths associated with a lack of leisure-time physical activity.
- Expand ADA-accessible boat and kayak launches

Climate Change

Recent and rapid warming of the earth over the past century has been cause for concern, as this accelerated warming has been found to be the result of the accumulation of human activities (IPCC). When greenhouse gasses are emitted from motor vehicles, they remain in the atmosphere and trap radiant heat from the earth, resulting in rising pavement, air, and water surface temperatures (EPA).

Increased water surface temperatures can lead to ice melt from ice sheets and glaciers and water expansion. The Intergovernmental Panel on Climate Change (IPCC) noted in their Fifth Assessment that sea level has risen significantly since accurate sea levels were first kept in the 1870s (IPCC). Since 1921, the Charleston harbor has risen 1.07 feet. The most recent assessment also notes that the rate of sea level rise has been increasing over the last 50 years. Researchers at the Virginia Institute of Marine Science measured a 2-inch rise in sea level in Charleston between 2000 and 2010 and a 2.7-inch rise between 2010 and 2020 (The Post & Courier). While global sea level is projected to rise between 1.97 feet and 3.28 feet in the next 80-100 years, NOAA projects that Charleston will experience between 2 ft (see **Map 2-21**) and 7 feet (see **Map 2-20**) of sea level rise in the next 100 years (City of Charleston, Sea-level Rise Strategy).

In 2023, an International Panel on Climate Change (IPCC) report found that the transportation sector accounted for 23% of total CO_2 emissions. The IPCC highlights the four most efficient mitigation strategies for transportation to target:

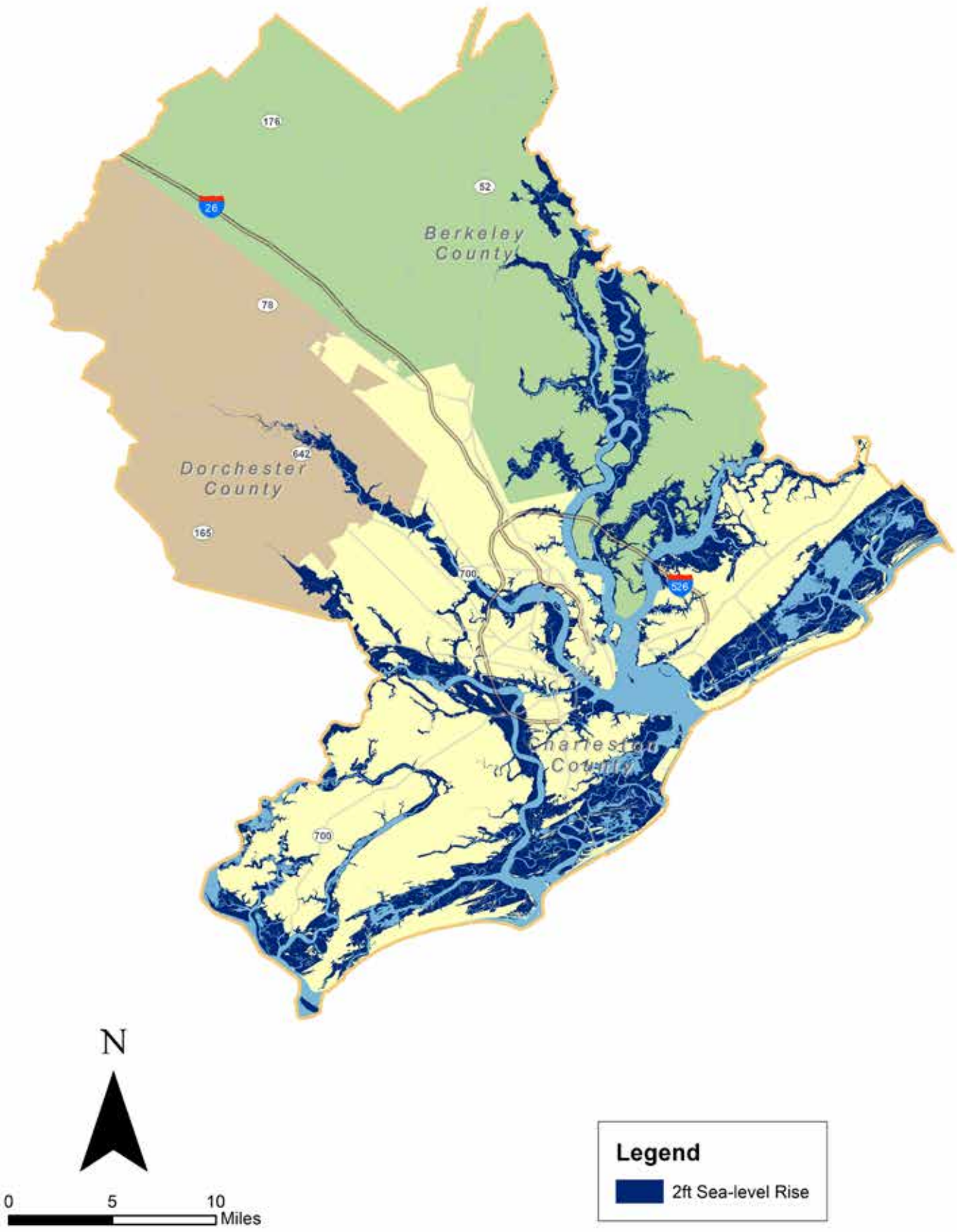
1. Avoiding journeys where possible by actions such as densifying urban landscapes, sourcing localized products, internet shopping, restructuring freight logistics systems, and utilizing advanced information and communication technologies

2. Modal shift to lower-carbon transport systems by increasing investment in public transport, walking, and cycling infrastructure, and modifying roads, airports, ports, and railways to become more attractive for users and minimize travel time and distance

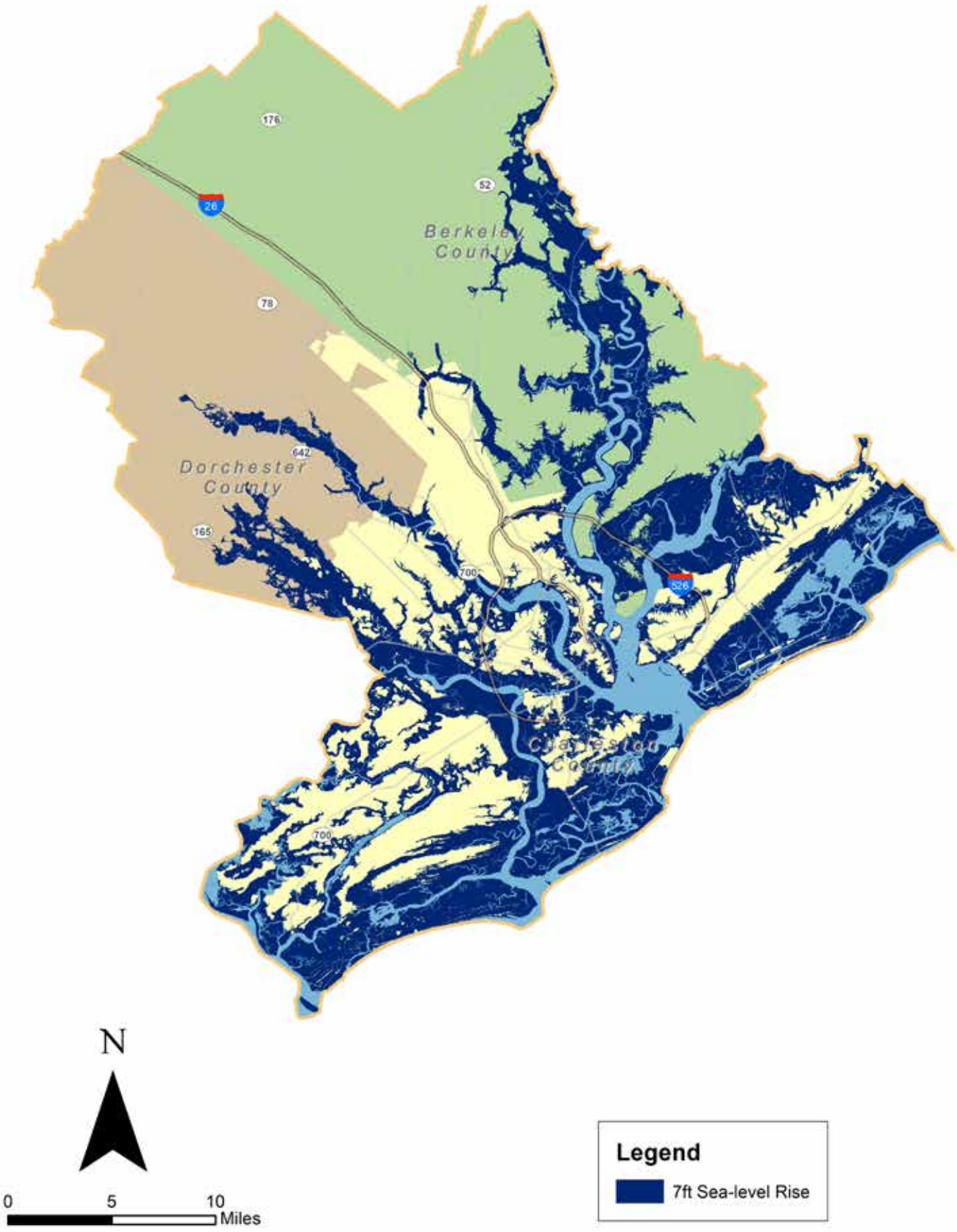
3. Lowering energy intensity by enhancing vehicle and engine performance, using lightweight materials, increasing freight load factors and passenger occupancy rates, and deploying new technologies

4. Reducing carbon intensity of fuels by substituting oil-based products with natural gas, bio-methane, or biofuels, with electricity or hydrogen produced from low GHG sources

Map 2-21: Impacts of Sea-level Rise, 2 feet (NOAA)



Map 2-22: Impacts of Sea-level Rise, 7 feet (NOAA)



Hazards

The need for a durable and resilient transportation network that can expeditiously evacuate residents, withstand natural hazards, and provide access for emergency responders during and after an event is increasingly relevant as the risk of natural disasters has increased in recent years and may continue to increase as a result of climate change.

