GREATER NASHVILLE
REGIONAL COUNCIL

Priority Climate Action Plan

Nashville-Davidson-Murfreesboro-Franklin, TN MSA

March 2024

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List of Abbreviations and Acronyms

AFOLU	"Agriculture, Forestry, and Other Land Use" Emissions Sector
BAU	Business as usual
CAA	Clean Air Act
CAPs	Criteria Air Pollutants
CARP	Metro Nashville's Climate Adaptation and Resilience Plan
CCAP	Comprehensive Climate Action Plan
CEJST	Climate and Economic Justice Screening Tool
CH_4	Methane
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPRG	Climate Pollution Reduction Grant
C & D	Construction and demolition landfill
DOE	U.S. Department of Energy
DMU	Diesel Multiple Unit
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EV	Electric Vehicle
F-gases	Fluorinated Gases
FLIGHT	EPA's Facility Level Information on Green Houe Gases Tool
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program (40 Code of Federal Regulations Part 98)
GNRC	Greater Nashville Regional Council
GWh	Gigawatt hour
HFCs	Hydrofluorocarbons
ICE	Internal Combustion Engines
IRA	Inflation Reduction Act
ICLEI	Local Governments for Sustainability (formerly known as the International Council for Local Environmental Initiatives)
kW	Kilowatt
kWh	Kilowatt hour
LEARN	ICLEI's Land Emissions and Removals Navigator Tool
LED	Light Emitting Diode
LIDAC	Low-income disadvantaged community
LPC	Local Power Companies
MDHA	Metropolitan Development and Housing Agency
MMT	Million Metric Ton

MPO	Metropolitan Planning Organization
MSW	Municipal Solid Waste
MSA	Metropolitan Statistical Area
MT	Metric Ton
MW	Megawatt
MWh	Megawatt hour
NDOT	Nashville Department of Transportation
NEI	EPA's National Emissions Inventory
NES	Nashville Electric Service
NF_3	Nitrogen Trifluoride
N_2O	Nitrous Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NREL	National Renewable Energy Laboratory
O_3	Ozone
PCAP	Priority Climate Action Plan
RTP	Regional Transportation Plan
SF_6	Sulfur Hexafluoride
SO_2	Sulfur Dioxide
QAPP	Quality Assurance Project Plan
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TIP	Transportation Improvement Program
TVERS	Tennessee Voluntary Emissions Reduction Strategy
TCC	Transportation Coordinating Committee
TPB	Transportation Policy Board
VMT	Vehicle Miles Traveled
VOCs	Volatile Organic Compounds
WARM	Waste Reduction Model

1.0 Introduction

1.1 Program Overview

The U.S. Environmental Protection Agency's Climate Pollution Reduction Grants (CPRG) program provides $5 billion in grants to states, local governments, tribes, and territories to develop and implement ambitious plans for reducing greenhouse gas emissions and other harmful air pollution. Authorized under Section 60114 of the Inflation Reduction Act, this two-phase program provides $250 million for noncompetitive planning grants, and approximately $4.6 billion for competitive implementation grants. Through the CPRG program, EPA is seeking to achieve three broad objectives:

- Tackle damaging climate pollution while supporting the creation of good jobs and lowering energy costs for families.
- Accelerate work to address environmental injustice and empower community-driven solutions in overburdened neighborhoods.
- Deliver cleaner air by reducing harmful air pollution in places where people live, work, play, and go to school.

CPRG includes two phases of investment. Phase 1 provides noncompetitive grants to state and local/regional agencies to develop custom plans to reduce greenhouse gases (GHGs). Phase 2 provides funding to help implement priority measures identified in those plans. Priorities for the phase 1 planning grants include:

- Establishing ambitious measures that will achieve significant cumulative GHG reductions by 2030 and beyond;
- Prioritizing strategies that will achieve substantial community benefits (such as reduction of criteria air pollutants (CAPs) and hazardous air pollutants (HAPs), particularly in low income and disadvantaged communities;
- Identifying opportunities to leverage other funding sources to maximize these GHG reductions and community benefits; and
- Crafting innovative policies and programs that are replicable and can be "scaled up" across multiple jurisdictions.

Priority Climate Action Plan

The first deliverable of the CPRG planning grant is a Priority Climate Action Plan (PCAP). The PCAP must include a focused list of near-term, high-priority, implementation-ready measures that have been identified for implementation by the lead organization and any other collaborating entities (e.g., municipalities, tribes). The PCAP includes:

- A GHG inventory;
- Quantified GHG reduction measures;
- A low-income and disadvantaged communities benefits analysis; and,
- A review of authority to implement.

A Comprehensive Climate Action Plan (CCAP) will be completed following the PCAP. The CCAP provides the scope for more detailed inventory, modeling, technical analysis, and community engagement.

1.2 Lead Entities

In response to the opportunities provided by EPA through the CPRG, the TN Department of Environment and Conservation (TDEC) is leading a statewide effort to develop the Tennessee Volunteer Emission Reduction Strategy or TVERS.

Local partners of the three largest metropolitan statistical areas (MSAs) within Tennessee are working in partnership with TDEC to develop regional emissions reduction plans for their respective areas. The Greater Nashville Regional Council (GNRC) is designated as the lead entity for the EPA's CPRG Program across the Nashville-Davidson- Murfreesboro-Franklin, TN Metropolitan Statistical Area (MSA).

GNRC is a public body corporate and politic originally established by the Tennessee Development District Act of 1965. Today, GNRC serves as council of governments empowered by State law to convene local and state leaders for the purposes of planning and programming state and federal investments into a range of social services and public infrastructure across a thirteen-county region. The 93-member governing body of the Regional Council includes 13 county mayors, 52 municipal mayors, 2 state legislators, a private citizen from each county representing issues of business and commerce, and a private citizen from each county representing issues of social equity and inclusion.

GNRC's mission is to assist local communities and state agencies in the development of plans and programs that guide growth and development in the most desirable, efficient, and cost-effective manner, while ensuring the continued long-term livability of the region. GNRC carries several designations as it works on behalf of State and local partners.

- GNRC is designated by the U.S. Economic Development Administration as the region's economic development district to act on behalf of local officials, chambers of commerce, and private sector investors.
- GNRC staff provide regional transportation planning for the Nashville Metropolitan Planning Organization (MPO) and has representation on the neighboring Clarksville Urbanized Area MPO, Middle Tennessee Rural Planning Organization (RPO), and Dale Hollow RPO.
- GNRC is designated as the Area Agency on Aging and Disability for the primary purpose to coordinate the delivery of services and programs to enhance the quality of life of the region's older population.
- GNRC staffs the Mid-Cumberland Area Development Corporation and administers lending programs to small businesses with resources provided by the U.S. SBA and the U.S. EDA, and USDA.
- GNRC staffs the Middle Tennessee Tourism Council to provide tourism marketing and other promotional support to the tourism economy.
- GNRC staffs Cumberland Region Tomorrow to encourage responsible growth and ensure that the region's communities grow to be vibrant and livable places that offer a range of transportation and housing choices, while preserving the region's natural environment.

GNRC's professional staff have decades of combined expertise in community development; land use, environment, and transportation planning; economic development; project and program management; grant writing and management; aging and disability services; policymaking; and data analysis. The organization's extensive experience and permanence in Middle Tennessee have enabled GNRC to establish relationships with organizations and agencies in the public, private, and non-profit sectors to better serve the region's residents and communities. GNRC staff are often working with federal, state, and local departments of transportation and economic development agencies; community housing agencies; water and sewer utilities, electric and natural gas utilities, and broadband service providers; religious and community-based organizations;

community health and private health organizations; and universities in addition to local governments and the public.

GNRC is uniquely positioned to leverage its existing capacity and organizational structure to convene key decision makers, practitioners, and public and private sector stakeholders in developing the CPRG deliverables that address the unique concerns of the MSA and position municipal and county governments and other implementing agencies for subsequent EPA grants and other federal funds to achieve the climate pollution reduction goals of the PCAP and CCAP.

1.3 Geographic Scope

GNRC's planning area for the CPRG program consists of seventeen counties within Middle Tennessee. As a multi-faceted organization, GNRC serves a variety of counties in its day-to-day activities. For example, GNRC member counties differ slightly from the counties found in the Nashville MSA, which in turn differ slightly from the counties served by the Nashville MPO, which is also staffed by GNRC. In recognition of this fact, GNRC has extended its Climate Action Planning Area to represent the thirteen counties included in the Nashville MSA, along with four additional counties that are traditionally included in GNRC's area of service. The complete list of counties included in the PCAP are as follows: Cannon County, Cheatham County, Davidson County, Dickson County, Houston County, Humphreys County, Macon County, Maury County, Montgomery County, Robertson County Rutherford County, Smith County, Stewart County, Sumner County, Trousdale County, Williamson County, and Wilson County.

1.4 Interagency Coordination

In its role as a regional convenor, GNRC coordinates with state and local agencies and organizations on regional and local planning efforts and continued to expand these relationships through the CPRG planning effort. GNRC leveraged its existing capacity and organizational structure to convene key decision makers, practitioners, and public and private sector stakeholders to develop PCAP deliverables that address the unique concerns of the planning area. Specifically, GNRC currently facilitates regional dialogue among the following relevant groups:

- Regional Council Body: The Regional Council body is comprised of 93 members and includes 65 mayors and county executives, 26 mayoral appointments, and 2 state legislators.
- Transportation Policy Board: The board is empowered to adopt formal transportation plans and programs on behalf of the Nashville Area Metropolitan Planning Organization. The TPB is comprised of mayors and county executives of member governments, the Governor (or TDOT designee), a representative of area transit agencies, a representative of county highway departments, and representatives of the Federal Highway Administration and Federal Transit Administration.
- Middle Tennessee Mayors Caucus: The Middle Tennessee Mayors Caucus was formed in 2009 in order to provide leadership on important issues facing a rapidly changing regional landscape. Transportation, and particularly the pursuit of a modern regional transit system, served as the early catalyst, but in its brief history, the Caucus has served as an effective forum for building working relationships among mayors and has helped local governments support each other on issues ranging from flood recovery to state and federal legislative and policy priorities. Today, the Caucus serves as GNRC's primary forum for area mayors to advocate for the region's policy and legislative priorities.
- Economic Development Advisory Committee: The Economic Development Advisory Committee advises GNRC on a variety of projects and initiatives aimed at supporting regional economic development goals. Its primary purpose is to guide the development of the federally required

Comprehensive Economic Development Strategy for northern Middle Tennessee which opens doors to federal grants. The membership is comprised of three mayors appointed by the GNRC chairperson, business representatives appointed by each of the thirteen (13) county mayors, and social equity representatives also appointed by county mayors.

- Regional Environmental Roundtable: Recognizing the impact of rapid growth and development in Middle Tennessee and the need for collaboration, GNRC convenes a regional environmental roundtable comprised of local experts, practitioners, and advocates from non-profit organizations and State and federal public agencies to collaborate on issues and challenges related to the environmental quality of the region. The group was established by GNRC in 2020 to assist in a major update to the regional transportation plan and to help inform the Council's activities in environmental and conservation focus areas.

In addition, GNRC worked closely with the statewide CPRG planning effort, TVERS, and the two CPRG TN MSA planning grant recipients, the cities of Knoxville and Memphis, and the City of Chattanooga. In the Nashville planning area, GNRC collaborated with Metro Nashville's Mayors Office and Office of Sustainability and the Metro Nashville Health Department.

1.5 Community Engagement

GNRC conducted community engagement to provide an opportunity for members of the general public to help shape the priorities presented as part of the PCAP. Building relationships takes time, commitment, and transparency. The timeline associated with the development of the PCAP was short. More extensive community engagement and partnerships with other agencies will be conducted in the development of the CCAP.

Coordinating with the statewide CPRG effort, TVERS, GNRC hosted four public events in the Nashville planning area to engage with community members. Three of the events were in-person where attendees could ask questions and provide input on the planning elements. One of the public events was a virtual meeting with polling using Poll Everywhere software to engage participants and receive feedback. Two of the facilities are in a low-income disadvantaged community as identified using the CEJST.

- October 19, 2023, Lentz Public Health Building, Nashville
- February 22, 2024 – Virtual Meeting
- February 27, 2024 – Hadley Park Community Center, Nashville
- February 28, 2024 – Southeast Community Center, Nashville

In addition, through its partnership with TDEC, GNRC was able to review the responses from the statewide planning survey. The survey was available to the public from September to November 2023 and was on the MetroQuest platform. TDEC provided GNRC with response data from participants who identified a home location in the Nashville planning area. The statewide survey had 1,639 total responses with 540 respondents in the Nashville planning area.

1.6 Findings from Outreach

During stakeholder and community meetings, GNRC provided an overview of air pollution, GHG emissions and an overview of the EPA's CPRG within the context of the Nashville planning area and the statewide effort, TVERS. GNRC staff had conversations with attendees and activities were available to solicit input from individuals. Activities focused on identifying the community's priorities for emissions reduction by sector and levels of support for their jurisdictions focus on emissions reduction measures. In addition, individuals were asked to share what actions they currently take that reduce emissions and what were the challenges and barriers to doing more.

Prioritization of Sectors to Reduce Emissions:

1. Transportation
2. Grid Electricity
3. Solid Waste
4. Stationary Fuels
5. AFOLU

Most individuals who participated in an engagement activity already do the following to reduce their emissions:

- recycle and reduce their waste and compost organic materials,
- use energy efficient appliances and lightbulbs,
- consolidate their errands and daily trips to reduce the miles that they drive, and
- take transit and/or walk and bike instead of drive.

The primary challenges for reducing their emissions are:

- The lack of a safe, connected, and convenient transit, pedestrian and biking infrastructure makes it difficult to not have to drive,
- High cost of efficient or sustainable alternatives, and
- Limited knowledge or information

Actions that they would like their community, city, or county to focus on include:

- Incentives for waste and recycling,
- More transit options – trains and buses – and free service,
- Expand and improve existing local and regional transit systems and infrastructure,
- Invest in building energy efficiency and weatherization improvements and programs,
- Protect and increase the tree canopy,
- Reduce travel demand and increase alternative travel modes with choices, behaviors, and incentives, and
- Improve transportation infrastructure and ITS to reduce travel times and idling.

1.7 Future Coordination and Engagement

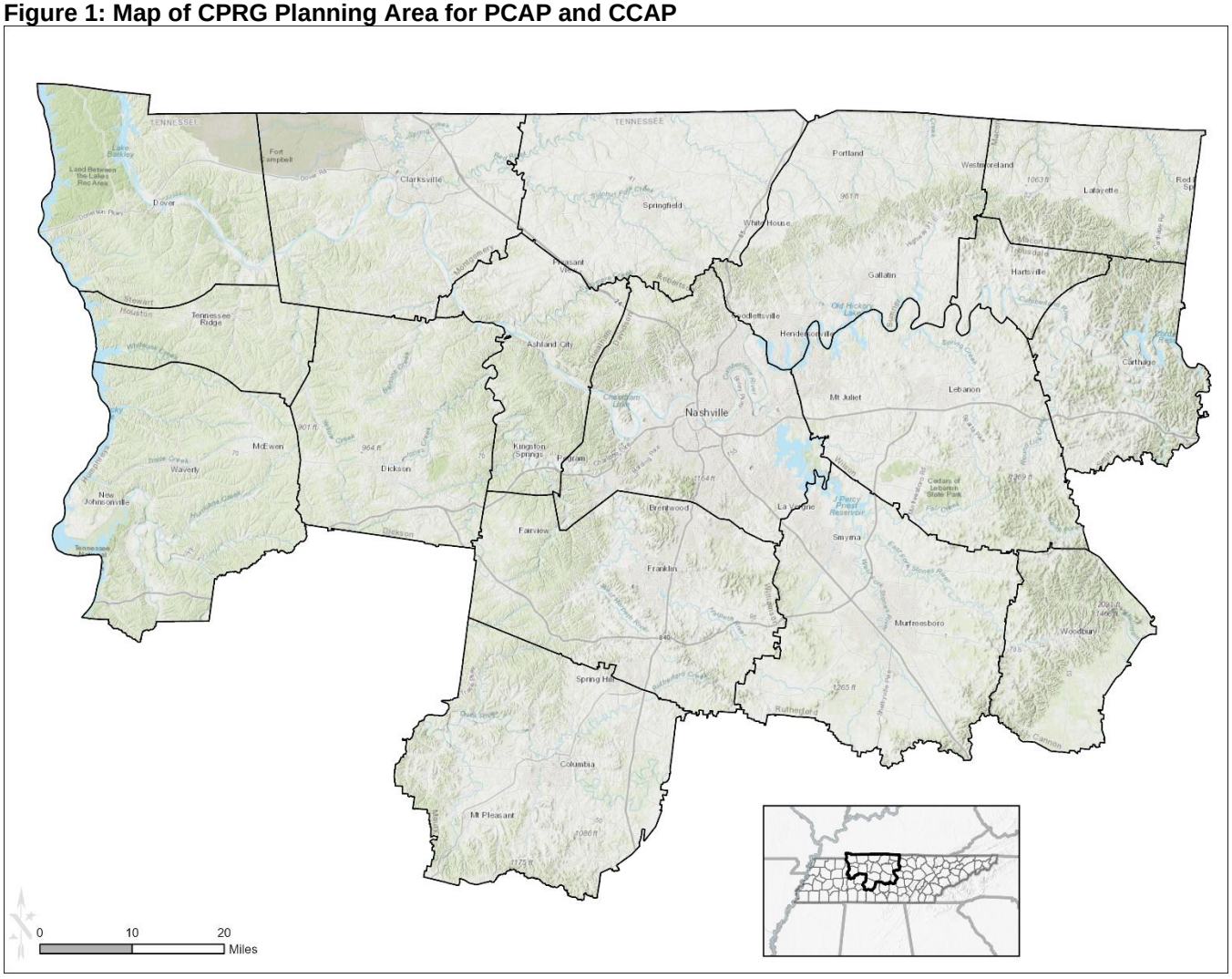
To complete the CCAP, GNRC will expand coordination and engagement efforts undertaken in developing the PCAP. The activities and relationships built during the PCAP establish a foundation to build from and expand outreach.

2.0 Regional Context

2.1 Geographic Extent

The geographic extent of the PCAP encompasses the 14 counties located within the Nashville-Davidson-Murfreesboro-Franklin, TN MSA including Cannon, Cheatham, Davidson, Dickson, Hickman, Macon, Maury, Robertson, Rutherford, Smith, Sumner, Trousdale, Williamson, and Wilson, as well as 4 additional counties located outside of the MSA that are represented in the ongoing planning efforts of the GNRC including Houston, Humphreys, Montgomery, and Stewart.

Figure 1: Map of CPRG Planning Area for PCAP and CCAP



2.2 Key Issues and Challenges

Rapid Population Growth

The 17-county CPRG Nashville planning area has experienced significant change since 2000. In 2000, over 1.5 million people lived here and by 2019 an additional ~645,000 people lived in the region pushing the population over 2.1 million. It is anticipated that by 2030, nearly 2.6 million people will live here, an 18% increase from

2019. And by 2050, over 3.2 million people are anticipated to live in the region, which is a 25% increase from 2030. Similarly, employment is expected to increase over the next three decades. In 2019, there were approximately 1.5 million jobs, and it is anticipated that by 2030 there will be 1.9 million and over 2.6 million jobs by 2050.

Sprawling Development Patterns, High Vehicle Miles Traveled, Traffic Congestion

Sprawling development patterns create greater distances between where people work, live and shop. Future projections indicate the fastest growing areas of the 17-county CPRG region are expected to be in counties surrounding Metro Nashville/Davidson County which are; Rutherford, Sumner, Williamson, and Wilson County as well as a few counties separated from Davidson County such as Trousdale and Montgomery County.

In 2021, one out of every three residents work in a different county in which they live across the metropolitan planning area. This geographic mismatch between locations of work and home contributes to the region's high vehicle miles traveled. In 2019, the base year for the GHG inventory, over 26.5 million annual vehicles miles were traveled, a 33% increase from 2005's 19.9 million annual vehicle miles traveled. And it is estimated that by 2050, over 41 million annual vehicle miles will be traveled, a 106% increase from 2005In 2019, the daily VMT per capita was 33.3 miles and if these trends continue, the daily VMT per capita in 2050 is anticipated to increase to 35 miles. .

Traffic congestion is often the first visible sign of economic prosperity as more people commute to work and school and make more trips to spend their increased discretionary income. The region's rapid growth has led to additional traffic volumes and increased demand on the existing transportation system. As a result, the duration of congestion has increased and the reliability of congestion has worsened in recent years. Based on NPMRDS (INRIX) data, the duration of congestion, measured by person-hours of excessive delay, has increased two percent annually for the Nashville area.

In the future, the region will need to move people more efficiently than driving alone. According to Transportation for America's The Congestion Con report, the region has added freeways faster than the population has grown, but it has not prevented congestion. Over the last 25 years, the Nashville urbanized area has increased freeway lane miles by 107%, population by 101%, yet increased annual hours of delay by 329%. Transit solutions and safe access to active transportation are necessary to maintain mobility across the region and access to economic opportunities.

Limited Public Transportation Options

The region's public transit services are provided by local governments. WeGo Public Transit (MTA) and other local transit agencies operate limited systems within their jurisdictions. WeGo Public Transit (RTA) provides regional services with express buses to locations in Montgomery, Robertson, Rutherford, Sumner, and Williamson County. The Music City Star, a commuter train service, provides connections to Wilson County.

Rising Cost of Living

Rising housing costs have pushed many families to seek housing farther from places of employment. As a result, they may be hindered by longer commutes and/or higher transportation costs, or worse yet, pass on employment prospects due to limited transportation mobility – not only affecting individual households but the region's economic vitality.

The cost of housing and transportation can be a burden to households. Cost-burden is a measure of the amount of income spent on housing and/or transportation. Those who spend more than 30% of their income on housing are considered cost burdened. Transportation cost is considered a burden if the cost accounts for more than 15% of a households' income. In the Nashville planning area 47% of households are cost burdened - 25% of households are housing cost burdened and 22% are transportation cost burdened.

Diversity and Demographic Shifts

The Middle Tennessee area continues to grow and diversify. The region's total population added nearly 330,000 residents between 2010 and 2020, an increase of more than 22%. Over the same time period, the percentage of ethnic and racial minorities increased by 13% and the elderly population rose by 52% regionwide, both outpacing the total population growth.

The region's recent growth outpaces many of our peer regions such as Indianapolis, Kansas City, and Louisville, and growth is projected to continue. By 2045, the MPO region is expected to reach more than 2.7 million residents - an additional million people in the next 25 years. Over that time horizon, the region's racial minority population is expected to increase at a faster rate than the total population and represent 22% of the region's population by 2045. In addition, the senior population is projected to more than double to nearly half a million seniors by 2045.

Climate Shifts and Extreme Weather

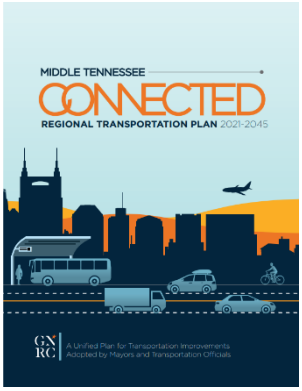
Climate change and its implications have been the focus of ongoing conversation across the globe for more than two decades. Locally, the Nashville region has seen the impact of extreme weather on its communities with unprecedented flooding in 2010, the March 2020 Tornado, increasing periods of drought and rain, as well as extreme temperature fluctuations. From rolling hills to lush farms to meandering streams, Middle Tennessee offers unmatched beauty. But the environment's importance goes well beyond beauty. Its health and vitality are directly tied to the physical and emotional health of its residents, as well as their economic well-being.

2.3 Related Plans and Programs

Comprehensive Economic Development Strategy (GNRC)

The Comprehensive Economic Development Strategy (CEDS) is a federally required document that serves as a gateway for grant-based investments from the U.S. Economic Development Administration. The CEDS is a regional blueprint for creating a stronger, more diverse economy and includes a set of strategies and proposed actions to ensure the continued prosperity and resiliency of the greater Nashville area.

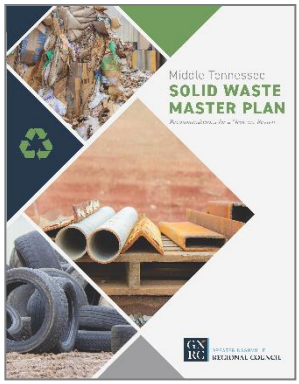
GNRC.org/CEDS



Regional Transportation Plan (GNRC)

In early 2021, mayors and transportation officials from across Middle Tennessee adopted an update to the region's transportation plan. The RTP allocates more than $10.5 billion in anticipated federal grants and matching funds to improve transportation throughout a seven-county planning area that includes Nashville and the surrounding counties of Maury, Robertson, Sumner, Rutherford, Williamson, and Wilson.

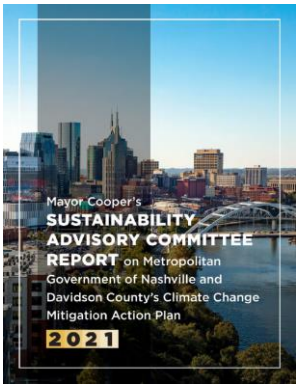
GNRC.org/Transportation



Regional Solid Waste Master Plan (GNRC)

GNRC, in partnership with local solid waste departments and the TN Dept. of Environment and Conservation, recently completed Middle Tennessee's first regional master plan for solid waste. The effort was launched as a response to a call-to-action by the GNRC Mayors Caucus to build support and capacity for multi-jurisdictional coordination on a range of issues impacting local solid waste management.

GNRC.org/SolidWaste

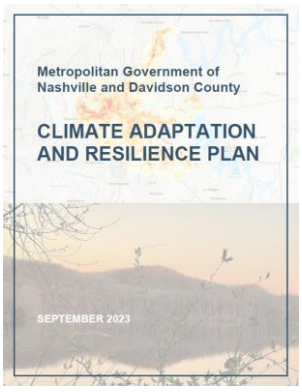


Climate Action Plan (Metro Nashville)

The plan serves as Metro Nashville's guiding document for its sustainability goals. A central recommendation of the CAP is that Metro carefully focus short- and long-term attention on the three key areas or "forks in the road" that will result in the greatest carbon reductions and enable the City to reach its sustainability targets:

- Decarbonization of the electrical grid;
- Electrification of motor vehicles; and
- Electrification (greening) of buildings.

Driving change in these three areas typically results in 60% to 70% greenhouse gas reductions and makes most cities' mitigation goals attainable.



Climate Adaptation and Resilience Plan (Metro Nashville)

The plan serves as Metro Nashville's guiding document for its resilience goals and represents the city's first effort to approach the climate crisis from a stance of resilience and is intended to inform future Metro investments and programs. It focuses on Nashville's five main climate hazards—flooding, tornados, extreme heat and heat waves, extreme cold and winter storms, and thunderstorms—and documents the outcomes of a high-level vulnerability assessment that considered the direct and indirect impacts of climate-driven disruptions, and the opportunities to build adaptive capacity across the built environment, natural environment, economic systems, and public services. It sets forth a strategic plan for deploying proactive strategies to reduce vulnerability and lower risk.

