OSBM

COLLECTING, MANAGING, AND PROVIDING INFRASTRUCTURE DATA

Management Study

As Directed by Session Law 2005-276, Section 6.33(a) and 6.33(b)

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Prepared By:

Office of State Budget and Management

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INTRODUCTION

Scope of Study

The Office of the State Budget and Management (OSBM) was directed by the General Assembly in Sections 6.33(a) and 6.33(b) of Section Law 2005-276 to (1) determine the best methods for collecting, managing, and providing access to information about technology, water, sewer, and other modern infrastructures needed to assist communities in becoming and remaining economically viable and (2) define the term "infrastructure", including modern communication technologies for the General Statutes.

Methodology

In order to conduct the study, the OSBM team performed the following tasks:

- Reviewed General Statutes related to infrastructure within North Carolina State government,
- Identified State agencies and other organizations which collect and maintain infrastructure information,
- Identified the types of infrastructure data collected and managed by State agencies and others organizations,
- Interviewed data management personnel in several State agencies,
- Attended meetings of the Business and Education Technology Alliance (BETA), and
- Researched other states' infrastructure management structure.

BACKGROUND

The American Heritage Dictionary defines infrastructure as "The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions. As a working definition for this study, the North Carolina infrastructure consists of the underlying framework of facilities, services, resources, installations, and technology which supports the growth and development of the state and communities. Specifically, the state's infrastructure consists of modern communication and technology systems (telephone, wireless, fiber, satellite, cable, and computer networks), transportation (roads, bridges, airports, seaports, and railroads), energy (power generation facilities, and electricity and gas distribution lines), water-related services (drinking water, sewer treatment, and stormwater systems), health-related services (hospitals and other medical facilities), and education (public and nonpublic schools, community colleges, and colleges and universities). Infrastructure may also include government buildings that are essential to public services.[1]

The most informative way to present infrastructure data is to create maps of the structures within the context of jurisdictional boundaries. Data that are referenced to the earth and represented on maps are called "geospatial" data. Geospatial data include map features such as lines (roads), points (wireless towers), areas (public sewer service areas), and aerial photography that has been referenced to the earth. The tools used to organize and analyze geospatial data and create maps are called geographic information systems (GIS). Access to geospatial data and maps is invaluable for economic and community development, transportation planning, environmental protection, and public and private efforts that support economic viability. Therefore, this study places emphasis on collecting, managing, and disseminating geospatial data relating to infrastructure.

[1] The emergency management concept of critical facilities covers the previously discussed categories plus emergency operations centers, potential shelters, landfills, and other facilities that are vital to disaster recovery. Further, the National Strategy for Homeland Security includes farms and food-processing plants, defense industries, banking and finance, chemical plants, hazardous materials, postal and shipping sites, national monuments and icons, and large office buildings among the nations "critical infrastructure".

Agencies and Organizations Current Roles and Responsibilities

The responsibility for collecting, managing, and disseminating information and data pertaining to the infrastructure in North Carolina is shared by several State agencies and organizations. The primary agencies and organizations that are responsible for collecting, managing, and disseminating infrastructure data are:

- e-NC Authority
- North Carolina Rural Economic Development Center
- Department of Environment and Natural Resources
- Department of Transportation
- Department of Commerce, North Carolina Utilities Commission
- Department of Public Instruction
- Department of Administration
- Department of Health and Human Services
- Department of Crime Control and Public Safety
- Department of Agriculture and Consumer Services
- Office of Information Technology Services
- Office of State Budget and Management, State Data Center
- Geographic Information Coordinating Council

The roles and responsibilities of these agencies and organizations as they relate to data development, analysis, maintenance, dissemination, and reporting are:

E-NC Authority

The e-NC Authority is dedicated to (1) ensuring that all North Carolina citizens, businesses, and communities know how to use and have access to high-speed Internet services at affordable prices and (2) creating local opportunities for technology-based economic development and job creation. The predecessor of the e-NC Authority was the Rural Internet Access Authority.[2] The purpose of the Authority was to use the Internet as a tool for helping people to improve their quality of life through improved commerce, health care, education, and government services.

E-NC Authority goals relating to infrastructure include:

- Maintaining a web site to provide North Carolinians with complete information on Internet and telecommunications services, including how they can be obtained and what types of services will be available in the future;
- Developing Internet applications that improve government services in areas, such as education and health care, and make it easier and more convenient for citizens to receive services;
- Encouraging all potential Internet service providers to participate in the effort, regardless of the technologies (telephone, cable**,** fiber, wireless, satellite) they employ; and
- Recommending to the Governor and General Assembly actions to improve Internet access statewide.

The Authority maintains telecommunications infrastructure data through the e-NC Service Provider Update (SPU) database and provides access through its GIS infrastructure web mapping (www.e-nc.org). The Authority, funded by non-state funds between 2000 and 2004, developed telecommunications infrastructure data at an initial cost of about $400,000 with an additional $200,000 spent on servers, licenses and development, and updates of software. The e-NC Authority's annual cost of maintaining the data is $100,000. The Center for Geographic Information and Analysis (CGIA) hosts e-NC's server. E-NC contracts with a

[2] The Rural Internet Access Authority was created in 2000 by the N.C. General Assembly, and continued as the e-NC Authority under Session Law 2003-425. E-NC Authority board members are appointed by the General Assembly and the Governor.

software developer to assist with this project and reimburses CGIA for assisting with GIS software and application and server support.

Along with the GIS mapping program, e-NC produces regular surveys and reports on high-speed Internet connectivity in the state. This information is used routinely by citizens and telecommunications companies. Services provided by e-NC include responding to questions from citizens, businesses, the Utilities Commission, the Public and Legislative Staff, newspapers, the General Assembly, and economic developers. According to the Federal Communication Commission's 2006 report[3], E-NC's work with counties to become e-communities[4] has resulted in North Carolina being ranked 11th nationally in the number of broadband lines.

The e-NC Authority is also assisting the Lieutenant Governor's Business Education Technology Alliance (BETA) initiative to (1) expand high-speed broadband to schools, (2) allow more access to high value learning content, and (3) provide professional development content for students and teachers. As part of this project, the General Assembly directed the e-NC Authority to study regional points of presence which will ensure local education agencies are provided sufficient bandwidth connections for schools to ensure "21st Century Learning". The report is due to the General Assembly in May 2006. Other recent efforts by the e-NC Authority include a 2006 study of cross-border technology access and economic development and a grant program for developing e-NC Business and Technology Telecenters. The three initial Business and Technology Telecenters were funded with Rural Internet Access Authority funds received from MCNC. These Telecenters have created nearly 900 jobs in the most distressed areas of the State and served more than 18,500 clients with technology consulting services since 2002. Four additional Telecenters are being funded by the General Assembly through the e-NC Authority.

North Carolina Rural Economic Development Center (The Rural Center)

The Rural Center led the Water 2030 Initiative (www.ncruralcenter.org/water2030) which developed an inventory of public water and sewer facilities and stormwater systems. The inventory contains information about service areas, system capacities, rates, and capital needs within the context of water supply, economic development, and quality of life through 2030. In addition to updated statistics in 2005, a set of statewide water and sewer service area boundaries will be available in geospatial format in 2006. Comprehensive collections of boundaries and statistics between 1998 and 2005 from local governments were time-consuming and expensive. Further, the most recent update for 2005 does not include water distribution lines and sewer pipes, and other facilities. While the Rural Center has been a catalyst for data collection and analysis, a more efficient way to update information on all water, sewer, and stormwater systems would be for state and local governments to collaborate in creating digital data within the context of local capital improvements and state oversight of local systems.

Department of Environment and Natural Resources (DENR)

The Department's Center for Geographic Information and Analysis is the state agency responsible for (1) providing geographic information and services statewide, (2) building and maintaining NC OneMap,[5] and (3) serving as lead agency for GIS coordination in the state. See page 8 for additional discussion of NC OneMap. Since 1977, CGIA has completed more than 500 projects with state agencies, counties, municipalities, nonprofit organizations, universities, and businesses. CGIA has extensive experience in database management, data creation, custom computer applications, analysis, reporting, custom mapping, and presentations.[6] CGIA is funded by the fees charged for the technical services it provides to other clients, such as governmental agencies,

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[3] High Speed Services for Internet Access: Status as of June 30, 2005, Industry Analysis and Technology Division, Wireless Competition Bureau, Federal Communications Commission, April 2006.

[4] The e-communities program is a grassroots community outreach effort to create local commitment and participation in bringing high-speed Internet access, technology awareness, and training to all areas of the State.

[5] *NC OneMap* is a statewide framework of geographic information that promotes the maintenance of economic vitality in our communities, public health and safety, and the quality of life for all North Carolinians.

[6] CGIA also serves as staff to the North Carolina Geographic Information Coordinating Council (GICC). The Council fosters cooperation among government agencies, universities, and the private sector.

nonprofit organizations, and the public. CGIA's role in creating and maintaining infrastructure data has been to provide clients with technical services, which has resulted in the development and management of additional infrastructure datasets in many instances. CGIA occasionally updates data layers for educational institutions to meet specific technical service project needs, establishing approximate point locations for water treatment and sewer treatment plants, and updates a dataset for landfills for the State Energy Office.