The Federal Emergency Management Agency defines resilience as a community's ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover quality from disruptions. Using data from the University of South Carolina's Hazards Vulnerability Research Institute and 2020 American Community Survey data, FEMA analyzed resilience factors, including existing infrastructure and economic conditions, for each county in the United States. The results of the analysis showed that Charleston County's community resilience is "very high", Berkeley County is "relatively high", and Dorchester County is "relatively moderate". Although more prepared to anticipate, adapt, withstand, and recover from natural hazards compared to the rest of the nation, counties within the CHATS boundary are at greater risk of experiencing hurricanes, earthquakes, and other natural hazards (see **Table 2-7**).

Table 2-7: Risk from All Natural Hazards, by County (FEMA, National Risk Index)

Hazard Risk	Berkeley County	Charleston County	Dorchester County
Estimated Annual Loss from All Natural Hazards (national percentile)	$2022 million (98th percentile)	$477 million (99th percentile)	$149 million (97th percentile)
Estimated Fatalities from All Natural Hazards	3 people per year	5 people per year	2 people per year
Hurricane Risk	Relatively High	Very High	Relatively High
Earthquake Risk	Relatively High	Relatively High	Relatively High
Heat Wave Risk	Relatively Moderate	Relatively Moderate	Relatively Moderate
Ice Storm	Relatively Moderate	Relatively Moderate	Relatively High

Hurricanes, Storm Surge, & Flooding

Coastal areas in the Southeast US have a high risk of being impacted by hurricanes. FEMA scores and rates a community's relative risk for hurricanes compared to the rest of the United States. The risk is based on the average number of recorded hurricanes per year over the last 170 years and the expected population, building, and agriculture loss caused by a hurricane in a given year. The Census Tracts within the CHATS, as shown in **Map 2-23**, range between "relatively high" and "high" risk for hurricanes each year. Coastal Census Tracts in Charleston County are forecasted to experience one hurricane every two to three years (0.4 hurricanes per year).

Although there is no clear trend of an increased frequency of hurricanes in the North Atlantic making landfall in the United States, the intensity of tropical cyclones has risen noticeably over the past 20 years and has a correlation with rising sea surface temperatures, as shown in **Figure 2-21**. These large, intense, and oftentimes costly, weather events can span hundreds of miles in width and potentially cause other natural hazards to occur such as tornadoes, flooding due to the heavy rainfall, and storm surge (NOAA). In addition, hurricanes and tropical cyclones can result in down power lines and roadway blockages, delaying the ability to provide emergency coverage during a disaster or the post-disaster recovery effort.

In particular, vulnerability to storm surge flooding is not just a beachfront problem. The risk of storm surge flooding can extend many miles inland from the immediate coastline. **Map 2-24** through **Map 2-28** show the increased risk of storm surge flooding as a tropical cyclone increases in intensity from a Category 1 to Category 5 hurricane.

Map 2-23: Hurricane Risk Index (FEMA, National Risk Index)

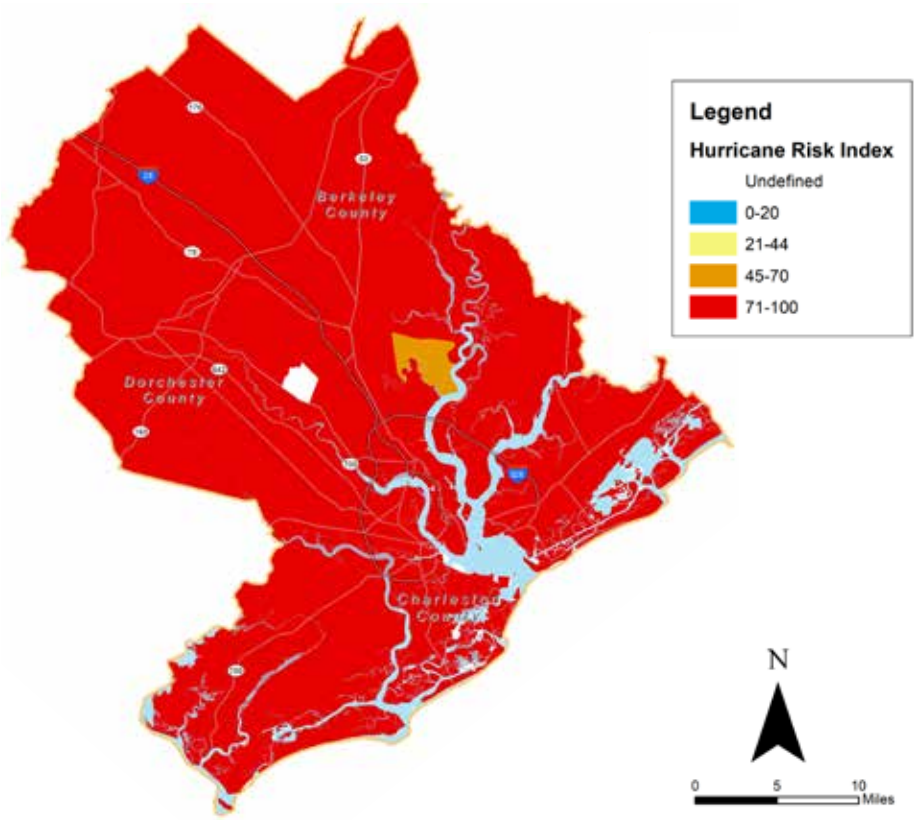
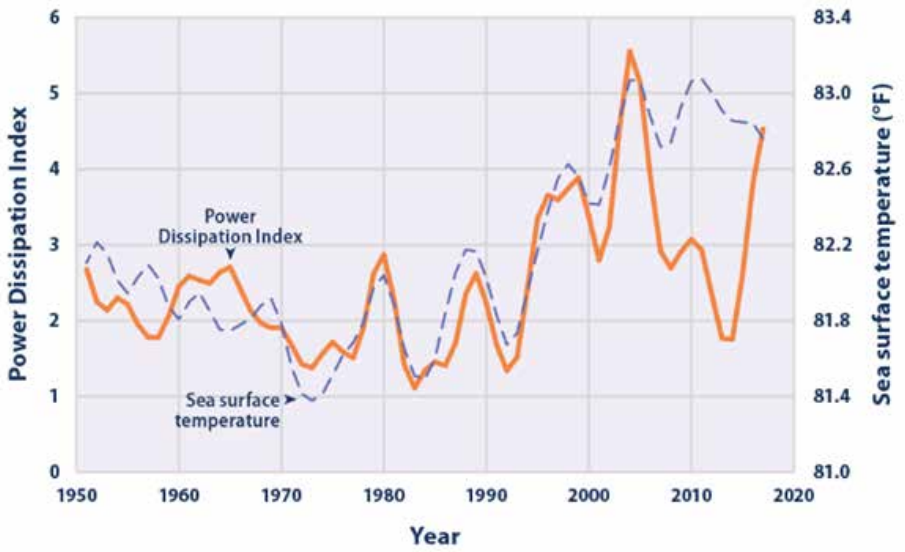
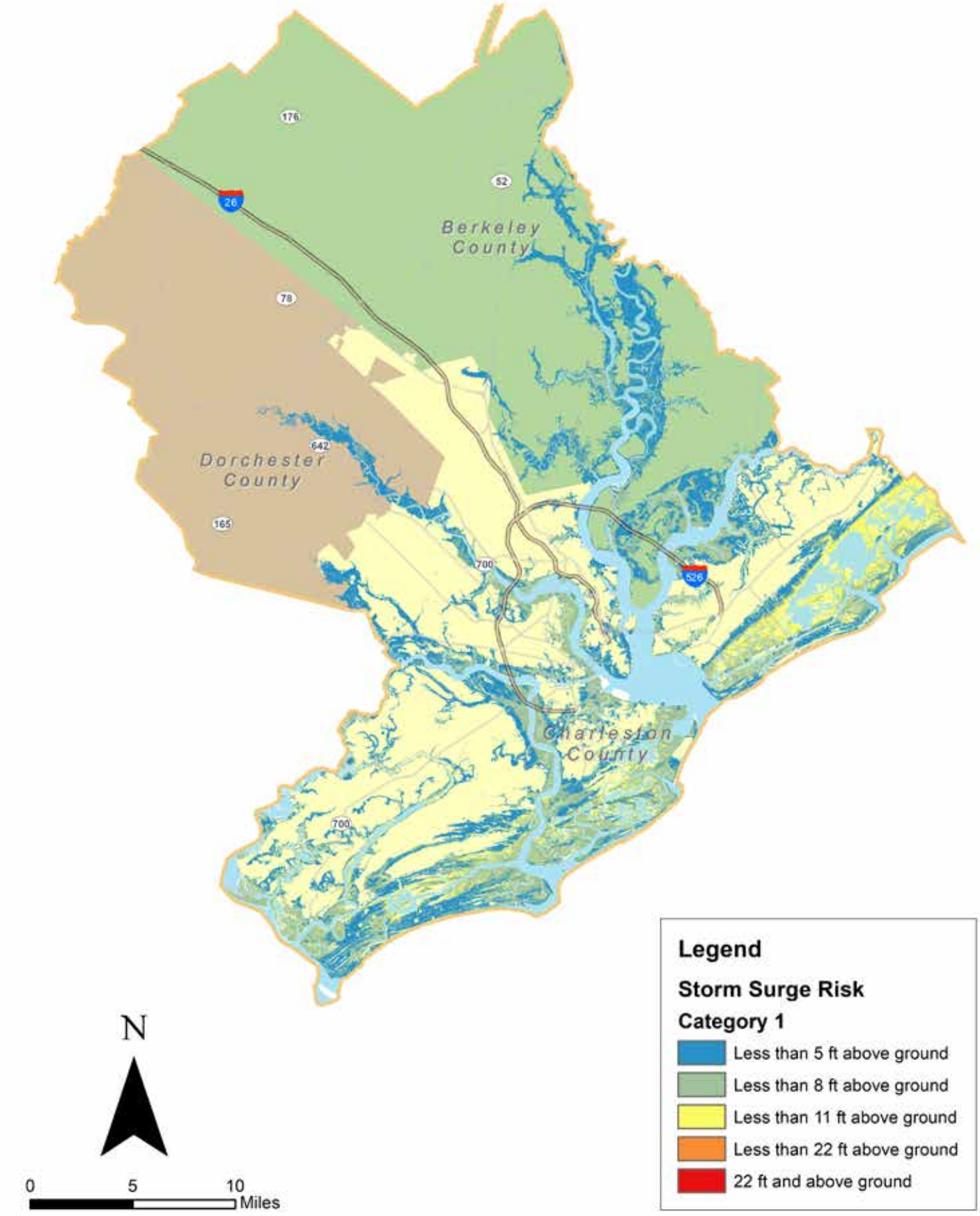