3.0 Greenhouse Gas Inventory

3.1 Scope of the Inventory

A greenhouse gas (GHG) inventory accounts for emission sources and their associated quantified emissions. The GNRC PCAP GHG inventory was developed through ICLEI's ClearPath tool and includes the following sectors: transportation; solid waste; grid electricity (residential, commercial, and industrial); stationary fuels; solid waste; water and wastewater; agriculture, forestry, and other land uses (AFOLU); and other sources. The year 2019 was chosen as the inventory's base year to provide a more representative pattern of general emissions before the pandemic the following year.

3.2 Data Review and Accounting Method

Various data sources, including national data sets and locally reported data, were used for input in ClearPath to calculate emissions for each sector. The table below highlights the data required for each sector along with its corresponding data source.

Figure 2: Data Sources for each Emissions Sector

Sector	Data Required	Data Source
Transportation	Vehicle Miles Traveled (VMT)	TDOT – 2019 HPMS
	Fuel Economy and Emission Rates	ClearPath Default Factor Set
	Emissions Estimates for Rail, Marine, Aviation, and Off-Road Mobile Sources	EPA National Emissions Inventory (NEI)
Grid Electricity	Consumption Data for Residential, Commercial, and Industrial Electricity	NREL SCOPE
Stationary Fuels	Fuel Consumption Data for Coal, Distillate Fuel Oil, HGL/Propane, and Wood and Waste	State-Level Energy Information Administration (EIA) Data, Downscaled to Planning Area
	Consumption Data for Residential, Commercial, and Industrial Natural Gas	NREL SCOPE
AFOLU	Emissions from Natural and Working Lands	ICLEI LEARN Tool
Solid Waste	Landfilled Waste at MSW and C&D Landfills	TDEC – 2019 ReTrac

ClearPath is a greenhouse gas inventorying tool provided by ICLEI to ICLEI member communities. The tool performs both local government operations or community-wide inventories. The tool works by taking activity data (e.g. vehicle miles traveled) or usage data (e.g. gallons of diesel consumed) and uses emissions factors from national databases to calculate emissions. Additionally, ClearPath will accept calculated or modeled emissions data. For the PCAP, GNRC used the community-wide track of the ClearPath tool. GNRC obtained county-level data for each of the 17-counties and summed the data to create the regional priority GHG inventory.

3.3 Regional GHG Emissions

The priority GHG inventory developed for the PCAP has a baseline year of 2019. The Transportation Sector has the highest emissions, followed by Grid Electricity, and Stationary Fuels. The top three sectors account for over 90% of total emissions in the region. The PCAP GHG inventory does not include Water and Wastewater Sector or Other sources. Those will be accounted for in the CCAP GHG inventory.

Figure 3: Total GHG Emissions by Sector

Sector	Million Metric Tons of Carbon Dioxide Equivalents (CO_2e)	Percent of Total CO_2e Emissions
Transportation	14.4	44%
Grid Electricity	13.3	41%
Stationary Fuels	3.2	10%
Agriculture, Forestry, and other Land Uses	1.1	3%
Solid Waste	0.5	2%
Total Emissions	**32.6**	**100%**

Transportation

Similar to the U.S., the Nashville planning area's largest source of GHG emissions were Transportation activities (44%) of total GHG emissions. Transportation activities were the largest source (28.6 percent) of total U.S. greenhouse gas emissions in 2019[1]. From 1990 to 2021, transportation CO_2 emissions from fossil fuel combustion increased by 19%. Transportation activities occur in all communities and the transportation sector is comprised of several sub-sectors of mobile sources: on-road vehicles, offroad vehicles, aviation, watercraft, and rail.

In the planning area, on-road vehicles are the largest source of emissions with 90% of CO_2e which includes light-duty (gasoline) passenger vehicles and heavy-duty (diesel) vehicles. The heavy-duty on-road sub-sector is mainly freight and services vehicles and public transit vehicles.

Offroad equipment is the second largest source of emissions in the transportation sector with 8% of CO_2e emissions. Offroad equipment includes construction equipment, generators, offroad vehicles, farm equipment, and other miscellaneous equipment.

Figure 4: Sources of Transportation Sector Emissions

Source	Million Metric Tons of Carbon Dioxide Equivalents (CO_2e)	Percent of Total Transportation Sector CO_2e Emissions
On-road	12.9	90%
Offroad	1.2	8%
Aviation	0.2	1%
Rail	0.1	1%
Water	0.1	>1%
Total Transportation Sector Emissions	**14.4**	**100%**

Grid Electricity

The electric power sector accounted for 25% of total U.S. greenhouse gas emissions in 2019. Power generation and/or consumption occurs among all communities. In the Nashville planning area, this sector was the second largest source of emissions with 41% of total CO_2e. This sector's emissions are comprised of the energy used by residences, businesses, and industries.

[1] U.S. Department of Energy. Alternative Fuels Data Center. Maps and Data- Greenhouse Gas Emissions by Economic Sector. https://afdc.energy.gov/data/10802

Figure 5: Sources of Grid Electricity Sector Emissions

Source	Million Metric Tons of Carbon Dioxide Equivalents (CO_2e)	Percent of Total Grid Electricity Sector CO_2e Emissions
Commercial	6.1	46%
Residential	5.2	39%
Industrial	2.0	15%
Total Grid Electricity Sector Emissions	**13.2**	**100%**

Stationary Fuel

The stationary fuel sector includes the energy used to heat buildings for air and water temperature comfort. The primary sources of GHG emissions are from fuels such as natural gas, kerosene and other fuels including wood. Emissions from the commercial and residential sectors have increased since 1990. In the Nashville planning area, 10% of GHG emissions are attributable to stationary fuels.

Agriculture, Forestry and other Land Uses

This sector includes fluxes of carbon from activities such as converting forests to agricultural use and practices that remove CO_2 from the atmosphere and store it in long-term carbon sinks like forests. In 2019, 3% of total regional GHG emissions come from these activities.

Solid Waste

This sector includes landfills, composting, and anaerobic digestion. Landfills were the third largest source of anthropogenic methane emissions in 2021, and landfills accounted for 1.9% of total U.S. greenhouse gas emissions. In 2019, 2% of the total GHG emissions come from landfills (MSW and C&D) in the region.

3.4 GHG Emissions by Type of Gas

Greenhouse gases are gases in the atmosphere that act similarly to the glass in a greenhouse: they absorb the sun's energy and heat that is radiated from the Earth's surface, trap it in the atmosphere and prevent it from escaping into space. This process is the main reason for the greenhouse effect that keeps the Earth's temperature warmer than it would otherwise be, allowing life on Earth to exist. Many greenhouse gases occur naturally in the atmosphere, but human activity adds enormous amounts, boosting the greenhouse effect that is contributing to global warming.

Carbon Dioxide (CO_2) and other greenhouse gases like methane and nitrous oxide are emitted when we burn fossil fuels, produce materials such as steel, cement, and plastics, and grow the food we eat. The primary sources of greenhouse gas emissions in the United States are carbon dioxide (CO_2) and methane (CH_4). Smaller emissions include Nitrous oxide (N_2O) and fluorinated gases (F-gases) including Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur hexafluoride (SF_6).

Greenhouse gases are also absorbed through natural and man-made processes. Natural causes of greenhouse gas absorption include oceans and plants. Manmade processes of greenhouse gas absorption include carbon capture systems. There are also some industrial cases of using gases produced on-site and either capturing & storing the gas or using that gas in other industry activities (kind of like recycling). This includes manufacturing concrete and steel.

CO_2 emissions are the largest GHG emissions in the region, with nearly 94% of the total emissions. And the primary sources of those emissions are the transportation sector and production of electricity to power our homes and businesses.

Figure 6: Total GHG Emissions by Sector and Type of Gas

Sector	CO_2	CH_4	N_2O
Transportation	14,318,971	774	277
Grid Electricity	13,199,205	1,209	181
Stationary Fuels	3,102,350	4,314	21
AFOLU	0	0	89,550
Solid Waste	0	19,554	0
Total	**30,620,526**	**25,851**	**90,028**

4.0 GHG Reduction Measures

4.1 Regional Priorities

Existing projects and planned projects identified through stakeholder engagement and interagency and intergovernmental coordination provided an inventory of existing GHG reduction measures in the Nashville planning area. These measures were considered in the selection of priority GHG reduction measures. In addition, selection of priority measures was based on the regionwide emissions inventory with a focus on achieving the most significant reductions possible while considering regional and community goals and input from planning partners, stakeholders, and the public.

For the Nashville region's PCAP, an emissions reduction measure includes programs and projects that will achieve or facilitate the reduction of greenhouse gas air pollution in the 17-counties. These are near-term, high-priority, implementation-ready measures that will be led by GNRC and/or collaborating entities or other entities in the planning area. This list is not exhaustive of the Nashville area's priorities. Additional GHG reduction measures will be included in the CCAP.

Figure 7: List of Strategies and Priority Measures

Strategy 1: Transition to cleaner mobile sources such as electric, hybrid and other alternative fuels and support these vehicles through the availability of fueling infrastructure.	**Measure 1.1 -** Electrification of Light- and Heavy-Duty On-Road Vehicle Fleets **Measure 1.2 -** Electrification or Hydrogen Conversion of Public Transit Bus Fleet **Measure 1.3 –** Electrification or Hydrogen Conversion of Commuter Rail Fleet
Strategy 2: Increase use of alternative modes of transportation with programs, policies and projects that improve existing and expand bicycle and pedestrian infrastructure.	**Measure 2.1 -** Launch Rebate Program to Incentivize Individuals to Purchase an e-Bike
Strategy 3: Implement travel demand management strategies and expand public transit options to reduce VMT from personal automobile use.	**Measure 3.1 -** Implement TDM Programming and Expand Transit Options
Strategy 4: Invest in residential, commercial, and government facilities energy efficiency and weatherization improvements and programs.	**Measure 4.1 -** Retrofit Residential Buildings for Natural Gas and Electricity Efficiency; Electrification **Measure 4.2 -** Retrofit Commercial and Industrial Buildings for Natural Gas and Electricity Efficiency, including exterior infrastructure; Electrification **Measure 4.3 -** Retrofit Exterior Public Lighting with higher efficiency lightbulbs; Electrification **Measure 4.4 -** Weatherization of Low-Income Residential Buildings and Units

Strategy 5: Invest in renewable energy capture and storage infrastructure.	**Measure 5.1 -** Increase Residential Renewable Energy Capture and Storage Infrastructure **Measure 5.2 -** Increase Other Renewable Energy Capture and Storage Infrastructure
Strategy 6: Reduce emissions from landfills through programs, policies, and projects that divert waste and/or capture methane emissions.	**Measure 6.1 -** Invest in Landfill and Methane Gas Recovery **Measure 6.2 -** Invest in Waste Diversion and Sustainable Materials Management
Strategy 7: Reduce tree canopy lost to land development and replace trees lost to development, natural disasters, and natural loss.	**Measure 7.1 -** Expand Tree Canopy Coverage

4.2 Transportation and Mobility Reduction Measures

An efficient, accessible multimodal transportation system that moves people effectively whether by transit, carpooling, walking and biking, or individual vehicles has the power to transform the quality of life in the region as well as reducing environmental impacts. Implementing the region's long-range transportation plan (RTP 2045) and locally adopted transportation and community plans can transform our region and communities into better places to live, work, and socialize.

Strategy 1: Transition to cleaner mobile sources such as electric, hybrid and other alternative fuels and support these vehicles through the availability of fueling infrastructure.

Measure 1.1 Electrification of Light- and Heavy-Duty On-Road Vehicle Fleets

Action	15% increase in on-road EVs
Estimate of quantifiable GHG emissions reductions through 2030	134,502 tons of CO_2e
Implementing agency or agencies	Local Governments
Implementation schedule and milestones	Year 1-3: Complete fleet transition plan/infrastructure plan. Establish pre- and post program evaluation; Implement any electrical infrastructure upgrades (e.g., transformers, panels, etc.). Begin to install supportive infrastructure and purchase vehicles. Year 3+: Continue to purchase and use electric vehicles (dependent on fleet turnover and vehicle availability for purchase).
Geographic location (if applicable)	GNRC 17 County CPRG Region
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Rates at which internal combustion engines are retired and replaced with electric engines.
Applicable inventory sector	Transportation

Measure 1.2 Electrification or Hydrogen Conversion of Public Transit Bus Fleet

Action	Replace diesel bus fleet with EV or Hydrogen bus fleet
Estimate of quantifiable GHG emissions reductions through 2030	CO: 76.39 kg/day NOx: :105.19 kg/day $PM_{2.5}$: 0.21 kg/day PM_{10}: 0.21kg/day VOC : 2.45kg/day
Implementing agency or agencies	Metro Transit Authority (MTA)
Implementation schedule and milestones	Year 1-2: Complete design/engineering of the project to include permitting and construction documents. Establish pre- and post-program evaluation measures. Put project out to bid and secure construction contractor. Year 2-4: Begin construction. And implement any infrastructure upgrades (e.g., transformers, panels, hydrogen fueling stations, etc.). Begin to install supportive infrastructure and purchase vehicles. Year 4+: Purchase and use new vehicles (dependent on fleet turnover and vehicle availability for purchase).
Geographic location (if applicable)	GNRC 17 County CPRG Region
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, FTA, State and Local Funds
Metrics for tracking progress	VMT Reduction; Annual average daily traffic (AADT) before and after project implementation; Number or percent of public transit fleet vehicles electrified or transitioned to alternative fuels ; Number and type of maintenance equipment converted ; Number of communities, including LIDACs, served by buses; Gallons of fuel use avoided
Applicable inventory sector	Transportation

Measure 1.3 Electrification or Hydrogen Conversion of Commuter Rail Fleet

Action	Replace uncontrolled tier diesel commuter rail with tier 4 DMU or Hydrogen rail rolling stock
Estimate of quantifiable GHG emissions reductions through 2030	CO2e: no reduction but benefits in other GHGs NOx:1,132.73 kg/day $PM_{2.5}$: 28.47 kg/day PM_{10}: 29.35 kg/day VOC: 67.64 kg/day
Implementing agency or agencies	Regional Transportation Authority (RTA)
Implementation schedule and milestones	Year 1-2: Complete design/engineering of the project to include permitting and construction documents. Establish pre- and post-program evaluation measures. Put project out to bid and secure construction contractor. Year 2-4: Begin construction. And implement any infrastructure upgrades (e.g., transformers, panels, hydrogen fueling stations, etc.). Begin to install supportive infrastructure and purchase vehicles.

	Year 4+: Purchase and use new vehicles (dependent on fleet turnover and vehicle availability for purchase).
Geographic location (if applicable)	GNRC 17 County CPRG Region
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, FHWA, FTA, State and Local Funds
Metrics for tracking progress	VMT Reduction; Annual average daily traffic (AADT) before and after project implementation; Number or percent of public transit fleet vehicles electrified or transitioned to alternative fuels of communities, including LIDACs, served by rail; Gallons of fuel use avoided; Reductions in travel time or/and transit transfers; Transit ridership by service and number of new transit riders; Change in number of transit passengers trips per capita; Percent of residents within a 10 minute walk of transit station; Number of jobs within first-last mile of facility/station; Residential density within first-last mile of facilities/stations.; Walk score rating; Increase in policy/codes incorporating land use reforms which support alternative transportation
Applicable inventory sector	Transportation

Strategy 2: Increase use of alternative modes of transportation with programs, policies and projects that improve existing and expand bicycle and pedestrian infrastructure.

Measure 2.1 Launch Rebate Program to Incentivize Individuals to Purchase an e-Bike

Action	0.5% decrease in passenger vehicle trips per day through Nashville's E-Bike rebate program
Estimate of quantifiable GHG emissions reductions through 2030	46,187.24 kg of CO2e/day; 101,150.049 CO2e by 2030
Implementing agency or agencies	Metro Nashville
Implementation schedule and milestones	Year 1-2: Complete program plan and identify communities to participate. Establish pre- and post-program evaluation measures; Launch pilot program for specific communities. Year 3+: Expand program regionally and launch marketing, education and outreach activities.
Geographic location (if applicable)	Davidson County
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, others TBD
Metrics for tracking progress	VMT Reduction; Bicycling counts; Number or percent of users that are within LIDAC communities
Applicable inventory sector	Transportation

Strategy 3: Implement travel demand management strategies and expand public transit options to reduce VMT from personal automobile use.

Measure 3.1 Implement TDM Programming and Expand Transit Options

Action	10% reduction in on-road personal vehicle VMT
Estimate of quantifiable GHG emissions reductions through 2030	1,515,638 tons of CO2e
Implementing agency or agencies	Transit Agencies, Local Government, State Government
Implementation schedule and milestones	Year 1-2: Complete TDM program plan and identify communities to participate. Establish pre- and post-program evaluation measures; Launch pilot program for specific communities; Finalize plans to invest in transit capital upgrades to enable increased frequencies. Year 3: Implement new TDM programs; Begin construction on capital improvements.
Geographic location (if applicable)	GNRC 17 County CPRG Region
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, others TBD
Metrics for tracking progress	VMT Reduction; Annual average daily traffic (AADT) before and after program/project implementation; Reductions in travel time or/and transit transfers; Transit ridership by service and number of new transit riders; Change in number of transit passengers trips per capita; Gallons of fuel avoided
Applicable inventory sector	Transportation

4.3 Building and Infrastructure Reduction Measures

Our built environment including buildings, homes, and utility features consume energy to maintain a comfortable and safe environment for people and goods. There is potential to reduce direct and indirect greenhouse gas emissions through weatherization improvements and upgrades to more energy efficient appliances and products.

Weatherizing buildings – or sealing gaps where air leaks in or out of the building and adding insulation – can reduce the amount of energy used to heat and cool the air in buildings due to losses. This not only reduces energy consumption and associated GHG emissions, but it also improves comfort and saves occupants money by reducing their energy bill. Similarly, installing new, or replacing older, appliances and devices that use less energy to do the same operation can reduce GHG emissions.

Strategy 4: Invest in residential, commercial, industrial and government facilities energy efficiency and weatherization improvements and programs.

Measure 4.1 Retrofit Residential Buildings for Natural Gas and Electricity Efficiency; Electrification

Actions	4% per year retrofit for natural gas efficiency 3% per year retrofit for electricity efficiency 2% per year electrification of natural gas
Estimate of quantifiable GHG emissions reductions through 2030	Natural Gas Efficiency – 93,856 metric tons of CO_2e Electricity Efficiency – 591,529 metric tons of CO_2e Natural Gas Electrification – 112,820 metric tons of CO_2e

Implementing agency or agencies	Local Governments, Utilities, and Housing and Development Authorities
Implementation schedule and milestones	Year 1: Complete project design; Establish pre- and post-program evaluation measures; Secure contractors. Year 3+: Complete retrofits.
Geographic location (if applicable)	Metro Nashville and Surrounding Counties
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Number of housing units using natural gas retrofit/year, divided by the number of housing units using natural gas in the region = % natural gas retrofit achieved Number of housing units using electricity retrofit/year, divided by the number of housing units in the region using electricity = % electricity retrofit achieved Number of housing units using natural gas electrified/year, divided by the number of housing units in the region using natural gas = % electrification achieved
Applicable inventory sector	Grid Electricity; Residential Buildings

Measure 4.2 Retrofit Commercial and Industrial Buildings for Natural Gas and Electricity Efficiency, including exterior infrastructure; Electrification

Actions	5% per year retrofit for natural gas efficiency 5% per year retrofit for electricity efficiency 5% per year electrification of natural gas
Estimate of quantifiable GHG emissions reductions through 2030	Natural Gas Efficiency – 301,756 metric tons of CO_2e Electricity Efficiency – 1,174,746 metric tons of CO_2e Natural Gas Electrification – 466,283 metric tons of CO_2e
Implementing agency or agencies	Local Governments and Utilities, and governing bodies
Implementation schedule and milestones	Year 1: Complete project design; Establish pre- and post-program evaluation measures; Secure contractors. Year 3+: Complete retrofits.
Geographic location (if applicable)	Metro Nashville and Surrounding Counties
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Commercial sq. ft. currently using natural gas retrofits/year, divided by the number of commercial sq. ft. using natural gas in the region = % retrofit achieved Commercial sq. ft. currently using electricity retrofits/year, divided by the number of commercial sq. ft. using electricity in the region = % retrofit achieved Amount of commercial sq. ft. electrified/year divided by the amount of commercial sq. ft. in the region = % electrification achieved
Applicable inventory sector	Grid Electricity; Commercial Buildings

Measure 4.3 Retrofit Exterior Public Lighting with higher efficiency lightbulbs; Electrification

Actions	Replace streetlights and exterior lighting with LED bulbs at public facilities
Estimate of quantifiable GHG emissions reductions through 2030	10,665 MT CO_2e
Implementing agency or agencies	Local Governments and Utilities, and governing bodies
Implementation schedule and milestones	Year 1: Complete project design; Establish pre- and post-program evaluation measures; Secure contractors. Year 3+: Complete retrofits.
Geographic location (if applicable)	Metro Nashville and Surrounding Counties
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Number of light bulbs or fixtures/infrastructure replaced with LED bulbs; Number or precent of retrofits serving LIDAC communities
Applicable inventory sector	Grid Electricity

Measure 4.4 Weatherization of Low-Income Residential Buildings and Units

Actions	Implement weatherization program to improve building efficiency
Estimate of quantifiable GHG emissions reductions through 2030	1,078 metric tons of CO_2e
Implementing agency or agencies	Local Governments, and Housing and Development Authorities
Implementation schedule and milestones	Year 1-2: Complete design/engineering of the project to include permitting and construction/retrofit documents; Establish pre- and post-program evaluation measures; Put project out to bid and secure contractor; Begin construction/retrofit. Year 3+: Complete construction/retrofits.
Geographic location (if applicable)	Metro Nashville and Surrounding Counties
Milestones for implementing authority	No additional authority is required
Funding Sources	CPRG, federal and state rebates available for weatherization
Metrics for tracking progress	Number of retrofits implemented; Number or percent of buildings retrofitted serving LIDAC communities
Applicable inventory sector	Grid Electricity; Commercial Buildings

4.4 Renewable Energy Reduction Measures

Renewable energy, such as solar, are some of the cleanest sources of energy available. The Tennessee Valley Authority (TVA) has programs to encourage solar power production. TVA developed a roadmap for achieving Net Zero GHG emission by 2050 in the recently released The Valley Pathways Study. TVA and through local power companies (LPCs), such as Nashville Electric Services (NES), provide electricity to the Nashville planning area. This measure addresses the fossil fuel fired electric power generation sector by promoting increases in renewable energy. Specifically, expansion of solar power capture as the most likely near-term area for renewable energy growth by local jurisdictions and LPCs.

Strategy 5: Invest in renewable energy capture and storage infrastructure.

Measure 5.1 Increase Residential Renewable Energy Capture and Storage Infrastructure

Action	Installation of 125 residential 4kW system soler energy systems annually
Estimate of quantifiable GHG emissions reductions through 2030	1,657 Metric Tons CO_2e
Implementing agency or agencies	TVA, Local Governments
Implementation schedule and milestones	Annual rollout, starting in 2024 and ending in 2034. Progress should be assessed annually or biannually, ensuring installation goals are met. Quantitative milestones can be established by setting goals related to the number of systems installed and by hitting significant GHG emission reductions.
Geographic location (if applicable)	Because the entirety of the climate action planning area is served by TVA, the exact location of the solar installations is not specified.
Milestones for implementing authority	No additional authority is required.
Funding Sources	CPRG, federal and state renewable energy installation tax credits, others TBD
Metrics for tracking progress	Number of installations; Number or percent of installations serving LIDAC communities
Applicable inventory sector	Grid Electricity

Measure 5.2 Increase Other Renewable Energy Capture and Storage Infrastructure

Action	Increase solar capacity of 1000kW per year for non-residential buildings, with 125 system installations annually.
Estimate of quantifiable GHG emissions reductions through 2030	3,317 Metric Tons CO_2e
Implementing agency or agencies	TVA, Local Governments, and LPCs
Implementation schedule and milestones	Implementation will begin in 2024 and will continue throughout 2034. It is recommended that installation progress is checked annually to ensure the region is on track to reach its goal. Milestones should be established using major GHG emission reduction targets.
Geographic location (if applicable)	Because the entirety of the climate action planning area is served by TVA, the exact location of the solar installations is not specified.
Milestones for implementing authority	No additional authority is required.

Funding Sources	CPRG, federal and state renewable energy installation tax credits, others TBD
Metrics for tracking progress	Number of installations; Number or percent of installations serving LIDAC communities
Applicable inventory sector	Grid Electricity

4.5 Solid Waste Reduction Measures

These measures focus on programs and incentives to reduce or divert waste, including food and/or yard waste, and projects to capture methane emissions from waste.

Food and/or yard waste in the Nashville planning area is primarily disposed of in a landfill (MSW or C&D landfill). Reducing the volume of these materials may reduce the methane emissions at landfills. Diversion reduces methane emissions at landfills and provides economic benefits through creation of soil and increase in air space and lifespan of the region's landfills.

Strategy 6: Reduce emissions from landfills through programs, policies, and projects that divert waste and/or capture methane emissions.

Measure 6.1 Invest in Landfill and Methane Gas Recovery

Action	Implement methane gas recovery onsite and at remote locations for waste to energy production
Estimate of quantifiable GHG emissions reductions through 2030	355,784 tons of CO_2e
Implementing agency or agencies	Solid Waste Authorities, Local Governments
Implementation schedule and milestones	Year 1-3: Complete design of the programs or projects; Establish pre- and post-program evaluation measures; Begin implementation or construction. Year 3+: Finalize implementation; bring systems online.
Geographic location (if applicable)	GNRC 17-County CPRG Region
Milestones for implementing authority	No additional authority is required.
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Number of recovery collection infrastructure; Number of waste to energy infrastructure
Applicable inventory sector	Solid Waste

Measure 6.2 Invest in Waste Diversion and Sustainable Materials Management

Action	Increase in curbside recycling, composting, and other reuse programming
Estimate of quantifiable GHG emissions reductions through 2030	59,241 metric tons of life cycle CO2e
Implementing agency or agencies	Solid Waste Authorities, Local Governments
Implementation schedule and milestones	Year 1-3: Complete design of the programs or projects; Establish pre- and post-program evaluation measures; Begin implementation or construction. Year 3+: Finalize implementation; bring systems online.
Geographic location (if applicable)	GNRC 17-County CPRG Region

Milestones for implementing authority	No additional authority is required.
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Amount of food waste and recyclables diverted (pounds, tons); Number of customers served by composting program
Applicable inventory sector	Solid Waste

4.6 Land Use and Sequestration Reduction Measures

There is potential for preservation and reduction of tree loss in the Nashville planning area. As well as opportunities to increase trees with planting programs to replace tree canopy lost to natural disasters and storms. In the region, there are non-profit organizations and local governments that provide low-cost and/or free trees and tree planting services.

Strategy 7: Reduce tree canopy lost to land development and replace trees lost to development, natural disasters, and natural loss.