DENR's Division of Water Quality maintains information about surface water intakes, water treatment plants, and sewer treatment plants. The Division's Public Water Supply Section oversees public water systems, but it does not maintain geospatial data on the service areas and distribution systems. Further, the Division's Source Water Assessment Program creates and maintains geospatial data on public water supply sources to supplement the surface water intakes dataset. See http://www.deh.enr.state.nc.us/pws/index.htm) and (http://h2o.enr.state.nc.us/.

Department of Transportation (DOT)

DOT creates and maintains geospatial data that depict roads, bridges, railroads, rail crossings, airports, and other transportation-related features as part of its ongoing support of transportation planning, road construction, and facility management. Geospatial data are accessible at (www.ncdot.org). However, there are shortfalls in DOT's geospatial data. Specifically, bridge locations are currently represented by approximate points and a statewide dataset for roads does not include address ranges for the roads. DOT is currently analyzing the effort required to integrate, enhance, and maintain state and local road data. Additionally, GICC has developed a standard for road data to ensure consistent depiction of roads.

Department of Commerce, North Carolina Utilities Commission

The Utilities Commission regulates telecommunications, electric power, natural gas, water and sewer services, and other public utility services. Electric service territory assignment maps dating back to 1965 are maintained in hardcopy by the Commission. Additional efforts would be needed to complete a statewide map and update the service provider names associated with the 1965 territory assignments. In 2005 and 2006, CGIA provided technical assistance to ElectriCities of North Carolina, Inc. (a nonprofit organization representing municipal electric utilities) to develop geospatial representations of municipal and non-municipal boundaries for 32 counties.

Digital maps of power generation plants, statewide power distribution lines, and natural gas distribution lines (or service areas) are not available from the Utilities Commission. The only geospatial data in the public domain appears to be natural gas pipelines and electrical transmission lines which were captured from US Geological Survey (USGS) topographic maps in the 1990s. Water and sewer service areas are maintained by the Rural Center as described on pages 4 and telecommunications service geospatial data are maintained by the e-NC Authority as described on pages 3-4.

Department of Public Instruction

The Department publishes an Annual Media and Technology Report (http://tps.dpi.state.nc.us/amtr2005data/) that includes school information about Internet connectivity as reported by the schools. These data can be joined to the school locations for mapping purposes. The e-NC Authority is currently analyzing high-speed Internet connectivity by school under the BETA initiative as described on page 4. The Department also maintains information about the location of public schools statewide (www.dpi.state.nc.us). Geospatial data that depicts the approximate point location of public schools and school administration offices have been created by CGIA, but the data are updated infrequently.

Department of Administration

The Department's State Property Office (www.ncspo.org) maintains geospatial representations of the boundaries of all state properties, such as state office buildings, National Guard armories, and seaports. The

Department (www.doa.state.nc.us) also maintains a list of nonpublic schools with which CGIA has created approximate point locations for the schools. Infrastructure data are maintained on a regular basis by the State Property Office.

Department of Health and Human Services

The Department's State Center for Health Statistics (www.schs.state.nc.us/SCHS), specializes in developing, maintaining, analyzing, reporting, and mapping health statistics. The Center also has geospatial point locations for hospitals and a wide range of health care facilities across the state. The non-hospital facilities include home health care, mental health and nursing home facilities, homes for the aged, family care, hospice, ambulatory surgery, and cardiac rehabilitation. The Center updates the data annually as part of its normal operations.

Department of Crime Control and Public Safety

The Department is North Carolina's coordinating agency for homeland security and natural hazards preparedness, response, and recovery. The Department's Division of Emergency Management is, in turn, the lead agency responsible for preparing for, responding to, recovering from, and mitigating against hazards and threats. In this role, the Division, through its Geospatial and Technology Management (GTM) Office, manages a number of crisis management, hazard and threat identification, and alert applications that requires the acquisition, management, and dissemination of geospatial data. A key component to hazard/threat preparedness, response, and recovery is the acquisition and use of geospatial data—streets, political boundaries, orthophotography,[7] streams, and rivers—and other critical infrastructure data. Based on these needs, GTM manages a number of computer systems, networks, and applications that support a central geospatial database that also includes infrastructure data. Through data sharing agreements, GTM also uses county, municipal, state, and federal geospatial data. Additionally, GTM is in the process of acquiring real-time infrastructure and situational data from electric, telecommunication, and financial industries. Some of the systems and networks data are limited to agency use; however, other non-secured data are available to the public.

Department of Agriculture and Consumer Services

The Department has developed a Multi-Hazard Threat Database which it uses to protect North Carolina's $59 Billion dollar agriculture industry. The database has been used to deal with disease outbreaks in poultry and swine, quarantine and eradicate harmful plant diseases, and assist animals at risk during Hurricane Isabel. The database has also been used, in cooperation with several federal agencies, to model the potential outcome of foreign animal diseases. Further, the database has been used by the State Bureau of Investigation for security situations, such as the Wright Brothers Centennial Celebration and the 2005 US Open Golf Tournament. The database is a decision support tool that can be used to reduce threats and vulnerabilities to the State's citizenry, support state emergencies, and map and assess biological threat information. Key infrastructure data from several divisions of the Department of Health and Human Services are also integrated into the database. While the database has multiple uses and applications for the Department, other State agencies, and federal agencies, it is not accessible to the public.

North Carolina Office of Information Technology Services (ITS)

ITS provides information technology services to governmental agencies, including telecommunications, computing infrastructure, policy development, planning, and technical architecture. ITS operates the state's extensive array of data, voice and video telecommunications systems, and other services. The Office's users include state agencies, universities, community colleges, cities and counties, and public school systems. ITS also hosts and manages data and applications for other agencies; and provides shared and application services

[7] Orthophotography combines the image characteristics of an aerial photograph with the geometric qualities of a map. Thus, distortions due to relief displacement (hills, stream valleys, and buildings), camera lens, and aircraft attitude are removed so that all ground features are shown in their correct ground positions.

that meet individual agency needs. To date, the general locations of universities, community colleges, cities and counties, and public school systems are mapped in geospatial format (www.its.state.nc.us).

Office of State Budget and Management, State Data Center

The State Data Center maintains and coordinates statistical data about a wide range of topics (www.sdc.state.nc.us). Statistical topics relating to infrastructure include transportation, business and industry, and education. Data are maintained on a regular basis as part of its normal operations.

Geographic Information Coordinating Council

The Council fosters cooperation among government agencies, universities, and the private sector. It also creates policy and resolves technical issues related to North Carolina geographic information and GIS systems. The mission of the Council is to improve the quality, access, cost-effectiveness, and utility of North Carolina's geographic information and promote geographic information as a strategic resource for the State. The Council's strategic plan calls for enhanced coordination of geographic information in North Carolina through a statewide framework that encompasses federal, state, and local governments, lead regional organizations, universities, utilities, and the private sector.

We attempted to identify all State agencies and organizations that have information and databases related to North Carolina's infrastructure and include them in this study. If there are additional agencies or organizations, we believe that they should be included in future efforts to develop, manage, and disseminate infrastructure data in the State.

FINDINGS

Substantial amounts of geospatial data related to infrastructure are available among State agencies and non-profit organizations. Appendix A includes an inventory and Appendix B is a list of abstracts of the data managed by the State agencies and organizations discussed on pages 3-7. Appendix C includes examples of maps that illustrate how infrastructure datasets can be displayed in map format. While many of the datasets are complete and are used on a regular basis for economic development, education, transportation planning, environmental analysis, and other purposes, the usefulness of some datasets is limited because they are outdated, have data gaps, or are not readily accessible for public use.

While CGIA develops and maintains much of the infrastructure data, it relies on other State agencies and organizations to also develop and maintain data. In some cases these agencies and organizations reimburse CGIA for maintaining some of their databases. However, in many instances, there are delays in making the data from other agencies available to all users because of restrictions which they place on the data. Other datasets maintained by the private sector and some State agencies are proprietary, and therefore, disseminating the data to the public is limited. The proprietary nature of the data also impacts CGIA's ability to integrate the data into NC OneMap and its data distribution systems. In other instances, infrastructure datasets are not readily accessible from some sources. In particular, gaps or missing datasets in the geospatial data inventory are most apparent in the utility infrastructure. For example, there is no apparent geospatial data in the public domain that represents a full set of electric service territories, natural gas service territories, energy generation facilities, and main distribution lines for electric and gas utilities.

Two ongoing infrastructure related initiatives are directed at filling the gaps in data, making data more current, and providing online access to infrastructure information. These initiatives—NC OneMap and Interagency Leadership Team—are taking a comprehensive, long-term look at providing access to the best available infrastructure geospatial data that support public and private planning and economic decisions.

NC OneMap

NC OneMap is a statewide framework of geographic information that promotes the maintenance of economic vitality in communities, public health and safety, and the quality of life for all North Carolinians. NC OneMap was started in 2004 by an initial group of counties and municipalities (www.nconemap.net). It is currently developing more connections to local governments and looking for ways to carryout a five-year plan for full implementation. NC OneMap (1) serves the basic information requirements for decision-making in the community, statewide, and in support of national priorities, (2) provides information to support the daily business processes of numerous organizations and their functions, and (3) appears to users as a consolidated and integrated database even though it is physically distributed and maintained by a variety of data producers.