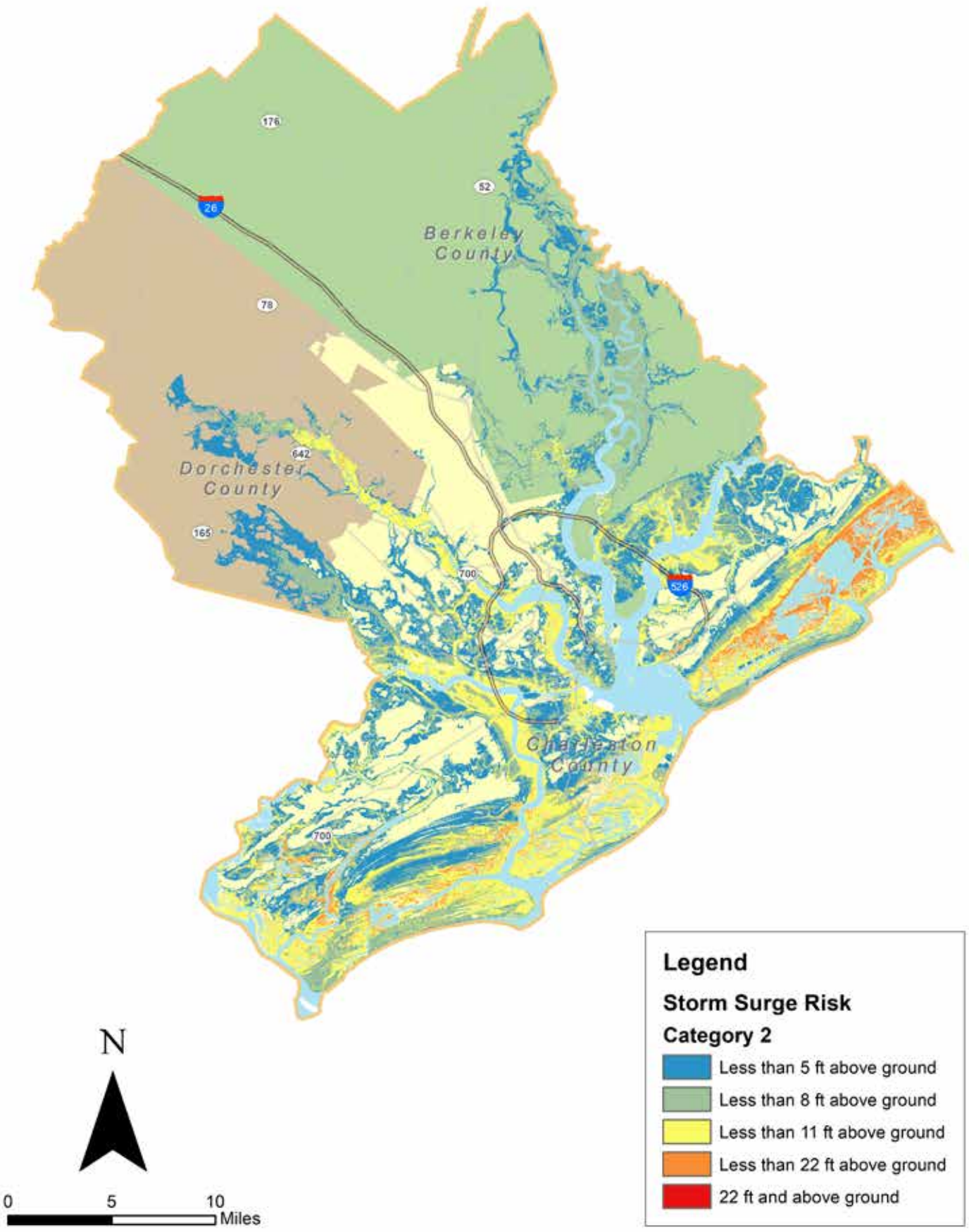
Figure 2-21: North Atlantic Tropical Cyclone Activity, 1949-2019 (EPA)



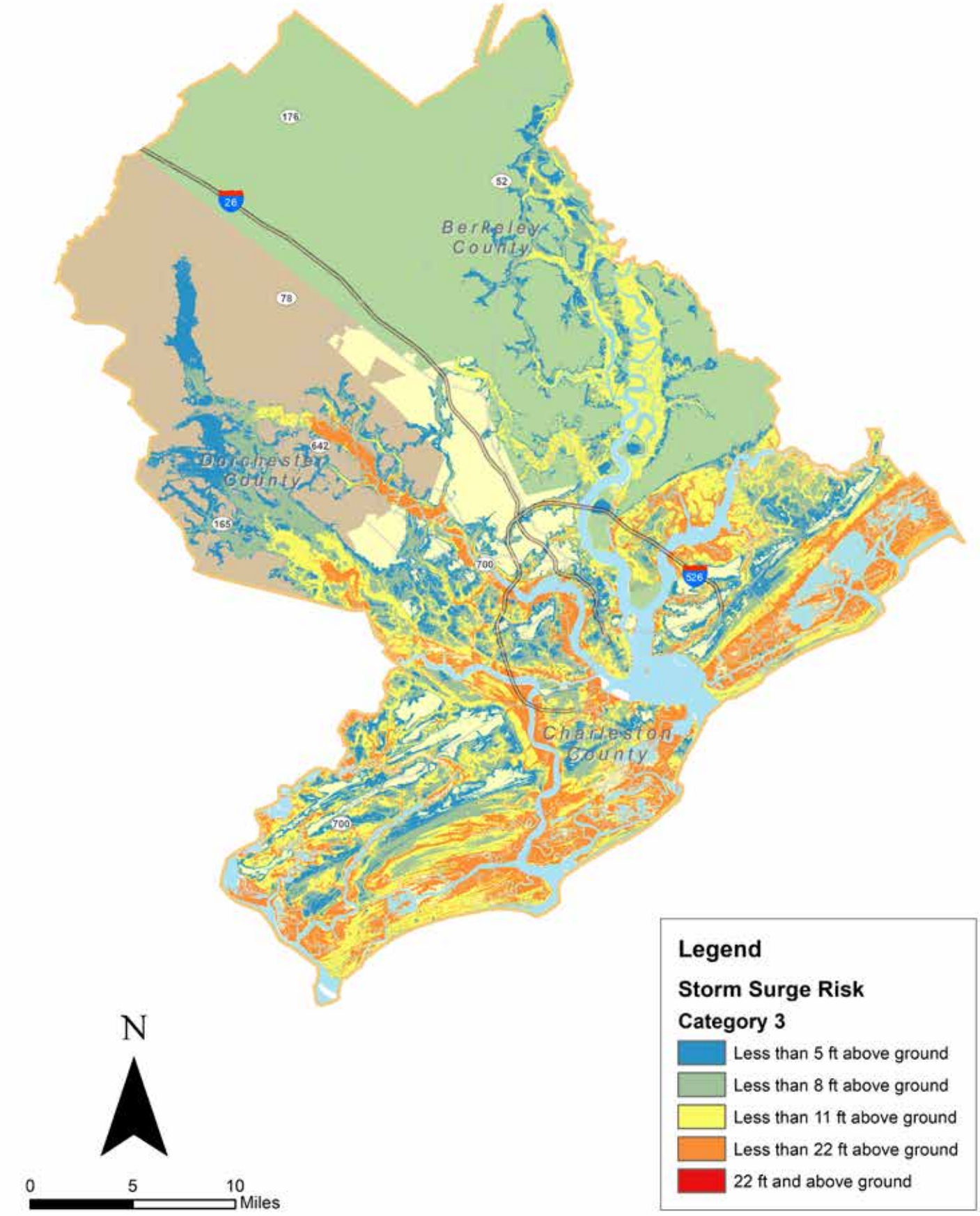
Map 2-24: Storm Surge Risk Map, Category 1 Hurricane (NOAA)



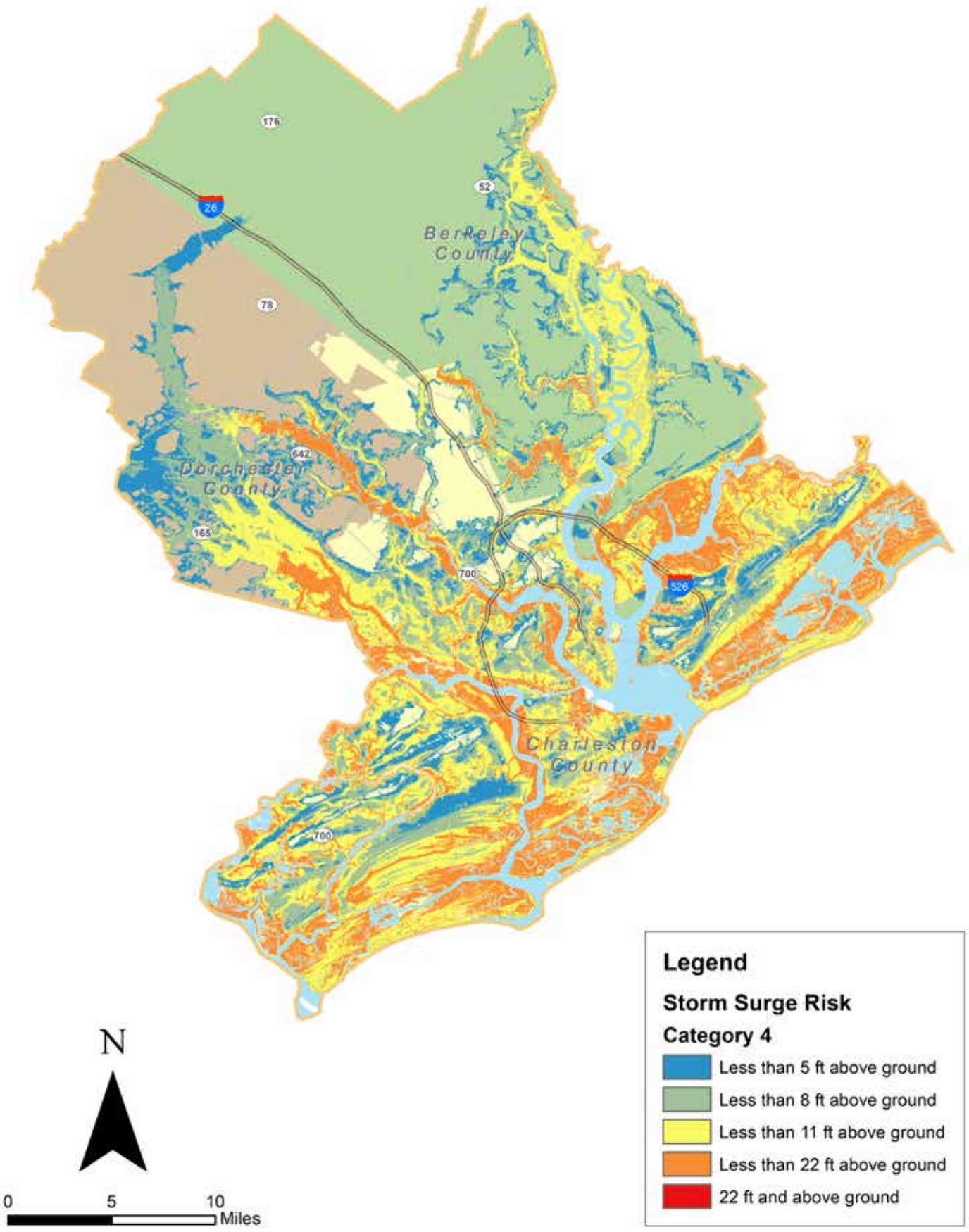
Map 2-25: Storm Surge Risk Map, Category 2 Hurricane (NOAA)



