Final

**GIS NEEDS ASSESSMENT
FOR THE
STATE OF SOUTH CAROLINA**

Submitted to:

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SECTION 1

SECTION 1
INTRODUCTION

The State of South Carolina is seeking to build on its successful history of Geographic Information System (GIS) use to improve the coordination of GIS initiatives and expand the effective application of GIS technology statewide. GIS is considered to be one major piece of an overall information architecture, important in addressing the missions and program needs for a wide range of organizations in South Carolina's public and private sectors. Government and private organizations in the State have shown the power and opportunities that GIS technology offers for over 10 years. The needs assessment documented in this report will help establish a foundation for successful and rewarding deployment and coordination of GIS in the future.

1.1.   PURPOSE OF NEEDS ASSESSMENT

As part of its mission of GIS coordination and promotion, the State's Standing Committee on Geographic Information (CGI), a formal body of the Information Resource Council (IRC), has commissioned a *GIS Needs Assessment* and *Strategic Planning* effort. CGI contracted with PlanGraphics, Inc., an independent GIS consulting firm, to conduct the statewide GIS needs assessment and to work with CGI to prepare a GIS strategic plan. The project is being administered by the State's Geodetic Survey. To oversee and manage the review and completion of the *Needs Assessment*, CGI assigned a project review team which includes representatives from the Geodetic Survey, Department of Commerce, Department of Natural Resources, University of South Carolina, and the City of Greenville. PlanGraphics has gathered information from a large number of stakeholder organizations in the State in preparation of this *Needs Assessment*. This report documents the results of the *GIS Needs Assessment* and serves as a reference source for the current status of GIS in the State and the specific program needs of key user organizations. The report also provides a foundation for preparation of the *GIS Strategic Plan* which will be undertaken after completion of the *Needs Assessment*.

This *Needs Assessment* is based on a clear definition of the missions and program needs of stakeholder organizations that impact the collection, use, analysis, and distribution of maps and geographic information. GIS needs are defined within the context of:

• **System resources,** including hardware, software, and networks	

• **Geographic data** and its ongoing maintenance and distribution	
• **Institutional requirements** encompassing the people, organizational structures, organizational roles and responsibilities, and GIS management, policies, and procedures.	

1.2.   PUTTING "GIS" IN CONTEXT

The term "geographic information system" (GIS) means different things to different people. For the purposes of this needs assessment and the long-term statewide coordination, "GIS" is used in a broad sense. GIS encompasses the data, the computer systems, and the applications used for mapping and all types of geographic query and analysis. Several key concepts elaborate this broad definition:

- GIS encompasses all data that is, in some way, geographically related. This includes data traditionally portrayed on maps, earth image data, tabular data (in a non-map database) that is associated with map feature or location, and document images that are related to a geographic feature or location

- Software that is considered part of a GIS includes not only traditional "GIS software packages" but database management software used to manage geographic data, image processing software, special GIS application packages, and other software applications (e.g., document management, modeling packages, property appraisal packages) that may be integrated with core GIS databases

- For GIS to be fully effective and to deliver wide-ranging benefits, it should be considered a core information technology that is one major part of an overall enterprise information architecture.

Figure 1-1: Elements of a GIS
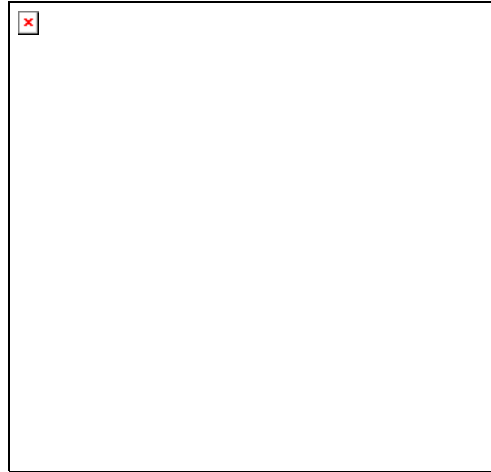
1.3.   ORGANIZATIONAL AND GIS USER ENVIRONMENT

1.3.1.   State GIS User Community and Stakeholders

CGI's vision for GIS is statewide and includes a broad spectrum of user organizations that have a "stake" in the future of GIS development and coordination. The roles that these stakeholders play may include:

- **Generators of GIS data** such as government agencies that develop data in-house or through contracts, and database development companies that work for government agencies through contracts. Other private companies obtain existing data and produce "value-added" products for sale.

- **Data distributors,** including government agencies or private companies that have formal procedures for distributing or selling GIS data to users by electronic or physical means.

- **Providers of the systems** that drive GIS such as vendors of computer hardware, network components, and software; consultants; or custom software developers.

- **Users of GIS technology** including personnel in government and private organizations that use GIS technology and data in their jobs or to support decision making.. This group includes technicians, office personnel, field workers, scientists, managers who may access GIS directly as well as senior decision makers and elected officials that may use products (e.g. maps, reports) generated with GIS technology. GIS users are expanding to include the general public as capabilities to access GIS via the Internet are becoming available.

- **Educators and trainers** at universities, technical schools, professional associations, and private companies that provide education about GIS concepts and use, or specific training on GIS management, software, and system administration.

This *Needs Assessment* involved examining the needs of a wide range of stakeholder organizations, including those listed in Table 1-1. Stakeholders include organizations that are grouped according to the categories listed below:

- Federal Government
- State Government Agencies
- Councils of Government
- Local Governments (Municipalities and Counties)
- Elected Officials at the local and state level
- Public and Private Utilities (gas, electric, water, sewer, telecommunications)
- Universities and Educational Institutions
- Professional Associations and Not-for-Profit Organizations

- Private Companies
- General Public.

Information collection for this study concentrated on State Government, Councils of Government, Local Government, and Universities but other stakeholder groups have been taken into account in the assessment of needs. Table 1-1 lists the organizations that have provided information for this project.

Table 1-1: Project Participants

State Agencies	Private Utilities
Adjutant General's Office-Emergency Preparedness Division	Laurens Electric
Department of Agriculture	South Carolina Electric and Gas
Office of Appellate Defense	
Department of Archives & History	**Private Companies**
Attorney General's Office	Arcadis Geraghty & Miller
Board of Juvenile Parole	BellSouth GIS Solutions
Budget & Control Board:	Carolina Capital Investment Corp.
• Division of Regional Development	Central Capital Investment Corp.
• Division of Operations—General Services State Building & Property Services	Greer CPW
	The Mathany-Burns Group
• Division of Operations-Office of General Services-Business Services	Vismar and Associates
• Division of Operations—Office of General Services-Facilities Management	Wilbur Smith and Associates
• Division of Operations—Office of Information Resources	**Local Government**
• Division of Budget and Analysis—Office of Research and Statistics-Digital Cartography Unit	City of Anderson
	City of Cayce
• Division of Budget and Analysis—Office of Research and Statistics-South Carolina Geodetic Survey	City of Clemson
	City of Clinton
Division of Budget and Analysis-Office of Research and Statistics-Technology Planning and Management Office	Colleton City Sheriff's Department
	City of Columbia
Department of Commerce	City of Florence
Commission on Higher Education	City of Goose Creek
Department of Corrections	City of Greenville
Department of Education	Town of Hilton Head
Educational Television Network	City of Myrtle Beach
Elections Commission	City of Rock Hill
Forestry Commission	City of Spartanburg
Department of Health and Environmental Control (DHEC)	City of Sumter
• Office of Commissioner-Information Systems	City of Union
• Office of Environmental Quality Control	Barnwell County
• Office of Ocean and Coastal Resource Management	Berkeley County
• Office of Environmental Health Services	Charleston County
	Cherokee County
Department of Health and Human Services-Bureau of Senior Service	Dorchester County
Higher Education Tuition Grants Commission	Georgetown County
Housing, Finance, and Development Authority	Greenwood County
Department of Insurance	Hampton County
Department of Juvenile Justice	Horry County
State Law Enforcement Division (SLED)	Lancaster County
Department of Mental Health	Lexington County
State Museum	Marlboro County

Table 1-1: Project Participants (continued)

State Agencies (continued)
Department of Natural Resources (DNR)
  • Bio-Diversity Program
  • Gap Analysis Program
  • Land, Water and Conservation Division
  • Marine Resource Division
  • Law Enforcement Division
Department of Parks Recreation and Tourism (DPRT)
  • Parks and Recreation Division
  • Business and Community Development Division
Department of Public Safety:
  • South Carolina Highway Patrol
  • State Transport Police
  • Bureau of Protective Services
Public Service Commission (PSC):
Department of Revenue
Santee Cooper—South Carolina Public Service Authority
Department of Social Services
Department of Transportation (DOT):
  • Planning Division
  • Engineering Division (Pre-construction, Construction,
    Maintenance, Traffic Engineering)
  • Information Technology Services
  • Mass Transit
Utilities Coordination Committee
 	
Public Utilities
Beaufort Jasper Water and Sewer District
Berkeley County Water and Sanitation Authority
City of Goose Creek Department of Public Works
Greenville Water District
Greer Commission of Public Works
Newberry County Sewer and Water District
North Charleston Sewer District
City of Orangeburg Department of Public Utilities
Parker Fire and Sewer District
Town of Summerville Commissioners of Public Works
Western Carolina Regional Sewer Authority
Western Carolina Regional Sewer Authority
(note: see Santee Cooper under State Agencies)
 	
Professional Associations
South Carolina Association of Realtors
South Carolina Society of Professional Land Surveyors
South Carolina Chapter of the American Planning Assn.
	Local Government (continued)
	Oconee County
	Pickens County
	Richland County
	Saluda County
	York County
	
	Universities and Educational Institutions
	Clemson University
	College of Charleston
	Coastal Carolina University
	Medical University of South Carolina
	South Carolina Institute of Archeology and Anthropology
	South Carolina Sea Grant Consortium
	South Carolina State University
	University of South Carolina-Department of Geography
	University of South Carolina-Digital Mapping Services
	University of South Carolina Baruch Institute
	University of South Carolina School of Medicine
	Wil Lou Gray Opportunity School
	
	Military
	Adjutant General' Office-Department of the Military:
	    - South Carolina Air National Guard
	      South Carolina Army National Guard
	
	COGs and Regional Planning Organizations
	Appalachian COG
	Catawba COG
	Central Midlands COG
	Lower Savannah COG
	Pee Dee COG
	Santee-Lynches COG
	Santee Wateree RTA
	Upper Savannah COG
	Waccamaw Regional Planning Council

1.3.2.   High-level Business Case for GIS

Analysis of business processes supporting State agency missions results in identification of application areas and potential benefits from expanded GIS technology. GIS has matured to the point where investment risks in GIS implementation have been reduced while opportunities for reaping benefits from GIS implementation have increased. Receiving benefits from GIS is, in large part, a matter of how it is introduced and adapted and how effectively it is used.

In South Carolina, the effectiveness of GIS implementation and its use will be enhanced through a statewide coordination effort. Many State agencies and organizations beyond the State government will benefit by leveraging the development activities of a few participants. In general, GIS provides the following benefits:

- **Better decision-making, service, and responsiveness** to citizens by providing staff and management with the information needed to respond quickly to problems or concerns, provide quality service, and to make sound, equitable decisions, which take into account all pertinent issues and impacts.

- **Improvement in the quality and timeliness of services,** particularly through use of GIS capabilities, often integrated with the Internet, to respond to information requests of citizens and businesses asking questions that are geographically related.

- **Productivity gains** by greatly reducing the labor and cost in accessing information, integrating multiple data sources, performing complex analyses, and presenting information in map form. Staff efficiency gains with GIS in the range of 20 to 60 percent have been observed in government agencies.

- **Avoidance of infrastructure costs** associated with remedial maintenance or duplicative excavation and construction work by using the GIS to better coordinate and plan road and utility maintenance work and avoid high-cost replacement. This benefit is especially relevant to local governments that operate public works departments along with water and sewer departments to coordinate between work on streets and replacement of pipes.

- **Avoiding future costs** by using the GIS to aid decision-making in such areas as planning and designing major capital projects; lowering the potential for risk and loss in natural disasters; more effectively meeting requirements of new State or federal regulations; and supporting many other potentially costly requirements of local governments.

- **Information security and protection against catastrophic loss** of valuable paper maps and records in the event of a fire or other disaster.

- **Partnerships and resource sharing** using the fundamental basis of GIS as an integrator of information to leverage partnerships and encourage joint projects, share systems and data, and encourage uniform practices based on sound standards. GIS is proven as a catalyst for State/Local government collaboration, as well as public/private partnerships to share funds and resources. Examples of this benefit will be the maintenance of street centerlines by local government agencies in cooperation with the State Office of Research and Statistics. Another example might be the development of licensing agreements between public and private entities for the use and distribution of data. These agreements may specify restrictions in the use of data or access that other organizations could have to specific data layers, so that data sharing between private industry and the government will take place.

- **Opportunities for outside revenues** by selling GIS data or products, using the GIS to help obtain outside grants, or joining in partnerships with other organizations in a local area (e.g., private utilities) to help fund GIS implementation.

- **Catalyst for technology advancement** by stimulating the growth of the private GIS industry in South Carolina and enhancing related economic and educational benefits.

- **Quality of life enhancement** because GIS technology contributes directly to planning and development work that influences the long-term quality of the State's economic, environmental, and cultural environment and the welfare of its citizens.

1.3.3.   Existing Information System and GIS Coordination Bodies in South Carolina

Coordination efforts and specific bodies aimed at enhancing GIS coordination in the State and promoting wise GIS use have already been created in South Carolina. In addition to the IRC's Standing Committee on Geographic Information (CGI), the State Mapping Advisory Committee (SMAC) has served in a coordination and advocacy role. These bodies coordinate together to promote efficient practices in mapping and geographic information management.

State Mapping Advisory Committee (SMAC)

The State Mapping Advisory Committee (SMAC) was established by executive order in 1978 to provide a common voice to the U.S. Geological Survey (USGS) regarding mapping priorities in the State of South Carolina. The role of SMAC has evolved over the years to encompass many educational functions, including the organization of an annual State Mapping Advisory Committee Conference that now serves as the State's annual GIS conference. Official documentation of SMAC's mission appears on their website:

The objectives of the South Carolina State Mapping Advisory Council shall be to:

1.   Serve as an advisory body to the Information Resources Council-Standing Committee on Geographic Information by recommending appointments to technical subcommittees as requested

2.   Facilitate education, communication, and cooperation between users and producers of map products

3.   Encourage the establishment and implementation of federal and State mapping standards and technology to facilitate the exchange of information resources between federal, State, and local governments, academia, and the private sector

4.   Encourage the adoption of National and State Data Standards

5.   Serve as a forum through which users and producers of mapping products may exchange information for improving the quality, efficiency, and effectiveness of mapping activities in South Carolina.

<u>Information Resources Council (IRC) and the Standing Committee on Geographic Information (CGI)</u>

The Information Resources Council (IRC) was originally created by **Executive Order No. 95** on March 6, 1996. IRC is a Governor-appointed advisory board of public and private sector leaders guiding South Carolina to becoming an acknowledged leader in using information resources, to support effective government, and to benefit its citizens and businesses.

The Information Resources Council was reauthorized by **Executive Order** on
March 1, 1999, by Governor Jim Hodges to:

1.   Assure that information/telecommunications technology is a tool and NOT a barrier to the achievement of the Governor's vision and goals for South Carolina

2.   Equip the State for accelerating success in a global economy to the end that our education, our work force, and our leadership are internationally competitive

3.   Enforce the principle of broad accessibility to government, and full responsiveness by government to citizens

4.   Stipulate and strictly adhere to the value that sound government must be based upon sound business plans, clearly articulating the purpose of the government activity, and using modern information/communication technology to achieve that expressed purpose.

The Information Resources Council designated the Standing Committee on Geographic Information (CGI) as a group dedicated to the coordination and development of GIS between State agencies. The formal mission of CGI, as documented on IRC's website, is given below:

Purpose:

The Standing Committee on Geographic Information would coordinate the development and management of geographic information systems (GIS) and geographic data in South Carolina.

Priorities:

To insure that South Carolina's public decision makers and other users have access to geographic information that is complete, timely, accurate, and reliable.

Foster cooperation among government agencies, universities, and the private sector, creating policy and resolving technical issues related to South Carolina's geographic information and GIS systems.

Develop and maintain an inventory of geographic data at all levels of government, provide electronic access via a home page with links to that data whenever possible, and coordinate and facilitate multi-agency geographic data projects.

Mission Statement:

"The Standing Committee on Geographic Data is charged by the Governor and the Information Resources Council to coordinate the development and management of geographic data in South Carolina. The Committee will seek to ensure that South Carolina's public decision makers have access to geographic information that is complete, timely, accurate, and reliable. The Committee promotes the use of Geographic Information Systems (GIS) and related technologies to more effectively and efficiently address problems of, develop plans for, and manage the natural, cultural, economical, and infrastructure resources of the State."

CGI has accomplished its purpose by establishing subcommittees tasked with researching topics relevant to GIS coordination, and developing standards and approaches that will facilitate the coordination of GIS development, data sharing, and the coordination of efforts between agencies.

1.4.   NEEDS ASSESSMENT INFORMATION COLLECTION APPROACH

This *Needs Assessment* has been conducted according to a defined methodology that began with a set of information collection tasks. Information was collected through on-site meetings, interviews, survey forms, a workshop, study of documentation, and phone conferences. The information collection process is explained in more detail below.

1.4.1.   Project Initiation Meeting with CGI

PlanGraphics' project manager met with the members of the Standing Committee on Geographic Information (CGI) prior to the State agency interviews. The meeting was used to formally introduce the project goals and scope to the committee members. A presentation was made explaining the steps involved in the project, the project schedule, and the products that would be delivered.

1.4.2.   On-site Interview Sessions

Interviews were conducted with representatives from State agencies and other organizations based on topical categories. In group interview sessions during the month of January, PlanGraphics personnel met with 113 people representing 73 organizations. These sessions were organized along the topical lines listed below.

Multiple agency representatives attended and provided information about missions, business needs, and impacts on GIS that related to each of these topics:

- Agriculture and Food Safety
- Cultural Resource Management
- Emergency Preparedness and Response Services
- Facility and Real Property Management
- Law Enforcement (Police, Fire, Courts)
- Public Works, Utility Service Provision and Management
- Social Services
- Transportation Planning
- Vehicle Dispatch and Routing.

- Geodetic Control and Base Mapping
- Education
- Environmental Protection and Permitting
- Community Planning and Economic Development
- Transportation Facilities and Engineering
- Titling, Licensing, Property Assessment, and Tax Collection
- Natural Resource Management
- Redistricting

Each interview ran from 2 to 3 hours and included from 2 to 25 people, generally averaging about 7. The interviews were used to determine the responsibilities of the departments relative to the interview topic. Then needs related to GIS applications and data were discussed.

1.4.3.   Survey Form Collection and Processing

Survey forms were developed and distributed to agencies and organizations with the potential for participating in the development, coordination, and use of GIS in South Carolina. The survey forms were designed to document some detailed types of information and to provide a basis for development of some rankings related to issues and elements of GIS to assist with the development of priorities. Three types of survey forms were distributed:

1. Committee Member—These forms were sent to members of the Standing Committee for Geographic Information (CGI). The members were asked to complete the forms from the perspective of a statewide view. These forms contained several charts requiring the respondent to evaluate the importance of various aspects of GIS, data layers, and approaches to coordination. The rankings of all Committee Member respondents were tabulated and cumulative totals for all the evaluations were determined.

2. State Agency—Representatives from each State Agency completed these forms from their agency's perspective. The State Agency forms also included ranking charts, but also required the respondents to document system resources they use and data they create and maintain. These forms contained opportunities for respondents to express views on important factors, technical difficulties, and obstacles to GIS implementation.

3. General Forms—These were sent to local governments, COGs, and private industry, including utilities. The organizations completed the forms according to their own perspectives. These forms also contained ranking charts and questions eliciting candid responses regarding factors and obstacles related to GIS development in their organizations.

The survey forms contained questions relating to the agency mission and resources for meeting the mission goals. The forms also contained questions and rating charts that allowed the respondent to evaluate the data and organizational needs for GIS development and coordination at the State level, as well as obstacles to development and coordination. Detailed results of survey form responses are included in Appendix A.

1.4.4.   Local Government/Utility Workshop

The Local Government and Utility Workshop was conducted on February 23rd at the Harbison State Forest Environmental Education Center. Sixty participants representing 50 local government organizations, COGs, and utility organizations attended. The workshop was used as a means of gathering information and discussing key issues with local government and utility users of GIS. The result was a better

understanding of the perspective and concerns of these important stakeholder groups.

A full day was used to generate some group perspective on several issues related to GIS development. The workshop informed participants about the long-term direction of GIS coordination in the State and helped them to gain a better understanding of GIS status, needs of local governments and utility organizations, and issues impacting GIS adoption and use.

The workshop included the following topics:

- Overview of IRC and Standing Committee on GIS

- Discussion of State Government GIS Activities Impacting Local Governments and Utilities

- GIS Technology Overview

- Status of GIS Deployment and Business Drivers for GIS

- Geographic Data Needs

- Education and Training Needs

- Limitations and Obstacles in GIS Development and Deployment

- Organizational Relationships and Coordination.

A workshop summary report was prepared and is included in Appendix B.

1.4.5.   Project Steering Committee Meetings

PlanGraphics met with the Needs Assessment/Strategic Planning Project Committee either face to face or through conference calls on four occasions to discuss results of the information gathering and to provide them with status reports. PlanGraphics also used those times to gather more information from the Committee members as the need arose.

1.4.6.   Follow-up Phone Calls

PlanGraphics conducted phone interviews with personnel who did not attend interviews or when further information was required from interview attendees. These phone calls supplemented the interview notes and provided information on specific topics that did not come up during the interviews and were not contained in the survey forms.

1.5.   ORGANIZATION OF THE REPORT

Subsequent to this Introduction section, this report includes 6 more sections:

Section 2—Geographically-related Programs and GIS Application Needs

This section covers the duties or business functions of the organizations that participated in the interviews, supplemented by information from survey forms. It describes some typical types of GIS applications and relates how those application types apply to the business processes that have been identified.

Section 3—System Configuration Status and Needs

This section describes the hardware, software, and network characteristics of the GIS installations present within the State. An overview of GIS issues within other organizations such as local governments is included as well. Needs are then identified and recommendations made regarding potential improvements in systems issues.

Section 4—Geographic Database Status and Issues

This section will begin with a review of the GIS data that are available and the efforts in place for developing new layers. Issues that need to be resolved are described and recommendations are made to resolve those issues.

Section 5—Organizational and Institutional Environment and Needs

This section documents the existing organizational structure within State government, Councils of Government, and local governments and how the structure impacts GIS development. Recommended changes to the GIS organizational structure at the State level will be made, including recommendations for how that structure will interact with State agencies and local governments.

Section 6—High-level Conceptual Design for Statewide GIS

This section will specify the integrated components of the statewide GIS design. It will cover all aspects of long-term GIS development, deployment, and operations across the State.

Section 7—Conclusions and Summary Recommendations

This section will summarize recommendations from the previous sections and discuss how the recommendations will impact each other.

SECTION 2

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SECTION 2
GEOGRAPHICALLY-RELATED PROGRAMS
AND GIS APPLICATION NEEDS
</div>

This *GIS Needs Assessment* is based on a sound understanding of the program responsibilities and missions of user organizations and the role that GIS plays in meeting those missions. GIS applications apply the technology to address program needs. This section describes the business needs of South Carolina organizations and a GIS application development framework that meets those needs.

2.1.   ORGANIZATION MISSIONS AND THE IMPORTANCE OF GEOGRAPHIC INFORMATION

The majority of information that is collected and used by government and utility organizations in the State is geographically-referenced. This summary of the missions of key GIS users or potential users underscores the importance of geographic information and the value that GIS technology offers.

2.1.1.   State Agency Missions

State government agencies represent a very key GIS stakeholder group by virtue of the large number of users, their role in generating and updating GIS data usable by many organizations, and the leadership role that they have in statewide GIS coordination.
Table 2-1 summarizes the missions and goals of the primary State agency GIS stakeholders and the significance that geographic information plays in supporting those missions.

Table 2-1: State Agency Mission Statement Summaries

Agency	Mission Statement Summary	Importance of Geographic Information
State Agencies		
Adjutant General's Office Emergency Preparedness Division	Develops, coordinates, and leads the State emergency management program, enabling effective preparation for, and efficient response to, emergencies and disasters in order to save lives, reduce human suffering, and reduce property loss.	The Emergency Preparedness Department will use geographic data to determine emergency routes and planning coordination
Department of Archives and History	To preserve and promote the documentary and cultural heritage of the State in accordance with the South Carolina Archives Act of 1954, the South Carolina Public records Act of 1973, the National Historic Preservation Act of 1966, the Rehabilitation Tax Credit provision of the Federal Tax Reform Act of 1986, and the South Carolina Historic Preservation Tax Incentive Act of 1990, and their amendments.	Geographic information will be used to map historical areas and to make decisions regarding the protection and management of cultural resources.
Attorney General's Office	The Attorney General is designated the chief legal officer for the State and has supervisory responsibilities over litigation involving State agencies, boards, and commissions, as well as all criminal prosecutions in the courts of this State. Furthermore, the Attorney General is required to appear before the South Carolina Supreme Court in any case in which the State has an interest.	Geographic information will be used by the Attorney General's office to analyze crime, and depict the location of crime scenes in support of criminal prosecutions.
Budget and Control Board (B&CB)	The State Budget and Control Board encompasses many government activities to remain responsive to the dynamics of the state. A five member body provides executive and legislative oversight when the general assembly is out of session. The Office of the Executive Director acts as a link between the five member body and the divisions of the board. The functions of the board are administered by the Office of the Executive Director and its consolidated divisions (Operations, Budget and Analysis, Retirement System, and Regional Development).	This agency has a diverse set of responsibilities, many with geographic aspects. The Division of Budget and Analysis, contains the Office of Research and Statistics which includes a Digital Cartography Unit and the South Carolina Geodetic Survey. Other divisions also use geographic information for routing deliveries and facilities management.

Table 2-1: State Agency Mission Statement Summaries (continued)

Agency	Mission Statement Summary	Importance of Geographic Information
State Agencies (continued)		
Budget and Control Board—Division of Regional Development	This Division fulfills the mandates of the South Carolina Comprehensive Infrastructure Development Act to coordinate infrastructure planning among state, regional and local units of government; assist in development of comprehensive regional infrastructure development plans and identify and provide funding and financial assistance for constructing and improving infrastructure.	Decision making and program support to regional agencies and local governments in the State is a geographic problem. GIS can play a role in helping to prioritize and coordinate infrastructure projects, planning and decision making that impacts local governments, and providing proper support and coordination among Councils of Governments.
Budget and Control Board—Division of Operations—Office of General Services	The Office of General Services exists to achieve efficiency and economy in the operation of state government by providing experts in areas of common need. We accomplish this mission through professional services, which include: • Real property leasing, purchasing, selling and appraisal • Maintenance, operation and renovation of State buildings • Leasing of vehicles, and vehicle maintenance and maintenance services • Disposing of Federal and State surplus property • Selling commonly used office and janitorial supplies • Providing mail services to government entities Procurement and professional assistance in contracting for construction, information technology and goods and services	The Office needs information that is geographic in nature and provides services to geographically dispersed "clients" in state government. GIS technology can help its operations by spatially enabling current or future applications and database that have a locational component. The result being added capabilities for program planning and providing services more efficiently

Table 2-1: State Agency Mission Statement Summaries (continued)

Agency	Mission Statement Summary	Importance of Geographic Information
State Agencies (continued)		
State Budget and Control Board—Division of Operations—Office of Information Resources	The Office of Information Resources (OIR) supports many South Carolina state government communication systems including the state government telephone system and MetroNet. OIR also operates the State's largest Data Center, managing numerous mainframe databases and applications for several state government agencies. OIR provides IT technical support and hosts web sites for agencies that request these services.	OIR will coordinate any network expansion that will be required for expanded GIS implementation. Many tabular databases that will be linked to GIS data are stored and managed by mainframe computers in the OIR State Data Center. OIR will host web sites that could include some GIS components and there will be requirements for their technical support staff to have knowledge of GIS software packages.
Budget and Control Board—Division of Budget and Analysis-Office of Research and Statistics	The Office of Research and Statistics, under the mandates of various State laws, the Budget and Control Board directives and executive orders, is charged with gathering, analyzing, and publishing data vital to the social, health, and economic well being of South Carolina. The Board, the General Assembly, other state agencies, local governments, and numerous interested citizens to guide planning, management and development decisions use these data. The office also works with other agencies to prevent overlap and duplication of data gathering activities. The categories of data and information resources administered by the office include—(1) Redistricting; (2) Economics; (3) Geodetic Survey; (4) Digital Cartography; (5) Technology Planning and Management; (6) Health and Demographics; (7) Census ; and (8) Special Projects.	GIS is used now and will be increasingly used in the future to support data compilation, mapping, data dissemination, geographic analysis, and a wide range of research and assistance tasks carried out by the Sections of this Office as mandated (described further below).
State Budget and Control Board—Division of Budget and Analysis—Office of Research and Statistics—Precinct Demographics and Digital Cartography Section	Fulfills ORS mandates to serve GIS digital mapping technology to various governmental units, to the legislature for redistricting, and to provide GIS technical assistance for geospatial data management. The section is responsible for maintaining maps of records that document the various election districts and voting precincts in South Carolina providing technical assistance in the development and modification of plans for these districts.	Provides GIS and database management and statistical services. Serves as the state Census data center. Empowers the SC client master file and the statistical datawarehouse. Maintains the redistricting support system.

Table 2-1: State Agency Mission Statement Summaries (continued)

Agency	Mission Statement Summary	Importance of Geographic Information
State Agencies (continued)		
Budget and Control Board—Division of Budget and Analysis—Office of Research and Statistics—South Carolina Geodetic Survey	Establishes horizontal and vertical geodetic control throughout the State to allow reference of land and land-related items to the national horizontal and vertical coordinate system, to ensure integrity of new geodetic data, and to maintain geodetic files. Also supports the development of an accurate, uniform statewide mapping system on a county-by-county basis to provide a large-scale map base for county and State land information systems.	The mission of the SC Geodetic Survey is directly related to the development and improvement of the geographic data available to the government agencies/citizens of SC. GIS technology directly supports survey monument densification, field data gathering, mapping, and the County cooperative program management by survey.
Budget and Control Board—Division of Budget and Analysis—Office of Research and Statistics—Technology Planning and Management Office	The Office of Technology Planning and Management sets the State's strategic directions in the area of information systems to provide for the most efficient technology and greatest access to information in the most cost-effective means through appropriate allocations of fiscal and technological resources. Function as a credible and impartial source of information technology management advisement and technical expertise to all levels of state government.	With its responsibility for overseeing standards for and directing effective use of related information systems, this office can play a role in formal definition and use of standards and collaborative efforts relating to GIS in coordination with CGI.
Department of Commerce	Works with communities to locate new quality investments and expand existing investments to create wealth and help achieve the highest quality of life for all South Carolinians.	Geographic data is used to determine locations appropriate for new businesses, to aid community development activities, and to support infrastructure planning and funding.
Commission on Higher Education	Promotes the quality and efficiency of the State system of higher education to foster economic development and human development in South Carolina.	The Commission on Higher Education can use geographic information to target areas for economic growth and human development.
Department of Corrections	Operates the State prison system in accordance with statutory and constitutional mandates.	The Department of Corrections must plan the transport of prisoners from prisons to court and to other prisons, as well as manage facilities spread over their prison compounds.
Department of Education	Provides leadership and services to schools and communities to enable all students, regardless of circumstances, to achieve world-class academic standards.	The Department of Education can use geographic information to determine school districts and assist with bus routing.

Table 2-1: State Agency Mission Statement Summaries (continued)

Agency	Mission Statement Summary	Importance of Geographic Information
State Agencies (continued)		
Forestry Commission	Manages or promotes the management of the forest lands of South Carolina to achieve the greatest good for the citizens. The Commission is responsible for both urban and rural forest lands, attending to timber, wildlife, water quality, air quality, soil protection, recreation, aesthetics, and other forest-related concerns. These responsibilities require enforcement of laws and regulations related to forest management, and development and promotion of appropriate technologies and Best Management Practices.	This agency needs geographic information to manage State forests and administer public outreach programs and conservation efforts.
Department of Health and Environmental Control (DHEC)	Promotes and protects the health of the public and the environment.	GIS is a source of information for DHEC managers and policy makers with decision support systems and applications that enable them to better analyze spatial information related to environmental and public health issues.
Department of Health and Human Services—Bureau of Senior Service	Improves the health and social status of South Carolina families by contracting with public and non-profit organizations, credentialed medical professionals, and private businesses to provide Medicaid, child care, and aging services.	The Department of Health and Human Services will use geographic information to coordinate transportation of people enrolled in their programs and the delivery of services to people and locations throughout the State.
State Law Enforcement Division (SLED)	Provides quality manpower and technical assistance to law enforcement agencies and conducts investigations on behalf of the State as directed by the Governor and the Attorney General.	State Law Enforcement will use geographic information to support crime analysis throughout the State.
Department of Mental Health	Works with citizens to assist those having mental disorders with the goal of improving their quality of life.	The Department of Mental Health will need geographic information to determine the location of their patients and assist in natural disasters as they occur.
Department of Natural Resources (DNR)	Develops and implements policies and programs designed to study, conserve, and protect the State's natural resources through management, assessment and monitoring, research, planning, education, technical assistance, and constituent involvement.	The Department of Natural Resources will use geographic data to determine natural resource areas. The information will aid in monitoring resources and will provide data to assist in management.

Table 2-1: State Agency Mission Statement Summaries (continued)

Agency	Mission Statement Summary	Importance of Geographic Information
State Agencies (continued)		
Department of Public Safety	Ensures the safety of South Carolina highways through enforcement of traffic and vehicle laws, regulation of drivers' licenses, and safety and law enforcement training programs. The Department also provides security for the Governor and the grounds of the State Capitol, Supreme Court, and Governor's Mansion.	Geographic information will help the Department of Public Safety by tracking traffic accident sites.
Public Service Commission (PSC)	Carries out regulatory and oversight functions and responsibilities pertaining to private utility and transportation companies.	The Public Service Commission needs to evaluate utility service area boundary information and information on customers. Possible future needs involve actual utility facility information.
Department of Revenue (DOR)	Administers the tax laws of the State and collects taxes in a fair and effective manner.	The Department of Revenue will use geographic information to support local tax assessors in property taxation.
State Housing and Finance and Development Authority	Promotes and provides safe, decent, and affordable housing for the citizens of South Carolina.	State Housing and the Finance and Development Authority can use geographic information to determine areas where housing assistance is required, and provide information on communities to assist in improving those areas.
Department of Transportation (DOT)	Provides a safe and efficient transportation system for the State of South Carolina by building and maintaining roads and bridges, as well as providing mass transit services to the citizens of the State.	Geographic information can assist the Department of Transportation in maintaining roads and bridges. Data can also be used to assist in determining areas in need of mass transit or additional roads.
Universities and Education Institutions		
Clemson University Agriculture and Forestry and Life Sciences	A land grant university, providing teaching, research, and service in agriculture, forestry, and life sciences that will benefit the citizens of South Carolina and the nation.	Clemson University Agriculture and Forestry and Life Sciences can use geographic data for research relating to forestry, agriculture, and life sciences. The information can also be used to assist in education outreach programs.

Table 2-1: State Agency Mission Statement Summaries (continued)

Agency	Mission Statement Summary	Importance of Geographic Information
Universities and Education Institutions (continued)		
University of South Carolina—Department of Geography	The education of the state's diverse citizens through teaching, research and creative activity, and service. It is committed to providing its students with the highest-quality education, including the knowledge, skills, and values necessary for success and responsible citizenship in a complex and changing world. It is dedicated to using research to improve the quality of life for South Carolinians and to provide service to its community, state, nation, and the world in such areas as public health, education, social issues, economic development, and family support systems	As one of the six founding members of the University Consortium on Geographic Information Science, USC is internationally recognized as a pioneer in innovative research in GIS, remote sensing and spatial analysis. More than 50 different units have actively used GIS and related technology in their teaching, research and service missions. It also developed and maintains an extensive infrastructure to support the successful adoption and utilization of GIS.
South Carolina Institute of Archaeology and Anthropology	A University of South Carolina (USC) research institute and State cultural resource management agency that performs operations to discover, record, and study South Carolina's archeology through both field and collections research. SCIAA also participates in USC activities, and contributes to the USC infrastructure and publication series.	Geographic information will be used to map historical areas, and to assist in field studies and other forms of research.
South Carolina Sea Grant Consortium	A university-based network supporting research, education, mapping, and outreach to conserve coastal resources and enhance economic opportunity for the people of South Carolina.	The Sea Grant Consortium will benefit from geographic information for use in research, map production, and the protection and conservation of coastal waterways.
Military		
Adjutant General's Office—Department of the Military—South Carolina National Guard	Provides an organization that is fully capable of accomplishing State and Federal missions as directed by the Governor of South Carolina and the President of the United States.	The National Guard will determine areas subject to flooding and other natural disasters by using geographic information. GIS will also be used to assist in the management of National Guard facilities and the natural resources of their lands.

2.1.2. Missions of Local Government and Regional Councils of Government

South Carolina includes 46 counties which exhibit a wide range of population and development characteristics.

The size of counties follows this breakdown:

	Population Range				
	Under 20,000	20,001 to 75,000	75,001 to 150,000	150,001 to 300,000	Over 300,000
Number of Counties	8	22	8	5	3

The largest county is Greenville County at 320,167 and the smallest is McCormick County at 8,868.

A similar breakdown of cities and towns is provided below:

	Population Range					
	Under 5,000	5,001 to 10,000	10,001 to 25,000	25,001 to 50,000	50,001 to 100,000	Over 100,000
Number of Municipalities	210	29	16	9	2	1

The largest city is Columbia at 110,840; all others are less than 100,000. Urban population centers are best depicted as metropolitan statistical areas (MSAs) that show the population for an area that is composed of multiple portions of municipalities and counties, sometimes including areas from different states. The major MSAs in South Carolina, all of which are experiencing considerable growth, include—Charleston-
N. Charleston (505,000 population); Columbia MSA (450,000 population); and Greenville-Spartanburg (830,000 population). It is

projected that figures from the
2000 Census will show at least 5 other MSAs exceeding 100,000 in population.

The fastest growing areas are in Horry County and Dorchester County. Growth in the MSAs has outstripped growth in the State as a whole. Approximately 2/3 of the State population lives in these 8 MSAs. Of the 365,974-person increase in total State population from 1980 to 1990, 308,185 of that increase occurred in the MSAs.

With the increase in urban populations, management of resources, planning, expansion and maintenance of infrastructure, and many other activities that are supported by GIS will increase in importance. In this context, it is important to examine the role of local governments.

The mission of city and county governments is to provide services, maintain public infrastructure, and administer programs responding to the needs of their citizens. To respond to this overall mission, local governments provide a range of services and carry out many support functions. Functions and services of local governments that are dependent on geographic information and which can make use of GIS technology fall into the following major program areas:

- Property/Parcel assessment and taxation
- Development review and approval (e.g., subdivision, building permits)
- Public Works facilities management and maintenance
- Permit/By-law enforcement
- Zoning/Business license administration
- Water and sewer facilities management and maintenance (sometimes the responsibility of a utility district)
- Long-range land use/development planning
- Park and recreation planning
- Economic development
- Emergency planning and response
- Public safety (e.g., Fire, Police, Emergency Medical)
- Health and social program administration and services
- General information dissemination.

All of these program areas imply a strong need for maps and geographic data. Many of these local program requirements have counter-parts at the State level which underscores the importance of improved coordination and sharing of geographic information and GIS technology.

Counties and municipalities all have planning functions within their own boundaries, but realistically, planning is also necessary at the regional level. For that purpose, regional councils of government were created. Councils of Government (COGs) were authorized by the State in 1976, through legislation that designated 10 multi-county regions. Each region could, if two or more counties within that region desired, form a Council of Governments, and all ten regions have chosen to do so. The COGs are charged with performing studies and making recommendations on issues that impact the region as a whole. The specific powers and duties as recorded in the enabling legislation of 1976 are (ARTICLE 3, Section 6-7-140):

1. Prepare studies and make recommendations on such matters as it deems appropriate

2. Coordinate and promote cooperative programs and action with and among its members and other governmental and non-governmental entities, including those of other states

3. Study and make recommendations on matters affecting the public health, safety, general welfare, education, recreation, pollution control, utilities, planning, development, and such other matters as the common interest of the participating governments may dictate

4. Provide continuing technical assistance, and information to the member local governments and other agencies and individuals

5. In general, the regional council of government shall have the power to carry out such planning activities and the development of such studies and programs as it deems to be in the interest of the area

6. Acquire and dispose of real and personal property necessary to the conduct of its business

7. After the coordination with the appropriate State, local, and Federal agencies, the regional council of government may adopt such plans and programs as it may from time to time prepare. Such plans and programs as are adopted shall constitute the recommendations of the regional council of government.

COGs are funded in various ways—State funds allocated in the State budget; receiving grants; contracts formed with other government agencies, private corporations, or any type of organization that could require its services; and through funds appropriated by member local governments. COGs do not have any direct authority over their member communities, but provide expertise and services, often involving GIS, to staff of local governments in their region. COGs are especially involved in land use and transportation planning because of the regional significance.

2.1.3. Utility Organization Missions

The primary missions of utility organizations are to provide reliable utility services to residential, commercial, and manufacturing customers through a network of utility lines and facilities. Public and private utilities in the State provide service for water, sewer, gas, electric, telephone, and other telecommunications. Utility organizations conduct planning and operations to design, build, and maintain facilities; track and support customers; manage property; and other geographically-related activities to support their mission. Gas, electric, water, sewer, or telecommunication utility organizations in the State will fall into one of the following ownership/administrative categories:

Investor-owned Companies

These are private corporations, often publicly traded, with shares allocated and traded among multiple share owners. In South Carolina, investor-owned utilities are typically electric companies. Primary investor-owned South Carolina electric companies are Duke Power, South Carolina Electric and Gas, and Carolina Power and Light.

Some natural gas companies are also investor-owned. United Cities Gas Company and Piedmont Natural Gas Company are investor-owned gas companies that operate in South Carolina, as well as in other parts of the southeast. SCANA is another investor-owned energy company that supplies both gas and electricity. Their natural gas distribution subsidiary is South Carolina Pipeline Corporation.

Several investor-owned companies serve the telephone industry in South Carolina. Investor-owned companies include Bell South, GTE, and ALLTEL.

Privately Held Companies

Lockhart Power Company is an electric company in South Carolina that is a privately owned corporation, but has not allocated shares for public trading.

Cooperatives

Other electric utility providers fall into the category of cooperatives. Cooperatives are member-owned utilities, usually serving rural areas. They purchase electricity wholesale from generators and transmitters, and distribute it to the residences and business locations of their members. A board of directors elected by the members manages electrical cooperatives. The board determines customer rates. Twenty electric cooperatives distribute power in South Carolina.

Twenty-seven telephone companies are certified as local exchanges in South Carolina. Most of these are small companies or cooperatives that serve a specific local area.

Public Utility Companies and Districts

Many water and sewer utilities are public utilities, either operated by a municipal government, or established as an independent District or Authority governed by a board of directors that serves a specific area covering all or parts of single or multiple cities or counties. Officials of the government jurisdictions that are served by the authority typically appoint water and sewer authority management boards. In most cases, they are self-supporting organizations that collect fees from their customers, but do not use tax dollars. Water and sewer departments in local governments may use tax dollars, but they often collect fees based on usage as well.

Santee Cooper is a unique electrical utility in that it is a State-owned public corporation owned by the State but managed independently.

The mission of utility organizations is to provide reliable and high-quality service to its customers. This mission is inherently geographically-based since it requires the construction, monitoring, and maintenance of distributed facilities and the management of customer services. This mission requires the utility organizations to carry out such functions as:

- Engineering planning and design
- Network modeling and analysis
- Facility inventory and monitoring
- Work management and facility maintenance
- Customer service monitoring and response
- Market analysis and marketing for new customers
- Environmental studies and assessment
- Property and easement acquisition and tracking.

2.1.4.   Federal Government Agency Missions

The missions of federal government agencies tend toward oversight responsibilities to ensure compliance with federal regulations. The Environmental Protection Agency regulates hazardous material storage and permitting of many facilities. The regulatory arm of the EPA in South Carolina is the State Department of Health and Environmental Control. The Department of Transportation and other departments must adhere to the terms of the National Environmental Protection Act (NEPA) and the National Historic Preservation Act. Specific

procedures are followed, including the preparation of environmental documents such as Environmental Impact Statements, and Environmental Assessments that are produced to meet those regulations. The Federal Highway Administration reviews those documents in the case of DOT. The State Department of Archives and History is also involved in meeting the requirements of the National Historic Preservation Act. They review reports of archaeological and architectural investigations and make recommendations regarding the eligibility of a site for inclusion in the national Register of Historic Places. Permits related to activities conducted on or near wetlands are required by the Army Corps of Engineers. Requirements related to the application for these permits and the monitoring of permitted activities fall to various State agencies such as DOT, DHEC, and DNR to be in compliance with the federal regulations. Many of these federally mandated activities are the basis for GIS applications.

Federal agencies also conduct several types of data collection and reporting. Many of these efforts directly involve mapping, as with the USGS mapping programs and the development of the NRCS county soil survey maps, while others involve data collected at specific locations that can be related to a point on a map, such as the U.S. Forest Service State forest inventory data. The State Department of Natural Resources makes extensive use of USGS data derived from the 7.5 minute quadrangles. These digital line graph (DLG) data layers are obtained by DNR, and examined for errors or the need for updates, and then used for DNR analysis, as well as offered to other agencies and the public through an Internet-based GIS Data Clearinghouse. USGS is also instrumental in the development of digital orthophoto quarter quadrangles that are used by DNR for quality control and to update the DLG data. This process not only benefits DNR but also all agencies that obtain the DLG data from the DNR clearinghouse.

Various federal agencies have been extremely important to GIS development for the South Carolina Department of Natural Resources through funding of projects and initiatives. A sample of federal funding assistance and the efforts that have resulted from those funds is provided below.

National Oceanic and Atmospheric Administration, National Geodetic Survey

The National Geodetic Survey has supported the state in establishing geodetic control throughout the state. NGS provides a yearly grant of between $300K and $500K for the county mapping effort. NGS is currently working with the state Office of the Geodetic Survey to develop techniques for GPS height determination which could replace classical leveling. In addition, the National Geodetic Survey has played and important role in other GIS-related projects:

- A pilot project in South Carolina for the Federal Aviation Administration's Precision Area Navigation Approach system that enhances airline and aircraft safety through GPS-controlled approach and landing systems.

- A cooperative project with the SC Emergency Preparedness Division and the US Army Corps of Engineers to analyze the safety of public shelter locations for hurricane evacuation relative to projected hurricane storm surges.

- A cooperative project with Clemson University using GPS to more efficiently apply fertilizer and pesticide, which reduces chemical runoff and enhances agricultural competitiveness through lower costs and higher crop yields.

- The SC Department of Natural Resources and the SCGS are working with FEMA on a pilot study that will transfer Federal responsibility for elevation certification to the State; thus, providing quicker approval while maintaining high standards of accuracy.

- A cooperative project with the NGS in the Port of Charleston to learn if pilots of ships can determine bridge clearances real-time using GPS.

- A cooperative project with the University of South Carolina to delineate active seismic areas by monitoring vertical movement of the ground surface over time.

- The NGS is working to improve coastal and harbor navigation by combining sonar and height modernization of real-time GPS on ships, allowing for precise estimations of under-keel clearance for marine vessels. This gives mariners an extra margin of safety and allows more cargo to be loaded onto a ship.

National Oceanic and Atmospheric Administration, National Ocean Service

- Funded Edisto River project.

- Funded 1:24,000-scale database development in the Edisto, Combahee, and Santee River basins and GIS technology implemented at the Land, Water and Conservation Division.

National Oceanic and Atmospheric Administration, Coastal Services Center

- Funded 1:24,000-scale database development in the Coastal Plain of the Pee Dee and Savannah River basins.

- Contributed to development of the SC DNR GIS Data Clearinghouse.

- Funded development of the DOQQ server and browsing software.

- Funded development of the ACE Basin Ecological Characterization.

U.S. Army Corps of Engineers, Charleston District

- Provided funding for soils and Digital Line Graph data development in the Ashley-Cooper basin.

U.S. Environmental Protection Agency

- Provided funding for a wetlands mitigation study in the Four Hole Swamp sub-basin.

- Funded development of wetlands and land use data for the Reedy River sub-basin.

- Provided funding for developing DLG boundary, transportation, and hydrography data for the Upper Savannah River basin.

- Funded the Winyah Bay project to identify and conserve significant resources in the area. SPOT and DOQQ imagery was purchased in this project.

National Aeronautics and Space Administration

- Funded Berkeley-Charleston-Dorchester urban change analysis and purchase of Landsat Multispectral Scanner and Thematic Mapper imagery.

U.S. Geological Survey

- Provided cost share agreements with 50/50 match for DLG and DOQQ database development.

U.S. Fish and Wildlife Service, National Wetlands Inventory

- Provided cost share agreements for wetlands database development.

- Provided quality assurance/quality control services for wetlands database development.

- Provided in-kind match to develop prototype procedures for wetlands update from DOQQs.

Natural Resources Conservation Service

- Provided quality assurance/quality control services for soils database development.

- Provided funding for digitizing soils data for Newberry and Charleston counties.

