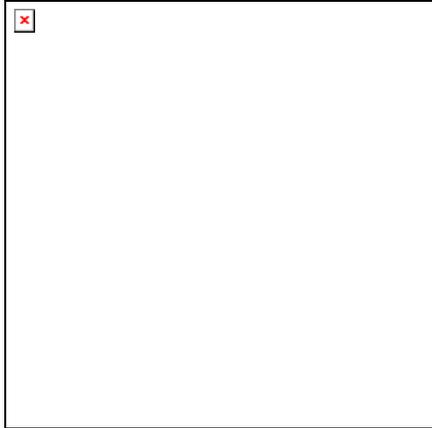


FINAL

**STRATEGIC PLAN FOR
STATEWIDE GIS TECHNOLOGY COORDINATION
IN SOUTH CAROLINA**

VOLUME II: STRATEGIC FOUNDATION AND WORK PROGRAM



Prepared by:

South Carolina Standing Committee on Geographic Information

With the assistance of:

**PlanGraphics, Inc.
112 East Main Street
Frankfort, Kentucky 40601-2314
(502) 223-1501
FAX: (502) 223-1235**

April 30, 2001

PREFACE

PREFACE

This *Strategic Plan* has been prepared under the direction of the South Carolina Standing Committee for Geographic Information (CGI). Its purpose is to provide direction and focus for improved GIS coordination and expanded use of GIS technology in South Carolina. This *Strategic Plan* follows a detailed GIS Needs Assessment and successful coordination work carried out by CGI since its creation in 1996. Several fundamental precepts set a context for this *Plan*:

- Future GIS initiatives will build on a long and successful history of GIS technology use and multi-agency coordination in South Carolina.
- GIS technology is of fundamental importance to South Carolina and is a core part of an overall enterprise information technology architecture.
- GIS coordination is approached from a statewide perspective encompassing different types of stakeholders at all levels of government, private industry, academia, and the public.
- The plan deliberately focuses not on the technology itself but how the technology can be used to address the needs of users and deliver benefits.

The full *Strategic Plan* consists of two separate Volumes:

- **Volume I: GIS Background and Business Case**—Explains GIS technology, briefly summarizes the history of GIS development and status in the State, and describes key State goals and business drivers impacted by GIS and potential benefits from improved GIS coordination and expansion in GIS technology use. This Volume provides a basis and context for understanding Statewide GIS goals and suggested initiatives.
- **Volume II: Strategic Foundation and Work Program**—Presents the stakeholders, mission, and major goals for statewide GIS coordination that gives a long-term foundation for the program and presents specific work elements, responsibilities and timing, and resources required for accomplishing goals.

This *Strategic Plan* provides a long-term vision for Statewide GIS coordination and use. The specific goals and work elements cover a 5-year period.

TABLE OF CONTENTS

TABLE OF CONTENTS

Title	Page
Section 1:..... Strategic Foundation and Structure	
1.1... GIS Stakeholders and Organizational Environment	
1.2... Mission and Goals for Statewide GIS Coordination	
Goal 1:.... Define and put in place an organizational structure and institutional relationships to support Statewide GIS coordination and use	
Goal 2:.. Create policies, procedures, and tools to encourage and enable joint GIS development and access and pursue joint projects.....	1-4
Goal 3:.. Build and maintain geographic data important for users Statewide	1-4
Goal 4:.... Establish a formal process and technical infrastructure for providing GIS data and services	
Goal 5:.... Establish, manage, and provide outreach and educational programs and services	
Goal 6:.... Explore and pursue effective partnerships and funding strategies to support GIS initiatives	
1.3... Strategic Importance of Goals	
1.4... Target Organizational Environment Supporting GIS Coordination	
Section 2:..... Statewide GIS Work Program	
2.1... Introduction	
2.2... Strategic Plan Work Elements and Approach	
2.2.1..... Priority Setting	
2.3... Timing and Responsibilities	
2.4... Budget	
2.4.1..... Summary of Proposed Budget	

List of Appendices

Appendix A:..... Overview of GIS-related Standards and Status of GIS-related Standards Development and Plans
Appendix B:..... Legal and Policy Issues Impacting Distribution and Sale of Geographic Information and Products
Appendix C:..... Summary of GIS Data Theme Priority
Appendix D:..... Initial Identification of GIS Data Maintenance Responsibilities for High and Very High Priority Data Themes
Appendix E:..... GeoSpatial Metadata Standards from the Federal Geographic Data Committee
Appendix F:..... State Government External Databases and GIS Integration
Appendix G:..... GIS Application Framework

TABLE OF CONTENTS (continued)**List of Figures****Page**

- Figure 1-1: GIS Stakeholder Groups
Figure 1-2:.... General Organizational Relationships among Proposed GIS Coordination Entities
Figure 2-1: Recommended Timing for all Work Elements