NC OneMap includes data that are current and accessible over the Internet statewide to all government agencies, utilities, private firms, schools, universities, and private citizens. Standards and procedures established by NC OneMap will ensure that data contain no unnecessary redundancies or inconsistencies and are adequately and uniformly documented. Security measures will protect confidential or restricted data on local databases. Partnerships and cooperative agreements between municipal, county, regional, state, federal agencies, utilities, and others will be in place to ensure that the geographic information infrastructure endures and continues to meet user needs. Additionally, the data available via the Internet will be free to State agencies, organizations, and the public to use and download at any time.

Complete, consistent, and current infrastructure data are essential to an effective and useful NC OneMap. Further, the "base map" layers from local, state, and federal agencies available in NC OneMap are important to users of infrastructure data. The base map is composed of "framework" geospatial data layers—rivers and streams, roads, tax parcels, geodetic control points, and aerial imagery. These datasets provide a frame of reference for infrastructure datasets such as bridges, telecommunication towers, and public water service areas. NC OneMap and current and emerging data standards from the GICC are organized around the framework data layers. Currentness of the framework datasets is essential for display of infrastructure data. The success of the NC OneMap depends, in part, on state and local servers having fast processors and adequate network bandwidth.

Interagency Leadership Team

The Interagency Leadership Team is comprised of ten State and federal agencies that are involved in transportation planning and environmental decision-making. A March 2006 report[8] by the team concluded that the transportation system is a vital part of infrastructure and should be planned hand-in-hand with economic development and the protection and enhancement of our state's cultural and natural resources. The team identified GIS and geospatial data as essential elements of a tool to support decisions with reliable, up-to-date, and complete data. Many of the geospatial data layers analyzed by the team are included in the infrastructure inventory in Appendix A. The Interagency Leadership Team proposed that:

- North Carolina establish a major, focused effort to create or update 171 GIS data layers and then maintain them on a specified basis depending on type of data.
- The CGIA, in cooperation with DOT, manage the proposed multi-year data development effort.
- The updated and maintained GIS databases are available over the Internet through NC OneMap.

Other Considerations

Ongoing efforts and initiatives to collect, manage, and provide access to infrastructure data involve, for the most part, public agencies and information in the public domain. Concerning the investments by publicly regulated

[8] "Enhancing and Managing a Shared GIS Database", Interagency Leadership Team Summary Report, March 10, 2006.

facilities in the physical infrastructure and service provision, public utilities and private service providers play a major role in the State's infrastructure. However, information about these publicly regulated facilities may be restricted by license agreements and proprietary concerns. Specifically,

- Public agencies use privately collected and licensed datasets relating to infrastructure. For example, geospatial data representing telephone and cable service areas in the e-NC Authority web map viewer are collected, processed, packaged, licensed, and sold by a private vendor. The vendors expend resources and time, and assume the risk of data development. The vendors charge fees for the data under a license agreement. E-NC uses the data for Internet mapping, but it is not allowed to distribute the data to third parties, thus limiting the public uses of the data.

- Public utilities are regulated by the North Carolina Utilities Commission to assure fair and affordable energy services as well as the viability of the utilities. The state does not require public utilities to share geospatial data with public agencies. Utilities, in the context of competition, treat geospatial data about the location of facilities as proprietary data. North Carolina has not defined a set of geospatial data for utilities that could be shared with public agencies without disclosing proprietary data. Two questions that should be considered are: (1) Could public utilities depict service territories and summary information in geospatial format that would be useful for a range of public purposes without compromising sensitive information? (2) Would public utilities be willing to make geospatial data available to state agencies in emergency situations under specific guidelines?

Communities and the private sector require complete, consistent, current, and available infrastructure data in recruiting and attracting new industry and development. Data available in a GIS is invaluable in planning and analyzing opportunities. However, the inventory of infrastructure data has shortcomings including gaps in the inventory, outdated data, and limited access to some data. Table 1 shows the costs to develop complete and up-to-date data for all infrastructure categories and to establish processes for regular maintenance, as well as, the costs to work with private organizations to develop utility infrastructure datasets for NC OneMap which is maintained by CGIA. Appendix D provides specific costs by agency and datasets.

Estimated Costs to Develop Complete, Up-to-Date Infrastructure Data

Table 1

Type of Cost	Year 1	Year 2	Year 3	Year 4	Year 5
Recurring	$ -	$ 237,000	$ 1,002,500	$ 1,781,300	$ 1,781,300
Non-Recurring	$ 294,300	$ 2,688,300	$ 1,580,300	$ 231,000	$ 231,000
Total	$ 294,300	$ 2,925,300	$ 2,582,800	$ 2,012,300	$ 2,012,300

CONCLUSIONS

As lead agency for geospatial data in North Carolina, CGIA collects, organizes, and disseminates most of the data listed in the infrastructure inventory. Further, CGIA has direct or indirect access to most of the datasets available in the public domain. Other organizations also play essential roles in creating and maintaining their respective geospatial datasets which fit into the statewide framework. That framework is now defined by the concepts and implementation of NC OneMap which is managed by CGIA in partnership with geospatial data producers and users statewide (www.nconemap.net). Because of the importance of the infrastructure data being available through State agencies and organization, it is essential that the infrastructure data developed, managed, and disseminated by State agencies and organizations be complete, up to date, and accessible to as many users as possible. Considering that billions of dollars are spent annually on North Carolina's physical infrastructure, it seems prudent for the State to also invest in a comprehensive system which maps and analyzes the State's infrastructure and supports planning and economic decisions by the public and private sector.

RECOMMENDATIONS

OSBM recommends the following definition for North Carolina's infrastructure. "North Carolina's infrastructure should consist of the essential facilities, services, and installations needed for the functioning and thriving of a community. Specifically, the infrastructure should include modern: communication and technology systems, transportation, energy, water-related services, health-related services, and public educational institutions."

OSBM recommends that the General Assembly designate CGIA through the NC OneMap as the lead agency responsible for coordinating the collection, management, and dissemination of North Carolina's infrastructure data. If the General Assembly designates CGIA as the lead agency for coordinating the data collection about North Carolina's infrastructure, OSBM recommends that CGIA work with other State agencies, organizations, and the private sector in identifying and completing their infrastructure datasets, ensuring all infrastructure datasets are maintained on a regular basis, and making the data available to all State agencies, organizations, and the public. It is further recommended that CGIA maintain a database of key contacts for the affected State agencies, organizations, the private sector, and the public to assist them in gaining quick access to North Carolina's infrastructure data. While estimated costs have been developed, a more detailed technical analysis to include equipment and bandwidth needs, project plan, and business case needs to be developed. Because of the additional responsibilities which CGIA and other State agencies and organizations will assume, the General Assembly should appropriate sufficient resources to allow these agencies to develop complete, up to date, and readily available infrastructure data.

ACKNOWLEDGEMENTS

OSBM wishes to express its appreciation to the Center for Geographic Information and Analysis, The Rural Center, the Office of Information Technology Services, the e-NC Authority, the Business and Education Technology Alliance, and the other State agencies and organizations which provided infrastructure information and their cooperation during this study.

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APPENDIX A
Inventory of Geospatial Data Representing Infrastructure

Title	Last Major Update	Source Agency	ILT *
Activated Cable Franchise Areas	2003	e-NC Authority	
Airports	2004	CGIA	Yes
Area Code Boundaries (telephone services)	2003	e-NC Authority	
Bridge Point Locations	2004	DOT-Bridge Maintenance	Yes
Cable Modem Service Areas (high speed Internet)	2003	e-NC Authority	
CLLI Central Offices (Telephone services)	2006	e-NC Authority	
Community College Locations	10/16/2001	CGIA	Yes
Dams (restricted use)	2002	DENR-Land Resources	
DSL Service Areas (high speed Internet)	2006	e-NC Authority	
Hospital Locations	06/01/2001	DHHS-State Center for Health Statistics	Yes
Independent (Private) Colleges and Universities	07/10/2003	CGIA	Yes
Landfills (solid waste facilities)	2004	DENR-Waste Management/CGIA	Yes
LATA Regions (Telephone services)	2003	e-NC Authority	
National Pollutant Discharge Elimination System Sites - Major	03/31/2006	DENR-Water Quality	Yes
National Pollutant Discharge Elimination System Sites - Minor	03/31/2006	DENR-Water Quality	Yes
Other Medical Facilities	06/01/2001	DHHS-State Center for Health Statistics	
Public Internet Access Sites	2004	e-NC Authority	
Public Libraries	03/25/2003	CGIA	Yes
Public Water Supply Water Sources	03/02/2004	DENR-Environmental Health	Yes
Sanitary Sewer Systems - Service Areas	2006	Rural Center/CGIA	Yes
Schools - Non-Public	06/18/2004	CGIA	Yes
Schools - Public	11/12/2004	CGIA	Yes
State Owned Complexes	03/13/2006	DOA-State Property Office	Yes
Stormwater Systems Service Areas	2006	Rural Center,/CGIA	Yes
Surface Water Intakes	08/06/2004	DENR-Water Quality	Yes
TowerMap Towers (cellular phone transmission)	2003	e-NC Authority	
Transportation - Interstate Highways	2004	DOT	Yes
Transportation - Primary Roads	2004	DOT	Yes
Transportation - Secondary Roads	2004	DOT	Yes
Transportation - Local Roads	2004	DOT	Yes
Transportation - Pipe and Transmission Lines (1:24,000)	12/1998	US Geological Survey	Yes
Transportation - Railroads (1:24,000)	11/19/2003	US Geological Survey and DOT-Rail	Yes