2.2. GEOGRAPHICALLY-BASED BUSINESS PROCESSES AND THE IMPORTANCE OF GEOGRAPHIC INFORMATION

This *Needs Assessment* begins with a focus on the program responsibilities of stakeholder organizations. These responsibilities and the impact GIS will have on them are identified by examining geographically-related "business processes." A geographically-related business process defines a specific program or set of activities that requires the collection, use, analysis, generation, or distribution of maps or geographic information. These are high-level definitions of work activities that provide a focus for defining GIS applications to support and provide improvements for agency operations.

Significant portions of government agency business processes are geographically related. Agencies must know where their work will take place, and often need to analyze areas to determine the allocation of resources or to efficiently access information based on proximity to specific locations.

Geographic Information Systems (GIS) provide a means of accessing and analyzing spatial information. Through GIS, map data are stored, manipulated, and analyzed to support agency responsibilities. GIS is used as a tool to organize and plan for the methods of meeting those responsibilities. The responsibilities will not be changed through GIS, but proper use of GIS will enhance the ability of an agency to fulfill its duties.

2.2.1. Business Process Categories

This sub-section summarizes key geographically related business processes for the stakeholder groups that represent key GIS or potential GIS users in the State—State government agencies, local governments and COGs, and utility organizations.
Appendix C provides details of business processes for State government agencies.
Table 2-2 summarizes major business process categories and their significance for specific stakeholders. The categories are provided as a means of generalizing specific business processes so that they can be related to "business drivers" or factors that could motivate policymakers to implement GIS, and to relate to types of GIS applications that will meet the needs of those business processes. The business process categories listed in Table 2-2 are described below.

Cultural Resource Inventory

Identification of locations and descriptions of the characteristics of archeological or important architectural sites, or any sites with special significance to the history, heritage, or identity of South Carolina, included are sites that carry special Federal, State, or local designation and protection.

Economic/Market Development

Activities related to identification and promotion of new or expanded markets or development (commercial, industrial, cultural) infrastructure, economic, and/or social benefits.

Educational Program Planning and Allocation of Services

Designing, establishing, and administering any primary, secondary, or higher educational services, includes evaluating educational needs, defining school attendance areas, planning and allocating school bus services, locating new school or training facilities, or allocating resources for special educational or training services statewide.

Emergency Planning and Response

Includes evaluation of risks and planning for response to natural or man-made emergencies, coordinating and providing response services,

assessment of impacts, and coordinating support to citizens and organizations affected.

Engineering Planning and Design

Includes preliminary evaluation, planning, and cost estimation for any type of construction project and all phases of detailed design and creation of engineering plans and specifications.

Environmental Regulation and Assessment

The oversight and monitoring required to respond to local, State, and Federal laws and regulations that protect the environment. This can involve review and approval of permits, site inspections, and reviewing development plans and all types of environmental impact assessment associated with development projects. Environmental regulation responsibilities entail enforcement authority.

Infrastructure and Facility Inventory and Monitoring

Gathering and tracking information about the location of infrastructure managed by government or private organizations (transportation facilities, utilities, buildings, etc.). Involves tracking the status and condition of facilities as a basis for their effective management and maintenance.

Field Surveys and Data Collection

Encompasses all types of special programs for the collection of data in the field for use in program administration. This includes natural resource inventories, socio-economic surveys, and other data collection activities.

Land Use and Growth Planning

The examination of existing population and land use factors, as well as projections for the future, to develop plans to regulate and influence patterns of growth and land use in the future. This process is focused on managing growth and movement of population while improving the quality of life and protecting the environment.

Map Compilation

The creation or update of map features on a regular basis to maintain a map or set of maps. This can include manual drafting or entry of digital data. The results may be a digital map database or hard copy maps created manually or printed from digital data.

Natural Resource Inventory

Includes the mapping, gathering of information, and generation of statistics about the State's physical and biological resources.

Permit Review, Tracking, and Enforcement

The review and approval of all types of permits mandated by local, State, or Federal authorities, and support provided to applicants. Once issued, the permits are tracked through the series of activities that must take place to meet the terms of the permit. Enforcement involves field inspections and resulting reviews of performance, and resulting enforcement actions.

Monitoring, Planning for and Allocation of Health Services and Conditions

The design, establishment, and administration of programs aimed at monitoring and improving the health of citizens and the maintenance of a healthy environment for their use.

Planning for and Allocation of Social Services

The design, establishment, and administration of programs aimed at monitoring and improving the health, safety, and living conditions of the State's citizens.

Public Hearings and Information Distribution

Involves preparation of materials for mandated public hearings, organizing and conducting hearings, and all aspects of public information distribution, including the sale and distribution of maps and electronic data. These programs may include the requirement to keep certain aspects of the information confidential or to determine whether or not an organization or individual is authorized to receive the information.

Public Property Management

The identification of publicly-owned or used land; the tracking of ownership, lease, and easement information; and the management of land acquisition and sale.

Public Safety Planning and Response (police, fire, military)

Responsibilities related to enforcement of laws, investigation of crimes, response to emergencies, and defense of the public. This business process encompasses the strategic planning, tactical, and administrative aspects of public safety programs at the State and local levels.

Real Property Assessment and Taxation

Involves the appraisal and assessment of all non-exempt real property (land, structures), the preparation of tax roles and collection of property taxes, and determining and collecting real property taxes.

Districting

Involves the analysis of demographic, physical, political, and infrastructure data for the delineation or re-delineation of political, administrative, or service districts. This includes political redistricting and other State or local districting functions (e.g., Fire or Police response areas, State program service areas, etc.).

Tourism Planning and Development

This activity involves the identification, development, and promotion of recreational, entertainment, and cultural sites and activities likely to attract tourists to the State.

Transportation Planning

Analysis of local or statewide transportation networks and traffic flow for the purpose of planning routes and for projecting future needs for transportation improvements and new development.

Technical Support

Providing staff resources for assisting agencies with less technical expertise in information technology. These duties could include installation of hardware and software, application development, and identification and resolution of problems. Technical support can also include conducting some computer analysis and creating products for an agency with computer resources.

Technology Planning and Review

Involves the responsibility of developing and reviewing plans and procurement documents for the improvement or expansion of information technology. The review process may result in approval or a set of recommendations for improving the plan or procurement document.

Utility Monitoring and Regulation

Covers governmental responsibilities for overseeing and regulating private utilities in the State. This includes review and approval of service territories, evaluation and approval of rates, taxation of utility infrastructure, and enforcement of health, safety, and environmental regulations.

Vehicle Tracking and Routing

Determining the optimal route for vehicles to follow when making deliveries or responding to an emergency, and keeping track of vehicle locations in reference to map features, normally a street centerline network. This applies to State and local government agencies involved in public safety, corrections, public transit, or delivery of services.

2.2.2.   State Government Agencies

Table 2-2 lists business process categories and the State agencies participating in this study. For each agency, a "P" is placed under a column indicating a primary business process category for the agency or an "S" for a secondary business process for the agency. If the agency does not have any significant responsibilities related to the category, no entry will be made under the column.

The most prevalent business process category is Public Hearings and Information Distribution. The nature of government agencies requires that all agencies respond to some general information requests from time to time, and many must distribute information or present findings to the public. Other categories that have a wide frequency of use among the agencies are those relating to data collection, emergency planning and response, educational program planning and social service planning and allocation, map compilation, and vehicle routing and tracking. Much of the GIS application development to be coordinated between agencies will focus on these areas.
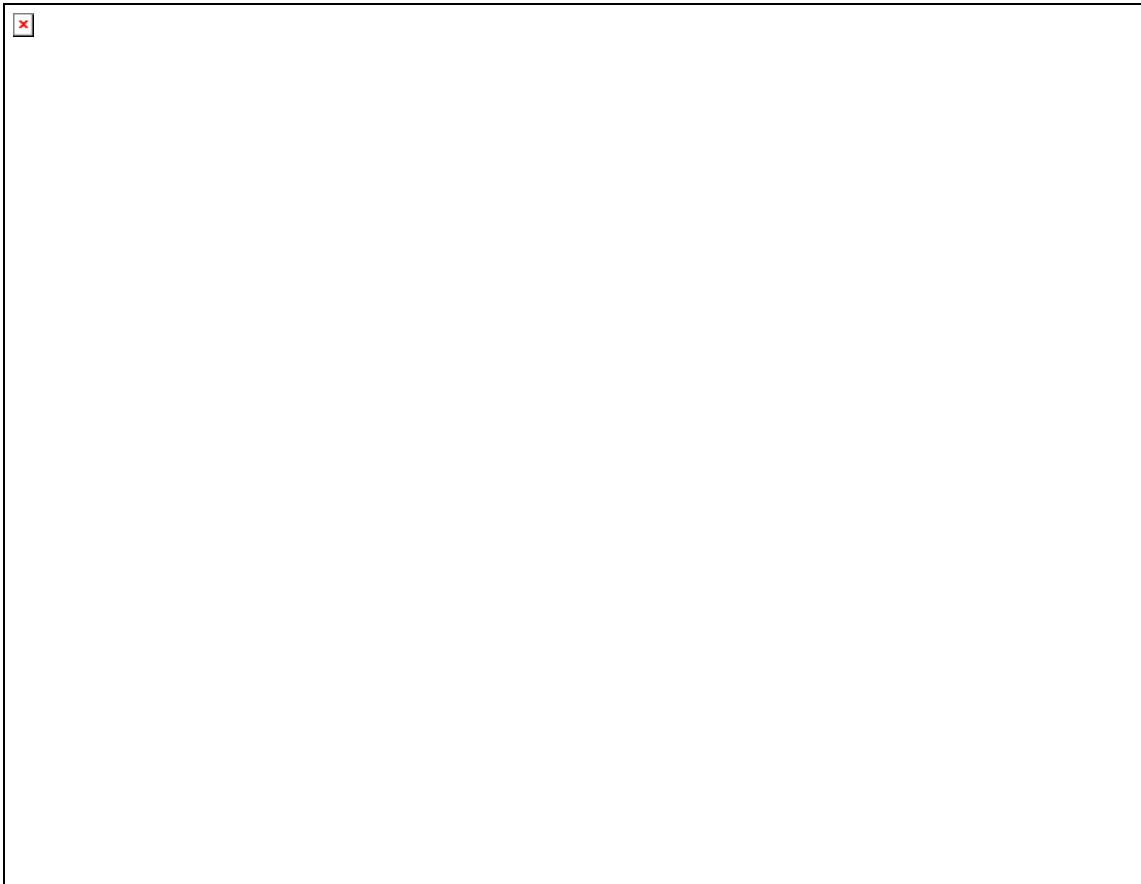
Table 2-2: Business Process by Organizations

Business Process Summaries

Summaries of State agency business processes are provided below, along with issues that are important to the use of GIS in the agencies. These summaries serve to document the specific functions of each State agency and describe the current and potential impacts GIS has on those functions. Each State agency's specific business processes are listed in Appendix C.

Department of Archives and History

This department is responsible for cultural resource management. They maintain an inventory of archeological and architectural sites used for compliance with the National Historic Preservation Act. The department must review site survey reports and track the eligibility of sites for the National Register. Confidentiality of site location is important for the sites' protection. The department provides location and site information to agencies and consultants that require it and are authorized to have it.

Department of Agriculture

The Department of Agriculture has responsibilities for some qualitative agricultural product inspections in South Carolina. The department assists farmers in marketing and locating markets for produce, and provides price and buyer information. Grading of eggs, vegetables, and grains falls under their jurisdiction. Three DOA inspectors cover over 1,000 food processors across the State. The department would benefit from the ability to map locations and violators. Other agencies inspect retail food, food service, shellfish, dairy (all DHEC), and meat and poultry (Clemson University). The DOA operates
1 large- and 2 moderate-sized farmers markets, as well as 7 livestock auction markets, all at fixed locations.

Institute for Archeology and Anthropology

The Institute for Archeology and Anthropology is affiliated with the University of South Carolina. The Institute has the responsibility of maintaining an inventory of South Carolina's archaeological sites. State law mandates the Institute to be a repository of cultural resource data. The Institute performs updates and maintains a master set of maps (USGS 7.5' quad sheets) with cultural resource locations indicated as points. A GIS database is kept and points are digitized into the GIS from quad sheets. Data for the Institute is collected from many sources. Heavy security is required and the Institute must adhere to terms of a Memorandum of Agreement that regulates the distribution of data they receive from contributing agencies.

Department of Commerce

The Department of Commerce's community planning and economic development responsibilities include compiling statistics related to suitability for business relocation in different regions of South Carolina. They also use GIS to answer many questions related to characteristics of State areas in terms of their suitability for specific economic development initiatives. To illustrate development potential and site characteristics, the department creates maps and other graphics. They have developed Insight, a GIS application paired with relevant data copied onto a CD and distributed to local governments and economic development agencies. The CD allows organizations promoting economic development in the State to answer questions and display information.

State Budget and Control Board (SBCB)

The State Budget and Control Board (SBCB) administers many programs that support the activities of other State agencies. The Board includes the following Divisions and Offices—the Office of Executive Director, the Division of Budget and Analysis, the Division of Regional Development, the Division of Operations, the Division of Retirement, the State Auditor's Office, and the South Carolina Confederate Relic Room and Museum. Some of these Divisions and Offices are not described below.

SBCB Division of Budget and Analysis, Office of Research and Statistics

This office administers a street centerline and address range assignment project, using GPS and field checking techniques for obtaining address information. They operate the Office of Technology Planning and Management (OTPM) that plans State technology initiatives and reviews all State agency computing, network, and communications system procurement documents for systems costing more than $25,000. ORS also performs GIS analysis operations on a contract basis with other State agencies to support them with specific GIS tasks. They annually compile data collected by many agencies and create incident maps for reporting purposes. Within the Office of Research and Statistics is the South Carolina Geodetic Survey. This office supports geodetic survey and base mapping in the State. They establish horizontal and vertical geodetic control throughout the State to support the registration of mapping to the national horizontal and vertical coordinate system. They support county base mapping by administering a program to provide grant money for county base mapping efforts that correspond to a set of standards developed by the Geodetic Survey. Parcel data conversion is promoted at the county level through funding and technical assistance. As part of this grant program, the Geodetic Survey provides assistance with the development of RFPs, establishing the required control for the mapping projects and quality assurance of the DOQs. Quality assurance takes the form of office review and field checking. This Geodetic Survey conducts a GPS training program for local government and COG personnel and is also administering a project to define and map the boundary between North and South Carolina, as well as boundaries between many South Carolina counties. The Geodetic Survey also coordinates the sharing of county data with all state agencies. Part of the granting process with counties is to allow the Geodetic Survey, with the cooperation of the counties, to distribute county GIS data to state agencies for their use.SBCB Division of Regional Development

The Division of Regional Development focuses on improving the infrastructure of the State in order to enhance conditions for economic development and to improve the quality of life for citizens of South Carolina. The Division provides assistance to the Councils of Government (COGs) in developing their regional and local infrastructure plans, and identifies and coordinates State resources for implementing programs that will develop infrastructure. This Division produces a Statewide Water and Sewer Infrastructure Plan.

SBCB Division of Operations, Office of General Services

This Office is responsible for facility and real property management and delivering inter-agency mail. Each day delivery vehicles must follow a different route depending on the mail that must be delivered. This is a statewide program. They are also responsible for delivering supplies to State agencies from the State central supply facility. The mail deliveries only take place within Columbia.

Department of Corrections

The Department of Corrections operates the State penitentiary system. This task requires the management of facilities such as water and wastewater treatment plants and the development of an emergency preparedness plan. During disasters, the department must decide whether to keep prisoners and correctional facility personnel in place or to evacuate. Evacuations rarely occur, but there is an evacuation plan. The Department is also responsible for vehicle dispatch and routing to transport prisoners between various facilities and courthouses.

Department of Education

The Department of Education owns all schools buses in the State and they are involved in determining school bus routing. They review all local school construction plans and monitor construction projects. EDULOG is used for school bus routing and siting new school construction. The Department also has a student information database to store student address information. School district boundaries must be periodically adjusted.

State Election Commission

The State Election Commission operates the State voter registration system, providing a list of registered voters to be used for each election. The Commission operates a statewide training program for poll managers and provides voter information to the public.

Adjutant General's Office, Emergency Preparedness Division

The Emergency Preparedness Division coordinates the activities of all agencies participating in the planning, response, post-disaster assessment and recovery, and mitigation measures related to emergencies. Their duties involve planning evacuation routes, designating and supplying emergency shelters, identifying and protecting critical facilities, locating and assisting citizens with special needs, and evaluating areas for their vulnerability. The Division's post-disaster responsibilities include coordinating damage assessment and reporting to FEMA, as well as identifying and implementing measures that will reduce the vulnerability of the community in case of another similar disaster.

South Carolina Forestry Commission

The Forestry Commission manages State forest lands, which includes conducting resource inventories; developing management plans for forest stands; administering contracts for thinning, harvesting, and planting; and other activities related to forest management. They fight forest fires and operate a prescription-burning program of State forest lands. The Commission provides voluntary participation in forest management programs to assist private landowners, as well as educational programs on forest conservation. The Forestry Commission uses MapInfo to support forest management functions by mapping and overlaying timber types, endangered species, and other data layers that impact management decisions. To support forest management responsibilities, the Commission digitizes timber stand delineation from rectified aerial photography. To perform its responsibility of law enforcement, the Commission conducts forest fire investigations to determine the cause of forest fires and, in cases where they have been deliberately set, to apprehend those that set the fires. Timber theft investigations are also conducted.

The Commission operates 3 dispatch centers for directing fire fighting crews. A Computer Aided Dispatch (CAD) system that works with MapInfo and Oracle is used to calculate the closest fire fighting resources. The Commission is required to maintain fire fighting equipment and buildings on State forests.

Department of Health and Environmental Control (DHEC)

DHEC must inspect retail food and food services providers, as well as shellfish and dairy producers; monitor shellfish waters for indications of toxic algae; and monitor inspection violations. Through the State Health Initiative Plan (SHIP), administered by DHEC, the construction of health facilities must be regulated through a licensing process. DHEC issues permits to schools, hospitals, and other facilities and collects GPS coordinates for many of these facilities. Other permitting responsibilities include issuing permits for any facility that impacts the environment. Lat/Long coordinates are collected for all permitted facilities. DHEC is the designated arm of the EPA in South Carolina for administering Section 401 of the Clean Water Act. They must issue permits and inspect any construction over or in State navigable waters. The Office of Coastal Resource Management administers the Coastal Zone Management Act and is the lead agency for issuing permits within the Critical Area. The Bureau of Solid Waste Management is recollecting location data for all CERCLA and RECRA hazardous material sites using GPS to get better coordinates. To monitor air and water quality stations, the Department obtains GPS coordinates. DHEC must monitor all public water supplies and submit reports to the EPA.

This department coordinates resources during disasters by operating GIS to display available resources such as shelters on a screen using a computer projection unit. When a shelter is full or another resource becomes unavailable, the symbol is changed to indicate the change in status. Response to toxic spills is another emergency response duty. When responding to toxic spills, GPS coordinates are collected for spill locations. This agency is also responsible for wellhead protection.

Through the Division of Biostatistics, DHEC maintains a cancer registry and collects and analyzes public health statistics such as births, deaths, and teen pregnancy. The distribution of these incidents is examined to look for spatial patterns. The Department analyzes health statistics in relation to environmental factors. They use GIS to map the spatial distribution of incidents in relation to census block groups and census tracts (e.g., birth and death certificates).

Department of Health and Human Services

Through the Office on Aging, DHHS administers programs to help elderly people, including delivery of meals and providing rides to medical appointments. The Office on Aging contracts with companies to transport elderly clients and to deliver goods to their homes. The Office on Aging must schedule trips and dispatch their transporters.

South Carolina State Housing Finance and Development Authority

The Authority sells bonds to raise funds for financing mortgages for single-family houses, multi-family houses, and assisted living facilities. The Authority must forecast where their assistance will be required and administer federal housing grant programs.

Department of Insurance

The Department of Insurance regulates insurance companies in the State of South Carolina. The Department provides information to citizens with questions about insurance coverage and investigates citizen complaints about insurance companies. After disasters, the Department of Insurance sends adjusters into the field to assist with damage assessment and reporting.

South Carolina Law Enforcement Division (SLED)

This agency maintains a database of all law enforcement activity in South Carolina based on reports received from law enforcement agencies throughout the State. SLED operates some special law enforcement units such as tracking teams and SWAT teams.

Department of Mental Health

This Department operates a forensic psychiatry unit that evaluates the mental competence of crime victims and perpetrators of crimes to assist in law enforcement. They provide personnel after disasters to counsel victims, and advise other disaster response personnel on treatment of victims (GO TEAMS). The Department operates community mental heath facilities and assists citizens with mental health disorders, including transport and monitoring activities. DMH must locate patients in relation to facilities and services provided. This Department operates the community mental health facilities, and population trends must be anticipated to predict where centers should be constructed or enlarged.

Adjutant General's Office, Department of Military

The Department of Military oversees the branches of the National Guard in South Carolina. The National Guard manages resources on their properties and collects and stores natural resource data to aid in managing the properties. GIS is used to map resources and plan management activities. When planning new construction, they must comply with NEPA regulations and the National Historic Preservation Act. Historical and cultural sites present on National Guard properties must be inventoried and protected. The National Guard also conducts inventories of, and maintains, buildings and equipment.

Department of Natural Resources

This Department administers programs to monitor and protect South Carolina's natural resources. They collect, store, and distribute data regarding the extent and status of natural resource features such as forests, wildlife, endangered plant and animal species, wetlands, coastal areas, rivers, streams, lakes, and cultural resources.

The Marine Resources Division monitors saltwater habitat, fish populations, and saltwater fishing. They obtain ocean bottom data (bathymetry). The Marine Resources Division administers a Beach Renourishment Program and identifies hard bottom areas (invertebrate habitat).

The Land, Water and Conservation Division is involved in statewide land use/land cover change detection. They track soil erosion across the State through Soil and Water Conservation districts, and collect well data to monitor State hydrological resources. The Division also monitors the State climate by collecting weather and temperature data. Through the Land, Water and Conservation Division, DNR operates a GIS data clearinghouse over the Internet. The clearinghouse allows users to download GIS data through the web.

The Wildlife and Freshwater Fisheries Division monitors wildlife diversity and State fisheries through maintenance of the State BCD database. The Department manages fish and game populations by issuing hunting and fishing licenses and setting bag limits.

Environmental Affairs is involved in permitting wetlands, conducting river conservation projects, and the GAP analysis program which requires superimposing wildlife habitat data with land ownership and protected lands data to see where wildlife habitat is protected and areas where important wildlife habitats are at risk due to development pressure. The land ownership data helps to identify parcels that could be acquired to protect important habitats.

DNR owns and manages 11 Heritage Preserves covering approximately 3,000 acres of land through the Heritage Trust Program. They have the responsibility for protecting the historical and cultural sites located on their preserves. They seek opportunities to acquire land through the Heritage Trust program to protect cultural resources and habitats for endangered plant and animal species.

Conservation officers carry out enforcement of hunting, fishing, boating, and other conservation-related laws. They conduct investigations and are involved in search and rescue missions.

Department of Parks, Recreation, and Tourism

This Department of Parks, Recreation, and Tourism (DPRT) maintains trails, picnic areas, campgrounds, and other recreation facilities and protects the environment within the State parks. Operation of State parks, and protection of the historical and cultural sites within, falls under this agency's responsibilities. They seek to acquire land to add to parks. They need the ability to identify historical and cultural sites that could end up under their protection upon purchase of land.

DPRT is involved in promoting interest in a South Carolina National Heritage Area (Heritage Corridor), one of 18 in the nation. GIS will be used in developing Discovery Center multimedia presentations to promote the Heritage Corridor. For tourism promotion, DPRT needs to know the historical and cultural sites that can be promoted and they need to perform demographic analysis, as well as other types of analysis, that contribute to tourism promotion.

Public Service Commission of South Carolina

The Public Service Commission is a 7-member oversight commission that monitors the utility industry and transportation companies in the State. The Commission possesses regulatory authority and responsibilities set by the State, and enforces those regulations with the goal of safeguarding citizens' rights to quality of service and to ensure that customer complaints are properly addressed. The Public Service Commission was established in 1910, with powers to "fix and establish in all cities of the State rates and charges for the supply of water, gas or electricity furnished by any person, firm or corporation to such cities, the inhabitants thereof, and to prescribe penalties." The Joint

Assembly elects one Commissioner from each of the 6 Commission Districts and one Commissioner at large. The Commissioners serve a 4-year term.

Department of Public Safety

The Highway Patrol enforces laws, issues traffic citations, and responds to accidents on South Carolina's highways. The Highway Patrol must document and store information on all traffic accidents with greater than $2,000 damages. The agency is developing a plan to collect better location data at traffic accidents and other incidents by using GPS receivers to record coordinates associated with these incidents. GIS will then be used to display, map, and analyze these incidents, providing the Highway Patrol with a stronger basis for planning operations and reporting activities. The State Transport Police regulate commercial trucking through weigh stations and other checks to ensure that trucking on South Carolina roads is conducted safely.

Department of Revenue

The Department of Revenue produces regulations for property tax assessment in South Carolina and works with county assessors to support the property assessment process. They are developing a plan to acquire a Computer Assisted Mass Appraisal (CAMA) system that will be available to county assessors through wide area network connections. The CAMA system will help assessor offices throughout the State analyze field data to determine property taxes in accordance with State regulations. The Department of Revenue responds to emergencies to estimate post-disaster property damage costs.

The Department of Revenue works with counties to appraise industrial and utility sites, and to determine tax credits for pollution control facilities. Drawings, acreage, and cost estimates are required for the appraisal of these sites and facilities. The Department assesses utility assets and properties.

Department of Social Services

This department operates programs to assist disadvantaged people. Programs include welfare to work programs and child assistance programs. They must analyze demographic information to forecast future program needs. Contracts with companies to provide transport to clients of the social programs are handled under this department. The Department of Social Services' transportation responsibilities require dispatching functions that often overlap with other agency programs such as the Office of Aging.

Department of Transportation

This department monitors the need for new transportation infrastructure, the improvement of existing infrastructure, and selects potential routes, determines the best alternatives, and identifies the best corridors for new road construction.

SC DOT is required to conduct studies in compliance with the National Environmental Protection Act and the National Historic Preservation Act. They must acquire permits for construction impacting wetlands and various types of water bodies. They conduct wetland mitigation for any wetlands that are filled during road construction.

The Right-of-Way Division is responsible for acquiring property within the proposed road right-of-way. Right-of-Way needs access to data regarding property boundaries within the proposed road corridor.

Hydraulic Engineering must meet NPDES requirements related to stormwater runoff. GIS is being used through a contract with an engineering firm to determine runoff sites and to identify where NPDES monitoring will occur.

All contracts with transport provider companies and non-profit organizations are handled through the Mass Transit Authority. They are developing a plan for an integrated dispatch system that will be used to coordinate the dispatching of a State-run transport and delivery operation.

Road centerline data covering the entire State is being developed using the best available data. An RFP has been issued to select a contractor to develop the centerline database.

Preconstruction surveying uses GPS to establish survey control for projects, and conducts field surveying to provide accurate base maps for project design and right-of-way acquisition.

2.2.3.   Local Governments and COGs

Local governments conduct a wide variety of geographically related business processes. Activities dealing with property include property assessment, subdivision and development review, creation of zoning regulations, and development of master and neighborhood plans.

Local governments also promote economic development and quality of life for citizens through services such as maintenance of water and sewer infrastructure, road maintenance and construction, building inspection, and development of park and recreational facilities.

Citizen protection services provided by local governments include fire fighting, police services, emergency medical services, and disaster planning and response.

COGs have a regional planning function and develop programs to provide local governments with technical assistance in many areas. GIS training and services are excellent examples of that type of assistance. COGs also cooperate with State agencies in conducting regional projects. In the course of these projects, COGs and State agencies exchange GIS data and share analysis results.

2.2.4.   Utility Organizations

Utility organizations are concerned with the following business process areas that have strong geographic components—1) property and automated facilities operation and management, 2) long-range and short-range planning, 3) customer management and service, and 4) compliance with regulations. When these 4 areas are compared with the more detailed categories in Table 2-2, utility operations cover several of the categories.

Property and facilities operation and management include the mapping and management of facility information for components of the utility networks from supply points to customer locations. GIS and related information technologies can support design and construction, inventory facilities, oversight on operations, and facility maintenance. Often, some level of integration will exist between the digital map data of the infrastructure and a work management system or facility inventory system that tracks maintenance of the facilities and holds valuable attribute information about the infrastructure components. This will also include categories such as natural resource management and data collection. Tracking and routing vehicles supports the efficient maintenance of facilities and properties.

Planning activities cover a number of short-range and long-range programs, including network modeling to support design or improved service enhancements, engineering design, projections on future demand, financial projections, and other analysis for decision support. When need for expansion is indicated, engineering planning and design will be necessary. Emergency planning and support is also an important planning component. Utility organizations must always plan for future technology needs in terms of new facility components and information technology and data collection devices.

Customer management and service involves identifying and connecting new customers on the utility network, processing utility billing and receipts, monitoring customer satisfaction, tracking complaints and responding to problems, and general communication with customers such as notifying them of service interruptions.

Compliance with regulations encompasses a variety of activities to ensure compliance with federal, State, and local statutes, regulations, ordinances for health and safety, financial reporting, and environmental protection. This requires that utility organizations gather, analyze, and report information in a geographically-organized way to meet permitting requirements, prepare environmental impact analyses, provide information, support tax assessment by public agencies, and provide customer information support rate settings.

2.2.5.   Universities and Technical Schools

A number of universities and technical colleges in South Carolina have GIS programs in place. The depth and range of GIS activities vary among institutions, but at least six State and private universities in the State have well-supported GIS programs. The University of South Carolina has the longest history in automated mapping and GIS, but others, including Clemson University, Coastal Carolina University, and the College of Charleston have GIS education and research programs. Greenville Technical College has recently launched a "Geomatics" program that includes training in GIS and related technical fields. This could serve as a model for offerings at other technical schools.

The primary offering of universities and technical schools is education and training. University educational programs address basic concepts and applications of GIS technology. Programs offered by universities and technical schools (as well as software vendors, training companies, and professional associations) provide training in the use of GIS, management of GIS, and specific GIS related practices.

In addition to education and training, faculty and students conduct research projects involving theory and application of GIS and related technologies. Some universities have procedures and organizational entities in place to provide GIS-related services, via contract with government or private organizations. These services may include database development, application development, and special application projects through contract with government agencies and private industry to perform special research projects. Research related to natural resources, land use, and community planning has important geographic components. Research often translates into specific information to be distributed and to better responses to general information requests. Research requires data collection and results in a variety of products, including compiled and distributed maps. GIS related research often covers topics such as land use and growth planning, assessing environmental risk and developing amelioration strategies, identification and analysis of cultural resources, and economic development.

2.3.   SUMMARY OF KEY BUSINESS NEEDS DRIVING GIS

GIS implementation is dependent on the support of policymakers who are especially attuned to issues facing citizens and are looking for ways to solve problems and meet needs in effective ways. How GIS will be used to address important State issues needs to be communicated to policymakers such as elected officials, local government administrators, State agency department heads, legislators, and the Governor.

An examination of the missions and business processes of the government, utility, and educational stakeholders who represent the key GIS user communities for GIS in the State shows a strong focus on geographic information. GIS can have a profound impact on responding to these organizations' needs. The most important "business drivers" for GIS technology implementation are presented below. These business

drivers provide a focus for GIS development and will become themes used in preparation of the *Strategic Plan*. A number of business drivers are general in nature and have a broad impact across all organizations and programs. A second group relate more specifically to organizational missions and programs.

2.3.1.   General Business Drivers

2.3.1.1   Improved Citizen/Customer Responsiveness

As technology has increased the accessibility of information, citizen expectations for information and services have risen, and government agencies and utility companies must respond. GIS, combined with the Internet, provides a means of delivering improved responsiveness to increased citizen expectations in the area of information access. GIS will also allow State and local government agencies to improve responses to citizen needs and concerns through improvements in analysis and use of data. The use of GIS will allow better products and services to be developed and made available to citizens and utility company customers, and will allow government and private companies to more quickly respond to information requests and provision of services.

2.3.1.2   Improved Efficiency and Coordination in Governmental Services

Information technology and GIS offer opportunities to greatly reduce waste and inefficiency in the provision of services by government agencies by allowing these agencies to share information and combine resources. Because geography is an overriding theme in service provision, GIS is a tool to improve coordination of services. GIS will be used to identify the locations and schedules of activities in order to identify opportunities for coordination or at least a logical scheduling of activities. The classic example is a street department paving a road a few weeks before another agency must dig the road up to replace underground utilities. These types of inefficiencies can be better avoided if scheduled activities of multiple agencies can be coordinated geographically. Some plans are in place at the State level that focus on improving inter-agency coordination and GIS technology can support such coordination.

2.3.1.3   Advancing Access to Technology by Citizens in the State

GIS is technology that will be used to communicate ideas and messages to the citizens of South Carolina. Whether as a method for presenting planning alternatives at public hearings; a component of tourist information multimedia stations as in the Heritage Corridor Discovery Centers planned by the Department of Parks, Recreation, and Tourism; or as part of web sites that provide citizens with a variety of information about their State and community, GIS technology will be combined with other types of technology such as GPS, remote sensing, and wireless data transmission to provide more opportunities to citizens for the use of GIS technology to improve understanding of their environment and give them more control over their lives.

2.3.2.   Program-related Business Drivers

2.3.2.1   Emergency Planning and Support

GIS already plays an important part in the emergency planning and the operational response to emergencies in South Carolina. Many aspects of post-disaster assessment and mitigation are also addressed through the use of mapping and analysis tools of GIS. Further, implementation of GIS will allow for the evaluation of alternative plans and disaster scenarios. Federal, State, and local programs for emergency planning, response, and relief will benefit directly from GIS and GIS will support coordination among multiple organizations. Some South Carolina communities, such as Greenville County and the City of Greenville, are already benefiting from this initiative. This is an important development since the resulting data will be more compatible with other digital data layers maintained by these local governments, such as buildings and property layers, allowing for improved determination of properties where FEMA funds will be allocated and better planning for flood events.

2.3.2.2   Development Planning

Development planning involves evaluation of short-term and long-term impacts of development and the guiding of development in a way that preserves and enhances the quality of life while delivering material benefits to citizens. GIS will provide the capability for modeling development alternatives and displaying projections of the future in a geographic context. GIS will also allow examination of development from a regional view. Because development and land use planning require the examination of so many physical, demographic, economic, and political variables, GIS tools are needed to help decision makers compare options and build consensus. This issue impacts current Smart Growth initiatives being promoted by the Governor. Efforts to implement the concepts behind Smart Growth will benefit from the use of GIS.

2.3.2.3   Economic Development

GIS will be used to quickly identify characteristics that are advantageous to businesses considering relocation to areas in the State by examining land use, demographic, accessibility, and other factors that drive location decisions. GIS, thus, is a tool to support promotion of economic development opportunities in the State (on a national and international scale) and to efficiently locate sites suitable to prospects and to the State. The extra bonus of a strong GIS user base and plentiful data resources will also be attractive to information technology firms that have a high potential for growth and provide high-salaried jobs, since the GIS industry itself (large range of products and services) is seeing rapid growth. The Department of Commerce has been very aggressive in using GIS to improve the information that can be quickly brought to bear in situations where a South Carolina community is in competition for the relocation or establishment of a

business. Timely and relevant analysis presented in professional and attractive format has been shown to be effective at selling the advantages of a community in these situations, and the products the Department of Commerce and regional Councils of Governments produce with GIS fit that mold. To provide local governments with a more direct means of gaining these types of information and products, Commerce has produced Insight, a combination of an application and data that is distributed on a CD. The Department has developed a GIS enabled web site that local governments can access to for research and to assist them with economic development projects..

2.3.2.4   Transportation Infrastructure Enhancement

GIS is and will continue to be used to analyze elements of the transportation infrastructure in South Carolina. GIS with transportation modeling tools can help decision-makers evaluate requirements and options for local or regional road system improvements and provide input to the preparation of capital budgets and road system planning. The effective use of GIS in transportation planning can result in huge monetary savings in road construction and can help avoid adverse development impacts. The Department of Transportation Planning Division and the regional Councils of Government use GIS for this purpose.

2.3.2.5   Real Property Assessment and Equitable Taxation

An important function of local and State government is assessing the value of public, private, and commercial real property, and taxation based on this assessment. This is a geographic problem with the need to sustain tax revenues while ensuring consistency and equity statewide. Parcel mapping programs at the local level and information management and reporting programs administered by the Department of Revenue will benefit from the use of GIS technology.

2.3.2.6   Improving Educational Services

GIS can contribute to the improvement of education in several ways. By assisting education administrators with analysis of school populations, GIS can help to determine locations for new schools and school attendance areas. GIS also supports the allocation and management of buses and the delineation of optimal bus routes for local school systems. GIS will be used to determine school bus routes. GIS has the potential for helping to evaluate educational quality and needs on a statewide basis. With appropriate demographic statistics, GIS can give a geographic picture of educational levels and special training needs (remedial skills, job training) to help target resources for special training and educational programs.

2.3.2.7   Natural Resource Planning and Protection

GIS is an ideal tool for visualizing the distribution of and characterizing renewable and non-renewable natural resources in the State. These land, water, and natural biological resources represent a tremendous asset from which the State derives a significant economic and social benefit. GIS is used to inventory and help manage these resources. DNR, the Forestry Commission, and other organizations in the State use GIS to help define critical areas due special protection and to wisely manage resources to ensure proper use and enhancement.

2.3.2.8   Evaluating and Reducing Health Risks

GIS is used to map incidents in relation to the environment or conditions of the landscape. When correlations are discovered, it is sometimes possible to take actions that will prevent further occurrences. When this is applied to incidents of sickness or disease, and a spatial pattern is evident, investigators may be able to take action to halt the spread of illness and deliver earlier treatments. DHEC conducts monitoring of this type through the Division of Public Health Statistics. This Division maintains a State cancer registry. Periodically, the Division performs an internal analysis by geocoding the cancer incidents to look for clusters. If clusters of cancer incidents are found, DHEC then knows to investigate an area for factors that may raise the chances of developing cancer in an area.

2.4.   OVERVIEW OF CURRENT GIS USE

Today, GIS use is widespread throughout the State, and its popularity is growing. Data resources have increased steadily, and with those resources, the number of users. GIS will continue to foster cooperative efforts by providing a forum for multiple agencies and organizations to contribute data and compare them in a common geographic context, developing a clearer view of the challenges to be faced and the resources to be managed. With this in mind, it is important to document the status and uses of GIS by State government, local government and COGs, utilities, and other organizations.

2.4.1. State Agency GIS Use

There is a long history of GIS use in South Carolina. Even before the advent of the technology, State agencies in South Carolina were coming together to communicate needs for mapping. In 1978, the State Mapping Advisory Committee (SMAC) was formed to identify mapping needs across the State and communicate those needs to USGS through a single voice. By the mid 1980s, digital map data and the analysis that accompanied those data were taking hold in South Carolina State agencies and educational institutions. The University of South Carolina was an early leader in the implementation of GIS.

Among State agencies, the Department of Natural Resources' history of GIS implementation is well documented, and those accomplishments represent progress made by the State as a whole since many other organizations have benefited from the products of their efforts.

Some of the major milestones in the development and deployment of GIS in South Carolina are documented below:

- 1972: University of South Carolina begins teaching computer mapping in the Geography Department.

- 1976: First GIS course taught at the University of South Carolina.

- 1978: The State Mapping Advisory Committee (SMAC) was formed.

- 1983: The City of Greenville implemented GIS, one of the first municipalities to do so.

- 1984: Cooperative County Mapping Program began

- 1986: The Land Resources Conservation Commission (LRCC) implemented GIS and Remote Sensing technologies to assist State and local governments in planning and decision support.

- 1987: The South Carolina Development Board, now the Department of Commerce, first implemented GIS.

- 1988: The Water Resources Commission followed suit in 1988 by implementing GIS and Remote Sensing technologies. 1:24,000-scale database development contracts were established with federal mapping agencies to support the Edisto River resource evaluation and assessment project. The project was funded with a grant from the National Oceanic and Atmospheric Administration.

- 1989: Initiation of the South Carolina Infrastructure/Economic Development Planning Project (SCIP). Originally funded by the South Carolina Coordinating Council for Economic Development and managed by the S.C. State Development Board, the project has been ongoing since then and has expanded its scope to the collection of several types of data beyond those that were originally designated for collection. In 1994, state government reorganized and the management of the project became the responsibility of the Department of Commerce.

- 1995: The Edisto River project was completed by the newly established Department of Natural Resources and the report, Managing Resources for a Sustainable Future—the Edisto River Basin Project Report was published in 1996.

- 1995: The Natural Resources Information Management and Analysis (NRIMA) Section of the Land, Water and Conservation Division was created to provide comprehensive systems and network, database, and applications management for GIS.

- 1997: In 1997, the SC DNR GIS Data Clearinghouse was established for on-line access to natural resource GIS data. That same year, the SC GAP analysis project started with a contract from the USGS Biological Resources Division through the Clemson University Fish and Wildlife Cooperative Unit.

- 1997: The first meeting of the Standing Committee for Geographic Information was held.

- 1997: The Department of Commerce began the Inventory of Key Quality of Life Data and Geographic Points. This ongoing project is focused on collecting data that represent amenities within a community.

- 1998: DLG hypsography and boundaries were completed for 566 quads of South Carolina, and a statewide urban change project was initiated.

- 1999: CGI initiates statewide GIS Needs Assessment and Strategic Planning Project.

- 2000: Ssurgo-level soils data will be completed for South Carolina.

This illustrates a considerable history of GIS implementation at the local level and statewide coordination activities. This provides an excellent foundation for enhanced GIS coordination and expansion.

2.5.   GIS APPLICATION NEEDS

GIS applications form the foundation for the design of any GIS. Data, system resources, organizational structure, and even many changes to operational procedures are planned with the purpose of meeting the needs of the GIS applications that have been defined.

2.5.1.   What is a GIS Application?

A GIS application defines the specific use of the technology to generate results and products that meet the needs of users. A product may be a hard copy map or map display, a text report, statistics resulting from a geographic inventory or analysis, an updated database, a data file for export, or some other tangible result. A GIS software package provides a set of tools (i.e., software functions) that may be used off-the-shelf or used as building blocks for custom applications aimed at specific sets of users. Customized applications use standard design

and programming capabilities to create easy-to-use menu

interfaces, to design customized outputs (i.e., displays, reports, maps), and to perform complex geographic analysis. GIS applications are built to meet the following objectives:

- To combine a complex set of GIS commands into a simple operation

- To make user interfaces more efficient to facilitate operation and to reduce the time and complexity of performing a task

- To produce custom output products, including screen displays, hard copy maps, and tabular reports

- To facilitate the translation and exchange of data between different platforms

- To ensure consistency, integrity, and efficiency in data maintenance operations.

Applications are developed using GIS software as a foundation, and a development language (e.g., Visual Basic, C++, proprietary software tools) may be used to customize applications. GIS applications also integrate non-GIS systems and databases with GIS data. The development of applications expands the GIS to a larger user base and allows an organization to better capitalize on a GIS investment.

The GIS application environment with which the user interacts is part of the overall GIS system architecture, illustrated in Figure 2-1.

Figure 2-1: GIS Functionality Integrated with RDBMS

There is almost an endless list of specific applications that may be developed using the tools and customizing capabilities in GIS software. This wide range of GIS applications may be generally described as falling into one of four categories, as illustrated in Figure 2-2.

Figure 2-2: Major GIS Application Categories

Standard Map Update and Production—This category of applications allows users to easily update digital map features and database entries as they change, or to make corrections to a data layer according to a more accurate reference layer such as recent digital orthophotography. This category also includes applications for designing and plotting maps, including capabilities to designate an area and a set of map features for the creation of a map and to apply standard map design rules governing sheet layout and format, symbology, and map margin information.

Geographic Query and Visualization—This application category covers a broad range of uses, allowing users to ask the database questions and receive results in map and/or report form. For instance, a user could ask the system to identify soils that meet certain suitability criteria, to geographically display road characteristics, or to display selected parcel-based information. The field of visualization plays an ever increasing role in GIS. More attention has been give to the format of the output; spanning beyond static maps to include multi-media and visual links to other graphic types.

Spatial Analysis—GIS technology can be used to perform or support a wide range of analyses involving measurement and geographic comparison, map overlay, or other statistical analyses of map features and data. Spatial analysis includes map overlay modeling, network analysis, terrain analysis to support such applications as transportation planning, economic development site suitability, environmental or health risk assessment, hydrologic modeling, or others.

Geographic Index to External Information and Records—Government and private organizations collect and maintain various records which are geographically-referenced but which are not in map form. In some cases, these documents are simply stored in hard copy form (field reports, deeds, engineering drawings, inspection forms), and in other cases, data are stored in word processor documents, spreadsheets, or a PC-database. An automated index to these documents may be established that allows a user to query and identify them through the GIS (by entering a key field or interactively picking a map location). This type of automated index could be used in a simple sense to help quickly locate hard copy records on file (like engineering plans or as-built drawings). It is also possible to scan documents, drawings, and photos, and retrieve and display them directly through the system.

2.6.   TARGET GIS APPLICATION FRAMEWORK

Many GIS applications have been developed and will continue to be deployed to meet the needs of State agencies, local governments, COGs, utilities, and other organizations in South Carolina. Some of these applications will be very specific to the responsibilities of a single organization or a small number of organizations, and others will have general characteristics that many, if not all, GIS users will find useful. A major objective of statewide coordination of GIS is greater collaboration in GIS application and deployment to get easy-to-use applications in the hands of users. This can be accomplished by providing standards and practices supporting—a) greater efficiency in application development through joint development efforts, b) improved consistency in an application development approach and "look-and-feel," c) more effective integration between GIS and non-GIS systems and databases, d) cataloguing and organizing applications, and e) deploying applications more widely.

An application development framework is needed as a structure for leveraging existing GIS resources and for developing and deploying applications in the future. The high-level application framework defined here provides a context for defining GIS needs and for GIS strategic planning. The framework that has been defined accounts for all types of application development situations, and it is dependent on the successful interaction of participants in the CGI. While it is aimed primarily at State agencies, it is a structure that allows increased sharing of GIS resources and applications among all users in the State.

Applications accessed by users via off-the-shelf ot customized graphic interfaces are the basis for GIS use. The application framework presented here is described in terms of three target GIS application environments that give a high-level structure for deploying applications. The framework defines three environments for developing and deploying applications—1) applications of use to most or all GIS users in the State which may be candidates for centralized development and access, 2) applications of use to multiple agencies or groups, but not all, and 3) applications with limited suitability outside the specific agency where they are required. The application framework concept is encompasses the following important elements:

• A **three-tiered application environment** (explained below) that responds to a range of users and access requirements

- **Implementation standards** defining development practices, software platforms, and technical tools

- An **organizational structure** that encourages, supports, and enables cooperation and collaboration in application development and use

- An **application catalogue and library** that serves as a directory to and repository of commonly accessed applications or re-usable application components

- A **central GIS service center** that maintains an application catalogue and general-user applications (see below) and provides access to them.

All of these components will be discussed in more detail in subsequent sections of this document. The three-tiered application environment, the foundation for the application framework, is explained in Table 2-3. This concept is based on the idea that the nature of user needs for GIS applications spans a range of specificity. At one end of this range is a set of applications that are common to many users, regardless of their organization, and at the other end are those applications that relate more specifically to a more narrow set of users. Creation of three-tiers helps define needs and provides a structure to plan for application development, maintenance, and access by users.

Table 2-3: Proposed Three-tiered GIS Application Environment

Application Tier	Explanation	Development Approach and Maintenance	Access and Deployment
TIER A: General Access Applications	Applications that are frequently needed by a large number of user organizations or which can be used as a basis for launching other applications. These can be considered common applications for which a high degree of centralization of development and maintenance is realistic and efficient.	A central body will be responsible for development and maintenance of the applications. This body will collect input from several agencies and a set of application requirements will be developed. A standard application development methodology will be used to develop these applications and all standards adopted by the Committee on Geographic Information (CGI) will be followed. Including, for example, adherence to a common datum and coordinate system for data compilation (NAD 83 and NAVD 88). These applications will use GIS data that is commonly available and which is regularly maintained by designated organizations.	The applications will be made available to all users through an "application server" or made available with packaged software and data on a CD-ROM. Designated applications may be made accessible to the public via the Internet.
TIER B: Multi/Joint User Applications	Applications in this tier have less applicability for multiple user organizations but still cross organizational boundaries and are needed by enough individual organizations to make joint development and support realistic and effective.	As in the case of Tier A, a standard development methodology will be used and CGI standards will be adhered to. Custom development, performed in-house or by an appointed contractor, will be the responsibility of an inter-agency committee or work group. A single agency has been given a primary role to manage or carry out develop-ment, but representatives from all participating agencies should be actively involved. The participating agencies will share in the funding of the application development and will have access to technical or administrative support from a central body. These applications will often use a commonly accessible GIS database but may use GIS data layers or tabular databases specific to an agency.	The interagency body responsible for developing the application will define procedures and the technical environment for access and deployment. Ideally applications in this category should be identified in a commonly accessible catalogue maintained by a central body as called for in Tier A.

Table 2-3: Proposed Three-tiered GIS Application Environment (continued)

Application Tier	Explanation	Development Approach and Maintenance	Access and Deployment
TIER C: Agency-specific Applications	Most applications will be developed to meet the specific needs of an individual agency. These applications address needs and require custom interfaces that are so specific to a specific organization that joint development and multi-organization use is not feasible.	These applications will be the responsibility of the specific agency, although that agency may request the help and support of a central body. Adherence to CGI standards and use of an accepted application development methodology are strongly encouraged but not mandated.	The agency will have full responsibility for deployment, support, and maintenance of the applications.