List of Tables

- Table 1-1:.... Roles of Stakeholder Groups
Table 1-2:.... Proposed Organizational Components for Statewide GIS Coordination
Table 2-1:.... Priority of Work Elements and Outcome/Products
Table 2-2:.... Roles and Responsibilities
Table 2-3:.... Projected Budget for Items Necessary to Support GIS Coordination Program
Table 2-4:.... Summary of Annual Budgets for State GIS Program Coordination and Clearinghouse/Support Units (FY 2000-2001)

SECTION 1

SECTION 1 STRATEGIC FOUNDATION AND STRUCTURE

1.1 GIS STAKEHOLDERS AND ORGANIZATIONAL ENVIRONMENT

A GIS “stakeholder” is an organization or individual that has a role in developing, supporting, or using GIS technology, or deriving benefits through access to GIS products and services. Stakeholders may be:

- Generators of GIS data
- Geographic data distributors
- Providers of the software and hardware supporting GIS applications
- Users of GIS technology and products generated from GIS
- Educators and trainers.

As shown in Figure 1-1, GIS stakeholders in South Carolina include government agencies at all levels; Councils of Government; universities and technical schools; private companies, including utility organizations, commercial firms, and vendors of systems; citizens; and not-for-profit associations and organizations.

Figure 1-1: GIS Stakeholder Groups



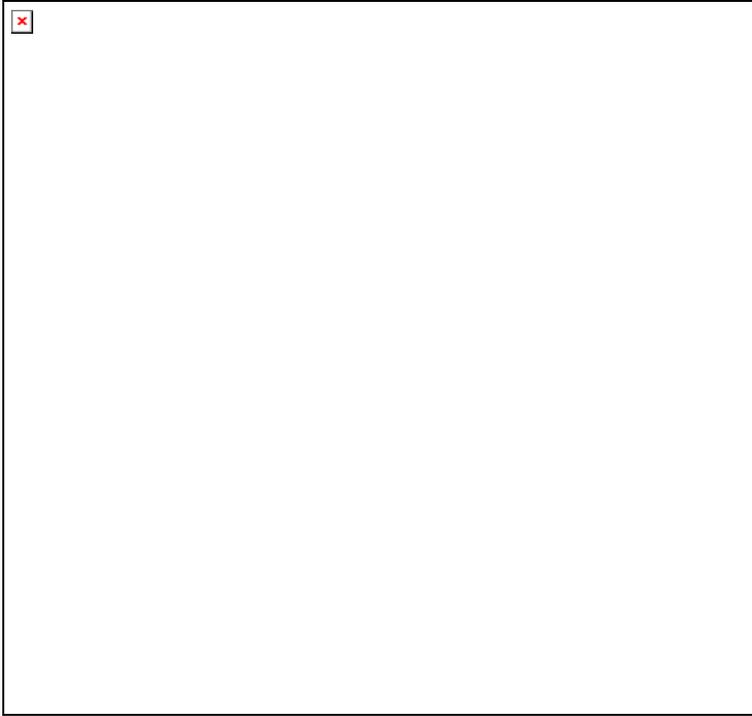
Coordination efforts aimed at enhancing GIS coordination in the State and promoting wise GIS use have already been created in South Carolina. The State’s Standing Committee on Geographic Information, a formal body empowered by the State’s Information Resource Council, is charged with the lead role to “coordinate the development and management of geographic data 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, educational, and advocacy role for GIS. These bodies together promote efficient practices in mapping and geographic information management.

Statewide GIS coordination involves State agencies, as well as all GIS user organizations in the State. Of particular importance is building more effective data sharing and technology support relationships between State agencies, COGs, and local governments. Local governments have a great need for GIS technology and can benefit from a higher level of support (funding, technical support, standards) from the State. Local governments and COGs can play an effective role in maintaining geographic data that is of vital interest to State agency programs and which benefits all of the State’s citizens.

GIS technology users in the State have and should continue to take a global perspective. In support of the federal government’s National Spatial Data Infrastructure (NSDI), South Carolina should encourage effective working relationships and information sharing with the federal government and other states. Such interaction will support the meaningful application of GIS technology for South Carolina and help keep the State in the forefront of national efforts.

A more focused view of the roles of stakeholder groups and coordination bodies is shown in Table 1-1. This table highlights existing groups or organizations that are now involved in GIS use or support, as well as new, recommended organizational entities (explained further in Volume II) that should be put in place to enable better GIS coordination and more effective use of GIS.

Table 1-1: Roles of Stakeholder Groups



1.2 MISSION AND GOALS FOR STATEWIDE GIS COORDINATION

This purpose of this *Strategic Plan* is summarized in the following mission statement for GIS and Geographic Information Coordination in South Carolina:

“To facilitate, coordinate, and promote the effective development, sharing, and use of geographic information within South Carolina for the benefit of its citizens.”

This mission will be accomplished through the following major goals.

Goal 1: Define and put in place an organizational structure and institutional relationships to support Statewide GIS coordination and use.

Description: This goal covers all activities aimed at establishing elements of an organizational structure and personnel resources for Statewide GIS coordination and individual GIS programs in stakeholder organizations. This includes coordination among State government agencies, as well as improving and enhancing State-COG-local government coordination and mutual support.

Goal 2: Create policies, procedures, and tools to encourage and enable joint GIS development and access and pursue joint projects.