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Inventory of Geospatial Data Representing Infrastructure

Title	Last Major Update	Source Agency	ILT *
Transportation - Railroad Grade Crossing (1:24,000)	03/01/1997	DOT-Rail	Yes
TV Stations	2003	e-NC Authority	
University Points	03/15/2006	CGIA/State Property Office	Yes
University Boundaries	03/15/2006	CGIA/State Property Office	Yes
Water Distribution Systems - Service Areas	2006	Rural Center/CGIA	Yes
Wire Center Boundaries	2005	e-NC Authority	
Wireless Tower Service Areas	2006	e-NC Authority	
Wireless Towers	2006	e-NC Authority	
* Interagency Leadership Team report; datasets with "Yes" were included in this report			

APPENDIX B
Abstracts of Infrastructure Geospatial Datasets

State agencies and non-profit organizations in North Carolina have created numerous geospatial data relating to infrastructure. The datasets available for use in a GIS for mapping and analysis are listed with an abstract for each.

Title: Activated Cable Franchise Areas
Publication Date: 200312
Abstract: The e-NC Authority leases the commercial MediaPrints Cable database from MapInfo. This dataset represents the known Cable Franchise Areas that are currently active in North Carolina.

Title: Airports in North Carolina Represented by Points Integrated from State and Federal Sources, 2003
Publication Date: 20040316
Abstract: NC Center for Geographic Information and Analysis (CGIA) developed a GIS dataset representing point locations for airports located in North Carolina.

Title: Area Code Boundaries
Publication Date: 200303
Abstract: This GIS layer contains telephone area code boundaries. It was created from the ExchangeInfo Plus Wire Centers. Area Code was dissolved to create this layer.

Title: Blue Ridge Parkway
Publication Date: 2001
Abstract: CGIA extracted this GIS layer from the 2001 NC DOT HPMS / National Highway System File.

Title: Bridge Point Locations in North Carolina for Bridges Maintained by NC DOT
Publication Date: 20040625
Abstract: CGIA developed this set of point locations forbridges maintained by the NC Department of Transportation. Data from multiple sources were integrated to produce the best approximation of North Carolina's bridge inventory. This theme does not include culverts and other structures maintained by NC DOT.

Title: Cable Modem Service Areas
Publication Date: 200312
Abstract: The e-NC Authority leases the commercial MediaPrints Cable database from MapInfo. This dataset is a subset of only the Cable Franchise Areas that are currently offering Cable-modem Internet Access. Where available, Current Cable Service Provider exports from e-NC Authority's Service Provider Update (SPU) database have been joined to this cable information on the unique ICA_ID field.

Title: CLLI Central Offices
Publication Date: Provider Info exported nightly from e-NC Authority's SPU database.
Abstract: This GIS layer is created from information contained in e-NC's Service Provider Update (SPU) Database, combined with information from the commercial ExchangeInfo Plus Telecom database. The CLLI Codes, Locality name, and the coordinate locations for these Central Offices are from the ExchangeInfo Plus release for NC. The remaining attributes are from e-NC's Service Provider Update (SPU) database. Telecom service providers that participate in the SPU program enter information into the database about the services they offer through each of these Central Offices. Selected database fields are exported from SPU on a nightly basis to this mapping application and joined to an ESRI format shapfile (from ExchangeInfo Plus) containing the Central Office point locations. The join is performed using the CLLI Code attribute.

APPENDIX B
Abstracts of Infrastructure Geospatial Datasets

Title: Community College Locations
Publication Date: 20011016
Abstract: CGIA developed the digital Community College Locations data from addresses provided by the NC Community College System. This file enables users to identify community college locations.

Title: Dams Registered by the Dam Safety Program
Publication Date: 20021004
Abstract: The Dam Safety Program in the Division of Land Resources of the North Carolina Department of Environment and Natural Resources, in cooperation with CGIA, developed the digital data for dam locations. More than 4,700 registered dams are represented by point locations and numerous attributes describing the features of each dam, impoundment features, hazard ratings, ownership, contact information, and inspection results. CGIA verified and edited point locations for more than half of the dams. Subsequently, the Dam Safety Program developed an update (2005) that has restricted availability.

Title: DSL Service Areas
Publication Date: Provider Info exported nightly from e-NC Authority's SPU database.
Abstract: This GIS layer is created from information contained in e-NC's Service Provier Update (SPU) Database, combined with information from the commercial ExchangeInfo Plus Telecom database. The CLLI Codes and the coordinate locations of the polygon centroid for these Wire Center Service Areas are from the ExchangeInfo Plus database. The remaining attributes are from e-NC's Service Provider Update (SPU) database. Telecom service providers that participate in the SPU program enter information into the database about DSL services they offer through each of these Wire Center Service Areas. This layer contains only the subset of Wire Center Boundaries where DSL internet service is offered. Selected database fields are exported from SPU on a nightly basis to this mapping application and joined to an ESRI format shapfile (from ExchangeInfo Plus) containing the Wire Center Service Areas Boundaries (polygons). The join is performed using the CLLI Code attribute.

Title: Hospital Locations
Publication Date: 20010601
Abstract: NC Center for Geographic Information and Analysis developed the digital Hospital Locations data from hospital addresses provided by the State Center for Health Statistics. This file enables users to identify hospital locations.

Title: Independent (Private) Colleges and Universities
Publication Date: 20030710
Abstract: CGIA developed the digital NC Independent Colleges and Universities data from addresses provided by the State Library of North Carolina on 7/08/03. This file enables users to identify independent college and university locations.

Title: Landfills (Solid Waste Facilities)
Publication Date: 20041104
Abstract: The North Carolina State Energy Office in the Department of Administration supported CGIA to develop a point layer of landfill locations in North Carolina, based on the inventory prepared by the US EPA Landfill Methane Outreach Program. This set of Landfill Methane Outreach Program (LMOP) Landfill Sites represent sites with methane gas generation potential. Methane gas is a byproduct of solid waste decomposition in landfills. The file identifies landfills in North Carolina from the LMOP Landfill Project, verified using information provided by the Division of Waste Management, NC Department of Environment and Natural Resources.

APPENDIX B
Abstracts of Infrastructure Geospatial Datasets

Title: LATA Regions
Publication Date: 2003
Abstract: This GIS layer contains the LATA region boundaries for NC. This layer was created by using the ExchangeInfo Plus Wire Center Boundaries and manually assigning attributes for LATA regions based upon a paper BellSouth LATA & Area Code map.

Title: National Pollutant Discharge Elimination System Sites Point Locations (Major and Minor), North Carolina, Division of Water Quality
Publication Date: 20041022
Abstract: The North Carolina Department of Environment and Natural Resources, Division of Water Quality, Planning Branch collaborated with CGIA to develop the GIS dataset, National Pollutant Discharge Elimination System Sites (NPDES), to enhance planning, siting, and impact analysis in areas which are directly affected by these sites. The file identifies outfall locations for individual NPDES permitted wastewater discharges to surface waters in North Carolina.

Title: Other Medical Facilities
Publication Date: 200303
Abstract: The North Carolina State Center for Health Statistics in cooperation with the Division of Facility Services in the Department of Health and Human Services, developed the GIS data set, Medical Facility Point Locations, to identify locations of health and medical facilities (other than hospitals) for the entire State of North Carolina. Point locations were geocoded from the facilities database provided by the Division of Facility Services.

Title: Public Internet Access Sites
Publication Date: 200401
Abstract: This GIS layer contains Public Internet Access Sites, the majority of which are public libraries. It was created by CGIA from two sources of information. The first source is addresses of public libraries provided by the State Library of North Carolina on 3/20/03. The second source is addresses of other Public Internet Access Sites provided by the e-NC Authority. Both sets of addresses were geocoded in Arcview using the GDT digital street network. In cases where addresses could not be geocoded properly, www.mapquest.com was used to determine an approximate location and the sites were manually located based upon the mapquest information. This data layer of combined public access sites enables users to identify Public Internet Access Site locations across the entire extent of North Carolina. As the e-NC Authority acquires updated information about new Public Internet Access Sites, those locations will be added to this data layer.

Title: Public Libraries
Publication Date: 20030325
Abstract: CGIA developed the digital Public Libraries data from addresses provided by the State Library of North Carolina on 3/20/03. This file enables users to identify public library locations.

Title: Public Water Supply Water Sources (Including Wells and Surface Water Sources)
Publication Date: 20040302
Abstract: The North Carolina Department of Environment and Natural Resources, Division of Environmental Health, Public Water Supply Section, in cooperation with CGIA, has developed the geographic data to provide accurate location of public water supply system sources in North Carolina.