A process is required for determining which Target Application Environment applies to the development of a specific application. In all cases, the development of GIS applications must follow a standard methodology to ensure consistency and success. Potential applications are listed below according to the Target Application Environment that best suits each. Several candidate applications for each tier are described in the following subsections.

2.6.1.   TIER A—General Access Applications

The General Access application development environment will center around applications related to the operation of a State GIS Service Center with data clearinghouse services, and the basic data query, mapping, and access applications needed by multiple users. Candidate applications include:

- Map Navigation, Viewing, and Query
- Transportation Centerline Maintenance
- GIS Data Status and Access
- General Routing and Direction Finder
- Standard Map Display and Plotting
- Statewide Thematic Map Generator
- Address and Jurisdiction Query.

A description of these candidate applications is provided in the following tables.

Application	MAP NAVIGATION, VIEWING, AND QUERY
Data	Potentially all data layers except for agency specific data layers and confidential data
Function	The ability to navigate to an area by choosing a type of area from a scrolling list that could include areas such as counties, administrative districts, USGS 7.5 minute quad sheet names, or natural features such as watersheds. Navigation will also be accomplished through the entry of an address and a zip code to zoom the user to a specific street location anywhere throughout the State.
	The ability to pick lists of data layers to be made available through a screen display legend. Data layers will automatically be assigned to the screen upon selection of a particular list. Each list will have a special combination of layers, as well as a standard set of symbology.
	The ability to toggle data layers on and off.
	The ability to select features in a variety of ways ranging from individual feature selection to group selection based on user-defined areas, circles of specific radii, buffers around selected features, and display attributes of the selected features.
Users	All State agency personnel, to begin. Eventually all State users.
Examples	Some county and city sites have similar applications that provide users with GIS access through an Intranet and a web browser—City of Boca Raton, FL; Prince George's County, MD; City of Lynchburg, VA. This type of application can be easily adapted to meet the needs of State government users. The Office of Research and Statistics currently has a MapObjects IMS application that allows users to input an address and a zip code to navigate to specific locations.
System Environment	Accessible as server-based applications via the Internet or Intranet, via standard Web-browsers, or locally if users choose to download application software and data. The most common GIS software will be ESRI ArcView, MapObjects, and ArcIMS but Intergraph's GeoMedia and GeoMedia WebMap may be used as well.

Application	TRANSPORTATION CENTERLINE MAINTENANCE
Data	Street centerlines, political boundaries, administrative boundaries, address data, parcels
Function	Authorized users will have the ability to add and correct street centerline data as new road construction takes place in their jurisdictions. The application eventually may contain a direct data entry interface, but

	to begin will probably contain a means for a user to identify a spot where new streets go and a means to send the State a small file with the new or changed street(s) and associated attributes. A central body will accept data and carry out quality assurance checks prior to posting to a centrally accessible database.
Users	A central body will set up maintenance tools and procedures. Designated local government representatives and designated State DOT personnel that keep track of new construction and changes in roads throughout the State will provide updated data on a regular schedule.
System Environment	Will likely use Internet-enabled GIS applications to allow data revisions against a central database, although applications could be run locally with uploads to a central service center.

Application	GIS DATA STATUS AND ACCESS
Data	Uses geospatial metadata about commonly used GIS data sets (e.g., survey monuments, transportation network, orthoimagery, hydrography, soils, etc.). Status will be shown according to county and municipal boundaries, administrative boundaries, and map sheet grids such as USGS quad sheet boundaries. Some major highways and hydrography will be included to provide reference information. Sample views of data should be accessible.
Function	This type of application can be thought of as a metadata query and status tracking tool. It will be designed to display jurisdictions such as county and city boundaries, COG regions, utility service areas, and State agency administrative districts. These jurisdictional boundaries will contain attributes related to the availability of GIS data layers and the status and location of development activities. Metadata files, links to web sites, and project descriptions will all be accessible through this interface. This application will be used as a front end to a statewide GIS service center. Users will identify relevant data in their area of interest and will then have the opportunity to download the data layers along with associated metadata or place an order for shipment of a CD. Functionality should include the capability for a keyword search of the existing metadata or by topical index.
Application	GIS DATA STATUS AND ACCESS (continued)
Users	All State agency personnel, to begin. Eventually all State users.
System Environment	Accessible as server-based applications via the Internet or Intranet, via standard Web-browsers, or locally if users choose to download application software and data. The most common GIS software will be ESRI ArcView, MapObjects, and ArcIMS but Intergraph's GeoMedia and GeoMedia WebMap may be used as well. An FTP site and compression software may be used to facilitate the data downloading requirements.

Application	GENERAL ROUTING AND DIRECTION FINDER
Data	Street centerlines, databases indicating client location addresses, hydrography, relevant facility locations, landmarks
Function	Users will enter a starting point (name of State office), some intermediate stops, and an end point, and the application will use the street centerline data to determine the most efficient route to travel. The application will generate maps and directions with base reference information and points of interest important to users.
Users	Potentially all State GIS users and eventually all citizens.
System Environment	Accessible as server-based applications via the Internet or Intranet, or via standard Web-browsers. The most common GIS software will be ESRI MapObjects and ArcIMS but Intergraph's GeoMedia and GeoMedia WebMap may be used as well.

Application	STANDARD MAP DISPLAY AND PLOTTING
Data	Potentially any data layer available through the general access interface. Will focus on frequently used base map layers (e.g., political and administrative boundaries, transportation, hydrography, orthoimagery).
Function	Will provide the ability to create standard map plots based on the screen display or a saved combination of data layers. The maps could conform to a designated map sheet grid or could be based on user-defined areas and data layer combinations. Users will have menu options to select general plotting criteria to define content, scale, and sheet format options.
Users	All State agency personnel, to begin. Eventually all local government personnel and State users.
System Environment	Accessible as server-based applications via the Internet or Intranet, via standard Web-browsers, or locally if users choose to download application software and data depending on the location of printing and plotting devices. May use ArcView, ArcInfo, or GeoMedia.

Application	STATEWIDE THEMATIC MAP GENERATOR
Data	Based on pre-selected boundary layers, including county, MSA, other census districts; other defined districts; or regions for which statewide data is typically collected. Often-used tabular data sets (e.g., demographic data) will be made centrally available.
Function	A menu-driven interface allows a user to select a unit of geography for mapping (e.g., counties), and a standard data set or a custom data set provided by the user. The application generates a shaded map by providing a limited set of options for users to define the number of classes, class breaks, map display parameters (shading, etc.), and sheet size or scale. The user may then choose to generate a hard copy on an available printing or plotting device.
Users	All State agency personnel, to begin. Eventually all local government personnel and State users.
System Environment	Accessible as server-based applications via the Internet or Intranet, via standard Web-browsers, or locally if users choose to download application software and data depending on the location of printing and plotting devices. May use ArcView, ArcInfo, or MapObjects. but Intergraph's GeoMedia and GeoMedia WebMap may be used as well.

Application	ADDRESS AND JURISDICTION QUERY
Data	Transportation centerlines, address ranges, political boundaries, administrative boundaries
Function	Allows a user to navigate to a particular location based on an address input, coordinate, or other means. The user will receive a tabular list of political and administrative districts that cover that area and a map display of selected boundaries that apply to that area (county, city, utility service area, State government jurisdictional regions, election districts, COG region).
Users	All State agency personnel, to begin. Eventually all local government personnel and citizens of the State.
System Environment	Accessible as server-based application via the Internet or Intranet, via standard Web-browsers, or locally if users choose to download application software and data depending on the location of printing and plotting devices. May use ArcView, ArcInfo, MapObjects, or GeoMedia.

2.6.2. TIER B—Multiple User/Jointly Supported Applications

Applications in this tier are important for multiple agencies or organizations but are not considered important for a large number of user organizations as are those in the "General Access" tier. Development, deployment, and maintenance responsibilities for these applications will be shared among multiple agencies. A large number of GIS applications could be included in this tier. The applications defined below are not considered to be a comprehensive picture of the tier, but they provide a sample of the types of applications in this category. Some of these applications may be considered templates that can be adapted by specific groups of users to match a more specific need.

Candidate Tier B applications include:

- Economic Development Site Assessment
- Permit Mapping and Tracking
- Law Enforcement Mapping and Analysis
- Traffic Accident and Ticketing Analysis
- Cultural Resources Identification
- Preliminary Environmental Screening
- Emergency Preparedness Planning
- Capital Project Mapping and Tracking
- Document Management and GIS Access.

Application	ECONOMIC DEVELOPMENT SITE ASSESSMENT
Data	The level at which an application will support economic development in a certain area will depend on the data resources available in that area. The capability for demographic analysis and viewing data that indicate the positions of points of interest and landmarks, utility service areas, and county and municipal boundaries, as well as roads, rivers, lakes, and streams, will be available throughout most of the State. There will be fewer opportunities for analysis of more detailed data depicting parcel boundaries, buildings, paved areas, and utility lines. As time goes by, those opportunities will increase, and the economic development application must be developed to account for those situations.
	Street centerlines, hydrography, administrative boundaries, county and municipal boundaries, census tracts and blocks, demographic data, utility service areas, and digital orthophotography.
	Eventually parcel, zoning, and planimetric data.

Application	ECONOMIC DEVELOPMENT SITE ASSESSMENT (continued)
Function	This application will allow users to view and query data layers that describe the potential for selected areas as candidates for a business relocation sites. The application will also be used to indicate where a few improvements in infrastructure could greatly enhance the economic development potential for an area.
Users	Dept. of Commerce, COGs, Economic Development organizations affiliated with South Carolina regions and local governments, commercial real estate companies
Examples	Insight, an application developed by the Department of Commerce, is distributed on a CD-ROM. It will serve as a model for the development of this Intranet/Internet application.
System	Accessible as server-based application via the Internet or Intranet, via standard Web-browsers, or locally if users choose to download application software and data depending on the location of printing and plotting devices. May use ArcView, ArcInfo, ArcIMS, MapObjects, or GeoMedia.

Application	PERMIT MAPPING AND TRACKING
Data	Permit databases, street centerlines, bridges, county and municipal boundaries, hydrography, wetlands, watersheds, soils, and other relevant environmental layers
Function	The Department of Health and Environmental Conservation must issue several types of permits and conduct inspections of many sites throughout the State. The Department of Transportation applies for permits when conducting projects and must keep track of their permitting requirements. Other agencies deal with permits as well, including local governments. This application will allow several agencies involved in obtaining, issuing, or inspecting permits to view their locations of concern along with other permit sites. This application will provide query tools that will allow users to view specific types of permits by their status. Permits will be displayed in reference to map features according to several types of geographic locators, including coordinates collected with GPS, facility ID numbers, and addresses.
Application	PERMIT MAPPING AND TRACKING (continued)
Users	DHEC; DOT; DNR; local governments; any agency applying for, receiving, inspecting, or issuing a permit
System	May use ArcView, ArcInfo, MapObjects, ArcIMS, perhaps with a third party permit tracking software

	package integrated with GIS.

Application	LAW ENFORCEMENT MAPPING AND ANALYSIS
Data	SLED law enforcement reporting database, street centerlines, county and municipal boundaries, hydrography, census tracts, and block groups. The incident locations will come in the form of addresses for the most part, although street intersections will be used, and in the future, map coordinates will be obtained using GPS receivers. There will be a variation in the quality of the location data that will be received. NOTE: Some of these data will be confidential in nature and there will have to be security associated with the databases so only authorized personnel will have access.
Function	This application will be used to display, query, and analyze incidents reported by law enforcement agencies throughout the State. The State Law Enforcement Division (SLED) receives reports from all law enforcement agencies in the State and maintains a database with records of crimes reported and arrests. This database is used to report statistics for the State and to perform crime analysis.
Application	LAW ENFORCEMENT MAPPING AND ANALYSIS (continued)
Users	SLED, Dept. of Public Safety, DNR Conservation Officers, Attorney General's Office, other State law enforcement personnel or investigators, local police forces, County Sheriff Departments
System	May use ArcView, ArcInfo, MapObjects, or GeoMedia. Applications may access data stored according to ESRI's new "geodatabase" environment using ArcSDE, or data could be maintained locally as shape files for ArcView.

Application	TRAFFIC ACCIDENT AND TICKETING ANALYSIS
Data	Traffic ticket and crash data from the South Carolina Crash and Ticket Tracking System (SCATTS), street centerlines, county and municipal boundaries, hydrography, census tracts, and block groups. The Dept. of Public Safety, Highway Patrol is in the process of planning procedures using GPS receivers that will facilitate mapping the locations of incidents. Currently, location data are recorded as distance from intersections and the measurements are not reliable.
Function	The Department of Public Safety State Highway Patrol monitors traffic citations and traffic accidents throughout the State. This application will allow users to view crash and ticket locations to plan activities and roadway improvements. Users will have the ability to select incidents by conditions and see their distribution on a GIS base map. Many agencies will need to access this application to assist with their planning process.
Users	Dept. of Public Safety, Department of Motor Vehicles, Dept. of Transportation, local and regional transportation planning organizations, local police forces, County Sheriff Departments
System Environment	May use ArcView, ArcInfo, MapObjects, or GeoMedia.

Application	CULTURAL RESOURCES IDENTIFICATION
Data	Street centerlines, State and Federally owned lands, National Register sites, sites being surveyed, archeological and architectural sites, project areas where surveys will take place
Function	Several agencies are required to keep track of archeological and architectural sites with historic significance. An application will be developed to display and query these types of sites along with data entry capabilities that will be used to catalog the sites.
Users	Authorized users only in Dept. of Archives and History, Institute for Archeology and Anthropology, DNR, DOT, DPRT, DHEC, Federal Agencies
System Environment	May use ArcView, ArcInfo, MapObjects, or GeoMedia.

Application	PRELIMINARY ENVIRONMENTAL SCREENING
Data	Street centerlines, all natural resource layers (hydrography, topography, soils, wetlands), flood zones, recreation sites and parks, environmentally sensitive areas or habitats, State and Federally owned lands, archeological and architectural sites.
Function	This application will carry out predefined GIS data searches and overlay operations to identify potential conflicts or environmental impacts of possible development activity. Users will enter a point or area location, and the application searches appropriate data layers. Based on a user-defined logic, the application will prepare maps showing potential environmental sites or areas on or near the designated location and a tabular report listing potential types of impacts that should be investigated in more detail.
Users	Institute for Archeology and Anthropology, DNR, DOT, Commerce, COGs
System Environment	May use ArcView, ArcInfo, MapObjects, or GeoMedia. Applications may access data stored according to ESRI's new "geodatabase" environment using ArcSDE.

Application	EMERGENCY PREPAREDNESS PLANNING
Data	Street centerlines, hydrography, flood zones, hurricane surge limits, evacuation routes, emergency shelters, staging areas, designated supply repositories, and other layers relevant to emergency response
Function	An application or a set of applications will be developed to support planning for emergency operations, tracking resources during emergencies, and assessing damage after emergencies. This application could be made available to all parties involved in emergency planning and response, as well as other personnel needing access to the data and the functions of the applications.
Users	Emergency Preparedness Division, county emergency preparedness coordinators, any agency involved in emergency coordination, and eventually citizens who may view a limited version over the Internet to get instructions accompanied by descriptive maps

Application	EMERGENCY PREPAREDNESS PLANNING (continued)

System Environment	May use ArcView, ArcInfo, MapObjects, or GeoMedia. Applications may access data stored according to ESRI's new "geodatabase" environment using ArcSDE, or data could be maintained locally as shape files for ArcView.

Application	CAPITAL PROJECT MAPPING AND TRACKING
Data	Transportation centerlines, hydrography, political and administrative boundaries, ortho imagery
Function	Users will be able to enter the location of a capital project by point location, linear segment (road segment), or area. They will be provided with a template form to enter identifying and status information about the project. Menu-driven query capabilities will allow users to query for types of projects and will display a map and a summary report of information about the project.
Users	Budget and Control Board, DOT, DNR, Revenue, Commerce, local governments, utility organizations
System Environment	Server-based Internet environment accessible via a Web browser. May provide direct interface to selected external project status databases.

Application	DOCUMENT MANAGEMENT AND GIS ACCESS
Data	Most base map layers and specific map features that provide a link to documents (scanned raster format or word processor format)
Function	This can be considered a template application that may be applied to many different cases. It provides a menu-driven environment for users to select a category of documents (e.g., engineering plans, property records, field inspection reports, etc.) that have a logical tie to a location or map feature. The application then allows the user to perform two types of queries—1) a database query to identify documents that meet certain criteria (based on database index fields stored for those documents) and identify their map locations, AND 2) pick map locations of features interactively and display documents that apply to those locations.
Users	Any organization that has a frequent need to locate and view documents based on geographic and map-based queries
System Environment	Requires GIS software to provide the map view and map-based queries, relational database software, and viewing software to display document files. May use ArcView or MapObjects and may be interfaced with a third party document management package.

2.6.3.   TIER C—Agency-specific Applications

Applications in this tier are specific to a particular organization or user group, and development and maintenance will be the full responsibility of the specific agency. A central body should encourage the use of system and development standards that apply to GIS applications in Tier A and Tier B, but there will not be any direct oversight by a central body unless such a body is asked to participate.

No agency-specific applications are defined in detail in this report, but they cover a broad range of topics important for most organizations. Some possible examples include:

- Road condition and facility inventory
- Gap analysis for DNR
- Assessment of environmental health impacts
- School bus routing analysis
- Support for political re-districting evaluations
- GIS support for transportation modeling
- Evaluation of parcel characteristics and sales values to support assessments
- Customer location and isolation analysis for utility networks
- A large range of custom map display applications needed for specific sets of users
- Custom agency specific query and display applications
- Custom field data capture or query applications.

2.7.   APPLICATION PRIORITIES

Development of mature GIS installations is a long-term proposition. The applications described in this report, and additional ones that will likely be identified after the GIS has matured, cannot all be put in operation at the same time. It is critical, therefore, that application development be staged over a period of time and that a plan be prepared for long-term implementation with enough flexibility to make changes if priorities or conditions change. CGI will be responsible for this planning.

The GIS design is based on a phased approach in which applications are developed incrementally. The timing for developing applications should be based first on their importance and level of need for users. This is a reflection of their impact on business drivers and organizational missions, the frequency of use and size of the user base, and any special circumstances that influence user need. In addition, decisions for development and deployment must consider the complexity and level of effort required to develop the application and the availability and/or the cost of developing the database layers upon which the application relies.

Typically the applications that receive the highest priority for development are those that are used to maintain, document, and allow access to GIS databases.

As part of a statewide GIS coordination effort, applications in Tier A (General Access) should all be considered the highest priority for

deployment through a central GIS service center.

SECTION 3

SECTION 3
INFORMATION SYSTEM AND
GIS CONFIGURATION STATUS AND NEEDS

This section focuses on the current computer hardware, software, and network environment for information systems in general, as well as GIS. It will review the status of information system and GIS deployment in the State and provide observations about future system needs to support GIS users.

3.1.   INFORMATION SYSTEM ARCHITECTURE SUPPORTING SOUTH CAROLINA GIS USERS

In this section, an overview of the background and status of information system infrastructure in South Carolina is provided.

3.1.1.   Recent Historical Perspective on State Government Information System Environment

According to the South Carolina Information Infrastructure Assessment (SCIIA) Report of 1996, produced by the South Carolina State Budget and Control Board, the State information technology infrastructure has been evolving in South Carolina since the mid-1960s with the development of specialized telephone service for State offices. Fragmented development of data networks occurred until 1983 when a State Plan On Technology (SPOT) was developed in response to the Consolidated Procurement Code of 1981. The Consolidated Procurement Code was passed by the General Assembly, and it mandated a State plan for the management and use of information technology.

The SPOT plan that resulted has shaped the development of information resource management since that time. SPOT established several initiatives that included:

1. Statewide office automation standards

2. Statewide integrated microwave communications network for video, voice, data, and radio

3. Shared communications network for computer centers

4. State government organizational structure for efficient and effective information resource management

5. Planning for the use and management of information technology resources

6. Education and training

7. Technical standards

8. Cost recovery

9. Tracking and accounting system information

10. Information locator system

11. Disaster recovery facility

12. Electronic printing network.

One result of SPOT was the formation of the Division of Information Resources Management that has since been reorganized into the Office of Information Resources (OIR) within the State Budget and Control Board. This office, along with the Office of Technology Planning and Management, sets the stage for developing and operating information technology in South Carolina along with the Information Resource Council.

Between 1987 and 1989, the State data network was developed. Known as the South Carolina Information Network (SCIN), it originally grew out of an integration of data and voice networks on a single communications backbone, established for State telephone systems. SCIN still exists and, as of 1996, the SCIIA report documented plans to expand it by establishing a Statewide Connectionless Data and Frame Relay Service to facilitate connecting agency LANs and by allowing high volume data traffic between connected locations.

Another impact on data communications has been the development of Metronet, serving the Columbia and Charleston metropolitan areas. Metronet is based on fiber lines connecting many State offices in and around the two metropolitan areas. FDDI protocol has been chosen for the operation of Metronet. Since the distribution of the SCIIA report in 1996, there has been significant expansion of the fiber lines available for data communications.

The State Budget and Control Board has been instrumental in coordinating all of these developments. Most State agencies and other operating units have used the resources for data communications. Within these operating units are computer systems that support unit

activities and internal information technology personnel. These units operate independently for the most part, but in the interest of coordination and adhering to the State plan, some standards have been established to ensure appropriate system procurement practices.

3.1.2.   Current Information System and Network Environment in State Government

Responsibilities for the planning, design, development, and administration of information systems for State agencies can best be described as a mixture of centralized and decentralized functions. Centralized services are provided by the Office of Information Services (OIR) that is responsible for the operation of the State's Data Center, housed in a new facility that consolidates 13 former individual data centers. OIR is also responsible for planning, monitoring, and supporting the State's wide area communications network. The Data Center includes mainframe and midrange computers and a variety of servers (NT and Unix) through which State users can access data and applications. Through the Data Center, OIR also maintains Internet Web servers and supports applications for State agencies. OIR also provides application development and support services for State agencies upon request.

The State has been aggressive about implementing a statewide backbone of high-speed wide area network connections linking all schools and libraries to the State's Data Center and to the Internet. A large number of regional and branch offices of State agencies are distributed throughout the State, but no unified plan for linking these office sites efficiently to the backbone has been prepared or executed. While many of these offices do have wide area network access, those connections have been set up on a case-by-case basis, by the individual State agency. While no specific documentation is available, it may be that these links are not configured in the most efficient way or that costs for wide area services (from third-party communication providers) may be reduced. To support a more robust wide area network supporting State government offices, a study examining the office locations and the most appropriate network connection scheme should be undertaken by OIR. Such a study would employ GIS technology to map locations of the connection sites (locations where fiber terminates) and the sites that need to be connected (State offices requiring connection to the fiber lines), to determine the best strategy for establishing connections.

- State agencies are given a high degree of freedom and autonomy in developing and maintaining their own information system applications and computing infrastructure. Most agencies have created individual information system offices. For the most part, responsibility for the administration of numerous agency-level local area networks, computer hardware, and individual software packages and applications rests with the individual agencies.

- The high degree of decentralization has resulted in an information system environment that can be characterized by the observations below:

  – There are few standards governing operating systems, local area network design, database management software, or other core software that supports enterprise applications. This results in a wide array of network configurations, operating systems, database management software, and office productivity software. NOTE: IRC standards have recently been approved designating Microsoft Windows as the standard desktop operating system and Microsoft Office Suite for office productivity.

  – Currently most interagency data communications (inter-LAN communication) occur over the Internet. In some cases, these Internet communications access servers at the Data Center, configured with appropriate firewalls and high-speed connection to external Internet Service Providers (ISPs), and in other cases, individual agencies have set up their own Web servers and ISP connections. There is no reported Intranet through which State agency users communicate or remote connections between separate local area networks allowing direct access to a remote server at an agency site. The Internet will likely be the most effective wide area medium in which users will communicate, although there will be GIS applications where direct LAN-to-LAN communication may be important.

  – Many agencies have put in place well-running applications, suited to their own users, and which meet the business needs of their agency.

  – In many cases, the decentralized approach to system planning, design, and development has likely allowed usable applications to be deployed quicker, but obstacles to information sharing among Divisions and across State Departments have resulted.

  – There is not currently a strong history or set of procedures that promotes multi-agency information system planning and development, but the activities of IRC and CGI are helping to create an environment where practical standards and joint system development and support are realistic.

The SCIIA report documents several wide area networks used in South Carolina and lists the organizations that participate in the use of those WANs. There is no clear indication of whether LAN-to-LAN connections are active across these WANs, and none have been reported by any project participants. The most significant of these for the scope of this project are Metronet and the South Carolina Information Network (SCINET). Several State agencies are connected to one or both of these, and the University of South Carolina GIS Data Clearinghouse is accessed through Metronet, discussed earlier in this section. It is a high-speed network backbone based on fiber cable and FDDI protocol producing data transfer speeds of 100 mbps, located in the Columbia metropolitan area. Metronet is attached to StateNet which is a statewide network based on frame relay and connectionless data services provided through a contract with Southern Bell. Agencies

and organizations connected to Metronet, or with plans to be connected at the time of the SCIIA Report publication, include:

- State Board for Technical and Comprehensive Education and the 16 Technical Colleges
- All offices of the Budget and Control Board
- DHEC
- Coastal Council - OCRM
- Francis Marion University
- Department of Natural Resources, Water Resources
- Commission on Higher Education
- State Department of Education
- Department of Commerce
- Governor's Office, Public Safety
- Department of Revenue
- Department of Probation, Parole, and Pardon Services
- State Library
- Department of Public Safety
- Governor's Office, Continuum of Care
- South Carolina Educational Television
- CoastNet
- APPNet.

SCINET is based on a backbone of leased T-1 lines with connections providing up to 56 or 64 kbps data transmission speed. Participants in SCINET include:

- Department of Juvenile Justice
- Department of Health and Environmental Control
- Department of Transportation
- Office of Information Resources
- Department of Mental Health
- Forestry Commission
- State Department of Disability and Special Needs
- State Department of Vocational Rehabilitation
- State Law Enforcement Division
- Department of Natural Resources
- Educational Television Network
- State Health and Human Finance Commission
- Department of Corrections
- University of South Carolina – Coliseum
- Election Commission
- Employment Security Commission
- Department of Social Services
- Clemson University
- Department of Revenue
- Protection and Advocacy for the Handicapped
- Health and Human Services Finance Commission – CSES
- Probation, Parole and Pardon
- Continuum of Care
- Department of Public Safety
- Commission for the Blind.

3.1.3. Information Technology among Other Organizations in the State

While this study did not include a comprehensive examination of the status of information systems and use among all GIS stakeholder groups in South Carolina, some general observations can be made about non-State government organizations that are or will be important users of GIS. GIS is one of several core information technologies that are important for local governments, utility organizations, and other groups and it is not possible to provide direct access to GIS without at least a basic computing infrastructure on which to deploy it. Therefore, an understanding of the status of information technology across the State is important.

Adoption of information technology by cities, counties, and utilities in South Carolina varies from very sophisticated mainframe, midrange, and client server systems operating over networks with hundreds of users to stand-alone PCs with records maintained using spreadsheets or word processing software. There is a wide diversity among local governments and public utilities in the extent of information technology adoption and the staff expertise available to design, support, and use the technology. This diversity is closely related to size (population or customer base) and local economic conditions. Many small, rural cities and counties still manage information in paper form, but most have adopted at least some use of personal computers and packaged software. The Windows operating system is standard on most client server

installations (Win95, Win98, or NT) with networks being run through Windows NT or Novell network operating systems. The most common use of these systems is for office automation—word processing, the use of spreadsheets, and e-mail—and the Microsoft Office suite is the most frequently used.

Most local governments and utility organizations have embraced the Internet. This has been encouraged by the State's role in providing wide area network access statewide. In some cases, Internet use by local government is limited to email, file transfer, and general Web access, but larger organizations are building sophisticated Internet applications for citizen access and information distribution, and e-commerce, and to gather and process citizen input, questions, and suggestions, but they have been slow to integrate the Internet with existing systems or to develop applications that can be used to update records or to perform analysis.

3.2.   GIS AND RELATED SOFTWARE USE IN SOUTH CAROLINA

GIS software is already widely used across South Carolina in many different organizations. As far as GIS software use is concerned, packages from ESRI predominate and have become a de facto standard for use by State agencies, councils of government, local governments, and many utility companies. However, GIS and computer-aided mapping software from Intergraph, MapInfo, Autodesk, and Smallworld is also in use by state agencies and other user organizations in the state. As part of its user survey, PlanGraphics asked questions about GIS software use and GIS project status. The details of this survey are included in Appendix A and a summary is provided in Table 3-1. A summary of the results of the survey responses, from State agencies and from local governments, COGs, and utility companies, is included below.

Table 3-1: Summary of Current GIS and Mapping Software Use

	# of Respondents	Software Company					
		ESRI	Intergraph	Autodesk*	MapInfo	ERDAS	Other
State Agencies	31	13	1	3	1	1	4
COGs	6	6		2		1	
Local Government	20	17		8		1	1
Utilities	18	15		12			1
Educational Institutions	5	5				2	

*Mainly AutoCAD for engineering drawing compilation and some computer-aided mapping.

Major observations resulting from PlanGraphics' information gathering are summarized below:

- ESRI software and AutoCAD are the predominant software packages used for GIS and digital mapping in South Carolina. MicroStation also plays a significant role as a CAD package and a fairly large implementation using Intergraph's GeoMedia software suite is in progress in the Department of Transportation. The wide use of ESRI software packages has made some ESRI data formats well accepted through import functions by other software packages. One ESRI format supported by the ArcView package, the shapefile (.SHP) is very popular. This format and the ESRI ArcInfo coverage format can also be directly accessed by some other vendor software (GeoMedia included). Where direct access to a data format is not supported, an option is to perform a batch file translation and exchange between software that maintains data in different formats. While this implies a time delay as well as duplicate storage of data, it is a technically simple and convenient way to provide access to data. ESRI and Intergraph along with other GIS and database vendors, have developed technology for storing GIS data in RDBMS files. Some agencies are beginning to experiment with this approach and due to the development direction being taken by the industry, eventually all GIS will be based on this approach. State agencies such as DNR, DOC, DHEC, and ORS are beginning to install Spatial Data Engine (SDE), ESRI's RDBMS-based GIS product, and translating data into the SDE geodatabase format. The transition from traditional GIS to RDBMS based GIS among other government organizations is occurring at a slower pace than at the State agency level.

- Another approach being used by ESRI and other vendors is the use of Microsoft COM compliant languages to create Windows-based applications with GIS objects that can be incorporated into programs written with the COM languages such as Visual Basic, Delphi, and Powerbuilder. State agencies have already developed some of these types of applications, and more are planned for the future. Other government organizations have started to create these types of applications as well.

- Significant development by GIS vendors has focused on providing tools for users to access and query GIS data over the Internet. State agencies have begun to use some of these tools to develop applications that provide information for users of their web sites. Other government organizations are developing Internet capabilities, but GIS components on those websites are slow to develop. Most major GIS software vendors including Intergraph, AutoDesk, and ESRI have web-enabled GIS software products that allow users to build server-based applications and databases that users can access through a standard Web browser. Some organizations are in the process of implementing MapObjects and MapObjects IMS applications. The Office of Research and Statistics (ORS) has established a MapObjects IMS Internet application to help citizens look up their election districts by entering their address and zip code. The Department of Commerce used MapObjects to develop Insight, the economic development support package distributed to COGs and local governments on CD-ROM. At this time, traditional GIS software and data predominate among users in South Carolina, but in the future, new software products based on RDBMS and the Internet will gain in popularity. These approaches provide the most economical methods of providing access of map data to a wide variety of people, scattered throughout the State.

3.2.2.   GIS and Related System Use in State Agencies

Table 3-2 summarizes the current use of GIS in State agencies.

Table 3-2: Status of GIS Use by State Agencies

State Agency	GIS Software in Use	Summary of Status and Use
Department of Agriculture	None Report	
Department of Archives and History	ArcView is used on NT	Collects and stores confidential digital map data and distributes it to authorized users.
Attorney General's Office	None Reported	
Budget and Control Board—Division of Operations—Office of General Services	AutoCAD, ArcView	Used to store and maintain building drawings and to support Master Plan Development.
Budget and Control Board— Division of Budget and Analysis—Office of Research and Statistics	Five floating point ArcInfo licenses on NT with ArcView, MapObjects, MapObjects IMS, and SDE for SQLServer; also has MapInfo and Atlas GIS	Develops and maintains a TIGER based road centerline database with E911 address ranges and road names. Coordinates development of accurate road centerlines with county governments, Geodetic Survey, and other entities. ORS is spatially enabling the SC Master file of state agency client information. This database will be web-enabled in a dataware-house construct for geostatistical analysis in the coming year. ORS supports the Governor's office with digital mapping services especially the Division on Victim Assistance. ORS provides GIS support services to the Dept. of Social Services for welfare reform and other special projects. ORS develops and maintains the redistricting support system which serves political geography down to the precinct level for reapportionment. ORS supports the state data center by providing Census TIGER line data. ORS provides GIS and GPS training and support for government and non-governmental entities.
Department of Commerce	UNIX and NT ArcInfo, ArcView, MapObjects—Moving to Oracle SDE	Maintains the SCIP database and develops applications to assist local governments and COGs.
Commission on Higher Education	None Reported	
Department of Corrections	None Reported	
Department of Education	**Office of School Facilities**—ArcView	Used for maintenance and access to a school location atlas.
Educational Television Network	Topo USA on PC running Windows '98	Used to locate tower sites.

Table 3-2: Status of GIS Use by State Agencies (continued)

State Agency	GIS Software in Use	Summary of Status and Use
Forestry Commission	MapInfo on NT, Maptitude	MapInfo is used for forest stand management and forest fire dispatch functions. Maptitude is planned for future deployment to field offices for desktop mapping/GIS uses in landowner assistance programs." ArcView is being evaluated for Urban Forest management and future fire dispatch functions.
Environmental Quality Control (EQC) (Bureau of Air Quality)	ArcView, ArcExplorer	Used to analyze the location of measurements and incidents to indicate patterns and present results. Regulate air emissions including: • Air quality permitting • Asbestos monitoring.
DHEC, EQC, Bureau of Ocean/Coastal Resource Mgm't.	ArcInfo, ArcView, ArcExplorer	Regulate Coastal Resource including: • Critical area permitting • Coastal zone consistency
DHEC, EQC, Bureau of Solid & Hazardous Waste Management	ArcInfo, ArcView, ArcExplorer, Currently testing MapObjects IMS	Regulate solid and hazardous waste including: • Hazardous waste facility permitting • Hazardous waste transportation • Infectious waste facilities permitting • Radioactive waste facilities permitting • Solid waste landfill permitting • Mining and reclamation permitting • Certificate to explore more minerals • Terminal facility registration • Oil and gas exploration, drilling, transportation, and production
DHEC, EQC, Bureau of Water	ArcInfo, ArcView, ArcExplorer, Currently testing MapObjects IMS	Regulate Water pollution and drinking water including: • Wastewater discharge permitting (NPDES) and land application permitting • State construction permitting • Stormwater NPDES permitting • Section 401: Water quality certification • State dams/reservoirs safety act permitting • Navigable waters permitting • State storm water management and sediment reduction act permitting • Shellfish sanitation-certification/permits • Public water system construction and operation permits • Interbasin transfer permitting program • Underground injection control permitting • Groundwater use permitting • Recreational waters construction and operating permitting.

Table 3-2: Status of GIS Use by State Agencies (continued)

State Agency	GIS Software in Use	Summary of Status and Use
DHEC, EQC, Bureau of Environmental Services	ArcView, ArcExplorer	Regulate: • Manages EQC's environmental laboratories Environmental lab certification program
DHEC, Biostatistics and Health Services	ArcInfo, ArcView (Spatial Analyst, Network Analyst StreetMap 2000), and Epimap, evaluating SDE, testing MapObject, RDBMS: Access, DB2	• Analyze and disseminate critical health statistics • Assist others in analysis of spatial health solutions • Monitor indices of health status • Construct designs for biologic and spatial statistical computation and modeling • Emergency management • Facility management.
Department of Health and Human Services—Bureau of Senior Service	None Reported	
Higher Education Tuition Grants Commission	None Reported	
State Housing Finance and Development Authority	Microsoft Streets 2000	Used to create maps to find rental units or complexes.
State Law Enforcement Division	None Reported	Planning the development of a web-based crime and arrest incident mapping and query application.
Department of Mental Health	AutoCAD	Used to store and maintain building plans and designs.
State Museum	None Reported	
Department of Natural Resources	Marine Resources Division—ArcInfo NT and ArcView). Land, Water and Conservation Division—ArcInfo and ArcView on NT and RISC 6000. MrSID, ERDAS Imagine, Future—SDE and ArcIMS	Marine Resources Division—Bottom mapping along the coast of South Carolina, ACE basin ecological characterization, shellfish mapping Land, Water and Conservation Division—NRIMA Section is responsible for the administration of the DNR GIS Data Clearinghouse/data quality control/updating.
Department of Parks, Recreation and Tourism	All Divisions—ArcInfo and ArcView on NT, MapObjects (planned)	Parks and Recreation Division and the Division of Business and Community Development/Heritage Tourism Development—create presentation and brochure materials, including park and tourist maps. Planning to use IMS products in the future.
Department of Public Safety	ArcInfo and ArcView on NT, SDE is planned for the future, and DPS will be upgrading to ArcInfo 8.0.1	Planning to implement SCATTS which will have a GIS component. Data will be collected in the field by officers, and downloaded, stored, and analyzed through GIS and the SCATTS RDBMS.
Department of Revenue	None Reported	

Table 3-2: Status of GIS Use by State Agencies (continued)

State Agency	GIS Software in Use	Summary of Status and Use
Department of Social Services	ArcView	GIS operations performed by the Digital Cartography Unit of the Office of Research and Statistics.
Department of Transportation	All Offices—Intergraph servers and workstations running GeoMedia and GeoMedia Pro on Windows NT, also MGE and MicroStation	Used for planning purposes, NPDES outfall location and monitoring project, developing a statewide centerline database to be integrated with LRS. Conducted GIS pilot project of State Interstate System, GIS-based website.
Clemson University Agricultural and Forestry Research System	SUN Sparc Station running Solaris 2.5 with ArcInfo 7.2 and ArcView 3.1; also ArcInfo 7.2 for NT and ArcView 3.2 on PCs with Windows NT and ArcView 3.2 on PCs with Windows 9x	Used for teaching, research, and management of the Clemson Experimental Forest.
College of Charleston	ArcInfo on UNIX and ArcView on NT	Teaching and research.

South Carolina Institute of Archeology and Anthropology	ArcInfo, ArcView software	Supported by the University of South Carolina Department of Geography Center for GIS and Remote Sensing which operates with both NT and UNIX. Maintains an inventory of archeological sites.
South Carolina Sea Grant Consortium	ArcView and AutoCAD both running on NT, ERDAS	LIDAR Data Analysis, view and query various spatial data layers, digitize buildings and other features.
University of South Carolina— Department of Geography	Dept. of Geography - ArcInfo, ArcView software on NT and ArcInfo and ERDAS on UNIX Throughout the University – mostly ESRI products, some MapInfo and Intergraph	Over 10 units in the University use GIS for research and support of student projects and class work, faculty and student research, contractual research, and campus projects
University of South Carolina—Digital Mapping Services	ArcInfo, ArcView , ERDAS, Mapinfo, AutoCAD, Microstation, MapObjects software. Both NT and UNIX platforms supported.	GIS analysis and support for a variety of University departments and other government agencies.
University of South Carolina Baruch Institute	NT PCs running ArcView and ERDAS Imagine, ArcInfo on SUN Ultra 10	Update of land use/land cover data, research, and teaching.
South Carolina State University 1890 Research Extension GIS Lab	ArcInfo for NT and ArcView with all extensions, SUN with Solaris 2.6, ArcInfo and ArcView with extensions, MapInfo, Atlas GIS, ERDAS Imagine	Supports GIS related research and development initiatives such as building geographic databases.
Adjutant General's Office—Dept. of the Military —Air/Army National Guard	Facilities Mgmt.—AutoCAD South Carolina Army National Guard—ArcView on Windows NT 4.0	Maintain building drawings and manage resources on properties.

The status of GIS portrayed by Table 3-2 indicates that ArcInfo and ArcView are the most frequently used software packages, but there is a trend toward use of the more recently released ESRI products such as SDE, MapObjects, and ArcIMS as well as MapInfo.

Of the RDBMS software in use by State agencies, Oracle is the most popular. Oracle and other RDBMS software will become more important as SDE becomes the GIS database repository in most agencies. The likelihood of this happening is high since ESRI and other vendors such as Intergraph and MapInfo are all focusing the development of their products in the direction of data storage in RDBMS format.

Intergraph mapping and GIS software are used by DOT. The primary packages are GeoMedia Pro and GeoMedia, with some continued use of MGE as well. MicroStation is the CAD package of choice. Oracle Spatial is being evaluated as the data storage and serving engine.

The Forestry Commission uses MapInfo for stand mapping and management. They also operate a Computer Aided Dispatch system based on Oracle with MapInfo supplying a digital map display component.

There is more variation in the use of relational database management software (RDBMS) throughout State government organizations. Oracle, SQL Server, Dbase, FoxPro, Access, and others are all used. Many State agencies also use mainframes to store and analyze their data. Several State agency mainframe applications are maintained at the new State Data Center operated by OIR.

3.2.3.   Non GIS Systems that will Impact GIS Development

Some of the non-GIS databases that will be linked to various GIS data layers are described below. A more comprehensive documentation of these databases is found in Table 3-3.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
Adjutant General's Office—Dept. of the Military	Vision 2K Access	Vision 2K is used to support management of real property. Database management.	A Vision 2K application will integrate with ArcView to assist users with facility inventory and management. Attributes contained in Access are linked to GIS data layers.
Department of Agriculture	AS/400, OS/400, EDCDIC, Windows 9x, FoxPro, Access	Data management.	None identified at this time.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
Department of Archives and History	Access	Access is used to store and manage cultural resource attribute data.	The cultural resource attribute data are linked to GIS.
Attorney General's Office	3 Compaq Proliant servers—1 with NT, 1 with Netware, and the last unknown	These systems run WordPerfect and Office, Lawbase, SQLServer, and IIS.	No integration planned or identified at this time.
State Budget and Control Board—Division of Operations—Office of General Services—State Building and Property Services	Access running on Windows '95 computers FoxPro running on DOS Oracle	Access for a project database, a leasing database, and a State land inventory. FoxPro for an appraisal database. SPANFM (Oracle-based) for Building Facilities Management. SPIRES (mainframe system) for tracking capital projects.	These databases could be linked to parcel data to create maps of State facilities and lands.
State Budget and Control Board—Division of Budget and Analysis—Office of Research and Statistics	SQLServer with ArcSDE; Oracle Server; Access for small database management; Excel for spreadsheets and reporting	Used for database management and storing and managing attribute data for GIS; SC Master Client Database;Oracle DataWarehouse.	Databases support a wide range of mapping and GIS applications. Work is proceeding to spatially enable existing databases.
Department of Commerce	Oracle, Access	Oracle is the RDBMS of choice for the Department	Oracle will be used with SDE to be the repository

		of Commerce. It is used for managing all major databases maintained by the Department. Access is used for data access and working with small databases.	for all GIS data.
Commission on Higher Education	Access	Database management.	None identified at this time.
Department of Education		Edulog System for tracking student populations and busing.	Opportunity for use of transportation centerline and address information for Edulog.
Department of Education—Office of Transportation	Access and SQLServer	Access—Manages a Maintenance Operation Database and a Pupil Transportation Info System.	May be used to facilitate school bus routing applications.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
Educational Television Network	PC with Windows VAX system operated by MIS	The PC is used to maintain 2 Excel files— 1 containing lat/long coordinates of SC ETV tower locations, the other containing lat/long coordinates of SC ETV school locations.	These databases can be mapped by GIS software using the lat/long coordinates.
Elections Commission	Mainframe voter registration	Address-based files maintained by local elections boards to define voting precincts.	Could benefit from GIS technology to support update, precinct delineation, map display, and query.
Department of Health and Environmental Control (DHEC)—Environmental Quality Control--Bureau of Air Quality	I-Steps	Emissions Inventory Database.	Maps are created by linking the emissions database to GIS data. In the future, an Internet-based application will allow users to see the values for sites through a map interface.
Department of Health and Environmental Control— Environmental Quality Control—Bureau of Water	FoxPro, Access	Management of databases—known groundwater contamination, public water supply wells, surface water intakes, underground storage tanks.	Linked to GIS through location references to visualize spatial patterns and enhance analysis of activities.
Department of Health and Environmental Control— Information Technology	Excel Dbase, Oracle	Oracle is the basis for the Environmental Facility Information System (EFIS). Dbase and Excel for database management and spreadsheets.	The EFIS is integrated with GIS to allow spatial analysis and visualization of facilities and sites that are monitored by DHEC.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
Department of Health and Environmental Control— Division of Biostatistics	Mainframe ASCI, (Birth, Death, Cancer, Facilities), and DB2 (coming later)	Population-based vital, disease, health services registries and permitted facilities provide the basis for health surveillance and intervention strategies.	The Division is building the State's largest vital and disease spatial database and it will be integrated with the Agency's enterprise DBMS (DB2) to form an integrated public health information system. Address-matching/ Global Position System (GPS) are used to capture spatial data. Geo-spatial analysis (Grid, TIN, Network analysis) are performed routinely to uncover spatial relationships
Department of Health and Human Services—Bureau of Senior Services	Windows 9x and NT Powerbuilder SQL, Access, Visual Basic, Crystal Reports, Ombud 3.0, WordPerfect, Lotus 123	PowerBuilder SQL— AIM Database. Access, VB, Crystal Reports—Case Management System. Ombud 3.0—Long-term Care database. WordPerfect and Lotus 123—Various reports and lists.	Possible opportunities for linking databases to GIS data for spatial analysis capabilities.
Department of Health and Human Services—Bureau of Community Services	IBM Mainframe OS390 with ADABASE, Clipper	Mainframe—Provider Billing Support database and a Client Records database. Clipper—ABC Child Care Voucher System databases.	Possible opportunities for linking databases to GIS data for spatial analysis capabilities.
Department of Health and Human Services— Division of Info Systems Management	Mainframe HDS Pilot 35 Enterprise Server with OS390 running CA IDMS/R	Manages Medicaid databases—Eligibles, Providers, and Claims.	Possible opportunities for linking databases to GIS data for spatial analysis capabilities.
Higher Education Tuition Grants Commission	FlexGen software	Maintenance of databases on an NT server—State Representatives, State Senators, counties.	GIS can be used to create a link to these databases as attributes to data layers depicting counties and election districts.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
State Law Enforcement Division	Mainframe-based (COBOL) incident-based reporting system	Updated daily through receipt of data from police departments across the State. Used for statistical reporting and crime analysis.	Will be linked to GIS data through location references to visualize spatial patterns and enhance crime analysis capabilities.
Department of Mental Health	Informix running on an IBM RISC 6000 FMS, on an IBM 9672—R22 with OS/390 InfoSpan, SQLAnywhere, Registrar, Starting Line, OTG, and IIS on Compaq PCs	Informix—Consumer Information System. FMS—Payroll and Patient Information.	Possible opportunity to link the patient information to the GIS data layers for analysis of activities and facility locations.
State Museum	PCs with Access	To maintain a database of South Carolina museums.	This database could be mapped with GIS software in reference to other data layers to create maps showing museum locations.
Department of Natural Resources Land, Water and Conservation Division	Oracle, Access, Cirrus, MS Office Pro, Adobe graphics, S-Plus	MS Office used for office automation. Oracle, CIRRUS, and Access used for database management and query. Adobe used for graphic design.	Oracle and Access store and manipulate databases to be linked to GIS data layers, and Oracle for Clearinghouse operations. NRIMA may use Oracle with SDE.
Dept. of Natural Resources—Law Enforcement Division	Violations summons system on mainframe	Updated with records of violations and summons handed out.	Will be linked to GIS data through location references to visualize spatial patterns and enhance analysis of activities.
Dept of. Parks, Recreation and Tourism—Parks and Recreation Division	Oracle and Access	Tourism Product Database runs on Oracle. Access is used for managing the Trails and Heritage Tourism Attributes database.	Attributes can be linked to GIS data.
Department of Public Safety	Access	Access is used for general database management.	The RDBMS used for the Crash and Ticket Tracking System will need to be compatible with Oracle which is used by DMV.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
Department of Revenue	None stated	In process of acquiring CAMA system.	Dept. of Revenue plans to acquire a CAMA system that will facilitate integration with GIS.
Department of Social Services	SAS on the UNIX OS	Used to maintain the CLIP database.	CLIP database is mapped through GIS for Social Services by ORS Digital Cartography Unit.
Department of Transportation—Planning Division— Data Services Division	Excel and Access to maintain databases Operates a COBOL Mainframe, TSO, and PCs to run FHWA programs, Entire Connections, Easytrieve and the MS Office Suite. Planning for conversion of LRS to Oracle.	Maintenance of traffic projection and socioeconomic projection databases. These software packages support a Linear Referencing System, a Bridge Inventory, a Pavement Management System, a Traffic Count database, and a Project Tracking System, as well as office automation.	These databases are linked to GIS data layers. The DOT GIS database will be integrated with the Linear Referencing System and the other databases to create an Integrated Transportation Management System.
Department of Transportation—	SQLAnywhere	Access bridge maintenance and National Bridge	The bridge management and inspection databases

Engineering Division (Pre-construction, Construction, Maintenance, Traffic Engineering)	PCs w/NT running MS Office, SiteManager Oracle application and Access Laptops for use in the field w/NT ADABASE on the mainframe Clipper, Pontis, and SQLAnywhere on PCs	Inspection databases. MS Office, SiteManager Oracle application and Access for a Construction Card File. Laptops—MS Office, SiteManager, and TerraModel. Accesses the bridge inventory data using ADABASE. Bridge data using Clipper, Pontis PC database, and SQLAnywhere.	will be linked to GIS data layers. Opportunities may exist to map the location of construction contracts to provide spatial reference and analysis. GIS will be used to assist users with bridge inventory, maintenance, and management.
Department of Transportation— Mass Transit	MS Office Suite Excel and Access on an NT network	Uses the MS Office Suite to maintain an Accident Report database, Railroad Inspections database, and a Project Files database.	Opportunities may exist to map the location of construction contracts to provide spatial reference and analysis.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
State Housing Finance and Development Authority	Pentium PCs running NT for NMMS software, DEC Alpha running NT, VAX system	VAX system for the AOD Home Program database and Section 8 voucher data. Access is used for Tax Credit Monitoring.	These databases could be viewed spatially by linking to GIS data through address fields.
Clemson University Agricultural and Forestry Research System	Mainframe MVS running SAS with SAS FSP, PCs also run Excel, Access and NT PCs run Oracle	Provide database management and statistical analysis capabilities.	These packages available for management of databases that contribute to projects conducted by the University.
College of Charleston	MS Access and MS SQLServer	Provide database management and statistical analysis capabilities.	These packages available for management of databases that contribute to projects conducted by the University.
South Carolina Institute of Archeology and Anthropology	MS Access, Excel, Claris Filemaker Pro 4.0; also uses an Apple Macintosh system	Filemaker Pro—project tracking database, bibliography of archeology. Access 2000—Archeological attribute data.	Archeological attribute data links to GIS.
South Carolina Sea Grant Consortium	Excel on a PC running NT 4.0	Used to maintain an inquiry database. Recently received a Coastal Structures database from OCRM.	May integrate the Coastal Structures database with GIS data in the future.
South Carolina State University	Redhat UNIX, Oracle for Solaris and NT	Builds demographic and socioeconomic databases.	These databases are integrated with GIS to perform geographic analysis of the demographics and socioeconomic characteristics.
University of South Carolina—Department of Geography	Department of Geography • Dbase on Windows NT • Access Throughout the University Several types of relational database software and other computer applications	Management of various databases, analysis of data, and records storage and access.	These packages available for management of databases that contribute to projects conducted by the University. About 4 units in the University analyze external databases with GIS software.