Measure 7.1 Expand Tree Canopy Coverage

Action	Tree plantings on easements and on new developments in locations with suitable soils and environmental conditions and the lowest risk for removal
Estimate of quantifiable GHG emissions reductions through 2030	22 lbs of CO_2/year per tree planted
Implementing agency or agencies	NES
Implementation schedule and milestones	Year 1-2: Complete program plan and establish pre- and post-program evaluation measures; Launch pilot program for specific communities. Year 3: Expand program regionally; launch education and outreach activities.
Geographic location (if applicable)	Metro Nashville and NES service areas and property
Milestones for implementing authority	No additional authority is required.
Funding Sources	CPRG, others TBD
Metrics for tracking progress	Number of trees planted
Applicable inventory sector	AFOLU

5.0 Benefits Analysis for LIDACs

5.1 Program Requirements

The CPRG program requirements for the LIDAC benefits analysis are to undertake meaningful community engagement and to advance the goals of the Justice 40 Initiative set forth in Executive Order 14008, which aims to deliver forty percent of the overall benefits of relevant federal investments to disadvantaged communities. Implementation of the reduction measures identified and included in this PCAP are anticipated to provide significant benefits to low-income disadvantaged communities.

The implementation of the emissions reduction strategies are anticipated to have a broad range of benefits beyond GHG emissions reduction and air quality improvement. They are anticipated to provide benefits to LIDACs in the planning area.

5.2 Identifying Low-Income and Disadvantaged Communities

To identify disadvantaged communities within the seventeen counties of this planning effort, a review of the Environmental Justice Screening and Mapping Tool (EJScreen), and the Climate and Economic Justice Screening Tool (CEJST). These tools provide information at the census tract-level by defined categories and thresholds.

Climate and Economic Justice Screening Tool (CEJST)

The CEJST classifies census tracts that are disadvantaged if it is:

1. At or above the threshold for one or more environmental, climate, or other burdens[2],
2. At or above the threshold for an associated socioeconomic burden[3], and
3. If the census tract is completely surrounded by disadvantaged census tracts/communities that meet the two burden thresholds above – and is at or above the 50th percentile for low income – it is also considered disadvantaged.

Figure 8: CEJST Categories, Burdens, and Description of Burdens

Categories	Environmental, Climate, or other Burden	Socioeconomic burden
Climate Change	Expected agriculture loss rate ≥ 90th percentile OR Expected building loss rate ≥ 90th percentile OR Expected population loss rate ≥ 90th percentile OR Projected flood risk ≥ 90th percentile OR Projected wildfire risk ≥ 90th percentile	Low Income
Energy	Energy cost ≥ 90th percentile OR PM 2.5 in the air ≥ 90th percentile	Low Income
Health	Asthma ≥ 90th percentile OR Diabetes ≥ 90th percentile OR Heart disease ≥ 90th percentile OR Low life expectancy ≥ 90th percentile	Low Income

[2] Environmental, Climate, or other burdens are census tracts at or above 90th percentile for one of the data indicators.

[3] Socioeconomic Burdens are: Low Income = 65th percentile or above for census tracts that have people in households whose income is less than or equal to twice the federal poverty level, not including students enrolled in higher education. And if high school education is less than 10% of people ages 25 or older in the census tract.

Housing	Historic underinvestment = Yes Housing cost ≥ 90th percentile OR Lack of green space ≥ 90th percentile OR Lack of indoor plumbing ≥ 90th percentile OR Lead paint ≥ 90th percentile	Low Income
Legacy Pollution	Abandoned mine land present = Yes OR Formerly Used Defense Site (FUDS) present = Yes OR Proximity to hazardous waste facilities ≥ 90th percentile OR Proximity to Superfund or National Priorities List (NPL) sites ≥ 90th percentile OR Proximity to Risk Management Plan (RMP) sites ≥ 90th percentile	Low Income
Transportation	Diesel particulate matter ≥ 90th percentile OR Transportation barriers ≥ 90th percentile OR Traffic proximity and volume ≥ 90th percentile	Low Income
Water and Wastewater	Underground storage tanks and releases ≥ 90th percentile (NEW) OR Wastewater discharge ≥ 90th percentile	Low Income
Workforce Development	Linguistic isolation ≥ 90th percentile OR Low median income ≥ 90th percentile OR Poverty ≥ 90th percentile OR Unemployment ≥ 90th percentile	High school education <10%

Environmental Justice Screening and Mapping Tool (EJScreen)

In addition to the CEJST, the EPA's EJScreen was used to complement the LIDAC identification and analysis. The EPA defines disadvantaged communities as:

1. Any census tract that is included as disadvantaged in CEJST;
2. Any census block group at or above the 90th percentile for any of the EJScreen's Supplemental Indexes when compared to the nation or state; and/or
3. Any geographic area within Tribal lands, as include in EJScreen

Figure 9: EPA's EJScreen Indexes and Indicators

Environmental Justice Indexes	Socioeconomic Indicators
Particulate Matter 2.5	Demographic Index
Ozone	Supplemental Demographic Index
Diesel Particulate Mater	People of Color
Air Toxics Cancer Risk	Low Income
Air Toxics Respiratory HI	Unemployment Rate
Toxic Releases to Air	Limited English Speaking
Traffic Proximity	Less than high school education
Lead Paint	Under age 5
Superfund Proximity	Over age 64
RMP Facility Proximity	
Hazardous Waste Proximity	
Underground Storage Tanks	
Wastewater Discharge	

5.3 LIDACs within the Planning Area

This section identifies the low-income disadvantaged communities within the seventeen-county planning area which includes the following counties in Tennessee: Cannon, Cheatham, Davidson, Dickson, Hoston, Humphreys, Macon, Maury, Montgomery, Robertson, Rutherford, Smith, Stewart, Sumner, Williamson, Wilson, and Trousdale County.

For the PCAP and CCAP climate action prioritization and analysis, EPA requires applicants to use the Climate and Economic Justice Screening Tool (CJEST), which excludes race as a determining factor. The CJEST tool was used to identify LIDAC communities for EPA's CPRG. The tool incorporates 21 factors correlated with high exposure risk, but it excludes race.

Regionwide, 23% of the population resides within a LIDAC. Davidson County has the largest population within a LIDAC, while Humphreys County has the largest proportion of its population within a LIDAC, 83%.

Figure 10: LIDACs Total Population and Proportion of Population by County

County	Total Population of County	LIDAC Population of County	Percent of Total Population identified as LIDAC
Cannon County	14,178	10,455	74%
Cheatham County	40,181	3,583	9%
Davidson County	687,488	263,971	38%
Dickson County	52,680	22,764	43%
Houston County	8,164	4,994	61%
Humphreys County	18,435	15,372	83%
Macon County	23,842	13,387	56%
Maury County	91,976	27,158	30%
Montgomery County	200,180	17,116	9%
Robertson County	70,280	16,774	24%
Rutherford County	315,815	30,963	10%
Smith County	19,740	15,042	76%
Stewart County	13,427	2,582	19%
Sumner County	183,437	30,162	16%
Trousdale County	10,231	0	0%
Williamson County	225,389	0	0%
Wilson County	136,666	11,740	9%
Regional Total	2,112,109	486,063	23%

Based on the analysis of climate and economic burdens, the most impacted communities, those census tracts that exceed multiple categories, are in Davidson County along the interstates of I65, I24, I40, and I440. Houston County on the far western side of the Nashville planning area is another area with LIDAC that exceeds multiple categories of burden including climate change, energy, and transportation burdens.

5.4 Existing Risks, Impacts and Vulnerabilities

The eight environmental, climate, or other burdens categories, along with the socioeconomic burden, as low-income or educational attainment, identified the LIDACs within the 17 countries. Health, Transportation, and

Climate Change are the categories of burdens that impact the largest number of people in the Nashville planning area.

Health

Health burdens include asthma, diabetes, heart disease, and low life expectancy combined with being low-income. Houston County has the largest proportion (22%) of the county's population in LIDACs while Davidson County has the largest total population, 106,774 people, in LIDACs that exceed any of the four heath burdens and socioeconomic burden according to CEJST.

Transportation

Transportation burdens include a high level of diesel particulate matter in the air, average relative cost and time spent of transportation relative to all other census tracts, and the number of vehicles (average annual daily traffic) at major roads combined with being low-income. Cannon County has the largest proportion (74%) burdens county's population in LIDACs while Davidson County has the largest total population, 98,245 people, in LIDACs that exceed any of the three transportation burdens and socioeconomic burden according to CEJST.

Climate Change

Climate Change burdens include expected agricultural value at risk from losses, expected building value at risk from losses , and expected fatalities and injuries due natural hazards(defined by CEJST); number of properties at risk of floods occurring in the next thirty years (projected from a high-precision climate model) from tides, rain, riverine and storm surges, or a 26% risk total over the 30-year time horizon; and wildfire exposure for any specific location in the contiguous U.S. today and with future climate change combined with being low-income. Humphreys County has the largest proportion (83%) of the county's population in LIDACs while Davidson County has the largest total population, 114,554 people, in LIDACs that exceed any of the five climate change burdens and socioeconomic burden according to CEJST.

Workforce Development

Workforce development burdens include share of households where no one over age 14 speaks English very well; low median income calculated as a share of the area's median income, share of people in poverty; and the number of unemployed people as a share of the labor force combined with the population with less than high school education. Macon County has the largest proportion (56%) of the county's population in LIDACs while Davidson County has the largest total population, 129,754 people, in LIDACs that exceed any of the four workforce development burdens and socioeconomic burden according to CEJST.

Housing

Housing burdens include census tracts that experienced historic underinvestment based on redlining maps between 1935 and 1940; share of households that are both earning less than 80% of Housing and Urban Development's Area Median Family Income and are spending more than 30% of their income on housing costs; share of land with developed surfaces covered with artificial materials like concrete or pavement, excluding crop land used for agricultural purposes; housing without indoor kitchen facilities or complete plumbing facilities; and share of homes built before 1960, which indicates potential lead paint exposure combined with being low-income. Cannon County has the largest proportion (29%) of the county's population in LIDACs while Davidson County has the largest total population, 122,137 people, in LIDACs that exceed any of the five housing burdens and socioeconomic burden according to CEJST.

Legacy Pollution

Legacy burdens include presence of an abandoned mine left by legacy coal mining operations; properties that were owned, leased, or possessed by the United States, under the jurisdiction of the Secretary of Defense prior to October 1986; number of hazardous waste facilities in proximity; number of proposed or listed Superfund or National Priorities list (NPL) sites in proximity; count of Risk Management Plan (RMP) facilities in

proximity[4] combined with being low-income. Davidson County has the largest proportion (10%) of the county's population in LIDACs and the largest total population, 69,366 people, in LIDACs that exceed any of the five legacy pollution burdens and socioeconomic burden according to CEJST.

Energy

Energy burdens include the average household annual energy cost in dollars divided by the average household income, and the percentile of fine inhalable particles with 2.5 or smaller micrometer diameters combined with being low-income. Houston County has the largest proportion (31%) of the county's population in LIDACs while Davidson County has the largest total population, 11,675 people, in LIDACs that exceed any of the two energy burdens and socioeconomic burden according to CEJST.

Water and Wastewater

There are no LIDACs impacted by water and wastewater burdens in the Nashville planning area.

5.5 Potential Benefits

The most impacted LIDACs, those census tracts that exceed multiple categories of burden, are in Davidson County and Metro Nashville and are near transportation infrastructure. Thus, most transportation priority emissions reduction measures in this PCAP will provide positive benefits to LIDACs because of their proximity to major highways and interstates as well as potentially reducing their transportation costs through transit investments and ITS infrastructure.

In addition, as TVA implements their net zero emissions the LIDAC communities in Humphreys and Stewart County may experience improved health impacts as there are two TVA power plants in those counties. The Cumberland TVA power plant is a coal-fired plant while the Johnsonville TVA power plant is a Natural Gas dual-fuel combustion turbine and combined cycle plant. TVA intends to retire the Cumberland Fossil Plant by 2028. Improvements to the region's buildings and built environment, investments in renewable energy, and upgrades to the electricity distribution infrastructure have the potential to provide positive impacts to the grid energy sector while reducing the cost of energy to families and business across the region and in LIDACs.

[4] These facilities are mandated by the Clean Air Act to file RMPs because they handle substances with significant environmental and public health risks.

6.0 Authority to Implement

GNRC has reviewed the existing statutory and regulatory authority to implement each priority measure. This plan is non-regulatory in nature and the priority GHG emissions reduction measures are a list of voluntary actions available to state and local governments for implementation. No new regulatory authority is given by the EPA CPRG and no new authority will be needed for these priority GHG emissions reduction measures. GNRC and the region's local governments have existing authority to apply for, administer, and subaward federal grants as allowed by the Tennessee Code Annotated (TCA), which provides sufficient authority for the voluntary implementation by state and local governments of these priority reduction measures. No actions are needed to obtain authority.