Title: Sanitary Sewer Systems - Service Areas
Publication Date: 2006
Abstract: The NC Rural Economic Development Center, Inc., in conjunction with AMEC, developed the digital Sewer Systems as mapped by individual system owners as required by contract. The data collected will facilitate planning, siting and impact analysis in the 70 individual counties of

North Carolina. This file enables the user to make various county-level determinations when used in conjunction with other data layers. This dataset contains information on type sewer systems which are existing community sanitary sewer systems which serve the general public accept domestic wastewater and are generally considered large systems. Data includes information on: system ID, system name, owners ID, parts of system, total number of parts, year of construction, description of the service area, number of residential customers, number of non-residential customers, number of bulk purchasers, maximum daily flow, average daily flow, average monthly charge for residential customers, average monthly charge for non-residential customers, average monthly charge for bulk purchase customers, average monthly usage for residential customers, average monthly usage for non-residential customers, average monthly usage for bulk purchase customers, basin transfer, current conditions/problems, engineers recommendations, estimate to implement recommendations, expansion of service area, projected maximum daily flow for year, projected maximum daily flow for year 2030, indebtedness, bond rating, and cash reserves. Older data exist with sewer lines and other appurtenances.

Title: Schools - Non-Public
Publication Date: 20040618
Abstract: CGIA developed the digital Non-Public Schools data from addresses provided by the NC Department of Administration, Division of Non-Public Education on 5/07/03. This file enables users to identify non-public school locations.

Title: Schools - Public
Publication Date: 20041112
Abstract: CGIA developed this set of point locations for public schools in North Carolina as part of a project for the NC Division of Emergency Management. School data serves multiple purposes, but foremost for this project, public schools are vital facilities in terms of emergency management. Many schools serve as shelters and all are critical to hazard vulnerability planning and emergency response. CGIA used two methods to generate point locations for public schools. First, CGIA used a road network from GDT, Inc. with ArcView GIS to geocode the addresses. This process matched 60 percent of the schools with a point on the road network. Point locations are approximate, based on an interpolation of street numbers along street segments. Second, CGIA worked with the NC Department of Public Instruction to use the Transportation Information Management System (TIMS) along with geographic layers from the NC Corporate Geographic Database to determine school locations. Many of these point locations are coincident with the center of school buildings on digital imagery or along driveways and may be more accurate than points located using the first method.

Title: State-Owned Complexes
Publication Date: 20060313
Abstract: The North Carolina Department of Administration, State Property Office, in cooperation with the NC Center for Geographic Information and Analysis, developed the GIS data set, State-owned Complexes, to define the exterior boundaries of state-owned complexes in North Carolina; examples include DOT maintenance yards, state parks, correctional facilities, and state universities.

Title: Stormwater Systems Service Areas
Publication Date: 2006.
Abstract: Service areas for local government stormwater management systems published by the NC Rural Economic Development Center as part of the Water 2030 project.

Title: Surface Water Intakes
Publication Date: 20040806
Abstract: The North Carolina Department of Environment, Health, and Natural Resources, Division of Water Quality, in cooperation with CGIA, developed the GIS dataset for Surface Water Intakes to enhance planning, siting and impact analysis in areas directly affecting water supply intakes

in North Carolina. The file enables users to identify point locations where communities draw raw water from a lake, river, or stream; treat it; and distribute treated water to residences and businesses in North Carolina. The original locations were developed by the DEHNR-Div of Environmental Health, Public Water Supply Branch in April of 1990. Locations have been altered, added and deleted by the Division of Water Quality who updates this file in accordance with the Water Supply Watersheds file.

Title: TowerMap Towers
Publication Date: 200309
Abstract: The e-NC Authority leases this commercial GIS data layer from TowerMaps. The towers are used for telecommunications.

Title: Transportation - Interstate Highways from NC DOT Roads, 2004
Publication Date: 20040202
Abstract: NC Department of Transportation developed the digital roads data to enable users to display and analyze primary, secondary and local routes. These data are statewide Interstate Highways.

Title: Transportation - Primary Roads from NC DOT Roads, 2004
Publication Date: 20040202
Abstract: NC Department of Transportation developed the digital roads data to enable users to display and analyze primary, secondary and local routes. These data are statewide Primary Roads consisting of US Routes, and NC Routes.

Title: Transportation - Secondary Roads from NC DOT Roads, 2004
Publication Date: 20040202
Abstract: NC Department of Transportation developed the digital roads data to enable users to display and analyze primary, secondary and local routes. These data are statewide Secondary Roads.

Title: Transportation - Local Roads from NC DOT Roads, 2004
Publication Date: 20040202
Abstract: NC Department of Transportation developed the digital roads data to enable users to display and analyze primary, secondary and local routes. These data are statewide Local Roads consisting of city streets, the Blue Ridge Parkway, and other public roads not primary or secondary.

Title: Transportation – Pipe and Transmission Lines (1:24,000)
Publication Date: 1998
Abstract: The US Geological Survey-National Mapping Division created the 1:24,000-scale Pipe and Transmission data for their published maps. CGIA developed the NC statewide Transportation-Pipe and Transmission Lines (1:24,000) digital data as a base layer showing pipe and transmission lines. This data was compiled directly from the DLGs. Apparent inconsistencies in specific areas may be due to different compilation dates of the source maps.

Title: Transportation - Railroads (1:24,000/1:100,000)
Publication Date: 1987
Abstract: The US Geological Survey-National Mapping Division created the 1:100,000-scale Railroads data from their published maps. The 1:24,000 scale railroads were derived from USGS's DLG (Digital Line Graph) Program. CGIA combined these two data sources to develop the NC statewide Transportation-Railroads digital data as a base layer showing railroad features. 1:24,000-scale data were used when duplicate tracks existed from both sources.

Title: Transportation - Railroad Grade Crossing (1:24,000)
Publication Date: 19970301
Abstract: The North Carolina Department of Transportation (NC DOT), Traffic Engineering and Safety Systems Branch in cooperation with the NC DOT GIS and Mapping Branch developed this GIS data set, Railroad Grade Crossing 1:24,000, to enhance planning, sitting and impact analysis in

areas directly affecting railroad crossing safety in North Carolina. These files enable users to identify areas which have high volumes of train traffic.

Title: TV Stations
Publication Date: 200307
Abstract: This GIS layer was originally created in 2001 by a contractor for e-NC Authority. Original source of information and collection methodology details were not provided. An Excel spreadsheet containing records and Latitude/Longitude values was used to create an ESRI format shapefile. In July 2003, duplicate stations, records with no Latitude/Longitude, and TV stations far outside of North Carolina were manually weeded out of the file by CGIA.

Title: University Boundaries
Publication Date: 20060315
Abstract: The North Carolina Department of Administration, State Property Office, in cooperation with CGIA, developed the GIS data set, State-owned Complexes, to define the exterior boundaries of state-owned complexes in North Carolina. CGIA extracted a subset of universities polygons from the statewide state-owned complex layer.

Title: University Points
Publication Date: 20060315
Abstract: The North Carolina Department of Administration, State Property Office, in cooperation with CGIA, developed the GIS data set, State-owned Complexes, to define the exterior boundaries of state-owned complexes in North Carolina. CGIA extracted a subset of universities points from the statewide state-owned complex layer.

Title: Water Distribution Systems - Service Areas
Publication Date: 2006
Abstract: The NC Rural Economic Development Center, Inc., in conjunction with AMEC, developed the digital Water Systems as mapped by individual system owners as required by contract. The data collected will facilitate planning, siting and impact analysis in the 70 individual counties of North Carolina. This file enables the user to make various county-level determinations when used in conjunction with other data layers. This dataset contains information on water intakes, including: data about customers, flows, projected flows, problems, recommendations, system description, costs, owner information and financial information. Older datasets exist with water lines and other appurtenances.

Title: Wire Center Boundaries
Publication Date: Provider Info exported nightly from eNC Authority's SPU DB.
Abstract: This GIS layer is created from information contained in e-NC's Service Provider Update (SPU) Database, combined with information from the commercial ExchangeInfo Plus Telecom database. The CLLI Codes and the coordinate locations of the polygon centroid for these Wire Center Service Areas are from the ExchangeInfo Plus DB. The remaining attributes (when provided) are from e-NC's SPU database. Telecom service providers that participate in the SPU program enter information into the database about the services they offer through each of these Wire Center Service Areas. Selected database fields are exported from SPU on a nightly basis to this mapping application and joined to an ESRI format shapfile (from ExchangeInfo Plus) containing the Wire Center Service Areas Boundaries (polygons). The join is performed using the CLLI Code attribute.

Title: Wireless Tower Service Areas
Publication Date: Exported from e-NC's SPU database nightly.
Abstract: This GIS layer contains circular buffers around the Wireless Towers locations - representing their service radius, in miles.