Table 3-3: Geographically-related Systems and Databases Used by State Agencies (continued)

State Agency	Software/ Database Name	Summary of Status and Use	Relationship/ Integration with GIS
University of South Carolina—Digital Mapping Services	Dbase and Access on Windows NT/95 INFO on UNIX	Access, Dbase and INFO used per project requirements.	All databases are integrated with GIS and are used to support project specific requirements.
University of South Carolina Baruch Institute	PCs run SAS and Excel, SPARC 5 as an Internet server	Excel used for entry of attribute data, SAS for statistical analysis.	Data entered through Excel is translated to ArcView as shapefiles and .DBF files.

Some of the more significant databases that may have an impact on GIS applications are discussed below.

DOT Databases

SCDOT uses several databases that have potential for being related to GIS data. Some of the most notable ones are described below. Others are documented in Table 3-3. Many of these data sets are indexed by county route and milepost. This allows them to be analyzed and accessed through a Linear Referencing System. If these data are to be related to GIS road centerlines, the GIS data will require County Route attributes and a special index that will keep track of distance along each County Route from a designated starting point to a designated end point.

- HPMS—The Highway Pavement Management System is a database containing characteristics of the roads maintained by SCDOT. These data are indexed by county route and milepost. They will be linked to a road centerline database that is structured to calculate locations of these database records along the centerline network.

- NBI—The National Bridge Inspection database is accessible through both an ADABASE mainframe application and a Clipper application through PCs. This database focuses on the inspection schedule and status of bridges in the State.

- Bridge Maintenance System—This PC database is maintained using Pontis software with data indexed by bridge ID. These data will be related to bridge features in the GIS database to view the distribution of bridge maintenance status and characteristics throughout the State.

- Accident Reports—Traffic Engineering maintains a database of accident reports. It will be valuable to link these data to the GIS road centerline data layer. This database originally comes from the Department of Public Safety. The geographic reference in this database is listed as variable. That indicates that there will be difficulties in performing links that will provide a consistent linkage to the GIS data. Significant modification may be needed to create a consistent geographic reference in this database. It may not be feasible to link some records to the GIS data.

- Traffic Projections—Planning maintains a traffic projection database with data indexed by traffic count station locations.

- Socioeconomic Projections—Planning tracks several socio-economic characteristics by Traffic Analysis Zones.

Department of Revenue

The Department of Revenue is currently involved in selecting and implementing a Computer Aided Mass Appraisal System (CAMA) that will be made available to local government assessor's offices to assist them with appraisals and record keeping. The project will provide assistance to local governments and will create increased consistency in data received from the counties and municipalities that participate. The results will have a large impact on the availability of parcel attributes as more and more parcel conversion occurs across the State.

The Department of Health and Human Services (DHHS) and the Department of Social Services

The DHHS Office of Senior and Long Term Care Services maintains many databases that have potential for linkage to GIS data through locational references. These include a Senior Centers List, a Case Management System, Service Delivery Sites, and Unit Cost Reports. Most of these databases contain addresses of clients or facilities and some have facility IDs. The Unit Cost Report has a field that references counties. Linking these data to GIS layers will allow spatial analysis of the services provided by the Office, and could provide insight for management decisions. These databases are contained in PC database software programs.

The Bureau of Community Services' ABC Child Care Voucher System has a similar set of databases that have potential for integration with GIS. These include records of Provider Facilities and Client Home and Work addresses. These are maintained through Clipper applications.

Other DHHS databases exist with potential for GIS integration. Examples of this type of integration of social program databases with GIS are already occurring through a cooperative arrangement between the Office of Research and Statistics' Digital Cartography Unit and the Department of Social Services. ORS has a contract to map the Client History Information Profile (CHIP) database using GIS. The CHIP database is maintained in SAS and mapped by ORS using their GIS facilities.

South Carolina Institute of Archeology and Anthropology and the Department of Archives and History

These organizations maintain databases of archeological sites, National Register Eligibility Determinations, National Register Sites, Cultural Resource Inventories, and several related databases that are routinely linked to GIS data using ArcView. The databases are maintained using Access. Address and UTM coordinates are the locational reference fields except in the case of the Archeological Site database that uses an archeological site number. SCIIA also maintains several other databases in Filemaker Pro, one of them a project tracking database.

Forestry Commission

The Forestry Commission operates a dispatch system based on an Oracle database. Some of the tables with records that can be depicted through the Commission's MapInfo software include:

- Incidents with lat/long coordinates, with associated tables documenting fire suspects, special equipment, and fire causes

- Burn notifications with lat/long coordinates, and associated tables documenting area and burn type.

The Forestry Commission also maintains an Access database of forest stand data collected from the State forests.

State Law Enforcement Division (SLED)

SLED maintains a database that will have significant impact on crime analysis throughout the entire State. The South Carolina Incident Based Reporting System (SCIBRS) is a mainframe application written in COBOL. It contains data gathered from all law enforcement agencies throughout the State. It is used to identify patterns of crime reported throughout the State. Integration with GIS will enhance the analysis capabilities of the database. SLED already has expressed an interest in developing a web-based crime and arrest data analysis application that will be available to all South Carolina law enforcement agencies.

Department of Health and Environmental Control (DHEC)

DHEC maintains many databases that are integrated with GIS.

Air Quality maintains an Emissions Inventory Database using I-Steps, a PC software package. The data are periodically linked to GIS data for pollution analysis.

The Bureau of Land and Waste Management integrates several Excel spreadsheets containing solid waste data location and attribute information with GIS. The Bureau maintains Municipal Solid Waste, Industrial Solid Waste, and Construction and Demolition Solid Waste records, while CERCLA and RCRA databases are obtained from EPA.

DHEC Environmental Quality Control uses an Environmental Facilities Information System Oracle database to record environmental regulatory information. DHEC has a project to integrate the EFIS database with GIS to allow users to view and analyze the distribution of regulated facilities and areas.

DHEC has many other GIS applications and projects that link tabular databases to GIS data for spatial analysis purposes. Table 3-3 contains a more thorough documentation of the tabular databases that may be integrated with GIS.

Department of Public Safety

The Department of Public Safety Highway Patrol maintains a mainframe database of accident records and traffic tickets. The Department is planning to upgrade that system to an RDBMS integrated with GIS. The project is called the South Carolina Crash and Ticket Tracking System (SCATTS). Part of the SCATTS project includes developing capabilities for collecting data digitally in the field. It will also improve the efficiency of distributing and providing access to the crash and ticket data. This will benefit the Highway Patrol, as well as the State Transport Police, local police agencies,
DOT planners and traffic engineers, and the Department of Motor Vehicles.

3.2.4.   GIS Use by Utility Organizations

Utility organizations in South Carolina cover a wide variety of businesses, cooperatives, public entities, and service providers. Several survey form responses from utilities representing all of these types of organizations were received and the results were analyzed. GIS is used by utilities for planning and relating maintenance attributes to facility maps. The survey forms contain little mention of plans for the use of Internet-enabled software, with the exception of Santee Cooper which has plans for porting their ArcView and ArcInfo applications into MapObjects applications available over their company Intranet, and Piedmont Gas which reported plans for the use of Internet/Intranet technology with their Smallworld system for allowing personnel throughout the organization to gain access to GIS data. They expect to go from less than 5 users to hundreds by using this approach.

Of the 16 utility organizations that responded to the survey form indicating use of ESRI software products, only 4 reported having ESRI's SDE software. For the most part, utilities are heavy users of CAD software. Among the utilities, there was more variation in terms of GIS

software being used than reported by local governments, State agencies, and COGs. Other systems in use beside ESRI were Smallworld, Intergraph FRAMME, and AutoCAD Map.

Other software used to manage facilities was mentioned in the survey forms. Stoner Gas Distribution Planning software was mentioned by South Carolina Electric and Gas. Southern Engineering Facilities software is used by several utility organizations, and there is significant integration of that package with GIS, especially AutoCAD Map. Both Laurens Electric Cooperative and Lynches River Electric Cooperative operate with that arrangement.

3.2.5.   Local Government and COGs System Use

Local government respondents reported almost exclusive use of ESRI software products, with one exception being a Genasys system. Half of the ESRI users reported having SDE with plans to implement it. Among well-developed and well-used systems is the City of Rock Hill that reports 40 to 60 users. The Town of Hilton Head Island has 50 users. The City of Greenville has 18 ArcView users and over 50 regular MapObjects users (70 licenses).

There is great interest in using the Internet for delivering information to the public. Greenwood County reports a public access website with interactive maps that is maintained and hosted by a third party off-site. In the future, they plan to host the web application themselves. The Town of Hilton Head Island plans to create Internet-based applications upon the release of ArcIMS. Berkeley County reported use of ArcInfo and ArcView as the mapping tools within their GIS Department and the use of MapObjects to provide most users outside the GIS Department with view and query capabilities. Local governments use mainframes and AS/400 minicomputers to operate their database applications, and there are several opportunities to perform integration of the databases maintained on those systems with GIS.

COGs are focused on assisting local governments in their regions. Their systems are used to provide local government users with analysis tools for GIS data such as the Economic Development Information System (EDIS), an ArcView application developed by the Appalachian COG to help local government users in the area to quickly compile data and maps that will support economic development activities. COGs also assist local governments with the creation of GIS data. The Upper Savannah COG is working with water and sewer authorities in their region to develop complete water and sewer databases, and is also working with one County to develop a parcel database. The Pee Dee COG is assisting a local government in their region with naming streets for the implementation of their E-911 system. Among COGs, two—Central Midlands and Appalachian—reported plans to implement an Internet-based application to enhance access to their GIS data resources.

3.3.   KEY SYSTEM CONFIGURATION ISSUES AND NEEDS

The goal of statewide GIS coordination is to provide a means to share the development and access to GIS data and application resources where appropriate. Hardware, software, and network components form the computing infrastructure and processing tools for accessing data and running applications. In order to properly identify the hardware, software, and network needs to best support statewide GIS initiatives in the future, several key issues are identified below:

1. **Extended LAN Connectivity**—Most individual State agencies have their own local area networks (LANs), and within each agency there are separate local area networks that serve separate buildings. Certain GIS applications may be best implemented through dedicated access to LANs, not the Internet. Some GIS database update tasks may be supported most effectively by direct access to LANs. It is important to establish a plan for accessing GIS servers by any required user site either by extending LAN cabling or by inter-LAN access via wide-area communications links. In some cases, if wide area network speeds are not sufficient, there may be a need to place "satellite servers" at remote sites that would replicate certain GIS data (with a clear technical process for data replication to synchronize data storage). All of this carries with it the need to respond to additional access security concerns and routine system and network monitoring and admininstration.

2. **Internet/Intranet Access and Wide Area Communications**—The most cost-effective means of providing widespread access to GIS data for display and query purposes is through an Internet or Intranet application operated by users through their Internet browser. Depending on the system used to create such an application, the access will be through the browser alone or through a plug-in to the Internet browser. Either way, the approach follows a "thin client" philosophy that reduces requirements for a software package with added complexity and many extra functions that will not be needed by casual users. This approach for general use applications will result in high volume use with relatively low cost development and a user-friendly interface.

3. **Interoperability and Data Exchange among Multiple GIS Software Packages—**In South Carolina, including the adoption of Intergraph software by the state Department of Transportation and wide use of AutoCAD as a drafting and mapping tool. software products are the most widely used for GIS. There are some notable exceptions among State government, local government, and utility users. Even among users of ESRI software, multiple packages and data formats are supported. The existence of multiple, largely proprietary data formats, suited primarily for single packages, creates obstacles in accessing and exchanging data among users with software. Vendors have made advances with software capabilities allowing direct access to native formats of other software packages. These multi-platform access capabilities often allow only viewing or query and map display options—usually not full analysis. Advances in effective data exchange tools have made it easier to perform batch translations from one format to another, but this is still not a transparent process, especially when attempting to translate non-standard symbols, complex data types, and complex sets of attributes. Therefore, there will be a continuing need to access and exchange data among different software packages. The technical environment created to support data access and distribution needs to take this into account.

4. **Migration into the ESRI "Geodatabase" (SDE Environment)—**The large number of ESRI GIS software users in the State are primarily users of ArcInfo and ArcView with applications dependent on the main data formats that these packages support (coverages and shape files). It can be expected, and it is recommended, that most ESRI user organizations, particularly those maintaining large data sets, look toward migration to ESRI's "geodatabase" environment. This geodatabase environment being promoted by ESRI uses a highly object-oriented architecture (based on standard environments such as MicroSoft's COM) in which "rules" can be defined for particular data objects and the development of applications employs object-oriented programming tools (like Visual Basic). ESRI is in the process of developing software releases and tools to fully enable this geodatabase environment. ESRI's Spatial Data Engine (SDE) package will provide a foundation for the geodatabase allowing spatial and attribute data to be stored and managed in a relational database management package (e.g. Oracle, SQLServer, DB2). A state GIS service center, with data based on SDE, but with options for distribution and access with different data formats, will best facilitate wide GIS use and sharing of data. Those state agencies and larger local governments and utility organizations that are users of ESRI software and which are maintaining large databases and user communities can begin now to plan migrations to the SDE geodatabase environment. It should be noted however that a migration into this new environment is a major effort which must be carefully planned and executed—a multi-year process for most organizations. This is one GIS development area that could benefit from some statewide coordination and support. statewide basis

5. **Hardware/Software Architecture for a Central GIS Service Center—**Recommendations in this report call for a central GIS service center with a data clearinghouse role to provide certain centralized data and application services. This implies the need for certain hardware, software, and network connections to support its operation. It is presumed that such a service center will require a robust server and sufficiently high-speed Internet connections along with database, GIS, and support software needed for users (operating with multiple CAD and GIS platform software) to be able to access certain data sets and central applications quickly.

6. **GIS-related Procurements—**Currently the Office of Technology Planning and Management (OTPM) reviews procurement documents for all information system projects worth more than $25,000. This will apply to procurements of hardware, software, and services related to GIS implementation. This procurement oversight can promote efficiency and resource sharing, but only if it is based on sound, practical specifications; an effective and quick review procedure; and involvement by GIS professionals. CGI should promote this procurement planning function and work closely with OTPM and IRC to create formal standards to guide it and to be involved in the process.

7. **RDBMS Standardization—**Much of the data that can be analyzed through GIS is best maintained and stored in a relational database management system (RDBMS). An RDBMS is the foundation of any GIS that uses a spatial database repository approach (e.g., ESRI's SDE, Oracle Spatial), and many external applications with which GIS applications need to communicate are based on RDBMSs (e.g., Oracle, SQLServer, Access). While communication between different RDBMSs is facilitated using the SeQueL (SQL) standard for query and Open Database Connectivity (ODBC), each RDBMS may use certain proprietary features that can frustrate integration. It is not feasible to establish a statewide standard governing specific RDBMS package use, but some additional uniformity in procurement and guidelines about system implementation on RDBMS platforms can help system integration efforts. Further uniformity in RDBMS use can also lower overall license costs and allows user organizations to better utilize staff for application development.

8. **GeoSpatial Metadata Software—**Some user organizations in the State have already acknowledged the importance of maintaining a geospatial metadatabase for GIS data sets. Correct and updated metadata is important for—a) a basis for search and query on data availability, b) users' assessment of the suitability of a data set to support needed applications, c) support for a robust data maintenance program, and d) a basis for automating on-line access, data distribution, or data orders (for shipment). In addition to standards that dictate the format and content of the metadatabase (see Section 4), it is important to define and possibly customize software tools to maintain metadata and to allow user queries (Web-based) against the metadata. Some metadata maintenance tools are provided as part of the ArcInfo 8.x package, and Intergraph's GeoMedia, and a number of third parties offer metadata maintenance tools. It is a good idea to reach a consensus on metadata software and put in place as much consistency as possible. Ideally, metadatabase maintenance should occur, in part, as an automated result of GIS data update.

9. **Standards Impacting Application Development—**With an ultimate goal for sharing and greater portability of custom GIS

applications, it will be advantageous to define and adopt standards for GIS application development. The adoption of standards is being encouraged by the industry as a whole with a strong trend toward uniformity in user interfaces (Windows and Web-based browsing) and the use of industry-standard development tools (Visual Basic, C++, Java) as standard environments for GIS vendors. A suite of applications, especially those proposed for the GIS service center, will be enhanced by establishing standard rules for interface layout and basic functionality. In order to further facilitate application development within all three application development environments (general use, multiple/joint user, and individual organization), a "library" of re-usable application components will be established that all users will have access to as building blocks for new applications to be developed. This approach is especially relevant with the evolution toward object-oriented GIS and object-oriented programming.

10. **Integration with External Programs and Applications**—Many GIS applications will be dependent on data and sometimes processing performed by a system external to GIS (e.g., hydrologic modeling, transportation modeling, work management, computer-assisted mass appraisal, crime or accident databases, etc.). Depending on the type of system storing the data and the frequency with which the data files must be updated, the integration of the data files will require varying procedures and technical approaches to make it available to GIS users. In an ideal case, the GIS application and the external system would communicate seamlessly and in real time without requiring extraction and downloading of data or user intervention. Standards and software supporting a high-level of real-time system connectivity are making such seamless integration possible, but it is not realistic in all cases given such technical obstacles as operating system differences, database software or data schema incompatibilities, network speed limitations, etc. System integration requirements should be examined on a case-by-case basis, but any new design and development work should be carried out to facilitate integration rather that creating unneeded barriers to it.

11. **Accessing GIS in the Field**—Several agencies have staff that needs to access GIS data and applications or gather/update geographic data while away from the office and not connected directly to a network. Such "field GIS access" would use notebook or handheld computers and special software and applications. It implies, initially, the need to have efficient procedures and applications to upload and download data to and from these computers. Ultimately, it will likely involve some wireless data access as well. Field GIS use will be an increasingly important part of GIS use by government and utility organizations, and GIS implementations and technical designs need to accommodate this while working in the field. These needs encompass obtaining access to map data and the attribute data related to them. Using GIS in the field also covers data collection. Battery-powered data collection devices are available, often paired with GPS receivers, so that coordinates can be associated with data that are entered about a location or incident.

3.4. INITIAL SYSTEM OBSERVATIONS AND RECOMMENDATIONS

Initial recommendations for a system environment to support statewide GIS use and coordination are provided in this subsection. These recommendations, in Table 3-4, respond to the system configuration issues discussed above. In Section 6, a conceptual design is provided which provides a general "blueprint" for the technical aspects of GIS addressing the hardware, software, and network topics covered in this section.

Table 3-4: Initial System Implementation Recommendations

Issue	Recommendation
1. **Extended LAN Connectivity**	Examine specific needs that require direct LAN-to-LAN connectivity or creation of interconnected LAN domains that may be needed to support GIS applications (cases where Internet connectivity is not appropriate) and prepare a plan for this access in light of application requirements. Use existing local or wide area communication facilities where possible, and set up network domains, directories, and user permissions to support the Wide Area Network. Links will be developed and communication hardware and software will be acquired to connect Local Area Networks at different buildings. Put in place appropriate tools and procedures to ensure access security and effective network administration and monitoring.
2. **Internet/Intranet Access and Wide Area Communications**	Acknowledge that the Internet (and possibly an Intranet for State agencies) will be the primary medium for statewide GIS access. The Internet supports connectivity among multiple data servers (including a State GIS service center server), data access and downloading, and running of server-based applications. CGI should work with OIR to examine wide area communication links to all State offices and local government offices and to prepare a plan for upgrading connections and making them more efficient.
3. **Interoperability and Data Exchange among Multiple GIS Software Packages**	Based on the fact that application integration and data exchange becomes more complicated as the number of target GIS software environments increases, CGI should consider identifying a limited number of packages that are defined as "preferred" for new procurements. Procurement rules (mandatory for State agencies and usable by other organizations) can allow deviation only when there is a defined functionality need not met by those packages on the "preferred" list. A State price contract may be set up as well. CGI and a State GIS service center should set up procedures and tools for exchange of data in multiple supported formats and general guidelines may be published for use of vendors' multi-platform access tools to lessen the need for repetitive data

	exchange to support certain applications (requiring data viewing and basic query).

Table 3-4: Initial System Implementation Recommendations (continued)

Issue	Recommendation
4. **Migration into ESRI "Geodatabase" (supported by SDE Environment)**	With recognition that the large majority of GIS users in the State have selected software from ESRI, CGI should formally acknowledge that a planned, multi-year migration to the SDE geodatabase environment, and the overall object-based architecture being promoted by ESRI, is in the interest of most users—at least user organizations maintaining large data sets using ESRI software. Such a migration can support long-term integration and data sharing. Since full migration to the geodatabase environment implies a data architecture that is different than traditional ArcInfo coverages and therefore, there may be a requirement to modify logical data models and physical database designs already in place. CGI and the GIS Coordinator should prepare a high-level plan to coordinate the migration at the State level and to provide support to individual agencies in the migration. Such a migration must also acknowledge that not all users will have ESRI software fully supporting this data environment. Such a migration must leverage opportunities for multi-vendor access to the data as well as tools to easily translate and exchange data when necessary.
5. **Hardware/Software Architecture for Central GIS Service Center**	A State GIS service center with a data clearinghouse role should be designed to support central data and application access services along with other GIS support services. This includes hardware and software to support an Internet server, with appropriate links to other servers and necessary firewall security. The service center should be provided with sufficient data storage, GIS and RDBMS software, other application software, and system administration software to support its operation on a 24x7 basis. CGI, working with technical representatives from designated agencies, should identify the physical location for this service center and prepare a technical design for the hardware, software, and network connections required to support it.
6. **GIS-related Procurements**	CGI should promote system procurement planning and work closely with OTPM and the IRC to create formal standards to guide it and to be involved in the process. CGI Subcommittees should accelerate efforts to develop standards that can support effective procurement planning.
7. **RDBMS Standardization**	CGI should approach the IRC about the creation of guidelines regarding the procurement and use of specific RDBMS packages. In addition, at the State level, basic database design "rules" should be prepared that will guide RDBMS development to promote connectivity (e.g., use of ANSI data types). CGI may decide to identify several RDBMS packages that it deems most effective in supporting GIS applications and encouraging statewide data sharing.
8. **GeoSpatial Metadata Software**	The State will require data maintenance applications that have metadata components. Metadata capabilities may be programmed directly into the applications from scratch or special metadata software may be incorporated into the applications. CGI should prepare a recommended geospatial database design, based on the FGDC standard, possibly with several profiles for specific user groups, and should identify metadata maintenance and query software. The GIS service center should take the lead role in setting up the necessary software and applications using metadata to support GIS data searches. CGI should consider establishing a formal NSDI Clearinghouse node (based on FGDC standards).
9. **Standards Impacting Application Development**	General standards should be set that will guide the design (interface and look-and-feel) and programming languages for the development of GIS applications. Some of these standards may be vendor-neutral and others may apply specifically to a particular package. As part of the service center, a process and format should be set up for maintenance and access to a central application catalogue. This catalogue will maintain query information about GIS applications (in State government and all GIS users in the State), to encourage sharing and re-use of custom applications.

Table 3-4: Initial System Implementation Recommendations (continued)

Issue	Recommendation
10. **Integration with External Programs and Applications**	Each external system to be integrated with GIS will be evaluated in terms of the procedures required to perform the integration. Plans will be made to translate data, if necessary, and to enable communication between systems with specialized software packages if necessary.
11. **Accessing GIS Data in the Field**	CGI and individual agencies should recognize the growing importance of field applications for GIS, including future wireless data access. CGI should appoint a subcommittee or working group to research the state of field and wireless GIS and to define basic hardware, software, network requirements, and standards and a basic model to be used as a target for implementing applications.

Many of the issues and recommendations impacting the technical GIS environment impact the creation of a state GIS service center. Section 6 will provide more ideas about how such a service center may operate, but several key points are raised below:

- The purpose of the service center will be to provide clearinghouse services for access to GIS data and to support a range of other information and services (e.g., Tier A applications) to support the state's mission for GIS coordination and to encourage the sharing and integration of geographic information and promotion of GIS use on a statewide basis.

- Primary access to data and on-line applications and services from the service center will be through the Internet. Access will be facilitated through a custom Web-based portal and Web-based applications that support searches and access to GIS resources.

- The service center concept implies the need for a central facility housing hardware, software, and certain data sets, but it will also incorporate links to other Internet web sites (maintained by state agencies, federal agencies, and other organizations).

- The service center will be set-up to provide various options that meet user needs. These needs may include—a) metadata queries and examination,
  b) access to certain data sets for download or ordering, c) direct interactive access to geographic data and central GIS applications, and d) examining a directory of information about GIS projects, programs, and users in the State. Such a clearinghouse can function as a support to a GIS coordinator and CGI to provide information and support GIS collaboration.

- Technical and administrative staff will be required to support service center activities and ongoing services. Depending on how resources are allocated, the service center may provide technical services such as training and implementation support. Service center staff could provide such a technical support role and/or the service center may become a contact point for technical services provided by other parties.

- Service center services will be based on well-crafted standards and technical designs. For instance, as part of its data services, there will be a need to establish standards and a procedure for high-level quality assurance for data sets accessed directly from the service center.

SECTION 4

SECTION 4
GEOGRAPHIC DATABASE STATUS AND NEEDS

This section covers two main areas that are important in planning for a well-coordinated program for GIS data maintenance and access in the State:

- The status of existing geographic data resources and data development programs managed by organizations in South Carolina that support GIS applications

- Future data content, format, and management requirements and an initial conceptual design for geographic data organization.

4.1.   INVENTORY OF MAPS AND GEOGRAPHIC DATABASES

4.1.1.   State Agency Maps and Geographic Databases

PlanGraphics gathered information from State agencies in order to summarize current databases and programs for collecting, maintaining, and distributing geographic data. The results are provided in two tables that present and identify map and tabular databases and summary characteristics about each. Table 4-1 lists the hardcopy maps and digital map data that have been developed and are maintained by State agencies. Table 4-2 lists the databases that have a geographic context, and have potential for being related to digital map data through the functions of GIS software. The tables list data resources held by State agencies only.

Table 4-1 reveals that State agencies in South Carolina currently use digital maps considerably. In some cases, hard copy maps are documented when there are digital versions of the same maps. At the State level, many digital map data sets are complete for the entire State. In the case of the 1:24,000 layers, most of which are available on the DNR GIS Data Clearinghouse, the availability of the individual layers by map sheet can be checked by referencing a set of index maps that are maintained as part of the DNR Data Clearinghouse website. Many of the maps and map data contained in this table will also appear in the conceptual database design. The conceptual database design will group the data into categories based on scale and other characteristics documented in this table.

Table 4-1: Summary of Reported Map Use by State Agencies

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ment of Agriculture							
d Use Map		Hard Copy			Land Resources		
ment of Archives and History							
l Register Sites	7.5 Minute Topo	Digital and paper	1:24000	Quarterly	Archives and History	Four, Statewide	Used to maintain an inventory of sites listed in the National Register.
Ground inations of NR y	Topo	Digital	1:24000	Weekly	Archives and History	Two, Statewide	Used as an inventory.
l Resource Surveys	Topo	Digital	1:24000	Weekly	Archives and History	Two, Statewide	Used as an inventory.
Architectural s	Topo	Digital and paper	1:24000 and others	Not Updated	Archives and History	Eight digital (working on others), Countywide	Used as an inventory of surveyed properties.
logical Sites	Topo	Digital	1:24000	Quarterly	SCIAA	One, Statewide	Used as an inventory.
and Control Board—Division of Operations—Office of General Services—State Building and Property Services							
g Drawings	State-owned Buildings	Paper, Sepia, Mylar	Varies	As Needed	Statewide Building Services	Over 600	
g Drawings	Budget and Control Board Buildings	Digital	Varies	Daily or As Needed	Construction and Planning	Approximately 1,560	AutoCAD format. Drawing used for information, as a base for new construction drawings, for renovations, and for computerized maintenance management system.
g Drawings	Budget and Control Board Buildings	Paper, Sepia, Linen, and Mylar	Varies	As Needed	Construction and Planning	Approximately 20,000	Drawing used for information, as a base for new construction drawings, for renovations, and for computerized maintenance management system.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
and Control Board—Division of Operations—Office of General Services—State Building and Property Services (continued)							
g Files	Construction and Maintenance Records for Board Buildings	Digital and Hard Copy	No scale	Daily or As Needed	Construction and Planning	Approximately 2,000	Drawing used for information, as a base for new construction drawings, for renovations, and for computerized maintenance management system.
and Control Board, Division of Operation— Office of Research and Statistics—South Carolina Geodetic Survey							
ed TIGER Road ne Map	Original Census Bureau TIGER files	Digital	1:100,000	Continual	ORS-xxxx	N/A	
cale Road nes	Digital Orthos or GPS	Digital	1:4,800	For County Projects	ORS-xxx	N/A	Accurate centerlines compiled for counties under cooperative program to support E911 program and GIS needs.
ment of Commerce							
ines	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		Used in site selection processes for recruiting industry.
Sales Meters	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the water lines database.
Wells	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the water lines database.
Storage Tanks	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the water lines database.
Treatment Facilities	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the water lines database.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ment of Commerce (continued)							
urface Storage	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the water lines database.
ervice Area s	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		Gives a general idea of water supply in an area/county.
ines	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		The sewer lines are used in site selection processes for recruiting industry.
ischarge Sites	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the sewer lines database.
reatment Facilities	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the sewer lines database.
ales Meters	TIGER and + County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the sewer lines database.
umps	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		An asset to the sewer lines database.
ervice Area s	TIGER and County Highway	Digital	Not Stated	Ongoing	Maintained by Commerce, distributed by DHEC		Gives general idea of sewer service in an area/county.
Industries	TIGER and County Highway	Digital	Not Stated	Bi-monthly	Local Developers and DOC		Used to locate suppliers and/or competitors for potential industries.
of Life, trative Offices	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ent of Commerce (continued)							
f Life, Shopping	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Civic tions	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Churches	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, County epartment	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government, DHEC		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Daycare	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government, DHEC		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Foreign	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Fire ents	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government, Forestry Commission		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ent of Commerce (continued)							
f Life, Ethnic Stores	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, HealthCare	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Internet	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Libraries	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Magnet and Schools	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Newspapers	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Private	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ent of Commerce (continued)							
f Life, Public	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Private	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Professional tions	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Public tation	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Radio	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, Regional	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, International nts	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government		Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ent of Commerce (continued)							
f Life, Motor Trucking Terminals	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government	Complete	Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
f Life, ons	TIGER and County Highway	Digital	Not Stated	Not Stated	Councils of Government	Complete	Databases are complete and have been distributed to COGs. Also available on the Univ. of South Carolina clearinghouse. Will use data in proposals for recruiting industries.
Water Supply cture Services	TIGER and County Highway	Digital	Varies	Ongoing	South Carolina Department of Commerce	46	Used in the updating process to show the systems what commerce has stored in the database for their system.
Water Supply,	TIGER and County Highway	Digital	Varies	Ongoing	South Carolina Department of Commerce	268	Shows water infrastructure lines.
Water Supply, 36	TIGER and County Highway	Digital	Varies	Ongoing	South Carolina Department of Commerce	268	Used in the updating process, mailed to each system to verify accurateness and completeness.
Sewer Supply, 36	TIGER and County Highway	Digital	Varies	Ongoing	South Carolina Department of Commerce	46	Used in the updating process, mailed to each system to verify accurateness and completeness.
Industry by	TIGER and County Highway	Digital	Varies	Ongoing	South Carolina Department of Commerce	213	Mailed to local county developers to verify location of existing industries and to help locate new industries.
Sewer Supply cture Services	TIGER and County Highway	Digital	Varies	Ongoing	Department of Commerce	213	
Sewer Supply,	TIGER and County Highway	Digital	Varies	Ongoing	Department of Commerce	46	

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...ment of Education							
...us routing	Usually State highway map	Paper	Not Stated	Updated annually unless a new school opens.	Department of Transportation	Varies by number of routes per school. Approx. 17,000 routes are operated	Used to show the routing of school buses supported by data tables and written description. Used by the State to approve the allocation and use of State buses and funding.
...Atlas	Road Map	Digital	Not Stated on Survey	Irregular	Department of Education	Statewide	Have the objective to get this in digital form.
...Commission							
...rest Compartment	1:1320 Scale rectified Aerial Photography	Paper (changing to digital)	1" = 1,320'	Annually	Forestry Commission	16+	Used to show roads, timber types, and age.
...Fire Grid Map	South Carolina Department of Transportation County Highway Map	Paper	Varies	Sporadic	Department of Transportation	46	Used for fire prevention.
...ment of Health and Environmental Control—Division of Biostatistics							
...e Births	South Carolina County, tract, and block Group	Digital	Not Stated	Periodic Additions	South Carolina Department of Health and Environmental Control	1 ArcInfo coverage	Contains a coverage relating to Total Live Births.
...ncer	County, tract, and block Group	Digital	Not Stated	Periodic Additions	South Carolina Department of Health and Environmental Control	1 ArcInfo coverage	Contains a coverage relating to cancer patients
...aths	County, tract, and block Group	Digital	Not Stated	Periodic Additions	South Carolina Department of Health and Environmental Control	1 ArcInfo coverage	Contains a coverage relating to total deaths.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...ment of Health and Environmental Control—Division of Biostatistics (continued)							
...Regulated	TIGER	Digital	Not Stated	Periodic Additions	South Carolina Department of Health and Environmental Control	1 ArcInfo coverage	Contains a coverage relating to the Department of Health and Environmental Control regulated Clinics.
...Regulated ...Facilities	TIGER	Digital	Not Stated	Periodic Additions	South Carolina Department of Health and Environmental Control	1 ArcInfo coverage	Contains a coverage relating to the Department of Health and Environmental Control regulated Health Facilities.
...ment of Department of Health and Environmental Control—Bureau of Water							
...S Discharge	1:24,000 topo quads	Digital	1:24,000	Quarterly	South Carolina Department of Health and Environmental Control		
...ted Agriculture ...es	1:24,000 topo quads	Digital	1:24,000	Monthly	South Carolina Department of Health and Environmental Control		
...sh Harvest ...ications '95-'99	1:24,000 topo quads	Digital	1:24,000	Annually	South Carolina Department of Health and Environmental Control		
...ert. Sites	1:24,000 topo quads	Digital	1:24,000	Daily	South Carolina Department of Health and Environmental Control		
...Quality Monitor	1:24,000 topo quads	Digital	1:24,000	Annually	South Carolina Department of Health and Environmental Control		

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...ment of Health and Environmental Control—Air Quality							
...cilities/Monitors	County Boundary	Paper	Not Stated	Sporadic	South Carolina Department of Health and Environmental		

					Control—Bureau of Air Quality		
Non-attainment :ions	County Boundary	Paper	Not Stated	Sporadic	South Carolina Department of Health and Environmental Control—Bureau of Air Quality		Maps used to depict areas where projections show that acceptable ozone levels will not be attained.
Analysis	Topo Quad	Paper	Not Stated	Sporadic	South Carolina Department of Health and Environmental Control—Bureau of Air Quality		Maps used to determine air quality compliance.
ment of Health and Environmental Control-General							
ality Data	USGS 7.5' Topographic Quadsheets	Digital	1:24,000	Periodic Additions	South Carolina Department of Health and Environmental Control	2 ArcInfo coverages	Contains coverages relating to air monitoring stations and air regulated facilities.
nd Hazardous Data	Various	Digital	1:24000 and smaller	Periodic Additions	South Carolina Department of Health and Environmental Control	8 ArcInfo coverages	Contains coverages relating to Comprehensive, Environmental Response, Compensation and Liability Act of 1980, Domestic Solid Waste Landfills, Hazardous Waste Permit Sites Regulated by the Federal Resources Conservation and Recovery Act (RCRA), Industrial Solid Waste Landfills, Municipal Solid Waste Landfills, National Priority List Sites, Regulated Solid Waste Landfills, and Toxic Chemical Release Inventory Facility Sites.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...ment of Health and Environmental Control-General							
...Quality Data	Various	Digital	Varies: 1:24,000 and smaller	Periodic Additions	South Carolina Department of Health and Environmental Control	17 ArcInfo coverages	Contains coverages relating to Ambient Groundwater Quality Stations, Biological Stations, Capacity Use Wells, Dams, Fish Consumption Advisory, Industrial Surface Water Intakes, Known Groundwater Contamination Sites—Bureau of Water, Known Groundwater Contamination Sites—Underground Storage Tank, National Pollutant Discharge Elimination System Permit/ Discharge Locations, Public Water Supply Wells, Shellfish Classification (95-97), Shellfish Monitoring Stations, Surface Water Intakes, Underground Storage Tanks, and Water Quality Monitoring Stations.
...l Resources	Various	Digital	1:24,000 and smaller	Periodic Additions	South Carolina Department of Health and Environmental Control	5 ArcInfo coverages	Contains coverages relating to Boat Ramps, Marina Locations, National Estuarine Research Reserves, Ocean and Coastal Resources Management Permitted Sites 1992-1996, and Port Locations.
...aries	Various	Digital	Varies	Periodic Additions	South Carolina Department of Health and Environmental Control	11 ArcInfo coverages	Contains coverages relating to: Census Geography, City Boundaries, County Boundaries, Councils of Government, Environmental Quality Control Districts, Health Districts, State Boundary, and Zip Code Boundaries.
...ructure	Not Stated	Digital	Equivalent of TIGER, 1:100,000	Periodic Additions	South Carolina Department of Health and Environmental Control	14 ArcInfo coverages	Contains coverages relating to: Department of Motor Vehicle Facilities, Military Bases, National Weather Stations, Nuclear Power Stations, Sewer and Pipeline Utilities, Social Security Offices, and Transportation Systems
...raphic Reference	Various	Digital	1:24000 and smaller	Periodic Additions	South Carolina Department of Health and Environmental Control	2 ArcInfo coverages	Contains coverages relating to: Geographic Points of Interest and Topographic Quadrangle Indexes

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...ment of Health and Environmental Control-General							
...graphy	Not Stated	Digital	1:100,000, 1:500,000	Periodic Additions	South Carolina Department of Health and Environmental Control	20 ArcInfo coverages	Contains coverages relating to: Watersheds, Streams, Lakes, and Estuaries.
...Base	Various	Digital	1:24000 and smaller	Periodic Additions	South Carolina Department of Health and Environmental Control	7 ArcInfo coverages	Contains coverages relating to: Geology, Soil, Digital Elevation Models, Land Resources, Land Use/Land Cover, and National Wetland Inventory.
...ersity and ...ts	Not Stated	Digital	N/A	Periodic Additions	South Carolina Department of Health and Environmental Control	1 ArcInfo coverage	Contains a coverage relating to Rare, Threatened and Endangered Species.
...g, Finance, and Development Authority/Rental Assistance and Compliance Division							
...reets 2000	TIGER	Digital	Varies	Daily	Microsoft	One per contract; 3,000+ statewide	Used to find the rental unit or complex; they are printed as needed.
...ment of Juvenile Justice							
...wn	Topographic	Photo		Unknown	Geodetic Survey	Broad River Road Facilities	Used for General Reference
...r Guide	County Road Map	Paper		Unknown	DNR	Approximately 50 SC Counties	Used for site locations
...s Plats	Parcel Maps	Paper		N/A		Several Land Parcels	Used to define property boundaries
...ment of Natural Resources—Land, Water and Conservation Division—Natural Resources Information Management and Analysis Section							
	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...ment of Natural Resources—Land, Water and Conservation Division—Natural Resources Information Management and Analysis Section (continued)							

Wetlands	NAPP CIR aerial photography	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA/ U.S. Fish and Wildlife Service	465 available now. No current funding for remaining 101	Available through the DNR GIS Data Clearinghouse
Use	NAPP CIR aerial photography	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA/ U.S. Fish and Wildlife Service	465 available now. No current funding for remaining 101	Available through the DNR GIS Data Clearinghouse
Elevation s	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
Raster ics	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Acquired by the Dept. of Commerce and available through the DNR GIS Data Clearinghouse
raphy	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
graphy	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Mapsin Set and Geographic Coverage	Comments
tment of Natural Resources—Land, Water and Conservation Division—Natural Resources Information Management and Analysis Section (continued)
ids	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
s	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
and nission Lines	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
es	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
ations	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
es	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
palities	USGS 7.5' topographic quadsheet	Digital	1:24,000	Varies with availability of new data	DNR—NRIMA	566	Available through the DNR GIS Data Clearinghouse
e Recording s	USGS 7.5' topographic quadsheet	Digital	1:24,000	Hourly to Daily	DNR—NRIMA	Unknown	Point locations in UTM and lat/long
Wells	USGS 7.5' topographic quadsheet	Digital	1:24,000	Monthly to Weekly	DNR—NRIMA	Unknown	Point locations in UTM and lat/long

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Mapsin Set and Geographic Coverage	Comments
tment of Natural Resources—Land, Water and Conservation Division—Natural Resources Information Management and Analysis Section (continued)							
Orthophoto er Quadrangles	1994 NAPP Color Infrared and B&W Aerial Photography	Digital	1:12,000	None	DNR—NRIMA	600 (8 coastal counties, 1994 CIR) 1656 (rest of state)	8 coastal counties are compiled from 1994 color infrared photography and rest of state from earlier color infrared and B&W photography.
tment of Natural Resources—Marine Resources Division							
sh Maps	Paper/Mylar/ Digital	Paper/Mylar/ Digital	1" = 24,000	Annually	MRD	5	Used for shellfish classifications for harvesters and marine scientists/biologists.
asin cterization	County Road Map	Digital	1" = 24,000	As Needed	MRD	20+	Used for wetland classification, hydrography, soil classification, plant communities, and biological resource dispersment..
RMAR MMS n Map	GPS/Sonar/Loran, etc	Digital	1" = 24,000	Ongoing project	MRD	20+	Used to detach location of hard bottom resources, proximity to erosional beaches.
tment of Natural Resources—Law Enforcement Division							
Carolina Atlas azetteer	Topographic Quad	Paper	1:1500,000; 1" = 27 miles	Unknown	Commercial	State of South Carolina, 48 Quads	
Carolina e Facilities	County Road	Paper	1" = 3 miles	Unknown	SC Department of Natural Resources in-house	State of South Carolina, 46 Counties	
ls Inlet, South na	Land Use, Land Cover, National Aerial Photo- graphy Program Photography	Digital Transparency	1" = .6 miles	Sporadic	United States Geologic Survey	1	

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
...artment of Natural Resources—Law Enforcement Division (continued)							
...n Inlet, South ...lina	Land Use, Land Cover, National Aerial Photography Program Photography	Digital Transparency	1" = .6 miles	Sporadic	United States Geologic Survey	1	
...artment of Parks, Recreation and Tourism—Parks and Recreation Division							
... Park Trails ...	Topography, DEM	Paper, Digital	1:24000	Continuous	SCPRT—RP&E and State Parks	1 Per Park; geographic coverage is extent of state park	Given to park visitors for identification of trails.
...eral Orientation ... Maps	Road Map	Paper	Varies	Continuous	SCPRT—RP&E and State Parks	Varies per park; geographic coverage is extent of state park	Given to park visitors for familiarization of park layout.
...entation Maps	Varies	Paper	Varies	Upon Request	SCPRT—RP&E and State Parks	Varies	Used for visual aid.
...ing Maps	Statewide Roads	Paper, Digital	Varies	Upon Request	SCPRT—RP&E and State Parks	Varies, Statewide coverage	
...specific maps	Orthophoto, plat, engineering plans, landscape design	Paper, Digital	Varies	Varies	SCPRT—RP&E and State Parks	Varies, Coverage specific to site	Maps of specific sites.
...artment of Parks, Recreation and Tourism— Parks and Recreation Division							
...e Parks ...erty Plats, ...neering Plans, ...scaping Plans	AutoCAD drawings	Digital	Not Stated	Daily	Recreation, Planning & Engineering	Not Stated	
... Themes	Topographic Quadsheets	Digital	Not Stated	Monthly	GIS Services	Not Stated	
...age Corridor	Not Stated	Digital	Not Stated	Daily	Heritage Tourism	Not Stated	

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
: ...ent of Parks, Recreation and Tourism— Parks and Recreation Division (continued)
...rks	Topographic Quadsheets	Digital	Not Stated	Weekly	GIS—Parks	Not Stated	
	Not Stated	Digital	Not Stated	Sporadic	SCPRT	Not Stated	
...Tourism ...abase	Not Stated	Digital	Not Stated	Daily	SCPRT—Heritage Tourism	Not Stated	
: ...ent of Parks, Recreation and Tourism—Business and Community Development Division
...nagement	Topographic Quad	Digital	Varies	Sporadic	PRT, G. Carter, J. Clingman	Over 50	Used for: guest campground and park orientation, public meetings, building and facility inventory, progress on natural resource inventory projects, trails layouts, and park sectoring projects.
: ...ent of Public Safety—Bureau of Protective Services
...Road ...es	Various, Orthophoto, GPS	Digital	Varies	Sporadic	County Government	14 to date	To be used as future base map.
...ocation Data	UTM State Map, Location of towers by Lat/Longitude	Digital	Not Stated	Sporadic	Government Agencies	1	Used to evaluate communication distribution and tower availability throughout state.
...on Maps, HP, ...IV	UTM—State Map	Digital	Not Stated	Annually	Not Stated	3	Only coding for each agency's district assignment
: ...ent of Revenue
...ax Maps	Not Available from Survey	Mylar	1" = 400'	As Needed	County	3,000	Used to locate industrial sites/plants for the purposes of appraisals.
: ...ent of Social Services
...story Info	Street Centerline Data	Digital	1:100,000	Sporadic	Budget and Control Board/ Office of Research and Statistics	Not Stated	Maintained by ORS Digital Cartography Unit through contract.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

Map or Map Set Name	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ent of Social Services (continued)							
hoods	County Road Map	Mylar and Paper	Varies	Sporadic	Budget and Control Board/ Office of Research and Statistics	46	Maintained by ORS Digital Cartography Unit through contract.
ent of Transportation—Planning Division							
mand ng	TIGER	Digital	Varies	3 to 5 years	Department of Transportation	13 sets	Used to verify traffic demand model. Once model is verified, model is utilized to predict future traffic counts and new or upgrade road needs.
ation ent Program	TIGER	Digital	Varies	Continuous	Department of Transportation	10 sets	Locates proposed project for next five years.
ent of Transportation—Engineering Division (Pre-construction, Construction, Maintenance, Traffic Engineering)							
e	Not Available from Survey	Paper	1" = 1 Mile	Sporadic	Dept. of Transportation DOM	Varies	Used as a base to overlay other information; contains roads, road numbers, and road names.
	Not Available from Survey	Paper	1" = 1 Mile	Annually	Dept. of Transportation County RME	Varies	Used as a base to overlay other information; contains roads, road numbers, and road names.
	Not Available from Survey	Paper	1" = 1 Mile	Annually	Dept. of Transportation County RME	Varies	Used as a base to overlay other information; contains roads, road numbers, and road names.
ng	Not Available from Survey	Paper	1" = 1 Mile	Monthly	Dept. of Transportation County RME	Varies	Used as a base to overlay other information; contains roads, road numbers, and road names.
	State Map	Digital		Sporadic	Dept. of Transportation/ Planning	Unknown	Used for presentations, strip maps, and evacuation plans.
ap	County Map	Digital		Sporadic	Dept. of Transportation/ Planning	46	Used for presentations, strip maps, and evacuation plans.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

p or p Set ame	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
ent of Transportation—Information Technology Servic3es							
Highway	Topo Quad, ASCS/NAPP Photo	Scanned Raster Digital	1" = 5,280', 1" = 10,560', 1" = 1,320'	Biennial/ Annual	46 Counties	378	DOT Survey data used to indicate whether maps need to be updated
nty Traffic s	General Highway Maps	Scanned Raster Digital	1" = 10,560' 1" = 1,320'	Annually	Data Services	194	
hway Map	Reduced County Maps	Digital	1" = 6 Miles	Annually	Data Services	1	
ffic Flow	State Highway Map	Digital	1" = 6 Miles	Biennial	Data Services	1	
al Class	General Highway Maps	Scanned raster digital	1" = 10,560'	Created once every 10 years	Data Services	103	Updated Sporadically
Highway	General Highway Maps, State Highway Maps	Digital	1" = 6 Miles, 1" = 1,320'	Created once every 10 years	Data Services	11	Updated Sporadically
tion Books	State Highway Map	Digital	N/A	Annually	Data Services	46	
University							
s	Topography/Air Photo	Digital	1" = 1,000'	Sporadic	Knight Cox	As Needed	Used for general reference for Clemson University
	Road/Property	Digital	1" = 1,000'	Annually/ Semi Annually	Knight Cox	As Needed	Used for hiking, biking, and horse trails on the Clemson Experimental Forest; public distribution map not yet updated..
	Topography/DOQQ	Digital	1" = 1,000'	Once/Several Times a Month	Knight Cox	As Needed	Used for forest management planning activities.
of Archaeology and Anthropology							
l Map	Municipal Map	Paper	1" = 1,000'	Sporadic	Dept. of Transportation/ Planning	382	Used for presentations, strip maps, and evacuation plans.