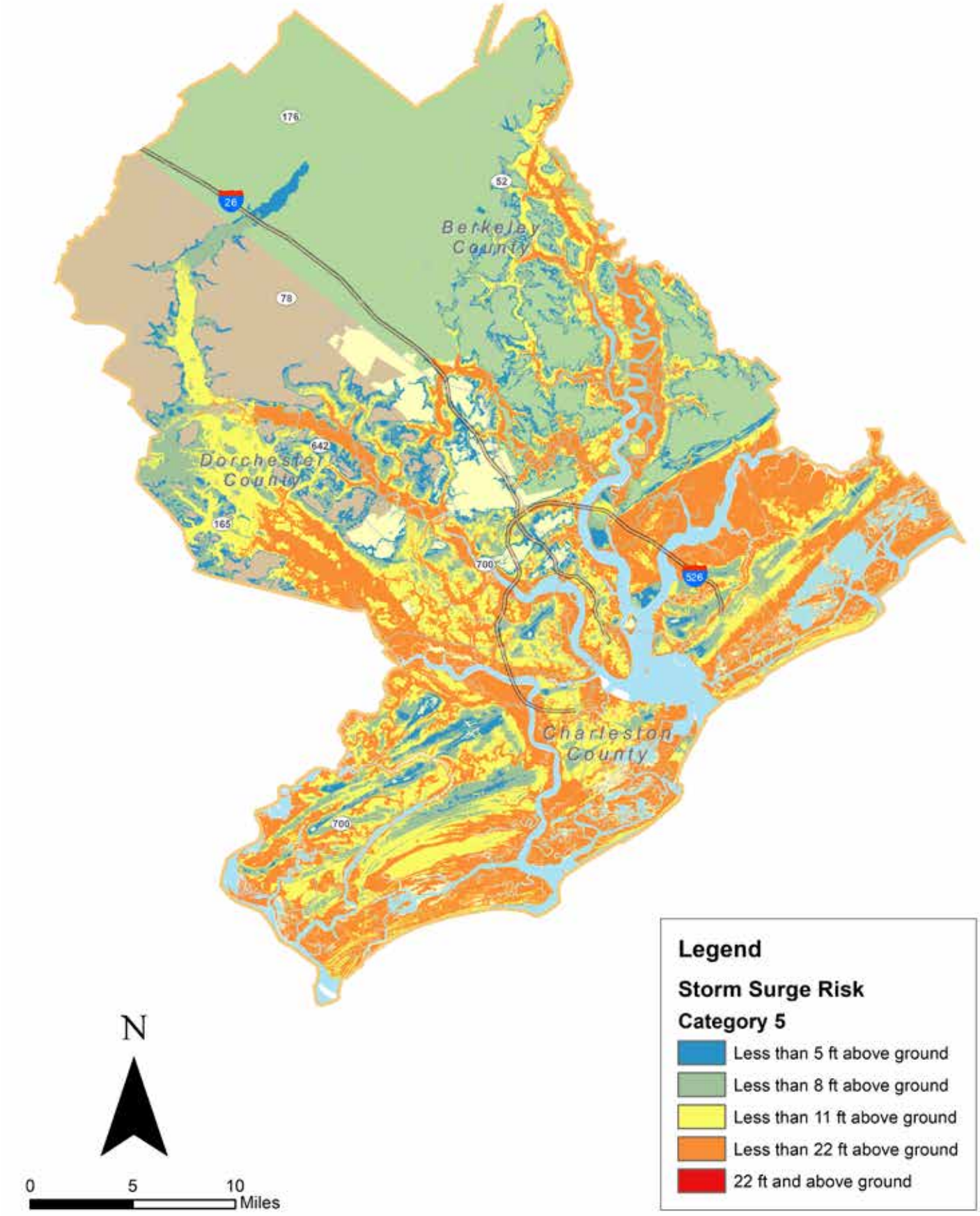
Map 2-26: Storm Surge Risk Map, Category 3 Hurricane (NOAA)



Map 2-27: Storm Surge Risk Map, Category 4 Hurricane (NOAA)



Map 2-28: Storm Surge Risk Map, Category 5 Hurricane (NOAA)



The BCD region is very aware of the risks for disruption of infrastructure and services resulting from weather events, particularly for the transportation network. CHATS embraces the need for strategies, such as those recommended by the Center for Climate & Energy Solutions below, as means for bolstering the region's resiliency to the impacts of hurricanes: Preserving coastal wetlands and dunes to absorb storm surge

- Replenishing beaches and improving infrastructure that affords coastal protection, such as seawalls
- Designing structures to be resilient to high wind and flying debris
- Preparing directly prior to a storm's arrival by implementing thorough community awareness initiatives and activating an evacuation plan

The South Carolina Emergency Management Division (SCEMD) published an evacuation zone map for Berkeley, Charleston, and Dorchester counties that illustrates the region's evacuation zones and routes (see **Map 2-29**). The proximity to and enhancement of evacuation routes is one factor in the environmental scoring of candidate projects within the LRTP.

Although the frequency of hurricanes has not increased over the past several decades, there has been an increase in the frequency of flooding events in the Charleston area. As shown in **Figure 2-22**, the average number of annual flood days increased from 1.7 in the 2000s to 4.9 in the 2010s (NOAA). Forecasts from NOAA estimate that this trend of increased flood events in the Charleston area will continue, with the frequency of just high-tide flood events increasing by over 1,000% between 2020 and 2050 (NOAA, intermediate scenario). Flooding has a direct and sometimes unforeseen impact on the transportation network in the CHATS region.

USDOT's *Climate Action Plan* (2021) recommends using a risk-based management framework to assign a climate sensitivity and adaptive capacity score to each critical facility, and then prioritizing cost-effective measures for mitigating that risk. For project-by-project evaluation, the National Fish & Wildlife Foundation's Coastal Resilience Evaluation & Siting Tool (CREST) allows agencies to analyze the proximity of critical facilities in flood-prone areas to underlying conditions such as impermeable soils, soil erodibility, and areas of low slope. And as critical facilities in flood-prone areas are identified, the EPA's *Green Streets Handbook* (2021) advocates for expanding the definition of Complete Streets to include strategies for capturing stormwater. Potential strategies vary by facility type and include:

- Bioretention
- Bioswales
- Stormwater curb extensions
- Stormwater planters
- Street trees
- Infiltration trenches
- Subsurface infiltration and detention
- Permeable pavement

Map 2-29: Hurricane Evacuation Routes (SCEMD)

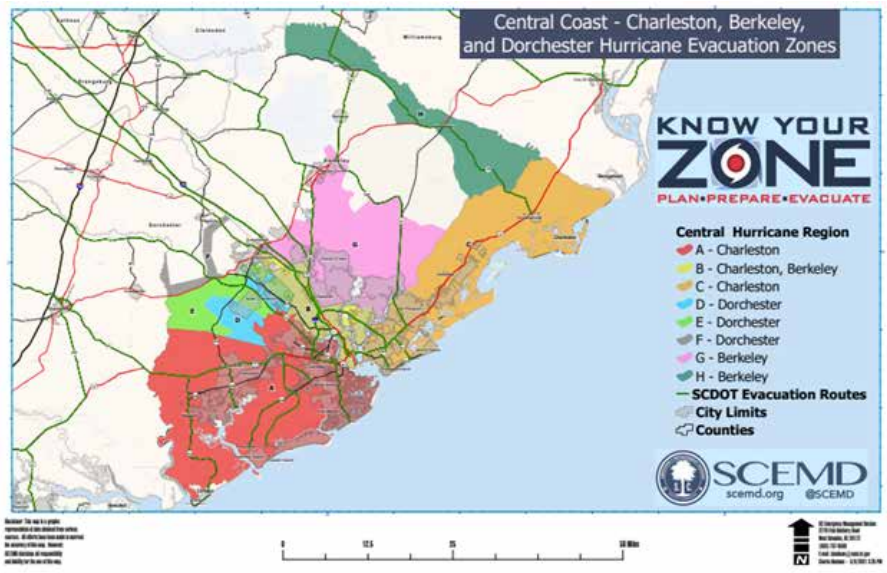
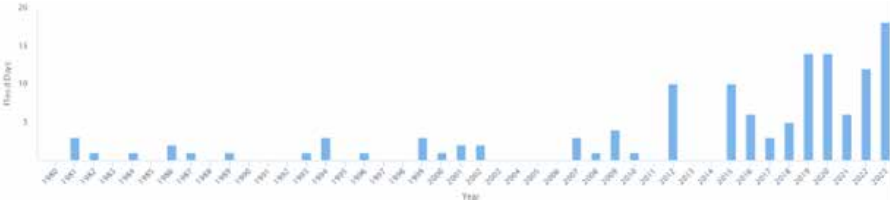


Figure 2-22: Annual Flood Days, Charleston (NOAA)



Earthquakes

The failure of critical transportation facilities, such as bridges, during an earthquake can result in loss of life. To design a bridge to resist earthquakes, understanding the seismic vulnerability of the bridge's location is essential. A "fault" is a zone of fractures between the Earth's crust that allow the different blocks of the crust to move. When those blocks of crust move rapidly, earthquakes take place within the fault zones. A major fault zone cuts across the CHATS planning area, as shown in **Map 2-30**. Critical facilities within this fault zone are particularly at risk of damage because of the composition of the area's soil. When a high stress condition, such as an earthquake, acts on the area's soil, it behaves as a liquid instead of a solid.