APPENDIX B
Abstracts of Infrastructure Geospatial Datasets

Title: Wireless Towers
Publication Date: Exported from e-NC's SPU database nightly.
Abstract: This GIS layer is created from information contained in e-NC's Service Provider Update (SPU) Database. Wireless service providers who cooperate with e-NC enter information about their wireless services and the towers their antenna are located on. They also provide the Latitude/Longitude coordinates of the tower location. These towers may be owned by the service provider, or they may lease space on a commercially available tower. If they lease space on a tower that is included in the commercial TowerMaps Wireless Antenna Facility Location database, then these coordinates are used and the TowerMaps tower is identified. If the tower in question is not included in the TowerMaps data, then approximate Latitude/Longitude coordinates are provided. In addition to information from the TowerMaps database (if applicable), selected SPU database fields and the spatial coordinates are exported on a nightly basis to this mapping application. An ESRI format shapefile is generated from this tabular data.

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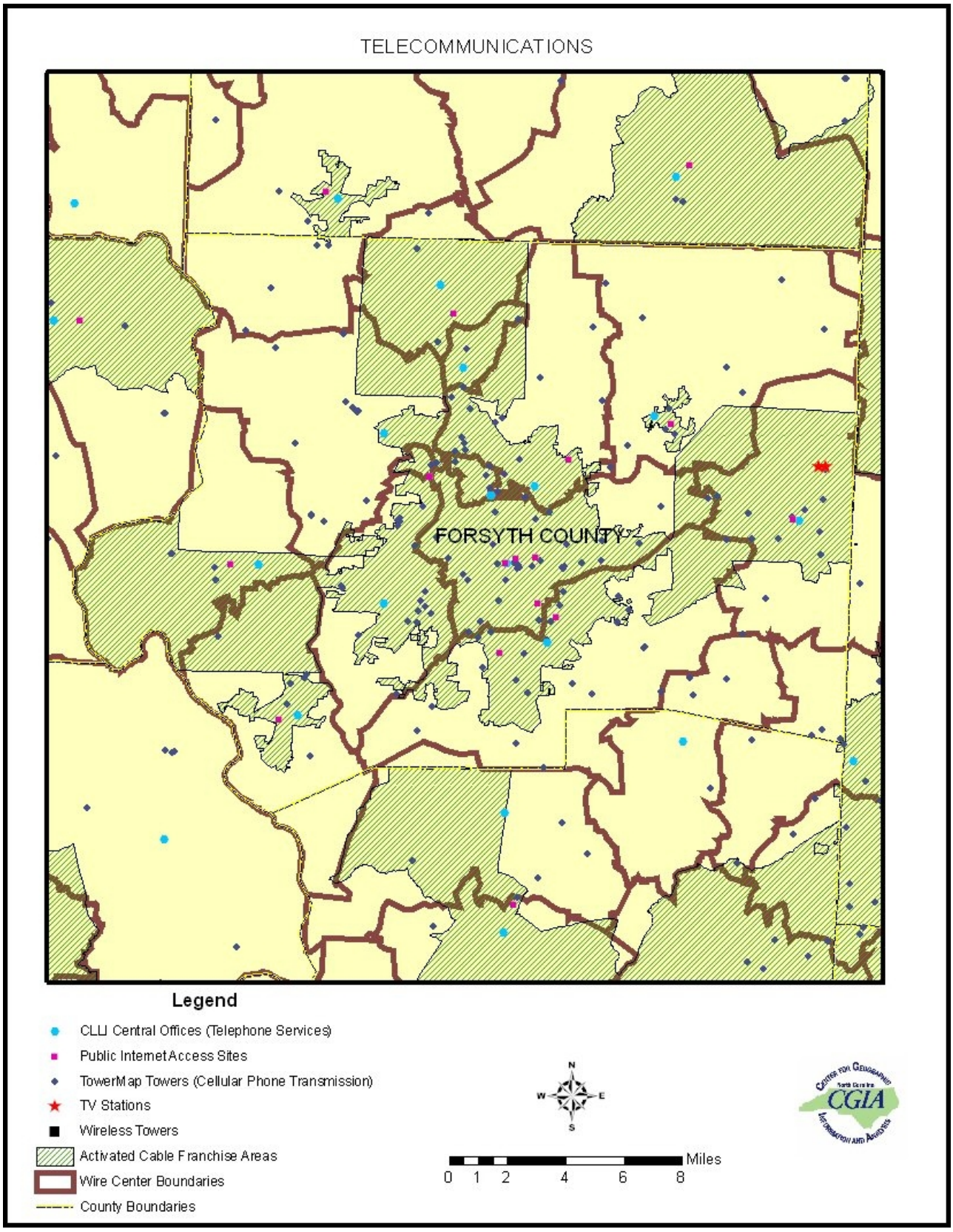
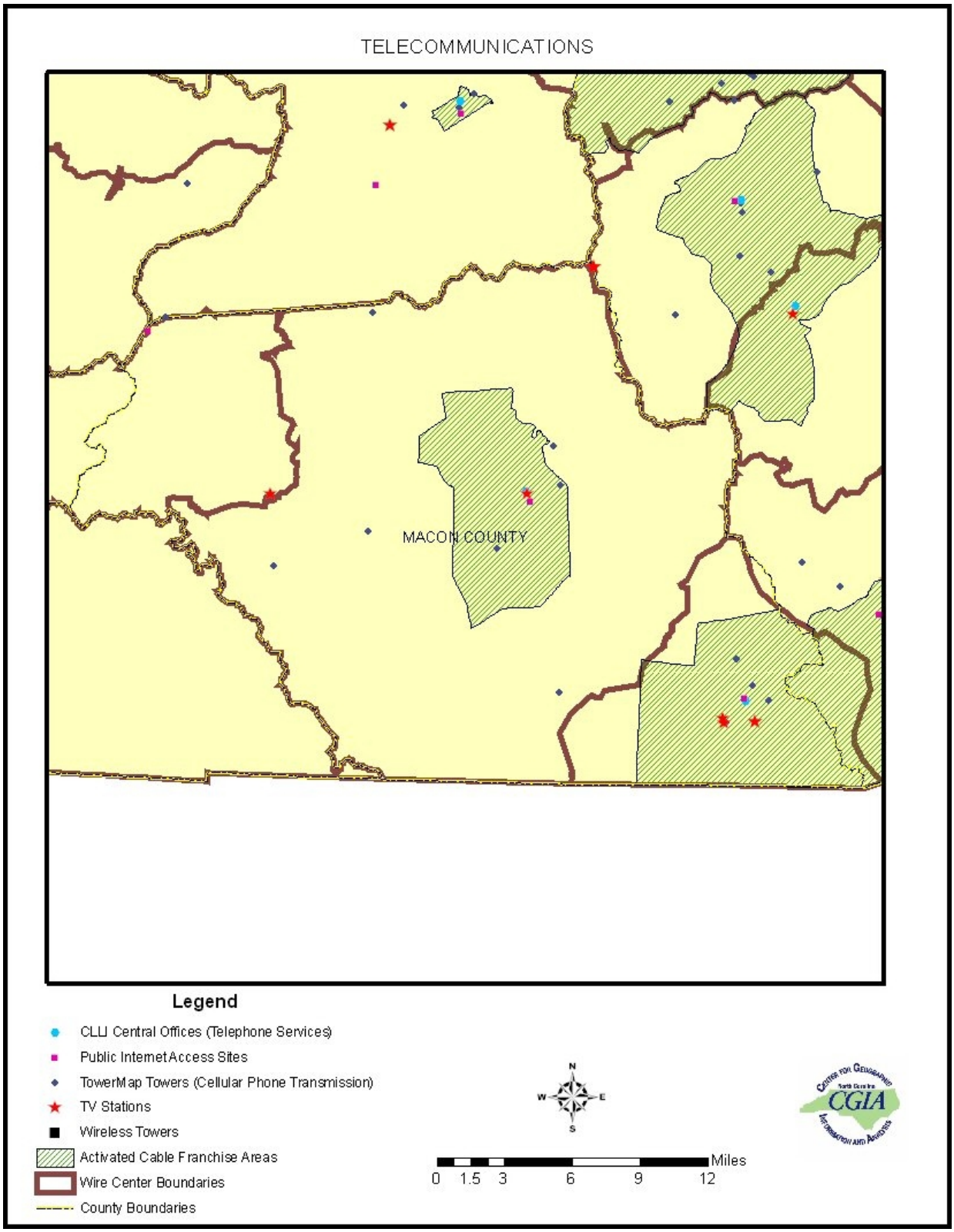
APPENDIX C
Maps of Infrastructure Geospatial Datasets



Source: Center for Geographic Information and Analysis based on data collected by e-NC Authority

APPENDIX C
Maps of Infrastructure Geospatial Datasets



Source: Center for Geographic Information and Analysis based on data collected by e-NC Authority