Appendix

A. Atlas of Maps

Figure A: GNRC Planning Area – State and National Context

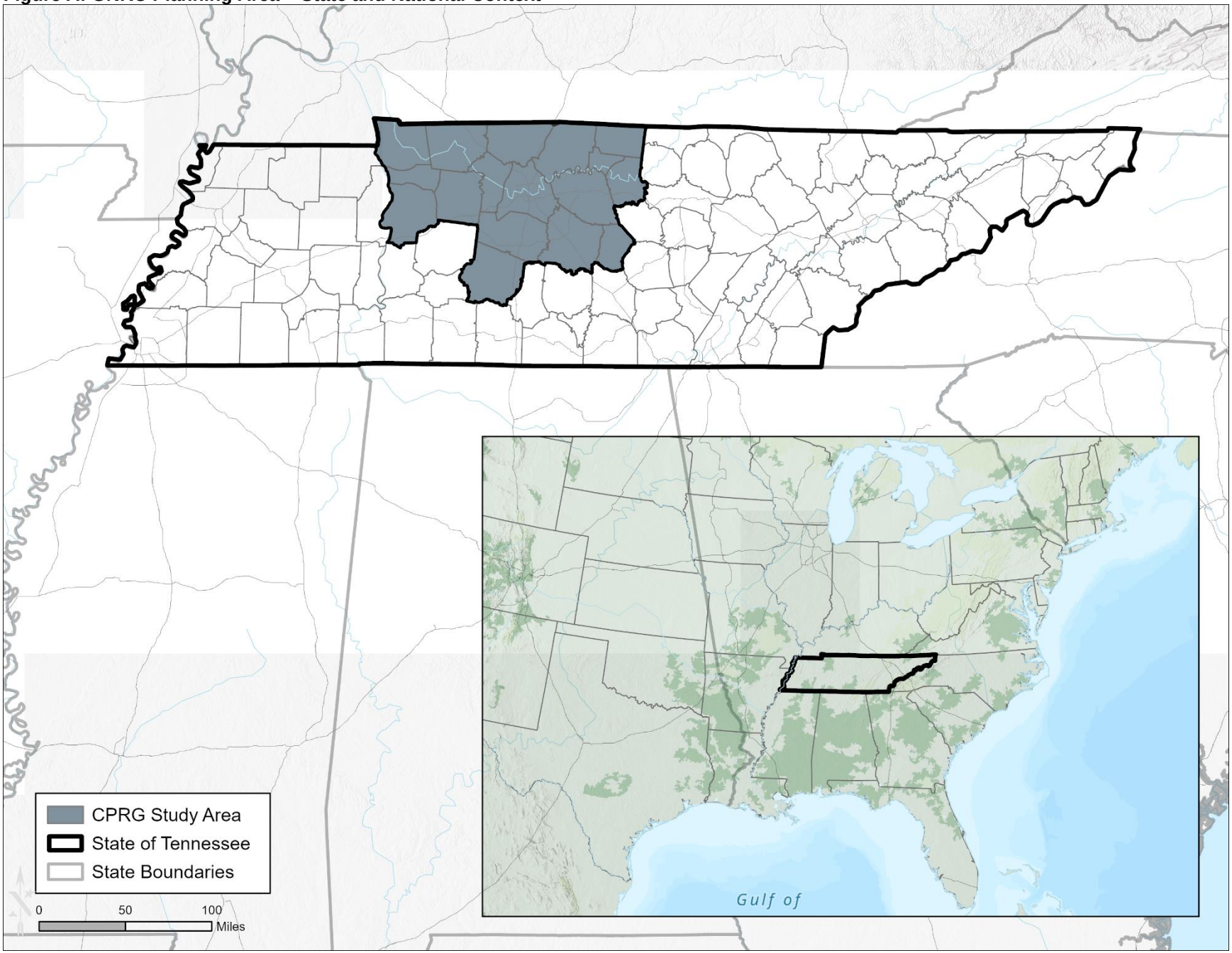


Figure B: GNRC Planning Area – Regional Context

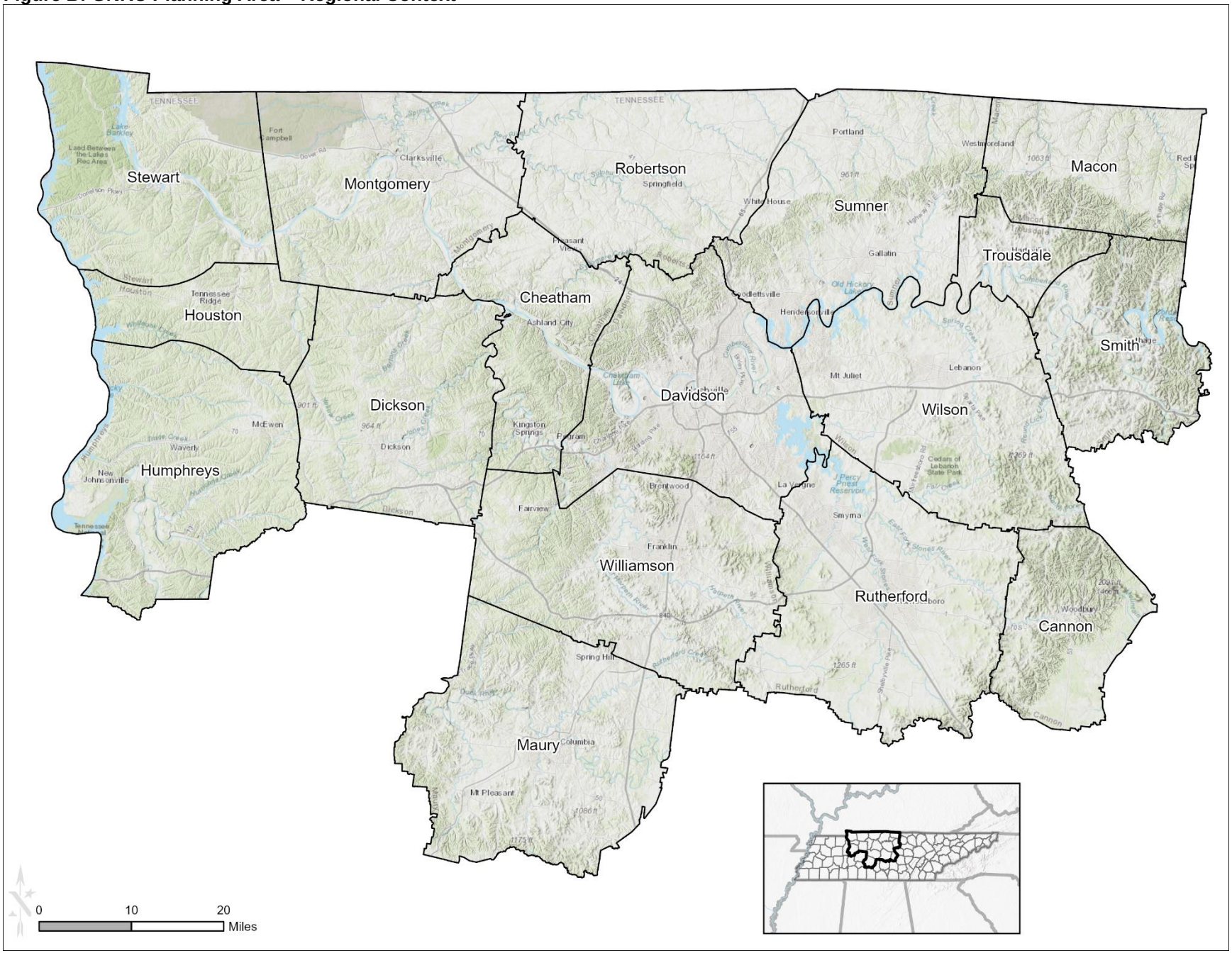


Figure C: Health Factors for Low Income and Disadvantaged Communities

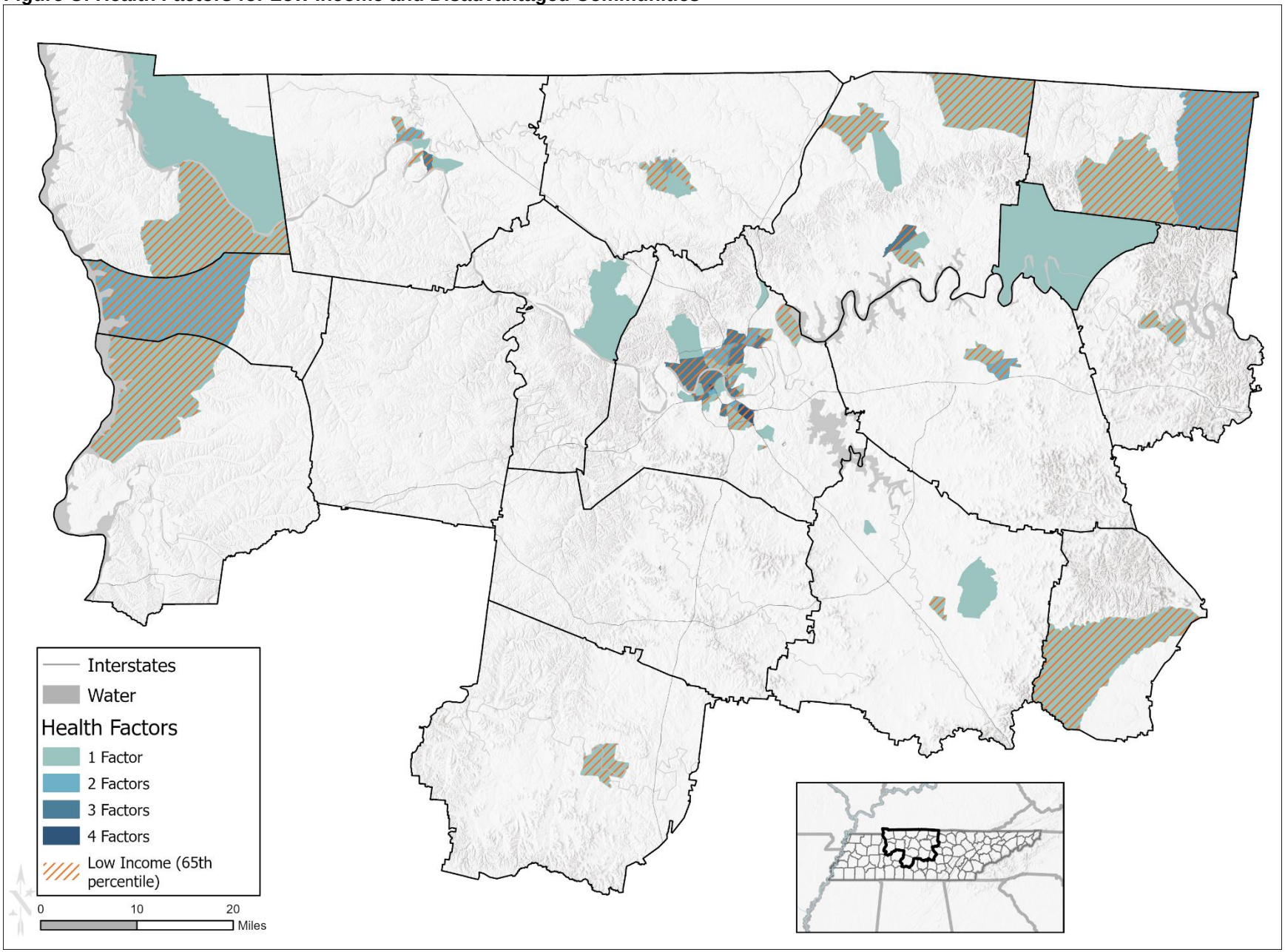


Figure D: LIDAC Health Factor - Asthma

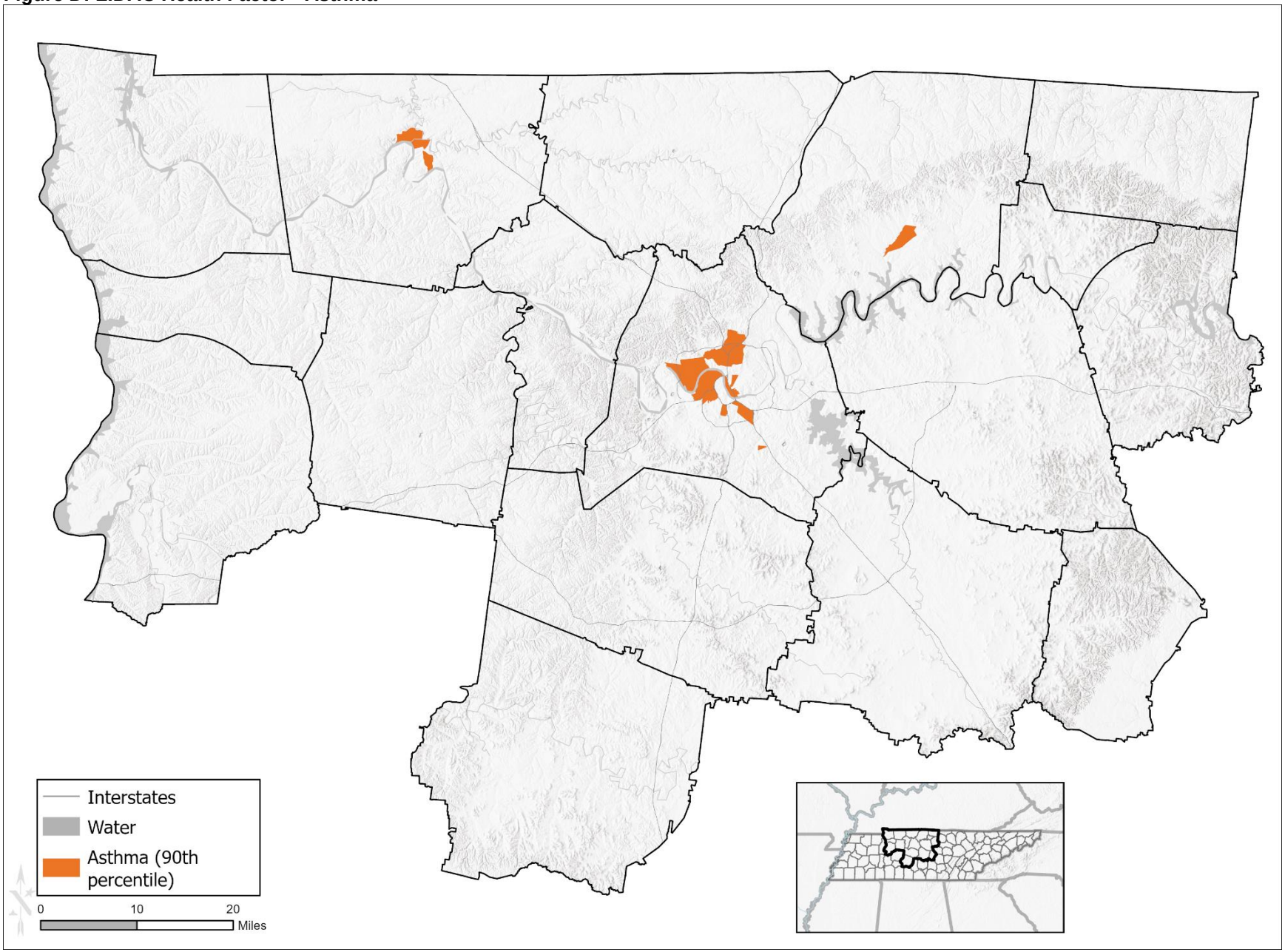


Figure E: LIDAC Health Factor - Diabetes

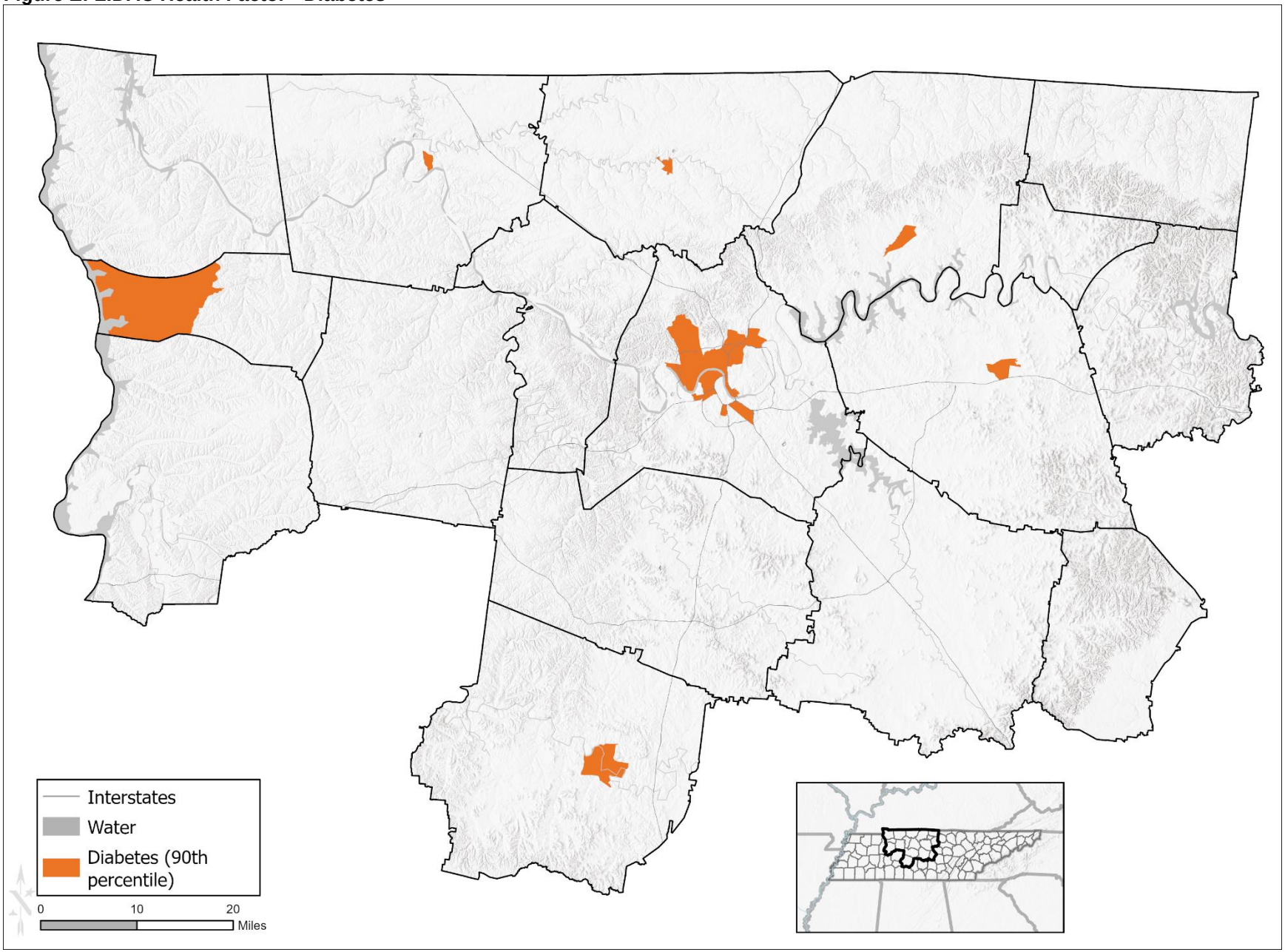


Figure F: LIDAC Health Factor - Heart Disease

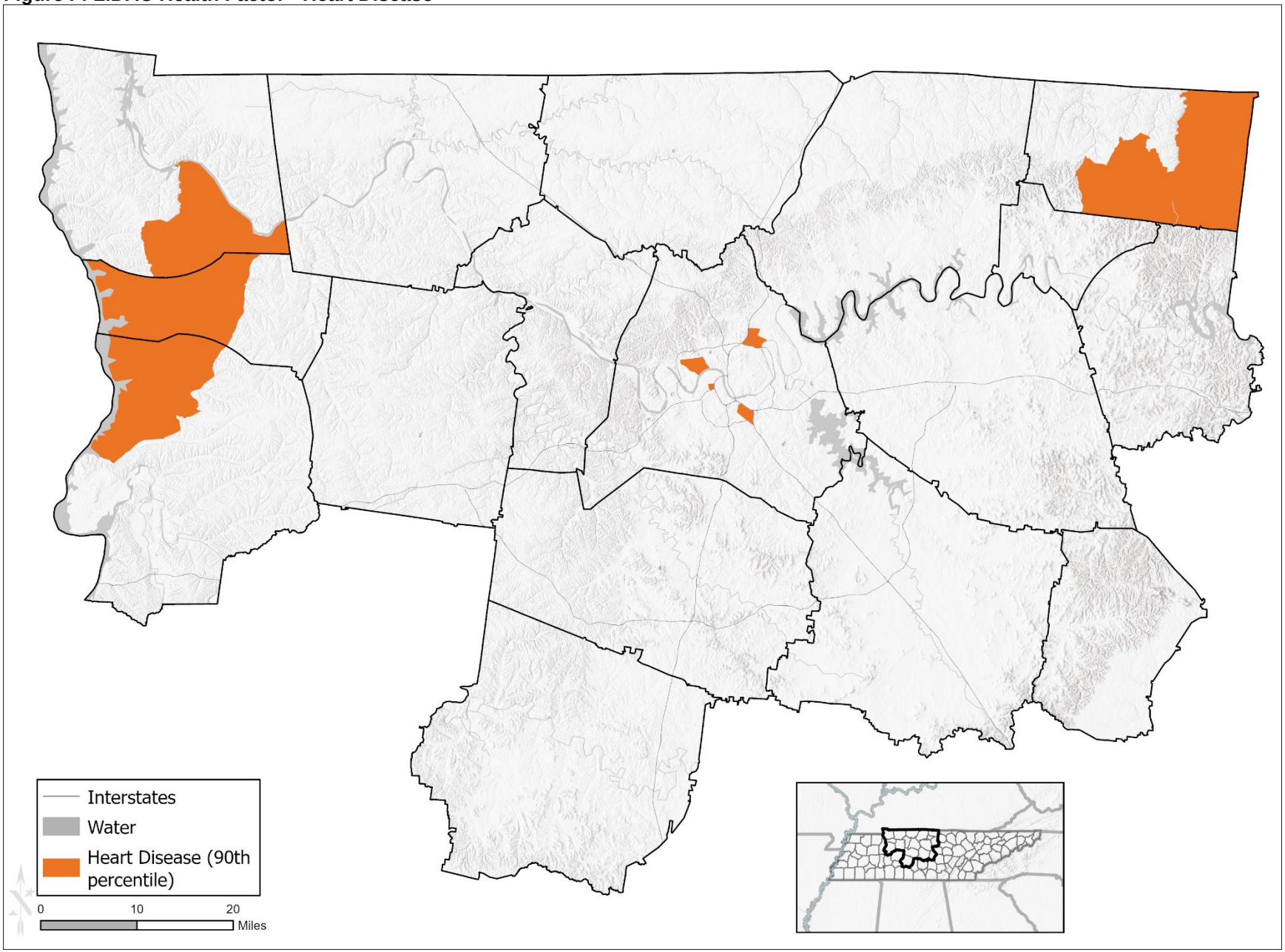


Figure G: LIDAC Health Factor - Low Life Expectancy

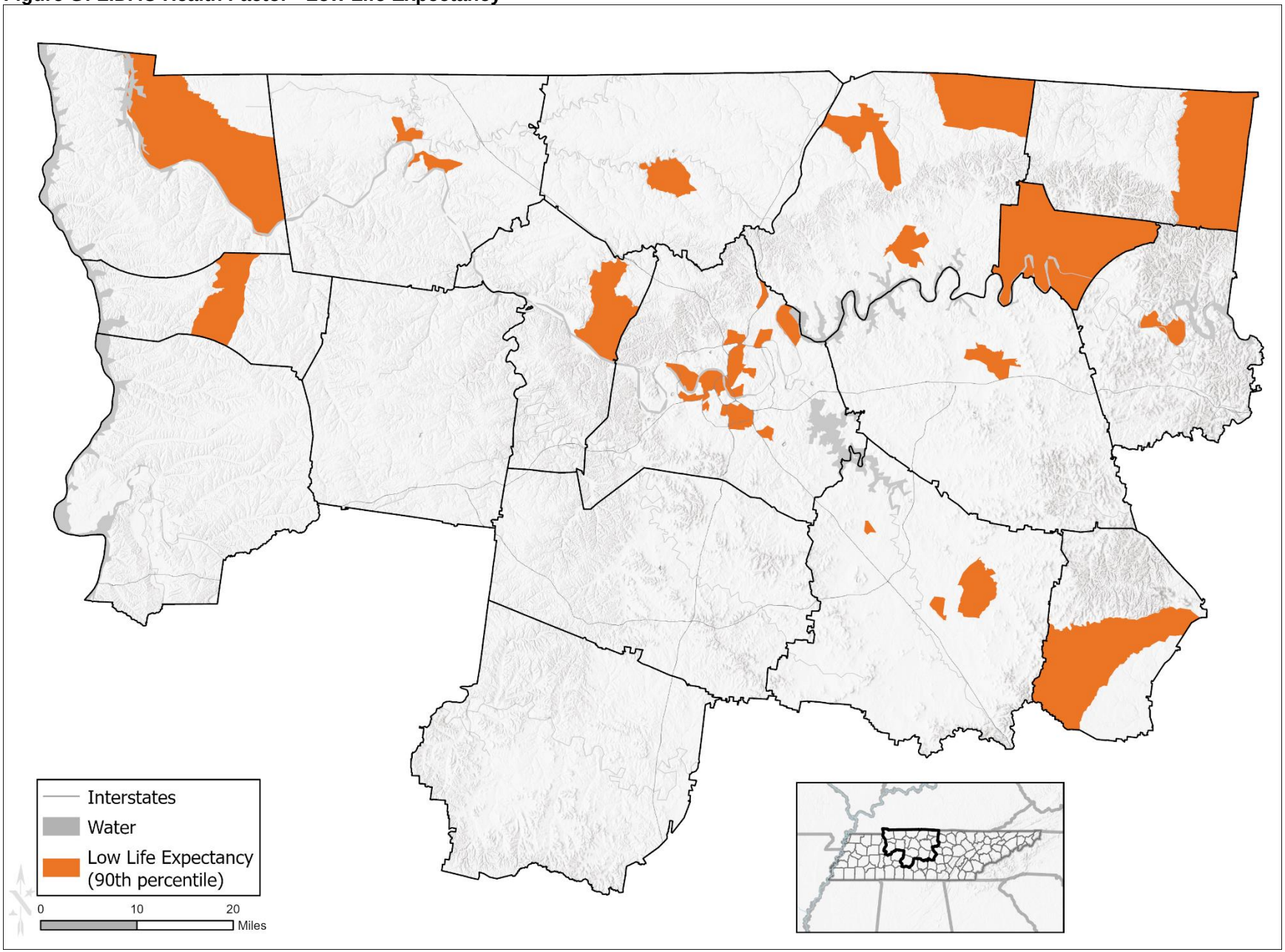


Figure H: Transportation Factors for Low Income and Disadvantaged Communities