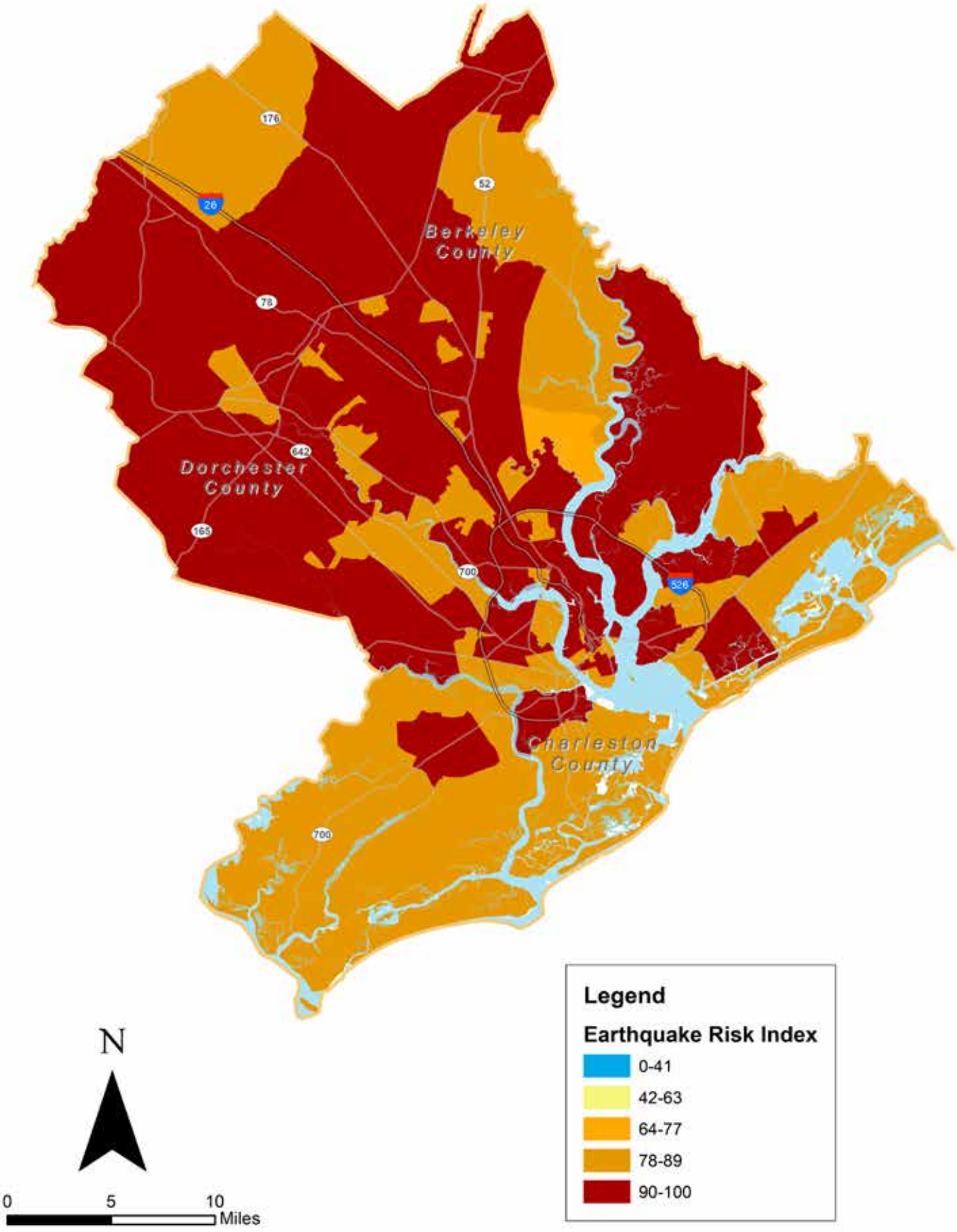
The presence of a fault zone and existing soil conditions make Census Tracts within the CHATS planning area particularly at risk of sustaining damage during a major earthquake compared to the rest of South Carolina (see **Map 2-31**). Retrofitting is the most common method of mitigating risks. In some cases, however, the cost might be so prohibitive that abandoning the bridge (total or partial closure with restricted access) or replacing it altogether with a new structure may be favored. The decision to retrofit, abandon, replace, or do nothing requires careful evaluation of the importance of the bridge and its degree of vulnerability. Limited resources generally require that deficient bridges be prioritized, with important bridges in high-risk areas being retrofitted first. Bridges constructed prior to 1971 in particular need to be retrofitted, based on seismicity and structural types (FHWA). In 2006, FHWA issued new standards for the seismic design of new bridges in Seismic Retrofitting Manual of Highway Structures - Part I (Bridges) and Part II (Retaining Structures, Slopes, Tunnels, Culverts, & Roadways). This two-volume manual contains the following procedures for evaluating and upgrading the seismic resistance of existing highway bridges:
A screening process to identify and prioritize bridges that need to be evaluated for seismic retrofitting

- A methodology for quantitatively evaluating the seismic capacity of a bridge
- Retrofitting approaches and techniques for increasing the seismic resistance of existing bridges
- A methodology for determining the overall effectiveness of alternative retrofitting measures, including cost and ease of installation

SCDOT is the lead agency in bridge repairs and replacements for roads in the CHATS transportation network. These procedures are also recommended for application by the counties as they evaluate bridges on secondary roads.

Map 2-30: Charleston Fault Area (USGS, U.S. Quaternary Faults)

Map 2-31: Earthquake Risk Index (FEMA, National Risk Index)

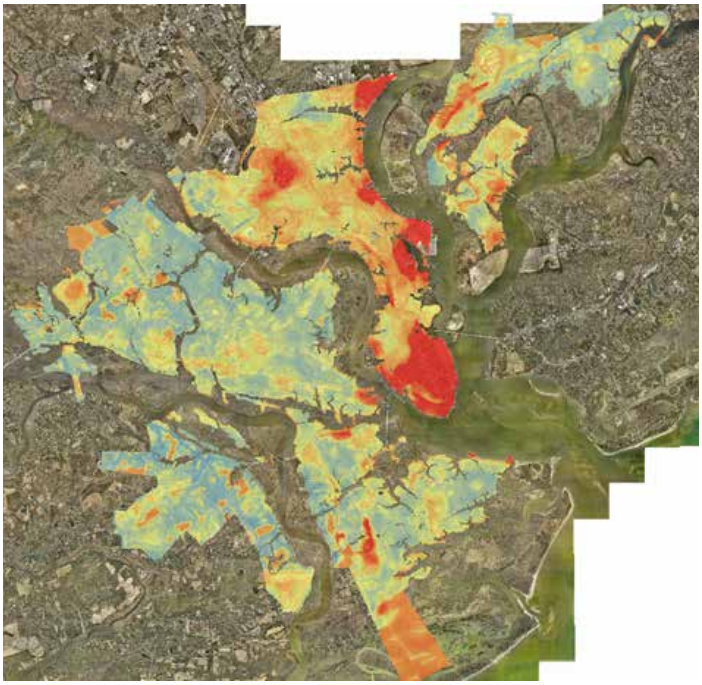


Heat Waves

Extreme heat kills more Americans annually than any other weather event. The compounding negative health effects of heat stress are felt most by those of vulnerable populations including children, seniors, pregnant women, people with preexisting health conditions, and people without access to cooling strategies like air conditioning.

In 2021, the City of Charleston was one of 42 communities that participated in NOAA's National Integrated Heat Health Information system urban heat island mapping campaign. The project collected and mapped morning, afternoon, and evening air temperatures from sensors attached to bicycles and motor vehicles to identify "urban heat islands". An urban heat island occurs in areas with a high prevalence of impervious surfaces. Heat radiates off street infrastructure and surrounding buildings, causing highly urbanized areas to retain more heat throughout the day and nighttime than rural areas. When heat does not have the opportunity to dissipate at night, the community does not have a chance to cool down (CAPA Strategies, *Heat Watch Report, Charleston, SC*). This lack of cooling deteriorates public health and infrastructure quality while increasing economic and energy demand for air conditioning and other cooling strategies. As shown in **Map 2-32**, downtown Charleston and port facilities along the Cooper River had the highest evening heat indices.

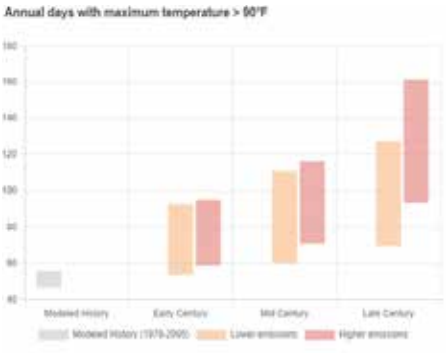
Map 2-32: Evening Temperature Model (City of Charleston)



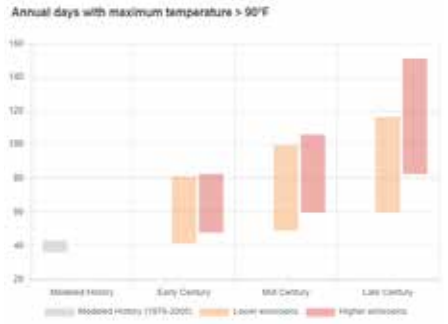
FEMA defines extreme heat as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees (FEMA). Extreme heat can damage transportation infrastructure through material heat stress expansion that causes asphalt, concrete, and trail tracks to distort or buckle. The U.S. Global Research Program forecasts an increase in the annual days of extreme heat in Berkeley, Charleston, and Dorchester counties by 2044 (see **Figure 2-23**).