Table 4-1: Summary of Reported Map Use by State Agencies (continued)

p or Set me	Base Map on which this Map is Compiled	Media (e.g., Digital, Mylar, Paper, Photo, Linen, Sepia)	Compilation Scale	Update Cycle	Source Agency/ Maintained by?	Number of Maps in Set and Geographic Coverage	Comments
of Archaeology and Anthropology (continued)							
Tracings	Interstate Routes	Sepia, Digital, Paper, Mylar	1:50	Sporadic	Dept. of Transportation/ Traffic	Unknown	
d ons	Aerial Photo	Digital, Photo		Sporadic	Dept. of Transportation/ Traffic	Unknown	Used to plot the geometry of an intersection.
aps	County Road Map	Digital and paper	Not Stated	Not Stated	Department of Transportation		
o	State Road Map	Paper	Not Stated	Not Stated	Department of Transportation		
General's Office, Department of the Military—South Carolina Air/Army National Guard							
TM Grid	UTM Coordinate	Digital	Not Stated	N/A		1	The coverage is used as a reference so when the map is taken out into the field and a site location is identified, it will be possible to calculate the UTM coordinate based on the map and map scale.
ent	Not Stated	Not Stated	Varies	Sporadic	National Guard	11	Used for orientation to the training center.
	Not Stated	Not Stated	Varies	Varies	National Guard	1	Used for orientation
	Parcel Map	Paper	Varies	Not Stated	McEntire ANG Sta.		
	County Road Map	Paper	1" = 2 Miles	Not Stated	SC DOT		
	Topographic Quad	Paper	1:24,000	Not Stated	USGS		
	Parcel Map	Paper	Varies	Not Stated	McEntire ANG Station		
	County Soils Survey	Paper	1" = 1,667'	Not Stated	Natural Resource Conservation Service		

The databases in Table 4-2 will sometimes be sources for creating GIS map layers or for providing attribute data to support GIS applications. The files will be linked to the GIS data layers through the primary key fields. A common primary key field consists of Address, although many of the DOT databases are indexed based on County Route and milepost. Other primary key fields include Parcel Number, Facility or Building IDs, Zip Code, and County code. These key fields provide a possible means for linking these databases with features stored in a GIS.

The database files documented in this table will form the basis for many of the attributes that will be associated with the GIS data layers. Some of these data may be made available to all users through the data clearinghouse, but many of these database attributes will have significance to only the department that maintains them. In either case, the flexibility of a GIS database to either store attribute data along with the data layer itself, or to store attribute data separately containing key fields to allow a temporary linkage to a GIS data layer, will provide a means of using GIS data for many purposes without compromising efforts to maintain confidentiality or to experiment through modeling routines that may not produce results that are appropriate for general access.

Table 4-2: Summary of Reported Geographically-related Databases

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
Department of Archives and History					
Determinations of National Register Eligibility	**Access**	Site or Structure ID	**Daily**	Contains National Register of Historic Places eligibiltydescisions rendered by the SHPO	SC Dept. of Archives and History
Archaeological Site Attribute Data	**Access**	Site Number	**Sporadic**	Contains attribute information about archaeological sites	SC Institute of Archaeology and Anthropology
Budget and Control Board, Division of Operations – Office of General Services, State Building and Property Services					
Project Database	PC Access	Building #, Project #, Building Owner	Not Stated	Not Stated	State Building and Property Services
Leasing Database	PC Access	Not Stated	Not Stated	Not Stated	State Building and Property Services
State Land Inventory	Not Stated	Not Stated	Not Stated	Not Stated	State Building and Property Services
Appraisal Database	DOS, FoxPro	Parcel Number	Not Stated	There are 32,000 records.	State Building and Property Services
Department of Health and Environmental Control—Environmental Quality Control—Air Quality					
Emissions Inventory Database	Novell, I-Steps	Facility ID	Daily	Use for pollution analysis	South Carolina Department of Health and Environmental Control—Air Quality
Department of Health and Environmental Control—Division of Biostatistics					
Cancer	ASCII	Address	Annual	Cancer Cases	South Carolina Department of Health and Environmental Control-Central Cancer Registry
Death Certificates	ASCII	Address	Annual	Deaths, Infant Deaths, Fetal Deaths	South Carolina Department of Health and Environmental Control-Vital Records Office
Birth Certificates	ASCII	Address	Annual	Live Births	South Carolina Department of Health and Environmental Control-Vital Records Office
Immunizations	ASCII	Address	Daily	Immunized population	South Carolina Department of Health and Environmental Control-Public Health Statistics and Information Systems
Health Facilities		Address	Daily	Regulated and Permitted Health Facilities	South Carolina Department of Health and Environmental Control-Health Regulations

Table 4-2: Summary of Reported Geographically-related Databases (continued)

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
Department of Health and Environmental Control—Bureau of Water					
...n Groundwater ...amination	PC, FoxPro	Facility ID	Annually	Used to locate sources of contamination, and sampling frequency.	South Carolina Department of Health and Environmental Control
...c Water Supply Wells	PC, NT, FoxPro	Facility ID, Source ID	Weekly	Used to model capture zones, and score sites with contamination.	South Carolina Department of Health and Environmental Control
...rground Storage Tanks	PC, NT, FoxPro	Facility ID	Daily	Used to determine zone of contributions.	South Carolina Department of Health and Environmental Control
Department of Health and Human Services—Bureau of Senior Services					
...or Centers List	Paper	None Stated	Annually	Used for internal purposes to track available resources and services.	Outside Organization
...Database	PC Windows 95, 98, NT SQL	Address	Daily	Used for planning, analysis of client demographics, clients' service usage, and state and federal reporting.	Outside Organization
...Management System	PC, Various software, VB, Access	Facility ID, Address	Daily	Used to track applicants and client information	Community Long-term Care
...-term Care Ombudsman ...plaints	PC, Ombud 3.0	Facility, Address	Quarterly	Used to provide federal and state reports.	Outside Regional Ombudsman Offices
...tee Mailing List (Aging ...ork)	PC, WP	Address	Sporadic	Used to provide contact information on services to Senior Citizens.	Outside Organization
...ce Delivery Sites and ...ces	PC, WP	Address	Annually		Outside Organization
...of Service Report (Aging ...ork)	PC, Lotus 123	County by County	Annually	Planning and analysis of service distribution, response to questions.	Outside Organization
...Cost Report	PC, Lotus 123	County	Annually	Planning, analysis of costs, response to questions.	Outside Organization

Table 4-2: Summary of Reported Geographically-related Databases (continued)

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
Department of Health and Human Services—Bureau of Community Services, ABC Child Care Voucher System					
...ider (Provider Facility ...ess)	Novell Groupware, Clipper	Address	Sporadic	Used for: consumer education notices, service authorization/re-authorization, provider payment, technical assistance, training opportunities, notice of grant/contractual opportunities	Department and Outside Organization
...t (Client Home Address)	Novell Groupware, Clipper	Address	Sporadic	Consumer education notices; Service authorization/re-authorization; Technical assistance	Department and Outside Organization
...t (Client Work Address)	Novell Groupware, Clipper	Address	Sporadic	Consumer education notices; Service authorization/re-authorization; Technical assistance	Department and Outside Organization
Department of Health and Human Services—Bureau of Information Systems/Division of Information Systems Management					
...caid Eligible	Various: HDS Pilot 35, Enterprise Server, OS/390 CA IDMS/R	County and Address	Daily	Used in editing healthcare claims for Medicaid recipients.	SCDSS-SCDHHS
...caid Providers	Various: HDS Pilot 35, Enterprise Server, OS/390 CA IDMS/R	County and Address	Daily	Used in editing and paying claims for Medicaid recipients.	SCDHHS
...caid Claims	Various: HDS Pilot 35, Enterprise Server, OS/390 CA IDMS/R	Linked to data set listed above	Daily	History of healthcare which were remitted to Medicaid for payment, more than 100 million records	Medicaid Providers

Table 4-2: Summary of Reported Geographically-related Databases (continued)

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
Department of Health and Human Services, Bureau of Community Services, Social Services Block Grant					
...S Provider Billing Support— ...Post—DHHS Post Units ...ded	IBM Mainframe, ADABAS	Facility ID, Address, Service Codes, Clients	Monthly	Links provider data with clients authorized to receive services; updates and maintains contractor	SCDSS-SACWIS

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
				files for Social Services Block Grants.	
t Records	IBM Mainframe, ADABAS	Client Name, Address, Client ID, Family ID	Daily	Various reports generated from database, linkages to providers, aggregate regarding client demographics	SCDSS-SACWIS
r Education Tuition Grants Commission					
Senators	PC, Flexgen	Legislative district by zip code	Annually	Used to provide information to legislators and colleges.	Not Stated
ties	PC, Flexgen	County Codes	Annually	Used to check county residency of grant recipients.	Not Stated
ing, Finance, and Development Authority—Executive					
) Home Program	Not Stated	Not Stated	As Needed	Used for the administration of programs. Planning, budgeting, tracking of funds, etc.	Information Technology
ing Trust Fund	Excel	Not Stated	As Needed	Used for the administration of programs. Planning, budgeting, tracking of funds, etc.	Information Technology
ncome Housing Tax Credit	Microsoft	Not Stated	As Needed	Used for the administration of programs. Planning, budgeting, tracking of funds, etc.	Information Technology
ing, Finance, and Development Authority (Rental Assistance and Compliance Division)					
on 8 Cert/Voucher	Pentium Windows NT, NMMS	Address	Daily	Used to administer one HUD section 8 program.	Rental Assistance and Compliance
on 8 NC	VAX, AOD	Address	Daily	Not Stated	Rental Assistance and Compliance
Credit Monitoring	Alpha Windows NT, Access	Address	Daily	Not Stated	Rental Assistance and Compliance

Table 4-2: Summary of Reported Geographically-related Databases (continued)

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
rtment of Mental Health—Information Resource Management					
umer Information System	RS 6000 Unix, Informix Relational Database	Facility ID Program, County Address	Daily	Used to track admissions, services received and discharge of consumers.	CIS Support
Museum					
raphic locations for all al History items.	Not Stated	Not Stated	Not Stated	Not Stated	South Carolina Museum Registrar
rtment of Transportation—Planning Division					
Projections	PC, Tran Plan, Excel, and Access	Traffic Count Stations	3 to 5 years	Use to determine road widening	Department of Transportation
-economic Projections	PC, Excel, and Access	Traffic Analysis Zones	3 to 5 years	Used for traffic demand models	Department of Transportation
Inventory/Highway Index/ S	Various: PC and Mainframe	County, Route, Milepost	Daily	Attributes of roads indexed by mileage marker and county route.	South Carolina Department of Transportation Data Services
e Inventory	Various: TSO and Mainframe	County, Route, Milepost	Daily	Attributes of bridges	South Carolina Department of Transportation Data Services
	Various: PC and Mainframe	County, Route, Milepost	Daily	Geographic reference is site of traffic counting devices	South Carolina Department of Transportation Data Services
nent Management	PC	County, Route, Milepost	Daily	Pavement attribute of roads referenced by county route and milepost.	South Carolina Department of Transportation Data Services
rtment of Transportation—Engineering Division (Pre-construction, Construction, Maintenance, Traffic Engineering)					
nt Reports	PC, Service Rel.2	Varies	Varies/Quarterly	Used for identifying safety projects.	South Carolina Department of Public Safety
ad Inspections	PC, Service Rel.2	Varies	Varies/Quarterly	Inventory railroads.	South Carolina Department of Public Safety

Table 4-2: Summary of Reported Geographically-related Databases (continued)

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
ment of Transportation—Engineering Division (Pre-construction, Construction, Maintenance, Traffic Engineering) (continued)					
Files (Signing, Marking, provement, etc.)	PC, Service Rel.2	Varies	Varies/Quarterly	Used for signing, marketing.	South Carolina Department of Public Safety
cing	Paper	Road #, County Length termini	Not Stated	Visual representation of proposed work areas.	County District
as/Welcome Centers	Paper	Road #, County	Not Stated		County District
linary Projects	Paper	Road #, Area, Termini	Not Stated	Used for data retrieval and site location.	County District
Maintenance	Paper	Road #, County, Termini	Not Stated	Used for data retrieval and site location.	County District

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
...ction Card File	PC, Access	County, Road, Termini	Daily	Used for management reports and pay estimates.	Construction
...nager Construction ...ment Systems	PC, Site Manager and Oracle	System Key	Daily	Used for management reports and pay estimates.	Construction
...ment of Social Services—Planning and Research					
...istory Information Profile	SUN Micro Systems, SAS	Census, Longitude/ Latitude	Sporadic	Database of information on program participants	Department of Social Services
...ment of Natural Resources—Law Enforcement Division					
...lent Based Reporting	In-house COBOL, Mainframe	Not Stated	Daily	Database of crimes and arrests	All Police Agencies in SC
...Carolina Institute of Archaeology and Anthropology					
...Tracking	Macintosh Performa 636 CD, FileMaker Pro 4.0	Site Number	Daily	Database used to track archaeological projects conducted in the State from initiation to completion.	SC Institute of Archaeology and Anthropology
...arolina Bibliography of ...gy	Macintosh Performa 636 CD, FileMaker Pro 4.0	Archaeological Site Number	Sporadic	Used to collect background research of projects conducted found in a project area.	SC Institute of Archaeology and Anthropology

Table 4-2: Summary of Reported Geographically-related Databases (continued)

Database Name	Format/System (including software)	Primary Key	Update Cycle	Description	Maintained By?
...Carolina Institute of Archaeology and Anthropology (continued)					
...logical Attribute Data	Dell Optiplex, Windows NT, Access 2000	Archaeological Site Number	Sporadic	Attribute data is used to describe the time period, if present, at a specific archeological site location.	SC Institute of Archaeology and Anthropology
...logical Inventory List	Not Stated	Not Stated	Daily	Used mainly by the site file manager to assign specific and unique identifiers to an Archaeological Site location found in the State.	SC Institute of Archaeology and Anthropology
...arolina Sea Grant Consortium					
...Database	Windows NT, Excel	Address	Weekly	Used to monitor locations and effectiveness of publicity and interest levels throughout the State.	SCSGED—Coastal Hazards
...presentatives	PC, Flexgen	Legislative district by zip code	Annually	Used to provide information to legislators and colleges.	Not Stated

4.1.2.   Data Resources Maintained by Organizations Outside of State Government

Other types of data are typically handled by other organizations that use GIS throughout the State, especially COGs, local governments, and public or private utilities. These types of resources are often at a larger scale than those data layers maintained by State agencies (e.g., parcel maps and data). The larger scale data layers, though often too detailed to be practically maintained by State agencies, are of great interest to them, since so many State agencies' programs can make effective use of this larger scale, higher detail data. This underscores the need and benefit of a coordinated GIS program in the State where data can be easily shared among State government and the COGs, local governments, and utility organizations.

Parcel data are the most highly desired data layer since property ownership and configuration of land parcels have so much impact on activities and planning. Local governments digitize and maintain parcels, as well as other detailed data that depict features in their county or municipality. These include planimetric data, large-scale digital orthophotography, and zoning. COGs often use these layers when they are available. COGs may assist local governments with technical assistance and analysis capabilities. They may develop some GIS data layers that cover their region and share those data with their member local governments. COGs rely on many State datasets such as those that can be obtained from the Department of Commerce and the Department of Natural Resources.

Utility organizations commonly have needs for government-created data sets such as base map layers and parcels. They develop detailed GIS layers depicting their facilities. Governments are typically interested in those facility data layers, and there are sometimes opportunities for data sharing under terms of agreement on the use and distribution of data.

4.2.   CURRENT GEOGRAPHIC DATA CLEARINGHOUSE PROGRAMS

As identified above, a considerable amount of GIS data has been compiled by State agencies and other organizations in the State. Two groups in particular—DNR and the University of South Carolina—have created automated Internet-based clearinghouses that provide a capability to search for data and download data sets.

4.2.1.   DNR GIS Data Clearinghouse

The South Carolina Department of Natural Resources has developed a GIS data clearinghouse that operates over the Internet. The Natural Resources Information Management and Analysis (NRIMA) Section within the Land, Water and Conservation Division operates the Clearinghouse. The Clearinghouse offers GIS users in the State a means of downloading natural resources data layers covering various portions of South Carolina. Users of the site must acknowledge a disclaimer absolving the Department of Natural Resources of responsibility for completeness and accuracy of the map data contained within the site. Once into the site, the user is greeted by choices for selecting data to be downloaded. There is an index map showing the status of the available layers. All the data available within this site are referenced to the USGS 7.5' topographic quadrangle maps, and most originate from the USGS as digital line graphs (DLGs). The DLGs have been acquired by DNR, enhanced with attribution, edgematched, checked for errors, and corrected. The available layers are:

- NWI wetlands
- Land use
- Soils
- Scanned USGS 7.5' topographic quad sheets (Digital Raster Graphics)
- Digital Elevation Models (DEMs)
- USGS DLG layers:
    - Hypsography
    - Hydrography
    - Airports
    - County boundaries
    - Forest boundaries
    - Municipal boundaries
    - Parks boundaries
    - Power and transmission lines
    - Refuges
    - Reservations
    - Roads
    - Railroads
    - Wilderness areas.

The DNR data clearinghouse will be a model for the statewide GIS data clearinghouse that will make these data layers available, as well as layers from other agencies. The website can be visited at http://water.dnr.state.sc.us/water/nrima/gisdata/.

NRIMA also has digital orthophoto quarter quadrangles that are based on 1994 NAPP photography. These data are not made available through the Clearinghouse at this time, but they have been used to conduct quality control on many of the Clearinghouse data layers.

4.2.2.   University of South Carolina

The University of South Carolina Department of Geography Center for GIS and Remote Sensing, along with the College's Liberal Arts Computing Lab, maintain an on-line data clearinghouse of GIS data and related tables. Much of the information served has been created or supplied by other entities. The University serves all data that is not bound by licensing restrictions to the public via the Internet, while maintaining licensed files for internal use only. This GIS Data Clearinghouse includes South Carolina data layers, as well as many that cover other parts of the country. The layers offered for download by the University are organized into the following categories:

- Geography—Includes many political, census, and district boundaries for South Carolina, along with a broad set of data layers for the U.S. and the world (e.g., country boundaries and the world).

- Services and Facilities—Includes many types of businesses and landmarks in the area of Columbia and other portions of South Carolina (e.g., restaurants and churches). This site also contains the Dept. of Commerce's Quality of Life dataset, comprised of a variety of point features.

- Physical and Environmental—Links to other servers for downloading data, as well as some significant locations such as weather stations throughout the country.

- Hydrology and Related—Links to the DNR GIS Data Clearinghouse for hydrographic data and NWI wetlands.

- Imagery—Includes SPOT data, orthophotography, Thematic Mapper data, and USGS quad sheet raster data.

- Infrastructure—Many large-scale data layers such as parcels and zoning from Richland County and data related to water and sewer lines and other utility transmission lines.

- Hazards—No data can be downloaded under this category, but data layers are listed along with a phone number for an organization that can supply the listed data sets.

- USC Campus—This category holds large-scale data depicting features of the University of South Carolina Campus

- Miscellaneous/Reference—This category holds several types of map sheet grids.

- Other GIS Servers—Provide links to many other GIS data clearinghouses throughout the country.

The University of South Carolina website can be reached at http://www.cla.sc.edu/gis/dataindex.html.

4.2.3. State Demographic Data Center

The State Budget and Control Board, through the Office of Research and Statistics, operates The Health and Demographics office that coordinates the State census preparation activities and gathers and distributes information related to demographics and public health information for South Carolina. Through the website, http://www.orss.state.sc.us/census.html, users can obtain census data. Another website, http://www.orss.state.sc.us/healthdemo.html, provides users with capabilities for on-line queries of public health statistics based on user-defined parameters.

4.3. MAJOR STATEWIDE OR REGIONAL GIS DATA DEVELOPMENT EFFORTS

State agencies are currently involved with several programs with the purpose of developing new GIS data sets or augmenting existing GIS data resources, and the quality of mapping in South Carolina. Many of these programs are documented to account for their impacts on the coordination of GIS activities in the State. The major GIS data development programs that are now in place or are in the planning stages are summarized in Table 4-3 and explained in more detail below.

Table 4-3: Summary of Current Geographic Database Development Programs or Plans

Data Set or GIS Data Development Program	Organization Responsible	Status
CIR DOQQs	DNR NRIMA	Attempting to get funding for the program. CIR NAPP photography has been flown, acquired, and scanned.
Update and Correct DLGs	DNR NRIMA	Had plans to use updated DOQQs from 1999 photography to update hydrography, wetlands, and land use. However, funds for new DOQQs were not approved by the legislature.
Update NWI Wetland Maps	DNR NRIMA	Dependent on the production of the CIR DOQQs.
Large-scale Digital Orthophotography	Geodetic Survey	Available for any county that wishes to participate. Six counties have developed the true digital orthophotography, six counties are in the process of development, and five counties are planning for the project. Twenty-six counties now have hard copy orthophotos.
Monumented Control Densification Project	Geodetic Survey	Available for all counties that wish to participate. Advances in airborne GPS have reduced the necessity for the large-scale digital orthophotography program.

| Resurvey and Document County and State Boundaries | Geodetic Survey | Cooperating with N.C. Geodetic Survey to re-establish the state boundary through the Joint North Carolina–South Carolina Boundary Commission. |
| County Parcel Digitizing Program | Geodetic Survey | This program is currently available for county participation. Counties with small tax bases need further financial assistance. |

Table 4-3: Summary of Current Geographic Database Development Programs or Plans (continued)

Data Set or GIS Data Development Program	Organization Responsible	Status
911 Centerline Development	ORS	Street names and address ranges have been checked and corrected on TIGER centerlines for 34 counties, and centerlines with address ranges have been compiled through use of more accurate sources, including GPS, for 16 counties.
DOT Centerline Development	DOT	RFP has recently been released to solicit proposals from firms to develop the data set.
DHEC Permitted Facilities	DHEC	GPS data collection is underway for these sites.
DHEC Permitted Hazardous Material Sites (CERCLA and RECRA)	DHEC	GPS data collection is underway for these sites.
INTERMAR MMS Bottom Map	DNR Marine Resources Division	Ongoing project to map bathymetry using GPS, sonar, and Loran radar, to locate hard bottom.
Shellfish Mapping	DNR Marine Resources Division	Locations of shellfish habitat are determined and updated in the digital database on an annual basis.
South Carolina Infrastructure	Department of Commerce	Ongoing update of several data layers that depict utility infrastructure (e.g., water and sewer lines and facilities).
Quality of Life Data	Department of Commerce	Ongoing update of several data layers that depict facilities and amenities associated with quality of life.
Critical Facilities	Department of Commerce	Data collection of facilities important during emergency situations.
Floodplain Mapping for FEMA FIRM Maps	FEMA	Ongoing projects throughout the State for elevation mapping in river basins. Contractors are carrying out projects for FEMA.

4.3.1.   CIR DOQQs

The State of South Carolina, with primary support from the Department of Natural Resources has tried to obtain approval for funding the development of color infrared digital orthophoto quarter quads (DOQQs) for the entire State. The DOQQs will be based on NAD 83, have 1-meter pixel resolution, and will be developed to National Map Accuracy Standards associated with 1:12,000 mapping. Each DOQQ covers ¼ of a USGS 7.5 minute quadrangle. These DOQQs will provide a valuable update to the existing DOQQs (mix of black&white and color infrared) based on 1994 and earlier photography, and would be used as sources for conducting quality improvements and updating of existing DNR GIS data layers. Color infrared (CIR) film provides an excellent source for examining conditions of vegetation, water quality, and urban environments and can potentially be used in regional GIS applications by a number of Departments. However, funding for this DOQQ project has not been approved by the 2000 state legislature.

4.3.2.   Large-scale Digital Orthophotography

The South Carolina Geodetic Survey has instituted a program for assisting counties, both financially and technically, with the development of digital orthophotography. Geodetic Survey is promoting specifications for large-scale data with 2' pixel resolution with the intent of achieving full statewide coverage as soon as possible. These specifications are in line with requirements for base maps that support tax map conversion in rural areas and are part of an overall program, administered by the Geodetic Survey, for County-level GIS data compilation. Seed money provided to Counties by Geodetic Survey supports compilation of 1:4,800 scale digital orthos only, but Geodetic Survey is encouraging counties to develop data produced at higher standards of resolution and accuracy (1:2,400 and 1:1,200) for urban areas. Currently, 6 counties have completed their development of true digital orthophotos, and 6 counties are in the process of developing the imagery. Also, 5 more counties have plans to obtain the photography this spring and to begin developing the orthophotography soon. Twenty-six counties are using hard copy orthophotos. It is expected that the program will result in full State coverage of 1:4,800 digital orthophotography by 2006 or sooner.

4.3.3.   Monumented Control Densification

This program increases the monumented control points within counties that participate in the program. The program can be associated with the Large Scale Digital Orthophotography Program and is important to the success of the orthophotography program. The goal has been to establish points every 3 to 5 miles throughout the county. Recent technological advances in airborne GPS have reduced the requirement for closely spaced horizontal geodetic control points for the large-scale DOQ program but as counties explore the potential for highly accurate digital elevation model (DEM) compilation (to support topographic mapping and terrain analysis), vertical control requirements have increased but have been efficiently provided by special GPS vertical control techniques. The program is still in place for counties that want to increase the number of monumented control points even if the development of digital orthophotography is not immediately planned..

4.3.4. 911 Centerline Development

The State Budget and Control Board Office of Research and Statistics' (ORS) Digital Cartography Section administers a program to develop transportation centerline databases for all the counties in South Carolina to facilitate implementation of E-911 Computer Aided Dispatch (CAD) systems. The program focuses on developing centerlines of highways and local streets with address range attributes assigned to centerline segments typically defined by intersection points.

ORS considers several sources for the development of the centerline data. Preferred sources include existing planimetric databases that include centerlines, digital orthophotography, or a parcel database where centerlines can be generated from the rights-of-way. When these types of sources are not available, ORS generates centerline data by driving roads with a van outfitted with a GPS receiver to collect highly accurate centerline data. To date, TIGER centerline address ranges and segments for 34 counties have been checked and corrected to attain a 90 percent match rate when address matching. Centerline data have been developed for 16 counties using the accurate sources, including the van with GPS. Address ranges for these county centerline files have also been assigned to reach a minimum 90 percent match rate.

Address ranges are collected where needed and verified where the ranges exist. The address range attributes are applied to the centerline data through a set of fields specified by a database design and conforming to a set of addressing standards. The standards are currently under review for adoption by the Information Resource Council (IRC).

The primary long-term issue related to the development of accurate and reliable transportation centerline data is the update process. Development in some parts of South Carolina is progressing at a tremendous rate. New subdivisions will result in many new streets, and the State, on its own, will be unable to keep up with all of the new development. The strategy that is under consideration is to provide a website that will be used by participating counties to input changes to the county centerline file as new streets are approved and constructed.

4.3.5. DOT Centerline Development

The Department of Transportation is also developing a street centerline database to be linked to the Linear Referencing System. Much of the DOT road data are indexed based on route number and milepost. By developing a centerline file structured to work with milepost data, DOT will be able to link many of their databases to GIS and analyze those data in a spatial context along with other data layers that may impact traffic. An RFP has been prepared for creation of a statewide centerline layer to meet DOT needs. The DOT has prioritized sources from centerline compilation identifying the 911 centerlines (GPS-generated) and county orthoimages as the preferred sources and the ORS will support the DOT in providing data. USGS DLG data or centerlines generated from the Census Bureau TIGER files are a low priority to be used if other data are not available or cannot be generated in a reasonable timeframe. This DOT compilation effort is less concerned with street names and address ranges as attributes, and more concerned with county route numbers and the ability to link events or conditions to each route by the mileage along that route. It will be possible for a single street centerline file to meet the needs of both efforts. The important first step toward the integration of these two efforts has already taken place. The DOT plans to upgrade and update data over time as new or improved data becomes available.

4.3.6. County Parcel Digitizing Program

The South Carolina Geodetic Survey offers technical assistance to counties that want to digitize their cadastral data. This assistance takes the form of development of specifications to be placed in Requests for Proposals. Those specifications are altered from project to project to adjust to unique circumstances within the individual counties. Geodetic Survey promotes the use of coordinate geometry (COGO) techniques to recreate legal descriptions from deeds and plats into graphic representations, then to piece the results together into one continuous database. The process of piecing together the digitized parcels will be supported by the existence of a land base of known accuracy, so that the parcels, once converted into the digital form through COGO data entry, will be registered to features on the land base that indicate property boundaries.

4.3.7. Resurvey of County Boundaries and State Boundary between South and North Carolina

The Geodetic Survey is developing a plan for defining those boundaries between South Carolina counties and the portion of the boundary between North and South Carolina not defined by water bodies. The existing boundary descriptions refer to landmarks that no longer exist, and there are situations where disputes will be avoided and resolved by establishing and clearly marking these boundaries. Accurate boundaries used with GIS will provide the opportunity to properly allocate tax revenues, determine jurisdiction for services to be provided to border properties, as well as jurisdiction for the maintenance of roads and other infrastructure, by overlaying the accurate boundaries over other accurate digital map layers.

4.3.8. DHEC Programs

The Bureau of Land and Waste Management of the Department of Health and Environmental Control is currently involved in recollecting many locational data for all CERCLA and RECRA sites using GPS. The quality of the coordinate data varies depending on access to the site. The Bureau personnel know the accuracy limits of their GPS equipment and the methods they use to collect the location coordinates, but sometimes they have better access to a site than others. At times, they can do no better than collect a point at the driveway of a facility. This variation makes metadata files very important when accessing and analyzing these data.

Other DHEC data collection efforts include the collection of GPS coordinates for all wellheads, and the collection of latitude and longitude coordinates for all permitted facilities and facility discharge sites into either water bodies or the air. In recent collections of these coordinates, GPS has been used, but in older records, latitude and longitude have been determined from topographic maps at scales of 1:24,000 and 1:100,000.

Many of the DHEC public health data are tabular databases that can be mapped in reference to street centerline data with address ranges, or due to the confidential nature of many of these datasets, are generalized to census block groups or census tracts. In this way, data related to teen pregnancies, incidents of cancer and other diseases, and deaths can be analyzed in a geographic context.

4.3.9.   DNR Marine Resources Division

The Marine Resources Division of the Department of Natural Resources is actively involved in mapping bathymetry along the coast, as well as INTERMAR MMS ocean bottom mapping. As part of a beach renourishment program, the Division must determine where beaches are losing sand and where sand can be obtained on the sea bottom to replenish the sand lost due to wave action.

Marine Resources also maintains a GIS data layer of shellfish habitat to assist with their monitoring responsibilities.

The Division has also been involved in the development of the GIS database associated with the ACE Basin Ecological Characterization. Ninety-nine data layers have been developed for the region.

4.3.10.   Department of Commerce

The Department of Commerce has initiated and led the South Carolina Infrastructure Program that was a cooperative effort with COGs and local governments to develop a GIS database of utility infrastructure that will impact suitability for economic development. In a similar effort, Commerce has developed a Quality of Life database that is an ongoing process of recording locations of churches, shopping centers, and other amenities that characterize the cultural offerings in an area. The Emergency Preparedness Division has acquired the data resulting from the infrastructure and Quality of Life data collection programs to designate certain features as critical facilities for emergency planning and response purposes. Commerce has administered a program for collecting GPS coordinates that represent locations of all critical facilities such as schools, hospitals, and other gathering places or places that provide medical and support services in times of emergency.

4.3.11.   DNR Natural Resources Information Management and Analysis (NRIMA) Section

NRIMA maintains a vaiety of important natural resources data layers and makes much of this information available through its clearinghouse. These data, including soils, hydrography, NWI wetlands, land use, etc. (see Table 6-3) use the NAD 27 horizontal datum. NRIMA is anticipating a shift to NAD 83 after all data has been compiled. With available funding (not yet approved), NRIMA hopes to complete land use and wetlands for remaining 101 quadrangles. In addition, there are plans to do some updating and upgrading of existing hydrography, wetlands, and land use layers with new color infrared DOQQs.

4.3.12.   Floodplain Mapping for FEMA FIRM Maps

New floodplain mapping is occurring throughout the State. Improvements in accuracy and increased detail are goals of these new operations. Where possible, local data is being used for urban areas such as the City of Greenville and Greenville County. In some cases, 1" = 100' scale mapping and 2' contour intervals are being used to create new FIRM maps.

4.4.   REVIEW OF GEOGRAPHIC DATA NEEDS FOR SOUTH CAROLINA

PlanGraphics conducted a survey of CGI members, State agency representatives, and participants from local governments, COGs, and utility organizations, who were asked to identify the importance of certain types of geographic data. The results of this survey are presented in Appendix A but a summary is included below in Table 4-4. In this table, responses of importance ranged from "1" (little or no importance) to "8" (very high importance). Average responses for different respondent groups are presented in the table.

Table 4-4: Summary of Responses on Geographic Data Needs

Geographic Data Category	Avg. Score by Committee on Geographic Information Members	Avg. Score by State Agencies	Avg. Score by Local Governments, COGs, and Utilities
Administrative Districts	6.0	5.0	5.3
Buildings/Structures	5.3	5.1	5.7
Critical Facilities	6.8	4.3	5.4
Demographic Enumeration Districts/Data	6.6	4.8	5.0
Electric Transmission/ Distribution	5.4	3.6	5.3
Elevation-Contours	6.8	5.3	5.2
Elevation-Digital Elevation Models	6.5	5.0	4.8
Gas Transmission/ Distribution	5.2	3.4	5.0
Geodetic Control	6.7	3.7	4.4
Geology	5.5	3.9	3.3
Governmental Boundaries	6.6	5.8	6.4
Land Cover	6.5	4.9	5.0
Land Use	6.9	5.2	5.8
Orthoimagery	7.0	4.6	5.9
Parcels or Legal Lots	6.3	4.5	7.2
Sanitary Sewer Facilities	5.8	4.1	6.1
Soils	5.7	4.9	4.4
Street Addresses	7.3	5.8	7.0
Surface Hydrology	6.5	5.3	6.3
Subsurface Hydrology	5.4	3.9	N/A
Telecommunications Facilities	5.1	3.5	4.5
Transportation (St./Hwy Network)	7.5	6.1	7.3
Water Utility Distribution	5.6	4.0	5.8
Wetlands	6.5	5.3	5.0
Flood Zones	Not Scored	Not Scored	5.5
Service District Boundaries	Not Scored	Not Scored	5.6
Storm Sewer/Drainage Facilities	Not Scored	Not Scored	5.6

In addition to the categories included in the survey, some other data sets that were identified by the committee members as being important by some respondents include:

- Accident and Traffic Ticket Locations
- Air Quality Data
- Cultural Resource Information
- Governmental Facilities/Schools
- Hazardous Waste Facilities
- Museums and Cultural Attractions
- NAPP (National Aerial Photography Program)
- Public Health Data
- Solid Waste Facilities
- Water Quality Data
- Zoning.

Table 4-4 gives a good impression of geographic information needs in a collective sense for multiple user organizations in the State. Low scores for certain data categories do not necessarily mean that these data should be excluded in a statewide GIS development strategy. It may indicate that these data have a specific significance for a single agency or user group and are vital to the business of those organizations. In terms of statewide GIS coordination and data distribution, however, there should be a concentration on those high-priority data sets that are needed by multiple user organizations and which have the greatest impact on business drivers in the State.

CGI members were asked to respond to these surveys with a view to the overall needs of the State. Their responses reflect this view. The data layers with highest average scores are, in some cases, layers that are not as important to many individual organizations but are critical to the State due to public safety, or as the foundation for other data development efforts. The responses indicated, as with the others, that street and highway network and street addresses were important.

State agency users most frequently found the State street and highway network the most important data layer followed closely by governmental boundaries and street addresses. These layers tend to support applications that analyze large areas such as entire cities and counties. Other data layers that received high scores on the State agency forms included surface hydrology, wetlands, land use, and elevation contours and digital elevation models. There were no specific scale designations on the forms. Among State agency users, the data layers with relatively low scores included orthoimagery, parcels, and critical facilities. These are layers that meet specific purposes and/or depict features that are only conveniently depicted over small areas.

The lowest scores on the State agency forms were for layers that depict utility features such as telecommunication facilities, gas transmission lines, and electrical transmission lines. Water and sewer facilities received slightly higher rankings. Utility data is obviously of great importance to the utility organizations themselves and, to a lesser extent, the local government jurisdictions within which utility customers reside. Possible increased requirements for utility and infrastructure reporting[1] may raise the importance of GIS for use in tracking utility and infrastructure assets. Geology and subsurface hydrology are layers with limited use outside of a few agencies. While few agencies have a direct need to access monumented survey control points in their GIS applications, sound geodetic is required for the development of base maps that support all data development in the State. Access to the geodetic network has been simplified for mapping purposes by the establishment of a network of continuously operating GPS base stations. Mapping grade applications require the post-processing of raw GPS data to achieve positional accuracy commensurate with GIS applications. The differential corrected positions comes form the merging of data sets from the base stations and field receivers. Geodetic control is established by occupying known control points and now to a greater extent by relying on network connections obtained for the National CORS network. In SC we use CORS sites located in Savannah Beach, GA, Charleston, SC, Asheville, NC and Columbia, SC the latter being operated by SCGS.

The results shown on the local government and utility forms indicated that the most important data layers to these types of organizations are the street/highway network, government boundaries, parcels, surface hydrology, street addresses, and sanitary sewer facilities. These data layers are a mix of layers that depict detailed features that are managed by local governments and utilities, as well as reference information that can be applied to large areas such as an entire county or several counties. The water distribution systems data layer is slightly behind sanitary sewer, but still ranked fairly high. Other fairly high ranked data layers are buildings and structures, flood zones, land use, orthoimagery, and service districts.

Lower-ranked layers are those that represent features not administered by local governments or utility organizations, or features administered by only a few of the utility organizations. These include wetlands, telecommunication facilities, gas transmission lines, electric transmission lines, land cover, geology, soils, and geodetic control.

The average tabulations still indicate that the data layers of greatest importance to all GIS users in the State are street and highway network, street addresses, and governmental boundaries. These data layer rankings are in line with development efforts that are underway. The centerline development efforts by both ORS and DOT in compiling a street and highway network, and the ORS addressing project for E-911 applications, both meet the needs of virtually all GIS users in the State. Parcel data and land base data layers are also important. The land base layers include orthoimagery, surface hydrology, transportation features, geodetic control, buildings and structures, and other planimetric features. Those layers will be important for their impact on the development of many other layers. Parcel data was of high importance to local government and utility users, and committee members, but also to some State agency users, as indicated by their individual scores (see Appendix A). These include the Department of Parks, Recreation, and Tourism; the Department of Transportation; the Department of Revenue; the Department of Health and Environmental Control; the Department of Natural Resources; the Department of Commerce. Other state agencies will also find parcel data to be of great value in meeting their programmatic responsibilities.

4.5.   KEY ISSUES IMPACTING FUTURE GIS DATABASE DEVELOPMENT AND USE

A series of issues must be addressed to plan for statewide coordination of GIS in South Carolina. These issues focus on increasing the availability of data resources, ensuring that those resources are kept current and maintained through consistent and well-documented procedures, and the institution of other standards that make the data usable to many people, even those outside the agency that developed the data.

4.5.1.   Datum/Coordinate System

A common datum and coordinate system must be selected to facilitate data sharing and analysis. The data layers associated with USGS 7.5 minute quadrangles, the 1:24,000 Digital Line Graphs (DLGs), are stored in Universal Transverse Mercator (UTM) meters using the 1927

North American Datum. DLG data are available in NAD 1983 as well, but since most data exists in NAD '27, all State DLG data are being stored as NAD 1927 until the entire set of DLG data layers are available in 1983, then a full transition will take place to NAD 1983. Digital Ortho Quarter Quads are also stored in UTM meters, NAD 1983.

Larger-scale data typically developed by counties or cities are stored in State Plane feet. The State Plane Coordinate system is the coordinate system used for tax mapping. The datum should be NAD 1983 with the 1986 adjustment or additional minor adjustments based on CORS an HARN expected in 2003. South Carolina has only one State Plane zone and one UTM zone. This fact eliminates some obstacles to the creation of a fully seamless and continuous GIS database. Edgematching between GIS data files is still necessary, but there will be no points within the State where a shift due to a change in a coordinate system zone creates a break in the continuous nature of the data.

Many GIS software packages have capabilities to perform coordinate translations "on the fly" by setting up a file to be associated with a GIS data set. The file records the projection and coordinate characteristics of the data set in a structure to be read by the software so that the correct parameters are used to perform the projection that is assigned during the particular session. This capability, if universal among all software packages and applications that will be used to provide access to GIS data, would eliminate the need for a standard coordinate system and projection to be used when combining data layers. While software packages such as GeoMedia and the latest versions of ArcView and ArcInfo have this capability, the ability to embed this function into a web-based GIS application is not yet mature enough to count on as a solution for combining data sets with different projections and coordinate systems. Any permanent coordinate system/datum transformations that may be carried out (e.g., transformation of existing DNR NAD 27 data to NAD 83) should use translation programs that are based on original geographic coordinates (Latitiude/Longitude).

4.5.2.   Coordination of Transportation (Street/Highway) Centerline Development

Several State agencies and local governments have developed and are continuing to compile street/highway centerline data. These data are available at a variety of scales and levels of accuracy. Some centerline data sets are kept current through maintenance procedures, but many are not. The uses of street centerline data determine the necessary specifications of the files. Street centerlines were commonly used for address matching and representation of roads over large areas such as an entire city or county. Low accuracy Census Bureau TIGER file data are usually sufficient for these purposes.

If greater detail and accuracy were necessary, centerline data are compiled from large-scale aerial photography as part of the development of planimetric data. In these cases, address ranges are often not collected and, therefore, address-matching applications are impossible. The goals of the centerline development programs described above are to combine the advantages of both approaches by transferring the street name and address range attributes to the accurate street centerline segments in the case of the ORS street centerline development, and to apply county route attributes and structure the data so that events or conditions can be located along the State and county highway network according to the mileposts at which they start and end.

These needs arise from increased requirements for:

   a) E911 and emergency dispatch

   b) Automated street and highway map production and use as a base map layer for other maps

   c) Needs for integrated transportation databases using a linear reference system tied to the centerlines

   d) Upcoming political redistricting and election precinct delineation

   e) A wide range of address matching applications for local and State agencies

   f) Other district analysis applications making use of address and centerline data.

4.5.3.   Street/Highway Centerline File Maintenance

Once the centerline files are created, the primary database maintenance issue will be on-going update of these files. ORS has been developing a plan to work with county personnel through an Internet interface to allow updates across the web or to pass updates across the web to be merged with the main centerline database at an indicated position. For the State to receive the most benefit from such an application, DOT must be involved in its development to ensure that the updates will either handle the requirements for centerlines to be integrated with the LRS, or that the data passed to the State by local authorities are incorporated into the main database in a manner consistent with the requirements of both ORS and DOT. Opportunities may exist for DOT personnel to contribute to the update process as DOT districts oversee the construction of new roads. This cooperation will, if properly planned, ensure a single current set of street centerline files that will eventually cover the entire State and meet the needs of all agencies and local governments that require use of street centerlines.

4.5.4.   Digital Ortho Imagery and Potential Use of High-resolution Satellite Data

Digital orthoimagery at a variety of scales is important to many State users. Recent developments in the remote sensing community are

making new earth image products available that may serve to replace products previously compiled by traditional photographic methods. Several private companies (Space Imaging, Earthwatch, Orbital Sciences) and several national government programs (e.g., French SPOT and Helios programs, Israeli OFEQ and EROS, Russian IMSAT, and Indian IRSS) currently or will in the near future provide panchromatic and/or multispectral image products in the 1- to 5-meter resolution range and digital elevation data as well Horizontal and vertical accuracy of these data products will vary depending on the amount of post processing and ground control used to georegister the images. While the resolution and accuracy of these products will not approach that of large scale digital orthos produced from aircraft photography, the potential exists for use of these products for some applications given their advantages of quick capture and repeat coverage. Since the sales and distribution programs for these products are still in formative stages, it is not possible to predict price ranges and formats available but there is a strong interest by national governments and private companies to make them commercially viable.

4.5.5.   Parcel Data Conversion and Unified Parcel Identification Numbering

GIS data layers containing boundaries of legal ownership lots and assessment parcels, with associated attribute data, support a large number of GIS applications for local government, State government, utilities, and other user communities. Because of the sheer volume and complexity of this data and the varying quality and availability of source materials from county to county, this is one of the most challenging data layers to compile on a statewide basis. The potential benefits of statewide coverage, however, are profound.

Parcel data has already been compiled locally for many of the larger cities and counties in the State, and some of the counties have participated in the cooperative program administered by the Geodetic Survey. But resources are not often available for medium to small counties in the State to initiate parcel conversion efforts and GIS programs to make use of the data. In addition, in some counties, there is a resistance to move from paper maps and records with which staff and users are comfortable.

Traditionally, the responsibility of parcel data conversion has fallen on the local governments that receive the direct tax benefit from those parcels but the state's cooperative mapping program has had the goal of encouraging and supporting this work by providing partial funding. This needs assessment has shown that a digital layer with assessment parcels benefits many organizations and programs other than local government. Examples of these instances include:

a) Tax reporting, tax reform, and oversight by the Revenue Department.

b) Natural risk assessment and disaster response by the Emergency Management Division and other State agencies.

c) Identification and tracking of customers by utility organizations.

d)   One element of the GAP analysis program involves identifying lands to be acquired or determining where conservation easements could be established to protect important wildlife habitat. Often, these areas are located in rural counties. If parcel data were available, the GAP analysis program would benefit.

e)   DOT also benefits when there are parcel data available in areas where road construction is planned, since the Right-of-Way Division must acquire the land required for the necessary road construction.

f)   Use by the Department of Commerce to support site selection and marketing for economic development.

Other State offices need to see parcel data so they can identify parcels ideal for acquisition. The Department of Parks, Recreation and Tourism (DPRT) and the Forestry Commission both look for opportunities to acquire land—DPRT for the State Parks and the Forestry Commission for the State Forests. The Department of Natural Resources Heritage Trust searches for opportunities to protect endangered species habitats and archaeological sites. The availability of digital parcel data facilitates these efforts.

The presence of digital parcel data is of great use to COGs for many types of analysis, especially for economic development. COGs work with the State Department of Commerce to provide data and to answer questions regarding the suitability of communities within South Carolina for the relocation of businesses. The addition of parcel data will further enhance the ability of these organizations to find optimum sites based on specific criteria set by the companies looking to relocate.

It has been stated during the interview session related to economic development that the communities that need economic development the most are those same rural counties that can not afford to develop and maintain the digital data resources needed to analyze and quickly present the results of analysis that indicate sites advantageous to businesses. Here too, the benefit of having digitized parcel data can benefit the State as a whole at the same time that it benefits a single county or municipality.

The Geodetic Survey's cooperative assistance program for converting parcel data is based on a rigorous method of data conversion to create a parcel layer. This process is based on use of primary sources of legally created lots (deeds, recorded plats, other official surveys) as a basis for parcel boundary identification. This method results in digital parcel data that are as true to the legal documents as the original source material allows, although without very time-consuming legal research and rulings, it cannot resolve expected boundary discrepancies that are a result of errors or poor geographic references in the recorded documents themselves.

The rigorous conversion method described above, while usually resulting in the best quality, is by far the most time-consuming and most expensive and may not be the appropriate approach in all cases. The intent of parcel data conversion is NOT to create a legal representation of lot and parcel boundaries in the GIS but to provide a complete mapping of parcels at an acceptable level of accuracy with sound ties to a

coordinate system and sound registration to a base map layer (orthoimage and/or transportation centerline). Alternative map conversion methods may rely on existing parcel maps maintained by county governments. If such maps are of suitable quality (currentness, completeness, and positional accuracy), they may be digitized (board digitized or scanned with heads-up digitizing) and using a variety of "best-fit" techniques, registered with a base map layer. Best-fit techniques may involve automated adjustments based on the input of control points and possible manual local adjustments to match boundaries to base map features.