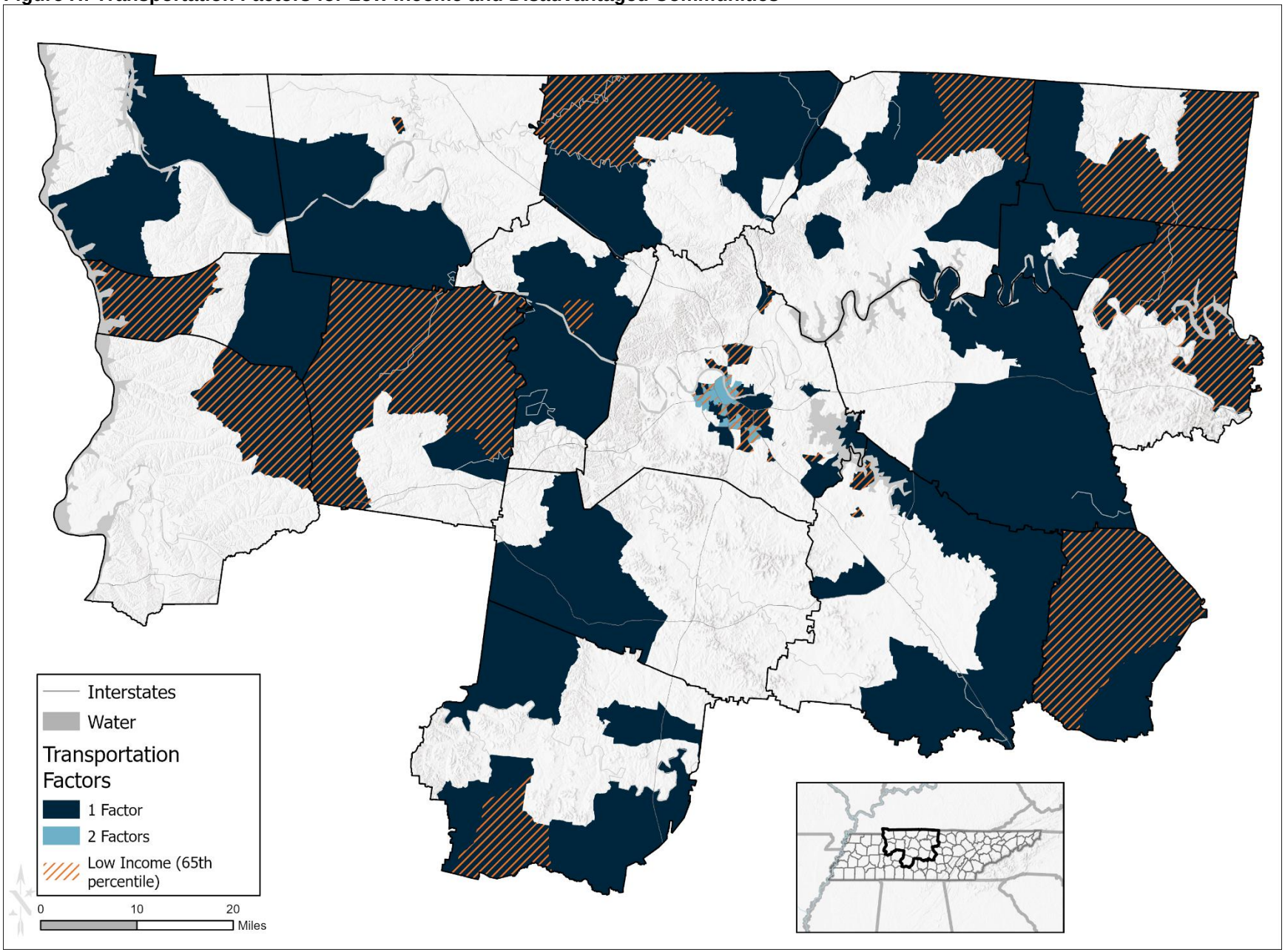


Figure I: LIDAC Transportation Factor - Traffic Proximity and Volume

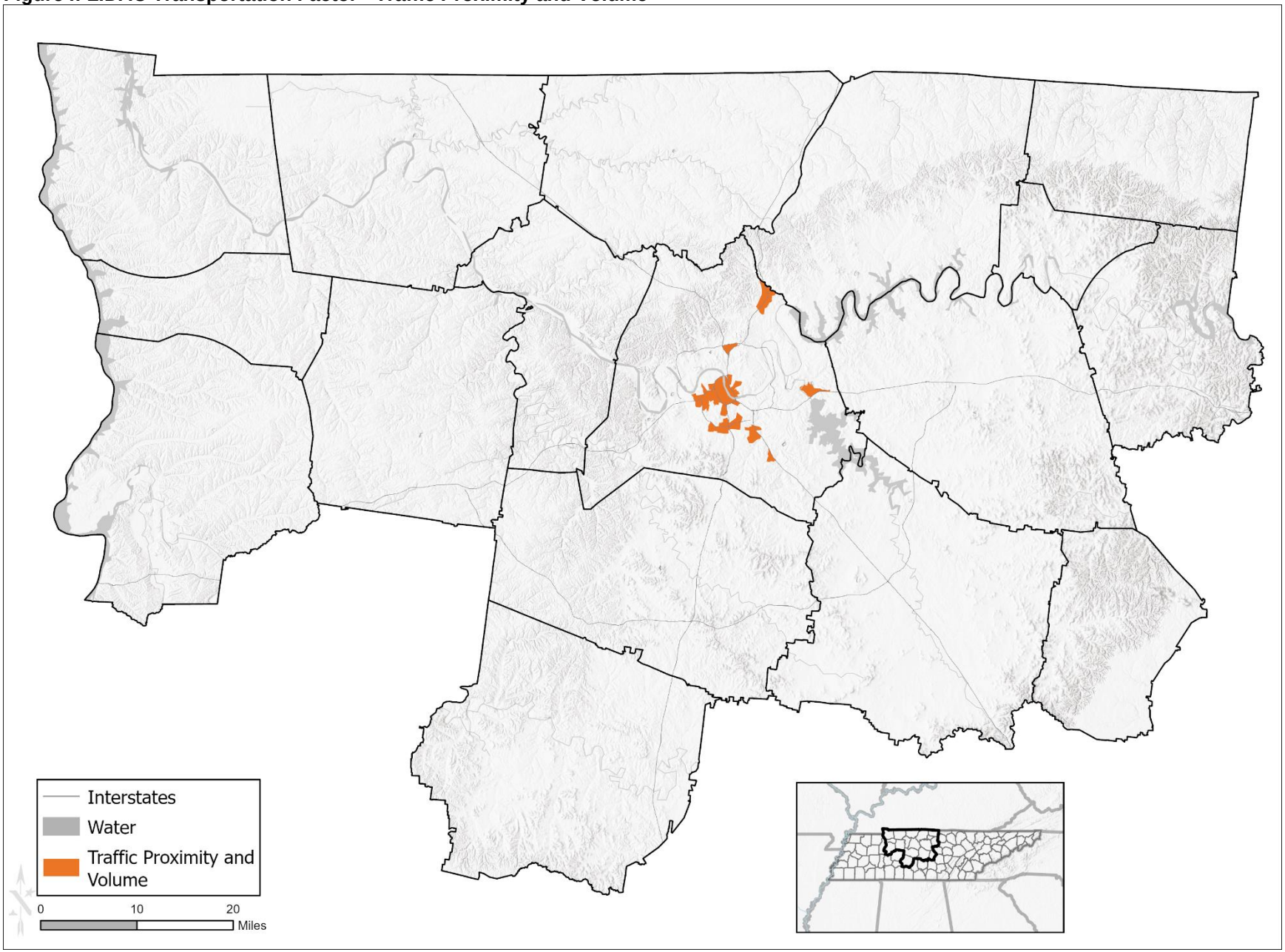


Figure J: LIDAC Transportation Factor - Travel Barriers

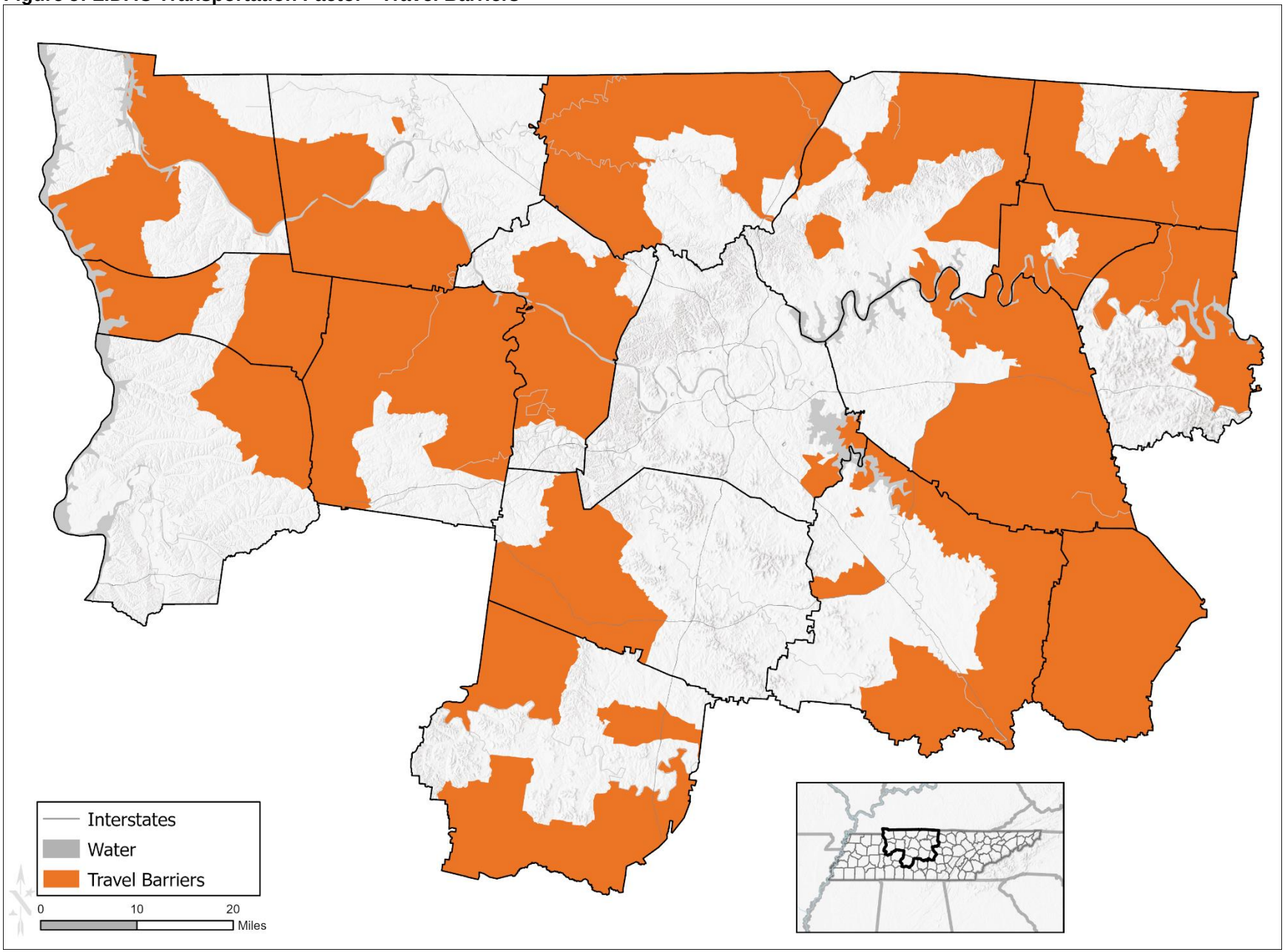


Figure K: Climate Change Factors for Low Income and Disadvantaged Communities

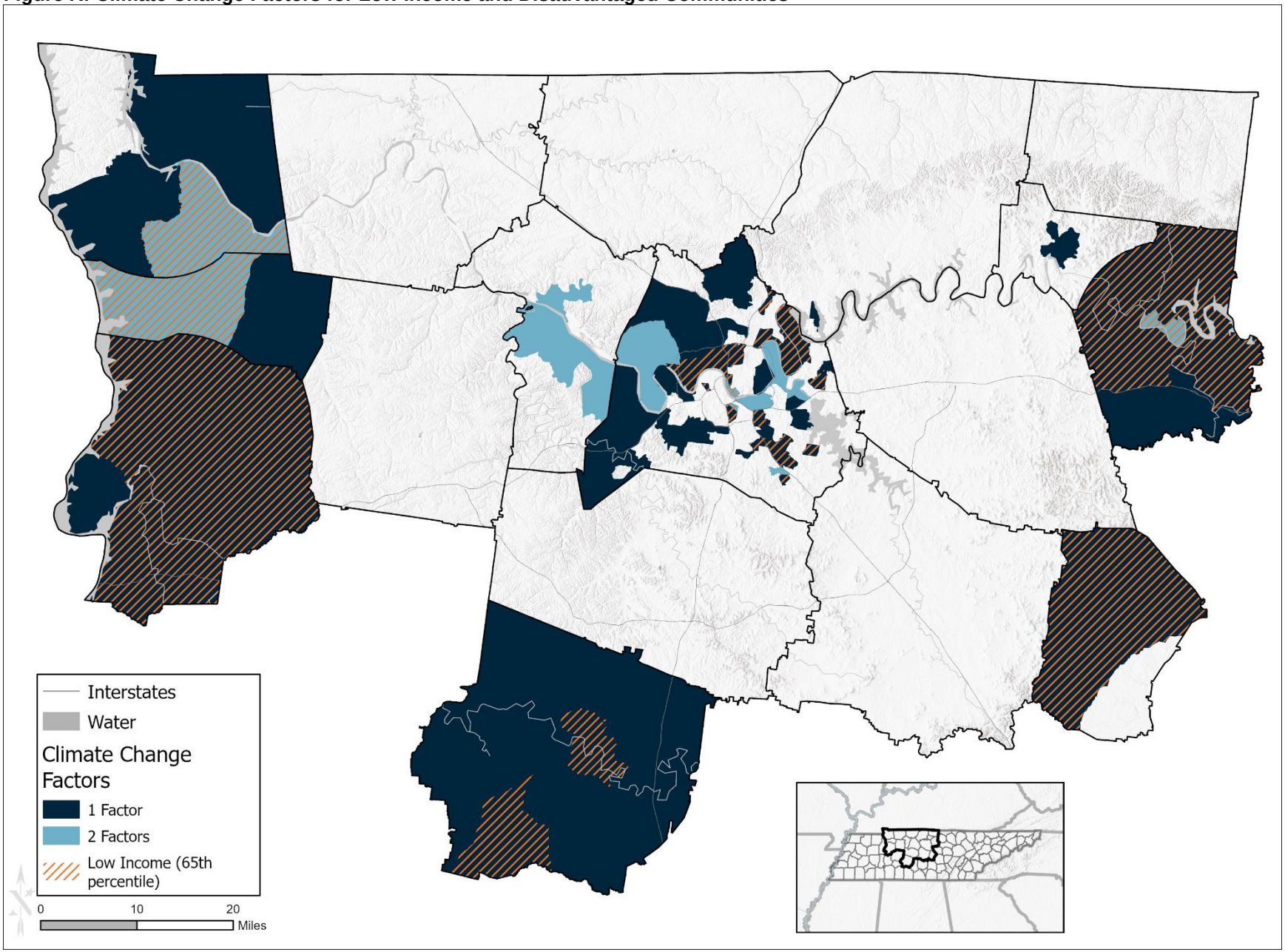


Figure L: LIDAC Climate Change Factor - Expected Building Loss

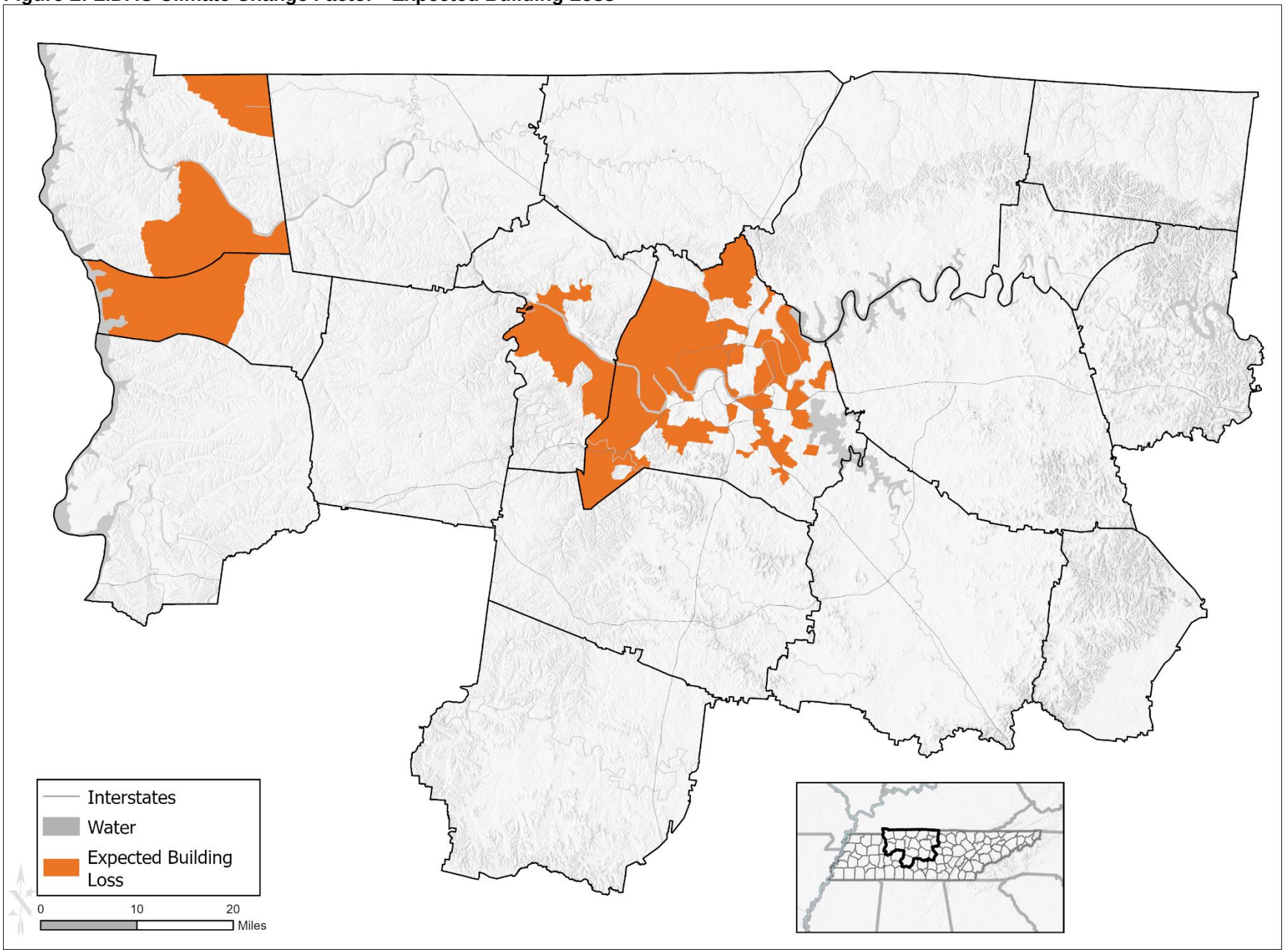


Figure M: LIDAC Climate Change Factor - Expected Population Loss

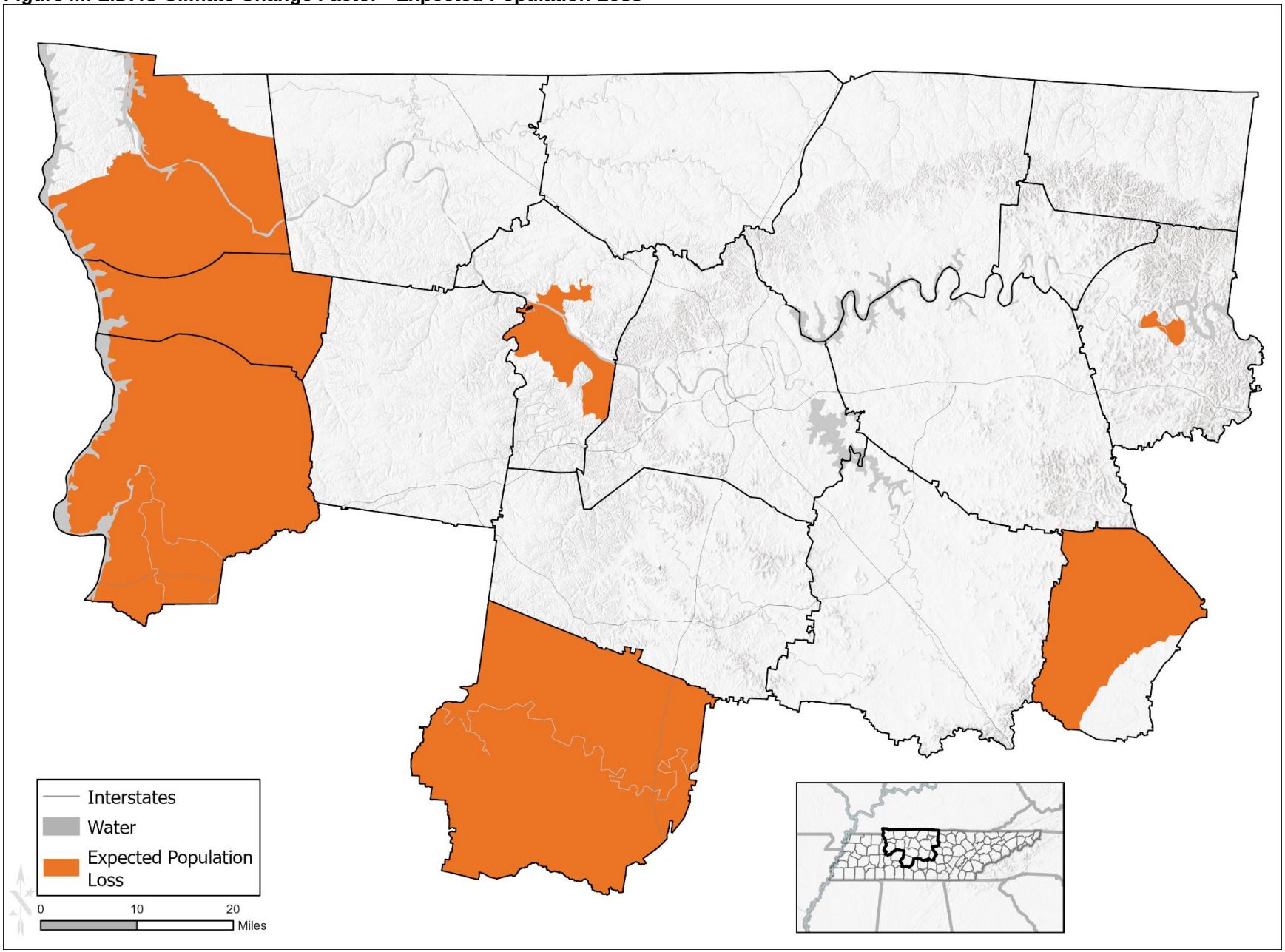


Figure N: LIDAC Climate Change Factor - Projected Flood Risk

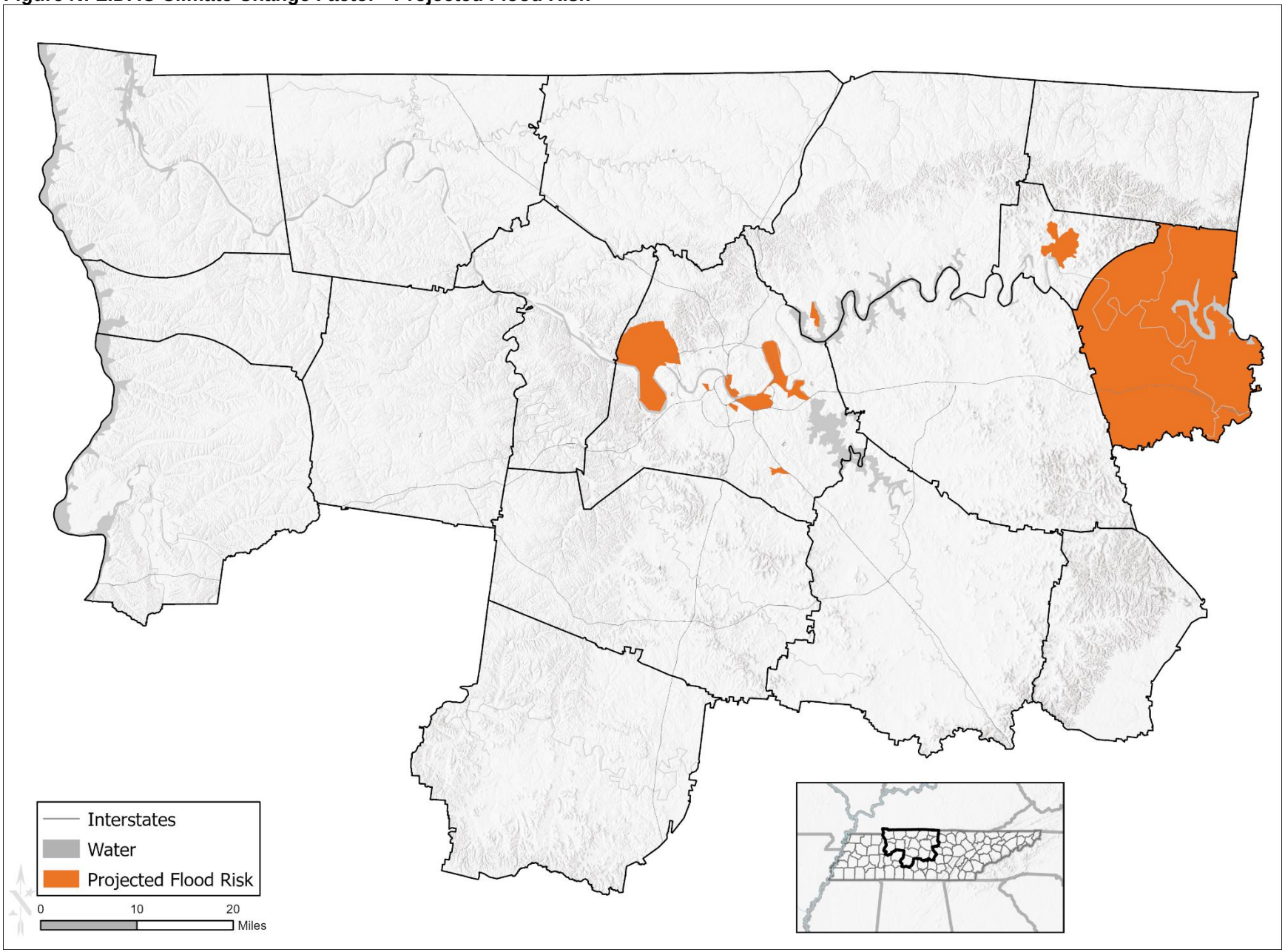


Figure O: Workforce Development Factors for Low Income and Disadvantaged Communities