Figure 2-23: Annual Days of Extreme Heat (U.S. Global Research Program, CMRA v1.2.1)

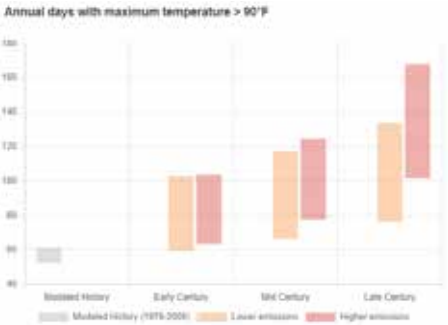
Berkeley County



Charleston County



Dorchester County



Mitigation strategies to reduce the impacts of urban heat islands include vegetative cover, reflective pavements, permeable pavements, and smart growth practices to reduce the total amount of paved surfaces.

Wildlife Impacts

Threatened & Endangered Species

Urbanization poses threats to endangered species in multiple facets. The investment of transportation infrastructure along beaches and other shorelines affects the survival mechanisms of sea turtles, estuarine turtles, and plants. Sea turtles are particularly vulnerable to urbanization along beaches because new hatchlings will follow the presence of light along roadways away from the sea and into traffic (SC DNR, Marine Turtle Conservation Program). **Map 2-33** shows the location of vulnerable wildlife species within the CHATS boundary.

Strategies to mitigate impacts by the region's transportation infrastructure's effects on endangered species could include decreasing light from infrastructure visible from beaches at night and restricting off-road vehicle travel.

Habitat Core

Many of the threatened and endangered species within the CHATS boundary are associated with the rivers, creeks, lakes, forest, and wetlands in the region. Besides the protected areas that are managed by federal and state agencies, such as the US Fish and Wildlife Service (USFWS), National Forest Service (NFS), National Park Service (NPS), and SC State Park System, there are many "out – conservation zones" considered as Habitat Core in the BCD region. **Map 2-34** shows existing minimally disturbed natural areas.

The presence or development of new transportation facilities in these natural areas may result in reduced landscape permeability, habitat loss, and increased habitat fragmentation. These factors should all be considered in the evaluation of proposed transportation improvements, particularly for new roads. Buffer zones of natural land preservation around new infrastructure projects can be used to reduce the environmental degradation effects of urbanization.

3.4.3 Wildlife Crossings

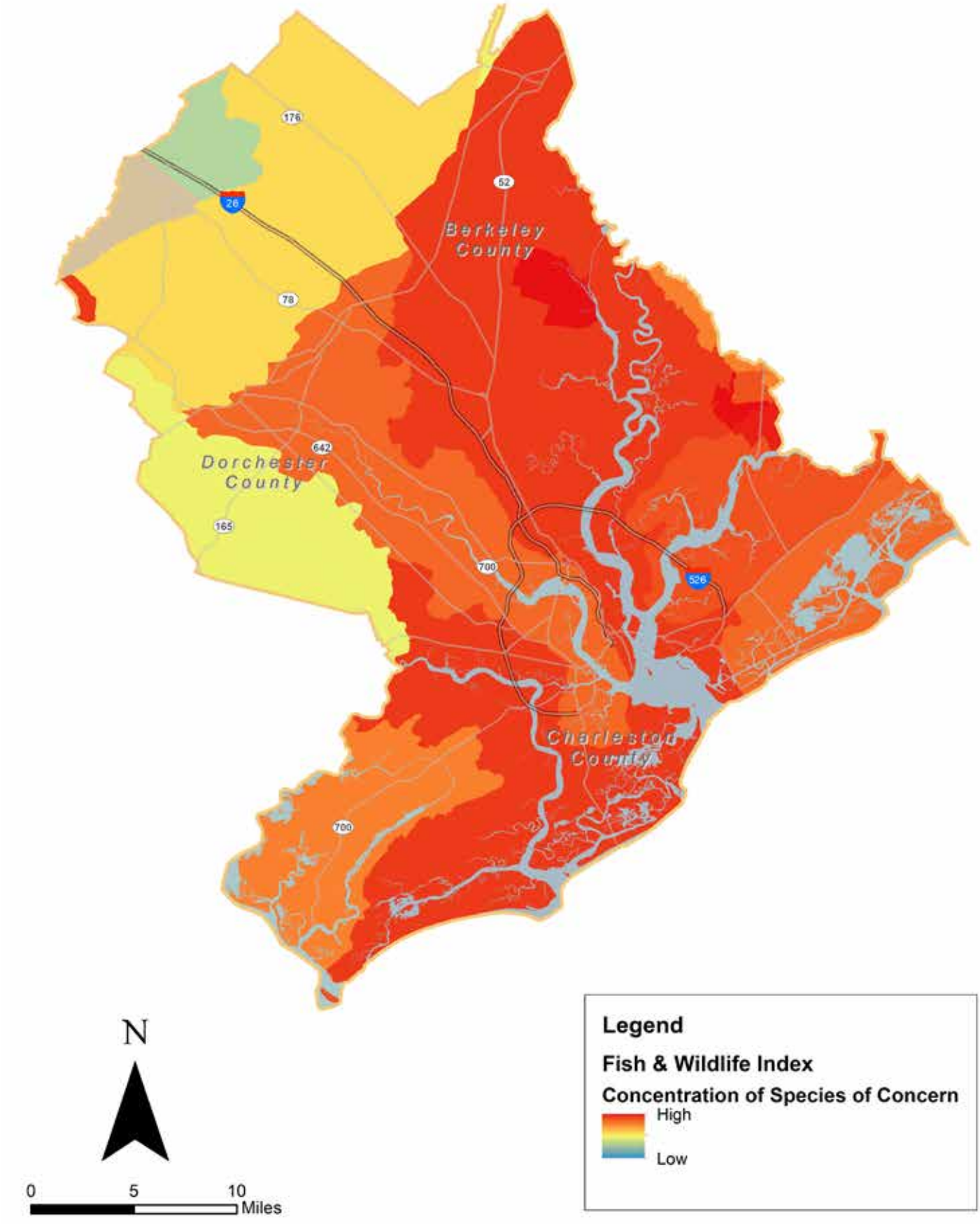
Every year, motorists are injured and die in collisions with wildlife. As shown in **Table 2-8**, there were 7,470 reported vehicle-animal collisions in 2021 resulting in 26 serious injuries and 4 fatalities. This was a marked uptick in total vehicle-animal collisions in 2021 compared to 2019 and 2020.

Table 2-8: Vehicle-Animal Collisions, South Carolina (2019-2021)

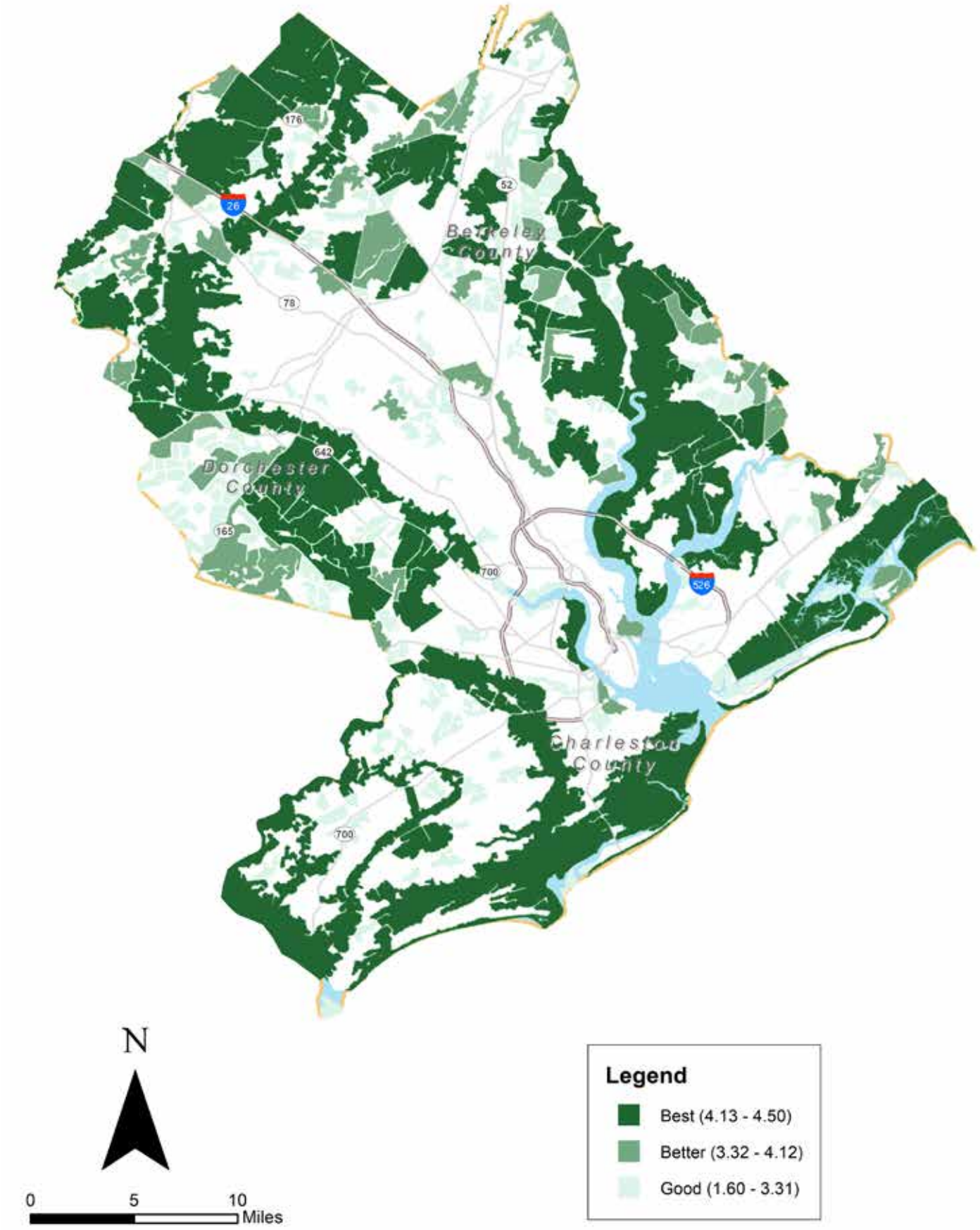
	2019 (SCDPS)	2020 (SCDPS)	2021 (SCDPS)
Reported Vehicle-Animal Collisions	4,024	3,552	7,470
Serious Injuries	36	26	26
Fatalities	10	2	4

Reducing the frequency of these collisions is a matter of good environmental stewardship, as well as highway safety. Animal-vehicle collision mitigation strategies include providing for animal overcrossings and undercrossings, seasonal advisories and changeable message signs, in-vehicle technologies (such as infrared vision or sensors) and buried cable animal detection systems.