No blanket statement can be made about what parcel conversion technique may be appropriate in a given case. A decision must be made on a case-by-case basis through an examination of data sources, cost, and timing. Such an evaluation can become part of the state's cooperative assistance program in which state government representatives work with local authorities, and possibly COG staff to make a decision on the most appropriate approach. A decision on an approach can be supported with written guidelines and parcel conversion projects can make use of an augmented set of "template" specifications to be used as a basis for conversion in a particular county or multi-county area.

The parcel conversion method will have an impact on time, cost, and the format of the results. Such issues as—a) whether to capture both legal lots and parcels,
 b) text annotation content and format, c) parcel attributes to capture, d) symbology,
e) tiling, etc.—also need to be considered in preparing statewide specifications. Whatever the conversion approach used, the goals should be to capture all parcels and to have a high level of uniformity in content, format, database design, and digital cartographic design.

As part of a unified set of specifications for parcel compilation, counties should use a common parcel identification number format. Current parcel numbers, based on a traditional book-page-block format, are effective for paper map maintenance but may not be the best for digital mapping systems. Geodetic Survey encourages counties to move to a coordinate-based system that uses the coordinates of centroids as the basis for the unique ID.

4.5.6.   Data Format Standards

The issue of data standards is a subject that encompasses many aspects of the development, storage, and delivery of GIS data. In order to effectively coordinate GIS efforts in the State, some standards for the development, storage, and transfer of data are needed. These standards must be designed with the goal of coordination in mind, not the goal of controlling the GIS operations in each agency.

Data layers designated for widespread access by participating agencies must be prepared for that access by the agencies responsible for their maintenance. Those agencies may work with those data in any desired format internally, but to prepare those data layers for widespread access, adhering to a standard format and consistent naming conventions will be required. Some standards will be specific to the data layer and, due to the nature of the data layer, may rely more on a consistent documentation of characteristics than a consistent set of characteristics, since some data layers may not be conducive to a consistent method of data collection.

File Names

File names must remain consistent and must be descriptive of the features that are depicted within. New files that are added to a dataset that include an area not previously covered must follow the same logical convention. Updates to existing files will be saved under the same name.

Directory Structure

The central coordination group will establish a directory structure on a data server. The data files that compose the general access database will have designated folders within the structure where they will be stored. This structure will facilitate the operation of applications and the protection of the general access database through the use of security tools that restrict user write access to critical portions of the directory structure.

File Format Standards

File formats will be specified to facilitate iexchange and direct access to geographic data. While there is considerable acceptance of ESRI software among GIS users in the State, there are other data formats that must be supported (e.g., AutoDesk AutoCAD, Intergraph GeoMedia, MicroStation). The objective is to define data file format standards that make it as easy as possible to support central service center functions and provide data to users, in an easily accessible format regardless of the software they may be using.

Important data format issues are:

- ESRI software supports multiple data formats for GIS data—which is appropriate.

- With the wide use of ESRI software, should GIS data management (particularly high-volume, frequently used GIS data) be based on ESRI's "geodatabase" environment that uses the ArcSDE format?

- Non-GIS software is used by some State agencies and other organizations and it is important that these users have an efficient means to access data and provide data to other users.

- At the local government level, among utilities, and for some State agencies, source data potential useful for GIS update is stored in AutoCAD or another CAD based data format (e.g., MicroStation). There should be an easy way to accept this data format and distribute data accessible through AutoCAD and MicroStation.

Other file format issues relate to the storage and distribution of digital raster image data—particularly ortho-imagery. Multiple options are available for storing and accessing these images in compressed and non-compressed form, and standards should be established to facilitate data management.

4.5.7.   Map Feature Positional Accuracy

Map accuracy is a measure of the conformance between the position of a feature's plotted location on a map as compared to its actual location in the field. Positional accuracy standards are described in terms of an acceptable error (e.g., "±5 feet"). Accuracy standards are most often described in terms of "absolute accuracy" which defines the maximum positional error in reference to an established geodetically defined coordinate system (e.g., State Plane or Universal Transverse Mercator).

Selecting suitable accuracy levels for the compilation and automation of map layers in GIS is a perplexing issue for most users. The objectives of map accuracy standards are to explicitly define and measure levels of accuracy, not to dictate what accuracy is appropriate for particular users. Accuracy standards address both horizontal and vertical placement of map features and describe maximum errors of displacement relative to their actual position. Since 1947, the *National Map Accuracy Standards* originally published by the U.S. Bureau of the Budget has been the accepted standard for defining the accuracy of topographic and other types of base maps. The Base Cartographic Subcommittee of the Federal Geographic Data Committee (FGDC) recently developed a "usability standard" for positional accuracy called the "National Standard for Spatial Data Accuracy." This standard is based on a standard originally proposed by the American Society of Photogrammetry and Remote Sensing (ASPRS).

This FGDC standard does not prescribe a particular level of accuracy but establishes standards for defining, testing, and documenting accuracy levels. It is left to users to define what level of accuracy is appropriate for their needs. The standard describes a way to test for and to document accuracy for maps or orthoimages. The accuracy description is based on a root mean square error (RMSE) that is an indication of average error (from true position) for a set of well-defined sample points whose positional accuracy is tested against positions measured using higher accuracy means (e.g., GPS).

Positional accuracy of GIS data is based on two things—1) the accuracy of the base map or source data, and 2) the methods used to collect and update the data. When documenting accuracy of data layers, both should be taken into account. Accuracy levels will vary among different data layers, but the important concern is to define a reasonable accuracy level that can be maintained and document this so that users are aware of it and data maintainers have a basis for data update procedures.

The 7.5' quad sheets are typically compiled to National Map Accuracy Standards providing an absolute accuracy of ±40 feet. The 1:4,800 digital orthophotography compiled according to federal specifications defined by the U.S. Geological Survey will typically have an absolute accuracy of ±10 feet.

Evaluations of accuracy needs and specifications for map compilation projects should take into account the difference between absolute accuracy addressed by the FGDC map accuracy standard and the NMAS. Absolute accuracy gives a statement of probability that a map feature's coordinate location will fall within a stated maximum error (distance from its true coordinate location). Users however, are often more interested in relative map accuracy which governs the error in the measurement of distances between map features (e.g., measured distance between curb line and a building). For maps and orthoimages that have been compiled using consistent and rigorous procedures, the level of relative accuracy is often better than the stated maximum absolute accuracy.

4.5.8.   Data Custodianship Standards and Procedures

Data custodianship responsibilities will be defined for all GIS data layers. This custodianship encompasses responsibilities and timing for data update, metadata maintenance, data quality assurance and posting, and managing the data in a system environment that permits easy access. In most cases, specific agencies will be assigned update responsibilities, although certain data layers may become the sole responsibility of a central body. It will be necessary to define data custodian standards in writing and get formal approval through CGI.

4.5.9.   Attribute Data Quality

Attributes must be consistently recorded with no variation in codes or abbreviations. All fields will be created for files according to a

database design. The design will define the field names and field characteristics. All field names should be descriptive of their contents. Decisions will be made regarding how attribute data will be stored. Some attributes will be included as part of the GIS files, and others will be stored in separate RDBMS files to be linked to the GIS data through key unique identifier fields. These relationships should be defined in a logical data model and the result should guide the development of a GIS database design and data dictionary.

4.5.10.   GeoSpatial Metadata Standards

Metadata can be considered catalogue information describing the content, format, quality, and availability of the geographic data sets. Geospatial metadata supports applications allowing users to find out about the existence and availability of GIS data and how best to use it. Well-maintained metadata also supports efficiency data update programs by providing information about sources, quality, currency, and compilation approaches. An effective geospatial metadata program will be important for South Carolina GIS users since GIS datasets originate from and are maintained by a wide variety of organizations. The Federal Geographic Data Committee (FGDC) has prepared a "Content Standard for Geospatial Metadata" that defines all metadata fields that are required for federal agency geographic database compilation programs. The State can use this FGDC standard as a basis for its own metadata program to make decisions about what fields are appropriate for its needs. GIS software packages, including ArcInfo version 8 and third-party software, are available to facilitate metadata maintenance.

4.5.11.   Digital Construction Drawing and Plat Submission Standards

Many maps maintained by local government or utility organizations are based on detailed plats or engineering drawings that are prepared based on field surveys. These drawings are submitted as plans to local government agencies for review and approval. After actual construction occurs, many local governments require the filing of "as-built" drawings that reflect actual conditions in the field and any changes that occurred from the plan drawing or subdivision plat. Today most of the firms that prepare these documents use CAD software (usually AutoCAD), but often they only submit a hard copy plot of the drawing. If the digital file was submitted as well, it could be used to update GIS data through a conversion routine. For this method to be effective, a set of standards should be established that will ensure a high enough level of consistency in content and format that will allow the CAD files to be used to update GIS data layers. The State can take a leadership role in developing such standards and working with local governments and engineering firms to adopt procedures for their use.

Another potential requirement that may be included in digital submittal standards is a reference to map coordinates. Currently, most plan and plat submittals have no consistent ties to actual coordinates making it difficult to register them to a base map. Including minimal requirements to include point symbols (at physical monuments or identifying locations) with horizontal State Plane coordinates noted will be helpful.

4.6.   SUMMARY OF GEOGRAPHIC DATABASE NEEDS AND RECOMMENDATIONS

Some recommendations have been developed regarding the GIS data development and coordination issues that have been documented above.

4.6.1   Response to GIS Database Issues

The following recommendations address the issues raised in the previous subsection.

Issue	Recommendation
Datum/Coordinate System	Develop a standard coordinate system and datum for GIS data to be available through the State GIS service center. Use the South Carolina State Plane Coordinate System, NAD 83, 1986, adjustment (coordinates in feet, not meters). All data available through the state GIS service center should be available in this coordinate system and datum. As time goes by, more parcel data will be available to State GIS users, as well as the 1:4,800 digital orthophotography. All of these layers will be stored with State Plane coordinates. The street centerline data being compiled by ORS also will be in the State Plane Coordinate System. This requirement will benefit local government agencies, as well as anyone that works with parcel data, centerline data, and large-scale digital orthophotography. It is true that many datasets that originate from federal agencies such as USGS are stored in UTM, but the procedures and programs to translate data from one coordinate system to another can be applied to most of these layers quickly and efficiently. The procedure becomes more involved in terms of computer processing when DOQQs are translated. However, translation of DOQQs can take place as well, although a demanding one-time process will be needed that will require many hours of computer processing time and large blocks of mass storage dedicated to the process. If new DOQQs are to be developed, specifications should be written to capture the data in the State Plane Coordinate System. Some agencies (e.g. federal government agencies for instance) may require federal data in the UTM coordinate system for internal analysis.
Coordination of Transportation Centerline Development	To date, ORS has developed spatially accurate street centerline data for 16 counties in the State. Those data will be used to develop the DOT centerline data. As the centerline data developed by ORS for county 911 systems covers new areas, they will be incorporated to the DOT centerlines, creating a statewide dataset with ever-improving levels of accuracy and more complete information.

Street/Highway Centerline Maintenance	The Office of Research and Statistics and the Department of Transportation must work together to develop a street centerline maintenance strategy. The two agencies will determine the most effective method for updating the centerline data as new roads are built. The strategy must result in data that will meet the needs of all users – DOT with their need for maintaining routes and linking their LRS and ORS with their commitment to maintaining current and accurate address ranges and a complete representation of all streets throughout the State.
Digital Orthoimagery and Potential Use of Satellite Imagery	At this point in time, CIR DOQQs provide the best combination of high-resolution (1-meter) and image characteristics for checking, correcting, and updating the NWI data. Satellite imagery is now available with 1-meter resolution, but those data are panchromatic DOQQs that will also be used for correcting and updating DLG data. In the future, satellite imagery will provide a constant source of data for updating DLGs. The 1-meter resolution in color or multispectral bands is not yet available.

Issue	Recommendation
Parcel Data Conversion and Unified Parcel ID Numbering	The State must increase funding for the 1:4,800 digital orthophotography program, since the development of that imagery will create excellent base map data for the creation of digital parcel data. Increased funding would accelerate not only the development of this large-scale orthorectified imagery, but the development of digital parcel data and other data layers throughout the State as well.
	Financial and technical assistance for the development of digital parcel data must be based on a process of source material evaluation that indicates the most effective method for converting the parcel data into digital form. This process will consider tax map conversion, as well as conversion of deeds and plats.
	The State must take a more active role in the financial assistance for county parcel data conversion. Many agencies and COGs express interest in the conversion of parcels throughout the State, but the responsibility falls on individual counties. Since many of the counties with the least ability to finance parcel conversion are also counties with small numbers of parcels and are often located in proximity to other counties with similar circumstances, the State could offer increased financial assistance in some areas to provide the counties with digital data and improve resources to be used for fostering economic development in those areas.
Data Format Standards	To establish a State GIS data clearinghouse, several data standards will need to be established to provide a consistent structure for the data to be made available for downloading or viewing through the service center applications. These standards will include:
	• Designated file names for each data layer
	• Assigned folders in a directory structure on a data server or a set of data servers.
	Data which is designated to be stored centrally as part of a managed state GIS Service Center may be maintained by designated custodians in a variety of accepted formats (ESRI .SHP, ArcInfo Coverages, Intergraph GeoMedia, AutoDesk AutoCAD DWG.) Procedures should be put in place to easily update Service Center data stored in an ESRI Geodatabase environment. As more users adopt the ESRI SDE Geodatabase environment, Service Center Data can be maintained in this format. Procedures and tools should provide for distribution of GIS data from the Service Center or other sources in multiple formats (ESRI, Intergraph, AutoDesk).
Map Feature Positional Accuracy	Accuracy of the base maps will be documented and each data layer will be associated with a base map. The actual accuracy level for each data layer will be assessed for each individual data layer based on the method of collection. If it is determined that there is a need for a more accurate data layer, CGI must work with the agency responsible for the data layer in question to develop a strategy for increasing the accuracy of data collection. This may require providing support to an agency in the form of funding for equipment, extra personnel, or extra time to be spent on a project. FGDC accuracy standards provide good guidelines for documenting accuracy, and data quality can be documented through the FGDC metadata standard according to standards that are promoted by the FGDC.
Data Custodianship Standards and Procedures	Data update responsibilities for GIS data layers will be determined through consensus of CGI. In most cases, the agencies currently having responsibility for the updates will keep those responsibilities. In the case of new data layers, CGI will designate an agency or call for a cooperative effort by multiple agencies.
Attribute Data Quality	With acceptance of database design standards currently in place, a physical database design for all GIS data layers needed by multiple parties will be well-documented with an identification of attribute domains. Standard entry codes that categorize data records according to types will be established for descriptive fields (e.g., standard categories for NWI Wetlands classification). This is an issue for eventual adoption of geospatial metadata documentation standards.

Issue	Recommendation
Geospatial Metadata Standards	Metadata database tables will be developed for the documentation of all important data layers (particularly those access through the state GIS service center). The tables will follow the recommended content of the FGDC metadata standards. Completion of metadata must be tied in with the data development activities. As users operate applications to convert or update GIS data, some metadata fields will be automatically populated. The maintenance applications will also include prompts for the user to provide information for other metadata fields.

	Collection and digitizing methods will be reviewed by CGI to ensure that the methods are in line with documentation provided in metadata files. CGI will require that data maintenance applications contain capabilities for automatically recording elements of metadata such as user ID of the person entering the updates and time and date of entry. The applications should also prompt users for entry of other metadata field values during or directly after the update process.
Digital Submission Standards	The State through the Geodetic Survey must encourage local governments to move toward requirements for receiving plat and "as-built" drawings in digital form. Receipt of these drawings in digital form will facilitate updating GIS data layers. The Geodetic Survey must develop a sample set of digital submission standards to be circulated to local governments and develop training programs that will instruct local government staff in methods for using digital plats to update GIS databases.

4.6.2   Multi-Departmental and Mult-Organizational Geographic Data Needs

This Needs Analysis has identified a high-level of cross-organizational requirement for geographic data. Multiple state agencies can benefit from GIS data often maintained by other state agencies. This is the clearly the case for certain base map layers (orthoimagery, jurisdicational and administrative boundaries, hydrography, and transportation centerlines) but it also includes certain thematic layers such as utility infrastructure, critical facilities, demographic data, and other geographic layers. Over the past ten years, state agencies have made excellent progress in sharing and exchanging data but this can be improved. Technical and institutional barriers still result in state government users not getting access to all available data and in some cases redundant data collection and management costing money and time.

Cross-organizational needs for geographic data exist not only horizontally among state agencies but vertically at different levels of government between state agencies, COGs and local governments. Each of these user groups act as generators and users of data and there is a major need for an improved level of cooperative GIS project work and sharing of data. Government programs supporting emergency planning and response, economic development, parcel mapping and appraisal, environmental regulation, natural resources and land use planning, and health services are dependent are effective flow of information between different levels of government. GIS technology and more effective statewide coordination will support this sharing of information.

Opportunities for governmental-private partnerships for the compilation of data and provision of GIS-related services has not been tapped to a great extent in South Carolina. Such public-private initiatives need to adhere to applicable state and local regulations and procedures, but the opportunity and potential benefit of joint GIS projects or information sharing agreements is great. Formal partnerships and joint projects between state or local governments and private utility companies, data reseller firms, land management and resource extraction companies, or commercial companies should be pursued with a goal to increase the availability of GIS data and the effectiveness of GIS applications.

SECTION 5

SECTION 5
ORGANIZATIONAL AND INSTITUTIONAL ENVIRONMENT AND NEEDS

This section will review the current organizational structure and institutional environment surrounding information technology and GIS and will examine the need to support statewide GIS coordination and collaboration in the future.

5.1.   CURRENT INSTITUTIONAL ENVIRONMENT IMPACTING GIS DEVELOPMENT AND COORDINATION IN SOUTH CAROLINA

5.1.1. Information System Planning, Coordination, and Central Support in South Carolina

As mentioned in previous sections, the State of South Carolina has made much progress in the last 2 decades in creating an institutional structure for high-level coordination and planning for information technology development and system support. Centralized information services are provided by the Budget and Control Board through the Office of Information Resources (OIR) and an information system planning function has been assigned to the Office of Technology Planning and Management (OTPM) in the Office of Research and Statistics. Also, as previously described, the Information Resource Council has a broad mission for information technology coordination and standards.

State Budget and Control Board, Division of Operations, Office of Information Resources (OIR)

OIR in the Budget and Control Board is responsible for information technology and telecommunications design and services such as applications development, data center operations, network management, printing services, and State telephone systems management. OIR has recently constructed a new data center that consolidates
13 previous data centers into one facility that is used to house several mainframe databases. OIR also provides web site design services and site hosting to State agencies. Through a distributed computing services office, OIR provides personal computer and local area network support to State agencies that request it. OIR also maintains the State Internet e-mail service and manages relationships with private Internet Service Providers. OIR provides technical services and their consulting is on a technical level related to implementation of system components.

State Budget and Control Board, Division of Budget and Analysis, Office of Research and Statistics, Office of Technology Planning and Management (OTPM)

The Office of Technology Planning and Management (OTPM) in the Office of Research and Statistics oversees information technology project planning and procurement for State agencies. OTPM works closely with OIR and the Information Resources Council to establish guidelines and standards and to review proposed information system projects. To encourage adherence to standards and efficiency and coordination in information system (including GIS) projects, OTPM has prepared a standard process for Departmental information technology planning. OTPM also reviews all proposed information technology procurements by State agencies' systems exceeding $25,000 and provides approval and comments on these procurements.

Information Resources Council

The Information Resources Council (IRC) is a Governor-appointed advisory board of public and private sector leaders guiding South Carolina to becoming an acknowledged leader in using information resources to support effective government and to benefit its citizens and businesses. IRC has appointed a series of standing committees that focus on specific information resource issues. Those standing committees include:

- Geographic Information
- Technology and Education
- Health and Human Services
- Criminal Justice Information Systems
- Local Government Applications
- Communications Architecture
- Technology Architecture.

Each of the standing committees develops a mission statement that is approved by the Governor's Office through the IRC and each standing committee then works to accomplish that mission.

5.1.2.   GIS Coordination and Organizational Structure

Management and coordination of GIS activities among State agencies and GIS users statewide require an organizational structure that will include policy-making entities, documented sets of procedures to be followed, a staff to carry out specified responsibilities, and a coordination role. In the State of South Carolina, several issues must be addressed to successfully coordinate GIS among all user organizations in the State. Concerns related to statewide GIS coordination are discussed below. These concerns focus on management, coordination, and staffing needs that are necessary for GIS coordination:

- Data coding and compilation standards

- Coordination of GIS compilation and update activities

- Current environment for GIS management and administration in individual organizations

- Administrative and policy framework for joint GIS projects in State government

- Data distribution policies, including possible sale of products or data

- GIS education and training

- Application development, coordination, and joint projects

- State/Local coordination and support

- Public/Private partnerships and joint projects

- High-level communication and promotion of GIS initiatives and benefits

- Funding GIS initiatives.

These concerns will be addressed throughout the rest of this section, and some recommendations will be made. Prior to a discussion of the issues and the statement of recommended approaches or options, organizations that provide coordination will be documented, as well as some examples of joint projects that have contributed to the development of GIS resources in the State.

<u>Geographic Information and GIS Coordination Bodies</u>

To date, GIS implementation has been coordinated through committees at the State level. The State Mapping Advisory Committee is the oldest body in the State addressing coordination in mapping and geographic information. SMAC became involved in the GIS technology coordination as it evolved in the State and has advised the Governor's Office since 1978. SMAC organizes the annual State GIS conference and advised the Information Resource Council and the Governor's Office on the formation of the Standing Committee on Geographic Information (CGI). The 1997 establishment of the Committee on Geographic Information in the Information Resources Council raised the profile and participation in GIS coordination activities in the State. Members of this committee work together to identify issues that impact GIS development across the State and to develop strategies for resolving the issues. CGI is composed of representatives from State government, local government, the private sector, and regional Councils of Government. Much of their work has been completed through the efforts of sub-committees. Some of those subcommittees and their activities are documented below.

GIS-related Standards Development

Standards development has been coordinated through CGI up to this point through the formation of subcommittees. Originally, three CGI sub-committees were formed:

- Standards
- Statewide Physical Foundation
- Coordination/Facilitation/Access.

The Statewide Physical Foundation subcommittee served to identify the foundation data layers. Those layers require standards that will be recognized by all user organizations in the State. The work of developing those standards has passed on to the working groups under the Standards subcommittee. The Statewide Physical Foundation subcommittee has served its purpose and is no longer an active body.

The Coordination/Facilitation/Access subcommittee developed a plan for the procurement of a consultant to develop a plan for statewide GIS coordination. The result of that initiative has been the State of South Carolina Needs Assessment and Strategic Planning Project. The Coordination/Facilitation/Access subcommittee is currently acting as a steering committee to oversee the project.

At this time, the Standards Subcommittee is focused primarily on the development of data coding standards. Under the Standards Subcommittee, there are working groups that focus on several data standards that are needed. The working groups are:

- Addressing
- Transportation Features
- Hydrologic Features
- Geodetic Control
- Cadastre
- Best Practices.

The Addressing working group has developed a document specifying the structure of street centerline attribute tables, including the fields and their characteristics necessary for recording street names and address ranges. This standard has been followed by ORS in the development of the county 911 street centerlines. This standard has been approved by CGI and submitted to the IRC for ratification. The Transportation Features working group is currently scheduled to deliver a draft set of standards for coding transportation features such as roads or railroads. The activities of the other working groups are currently in the planning stages. The one exception among the working groups is the Best Practices group. Best Practices is involved in identifying issues that will require coordination strategies, such as metadata needs, projection and datum standards, or the choice of mapping units. Once specific issues are identified, working groups will be assigned to resolve the issues and clear the way for cooperative efforts.

Cooperative Programs and Projects Led by User Organizations in the State

It is important to recognize the extent to which GIS development in the State has been fostered through cooperative efforts among specific groups of users. Many of the cooperative projects in the State have had a focus on the development of GIS that supports agency needs. Some examples of cooperative efforts initiated and managed by specific organizations include the Department of Natural Resources' (DNR) GIS Data Clearinghouse. It was made possible through contributions from the National Oceanic and Atmospheric Administration (NOAA), the Department of Health and Environmental Control, the South Carolina Department of Commerce, and South Carolina DNR.

Other joint projects of note include:

- ACE Basin Ecological Characterization Project—Many participants have joined forces to initiate conservation efforts in the ACE basin. In order to respond to the needs of these efforts, DNR has combined with the National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center (CSC) and the National Geophysical Data Center to develop a database of information about the region to be used by land managers to balance conservation of natural resources with economic development. The goal of the project is to provide a CD-ROM of data to be used for analysis of the region. GIS data is a major part of that CD-ROM.

- Edisto River Project—One of the rivers that form the ACE basin is the Edisto River that was the focus of another DNR led project. The Edisto River project focused on the development of management objectives for the Edisto River basin. It provides another example of using GIS to facilitate cooperative efforts between government agencies and community-based organizations. The Edisto River project involved using GIS capabilities to combine and analyze maps of characteristics in the river basin, and developing management objectives through the participation of nearly 200 residents of the Edisto River basin.

- Department of Commerce Economic Development Assistance—The Department of Commerce (DOC) has worked closely with the COGs and local governments to help with economic development by serving as a resource for local governments and COGs for research of characteristics in an area that impacts the suitability for economic development. DOC has also worked to provide local authorities with the tools to conduct these analyses themselves. A tangible result of this cooperative effort was the ArcView-based InSite.

- Underlined CAMA System Deployment—The Department of Revenue is involved in selecting a computer-assisted mass appraisal package and configuring it for use by all counties in the State with the goal of integrating property data and appraisal. While not specifically GIS, such a system can have direct links to a GIS parcel map layer and extend capabilities for GIS mapping and analysis.

- University of South Carolina Projects—The University benefits from the research aspects involved in a cooperative program with NASA to analyze the products of NASA programs such as use of GPS and GIS. Another project conducted for Norfolk Southern Railroad analyzed potential routes for the construction of a rail spur. The University developed a model that improved results over the methods used by the railroads. The University also developed a GIS based tool to identify optimum sites for business location based on a set of criteria combined through a model.

- State Legislature Support/Political Re-districting—The Office of Research and Statistics (ORS) in the State Budget and Control Board's Division of Budget and Analysis plays a support role to the legislature and coordinates with other organizations in providing maps and geographic data. ORS has also been assigned responsibility to process data and support legislative committees in statewide political re-districting using data from the 2000 Census.

The COGs operate GIS training programs for local government personnel within their regions. They also provide services and offer GIS related technical assistance. Some specific examples of COG cooperation with local governments include:

- Central Midlands COG using its GIS system, data, and capabilities to enhance the 911 CAD system for Newberry County

- The Berkeley, Charleston, Dorchester COG is participating with the State in a program funded by NASA to examine urban growth over a 20+ year period

- The Appalachian COG has used GIS to develop EDIS (Economic Development Information System). EDIS is a GIS application that uses data specific to the Appalachian Region, allowing counties and municipalities to develop some economic development analysis and presentation materials.

Map Data Distribution, Sharing, and Sales

Distribution of GIS data by State agencies is one of the primary goals of these organizations. Their activities are focused on providing users with opportunities to access data as easily as possible. The DNR Clearinghouse, the development of Insight by the Department of Commerce, and the plans for web sites by other agencies are all forms of data sharing. Insight and the Clearinghouse are both methods of distributing data free to other users in the State that need those layers. The South Carolina Geodetic Survey sells maps and data on their website. They sell USGS topographic maps, NOAA charts, city maps, Highway Department maps, and fishing maps. There is not much activity related to data sales at the local level, and it may be that data sharing arrangements will be more beneficial to all GIS users in the State. Utility organizations will make great use of base map and cadastral data supplied by local governments, and local governments will have great needs for facility data from the utility organizations. A trade or mutual sharing arrangement are promising. Often a few issues must be ironed out for these types of arrangements to work.

Training and Technical Assistance

Geodetic Survey has developed a GPS training program for staff from State government, local government, and COGs in South Carolina. Geodetic Survey also supports the county base mapping program with technical assistance in the form of writing specifications and selecting contractors for aerial photography, digital orthophotography production, base map compilation, and parcel data conversion.

Technical assistance at the State level is provided on a formal basis through the Office of Research and Statistics. ORS contracts with the Department of Social Services to conduct specific types of GIS analysis and mapping. On an annual basis, ORS supplies the Governor's Office with GIS map products that illustrate the distribution of public health and social condition data based on census tracts, block groups, and address matching to street centerlines. The data are gathered by several agencies throughout the year in a variety of databases. ORS receives database extracts from these agencies and maps them using GIS, for the presentation of statistics to the Governor's Office.

The issue of data maintenance for many counties is an issue of personnel. With a lack of personnel who have the capability to maintain GIS data and a GIS system, and the lack of funds required to hire and keep a person with those skills, some local governments choose to stick with traditional methods of maintaining maps. Since the regional Councils of Governments all have GIS capability, it has been suggested that once a set of GIS data has been developed for a county that fits this description, the regional COG could support GIS in that county through maintenance of their parcel data and some system administration. Some concern has been expressed that the COGs would not be able to attend to the parcel maintenance as often as would be needed and that, over the long term, the local government personnel would not learn the operation of their system and would not take ownership of it.

In spite of these concerns, the COGs do offer a strong alternative for maintenance and operation of a GIS that local governments can access. The counties that would benefit the most from COG support are those that have relatively few parcel updates to make over the course of a year, and often do not update their maps as soon as the records of changes arrive in their office. Typically, changes are saved up for a period of time, sometimes an entire year, before changes are made to the maps. This situation favors data maintenance support from COG personnel. Learning how to use the software and understanding the data and eventually taking ownership and responsibility for the system will need to be handled over time since GIS technology can take a long time to master. With training and opportunities to use the

software, existing staff will learn uses for the GIS data and how to create some custom products using in-house desktop mapping software.

The regional Councils of Government can provide support to counties with GIS data requiring maintenance, and can serve GIS data to county personnel through Internet applications. COGs interact with local government personnel frequently and are often in a good position to provide some GIS training to local government staff due to offices being close by and their familiarity with local government issues, data, and needs. When requested, the COGs must be able to provide these types of services. By strengthening GIS resources at the COGs, the State may provide local governments with valuable GIS expertise and services.

Based on input from project participants, several observations may be made that will guide the provision of GIS training to State users:

- Local government and COG GIS users, especially those in areas removed from population centers, do not have ready access to software courses they would like to have. Courses supplied by vendors, government agencies, COGs, universities or colleges, and third party vendors need to be available to local government users.

- The passage of the "Surveyor's Bill," which requires certification for GIS practitioners, increases the need for educational and training opportunities in the State.

- State Universities will continue to play a role in foundational GIS education, as well as software-specific training for traditional and non-traditional students.

- The new Geomatics program at Greenville Technical College may become a model for more accessible practical education and training statewide.

- Some solutions may be available through coordination of training between county and municipal personnel in close proximity to each other. COGs and State government agencies could contribute regional data, and universities and technical colleges could sponsor the development of some continuing education courses or seminars based on hands-on operation of GIS software that highlights new capabilities and features.

- State government GIS users could benefit by better internal programs for support and collaboration among multiple agencies.

- Formal training programs, conducted by vendors, educational institutions or other groups, should use South Carolina-specific data sets and application examples wherever possible.

5.2.   KEY ISSUES IMPACTING FUTURE GIS COORDINATION AND INSTITUTIONAL RELATIONSHIPS

Coordination of GIS activities in the State of South Carolina has resulted in several successful projects and has produced communication about resources and activities, the development of data, and opportunities for data sharing. Standards are being developed and data are available through data clearinghouses. The efforts of GIS users throughout the State who have donated their time to the functions of the Committee for Geographic Information are to be commended. In order to fully realize the benefits of their work to this point, it is important for the State to take further steps that will increase the level of coordination and provide greater opportunities to a larger number of potential GIS users throughout the State. If the challenges listed below are met through an organizational structure composed of personnel dedicated to the tasks of GIS coordination, South Carolina will enjoy improved greater sharing of GIS resources, and the realization of the benefits of GIS to all stakeholders among federal, State, and local governments; regional planning organizations; public and private utilities; and educational institutions.

5.2.1.   Institutional and Management Challenges

The following institutional and organizational challenges must be addressed in the creation of a *GIS Strategic Plan* for South Carolina to promote efficiency, collaboration, and the sharing and effective use of GIS resources (data, applications, system infrastructure, and staff):

- Establishing a process for senior management briefings, input, and support

- Budgeting, approval, and allocation of funds for GIS projects

- Routine coordination and liaison with GIS users throughout the State

- Establishing and using a structure for communication and participation by stakeholders in a statewide context involving not only State agencies but all user groups

- Facilitating the adoption of GIS and use of GIS services more widely in local governments (particularly small cities and counties)

- Establishing appropriate standards and a process for multi-Departmental and multi-organizational procurement of shared GIS resources (data, software, custom applications) which may include systems and database development services

- Defining, adopting, and coordinating standards and procedures for database development, maintenance, sharing, metadata, and data distribution

- Defining, adopting, and coordinating standards and procedures for application development and deployment

- Oversight of data maintenance and administration to ensure compliance to standards and procedures established for data that will be made available to the community of GIS users.

- Documenting, assigning, and overseeing organizational roles in data maintenance and other system support activities

- Crafting and approving policies that will guide access to GIS, use of centralized resources, distribution and sale of GIS data, and organizational relationships for joint projects (e.g., public-private partnerships)

- Addressing requirements for communication and education at all levels to promote wide use of GIS and technical support to users.

As evidenced in this report, significant progress has been made in the creation of organizational structures and standards to address the concerns above. Initially SMAC, and now CGI and its subcommittees, have provided a structure that supports and encourages coordination in GIS activities. Accelerating these efforts and putting in place a more effective structure for coordination are needed. Much of this requires reaching a consensus about management, coordination, and support activities that can benefit from a greater level of centralization. With a consensus on the level of centralization, attention needs to be given to an institutional environment that supports and encourages decentralized GIS development and use while ensuring a high level of resource sharing.

5.2.2.   Centralization vs. Decentralization of Management, Coordination, and Support

The organizational structure and specific organizational roles developed to support all of the activities that have been described thus far in this report will be the primary factor in the success of this coordination effort. The structure of GIS coordination must meet the need for consolidating efforts where opportunities exist without inhibiting the normal operations of individual agencies to an unacceptable level.

Many of the decisions about organizational structure, roles, and institutional relationships have to do with reaching a consensus on the level of centralization or decentralization of various coordination activities and services. PlanGraphics examined responses from survey forms that asked opinions on whether centralization or decentralization is appropriate for certain services. Those responses are documented in Table 5-1.

**Table 5-1: Tabulation of Committee Member Responses
to Designation of Responsibility for GIS Management Functions**

GIS Services	Centralized	User Department	Number of Responses
Establishing/Overseeing Technical Standards	23	6	29
Preparing/Monitoring GIS Policies and Legislation	24	7	31
Planning/Coordinating Joint Projects	18	18	36
Documenting/Providing Access to Framework Data	18	11	29
Managing/Overseeing Framework Data Development	19	11	30
Updating Framework Data	11	15	26
Database Quality Assurance and Posting to a Central Database	18	19	37
Training and Orientation Services	20	12	32
GIS Needs Assessment and Planning	18	16	34
GIS Implementation Support/Application Development	14	20	34
System and Network Administration	13	20	33

The overall results indicate the recognition of a need for an organization with some centralized GIS coordination responsibilities. The primary responsibility most committee members envision for a centralized organization is oversight of technical standards, the development of GIS policies, and training and orientation. A majority of committee members are opposed to the centralization of system and network administration by a central organization, as well as support for implementation and application development. Members are divided on the responsibility for other activities. A discussion of the management of these activities follows.

Establishing and Overseeing Technical Standards

To date, CGI has coordinated the process of developing standards for GIS data at the State level through a proposal-review-consensus approach . This has occurred through the creation of subcommittees for the definition of standards for specific data categories. The development of standards should continue to be conducted through a committee structure since the standards impact all users and everyone must approve them. To the extent that standards development and approval through the IRC, this will help support the standards setting process. With the establishment of standards, the next step is to have them fully adopted and used by state agencies (and perhaps other organizations in the state). The CGI is not in a position to mandate use of standards for specific agencies. The CGI should evaluate mechanisms for fully implementing standards and overseeing their use by agencies. GIS data and services that may become part of a central clearinghouse in the state will require clear standards. Whether or not strict requirements are put in place for agency adherence, full adoption of standards can be supported by good education, a continued spirit of cooperation, and an illustration of the use of well-crafted

standards will bring long-term benefits.

Preparing and Monitoring GIS Policies and Legislation

The development of policies related to GIS will occur at many levels. CGI will identify procedures and positions that will apply to the operations of the statewide clearinghouse. If applicable, these policies will be encouraged in individual agencies but not required.

CGI may identify needs that can only be met through the preparation of legislation that impacts all State GIS users. Proposed legislation may include attempts to create funding mechanisms or to require specific characteristics for the compilation of data. If a need is identified and approved by the committee, the committee will take responsibility for the development of that legislation, getting input from committee members and any other people that the committee may deem appropriate. Monitoring the progress of the legislation may occur through the efforts of individual committee members or by a GIS coordinator at the direction of the committee.

Planning and Coordinating Joint Projects

There was an even split among committee members concerning coordination of joint projects that may impact multiple organizations. A coordinated approach to planning a joint project would require identification of participants or "project stakeholders" based on the knowledge of agency and organizational needs throughout the State. This could result in the development of a fuller set of requirements for the project. Afterward the actual development could be managed by designating a a project manger and project team.

Clearly, creating a climate for greater multi-agency project collaboration requires a level of GIS coordination, administrative procedures and tools, and GIS standards that are not in place today. Creating these elements is one of the challenges that the state faces.

The reason to encourage joint project planning and development is to reduce redundant efforts and ensure a greater level of information sharing. This does not imply that all GIS projects undertaken by State agencies would be jointly managed or funded or under any direct oversight of a state GIS coordination body. But development projects (like the street centerline/E911 effort) that have a great impact on many organizations, should be planned and conducted in a collaborative manner. Defined standards and better procedures for GIS coordination will support collaborative efforts. It is hoped that even those projects which are carried out soley by a specific agency will, as a matter of course, consult accepted standards and consider potential access by other agencies in the project design and execution.

Documenting and Providing Access to Reference Data

This activity will be the essence of the operation of the state GIS service center. Reference data are those data layers that are used as reference layers or layers that are used to create other data layers (e.g., updating DLGs by using DOQQs). Documentation of data is best handled by the agency that maintains the data, but the purpose of having a state GIS service center is to provide access to data depicting geographic features of the State. Of top importance among those data layers will be the reference data.

Managing and Overseeing Reference Data Development

The development and maintenance of reference data will be the responsibility of designated agencies. It is important for the reference data to have a reliable set of specifications since those data layers are commonly used as frames of reference. CGI must be involved in the development of these data layers, but it is likely that the development of specifications and oversight of development will be best handled by an existing agency such as South Carolina Geodetic Survey (SCGS) or by a contractor administered by SCGS. Often, reference data sets are developed by federal agencies and acquired, checked, and corrected or improved by State agencies. This arrangement has worked well and will continue to work well, with thorough documentation of methods and standards through consistent maintenance of metadata.

Updating Reference Data

Updating the reference data will be the responsibility of individual agencies much like the development. CGI and the central coordination group will only require adherence to standards and will conduct some aspects of quality control (format and design-related characteristics) on data submitted for inclusion into the state GIS service center.

Database Quality Assurance and Posting of Data to a Central Database

Quality assurance is an independent check on quality. Quality assurance of a GIS database involves many types of checks. Some of these checks are best handled by the agency responsible for the development and maintenance of those data. It will be the responsibility of individual agencies to conduct checks for content and completeness, including both the presence and correct representation of graphic features and the correct entry of attribute information. Recommendations in this report call for creation of a state GIS service center. Data services provided by a service center would augment, expand, and enhance services already provided by existing clearinghouses (e.g., DNR, University of South Carolina). This carries a responsibility for the service center, in conjunction with expected quality control by a data custodian, for some level of quality assurance responsibility. The concept of a central service center with a data clearinghouse role does not mean that all data accessible through it would be centrally located on one physical server maintained by the service center. To facilitate access and ensure consistent services and adherence to standards, it is likely that some important and frequently accessed data sets would be located on a central server (perhaps replicating data maintained by another agency). However, to be effective, the service center would also function as a Web portal to other sites (agency specific servers) where data, maintained according to applicable standards, could be accessed. See Section 6 for a greater discussion about data priorities and data components that may be access through a state GIS service

center.

Training and Orientation Services

Training and orientation services encompass a wide range of topics and needs. CGI and the service center staff will act as a training management center for all users in the state, helping them to identify and develop training programs throughout the State. State agency personnel are not the only users that will require training. During the local government and utility workshop, there was a strong call for better training opportunities, especially in areas of the State that are remote from universities and large population centers.

Training opportunities will be developed through colleges and universities, software vendors, COGs, and State agencies that provide training such as GPS training by SCGS, and through looking for opportunities to combine training schedules of personnel from different organizations in close proximity to each other.

GIS Needs Assessment and Planning

For specific implementation and deployment of GIS technology within specific organizations, it may be important to conduct a detailed needs assessment and implementation plan. Depending on the scale of needs assessment and planning that is required, different approaches can be taken. CGI and a State GIS Coordinator should provide guidelines for such efforts. In some cases, a sub-committee assigned by CGI will be able to conduct a study for major multi-organizational GIS projects. Otherwise CGI may suggest and provide examples and templates and, if necessary, support the hiring of consultant support for this work.

GIS Implementation, Support, and Application Development

The approach to application development is discussed in Section 2. A three-tiered application development framework is based on three environments. Most survey respondents indicated that application development should be conducted by individual agencies. Under the proposed application development framework, most application development will take place at the agency level. There will, however, be some application development associated with the creation of the state GIS service center. CGI will also constantly be looking for opportunities to prompt the development of some applications that will serve multiple agencies and/or organizations. When these opportunities are identified, a development working group will be created to administer the development of the application. These development efforts will be conducted according to an application development methodology and, where possible, will use components from other applications, including user interfaces, that will give all applications a similar "look and feel," thereby making a more user-friendly application environment. One goal of the state GIS service center will be to compile a library of applications and application components from GIS applications throughout the State. This will be used to streamline new development efforts within all development tiers.

Support for GIS implementation and operations in an agency may be handled in various ways. Some support functions may be provided by other agencies such as the Office of Research and Statistics, to university staff, or to private firms. Each agency will have the choice to handle their situation as they wish. CGI will be available for advisement and recommendations for an approach. CGI may also be able to assist in setting up the terms of a contract.

System and Network Administration

All administration of system and network resources will be the responsibility of individual agencies except for the system and network resources associated with the state GIS service center. The recommended system configuration associated with the service center is described in Section 3. The state GIS service center will require a management staff to administer the system. This staff will need to have expertise in high-end RDBMS, SDE, ArcInfo, a COM compliant language such as Visual Basic or Delphi, MapObjects, MapObjects IMS, and ArcView. In the future, Java programming will be useful as well.

5.3.   ORGANIZATIONAL AND INSTITUTIONAL NEEDS FOR GIS COORDINATION

To provide a foundation for greater coordination of GIS activities and expanded use of GIS technology for the benefit of all stakeholders and their constituents, changes should be made in the current statewide GIS coordination structure. The bullet points below summarize the major needs for a new institutional environment for GIS which recognizes the importance of centralized coordination and support, as well as the value of
GIS programs and support activities among user organizations. Section 6 provides some additional ideas and options for how to respond to these needs.

- **State GIS Coordinator:** A State GIS Coordinator should be assigned as a State employee and placed in an appropriate administrative location to facilitate the multi-departmental and multi-organizational role. This is a high-level position that works closely with CGI and user organizations. The Coordinator oversees standards setting, promotes joint project work, provides high-level promotion and education, is directly involved in policy creation and legislation impacting GIS, evaluates and helps secure grant funding for GIS programs, and works closely with an established service center group. The Coordinator will require some administrative and technical staff support.

- **State GIS Office:** While perhaps not necessary immediately, GIS coordination and expansion in the State could benefit by the

creation of a GIS office, with a small staff, to better operate in a statewide role and oversee certain centralized services and joint GIS activities.

- **SMAC and CGI:** The leadership of the State Mapping Advisory Committee and the IRC's Committee on Geographic Information should consider a formal consolidation. This observation recognizes the role and past record of both groups, but such an action could remove some ambiguity of roles and join efforts, ideally, under a strengthened CGI. The subcommittee structure in CGI should continue and be augmented. Activities being carried out by SMAC should be formalized within CGI.

- **Joint Project Facilitation and Coordination**: One key role of the GIS Coordinator and CGI is to create an environment, prepare the administrative tools and procedures, and facilitate interaction between parties on multi-departmental and multi-organizational GIS projects. This may involve large data compilation efforts, application development, or other types of major, high-profile GIS projects. Work that has already begun for the development of template specifications and agreements, joint project management support, etc., should be accelerated and augmented.

- **State-Local Coordination**: Full deployment of GIS in the State ultimately means getting the technology in use at the local level—even the small, rural counties where information technology adoption is low. This will be a long-term effort, but the State agencies, along with COGs, the State educational system (universities, technical colleges, high-schools), and the private sector, can encourage information technology adoption. State government should take a leading role and devise and support programs for technology transfer, education, and GIS use statewide. A more formal role, and financial support for COGs, as service bureaus for local governments, should be considered.

- **GIS Promotion and Advocacy:** There is a very important need for continued high-level promotion, education, and briefings about the practical benefits of GIS technology. Such a role, to be shared by the GIS Coordinator, members of CGI, and other proponents of GIS in the State, will keep decision makers aware of the role that GIS can play in supporting critical business drivers in the State. There is also a need for leaders in the State GIS community to be involved in the creation of formal State policies and legislation, and funding approval that impacts GIS.

- **Central** State GIS Service Center: Previous sections of this report have pointed out the need for some level of centralization of GIS services—key data and application services that have a multi-organizational significance and therefore can benefit from central oversight and support. This need can best be realized through establishment of a service center that provides metadata access and search, access to certain key data layers (for direct access or for download in a format that meets users' needs), and access to multi-user applications. The existence of such a service center does not lessen the need for data and application services carried out by individual agencies—on the contrary, it leverages these agency roles and provides a structure to better collaborate, and to make data and applications available to users who need them.

- **Technical GIS Support and User Services**: A range of support services will be needed on a continual basis. Among these services are education, specific training on software and techniques, technical support for system and application design, application development support, and all basic system administration and network support functions. While it may be appropriate for a central body to provide minimal support in some of these areas (some basic education or design help to get projects moving), the best environment is for these services to be decentralized with multiple service providers (user organizations, universities, technical colleges, professional associations, and private software or service companies).

SECTION 6

SECTION 6
HIGH-LEVEL CONCEPTUAL DESIGN FOR
LONG-TERM STATEWIDE GIS COORDINATION AND USE

6.1.   CONCEPTUAL DESIGN OVERVIEW

This conceptual design provides a target or general blueprint to guide short-term and longer-term development of a statewide program for expansion of GIS and statewide GIS coordination. This design addresses the three major elements of a successful GIS effort:

1.   The **technical configuration**—the hardware, software, and network environment within which the GIS operates

2.   The content and format of the **GIS database** and access to it, as well as the integration of important geographically-related data on a non-GIS system

3.   The **institutional environment** and all issues impacting management, staffing, and coordination of GIS activities.

This design has a strong focus on State government as the leader in facilitating more effective GIS coordination and in providing a practical set of standards, certain important GIS services, and program coordination for all users. The design recognizes a role for and participation of all stakeholder groups in the State. The design also acknowledges that some coordination activities require centralization and services without negatively impacting decentralized development and GIS operations in individual agencies.

This conceptual design is intended to provide a direction for GIS development that will lend a focus to the strategic plan and specific actions that it contains.

The design includes a number of major components that are described in more detail below:

- A **GIS coordinator and eventually a GIS Office** to coordinate GIS programs, facilitate collaboration in GIS projects, and work with the CGI all stakeholders to promote and encourage GIS use and information sharing by organizations in the State

- A state GIS service center, with robust technical infrastructure using the Internet to support GIS access and virtual links to other servers

- An continued active and influential **Committee on Geographic Information** that, as an organ of the Information Resources Council, provides a forum for standards and policy creation and dialogue among stakeholder organizations.

- An **organizational and coordination structure** (with appropriate mechanisms, documented and procedures, and administrative tools) that supports and encourages multi-Department collaboration, communication among GIS users, State-local coordination, and public-private partnerships for GIS

- Easily **accessible geographic data,** including high-priority GIS data "layers," commonly needed geographic databases, a well-designed metadata environment, and effective procedures for database maintenance and access

- An **organized, standards-based environment for GIS applications**, with common access to those that are of general applicability to multiple users

- Multiple **options for technical support and a range of GIS services** (e.g., training, data compilation, application development, etc.) that user organizations may access to support their GIS implementation and operation.

6.2.   SYSTEM CONFIGURATION ENVIRONMENT AND GIS SERVICE CENTER

As described in Section 3, the needs of GIS users in the State, and the recommendations in this report, call for a system environment that provides enhanced access to GIS data, applications, and other GIS resources. Such an environment leverages the existing statewide area network and Internet with future improvements and the system capabilities that are maintained by individual user organizations.