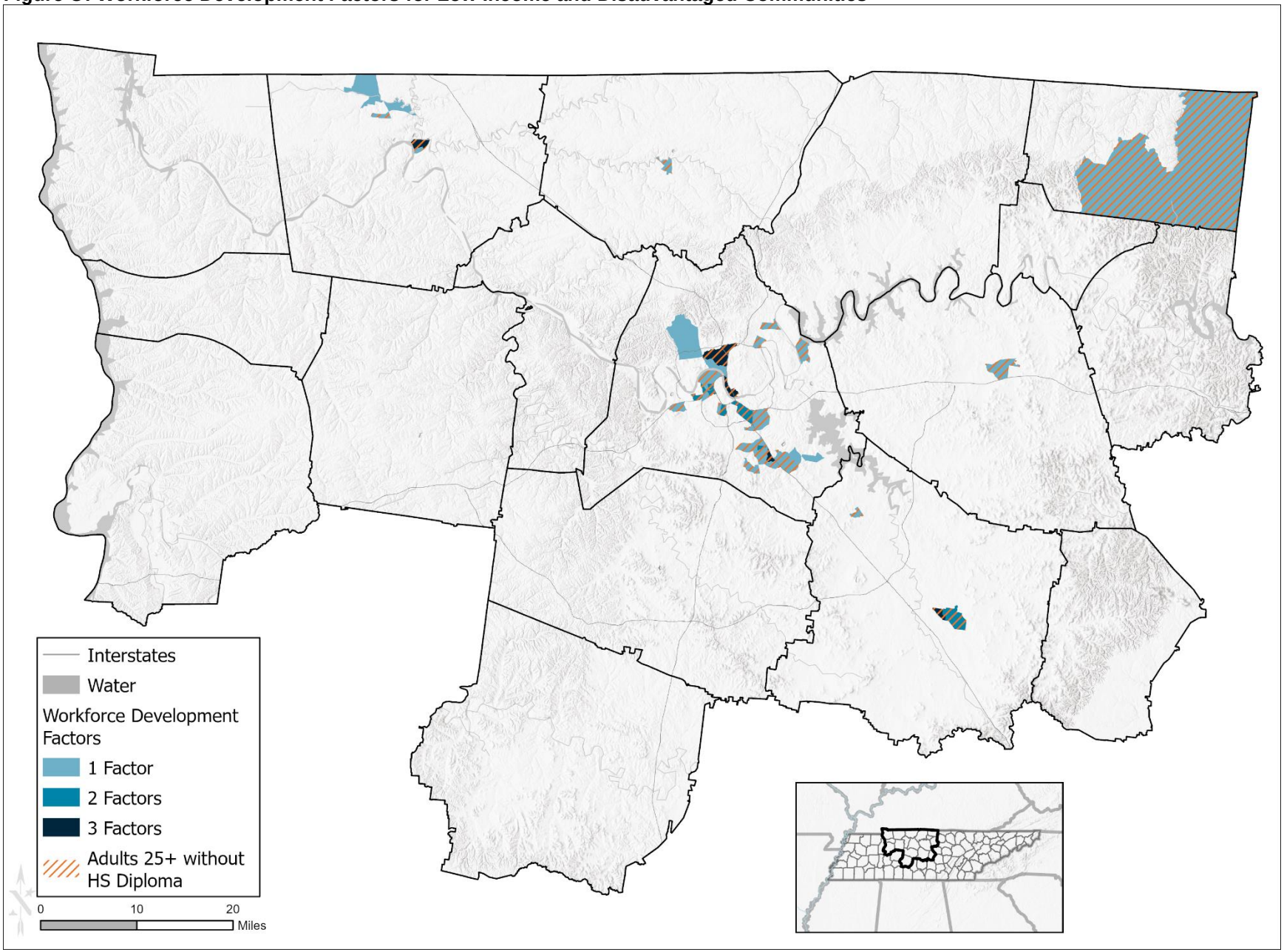


Figure P: LIDAC Workforce Development Factor - Linguistic Isolation

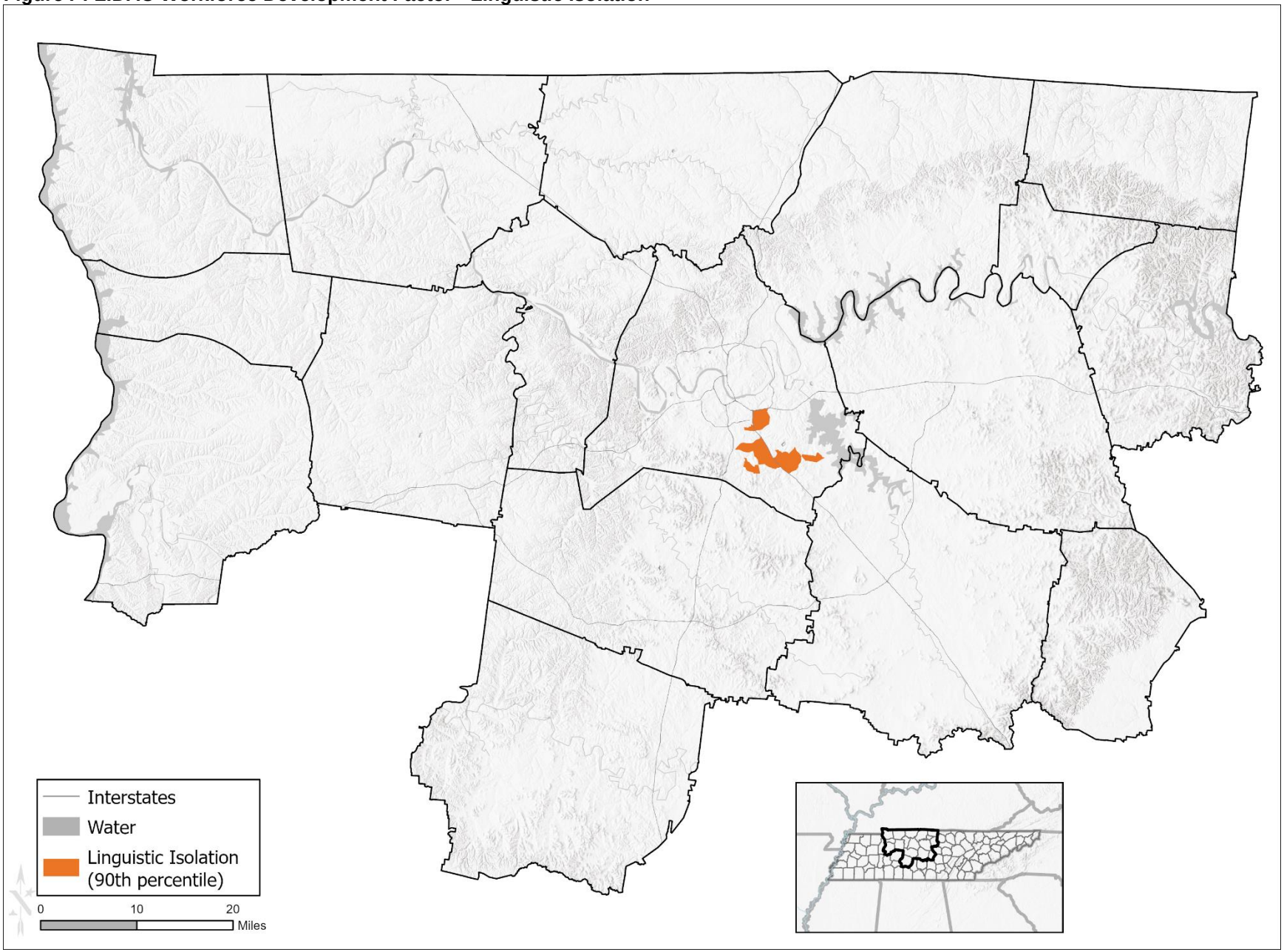


Figure Q: LIDAC Workforce Development Factor - Low and Median Income

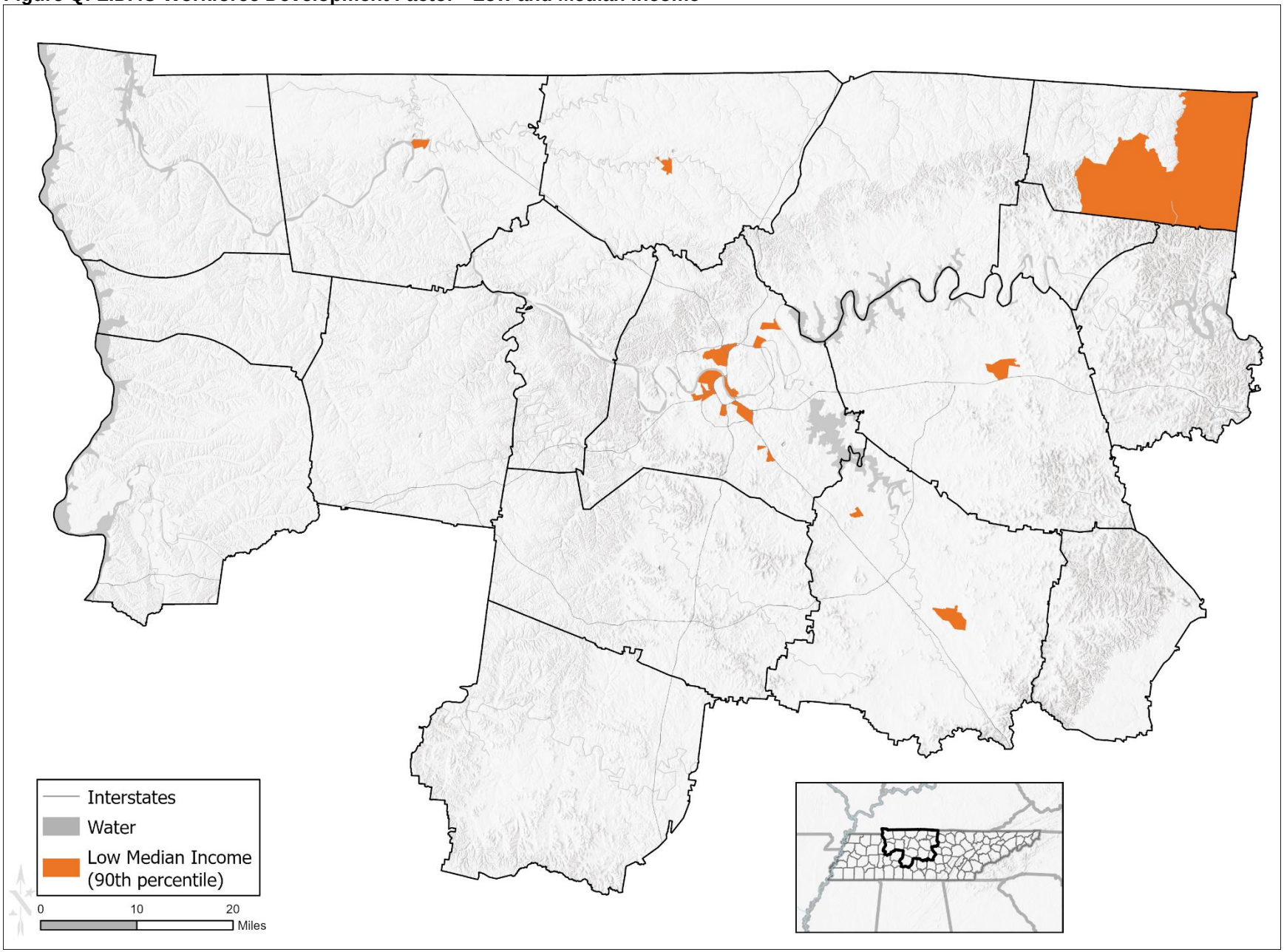


Figure R: LIDAC Workforce Development Factor - Poverty

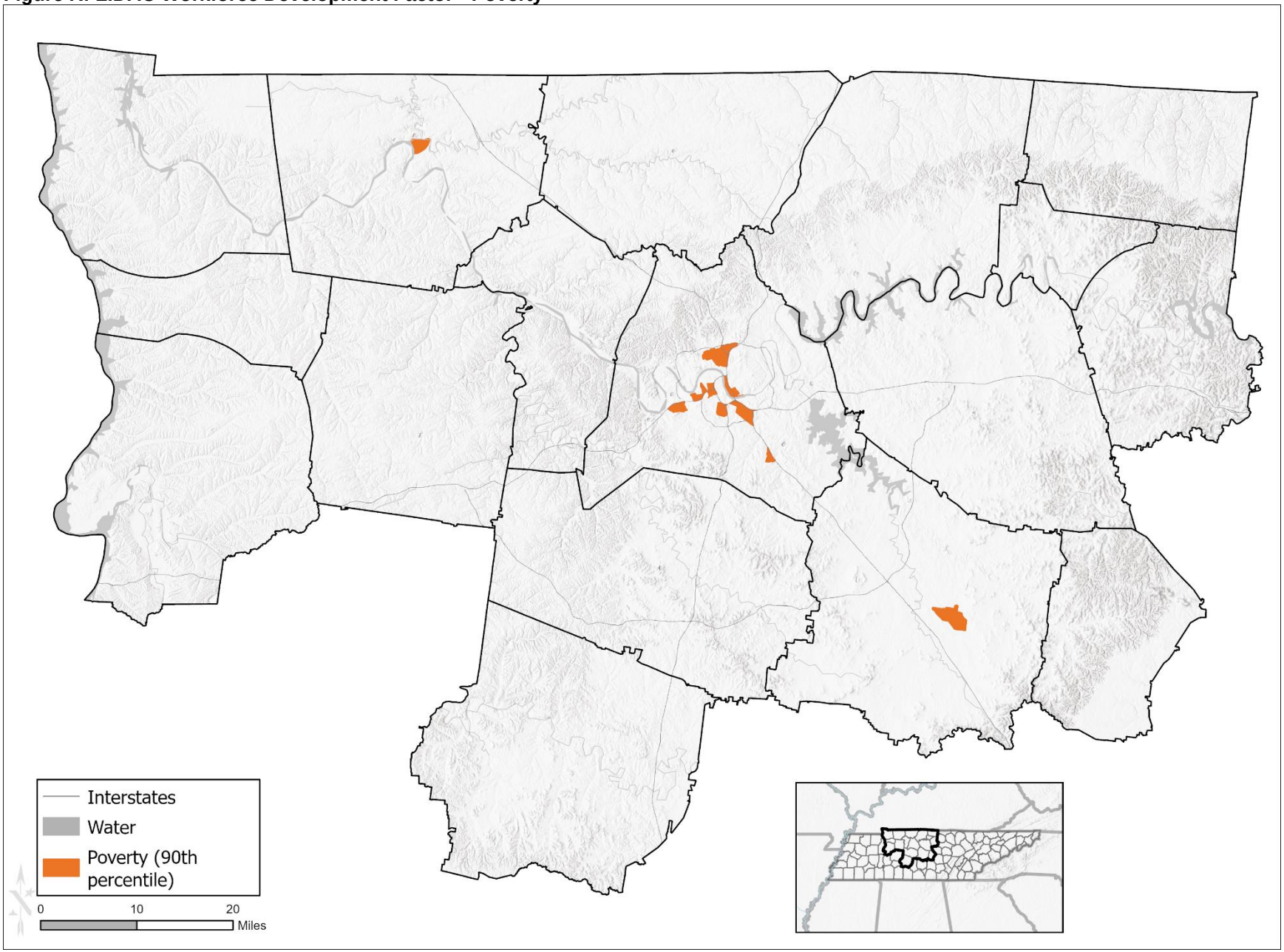


Figure S: LIDAC Workforce Development Factor - Unemployment

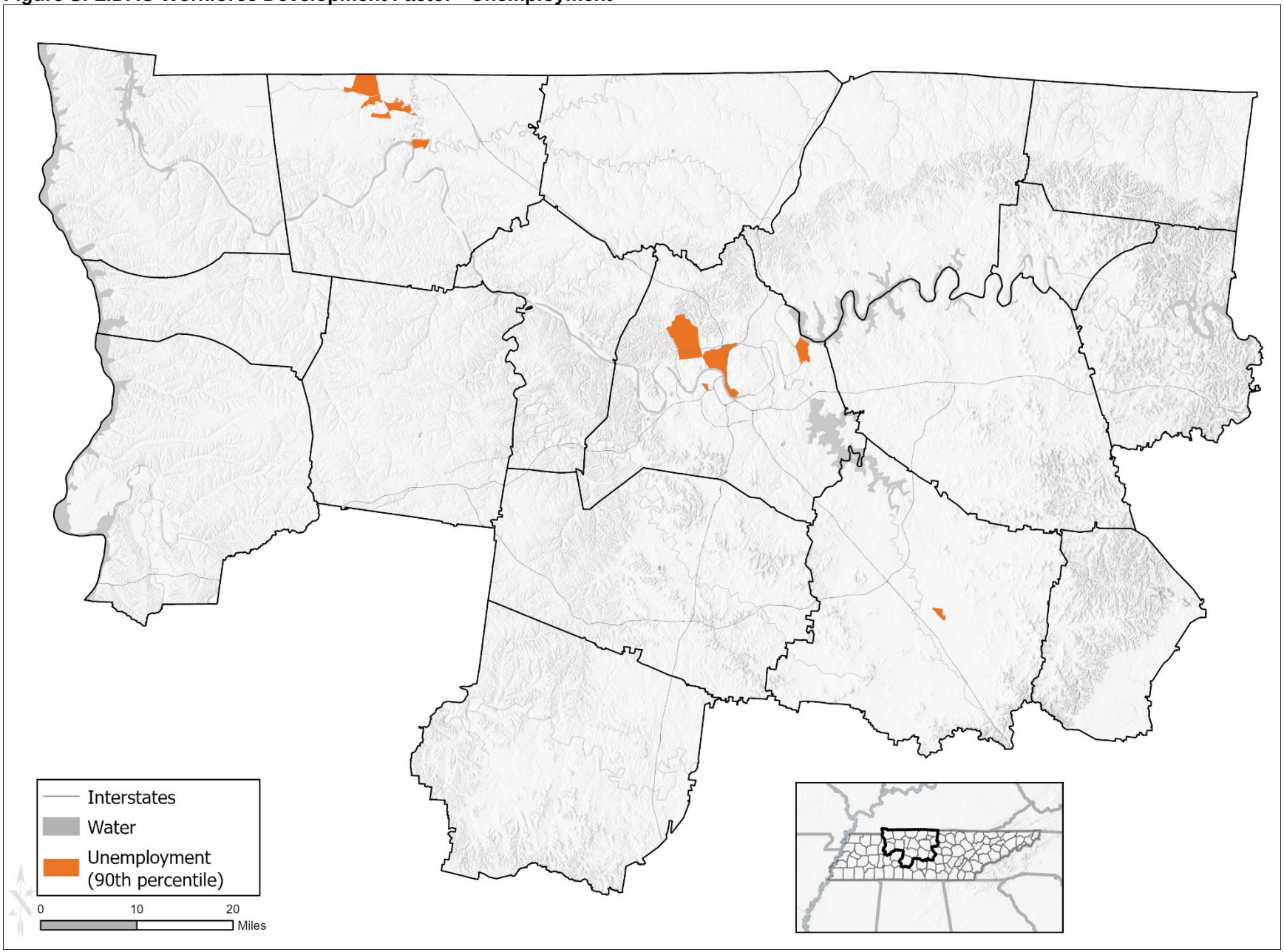


Figure T: Housing Factors for Low Income and Disadvantaged Communities

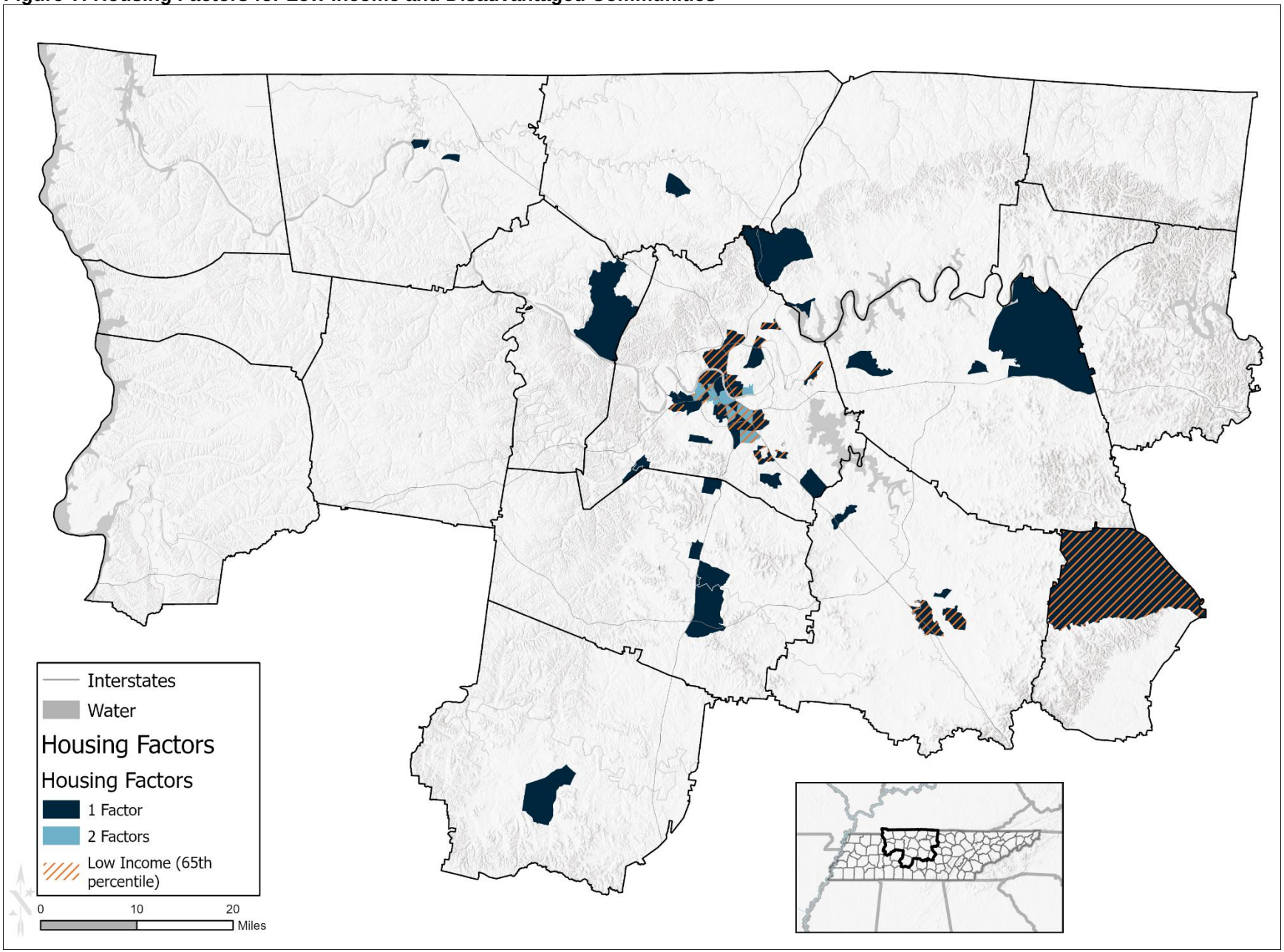


Figure U: LIDAC Housing Factor – Housing Burden

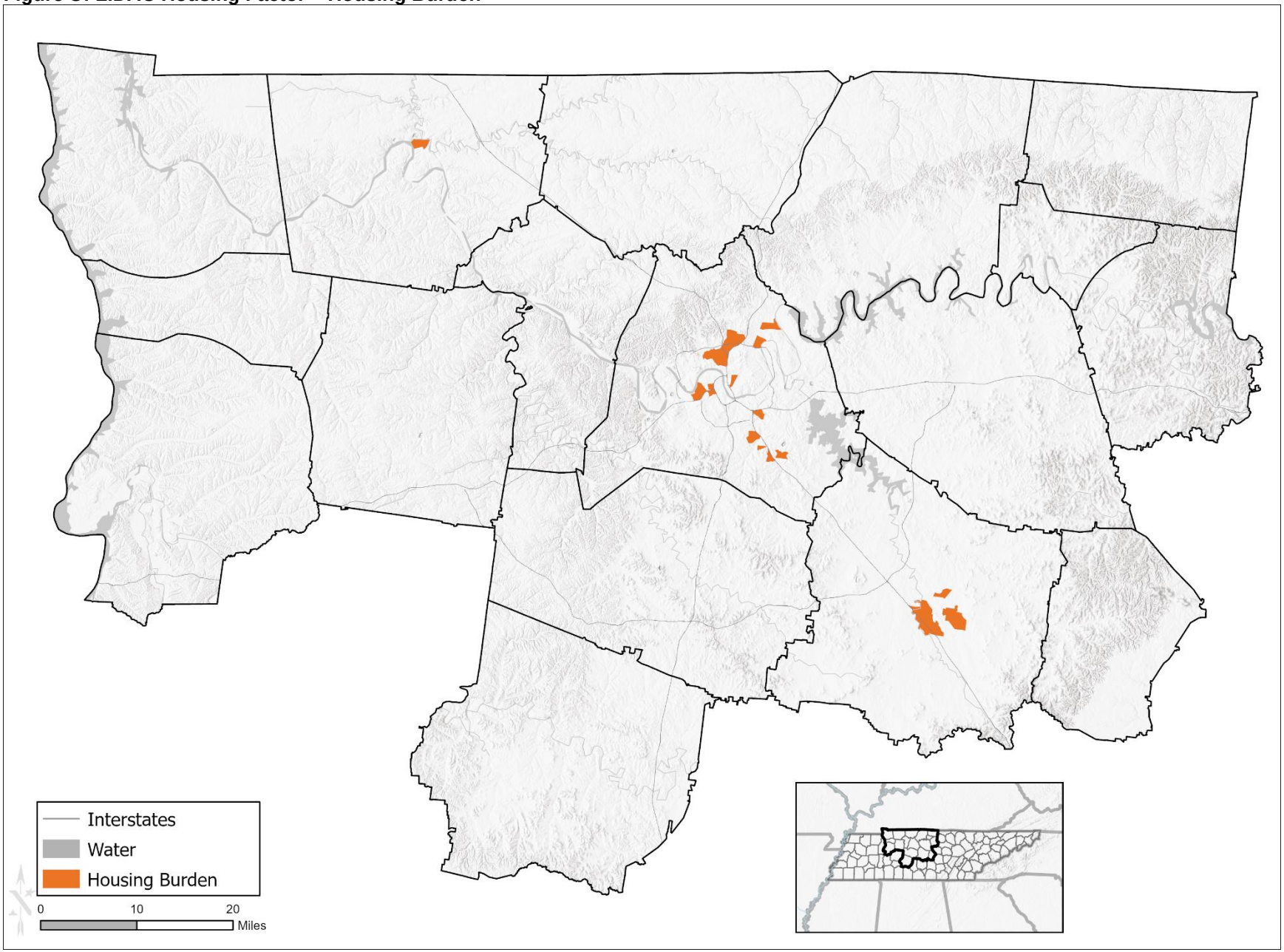


Figure V: LIDAC Housing Factor – Lack of Greenspace

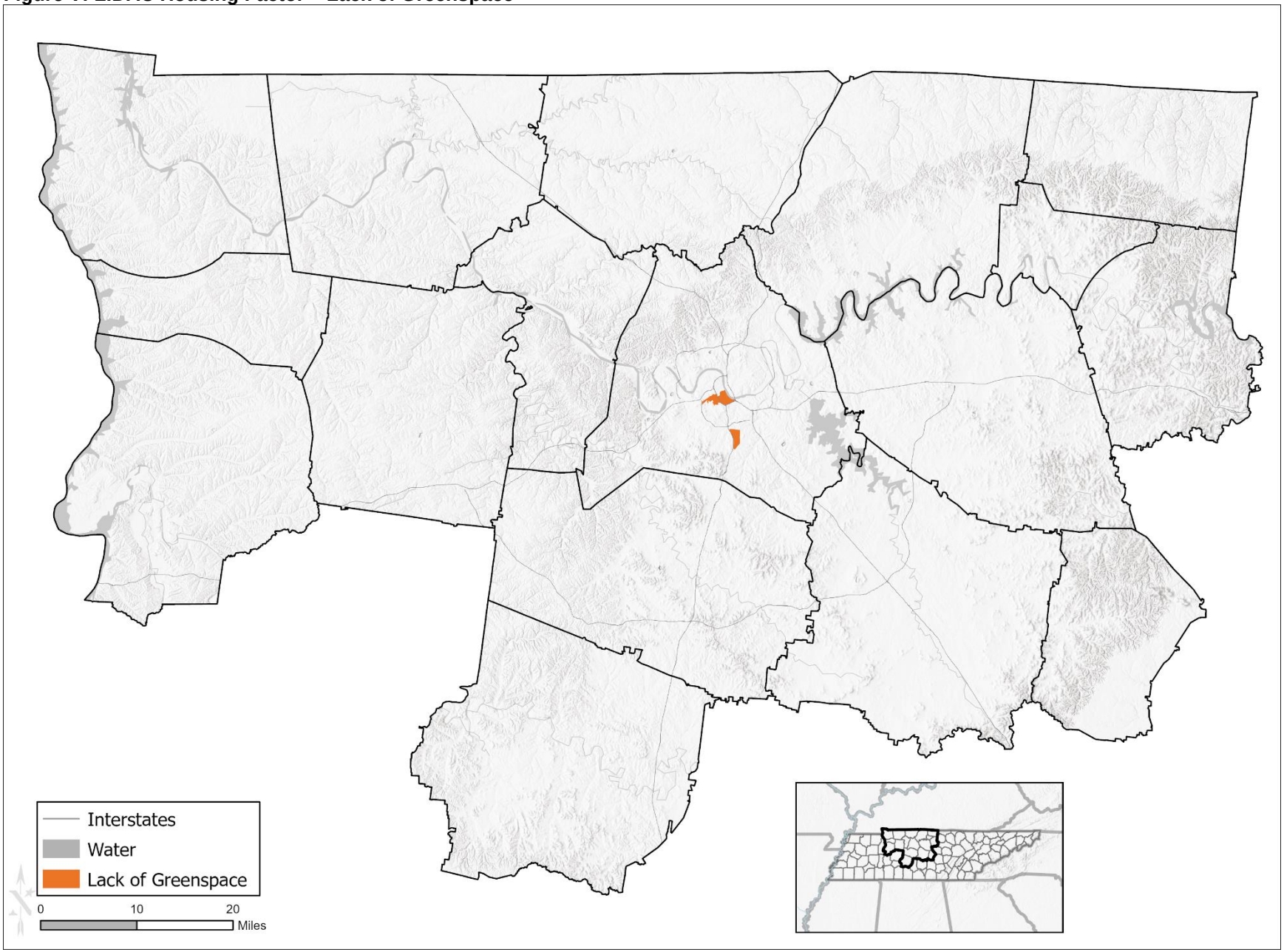


Figure W: LIDAC Housing Factor – Historic Underinvestment

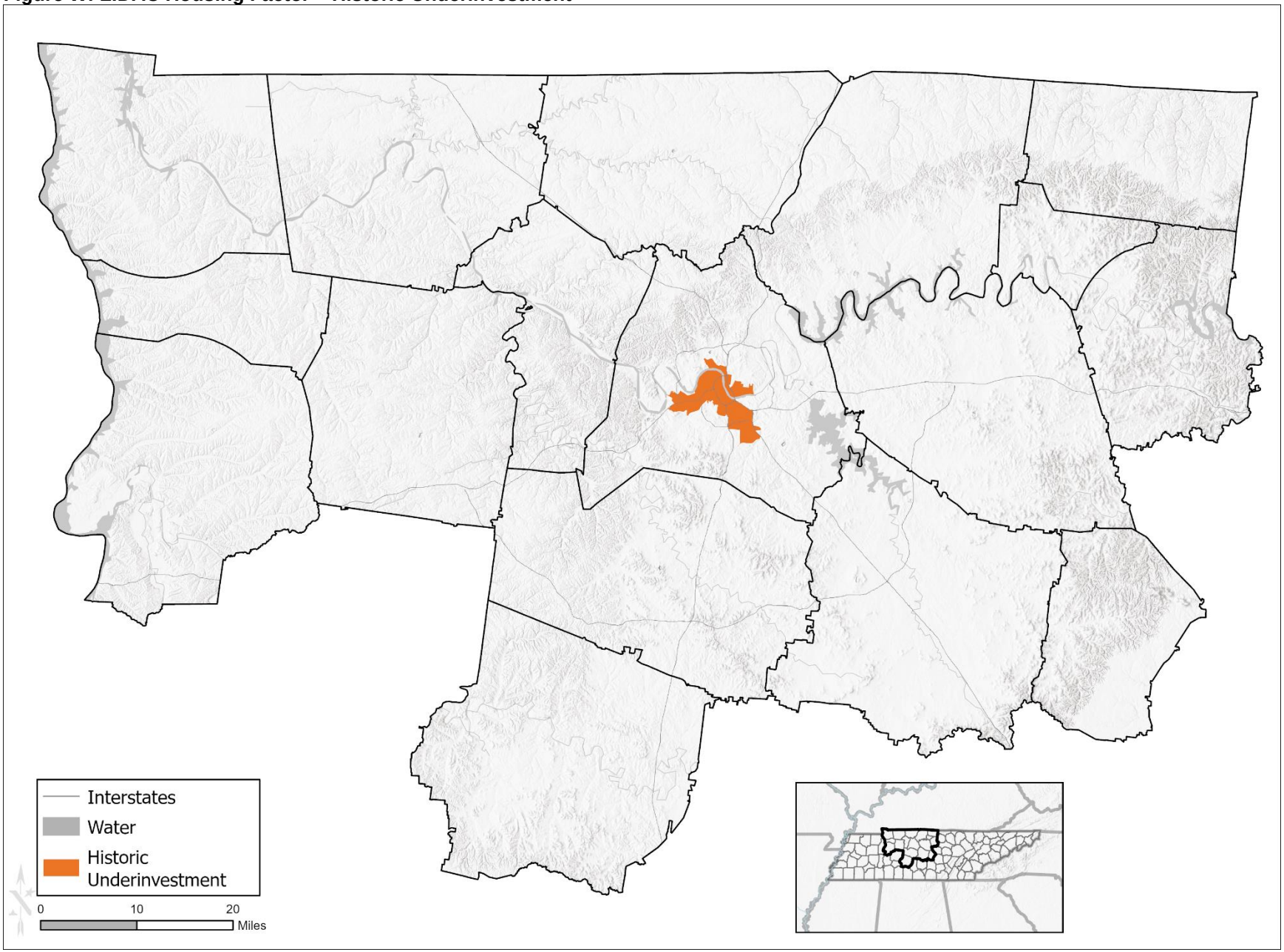


Figure X: LIDAC Housing Factor – Lack of Indoor Plumbing or Kitchen