Map 2-33: Fish & Wildlife Index (NFWF CREST)

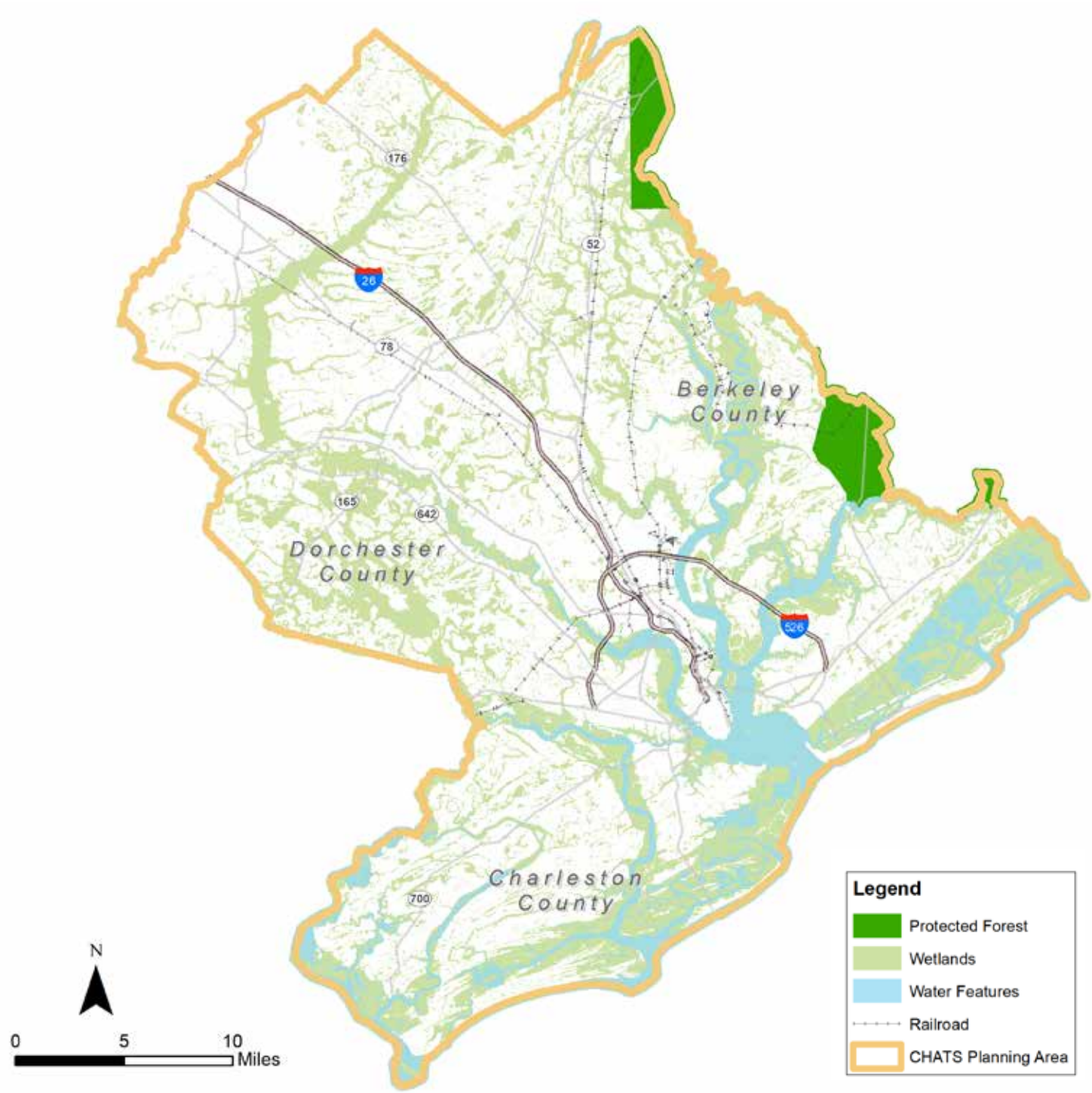


Map 2-34: Intact Habitat Core (Esri, Green Infrastructure Initiative)



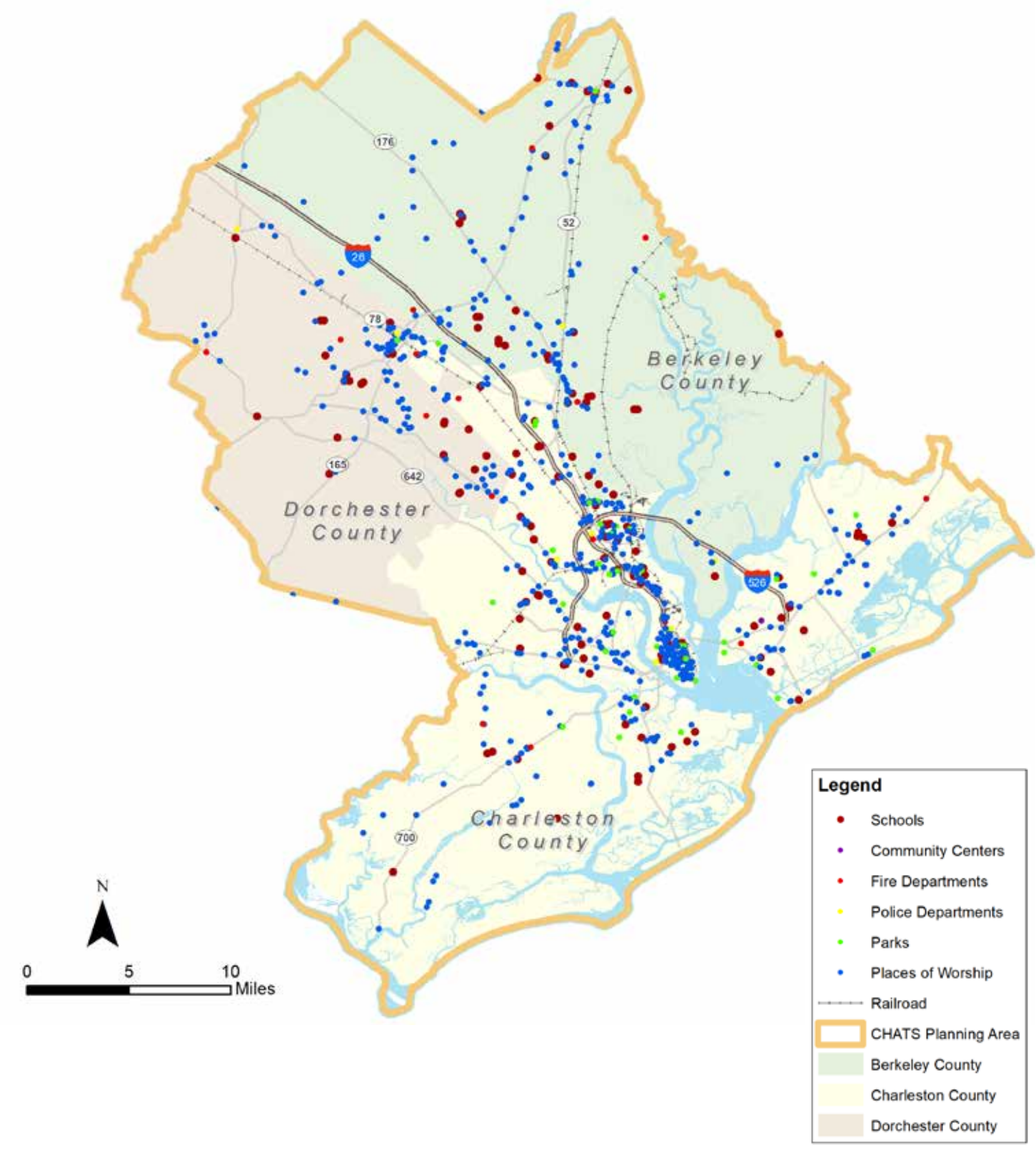
The following maps provide additional environmental resource available.