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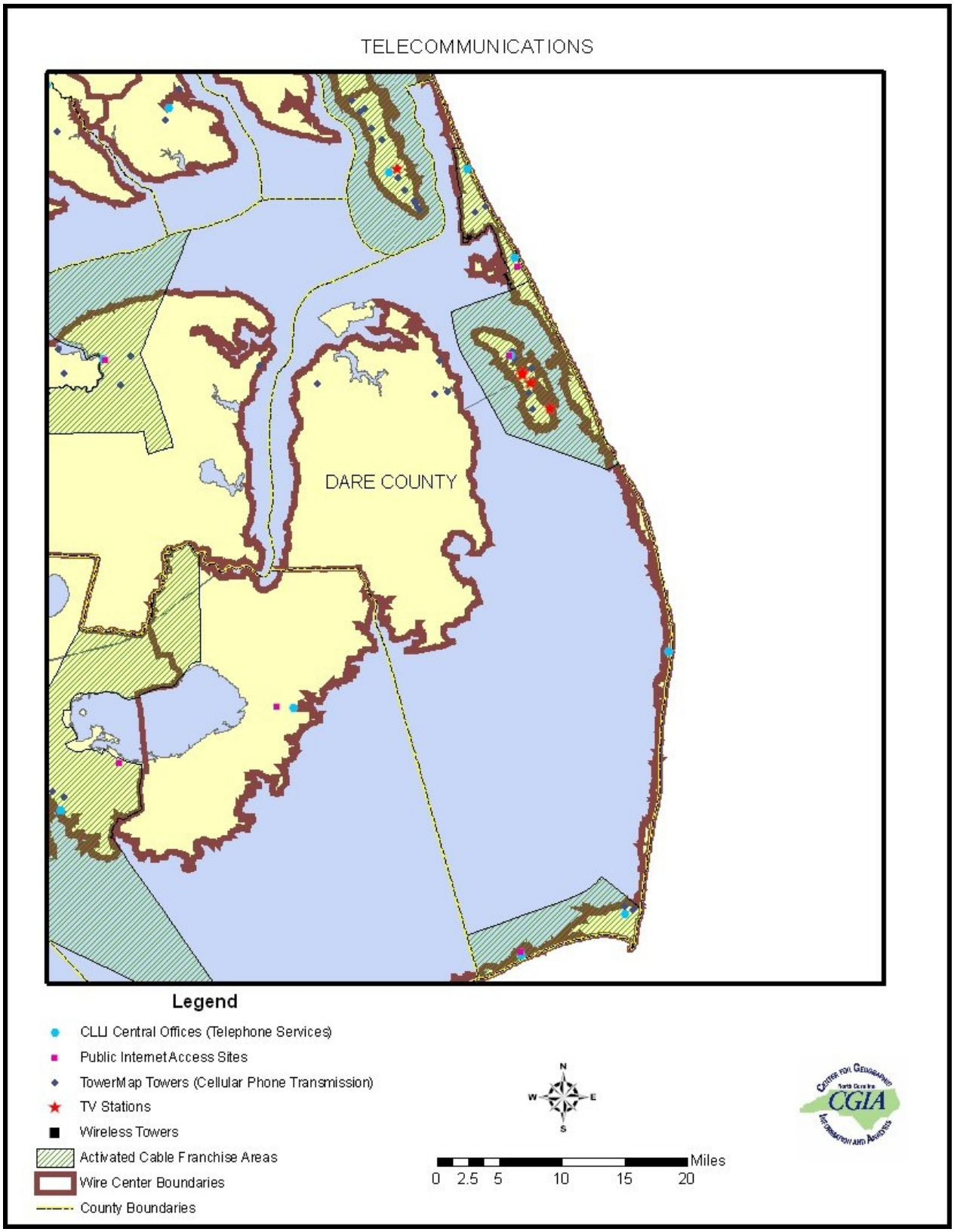
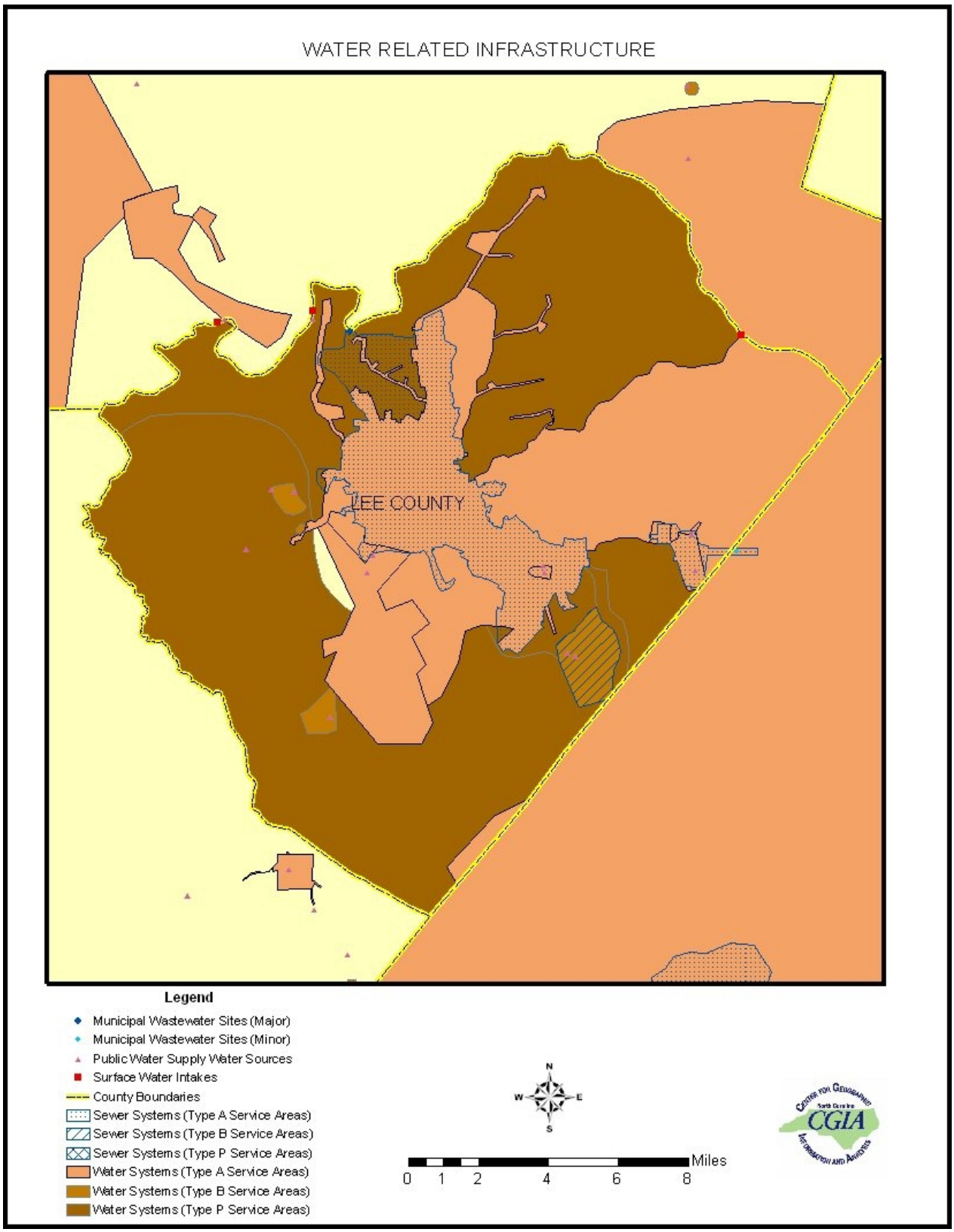
Maps of Infrastructure Geospatial Datasets



Source: Center for Geographic Information and Analysis based on data collected by e-NC Authority

APPENDIX C
Maps of Infrastructure Geospatial Datasets



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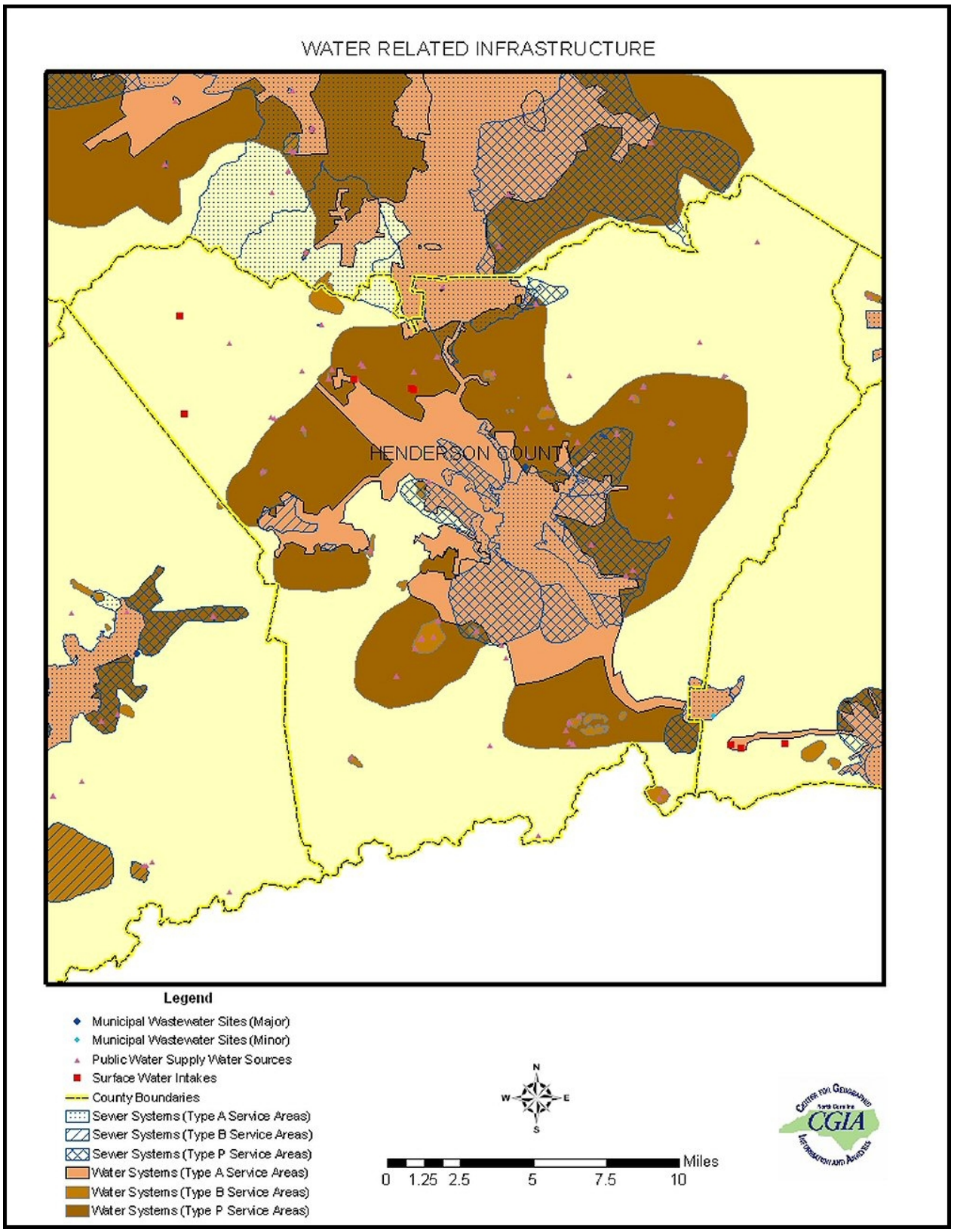
APPENDIX C
Maps of Infrastructure Geospatial Datasets