A focal point for a future GIS system environment is a state GIS service center. The purpose of the service center will be to facilitate access to GIS data and applications and generally support the currently stated CGI mission to encourage the sharing of geographic information and promotion of GIS on a statewide basis. This service center may be characterized as follows:

- The service center implies the need for a central facility housing hardware, software, and certain data sets, but it will also act as a virtual clearinghouse to facilitate access to other Internet sites. The clearinghouse will be technically set up and administered in a sound manner with proper attention given to performance monitoring, security, efficiency of user access, and high availability.

- The service center will be set up to provide various options that meet user needs. These needs may include—a) metadata queries and examination,
b) access to certain data sets for download or ordering, c) direct interactive access to service center data and central GIS

applications, and d) examining a directory of information about GIS projects, programs, and users in the State. Such a service center can function as a support to a GIS coordinator and CGI to provide information and support GIS collaboration.

- Web-based services provided through the service center are delivered through a custom Web portal—a focused Web Page that efficiently presents options (data and services) to a target set of users. The Web portal is developed using State-of-the-art design and monitoring tools with particular emphasis on effective links to available databases and applications (perhaps using XML, custom programming in JAVA, and other robust development tools).

- Service center services will be based on well-crafted standards and technical designs for GIS data and applications. For instance, as part of its data services, standards and a procedure for high-level quality assurance for data set access directly from the clearinghouse will need to be established.

- The metadata search and query function may simply deliver reports about the characteristics, quality, and availability of geographic data sets, but it may also be set up as a front-end for download or direct access to data, or ordering of data. This metadata access may work in tandem with a formal FGDC National Spatial Data Infrastructure (NSDI) Clearinghouse Node.

- Technical and administrative staff will be required to support clearinghouse activities and ongoing services, to monitor performance, and to modify clearinghouse services and interfaces to better support users. Eventually, the service center should provide technical services such as training and implementation support. Such a technical support role could be provided by service center staff and/or the service center may become a contact point for technical services provided by other parties.

A diagram explaining the conceptual configuration to support GIS access and operations statewide and the concept behind the central service center are provided in Figure 6-1.

**Figure 6-1: General Technical Configuration for
Statewide GIS Access through a State GIS Service Center**
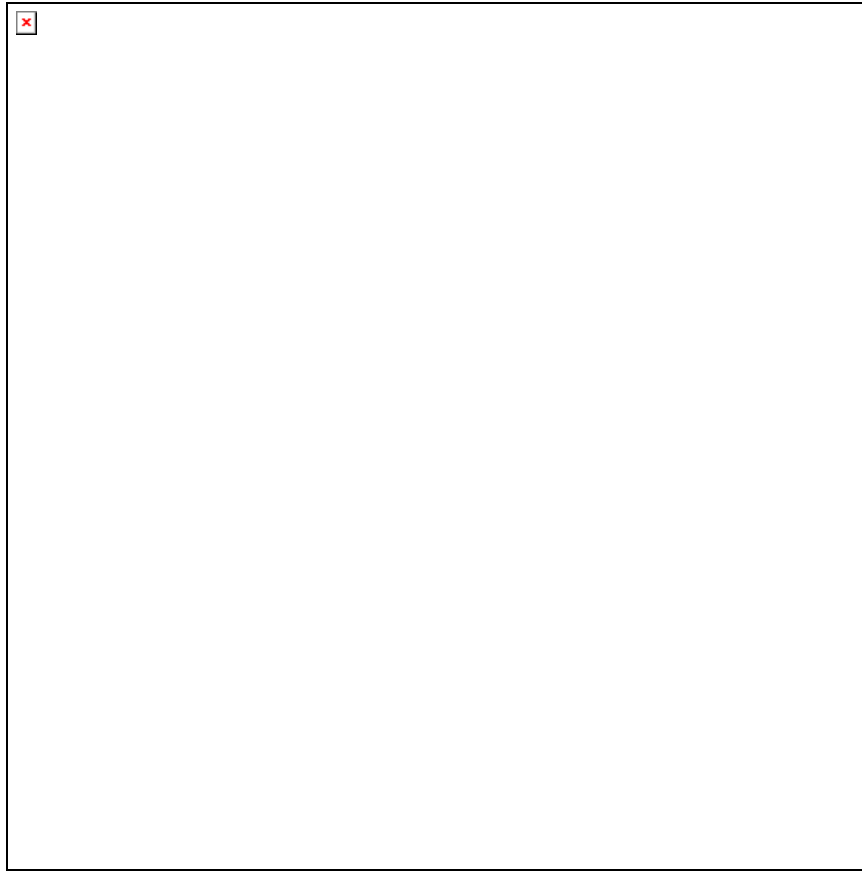
6.3.   CONCEPTUAL GEOGRAPHIC DATABASE DESIGN AND DATA MAINTENANCE

6.3.1.   GIS Database Context

Data required to support GIS applications may be managed and maintained by a GIS software package or it may be part of an "external" system creating a need for some level of integration with GIS. In a general sense, geographic information may exist in a number of formats and logically categorized as shown in Table 6-1.

Table 6-1: General Categories of GIS and Geographically-related Data

Data Category	Explanation
Vector GIS	Vector-based representations of map features and locations as point, line, area, or complex objects (e.g., networks).
GIS Attributes	Tabular attribute data (text or number values) stored in a recognized database format logically associated to map features and managed through a GIS software package.
GIS Annotation	Permanently stored text in a GIS software package associated directly with vector map features or areas in the GIS database.
Raster Geographic Image	A geographically registered "layer" that is in raster, not vector, map form. This could be a digital orthoimage (compiled from aerial photography or satellite data), a geo-registered image without full ortho control (e.g., scanned a rubber-sheeted aerial photograph), or a map stored in grid format with values assigned to cells.
Digital Elevation Model (DEM)	Elevation data stored in one of several proprietary formats (e.g., ESRI TIN) that can be used by GIS software for display and analysis.
CAD File	A vector graphic file usually containing engineering design information (usually for spatially limited project areas) that is stored in an accepted CAD format (usually AutoCAD or MicroStation). CAD files are differentiated from Vector GIS files in that they store features using CAD-based parametric definitions and do not explicitly reference a true spatial coordinate system or map projection.
Document	Any record (e.g., form, report, legal document, site photograph, meeting minutes, etc.) usually scanned and stored in a standard raster format and associated with database index data to support queries and retrievals.
External Tabular Database	Any tabular database, normally maintained using a commercial database management package that is maintained separate from a GIS software package. It contains one or more key fields that allow the data to be logically related or "joined" with features or locations in a GIS database.
Multi-media Data	This category covers other, "non-traditional" data that may have a logical relationship with a map feature or location. It includes video or sound clips or other special data types.

Organizing a collection of GIS data in a way that makes it easy to access and distribute is complicated by the fact that it is a two-dimensional and sometimes a three-dimensional format. GIS data sets occupy a certain geographic extent and also have an inherent scale and accuracy associated with its compilation and which governs its use. The conceptual database design presented below includes a general categorization about compilation scale and typical scale for use and presentation of the data. These categories are
Site-specific (scales larger than 1:1000 or 1" = 83'), **Local** (scales from about 1:1,000 to 1:20,000 or 1" = 83' to 1" = 1,250'), **Regional** (scales from about 1:20,000 to 1:250,000), and **Statewide** (scales from about 1:250,000 to 1:3 million).

6.3.2.   GIS Data Themes for South Carolina

Table 6-2 identifies major GIS data "themes" needed by State users. Themes are included if they have some multi-organizational significance and potential use. GIS data themes that have a very specific programmatic or project focus for specific Departments or organizations are generally not identified. This table organizes the themes into the major groups of:

- Base Map Themes—Those reference layers in the GIS that provide a foundation for other layers and which are frequently needed by a large number of users. The themes in this group are generally consistent with the Framework data concept defined by the Federal Geographic Data Committee (FGDC).

- Governmental/Service/Administrative Districts—Data layers that represent boundaries of governmental jurisdictions, areas designated for administration of services or program management, or political districts associated with elections of local, State, or federal officials.

- Utility and Infrastructure—Data layers dealing with man-made facilities that are related to transportation, the delivery of utility service, buildings, or other constructed facilities.

- Emergency Planning and Management—These data layers depict features that are essential to planning for and responding to emergencies.

- Natural Resources and Physical Landscape—Data layers that delineate and characterize land, air, water, and biological features and areas. This includes physical attributes of the landscape, location of the resources, and areas to which special protection and management apply.

- Property-related—All data representing the legal and assessed boundaries of real property, and associated features that relate to

property taxation, land subdivision and development, and the conveyance of rights associated with tracts of land.

• Socio-economic—Data themes that deal with economic, business, demographic, and land use characteristics of the land.

Table 6-2: Description of Possible GIS Data Themes for South Carolina

GIS Data Theme	Data Category*	Explanation	Compilation or Data Gathering Scale	Typical Use/ Presentation Scale
Base Map Themes				
Digital Raster Graphics	Raster	Scanned USGS 7.5' topographic quadrangles registered to the UTM coordinate system.	Regional	Local/ Regional
Elevation—Detailed DEM	DEM	DEMs used to create detailed contours are collections of elevation values that consist of breaklines and masspoints. The breaklines are formed by a series of points that follow terrain breaks, such as ridgelines and drainages. The masspoints are elevation values sampled between the breaklines at a designated density.	Local	Local/ Regional
Elevation—USGS DEM	DEM	A grid of elevation values sampled at a designated interval. In the case of the 7.5' USGS DEMs, the grid is based on a 30-meter x 30-meter interval of elevation values.	Regional	Local/ Regional
Engineering Drawings	CAD, Document	Large-scale drawings that map a site to a high degree of accuracy and detail for the purpose of planning construction and limiting impacts to maintain safety and a healthy environment.	Site-specific	Site-specific/ Local
Orthoimagery—DOQQ	Raster	Orthorectified raster data derived from scanned aerial photography (a mix of color infrared and B&W). These data are derived specifically from USGS NAPP photography (19xx to 1994), and each file is compiled to cover ¼ of a USGS 7.5' quadrangle, with 1-meter pixel resolution.	Local	Local/ Regional
Orthoimagery—Large-scale	Raster	Orthorectified raster data derived from scanned aerial photography. Scales encountered in South Carolina include 1:4,800; 1:2,400; and 1:1,200 with resolutions from 2 feet to 6 inches.	Local	Local
Planimetric Features	Vector GIS	Features digitized from aerial photography through stereocompilation. These data are typically large scale and can contain many detailed features such as sidewalks, curbs and road edges, building outlines, parking lots, and other paved areas.	Local	Site-specific/ Local
Survey Control Monuments	Vector GIS	Horizontal, vertical, and horizontal/vertical control points established through field survey techniques and marked with a permanent marker.	Site-specific	Site-specific/ Local/ Regional
Transportation—Local Streets	Vector GIS	Local streets with address range attributes and County Route numbers when they exist.	Local	Local/ Regional
Transportation—Major Roads and Highways	Vector GIS	Interstates, State and County highways with attributes for street names, address ranges, and County route numbers.	Regional	Regional/ Statewide
Governmental/Service/Administrative Districts				
Governmental Jurisdictions	Vector GIS	State, County, and municipal boundaries. These boundaries can be digitized from many sources. USGS provides DLGs of these boundaries, but more accurate boundaries can be developed from actual legal records, original government surveys or re-surveys, or legal documents defining annexations by municipalities.	Local/Regional	Local/ Regional/ Statewide
Local Administrative Districts	Vector GIS	Districts defined by or for local government agencies to support administration of local programs or allocation of local services. Examples may include fire districts school districts, local public works improvement zones, planning neighborhoods.	Local	Local/ Regional

*A large number of the Vector GIS data themes will have associated GIS attribute data sets (stored in relational database tables), and many will be used in GIS applications with access to External Tabular Database.

Table 6-2: Description of Possible GIS Data Themes for South Carolina (continued)

GIS Data Theme	Data Category*	Explanation	Compilation or Data Gathering Scale	Typical Use/ Presentation Scale
Governmental/Service/Administrative Districts (continued)				
Local Election Districts	Vector GIS	The boundaries of districts represented by local elected officials, such as judges, and members of city or county councils.	Local	Local/ Regional
State Administrative Districts	Vector GIS	Districts developed by State agencies to organize the administration of duties and the delivery of services.	Regional	Regional/ Statewide
State and Federal Election Districts	Vector GIS	The boundaries of the federal and State representative and State senatorial districts.	Local/ Regional	Local/ Regional/ Statewide
Utility Service Areas	Vector GIS	Areas served by a designated public or private utility.	Local/ Regional	Local/ Regional/ Statewide
Voting Precincts	Vector GIS	The boundaries of precincts that are assigned to voters, indicating the polling location where they will vote.	Local	Local
Other Special Districts	Vector GIS	Other geographically defined areas that have some significance to local or statewide programs. Examples include zip code areas, permanent or temporary areas to which access restrictions apply.	Local/ Regional	Local/ Regional/ Statewide
Utility and Infrastructure				
Electric Distribution Facilities	Vector GIS	The facilities that form the infrastructure supporting the distribution of electrical power to individual buildings and sites. These features include poles, distribution lines, and transformers.	Local	Local/ Regional
Electric Generation and Transmission Facilities	Vector GIS	The facilities that form the infrastructure supporting the generation and transmission of electrical power. Features may include power generation plants, transmission towers, substations, and transmission lines.	Regional	Local/ Regional/ State
Highway-related Transportation Facilities	Vector GIS	Infrastructure related to the construction and operation of highways in the State, such as bridges, overpasses, highway signs, pavement characteristics, etc.	Local/ Regional	Local/ Regional
Local Project Areas	Vector GIS	Planned or current construction or development projects throughout the State and administered by local authorities.	Local	Local/ Regional
Local Road-related Transportation Facilities	Vector GIS	Infrastructure related to the construction and operation of local roads such as traffic signs, signals, pavement types, and other road characteristics.	Local	Local/ Regional
Oil and Gas Supply and Transmission	Vector GIS	The infrastructure required to extract, process, and transmit oil and gas from sites of production to sites of consumption.	Regional	Regional
Public/Private Transit	Vector GIS	Public transit facilities and routes, private transport facilities, and areas served by private transporters.	Local/ Regional	Local/ Regional
Railroad Lines and Facilities	Vector GIS	All facilities that support railroad operations, including active and abandoned rail lines, railroad stations, etc.	Local/ Regional	Local/ Regional/ Statewide
Sanitary Sewer Treatment and Collection System	Vector GIS	All facilities associated with collection and treatment of wastewater. Features include treatment plants, interceptor lines, sewer mains and laterals, lift stations, manholes, etc.	Local	Local/ Regional
State Project Areas	Vector GIS	Planned or current construction or development projects throughout the State and administered by State agencies.	Regional/ Statewide	Regional/ Statewide

*A large number of the Vector GIS data themes will have associated GIS attribute data sets (stored in relational database tables), and many will be used in GIS applications with access to External Tabular Database.

Table 6-2: Description of Possible GIS Data Themes for South Carolina (continued)

GIS Data Theme	Data Category*	Explanation	Compilation or Data Gathering Scale	Typical Use/ Presentation Scale
Utility and Infrastructure (continued)				
Storm Sewer Facilities	Vector GIS	Maintained storm sewers and associated facilities designed to collect and control storm drainage in local areas. Includes underground storm sewers, catch basins and inlets, maintained open channels, etc.	Local	Local/ Regional
Telecommunication Facilities	Vector GIS	All facilities supporting telecommunications, including cellular phone towers, telephone lines, and exchange boxes, as well as cable TV infrastructure.	Local/ Regional	Local/ Regional
Water and Air Transportation Facilities	Vector GIS	Airports, seaports, river ports, locks, and all associated facilities that support the movement of goods through the air or on the water.	Local/ Regional	Local/ Regional/ Statewide
Water Distribution System	Vector GIS	All the water distribution facilities, including mains, hydrants, valves, service lines, pump stations, etc.	Local	Local/ Regional
Water Supply and Transmission	Vector GIS	All facilities related to the supply and treatment of water from wells and reservoirs to the transmission of water (through major distribution mains) to the local distribution network.	Local/ Regional	Local/ Regional
Emergency Planning and Management				
Areas at Risk	Vector GIS	Sites or areas at risk for the greatest amount of damage during a disaster such as hurricane surge zones, or places where dangerous chemicals or gas are stored. Nuclear power plants, hazardous material storage sites, and similar locations are examples.	Local	Local/ Regional
Critical Emergency Facilities	Vector GIS	Facilities such as Emergency Operation Centers, shelters, and other sites that support the management of events during emergency operations.	Local	Local/ Regional
Critical Facility Building Plans	CAD	CAD drawings or scanned blueprints of the critical facilities and other public buildings that may require special attention.	Site-specific	Site-specific
Emergency Reference Data	Vector GIS	Locations and data associated with equipment and features that are used to detect and monitor emergency situations. Examples include weather stations, flood gauges, and latitude/longitude grid for directing helicopters.	Local	Local/ Regional
Emergency Supply Points	Vector GIS	Important repositories of supplies needed during emergencies. These may be storage locations of special equipment or commercial wholesalers of food, clothing, or medical supplies.	Local	Local/ Regional
Evacuation Routes	Vector GIS	Designated routes to be followed by citizens when evacuating areas in the case of a hurricane or similar emergency.	Local	Local/ Regional/ Statewide
Flood Zones and Flood Control Facilities	Vector GIS	Areas along river basins or stream courses susceptible to flooding as defined by the Federal Emergency Management Agency (FEMA). Also includes flood control facilities such as levees, dams, floodgates, or any other structures or devices with the purpose of controlling water flow and floodwaters.	Local/ Regional	Local/ Regional
Sites with Special Significance	Vector GIS	These include areas such as designated staging areas, helicopter landing pads, and sites where people may need special evacuation assistance. This will include residences of people with special needs, schools, churches, medical facilities, and public buildings.	Local	Local/ Regional

*A large number of the Vector GIS data themes will have associated GIS attribute data sets (stored in relational database tables), and many will be used in GIS applications with access to External Tabular Database.

Table 6-2: Description of Possible GIS Data Themes for South Carolina (continued)

GIS Data Theme	Data Category*	Explanation	Compilation or Data Gathering Scale	Typical Use/ Presentation Scale
Natural Resources and Physical Landscape				
Air and Water Monitoring Sites and Data	Vector GIS	Locations of facilities and equipment that are used to monitor the quality of air and water throughout the State.	Regional	Regional
Cultural Resources	Vector GIS	Locations of architectural survey sites, archeological survey sites, sites being evaluated as National Register sites, and other types of cultural resources.	Regional	Regional
Designated Environmental Areas	Vector GIS	All areas that have been designated for protection or management of the environmental features contained within the areas. These areas include government-owned forestland, refuges, conservation easements, and Heritage Trust properties.	Regional	Regional
Fire Management Data	Vector GIS	Data recorded to track incidents and investigations of forest fires, prescription burning, and forest fire prevention.	Regional	Regional
Forest Management Areas and Forest Data	Vector GIS	Forest compartments and stands used as the basis for prescribing management activities and data associated with those areas.	Local/ Regional	Local/ Regional
Land Cover	Vector GIS	A characterization of the vegetative or non-vegetative cover at the surface. Land cover is differentiated from "land use" which classifies areas based on the use of the land.	Regional	Regional/ Statewide
Local Park and Recreational Facilities	Vector GIS	All areas and features administered by local authorities that have been designated for recreational use. These features include trails, camping areas, swimming areas, parks, playgrounds, athletic fields, and picnic areas.	Local	Local/ Regional
Mineral Sites and Quarry Operations	Vector GIS	Delineated areas of known or suspected deposits of economically valuable minerals or rocks and actual sites of mining or quarrying operations.	Regional	Regional/ Statewide
Rare, Threatened, and Endangered Species	Vector GIS	Locations of recorded sitings of rare, threatened, and endangered species. This information will have restrictions on access and distribution.	Regional	Local/ Regional
Regulated Environmental Sites	Vector GIS	Sites and locations of activities that require permitting or must adhere to specific regulations.	Regional	Regional
Significant Plant or Animal Habitats	Vector GIS	Habitats associated with significant plant or animal species. These areas may or may not be protected areas. This information may have restrictions on access and distribution.	Regional	Regional
Soils	Vector GIS	Digitized boundaries of mapped soil units from County Soils Surveys conducted by the U.S. Natural Resource Conservation Service (NRCS)	Local/Regional	Local/Regional
State and Federal Park and Recreational Facilities	Vector GIS	All areas and features administered by federal or State authorities that have been designated for recreational use. These features include trails, camping areas, swimming areas, parks, and picnic areas.	Regional	Regional
Subsurface Hydrology	Vector GIS	Underground water bodies such as aquifers and underground rivers and streams.	Regional	Regional
Surface Hydrology	Vector GIS	All rivers, streams, lakes, ponds, and other water bodies visible on the surface.	Local/ Regional	Local/ Regional/ Statewide
Surficial Geology and Mineral Deposits	Vector GIS	Composition and geological type of bedrock or unconsolidated geological deposits at the surface or immediately below the soil.	Regional/ Statewide	Regional/ Statewide

*A large number of the Vector GIS data themes will have associated GIS attribute data sets (stored in relational database tables), and many will be used in GIS applications with access to External Tabular Database.

Table 6-2: Description of Possible GIS Data Themes for South Carolina (continued)

GIS Data Theme	Data Category*	Explanation	Compilation or Data Gathering Scale	Typical Use/ Presentation Scale
Natural Resources and Physical Landscape (continued)				
Watersheds	Vector GIS	Areas delineated by their drainage patterns, where all surface water in the area drains to a single river or stream. Watersheds may be delineated in a nested fashion where major watersheds (or hydrologic units) cover very large areas of the State and each encompasses successively smaller watersheds.	Regional/ Local	Local/ Regional/ Statewide
Wetlands	Vector GIS	Land areas in which the water table is high and which exhibit seasonal, ntermittent, or permanent wet conditions. The U.S. Fish and Wildlife Agency's National Wetlands Inventory (NWI) program is the most prevalent basis for classifying wetlands (based on landscape and vegetative conditions).	Regional	Local/Regional/Statewide
Property-related				
Assessment Parcels	Vector GIS	Parcels defined by local assessors (and recognized by the Dept. of Revenue) and defined on tax rolls with a unique parcel ID. A parcel may be formed from one or more legal lots.	Local/ Site-specific	Local/ Site-specific
Government Buildings	Vector GIS	Buildings owned by federal, State, or local government agencies	Local	Local/ Regional
Government-owned Properties	Vector GIS	Properties owned by federal, State, or local government agencies	Local	Local/ Site-specific
Legal Lots	Vector GIS	Legally defined lots documented through recorded subdivisions, official surveys, deeds, or other legal instruments that define boundaries under designated ownership.	Local/ Site-specific	Local/ Site-specific
Plat Drawings	CAD File	Scanned subdivision plats or CAD drawings of subdivision plats.	Site-specific	Site-specific
Special Tax Rate Areas	Vector GIS	Areas that have a special property tax rates orimpact on property assessment including tax neighborhoods, or other geographic areas to which factors that impact assessment are assigned .	Local	Local/ Regional
Subdivision Boundaries	Vector GIS	The boundaries of Parcel subdivisions that conform to the original parcel or portion of that parcel that was subdivided.	Local/ Site-specific	Local/ Site-specific
Taxing Districts	Vector GIS	A GIS layer that is derived from other layers to support the tax assessment and preparation of tax roles. Taxing districts may be created by comobing such entities as local administrative districts (fire protection, school districts); public utility service districts; special fee districts (e.g., street light improvement zones), etc.		
Utility and Railroad Easements	Vector GIS	Defined areas or corridors encompassing all or portions of single or multiple parcels that designate specific restrictions or rights associated with that area (e.g., corridor for the path of an underground water or electrical line).	Local	Local/ Regional
Socioeconomic				
Business License and Business Activity	Vector GIS	Data indicating locations where business licenses have been granted. These data will be point data and associated tabular databases.	Local	Local/ Regional
Census Geography and Demographic Characteristics	Vector GIS	Census areas consist of census tracts and block groups defined by the U.S. Census Bureau. Demographic data collected by the Census Bureau are associated with the block groups and tracts.	Local	Local/ Regional/ Statewide
Community Amenities	Vector GIS	Many data associated with quality of life in an area. These include restaurants, shopping centers, places of worship, specific types of schools, and availability of activities.	Local/ Regional	Local/ Regional

Table 6-2: Description of Possible GIS Data Themes for South Carolina (continued)

GIS Data Theme	Data Category*	Explanation	Compilation or Data Gathering Scale	Typical Use/ Presentation Scale
Socioeconomic (continued)				
Community/Regional Conditions Data	Vector GIS	These data depict conditions in an area such as traffic volumes, noise levels, or air quality, and climate conditions. It also includes regulatory conditions for land use in the form of zoning.	Regional	Regional
Economic Opportunity Data	Vector GIS	These data also relate to quality of life in terms of economic opportunities in an area. Industries, employers, and demographic characteristics all fit into this category.	Local/ Regional	Local/ Regional
Large-scale Land Use	Vector GIS	Land use characterizations based on parcel boundaries, often supported by large-scale aerial photography.	Local	Local/ Regional
Public Health Data	Vector GIS	Data associated with health statistics in an area. These data will be aggregated according to census tracts and block groups. These data will be in the form of tabular database files that are periodically related to GIS data to develop a thematic layer based on the census geography.	Regional	Regional/ Statewide
Public Safety Data	Vector GIS	Data related to the location of police and fire stations and locations of incidents such as accidents, traffic tickets, and fires.	Regional	Regional
Small-scale Land Use	Vector GIS	Land use characterization based on small-scale imagery such as satellite imagery, and not associated with property boundaries.	Regional	Regional

*A large number of the Vector GIS data themes will have associated GIS attribute data sets (stored in relational database tables), and many will be used in GIS applications with access to External Tabular Database.

Further information regarding the current status, current or potential users, and priority is presented in Table 6-3. The priority of the data theme is a reflection of its general importance to all GIS users and its role in a centrally coordinated, statewide GIS program. Priority is defined in one of the following categories:

- <u>Very High</u>—These themes are essential to the success of the statewide GIS program and are needed by all stakeholder groups. Very often, these are base map themes that serve as a foundation for other data compilation or map presentation. These themes should be considered part of a centrally managed, State GIS service center with clear standards governing their compilation, update, and distribution.

- <u>High</u>—Very important to the majority of GIS stakeholder groups in the State. These themes directly impact multiple business drivers in the State and their use is expected to deliver significant tangible and intangible benefits. These data themes should receive the highest focus (and allocation of resources) for full deployment and for access by users as part of a coordinated statewide GIS program.

- <u>Moderate</u>—These themes are needed by multiple user groups in the State and are considered an important part of a statewide GIS program. Some of these themes may be critical or play a very significant role supporting the programs of individual departments or user groups. They are considered a lower priority for allocation of resources for the statewide GIS program, but resources from specific user groups may support their development and maintenance on a more aggressive schedule.

- <u>Low</u>—These themes may be useful by some user groups but are not considered to be of great significance for a statewide GIS program. These layers may be developed on an as-needed basis perhaps only for project areas—not necessarily full State coverage.

- <u>Special</u>—These themes are of importance to only certain stakeholder groups in the State but are not of general significance on a statewide basis. Because these themes may be of great importance to specific groups, they are given Special priority and those specific groups may fund their development (e.g., a city, county, or utility company with a GIS program).

The assignment of priority is the result of PlanGraphics' review of reported data needs, as well as an evaluation of business processes, State GIS drivers, and the status of GIS database development.

Table 6-3: Status and Priority of GIS Data Themes

GIS Data Theme	Source/Status	Principal Users	Priority
Base Map Themes			
Digital Raster Graphics (DRGs)	DRGs are available through the DNR GIS Data Clearinghouse. All DRGs for the State are available. The Department of Commerce created the data set for use by State GIS users.	All Stakeholder Groups	High
Elevation—Detailed DEM	Some detailed DEMs are scattered throughout the State, usually developed for a county or municipality for development of contours over all or some portion of their area.	All Stakeholder Groups	Moderate
Elevation—USGS DEM	Available through the DNR GIS Data Clearinghouse. These are almost 100 percent complete and available for the entire State. As of April 1999, 6 quads were uncompleted.	Federal Government, State Government, Academic Institutions	High
Engineering Drawings	CAD drawings and documents created to support proposed and approved projects.	State Government, Local Government, Private	Special

GIS Data Theme	Source/Status	Principal Users	Priority
		Sector	
Orthoimagery—DOQQ	Current DOQQs are based on B&W 1994 photography. More recent CIR NAPP photography has been acquired and scanned, but presently, no funding for DOQQ production has been allocated.	Federal Government, State Government, Local Government, Academic Institutions, COGs, Utility	High
Orthoimagery—Large-scale	State Geodetic Survey runs a program to assist counties with the development of 1:4,800 and larger scale digital ortho production.	All Stakeholder Groups	High
Planimetric Features	A mixture of planimetric data is available throughout the State. Local governments and utilities have been involved in development of planimetric data at various scales and at various times.	State Government, Local Government, COGs, Utility, Private Sector	Special

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Base Map Themes			
Survey Control Monuments	Control points will be established through the use of survey quality GPS equipment according to proper methods required for developing the type of control necessary at that point. The Geodetic Survey is managing a statewide program for augmenting and documenting survey control monuments. Other Federal, State, and local government organizations and utility companies may also be placing and documenting survey control monuments (although not all meet FGDC requirements for documentation).	Federal Government, State Government, Local Government, Utility, Private Sector	Very High
Transportation—Local Streets	Street Centerlines being compiled for E-911 by the ORS Digital Cartography Unit.	All Stakeholder Groups	Very High
Transportation—Major Roads and Highways	Available as DLG data from the DNR GIS Data Clearinghouse, as well as the USC Data Clearinghouse.	All Stakeholder Groups	Very High
Governmental/Service/Administrative Districts			
Governmental Jurisdictions	County boundary DLGs are available for the entire State through the DNR GIS Data Clearinghouse. All available Municipal boundaries are available as well.	All Stakeholder Groups	Very High
Local Administrative Districts	No single source documents the existence of digital versions of these administrative district boundaries. An inventory of these data will need to be conducted, by asking local governments.	State Government, Local Government, COGs, Public	Special
Local Election Districts	No single source documents the existence of digital versions of these district boundaries. Local government agencies hold maps and records (often hard copy) documenting these boundaries.	State Government, Local Government, COGs, Public	Special
State Administrative Districts	These boundaries are developed and maintained by individual State agencies. Many are based on county boundaries. Department of Public Safety reports include digital versions of jurisdiction maps for the Highway Patrol, Department of Motor Vehicles, and the State Transport Police.	State Government, Local Government, COGs, Public	High
State and Federal Election Districts	These districts are available from the State Budget and Control Board Office of Research and Statistics and are used in an interactive web-based GIS application developed and maintained by the Digital Cartography Unit.	Federal Government, State Government, Local Government, COGs, Public	Very High
Utility Service Areas	Water and sewer service areas digitized by the Department of Commerce (which may require some updating). The Public Service Commission maintains hard copy maps of service territories of gas, electric, and telecommunications companies. Individual utility organizations normally keep detailed maps (sometimes in digital form) of their service areas.	State Government, Local Government, COGs, Utilities, Public	High
Voting Precincts	The State Elections Commission maintains a database, in coordination with local elections boards, defining voter precincts by address range. Maps do not exist in all cases, but the database is a source for map compilation.	State Government, Local Government, COGs, Public	Moderate
Other Special Districts	Depends on type of district	All Stakeholder Groups	Special
Electric Distribution Facilities	These facilities are digitized by individual utilities according to a variety of specifications. Not all of these facilities have been digitized for the State.	State Government, Local Government, COGs, Utility	Special

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Base Map Themes			
Electric Generation and Transmission Facilities	These facilities are digitized by individual utilities according to a variety of specifications. DLGs for power transmission lines are also available through the DNR GIS Data Clearinghouse.	Federal Government, State Government, Local Government, COGs, Utility, Academic Community	Moderate
Highway-related Transportation Facilities	DOT maintains a bridge inspection database and a bridge inventory database. A pavement management system and a Linear Referencing System all contain data of this nature. DOT is currently selecting a contractor to develop a road centerline database that will be used with these data.	State Government, Local Government, Private Sector	Special
Local Project Areas	Local projects are administered by local authorities, which all record their data differently.	State Government, Local Government, Private Sector	Special

Local Road-related Transportation Facilities	Local government public works departments will have records of streets and transportation facilities that they maintain, and DOT will also maintain data using the bridge and pavement management databases for State-maintained routes passing through local urban areas. These data will be linked to the centerline data being developed by ORS and DOT.	State Government, Local Government, Private Sector	Special
Oil and Gas Supply and Transmission	These facilities are digitized by individual utilities according to a variety of specifications. Not all of these facilities will be digitized for the State.	State Government, Local Government, COGs, Utility	Moderate
Public/Private Transit	The Department of Commerce has organized the development of many data layers related to quality of life, including public and private transportation routes, and stops for buses, vans, and private shuttles. These data are maintained on an ongoing basis. Local transit authorities or private transit companies hold other data elements in this theme.	State Government, Local Government, COGs, Utility, Public	Low
Railroad Lines and Facilities	Railroad data are available as DLGs from the DNR GIS Data Clearinghouse.	State Government, Local Government, COGs, Utility, Private Sector, Public	Moderate
Sanitary Sewer Treatment and Collection System	The Department of Commerce has developed a database of water and sewer infrastructure throughout the State. Many major sanitary sewer features are available for the State, including treatment plants, pump stations, and large sewer lines.	State Government, Local Government, COGs, Utility, Private Sector	Moderate
State Project Areas	No comprehensive database of construction or development projects administered by all State agencies exists. General Services** maintains a database identifying the majority of State capital projects and individual agencies and will track other development projects (e.g., DOT road projects). It would be necessary to create and update this theme as point and area features.	State Government, Local Government, Private Sector	Special
Storm Sewer Facilities	Local government departments will maintain data, often as individual engineering plans. Generally, maps showing the full extent of storm sewer facilities are not readily available.	Local Government	Low
Telecommunication Facilities	Individual companies digitize some telecommunication data layers, but no comprehensive layer is available through the State. An inventory of these layers is needed.	Federal Government, State Government, Local Government, COGs, Utility, Private Sector	Low

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Base Map Themes			
Water and Air Transportation Facilities	DLGs depicting airports are available through the DNR GIS Data Clearinghouse. There is no record of a comprehensive data layer depicting seaports, river ports, locks, or similar water transportation features.	State Government, Local Government, COGs, Utility, Private Sector, Industrial/ Commercial	Moderate
Water Distribution System	The Department of Commerce has developed a database of water and sewer infrastructure throughout the State. Some water distribution features may be available through this database, but most detailed data such as valves and hydrants are not available.	State Government, Local Government, COGs, Utility, Academic Community, Private Sector	Moderate
Water Supply and Transmission	The Department of Commerce has developed a database of water and sewer infrastructure throughout the State. Many major water supply and transmission features are available for the State, including treatment plants, water tanks, wells, pump stations, and large water lines.	State Government, Local Government, COGs, Utility, Academic Community, Private Sector	Moderate
Emergency Planning and Management			
Areas at Risk	Hurricane surge zones and flood zones, as well as facilities known to store hazardous materials, are available from various sources and acquired by the Emergency Preparedness Division.	Federal Government, State Government, Local Government, COGs, Public	High
Critical Emergency Facilities	Local authorities that develop plans for communities and are responsible for the operation of those plans digitize many critical facilities. The Department of Commerce has collected GPS point data of many features such as schools and hospitals that are also considered critical facilities.	Federal Government, State Government, Local Government, COGs, Public	High
Critical Facility Building Plans	State General Services maintains drawings for many State-owned buildings. Some are in CAD format and some are on paper or mylar. Other State agencies with facility management responsibilities maintain CAD files of their buildings (e.g., Corrections, Forestry Commission, others). Other building plans in CAD or paper format may be available from local authorities that approve building permits.	State Government, Local Government	Special
Emergency Reference Data	DNR has weather station location data, some flood gauges are tracked by USGS, and latitude/longitude grids can be generated by GIS software.	State Government, Local Government	High
Emergency Supply Points	Many supply points will coincide with location data digitized by the Department of Commerce. The data available from the DOC data collection effort must be compared with lists of supply points from local authorities and gaps identified. Then a plan for collection of the missing data will be developed.	Federal Government, State Government, Local Government, COGs, Utility, Public	High
Evacuation Routes	Local authorities that develop plans for communities and are responsible for the operation of those plans digitize evacuation routes.	Federal Government, State Government, Local Government, COGs,	High

		Public	

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Base Map Themes			
Flood Zones and Flood Control Facilities	Digital FEMA FIRM data is available throughout the State at various scales and levels of accuracy. Recent floodplain mapping has utilized detailed elevation contour data available from local governments (e.g., Greenville County and the City of Greenville). Flood control facilities are available from some local governments and are forwarded to the Emergency Preparedness Division, but a more consistent data collection is needed.	Federal Government, State Government, Local Government, COGs, Private Sector, Public	High
Sites with Special Significance	These types of locations will come from various sources, including local authorities; records of social programs that track elderly, mentally and physically disabled, and others with special needs; and other databases that will cover these sites.	State Government, Local Government, COGs, Public	High
Natural Resources and Physical Landscape			
Air and Water Monitoring Sites and Data	DHEC maintains these data	Federal Government, State Government, COGs	Moderate
Cultural Resources	The Department of Archives and History maintains several databases, and the State Institute for Archeology and Anthropology maintains archeological data. The State Museum Office is compiling data on locations and characteristics of museums and cultural/historical exhibits in the State.	Federal Government, State Government, Private Sector, Academic Institutions, Non-profit Organizations	Special
Designated Environmental Areas	The DNR GIS Data Clearinghouse contains data layers that correspond to several of the layers designated in this category – Refuges, Reservations, Forest Boundaries. The Forestry Commission maintains data related to State Forests.	Federal Government, State Government, Local Government, COGs, Non-profit Organizations, Public	High
Fire Management Data	The Forestry Commission collects and stores these data through their Computer Aided Dispatch system for forest fire response.	Federal Government, State Government, Local Government	Moderate
Forest Management Areas and Forest Data	The Forestry Commission maintains State Forest compartment maps and forest stand data, as well as data related to forest management plans of private landholdings.	Federal Government, State Government, COGs, Private Sector, Public	Moderate
Land Cover	These data are available through the DNR GIS Data Clearinghouse. Portions of the State have these data layers available, but there are areas where the land use characterization has not occurred.	All Stakeholder Groups	Moderate
Local Park and Recreational Facilities	Local authorities will have maps and, in some cases, digital map data depicting park locations.	State Government, Federal Government, Local Government, COGs, Public	Moderate
Mining Sites and Quarry Operations	These data will need to be digitized from existing maps	State Government, Local Government, Private Sector	Moderate
Rare, Threatened, and Endangered Species	The South Carolina Heritage Program maintains a Biological Conservation Database (BCD) of known sitings of rare, threatened, and endangered species. The locations of these sites are kept confidential to protect the species, but are used by authorized personnel for planning and review of proposed activities.	Federal Government, State Government, Local Government, COGs, Non-profit Organizations, Academic Institutions	Special

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Natural Resources and Physical Landscape (continued)			
Regulated Environmental Sites	DHEC maintains a database of these sites and they are in the process of updating and improving the database through GPS data collection.	State Government, Federal Government, Private Sector	Moderate
Significant Plant or Animal Habitats	As part of the GAP analysis program, DNR is identifying plant and animal habitats throughout the State.	State Government, Federal Government, Local Government, COGs, Non-profit Organizations, Academic Institutions	Special
Soils	The DNR GIS Data Clearinghouse contains digital County Soil Survey data (SSURGO) delineating mapped soil units.	State Government, Federal Government, Local Government, COGs,	Moderate
State and Federal Park and Recreational Facilities	The DNR GIS Data Clearinghouse contains Federal and State Park data. The Department of Parks, Recreation and Tourism also maintains data related to State Parks.	Federal Government, State Government, Local Government, COGs, Non-profit Organizations, Public	High
Subsurface Hydrology	None known.	Federal Government,	Low

		State Government, Academic Institutions	
Surface Hydrology	Surface hydrology DLGs are available for the entire State through the DNR GIS Data Clearinghouse. There is interest in upgrading these data in coordination with USGS to provide greater detail consistent with 7.5' USGS quadrangles and DOQQs.	All Stakeholder Groups	High
Surficial Geology and Mineral Deposits	These data will need to be digitized from existing maps	Federal Government, State Government, Private Sector	Low
Watersheds	No record of State digital watershed data is known to exist. The Natural Resource Conservation Service maintains digital watershed data.	Federal Government, State Government, COGs, Academic Institutions	Moderate
Wetlands	Digitized on a 7.5' quadrangle basis as part of the National Wetlands Inventory(NWI) program. 465 out of a total of 566 quads are complete and available. Digitization of the other 101 have not yet been funded.	Federal Government, State Government, COGs, Local Government	Moderate
Property-related			
Assessment Parcels	Some local governments have digitized parcels, and the State offers a program (administered by Geodetic Survey) of technical and limited financial assistance to counties for parcel conversion. Only a small number of counties have completed digital parcel mapping.	All Stakeholder Groups	High
Government Buildings	The Department of Commerce has collected GPS locations of many government-owned buildings throughout the State. State General Services also maintains data on State buildings.	Federal Government, State Government, COGs, Local Government	Moderate
Government-owned Properties	The Office of State Building and Property Services maintains data on State-owned property. The DNR GIS Data Clearinghouse includes DLGs of government-owned properties that pertain to natural resources. **General Services??	Federal Government, State Government, COGs, Local Government	Moderate

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Property-related (continued)			
Legal Lots	In the process of conversion, a local government will determine whether or not to convert and maintain legal lot boundaries (along with assessment parcels). As with assessment parcels, some local governments will have those data in digital form, but most exist in the form of hard copy recorded legal documents (subdivision plats, deeds, etc.).	Local Government, Private Sector, Public	Special
Plat Drawings	Local governments (Assessor, Clerk, or Recorder Offices) maintain approved plat drawings (usually in hard copy form but sometimes as digital CAD format).	Local Government, Private Sector, Public	Special
Special Fee or Tax Rate Areas	Local governments that have digital parcel data may have delineated these types of special areas.	State Government, Local Government, Utility, Private Sector	Special
Subdivision Boundaries	Subdivision boundaries will be derived from a digital parcel data layer or they can be compiled directly from locally recorded subdivision plats.	Local Government, Private Sector, Public	Special
Taxing Districts	Derived and created digitally by the overlay and combination of other selected district layers	State Government, Local Government, Utility,	Special
Utility and Railroad Easements	Parcels where utilities and railroads have right-of-way or access for the purpose of running facilities or servicing those facilities may be designated in a digital parcel layer or hard copy parcel maps maintained by counties. In many cases, these boundaries may only be defined through legal documents (plats or deeds) maintained by local Recorders' Offices or may be maintained by the utility or railroad companies themselves.	State Government, Local Government, Utility, Private Sector	Special
Socioeconomic			
Business License and Business Activity	Local governments that issue business licenses collect these data that are being continually updated (but not normally in map form).	State Government, Local Government, COGs, Private Sector	Moderate
Census Geography and Demographic Characteristics	Demographic data are updated on an annual basis through projections. Census geography changes every 10 years for a new census.	All Stakeholder Groups	Very High
Community Amenities	The Department of Commerce has developed a quality of life database with several types of community amenities. The location data were collected through GPS data collection.	All Stakeholder Groups	High
Community/Regional Conditions Data	DHEC and DOT collect data that indicate conditions around a community such as air and water quality and traffic volume data.	State Government, Local Government, COGs, Non-profit Organizations, Private Sector, Public	Special
Economic Opportunity Data	The Department of Commerce has developed a quality of life database with employment sites. The location data were collected through GPS data collection.	All Stakeholder Groups	Moderate
Large-scale Land Use	In some cases, parcel-based land use will exist in local governments that have GIS with parcel data and land use surveys based on parcel boundaries.	State Government, Local Government, COGs, Academic Institutions	Special
Public Health Data	DHEC maintains many public health datasets that are used for GIS analysis. Many are confidential in nature and must be aggregated to the census tract or block level.	Federal Government, State Government, Local Government, COGs, Private Sector, Public	Special

Table 6-3: Status and Priority of GIS Data Themes (continued)

GIS Data Theme	Source/Status	Principal Users	Priority
Socioeconomic (continued)			
Public Safety Data	The Department of Public Safety maintains crash and traffic ticket data, and the State Law Enforcement Division maintains a crime and arrest database.	State Government, Local Government, COGs, Public	Special
Small-scale Land Use	These data are available through the DNR GIS Data Clearinghouse. Portions of the State have these data layers available, but there are areas where the land use characterization has not occurred.	State Government, Federal Government, COGs, Academic Institutions	Moderate

6.3.3. Data Volatility and Data Maintenance Roles

The data themes presented above represent geographic entities or events that are changing over time. GIS applications demand data that meets certain requirements for currency that requires that most themes be updated according to some regular schedule. Applications do not necessarily require GIS data that is completely up-to-date at all times, but it is important to identify the currency, and the frequency of change (i.e., the "volatility") of changes, and to assign an update approach that is appropriate. Table 6-4 presents information about the volatility of data themes, a recommended frequency for ongoing update of the data theme, and an initial identification of parties' responsibilities for update.

Data volatility is a general indication of the frequency with which changes occur for geographic features included in the theme. Data update schedules will be governed in part by the volatility of the data changes. Ideally, update for all data themes should occur (and be reflected in the GIS database) on a continual basis with a short time lag after the change occurs. This is often unrealistic for technical reasons and because of difficulties in tracking changes, or the availability and limitations of sources that reflect changes.
Table 6-4 indicates a realistic goal for a GIS update program given these difficulties and limitations.

The column for appropriate data custodians is based primarily on the current allocation of data maintenance responsibilities that have developed as the result of agencies carrying out their missions. This arrangement will continue to work well in the future. Some data layers defined here that have not been developed or maintained to date have been assigned to an agency or group that are most likely to carry out the maintenance.

For data themes that will be managed or will be accessible through a State GIS service center, maintaining consistent standards of data content and format is particularly important. Also, it is generally appropriate, for these themes, to set up independent quality assurance procedures prior to "posting" to a State GIS service center. Each organization charged with update responsibilities will need to develop and adhere to strict procedures for data update and quality control—especially critical for those themes that are on a frequent update cycle.