Map 2-35: Natural Features



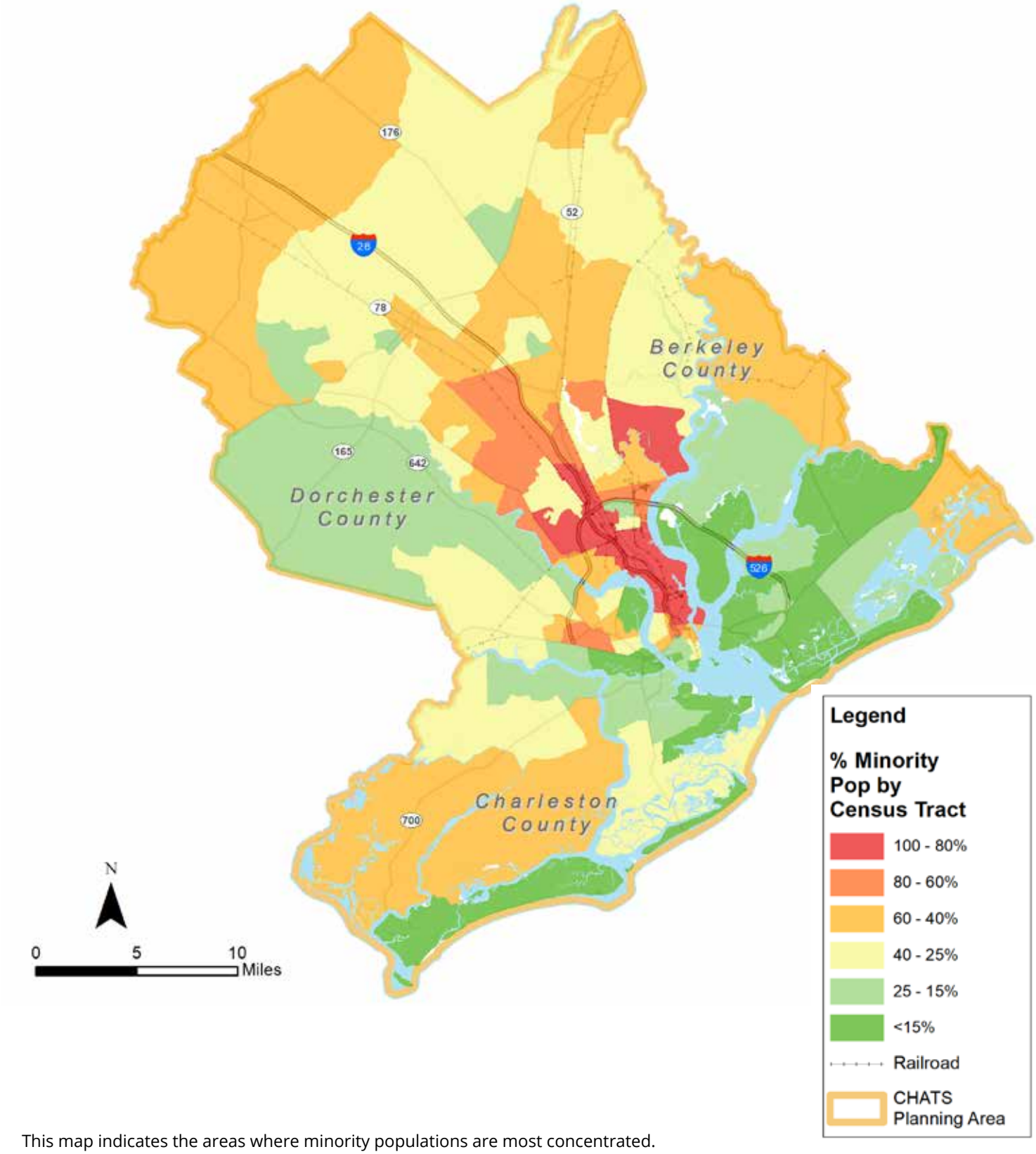
This map indicates the location of protected forests, wetlands, and water features. Environmental impacts of transportation projects should take the location of these features into account.

Map 2-36: Community Facilities



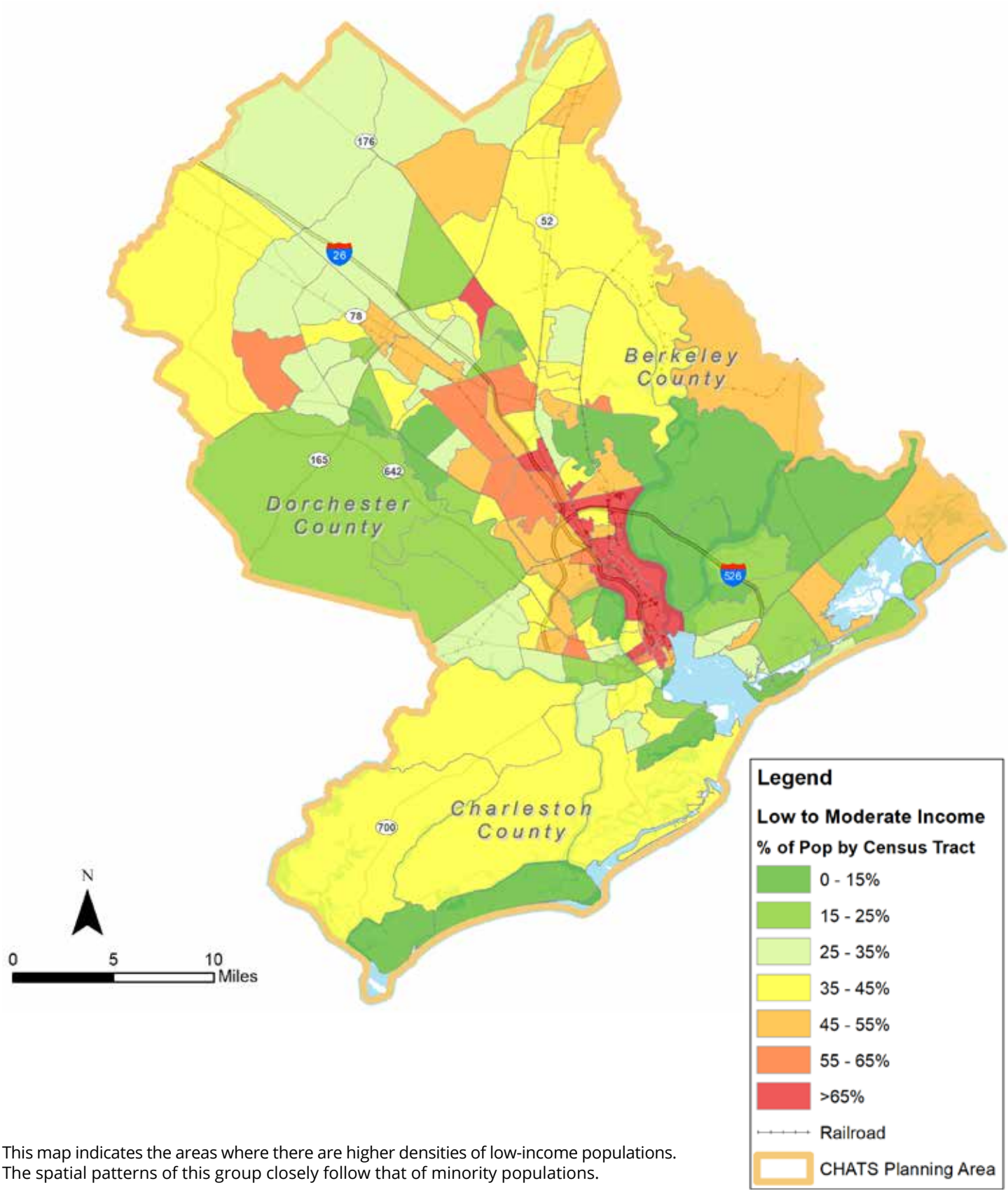
This map indicates the location of important cultural resources such as churches, schools, and parks.

Map 2-37: Minority Population Concentrations



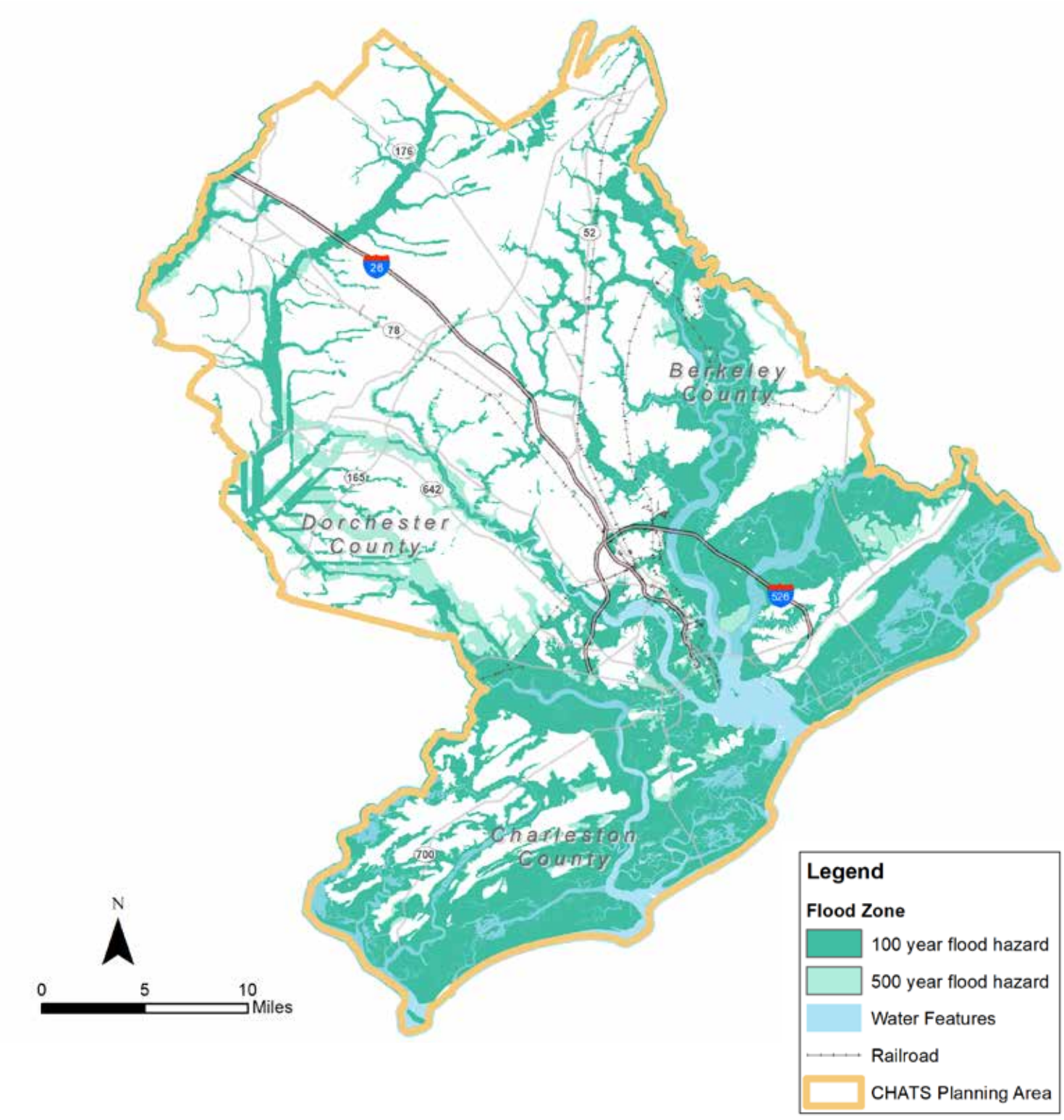
This map indicates the areas where minority populations are most concentrated.

Map 2-38: Low-Income Populations



This map indicates the areas where there are higher densities of low-income populations. The spatial patterns of this group closely follow that of minority populations.

Map 2-39: Flood Zones



This map displays areas where flooding may be most prevalent, and may create greater limitations for development and infrastructure provision.