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APPENDIX C
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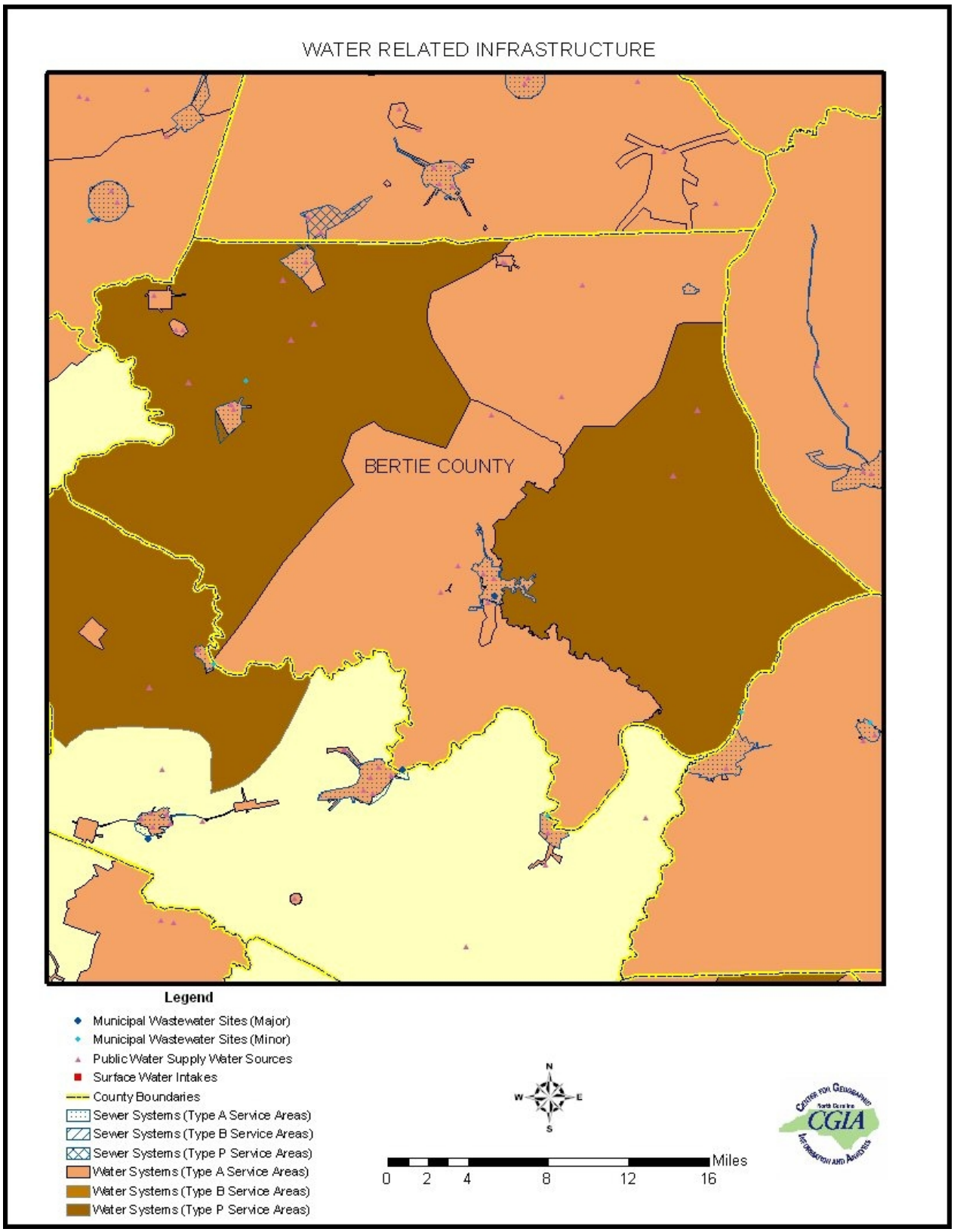

Source: Center for Geographic Information and Analysis based on data collected by e-NC Authority

APPENDIX D

Estimated Costs to Develop Complete, Up-to-Date Infrastructure Data

Department/GIS Data Layer	Year 1		Year 2		Year 3		Year 4		Year 5	
	Recurring	Non-Recur.	Recurring	Non-Recur.	Recurring	Non-Recur.	Recurring	Non-Recur.	Recurring	Non-Recur.
Department of Environment and Natural Resources										
Landfills (solid waste facilities)		$ 2,500		$ 1,800		$ 1,800	$ 1,800		$ 1,800	
National Pollutant Discharge Elimination System Sites		$ 1,000		$ 1,000		$ 1,000	$ 1,000		$ 1,000	
Surface Water Intakes		$ 800		$ 800		$ 800	$ 800		$ 800	
Sanitary Sewer Systems - Service Areas				$ 338,000	$ 270,000		$ 270,000		$ 270,000	
Sanitary Sewer Systems - Pipes				$ 496,000		$ 496,000	$ 359,000		$ 359,000	
Stormwater Systems Service Areas			$ 237,000		$ 237,000		$ 237,000		$ 237,000	
Water Distribution Systems - Service Areas				$ 432,000	$ 347,000		$ 347,000		$ 347,000	
Water Distribution Systems - Pipes				$ 838,500		$ 838,500	$ 405,000		$ 405,000	
Educational Institutions		$ 8,000		$ 8,000		$ 8,000	$ 8,000		$ 8,000	
Subtotal		$ 12,300	$ 237,000	$ 2,116,100	$ 854,000	$ 1,346,100	$ 1,629,600	$ -	$ 1,629,600	$ -
Department of Transportation										
Bridges - Point Locations		$ 20,000		$ 3,200		$ 3,200	$ 3,200		$ 3,200	
Transportation - System/Non-System Road Linework				$ 329,000	$ 148,000		$ 148,000		$ 148,000	
Transportation - Railroads and Grade Crossings		$ 8,500		$ 500	$ 500		$ 500		$ 500	
Subtotal		$ 28,500	$ -	$ 332,700	$ 148,500	$ 3,200	$ 151,700	$ -	$ 151,700	$ -
Other State Agencies										
Electric and natural gas service areas, pipes, transmission lines		$ 125,000		$ 14,500		$ 6,000		$ 6,000		$ 6,000
Project Management by DENR-CGIA		$ 25,000		$ 125,000		$ 125,000		$ 125,000		$ 125,000
Subtotal		$ 150,000	$ -	$ 139,500	$ -	$ 131,000	$ -	$ 131,000	$ -	$ 131,000
Total State Cost by Year		**$ 190,800**	**$ 237,000**	**$ 2,588,300**	**$ 1,002,500**	**$ 1,480,300**	**$ 1,781,300**	**$ 131,000**	**$ 1,781,300**	**$ 131,000**
Other Organizations										
e-NC Authority - Telecommunications Infrastructure		$ 103,500		$ 100,000		$ 100,000		$ 100,000		$ 100,000
Subtotal		$ 103,500	$ -	$ 100,000	$ -	$ 100,000	$ -	$ 100,000	$ -	$ 100,000
Total Cost by Year (State and Other Organizations)	**$ -**	**$ 294,300**	**$ 237,000**	**$ 2,688,300**	**$ 1,002,500**	**$ 1,580,300**	**$ 1,781,300**	**$ 231,000**	**$ 1,781,300**	**$ 231,000**