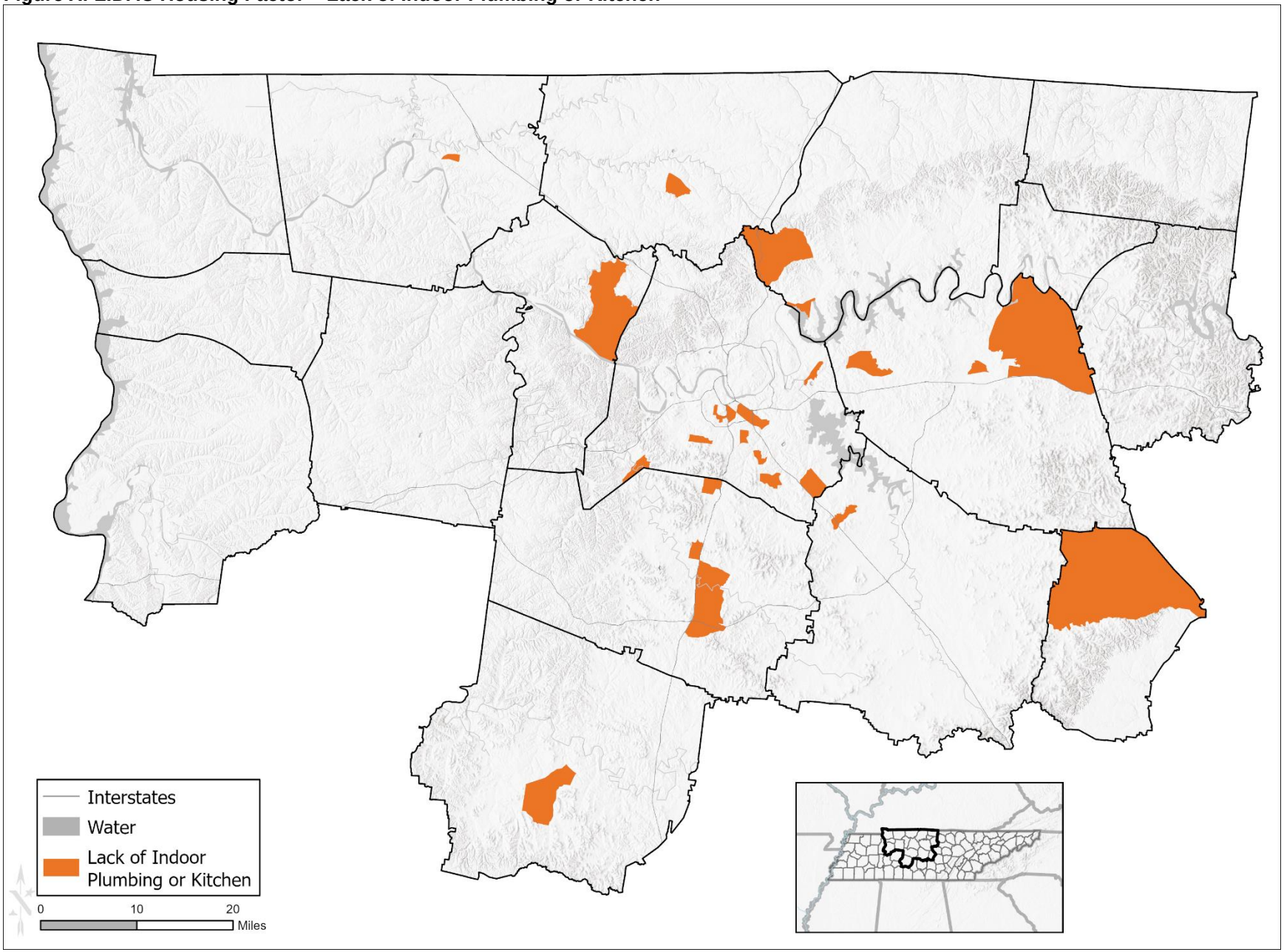


Figure Y: LIDAC Housing Factor – Lead Paint

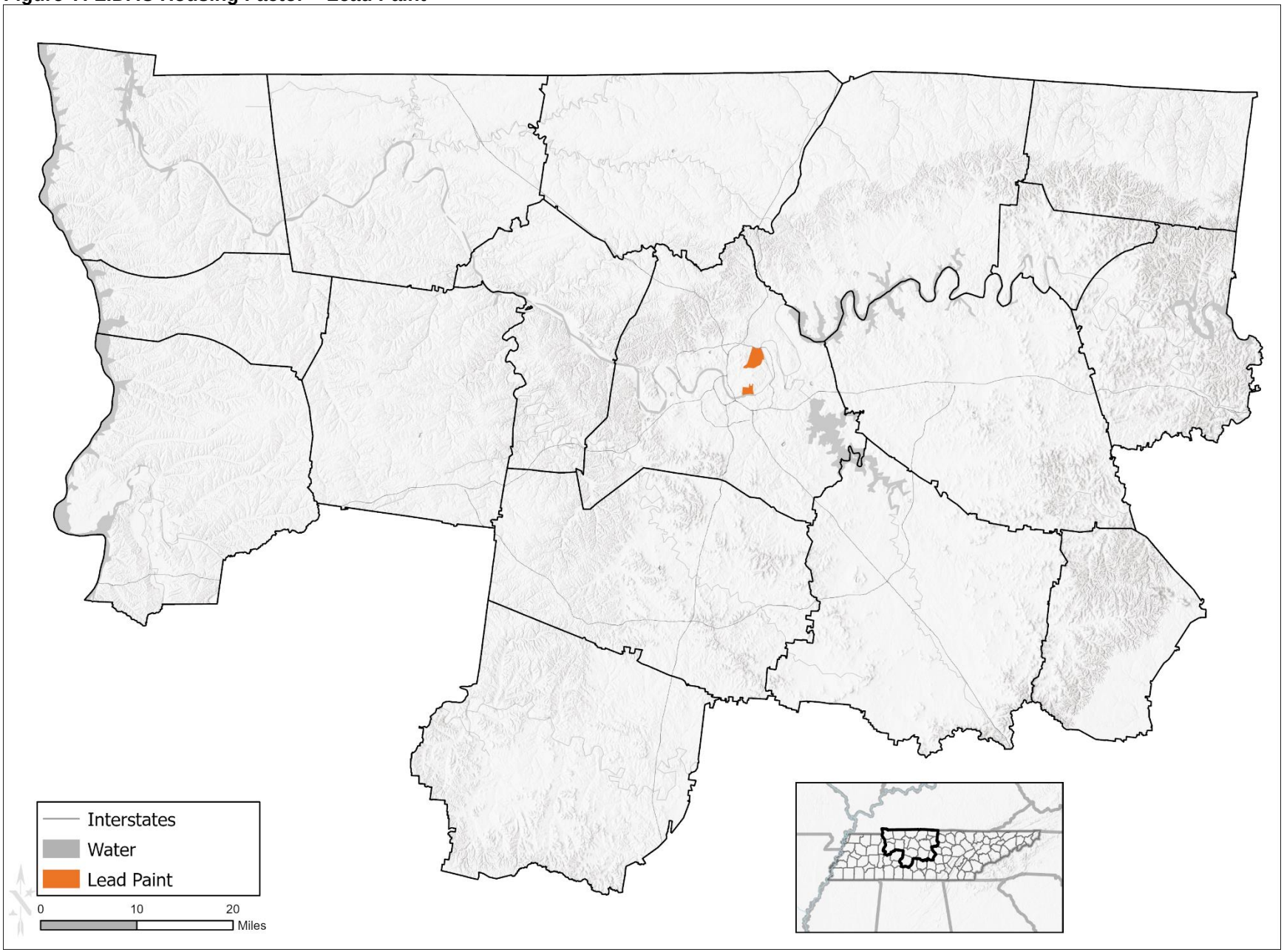


Figure Z: Legacy Pollution Factors for Low Income and Disadvantaged Communities

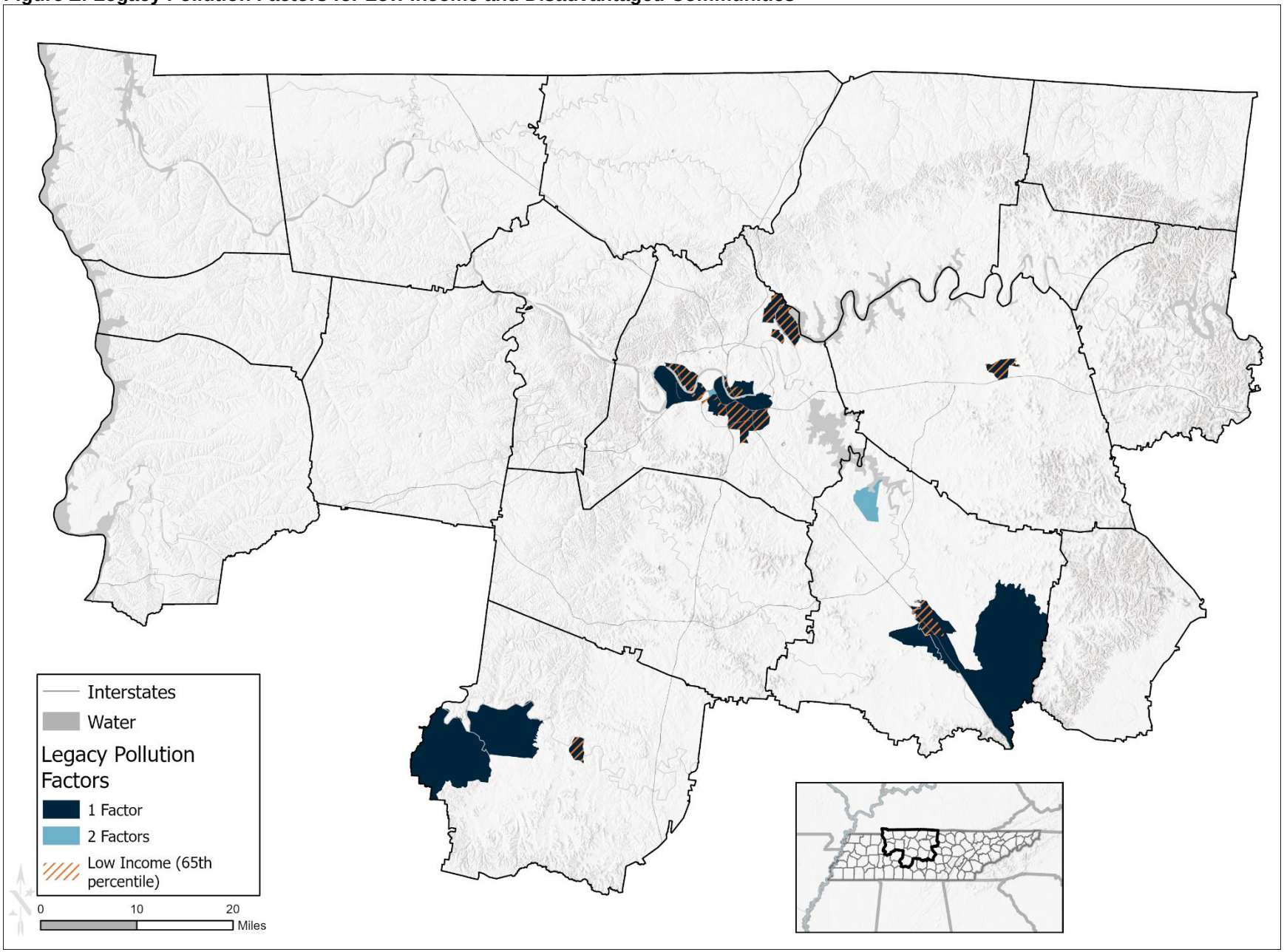


Figure AA: LIDAC Legacy Pollution Factor – Hazardous Waste Sites

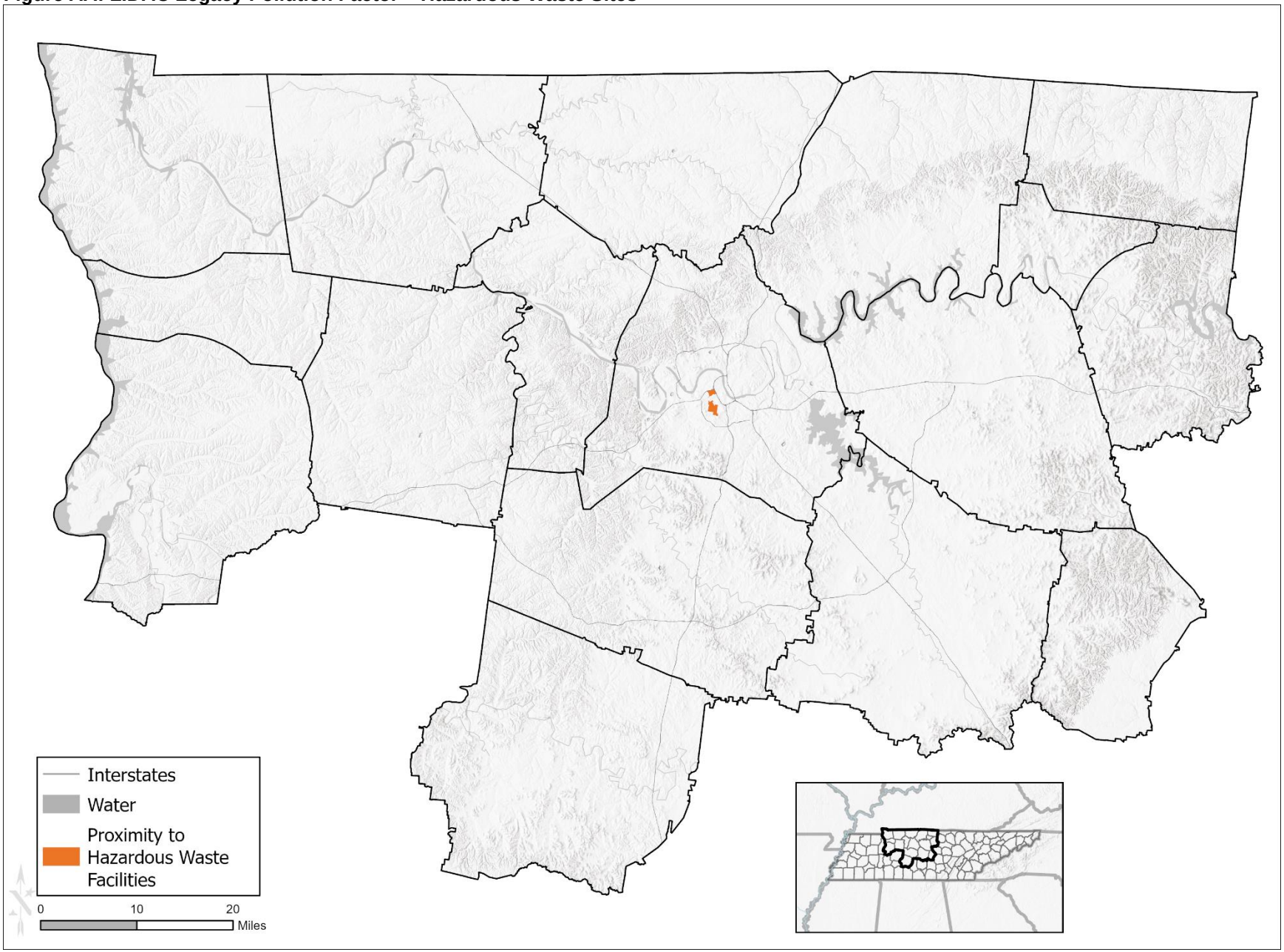


Figure BB: LIDAC Legacy Pollution Factor – Formerly Used Defense Sites

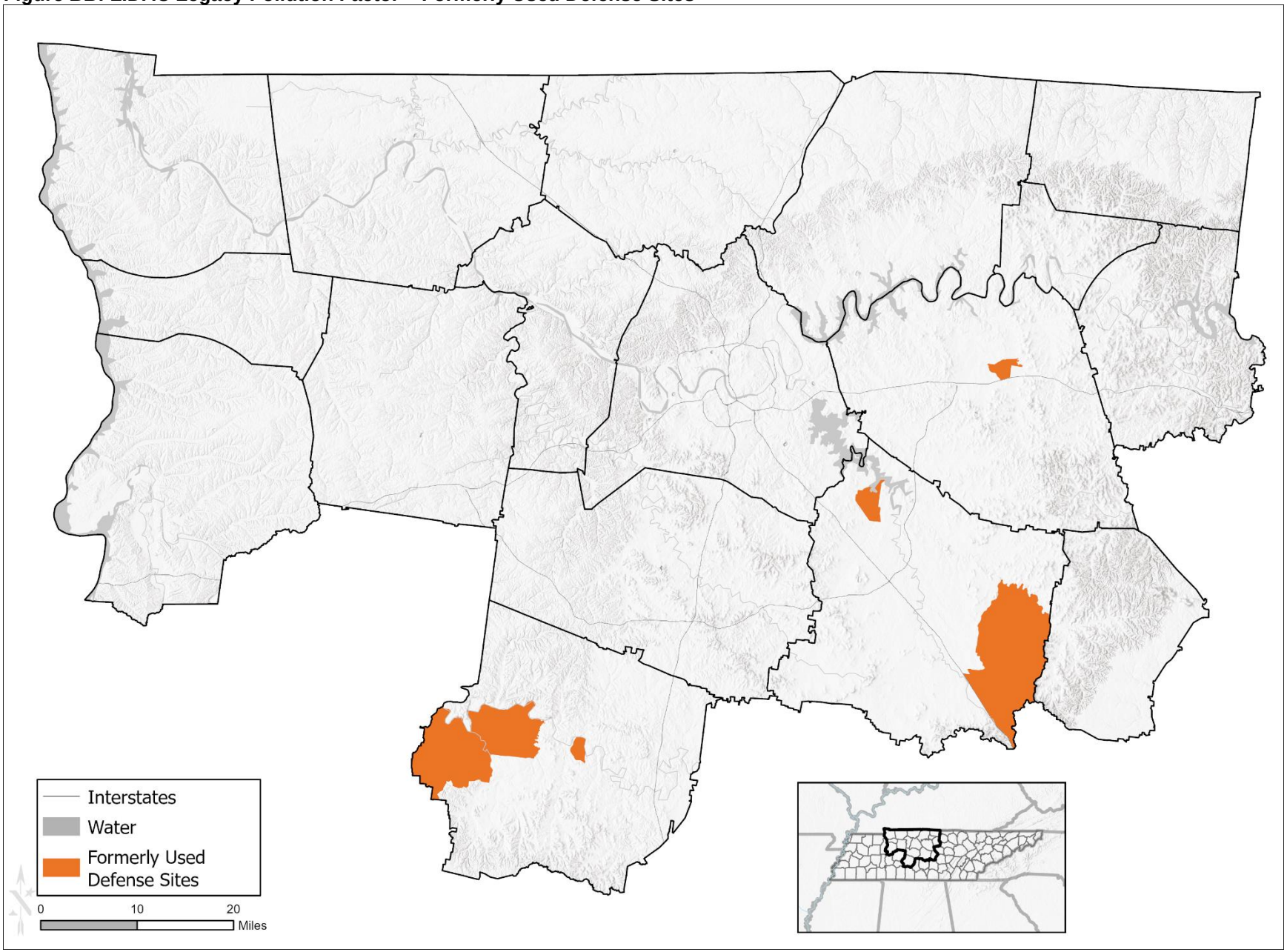


Figure CC: LIDAC Legacy Pollution Factor – Proximity to Risk Management Plan

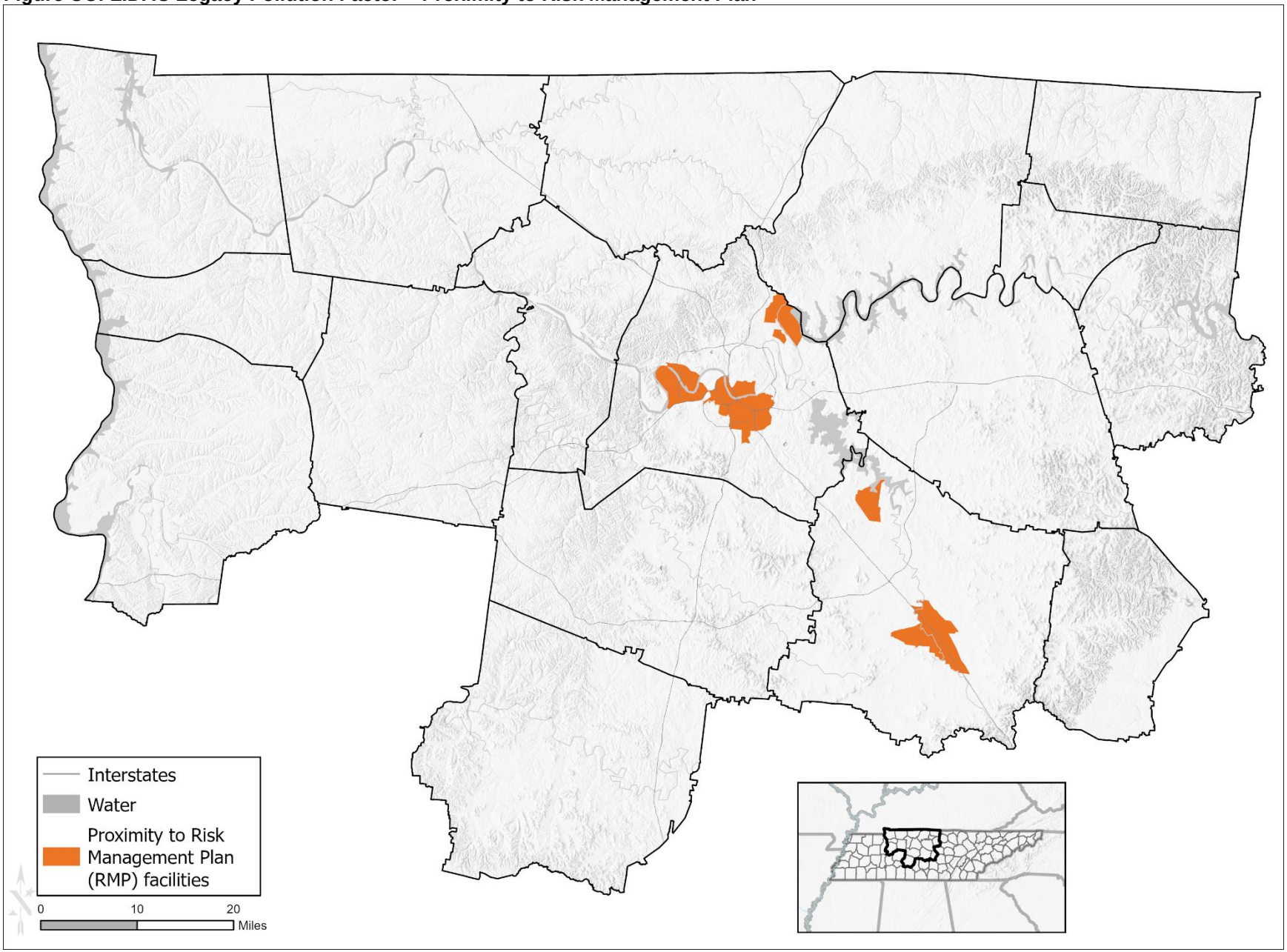


Figure DD: Energy Factors for Low Income and Disadvantaged Communities

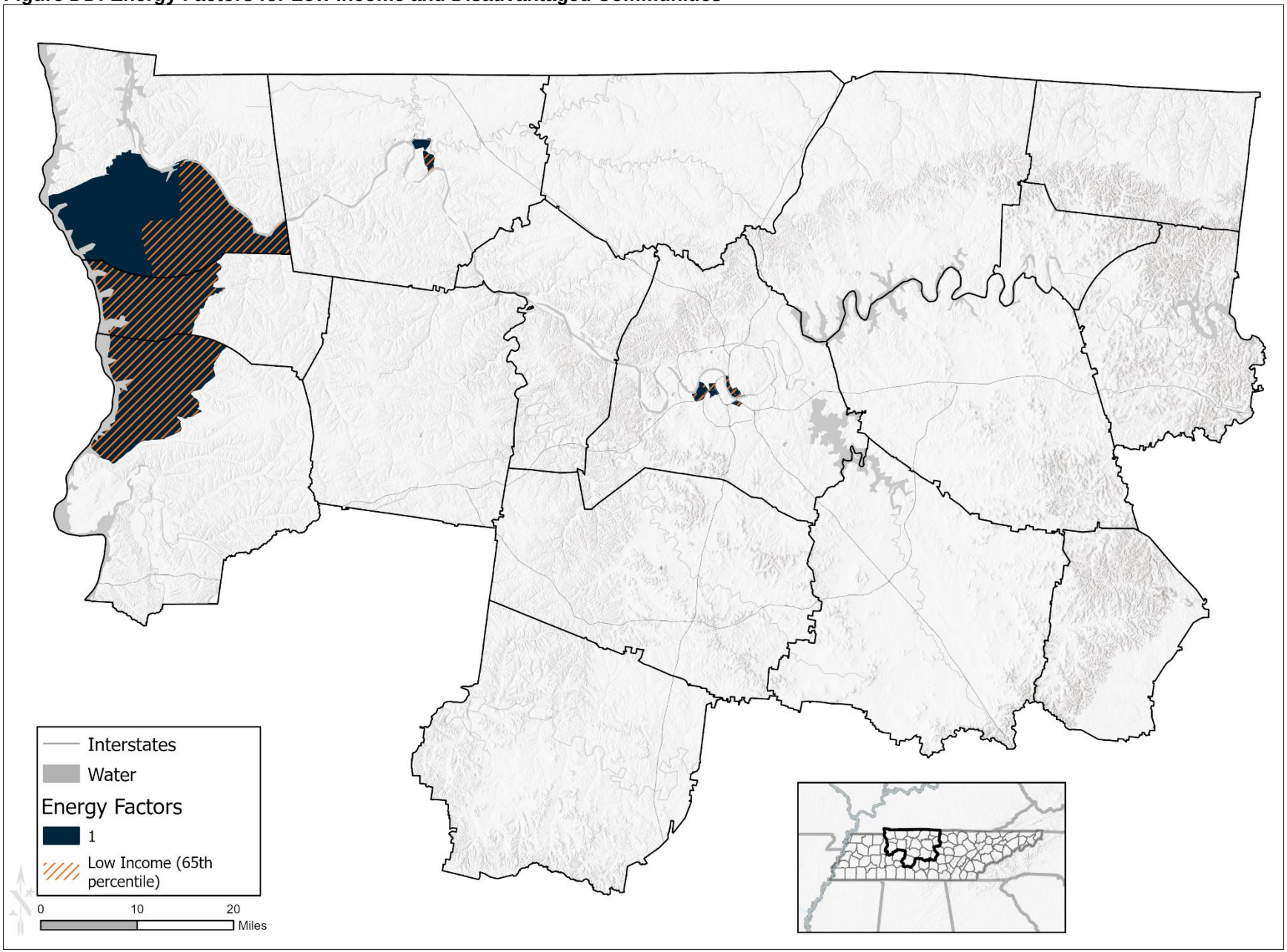


Figure EE: LIDAC Energy Factor – Energy Burden

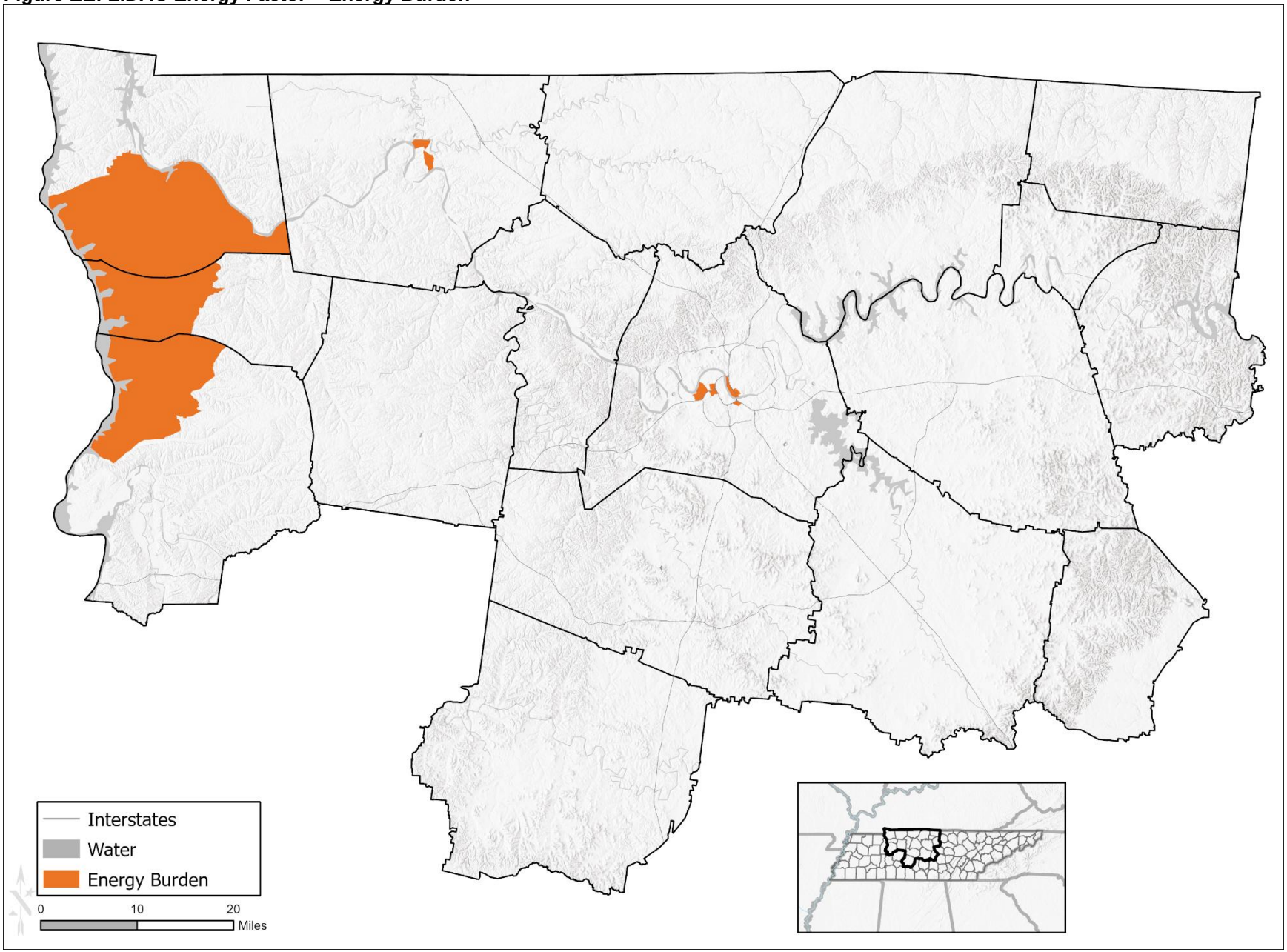


Figure FF: Water and Wastewater Factors for Low Income and Disadvantaged Communities