Table 6-4: Geographic Data Volatility, Update Sources, and Update Responsibilities

GIS Data Theme	Volatility	Ideal Update Frequency	Source for Update	Appropriate Data Custodians
Base Map Themes				
Digital Raster Graphics	NA	Rarely	Scanned or created from updated USGS Quad Sheets	USGS
Elevation—Detailed DEM	Project-driven	Rarely	Aerial photography or LIDAR	State Geodetic Survey/Local Gov't.
Elevation—USGS DEM	Low—Major Elevation Changes are Rare	Rarely	Aerial photography or LIDAR	USGS/DNR
Engineering Drawings	Project-driven	Continual (submitted for all major development projects)	Field survey or photogrammetric compilation	Any organization with responsibility for managing construction projects
Orthoimagery—DOQQ	Change Captured by Images Occurs Continually	2 to 4 years for areas under development	CIR NAPP photography or high-resolution satellite imagery	USGS/DNR
Orthoimagery—Large-scale	Change Captured by Images Occurs Continually	2 to 4 years for areas under development	Aerial photography	State Geodetic Survey/Local Gov't. or COG
Planimetric Features	Continual	Quarterly (for areas under development)	Aerial photography using photogrammetric compilation or heads-up capture from orthoimage	Local Gov't. or selectively by State agencies
Survey Control Monuments	Project-driven	Project Basis	Field surveys using GPS	Geodetic Survey
Transportation—Local Streets	High	Monthly	Photogrammetric compilation, GPS, or reconstructed from engineering drawings	Local Gov't. or COG
Transportation—Major Roads and Highways	Moderate	Quarterly	Photogrammetric compilation, heads-up capture from orthoimage, or mobile GPS, or reconstructed from engineering drawings	DOT/ORS
Governmental/Service/Administrative Districts				
Governmental Jurisdictions	Low	Rarely	Legal records or resolutions defining boundary changes (e.g., in cases of annexation	ORS or Department of Transportation

			by a city)	
Local Administrative Districts	Low	Rarely	Records of changes	Local Gov't.
Local Election Districts	Low	Rarely	Documented boundary changes approved by local governing bodies	Election Commission/Local Gov't.
State Administrative Districts	Low	Rarely	Records of changes	Individual State agencies
State and Federal Election Districts	Low	Rarely	Documented boundary changes approved by legislature	ORS
Utility Service Areas	Low	Rarely	Records of changes	Utility Companies/Public Service Commission
Voting Precincts	Moderate	Annually	Changes approved by local election boards	Election Commission/Local Gov't.
Other Special Districts	Low	Annually to rarely (depending on type of district)	Records of changes	Depends on type of district

Table 6-4: Geographic Data Volatility, Update Sources, and Update Responsibilities

GIS Data Theme	Volatility	Ideal Update Frequency	Source for Update	Appropriate Data Custodians
Utility and Infrastructure				
Electric Distribution Facilities	High (for areas undergoing urban development)	Monthly	Engineering drawings	Utility Companies
Electric Generation and Transmission Facilities	Moderate	Annually	Engineering drawings	Utility Companies/Dept. of Commerce
Highway-related Transportation Facilities	Moderate	Annually	Engineering drawings and database changes	DOT
Local Project Areas	Project-driven	Continually	Derive from databases that track local project status (e.g., State SPIRES system)	Local Gov't.
Local Road-related Transportation Facilities	High (for areas undergoing urban development)	Quarterly	Engineering drawings and database changes	DOT/Local Gov't.
Oil and Gas Supply and Transmission	Low	Annually	Engineering drawings	Utility Companies/Dept. of Commerce
Public/Private Transit	Moderate	Continually	Records of changes	DOT Mass Transit/Local Gov't.
Railroad Lines and Facilities	Low	2- to 3-year Cycle	Engineering drawings	Department of Commerce
Sanitary Sewer Treatment and Collection System	High (for areas undergoing urban development)	Annually to Continually	Permits and Engineering drawings	Local Gov't. , Public Utility District, or DHEC
State Project Areas	Project-driven	Continually	Derive from databases that track project status (e.g., State SPIRES system)	General Services/DOT
Storm Sewer Facilities	High (for areas undergoing urban development)	Annually	Engineering drawings	Local Gov't
Telecommunication Facilities	High (for areas undergoing urban development)	Annually	Engineering drawings	Utility and Cable companies
Water and Air Transportation Facilities	Low	2- to 3-year Cycle	Annual aeronautical chart	Dept. of Commerce
Water Distribution System	High (for areas undergoing urban development)	Annually to Continually	Permits and Engineering drawings	Local Gov't. , Public Utility District, or DHEC
Water Supply and Transmission	Low	Annually to Continually	Engineering drawings	Local Gov't. or COG (coordination by Dept. of Commerce)
Emergency Planning and Management				
Areas at Risk	Low	Annually	??	Local Gov't./Emergency Preparedness Division
Critical Emergency Facilities	Low	Annually	GPS field inventory	Department of Commerce/ Local Gov't./Emergency Preparedness Division
Critical Facility Building Plans	Moderate	Annually	Building permits blueprints or new CAD drawings	Local Gov't./General Services
Emergency Evacuation Routes	Low	Annually	??	Local Gov't./Emergency Preparedness Division

Table 6-4: Geographic Data Volatility, Update Sources, and Update Responsibilities

GIS Data Theme	Volatility	Ideal Update Frequency	Source for Update	Appropriate Data Custodians
Emergency Planning and Management (continued)				
Emergency Reference Data	Moderate	Annually	Records of Changes, GPS	DNR/Department of Commerce/Emergency Preparedness Division
Emergency Supply	Low	Annually	GPS field inventory	Department of Commerce/

				Emergency Preparedness Division
Points				
Flood Zones and Flood Control	Moderate (based on redelineation by FEMA)	As new data becomes available	Topographic cross-section data and flood surge calculations	FEMA
Sites with Special Significance	Moderate	Annually		Department of Commerce/ Local Gov't./Emergency Preparedness Division
Natural Resources and Physical Landscape				
Air and Water Monitoring Sites and Data	Moderate	Annually	Records of Changes and New Sites	USGS/DNR/DHEC
Cultural Resources	Moderate	Continually	Cultural resource management reports, National Register of Historic Places, SCIAA Site files	Department of Archives and History/Institute for Archeology and Anthropology
Designated Environmental Areas	Moderate	Annually	??	DNR
Fire Management Data	Moderate	Continually	Derived from database changes	Forestry Commission
Forest Management Areas and Forest Data	Low	Continually	Orthoimagery, engineering drawings	Forestry Commission
Land Cover	Moderate	2- to 3-year cycle	High- to moderate-resolution satellite imagery	DNR
Local Park and Recreational Facilities	Moderate	Annually	Site Plans	Local Gov't.
Mining Sites and Quarry Operations	Low	Annually	GPS, Photogrammetric compilation	??
Rare, Threatened, and Endangered Species	Moderate	Continually	Records of changes	DNR
Regulated Environmental Sites	Moderate	Continually	Records of Changes, Permit Records	DHEC/DNR
Significant Plant or Animal Habitats	Moderate	Continually	GAP program records	DNR
Soils	Low	Rarely	NRCS Soils Surveys	DNR with NRCS
State and Federal Park and Recreational Facilities	Moderate	Annually	??	Dept. of Parks, Recreation, and Tourism
Subsurface Hydrology	Low	Rarely	??	DNR
Surface Hydrology	Low	Rarely	USGS topographic quadrangles (DLG data) and orthophotography	USGS/DNR
Surficial Geology and Mineral Deposits	Low	Rarely	New geological mapping based on site surveys, geological well logs	DNR
Watersheds	Low	Rarely	Detailed digital elevation data, USGS topographic contour maps	USGS/DNR

Table 6-4: Geographic Data Volatility, Update Sources, and Update Responsibilities

GIS Data Theme	Volatility	Ideal Update Frequency	Source for Update	Appropriate Data Custodians
Natural Resources and Physical Landscape (continued)				
Wetlands	Low (except for areas undergoing urban development)	Rarely (more frequent in rapdily developing areas) changes in	Fish and Wildlife Agency NWI maps (if update). Local development plans (potential).	DNR
Property-related				
Assessment Parcels	High (for areas undergoing urban development)	Quarterly to Continually	Recorded plats and other real property documents (e.g., deeds)	Local Gov't. (coordination by Dept. of Revenue)
Government Buildings	Low	Monthly	Construction drawings, digital orthophotography	Local Gov't./General Services
Government-owned Properties	Low	Monthly	Parcel data; records of changes	Local Gov't./General Services
Legal Lots	High (for areas undergoing urban development)	Quarterly to Continually	Recorded plats and other real property documents (e.g., deeds)	Local Gov't.
Plat Drawings	High (for areas undergoing urban development)	Continually	New recorded plats	Local Gov't.
Special Fee or Tax Rate Areas	Moderate	Annually	Local Assessor records	Local Gov't.
Subdivision Boundaries	High (for areas undergoing urban development)	Quarterly to Continually	Recorded plats	Local Gov't.
Taxing Districts	High (for areas undergoing urban development)	Annually	Other layers of GIS	Local Gov't./Support from State Government
Utility and Railroad Easements	Moderate	Annually	Recorded plats and other real property documents (e.g., deeds) and survey records maintained by utility companies	Local Gov't./Utility companies
Socioeconomic				
Business License and Business Activity	High (for areas undergoing urban	Quarterly	Business licenses	Local Gov't.

	development)			
Census Geography and Demographic Characteristics	Moderate	??	Updated demographic data	US Census Bureau/ORS Digital Cartography Unit
Community Amenities	High (for areas undergoing urban development)	Annually	??	Department of Commerce
Community/Regional Conditions Data	High (for areas undergoing urban development)	Continually	??	DOT, DHEC, Department of Commerce
Economic Opportunity Data	High (for areas undergoing urban development)	Annually	??	Department of Commerce
Large-scale Land Use	High (for areas undergoing urban development)	Annually	Parcel and business license records	Local Gov't.
Public Health Data	Moderate	Continually	Records of changes	DHEC
Public Safety Data	High	Continually	Existing databases from State Agencies	Department of Public Safety, State Law Enforcement Division

Table 6-4: Geographic Data Volatility, Update Sources, and Update Responsibilities

GIS Data Theme	Volatility	Ideal Update Frequency	Source for Update	Appropriate Data Custodians
Socioeconomic				
Small-scale Land Use	Moderate	Every 2 to 4 years (for areas under development)	Satellite imagery, aerial photography	DNR/Dept. of Commerce

6.4.   GIS ORGANIZATIONAL STRUCTURE, MANAGEMENT, AND COORDINATION

The major organizational entities that make up statewide GIS coordination and support are identified in Table 6-5.

Table 6-5: Proposed Entities in Statewide GIS Coordination Structure

| Proposed Entity	Explanation	Entity(ies) Now Playing Role
GIS Coordinator/ GIS Coordination Office	The overall responsibility of the Coordinator and an eventual coordination Office with a small staff will be to act on the *GIS Strategic Plan* and oversee its fulfillment. The Coordinator works closely with CGI and user organizations and must expect staff support and contribution of resources. Main responsibilities are promotion of joint GIS activities, development and use of standards, preparation of procedures and administrative tools for collaboration, high-level education, investigating and securing funding for GIS activities, and other coordination functions. Depending on support staff that may be part of this office, it could provide some GIS services like basic support for new users in GIS design, system procurement, and help in GIS implementation.	Does not currently exist. The Committee on Geographic Information (CGI) and the State Mapping Advisory Committee (SMAC) provide some coordination.
Senior Advisory and Oversight Group (optional)	This optional entity fulfills a requirement that is not currently being addressed in a formal way. This involves keeping a close connection with high-level decision makers and supporters of GIS in the State (Governor's Office, Department Heads, industry leaders, possibly a State legislator). These individuals may be considered advisors and champions who can provide support for GIS initiatives. They would receive periodic reports of progress and activities and be asked to lend their support to specific, high-profile GIS initiatives.	CGI includes some senior manager representation, but it has a considerable focus on detailed coordination and technical development issues and is not the best forum to engage non-technical senior decision makers. IRC may be able to play this role.
GIS Standing Committee	This is the principal body (with representation from most stakeholders) that directs and oversees GIS planning, standards development, and overall GIS coordination on a statewide basis. This group oversees and works closely with the GIS Coordinator, the GIS Service Center, and the IRC to implement the *GIS Strategic Plan* and to promote statewide GIS.	IRC's Standing Committee on Geographic Information currently provides this function.
Technical Working Groups	Focused groups, formally assigned by the GIS Standing Committee, with a specific technical or programmatic objective (and normally a time-limited scope). Their purpose is to prepare technical designs and standards, facilitate technical development, and otherwise support GIS coordination, joint projects, and resource sharing.	Subcommittees appointed by CGI serve this purpose. Other Subcommittees need to address additional technical topics.
State GIS GIS Service Center	Centrally administered office, with technical resources, to provide access to important GIS data, central applications, and GIS information.	Data clearinghouses maintained by the University of South Carolina and the Dept. of Natural Resources. Neither of these existing groups provides the full range of services envisioned for the State GIS Service Center.

Table 6-5: Proposed Entities in Statewide GIS Coordination Structure (continued)

Proposed Entity	Explanation	Entity(ies) Now Playing Role
IT Procurement Oversight Group	A State agency with responsibility for information technology planning and oversight on hardware, software, and IT service procurements. A strong relationship needs to exist between CGI and the GIS	Office of Technology Planning and Management in the Office of Research and Statistics

	Coordinator to ensure that reviews and approvals on procurements for GIS are carried out with realistic and practical response to GIS standards.	(ORS)
User Group(s)	One or more user groups will help build support for GIS and will communicate knowledge, news, new applications, and technical tips among users. These user groups may be organized in an informal way with periodic meetings and a basic protocol for communication (principally using email). ESRI organization user groups may be an option.	User communication and programs are organized by SMAC and by individual user groups. There is an ESRI Users Group that meets once or twice each year.

Figure 6-2 is an organizational chart that gives a general picture of organizational relationships among the entities described above.

Figure 6-2: General Organizational Relationships Among Proposed GIS Coordination Entities
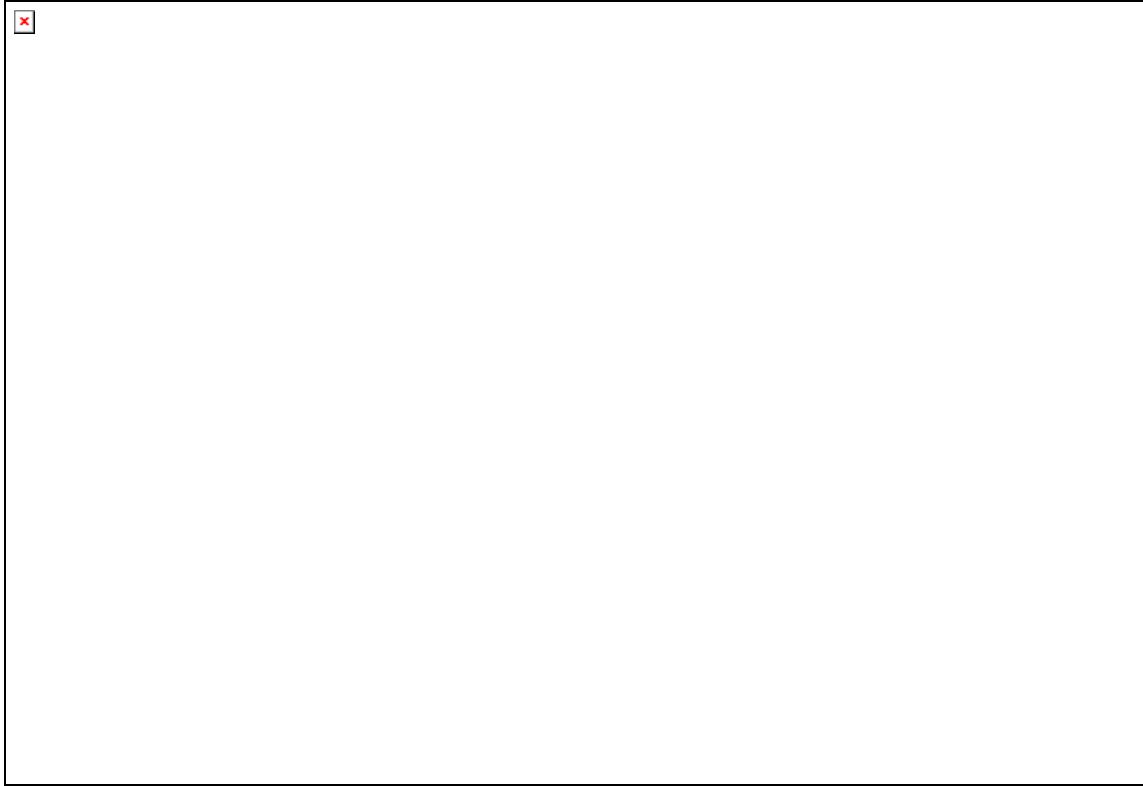
A number of decisions must be made to put in place a more formal organizational structure to support statewide GIS coordination. Among the questions that must be answered are:

- What is the proper administrative location of a GIS Coordinator, and what are the lines of authority directing the activities of this person?

- Should a GIS Coordination Office be created and, if so, where should it administratively be placed?

- Should a central GIS service center be created, where should it be placed, how will it be resourced, who will oversee its operation, and how would the roles of existing clearinghouses (DNR, University of South Carolina) be impacted

- What is the administrative relationship betweene GIS service center a st and the GIS Coordinator/Coordination Office?

- Should SMAC be eliminated as a separate organization with its functions merged with the Committee on Geographic Information?

- Is a Senior Advisory and Oversight Group needed to encourage high-level awareness and to garner support for GIS programs in the State?

- How can the IT planning and procurement oversight function be enhanced to make it an effective part of the GIS planning, development, and integration process?

- What organizational relationships can best support GIS expansion and technical assistance in local governments?

Perhaps the most immediate concerns revolve around the first three bullet points above—administrative placement of a GIS Coordinator, the need for a GIS Coordination Office, and the location and resourcing of a State GIS service center.

The states that have arguably been most effective in coordinating multi-Department and multi-organizational GIS activities have established GIS offices (independent from user organizations) and clearinghouses that provide access to high-priority data. If CGI reaches a consensus on establishing a GIS Coordinator position and possibly a GIS Coordination Office, several options exist for administrative placement. It is important that this placement satisfy several criteria in order to be most effective—a) it has enough perceived and real independence from specific user organizations so that it can freely operate in a statewide coordination role, b) it must not be unduly bound by administrative policies that restrict the ability to formulate partnerships and joint projects (federal-State, State-COG-local government, public-private), and to pursue innovative funding options, and c) it must be placed at a high enough position in the organizational hierarchy to carry sufficient perceived and real authority.

Some options for the organizational placement of the GIS Coordinator/Coordination Office are:

1. **Existing User Department in State Government**—While this is an option, particularly in the case of several larger, GIS-proficient Departments in the State, it is not the best option since it does not meet the major criteria of independence. Real and perceived conflicts with agency-specific programs would inhibit the ability for a GIS Coordinator to work in a multi-organizational environment.

2. **Cross-Departmental services group in State government**—Several options exist for placing a GIS Coordinator or Coordination Office within an existing State government agency that already acts in a cross-Departmental information services or planning role. A number of states with successful GIS coordination programs have taken this approach (e.g., Kansas, Texas, Utah, and Ohio).The Budget and Control Board is an alternative under this option. Placement of a GIS Coordinator in the Budget and Control Board should be investigated with attention given to what admininstrative location with this agency is appropriate. To maximumize the effectiveness of the Coordinator to act in a cross-Departmental environment with adequate real and perceived authority, an admininstrative location as high as possible in the Board would be preferable.

3. **Governor's Office**—Several State government GIS coordination offices have been created in the State's respective governor's office—often inside an office of technology led by a Chief Information Officer (CIO) or Chief Technology Officer (CTO). These states, such as Kentucky, Florida, New York, and North Carolina, have found this administrative placement to provide a basis for statewide coordination and information technology advancement. The State of South Carolina does not currently have a structure in its governor's office that could easily accommodate a GIS coordination function (although creation of an Office of Technology was proposed this year by the Governor but will not likely be created at this time). In an ideal sense, a Governor's Office location may present the best option if administrative lines of authority were defined in such a way to allow a GIS Coordinator/Coordination Office to operate effectively. While this option should continue to be considered, the lack of a clear administrative location, in the Governor's Office reduces the feasibility of this option at the current time.

4. **University of South Carolina**—The University's position as a public institution, its history in GIS and data clearinghouse services, its independence from any particular user group, and the recent creation of "GIS and Remote Sensing Center" give it certain credentials for taking on the coordination role. This alternative may have a downside because of a real or perceived lack of authority since the University is not part of the State government hierarchy.

5. **Independent Public Body—**A GIS coordination office could be established as an independent board or commission—perhaps under the direct oversight of the Information Resources Council. There are few examples of multi-organizational GIS coordination functions operating from this type of entity, and no precedents exist for similar types of bodies in the State. While perhaps attractive because of its independence, the complexity of setting up such an entity and unclear lines of authority casts doubt on its feasibility.

Establishing and operating a central service center is initially dependent on decisions about where it will be physically placed and, organizationally, how it is administered. Policies and procedures governing access to the service center services and its operation should be determined by CGI with oversight by a GIS Coordinator. A number of options exist, however, about where it is placed and what organizational group will manage its day-to-day operations and will carry out technical system administration chores. The options, the most obvious of which are identified below, concentrate on groups that already perform some type of Web-based access or information system service function:

1. **Existing User Department in State Government**—Several large State government Departments with data management and GIS expertise could be in a position to fill such a role (e.g., the Department of Natural Resources being one). Concern and practical issues regarding conflicts with agency mission versus responding to general need for all organizations could inhibit service center operation under this option but the expertise and infrastructure already in place lends support for consideration of this option.

2. **Information services group in State governmen**t—The Office of Information Resources (OIR) with is Data Center operations may be technically suited to provide such a function, although significant GIS expertise is not currently available among existing OIR staff.

3. **University of South Carolina**—The University's position as a public institution, its history in GIS and data clearinghouse services, its independence from any particular user group, and the recent creation of "GIS and Remote Sensing Center" may provide a sound environment for a GIS service center. The University has access to technical expertise that position it well as a coordinator or provider of technical support and training services as well. Many users of GIS in the State have indicated support for pursuing the development of a service center at the University.

4. **Outsourcing**—A number of outsourcing alternatives exist, including contracting with a private company for clearinghouse services or creation of a public corporation or other type of quasi-public entity to provide these services. This is the most administratively complex to set up and would likely be the most costly as well, but it has some operational and administrative advantages.

SECTION 7

SECTION 7
SUMMARY

This *GIS Needs Assessment* provides a comprehensive reference source about geographically-related business processes, current GIS activities, and requirements for GIS capabilities and data by a large set of stakeholder organizations in South Carolina. This needs assessment has provided considerable detail for programs and requirements of state government agencies but it has also identified current activities and needs of other significant stakeholder groups—particularly local governments, public and private utilities, and the public. This review of current status and needs provides a baseline and foundation for development of a strategic plan for future GIS coordination.

This document has also provided a high-level conceptual design addressing the following key areas of enterprise GIS:

- A **GIS application framework** providing a context for on-going development and coordination

- A **Geographic data** including and conceptual design of data themes, data content, and basic standards

- A **System configuration** with a general architecture governing hardware, software, and network access

- An **Organizational framework** defining major roles and policy and procedural issues.

With the completion of this Needs Assessment, the Committee on Geographic Information, with PlanGraphics assistance will proceed with development of the Strategic Plan. The goal is to build on the long and successful history of GIS development and use in South Carolina and create an environment in which the use GIS technology expands to address an increasing array of real-world problems and sharing of GIS resources becomes a standard practice on the part of all organizations in the state. This document provides a basis for that plan development and consensus building on key issues that will impact the direction of GIS coordination in South Carolina.

APPENDIX A

APPENDIX A
DETAILS OF SURVEY FORM RESPONSES

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DETAILS OF SURVEY FORM RESPONSES

This Appendix documents the distribution of Survey Forms and their Reponses. Three types of forms were sent out to GIS users across the State.

The three types or forms were:

- Committee for Geographic Information Members
- State Agencies
- Local Government and Utilities.

The forms were distributed by the State's primary project liaison to PlanGraphics, Inc. according to a list of agencies and organizations provided by the Governor's Office.

The forms consisted of questions requiring various types of responses, some with numeric ranking, some written, and some short answer. PlanGraphics tabulated the numeric rankings. For forms that used numeric values for importance levels, Excel spreadsheets were used to calculate results. Respondents were provided with the opportunity to rank the importance of GIS related topics and considerations. The results are presented in Tables below. The written and short answer portions of the forms were used for reference while writing the GIS Needs Assessment Report. PlanGraphics documented the survey respondents, and that list is also provided below.

Committee Member Surveys

Each member of the South Carolina Committee for Geographic Information was given a survey comprised of 5 survey forms. One important note about these surveys was that the members were to answer them as GIS issues and needs facing all users in the state not just their own organization.

The names of the forms are as follows:

Committee

- Committee Form 1:   Business Drivers for GIS
- Committee Form 2:   Geographic Data Needs
- Committee Form 3:   GIS Education Needs
- Committee Form 4:   GIS Services (Centralized or Distributed to Agency-to
                     Agency Responsibility)

<u>State Agency</u>

- State Agency Form 8:   Current GIS Program Description
- State Agency Form 9:   Geographic Data Needs
- State Agency Form 10:   GIS Education Needs

<u>Local Government and Utilities</u>

- Local Government and Utility Form 1:   GIS Activities
- Local Government and Utility Form 3:   Business Drivers for GIS
- Local Government and Utility Form 4:   Geographic Data Needs
- Local Government and Utility Form 6:   Obstacles and Limitations Impacting GIS Implementation and Operation

APPENDIX B

APPENDIX B
SUMMARY REPORT—
SOUTH CAROLINA GIS WORKSHOP—
LOCAL GOVERNMENT AND UTILITY ORGANIZATIONS

APPENDIX B
SUMMARY REPORT—
SOUTH CAROLINA GIS WORKSHOP—
LOCAL GOVERNMENT AND UTILITY ORGANIZATIONS

February 23, 2000

Harbison State Forest
Environmental Education Center

INTRODUCTION

This report summarizes the GIS workshop for local government and utility organizations sponsored by the IRC's Standing Committee on Geographic Information held on February 23, 2000, at Harbison State Forest. The objective of this workshop was to inform representatives of the local governments and utility organizations about the long-term direction of GIS coordination in the State and to gain a better understanding of the GIS status and needs of these organizations, as well as issues impacting GIS adoption and use. This is one part of the GIS Needs Assessment and Strategic Planning Project being carried out with the assistance of PlanGraphics, Inc.

Sixty people from 50 city and county governments, COGs, public utility districts, and private utility companies attended.

Workshop Summary

The workshop agenda included the following items:

1. Introduction and Overview of Workshop Topics
2. Overview of IRC and Standing Committee on GIS
3. GIS Technology Overview
4. Discussion of State Government GIS Activities Impacting Local Governments and Utilities
5. Status of GIS Deployment and Business Drivers for GIS
6. Geographic Data Needs
7. Education and Training Needs
8. Limitations and Obstacles in GIS Development and Deployment

9. Organizational Relationships and Coordination

10. Wrap-up.

Peter Croswell of PlanGraphics provided an overview of objectives and expectations and opened the meeting. Martin Roche, of the Department of Commerce, and Coordinator of the Standing Committee on Geographic Information, provided background about the IRC, the Committee, and its overall goals for coordinating and supporting GIS initiatives in the state. Peter Croswell gave a tutorial presentation about GIS concepts and applications. Presentations about State government activities that impact local users were provided by:

- Matt Wellslager, Office of Research and Statistics-Geodetic Survey—Cooperative programs—a county base map program and the GPS training program

- David Alexander, Office of Research and Statistics—Street/Road centerline compilation for counties

- Martin Roche, Department of Commerce—GIS initiatives oriented toward economic development

- Lynn Shirley, University of South Carolina (representing the Department of Natural Resources)—GIS data compilation and distribution from DNR.

General group discussion began with Agenda Item #5 (GIS Status and Business Drivers). To initiate discussion, "case study" presentations were made by Mark Depenning (City of Greenville), Brenda Carter (Lexington County), Wayne Meyer (South Carolina Electric and Gas), and Lynn Shirley (University of South Carolina). Group discussion continued with a discussion of geographic data needs. In the afternoon, attendees were divided into four small groups to explore and record key observations on the following topics—education and training needs, limitations and obstacles, and organizational relationships.

PlanGraphics personnel recorded notes during the workshop. The information presented and the ideas that the group explored will be used to prepare a *GIS Needs Assessment* report and the state *GIS Strategic Plan*.

Key Issues Raised

A brief summary of key points raised during the workshop follows. No attempt is made here to fully analyze or respond to the issues. The information presented and the ideas that the group explored will be used to prepare a *GIS Needs Assessment* report and the state *GIS Strategic Plan*.

Business Drivers/Benefits of GIS

Several overriding themes serving to justify the use of GIS in local government and utility organizations included efficiency gains in the administration of programs, opportunities to increase revenue (increased collection of fees and property taxes, support for grant applications), avoided costs, and meeting customer and citizen demands for services and information. It was noted that the proliferation of computer technology has raised expectations and demands by the public for quick response, and GIS can play a major role to respond to this need.

GIS should be targeted at the following specific business areas:

- Smart growth initiatives
- Economic development (within the context of wise land use planning)
- Support for real property assessment and management
- Public safety
- Emergency planning and response
- Transportation planning
- Customer service for utility organizations.

Geographic Data Issues

A discussion of data issues covered data layer requirements and GIS data conversion approaches. Key observations are summarized as follows:

- The State Plane coordinate system is the most suitable for use by local governments, although some users expressed an interest in using UTM coordinates which implies a requirement that statewide GIS data management must provide a flexible means for coordinate system transformation

- Orthoimage data is important to most local governments and utility companies, although it was noted that its utility decreases as it ages—particularly for areas experiencing high growth. Some users have employed ortho-imagery as a means to support GIS data capture (parcel data, utility data). Orthoimagery is an important source for road/street centerline compilation at the County level. Some attendees observed that orthoimagery is an excellent tool for monitoring growth and doing land use change detection. The current program, administered by the Geodetic Survey for ortho compilation at the 1" = 400' scale (2-foot pixel resolution) with options for more detail compilation for urban areas, satisfies the needs of most users. There was also interest in orthoimagery of

other types and resolutions (multi-spectral and lower resolution). This lends support for the DOQQ program being managed by DNR and perhaps use of high-resolution
(1-meter, 5-meter) satellite data that will be available from private ventures such as Space Imaging and other companies.

- The majority of attendees did not express a critical need for creation of detailed planimetric/topographic base maps showing physical features and elevation contours. This reflects, in part, the cost of acquiring such data using traditional photogrammetric compilation. Most users indicated that this type of data would be used if available. One key application that makes use of this data is the calculation of stormwater fees by parcel based on impervious surface. The preparation of planimetric/topographic mapping should be an option and it would be valuable to have some "template specifications" that counties could use.

- Parcel data (legal lot and assessment parcels) is important to all users. Different opinions were expressed about the most appropriate approach for parcel data conversion—whether to base map conversion to the greatest extent possible on legal records (using COGO and necessary adjustment) or to use other approaches that may save time and money. No single best method is appropriate for all cities and counties. In the interest of quality data and also the strong interest in compiling parcel data as soon as possible, the technical approach should be based on local circumstances, the nature of source documents and records, the relative mix of rural and urban parcels, and other factors. It would be valuable to provide guidelines and more detailed conversion specifications that can support county-level parcel compilation. A need was also expressed for a statewide standard Parcel Identification Number (PIN) format.

- Detailed utility data, particularly the position and characteristics of underground utilities, is very important for utility organizations themselves. While other local government users may not need to see all of the details of utility networks, it is important for most to see basic locations to answer questions about availability of service.

- Local sources providing a potential means for base map and utility update are not always readily accessible or provided with a proper level of quality to support such update. Not all local governments have a strict requirement for creation of as-built drawings (i.e., engineering drawings showing actual construction of roads, utilities, etc.).

- All organizations represented have a great need for accurate boundary information (usually mapped relative to road/street centerlines, parcels, and physical features). Such boundary information includes government jurisdictional boundaries and a host of special districts (utility districts, fire districts, school districts). Often there is ambiguity on the exact locations of the boundaries. There are also important questions about the location of some County boundaries that have a direct impact on administration of programs and property taxation and difficulty in tracking municipal annexations and boundary changes. Utility companies have a very important need for sound boundary information because of their reporting requirements and impact on tax assessment levied against their facilities.

- GPS technology combined with efficient field data collection tools is seen as a critical means for GIS data collection.

- Great interest was expressed in promoting a statewide standard for digital plat submittals, including a requirement for tying the plat to State Plane coordinates. Such a requirement must be considered along with the fact that currently not all surveying and engineering firms have all the technology needed to meet such a requirement (but that is changing).

Education and Training Issues

Discussion of education and training issues covered a large range of topics addressing needs at all levels. Key observations are:

- It is important to identify champions who are elected officials or policymakers at the local level to help drive GIS.

- It would be valuable for the State to prepare some targeted high-level GIS promotional and educational materials aimed at senior management and elected officials.

- Local governments could use a "template" description of GIS job positions, training requirements, and qualifications.

- University programs for GIS education and specific technical training should be expanded with increased options for continuing education programs for working professionals. Such programs should be offered at more locations around the state. The Geomatics program and Greenville Technical College may be a model that can be implemented at other Technical Schools around the state.

- Technical training (e.g., specific software training) is very critical and ways to expand training programs, reduce their cost, and make them more conveniently available should be explored.

- Curricula should be enhanced at the elementary and high school level for teaching basic geographic principals and GIS.

- Some local government representatives expressed concern that the job market makes it hard to retain good employees. Training makes employees more valuable and often contributes to their leaving for other job opportunities.

- Educational certification was a concern and of interest to some. The current Senate bill, which places training certification

requirements on people compiling GIS data, impacts the certification issue.

<u>Organizational and GIS Coordination Issues</u>

The following issues and observations relating to organizational structure, statewide coordination of GIS, and funding concerns were raised:

- All users expressed a concern about tight funding to support GIS implementation but, at the same time, there was acknowledgement that local funding can be made increasing available if the impact and potential benefits of GIS can be better illustrated to senior management and elected officials. There was some talk about opportunities for special fees that could help financially support GIS initiatives.

- Considerable support was shown for the cooperative programs (Geodetic Survey, ORS) supporting County data compilation, as well as an interest in increasing the level of funding to accelerate efforts.

- All attendees expressed an interest in appointing a state GIS coordinator. Advocating GIS and coordinating efforts statewide would be a major role for the state GIS coordinator. There was some discussion of where this position should reside administratively. The general concern is that the position be as independent as possible from any existing agencies or line Departments. Placing the coordination role in a new state "Office of Technology" was also discussed. Creating the Office of Technology was part of the Governor's proposed budget.

- Most agreed that COGs should continue to play an active role as GIS "service bureaus" to support local level GIS programs. This reflects activities that many COGs are already providing—developing GIS applications, training local staff, doing special projects, producing custom GIS products, and compiling data. There was some reservation about COGs being put in the position to carry out major data conversion and maintenance efforts as opposed to using the services of private firms that specialize in this work. It seems that more rural counties and small cities or those without the resources or staff to implement GIS in-house are the best candidates for using the COG as a service bureau. It was pointed out that there are some very rural counties (10 to 20) that may not, in the foreseeable future, be in a position to implement GIS technology in-house and would be long-term clients of COGs. With the development of Internet and intranet technologies, COGs may fill a role in the future as Application Service Providers for GIS applications by storing data and simple display and query applications on an Internet server accessible by designated local government agencies.

- The funding base and cost recovery environment of COGs currently do not always support an active GIS service bureau role.

- The Association of Counties, the Municipal Association, and key vendors are important stakeholders in the state GIS coordination.

<u>Other Issues</u>

- Local governments would like to see the state prepare a variety of standards that make practical sense. This includes basic data standards (including core data schemas) for key GIS data, metadata, template specifications for data conversion, and sample agreements for data sharing and licensing.

- There was some discussion about the legal and policy issues surrounding government distribution and/or sale of data and products from GIS. No specific conclusions were reached, but it is clear that some leadership and statements of policy at the state level would help to guide decisions at the local level. Amending the State Open Records law to provide more flexibility in distributing or selling GIS data was suggested.

- The state should play a major role in maintaining a GIS data clearinghouse to provide data, or in some cases, to serve metadata, to all users in the state.

- Utility organizations often need government-created GIS data such as parcels and land base data, but due to liability concerns, they may not want to share their facility data. One way to address this issue is to work with utilities to develop licensing agreements that will protect utility companies when they give their data to government agencies.

APPENDIX C

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STATE AGENCY BUSINESS PROCESS NOTES

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This Appendix includes a compilation of notes describing program responsibilities and geographically-related business processes of States agencies. These notes were derived from on-site interviews and survey forms.

Department of Archives and History

- Tracks archeological and architectural sites and reports them to the federal government in compliance with the National Historic Preservation Act.

- Reviews site survey reports for compliance with the National Historic Preservation Act makes determinations of eligibility

- Tracks eligibility of sites for inclusion in the National Register.

- Provides locations and site information to agencies and consultants that require it and are authorized to have it.

- Maintains confidentiality of the site locations for protection of the sites.

Department of Agriculture

- Provides assistance to farmers in marketing and finding markets for produce.

- Operates 1 large farmers market and 2 moderate-sized farmers markets, all at fixed locations.

- Operates 7 livestock auction markets at fixed locations.

- Provides price and buyer information to farmers in South Carolina.

- Conducts quality inspection of eggs, fruits and vegetables, and grains.

- Other agencies also inspect food—DHEC—retail food and food service, shellfish, and dairy; Clemson University – meat and poultry inspections

- Needs the ability to track outbreaks of food borne illnesses to determine location of origin and to eliminate threats in those areas

- 3 Department of Agriculture inspectors cover over 1,000 food processors across the State. Mapping locations and violators would help the inspectors.

Institute for Archeology and Anthropology

- Mandated by State law to be a repository of cultural resource data.

- Updates and maintains a master set of maps (USGS 7.5' quad sheets) with cultural resource locations indicated as points.

- Digitizing points from quad sheets into a GIS database.

- Collects data from many sources.

- Maintains heavy security and adheres to terms of a Memorandum of Agreement not to distribute the data they receive from the contributing agencies.

Department of Commerce

- Supports economic development in the State by compiling statistics related to suitability for business relocation in different regions of South Carolina.

- Uses GIS to answer many questions related to the characteristics of areas of the State in terms of their suitability for specific economic development initiatives.

- Creates maps and other graphics that illustrate development potential and characteristics of a site.

- Developed Insight, a GIS application paired with relevant data copied onto a CD and distributed to local governments and economic development agencies. The CD allows organizations promoting economic development in the State to answer questions and display information.

The State Budget and Control Board (SBCB)

- Administers many programs that support the activities of other State agencies. The board includes the following offices:

SBCB Division of Budget and Analysis, Office of Research and Statistics

   – Administers a street centerline and address range assignment project, using GPS and field checking techniques for obtaining address information.

   – Operates the Office of Technology Planning and Management (OTPM) that plans State technology initiatives and reviews all State agency computing, network, and communications system procurement documents for systems costing more than $25,000.

SBCB Division of Budget and Analysis, Office of Research and Statistics, South Carolina Geodetic Survey

   – Establishes horizontal and vertical geodetic control throughout the State to support the registration of mapping to the national horizontal and vertical coordinate system.

   – Supports county base mapping through administering a program for providing seed money for county base mapping efforts that correspond to a set of standards being promoted by Geodetic Survey.

   – Geodetic Survey promotes parcel data conversion at the county level through funding assistance and educational assistance.

   – Operates a GPS training program for local government and COG personnel. Administering a project to define and map the boundary between North and South Carolina, as well as between many South Carolina counties.

SBCB Division of Regional Development

   – Focuses on improving the infrastructure of the State in order to enhance conditions for economic development and to improve the quality of life for citizens of South Carolina.

   – Provides assistance to the Councils of Government (COGs) in developing their regional and local infrastructure plans.

   – Identifies and coordinates State resources for implementing programs that will develop infrastructure.

   – Produces a Statewide Water and Sewer Infrastructure Plan through the Office of Regional Development.

SBCB Division of Operations, Office of General Services

   – Delivers inter-agency mail. Each day delivery vehicles must follow a different route depending on the mail that must be delivered. This is a state-wide program.

   – Delivers supplies to State agencies from the State central supply facility. These deliveries take place only within Columbia.

SBCB Division of Operations, Office of Information Resources

   – Provides computing resources and support to State agencies that want the assistance.

Department of Corrections

- Operates the State penitentiary system, which requires the management of facilities such as water and wastewater treatment plants and the development of an emergency preparedness plan.

- In disasters must decide whether to remain and ride out the disaster or to evacuate. Normally they stay, but they must have an evacuation plan.

- Transports prisoners between various facilities and courthouses.

Department of Education

- Owns all schools buses in the State and involved in determining school bus routing.

- Reviews local school construction plans and monitors construction projects.

- Uses a student information database to store student address information, and uses EDULOG for school bus routing and siting new schools to be constructed.

- When necessary, modifies school district boundaries to reflect changes in population.

State Election Commission

- When needed, modifies election boundaries to reflect changes in population.

Adjutant General's Office, Emergency Preparedness Division

- Coordinates the activities of all agencies participating in the planning, response, post-disaster assessment and recovery, and mitigation measures related to emergencies.

- Plans evacuation routes, designates and suppliess emergency shelters, identifies and protects critical facilities, locates and assists citizens with special needs, and evaluates areas for their vulnerability.

- Post-disaster responsibilities include coordinating damage assessment and reporting to FEMA, as well as identifying and implementing measures that will reduce the vulnerability of the community in case of a repeat of the disaster.

South Carolina Forestry Commission

- Manages State forest lands, which includes conducting resource inventories; developing management plans for forest stands; administering contracts for thinning, harvesting, and planting; and other activities related to forest management.

- Fights forest fires and operates a prescription burning program of State forest lands.

- Provides forest management programs to private forest landowners to promote effective forest management practices throughout the State.

- Administers an environmental educational program to promote the concepts of conservation in South Carolina.

- Uses MapInfo to support land use management functions by overlaying and mapping timber types, endangered species, and other data layers that impact management decisions.

- Digitizes timber stand delineations from rectified aerial photography to support forest management responsibilities.

- Conducts forest fire investigations to determine the cause of forest fires and in cases where they have been deliberately set, to apprehend those that set the fires.

- Conducts timber theft investigations.

- Operates 3 dispatch centers for directing fire fighting crews.

- Uses a Computer Aided Dispatch system that works with MapInfo and Oracle to calculate the closest firefighting resource, but the current system only calculates a straight line distance instead of using a network trace function.

- Maintains buildings on State forests and fire fighting equipment.

- Lead agency for Emergency Support Function 4 (ESF 4) for fire fighting.

Department of Health and Environmental Control

- Inspects retail food and food service providers, as well as shellfish and dairy producers.

- Monitors shellfish waters for indications of toxic algae. Waters are shut down to shellfish fishing when the toxic algae are found.

- Monitors inspection violations.

- Through the State Health Initiative Plan (SHIP), administered by DHEC, many economic development activities, such as the construction of health facilities, must be regulated through a licensing process.

- Issues permits to schools, hospitals, and any facility that impacts the environment. DHEC has GPS coordinates for many of these facilities.

- DHEC is ESF 8 – Coordination of all evacuation facilities.

- Supports coordination of resources during disasters by operating GIS to display available resources such as shelters on a screen using a computer projection unit. When a shelter is full or another resource becomes unavailable, the symbol is changed to indicate that.

- Responds to toxic spills. They use GPS when responding to spills to get coordinates for the location of the spill.

- An accurate set of well site coordinates are needed to facilitate wellhead protection.

- Is the designated arm of the EPA in South Carolina for administering Section 401 of the Clean Water Act. Issues permits and inspects any construction over or in State navigable waters.

- The Office of Coastal Resource Management administers the Coastal Zone Management Act and is the lead agency for issuing permits within the Critical Area.

- The Bureau of Solid Waste Management is recollecting the location data for all CERCLA and RECRA sites using GPS to get better coordinates. They have difficulty being consistent in the method of obtaining the coordinates. They cannot always gain access to the sites to get an exact coordinate of the storage location so they have to settle for driveway entrances sometimes.

- Needs high-resolution satellite data for reference purposes when getting site locations.

- Permit applicants send in their location with the permit application. This has been used in the past as the method of recording

locations of these sites.

- Obtains GPS coordinates of air and water quality monitoring stations.

- Monitors all public water supplies and submits reports to the EPA.

- Issues permits to utility companies for sites impacting the environment, and DHEC air and water quality monitoring requires them to monitor utility facilities and occasionally cite utility companies for breaking environmental regulations.

- Through the Division of Biostatistics, collects and analyzes public health statistics, such as teen pregnancy and maintaining a cancer registry. The distribution of these incidents is being examined to look for spatial patterns.

- DHEC needs the ability to analyze health statistics in relation to environmental factors.

- Using GIS to map the spatial distribution of statistics in relation to census block groups and census tracts (e.g., birth and death certificates). Some requests include mapping school districts by number of teen pregnancies.

- Enforces environmental regulations related to handling of hazardous materials and toxic waste products.

- Employs law enforcement officers to administer the enforcement duties of DHEC.

Department of Health and Human Services

- Through the Office on Aging, administers programs to help elderly people, including delivery of meals and providing rides to medical appointments.

- The Office on Aging must schedule trips and dispatch their transporters.

South Carolina State Housing Finance and Development Authority

- Sells bonds to raise funds for financing mortgages for single family houses, multi-family houses, and assisted living facilities.

- Forecasts where their assistance will be required.

- Administers federal housing grant programs.

Department of Insurance

- Regulates insurance companies in the State of South Carolina.

- Provides information to citizens with questions about insurance coverage and investigates citizen complaints about insurance companies.

- Sends adjusters into the field to assist with damage assessment and reporting after disasters.

South Carolina Law Enforcement Division (SLED)

- Maintains a database of all law enforcement activity in South Carolina based on reports received from law enforcement agencies throughout the State.

- SLED operates some special law enforcement units such as tracking teams and SWAT teams.

Department of Mental Health

- Operates a forensic psychiatry unit that evaluates the mental competence of crime victims and perpetrators of crimes.

- Provides personnel after disasters to counsel victims, and advises other disaster response personnel on treatment of victims (GO TEAMS).

- Needs the ability to map GO TEAM service areas and locations of DMH clients in reference to facilities and locations of councilors.

- Operates community mental health facilities and assists citizens with mental health disorders, including transport and monitoring activities.

- Needs the ability to locate patients in relation to facilities and services provided.

- Needs the ability to anticipate population trends to predict where centers will need to be constructed or enlarged.

Adjutant General's Office, Military Department, South Carolina National Guard

- Manages resources on properties held by the South Carolina National Guard.

- Collects and stores natural resource data to aid in managing the properties.

- Uses GIS to map resources and plan for management activities.

- Complies with NEPA regulations when planning new construction.

- Inventories and maintains buildings and equipment.

- Some historical and cultural sites are present on National Guard properties, and they must be inventoried and protected.

Department of Natural Resources

- Administers programs to monitor and protect the natural resources of South Carolina.

- Collects, stores, and distributes data regarding the extent and status of natural resource features such as forests; wildlife; endangered plant and animal species; wetlands; coastal areas; rivers, streams, and lakes; and cultural resources.

- The Marine Resources Division monitors saltwater habitat and fish populations. Also monitors saltwater fishing. Needs to obtain ocean bottom data (bathymetry), and has a difficult time obtaining those data. Currently collecting bathymetric data and storing them as point data (about 14,000 points) in Access.

- The Marine Resources Divisions administers a Beach Renourishment Program, deals with permits related in any way to the coastal environment, and identifies hard bottom areas (invertebrate habitat).

- The Land, Water and Conservation Division monitors the State climate by collecting weather and temperature data.

- The Land, Water and Conservation Division is also involved in statewide land use/land cover change detection. Also tracks soil erosion across the State through conservation districts, and collects and monitors well data to monitor State hydrological resources.

- The Wildlife and Freshwater Fisheries Division monitors wildlife diversity and State fisheries through maintenance of the State BCD database.

- Manages fish and game populations through issuing hunting and fishing licenses and setting bag limits.

- Environmental Affairs is involved in permitting wetlands, conducting river conservation projects, and the GAP analysis program.

- GAP analysis requires superimposing wildlife habitat data with land ownership data and protected lands data to see where wildlife habitat is protected and areas where important wildlife habitat is not protected and is at risk due to development pressure. The land ownership data helps to identify parcels that could be purchased to protect important habitat.

- Operates a GIS data clearinghouse over the Internet. The clearinghouse allows users to download GIS data through the web.

- Owns and manages 11 Heritage Preserves covering approximately 3,000 acres of land through the Heritage Trust Program. They have a responsibility to protect the historical and cultural sites located on their preserves.

- Surveys the sites on their preserves. Of the architectural sites that have been identified, between 5 percent and 10 percent have been surveyed.

- Continually looks for more properties to acquire that will add to their Heritage Preserves. As a result, they need information on existing sites, areas under threat of development, land use patterns, and property boundaries.

- Enforces hunting and fishing regulations, boating regulations, and other conservation-related laws. Conservation officers carry out enforcement.

Department of Parks, Recreation, and Tourism (DPRT)

- Maintains trails, picnic areas, campgrounds, and other recreation facilities and protects the environment within the State parks.

- Operates State parks and is responsible for the protection of historical and cultural sites.

- Acquires land to add to parks. They need the ability to identify historical and cultural sites that could end up under their protection upon purchase of land.

- Promotes interest in a South Carolina National Heritage Area (Heritage Corridor), one of 18 in the nation.

- Develops Discovery Centers in the Heritage Corridor where multimedia presentations incorporating GIS data will be used.

- For tourism promotion, DPRT needs to know the historical and cultural sites that can be promoted and they need to perform demographic analysis, as well as other types of analysis that contribute to tourism promotion.

Department of Public Safety

- The Highway Patrol enforces laws, issues traffic citations, and responds to accidents on the highways in South Carolina.

- The Highway Patrol must document and store information on all traffic accidents with greater than $2,000 damages.

- The Highway Patrol is developing a plan to collect better location data at traffic accidents and other incidents by using GPS receivers to record coordinates associated with these incidents. GIS will then be used to display, map, and analyze these incidents, providing the Highway Patrol with a stronger basis for planning operations and reporting activities.

- The State Transport Police regulate commercial trucking through weigh stations and other checks to ensure that trucking on South Carolina roads is conducted safely.

Department of Revenue

- Produces regulations for property tax assessment in South Carolina.

- Works with county assessors to support the property assessment process.

- Developing a plan to acquire a Computer Assisted Mass Appraisal (CAMA) system that will be available to county assessors through wide area network connections. The CAMA system will help assessor offices throughout the State to analyze field data to determine property taxes in accordance with State regulations.

- Evaluates property damage costs after disasters.

- Supports tax mapping efforts in county assessor offices.

- Works with counties to appraise industrial and utility sites that get tax credit for pollution control facilities. Drawings, acreage, and cost estimates are required for the appraisal of these sites and facilities.

- Assesses utility assets and properties.

Department of Social Services

- Operates programs to assist eligible people such as welfare to work programs, child assistance programs, and other programs to help disadvantaged people.

- Analyzes demographic information to forecast future program needs.

- Contracts with companies to provide transport to clients of the social programs.

- Transportation responsibilities require dispatching functions that often overlap with other agency programs such as the Office on Aging.

Department of Transportation

- Monitors the need for new transportation infrastructure and the improvement of existing infrastructure.

- Selects potential routes, determines the best alternatives, and identifies the best corridors for new road construction.

- SC DOT environmental programs conduct studies in compliance with the National Environmental Protection Act and the National Historic Preservation Act.

- Conducts wetland mitigation for any wetlands that are filled during road construction.

- The Right-of-Way Division is responsible for acquiring property within the proposed road right-of-way. They must have access to the property boundaries within the proposed road corridor.

- Hydraulic Engineering must meet NPDES requirements related to stormwater runoff.

- GIS is being used through a contract with Woolpert to determine runoff sites and identify where NPDES monitoring will occur.

- Administers all contracts with transport provider companies and non-profit organizations through the Mass Transit Authority.

- Developing a plan for an integrated dispatch system that will be used to coordinate the dispatching of a State-run transport and delivery operation.

- Developing road centerline data covering the entire State, using the best data available.

- Preconstruction surveying uses GPS to establish survey control for projects, and conducts field surveying to provide an accurate base map for project design and Right-of-Way acquisition.

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[1]An example of increased requirements for reporting is the recently issued "Statement 34" of the Governmental Accounting Standards Board (June, 1999) which calls for State and local governments to significantly increase inventory and reporting of infrastructure assets.