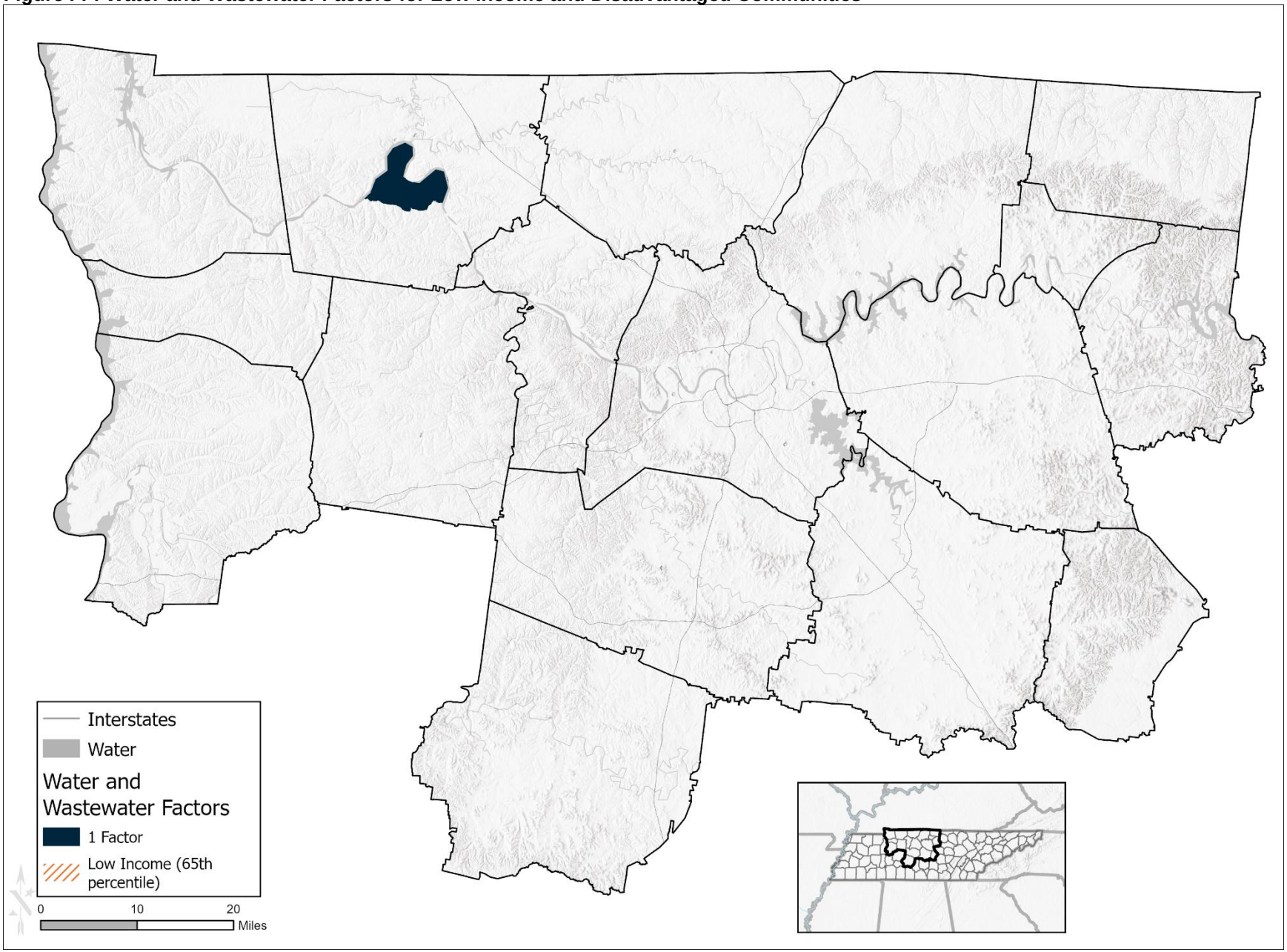
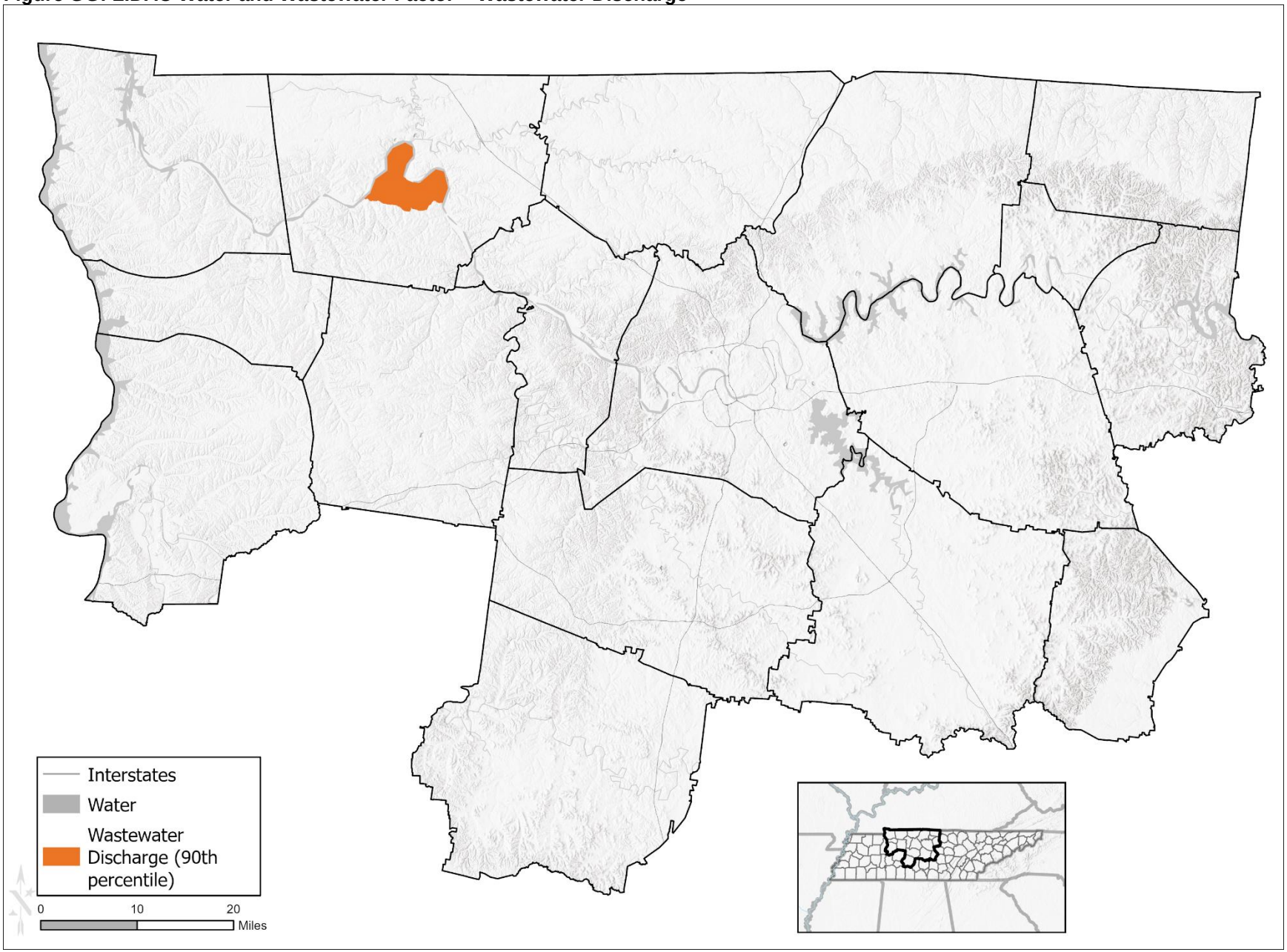
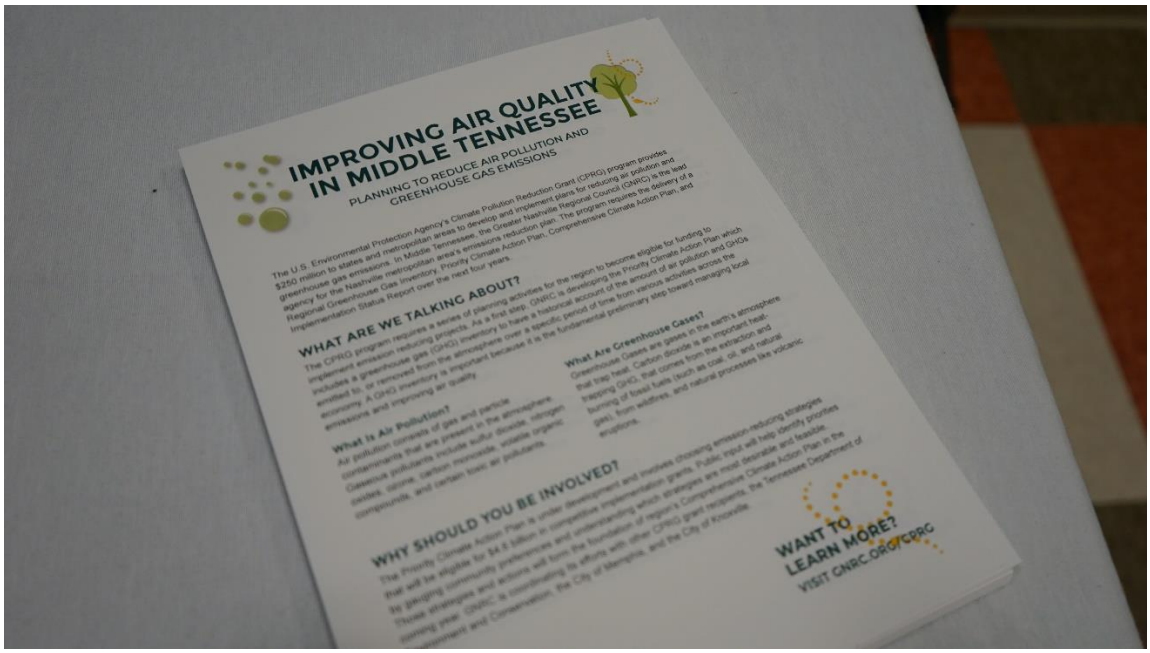
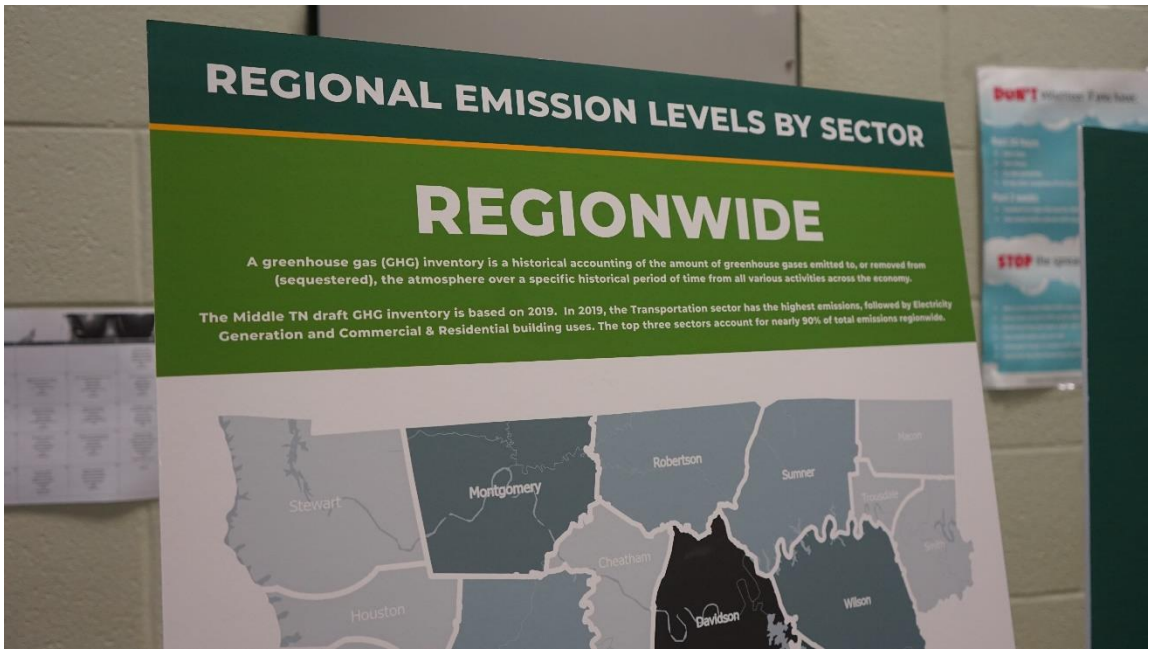


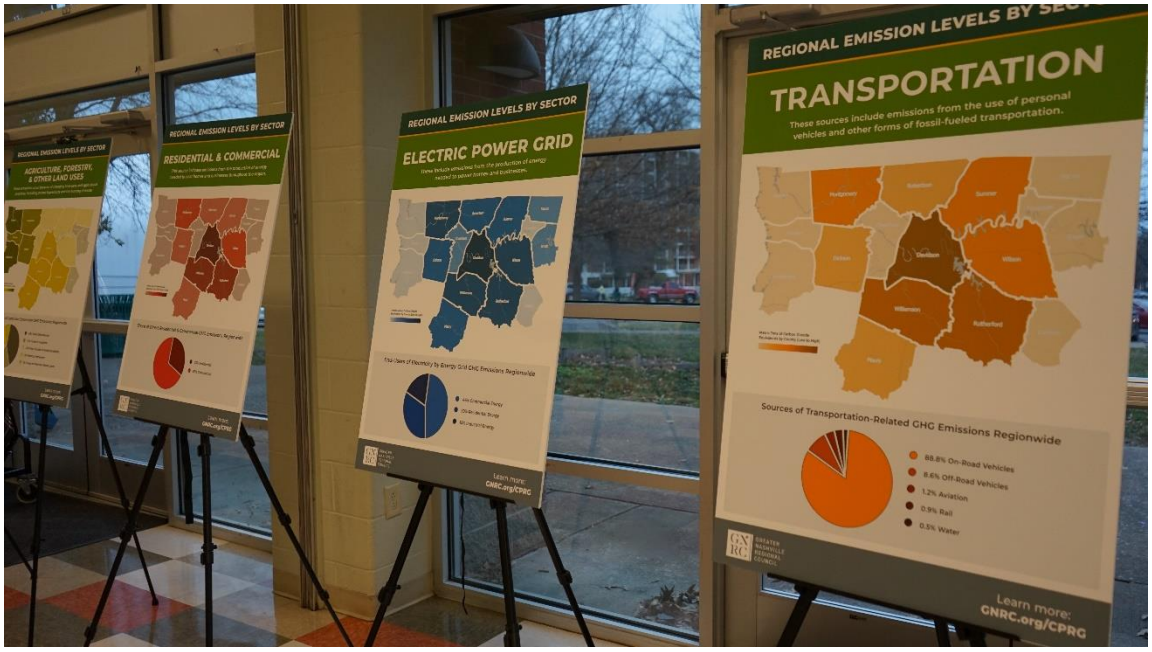
Figure GG: LIDAC Water and Wastewater Factor – Wastewater Discharge



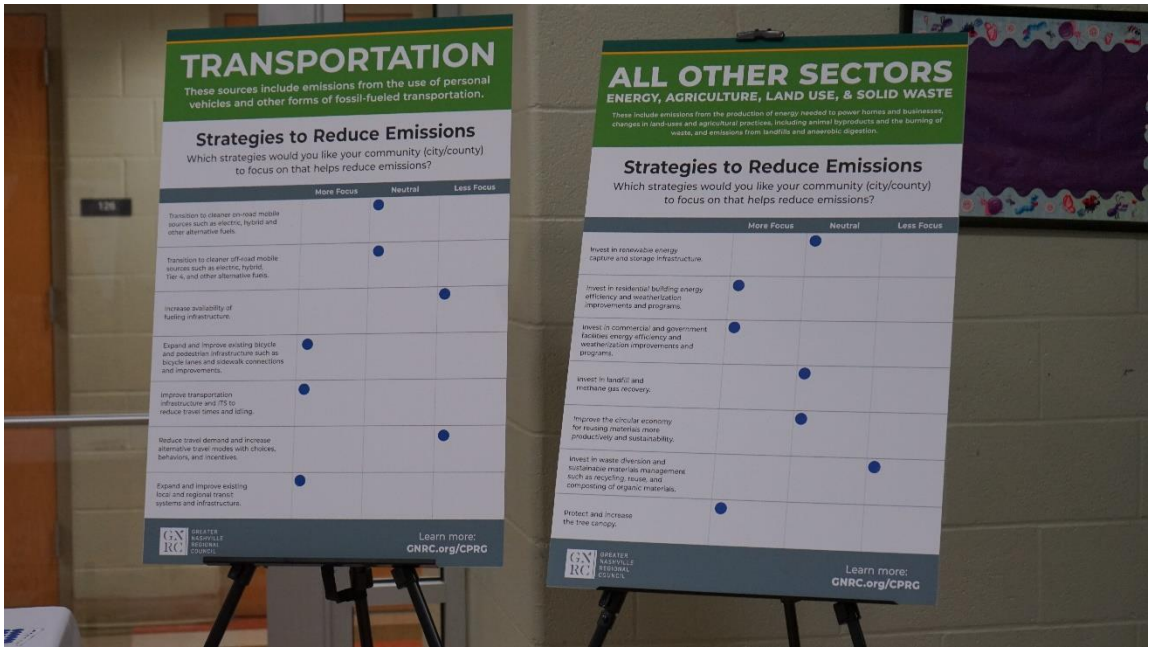
B. Community Engagement Materials

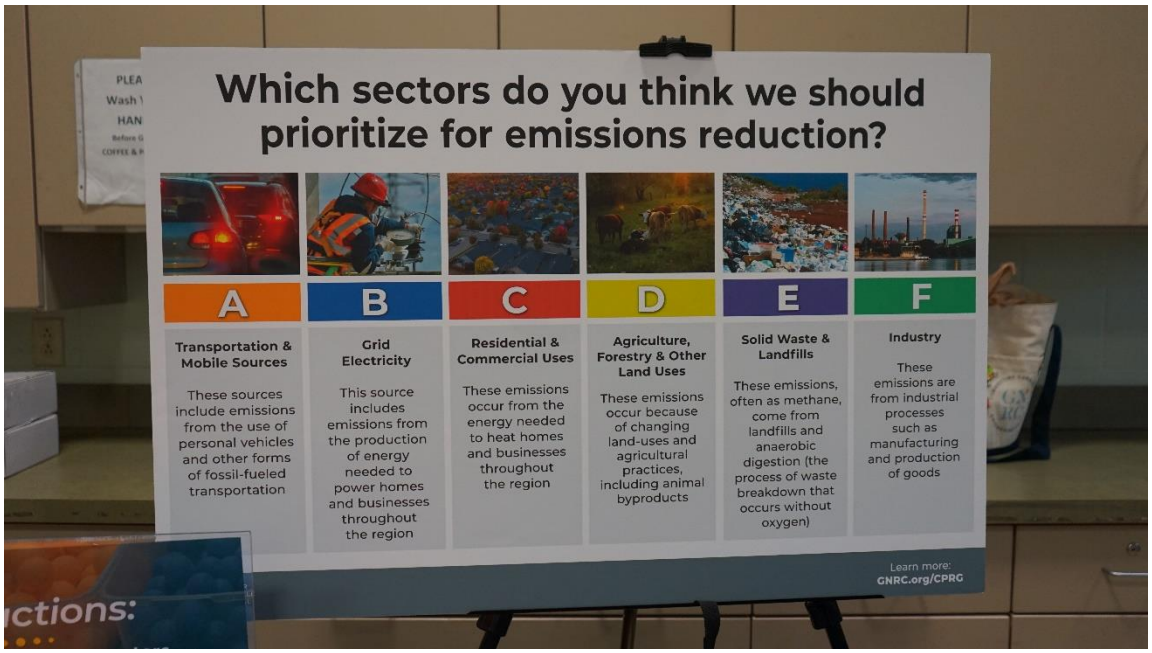


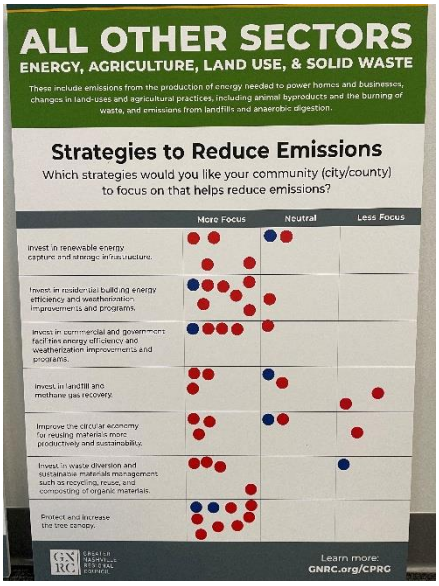

REGIONAL EMISSION LEVELS BY SECTOR
REGIONWIDE
A greenhouse gas (GHG) inventory is a historical accounting of the amount of greenhouse gases emitted to, or removed from (sequestered), the atmosphere over a specific historical period of time from all various activities across the economy.
The Middle TN draft GHG inventory is based on 2019. In 2019, the Transportation sector has the highest emissions, followed by Electricity Generation and Commercial & Residential building uses. The top three sectors account for nearly 90% of total emissions regionwide.
Stewart
Montgomery
Robertson
Sumner
Cheatham
Houston
Davidson
Wilson

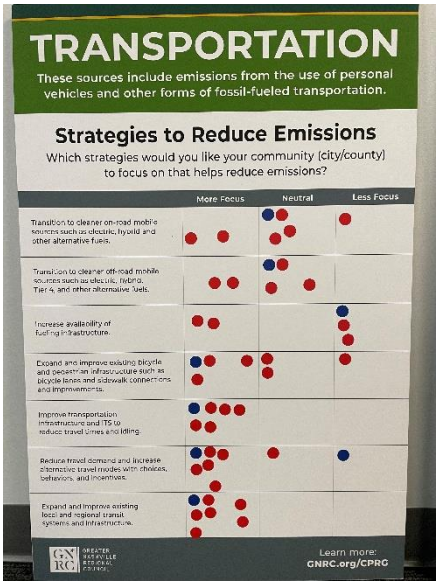

REGIONAL EMISSION LEVELS BY SECTOR
AGRICULTURE, FORESTRY, & OTHER LAND USES
REGIONAL EMISSION LEVELS BY SECTOR
RESIDENTIAL & COMMERCIAL
REGIONAL EMISSION LEVELS BY SECTOR
ELECTRIC POWER GRID
Learn more: GNRC.org/CPRG
REGIONAL EMISSION LEVELS BY SEC
TRANSPORTATION
These sources include emissions from the use of personal vehicles and other forms of fossil-fueled transportation.
Sources of Transportation-Related GHG Emissions Regionwide
88.8% On-Road Vehicles
8.6% Off-Road Vehicles
1.2% Aviation
0.9% Rail
0.5% Water
Learn more: GNRC.org/CPRG

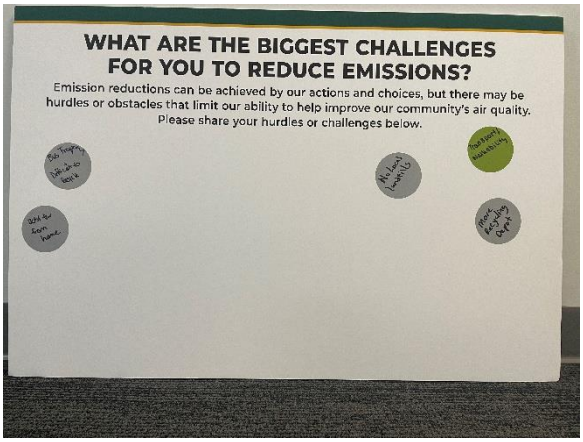

PLEASE
Wash Your
HANDS
Which sectors do you think we should prioritize for emissions reduction?
A
B
C
D
E
F
Transportation & Mobile Sources
Grid Electricity
Residential & Commercial Uses
Agriculture, Forestry & Other Land Uses
Solid Waste & Landfills
Industry
Instructions:
Identify your top three sectors for emissions reductions.
Take a corresponding ping pong ball and place each one in the order of priority into the tubes.
1st Priority
2nd Priority
3rd Priority

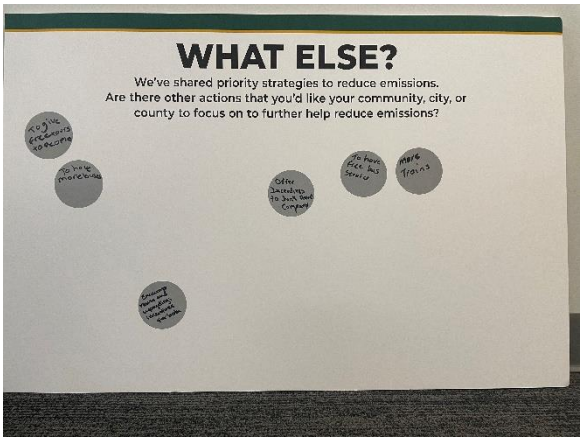

TRANSPORTATION
These sources include emissions from the use of personal vehicles and other forms of fossil-fueled transportation.
Strategies to Reduce Emissions
Which strategies would you like your community (city/county) to focus on that helps reduce emissions?
More Focus
Neutral
Less Focus
Transition to cleaner on-road mobile sources such as electric, hybrid and other alternative fuels.
Transition to cleaner off-road mobile sources such as electric, hybrid, Tier 4, and other alternative fuels.
Increase availability of fueling infrastructure.
Expand and improve existing bicycle and pedestrian infrastructure such as bicycle lanes and sidewalk connections and improvements.
Improve transportation infrastructure and ITS to reduce travel times and idling.
Reduce travel demand and increase alternative travel modes with choices, behaviors, and incentives.
Expand and improve existing local and regional transit systems and infrastructure.
Learn more:
GNRC.org/CPRG
ALL OTHER SECTORS
ENERGY, AGRICULTURE, LAND USE, & SOLID WASTE
These include emissions from the production of energy needed to power homes and businesses, changes in land-uses and agricultural practices, including animal byproducts and the burning of waste, and emissions from landfills and anaerobic digestion.
Strategies to Reduce Emissions
Which strategies would you like your community (city/county) to focus on that helps reduce emissions?
More Focus
Neutral
Less Focus
Invest in renewable energy capture and storage infrastructure.
Invest in residential building energy efficiency and weatherization improvements and programs.
Invest in commercial and government facilities energy efficiency and weatherization improvements and programs.
Invest in landfill and methane gas recovery.
Improve the circular economy for reusing materials more productively and sustainably.
Invest in waste diversion and sustainable materials management such as recycling, reuse, and composting of organic materials.
Protect and increase the tree canopy.
Learn more:
GNRC.org/CPRG


Which sectors do you think we should prioritize for emissions reduction?
A
Transportation & Mobile Sources
These sources include emissions from the use of personal vehicles and other forms of fossil-fueled transportation
B
Grid Electricity
This source includes emissions from the production of energy needed to power homes and businesses throughout the region
C
Residential & Commercial Uses
These emissions occur from the energy needed to heat homes and businesses throughout the region
D
Agriculture, Forestry & Other Land Uses
These emissions occur because of changing land-uses and agricultural practices, including animal byproducts
E
Solid Waste & Landfills
These emissions, often as methane, come from landfills and anaerobic digestion (the process of waste breakdown that occurs without oxygen)
F
Industry
These emissions are from industrial processes such as manufacturing and production of goods
Learn more:
GNRC.org/CPRG


ALL OTHER SECTORS
ENERGY, AGRICULTURE, LAND USE, & SOLID WASTE
These include emissions from the production of energy needed to power homes and businesses, changes in land-uses and agricultural practices, including animal byproducts and the burning of waste, and emissions from landfills and anaerobic digestion.
Strategies to Reduce Emissions
Which strategies would you like your community (city/county) to focus on that helps reduce emissions?
More Focus
Neutral
Less Focus
Invest in renewable energy capture and storage infrastructure.
Invest in residential building energy efficiency and weatherization improvements and programs.
Invest in commercial and government facilities energy efficiency and weatherization improvements and programs.
Invest in landfill and methane gas recovery.
Improve the circular economy for reusing materials more productively and sustainably.
Invest in waste diversion and sustainable materials management such as recycling, reuse, and composting of organic materials.
Protect and increase the tree canopy.
Learn more:
GNRC.org/CPRG


TRANSPORTATION
These sources include emissions from the use of personal vehicles and other forms of fossil-fueled transportation.
Strategies to Reduce Emissions
Which strategies would you like your community (city/county) to focus on that helps reduce emissions?
More Focus
Neutral
Less Focus
Transition to cleaner on-road mobile sources such as electric, hybrid, and other alternative fuels.
Transition to cleaner off-road mobile sources such as electric, hybrid, Tier 4, and other alternative fuels.
Increase availability of fueling infrastructure.
Expand and improve existing bicycle and pedestrian infrastructure such as bicycle lanes and sidewalk connections and improvements.
Improve transportation infrastructure and ITS to reduce travel times and idling.
Reduce travel demand and increase alternative travel modes with choices, behaviors, and incentives.
Expand and improve existing local and regional transit systems and infrastructure.
Learn more:
GNRC.org/CPRG


WHAT ARE THE BIGGEST CHALLENGES FOR YOU TO REDUCE EMISSIONS?
Emission reductions can be achieved by our actions and choices, but there may be hurdles or obstacles that limit our ability to help improve our community's air quality. Please share your hurdles or challenges below.


WHAT ELSE?
We've shared priority strategies to reduce emissions. Are there other actions that you'd like your community, city, or county to focus on to further help reduce emissions?


CONNECTING COMMUNITIES
GNRC
EMPOWERING PEOPLE