Description: This goal encompasses formal policies from CGI, IRC, or other bodies that provide a foundation for and establish basic principles governing project collaboration, data exchange, and access to geographic data and products. Also included here is the preparation of key "template" documents and instruments (e.g., memorandum of agreement, standard contract or RFP terms, access agreements, etc.) that may be used by different parties to efficiently establish joint project relationships or information sharing relationships.

Goal 3: Build and maintain geographic data important for users Statewide.

Description: All short-term and long-term activities associated with the development and maintenance of geographic data needed by multiple parties in the State are included in this goal. The long-term goal is to complete and keep up-to-date all GIS database layers identified in the *Needs Assessment* as "High" and "Very High" priority, as well as associated geospatial metadata. Critical data standards definition tasks are included in this goal, as is the assignment of clear responsibilities and procedures for ongoing database update.

Goal 4: Establish a formal process and technical infrastructure for providing GIS data and services.

Description: Putting in place procedures, operational programs, and the technical infrastructure for geographic data access by and distribution to users is covered by this goal. This includes creation and ongoing operation of a GIS Service Center and a Statewide network and computing infrastructure (relying on existing networks) to support access to and distribution of data and related services for all GIS users in South Carolina. Development and approval of appropriate standards that relate to computer hardware, software, and networks are defined, and specific procedures and technical tools are designed and deployed.

Goal 5: Establish, manage, and provide outreach and educational programs and services.

Description: This goal addresses important communication and education concerns. Activities will cover the development, execution, and provision of educational materials and special educational programs (e.g., State GIS conference) targeted at all levels. It also covers special promotional work and senior official briefings about the value and role of GIS technology and its benefits. Creation and provision of specific technical training are not part of this goal, but it does include some coordination and clearinghouse functions providing information about training opportunities and providers.

Goal 6: Explore and pursue effective partnerships and funding strategies to support GIS initiatives.

Description: This goal underscores the importance and value of establishing multiple sources for GIS project material support. In addition to annual budget appropriations approved by State and local governing authorities, activities will explore and secure other sources or approaches for GIS project financial support. This includes funding projects through public or private grants, organizational partnerships (including public-private partnerships) to provide funding, special revenue generation programs or fee structures, or other funding means.

1.3 STRATEGIC IMPORTANCE OF GOALS

Goal	Strategic Importance
1. Organizational structure and institutional relationships	Establishes an organizational foundation for long-term collaboration, sharing of resources, and project collaboration, and strengthens State-local information technology relationships.
2. Policies, procedures, and tools for joint GIS development and access	Provides administrative instruments to enable coordination and common direction based on accepted standards, and ensures consistency and efficiency in approach.
3. Build and maintain geographic data	Supports concept of data as a valuable resource and necessary foundation for GIS applications with value augmented over time through regular update.
4. Formal process and technical infrastructure for GIS data and services	Creates environment of wide access to data and critical GIS services enhancing the impact and benefit of GIS technology Statewide.
5. Outreach and educational programs and services	Maintains high-level understanding of the role of GIS technology and supports technology transfer and upgrade of user skills to better apply GIS.
6. Effective partnerships and funding strategies	Provides resources for GIS development and use through creative funding approaches and partnerships among State, local, and private users.

1.4 TARGET ORGANIZATIONAL ENVIRONMENT SUPPORTING GIS COORDINATION

This *Plan* calls for establishing an organizational structure and assigning specific staff roles to support GIS coordination and expanded use. This structure builds on the existing GIS coordination and organizational hierarchy to provide for improved GIS coordination and support. The major entities in this organizational structure are identified in Table 1-2 and depicted in Figure 1-2.

Table 1-2: Proposed Organizational Components for Statewide GIS Coordination

Proposed Entity	Explanation
GIS Coordinator/ GIS Coordination Office	An assigned coordinator whose 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. Provides staff support to CGI and works closely with CGI members and GIS stakeholders to accomplish goals of the <i>Strategic Plan</i> .
GIS Coordination Office	A formal office supervised by the GIS Coordinator who oversees a small staff that provides administrative and limited technical support for the Statewide GIS program. Placed at an appropriate organizational location, this office provides support, facilitation, and coordination for joint GIS activities in the State.
High-level Information Technology Policy Body	The role of this entity, now being filled in part by the IRC, deals with high-level information technology and GIS-related policy issues. This is a body that gives high-level approval to standards and policies developed and recommended by committees. It also is a conduit and a voice for senior managers and policymakers to provide input and direction.
Standing Committee on Geographic Information (CGI)	This is the principal body (with representation from State, federal, and local government agencies; COGs; utility organizations; and other designated stakeholder groups) 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 <i>GIS Strategic Plan</i> and to promote statewide GIS.
Technical Working Groups and Subcommittees	Focused groups, formally assigned by CGI, 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.
State GIS Service Center	Centrally administered office, with technical resources, that provides access to important GIS data and central applications, and acts as a clearinghouse and directory for information about the Statewide GIS program. The GIS Service Center targets a broad audience that includes not only State government agencies but all stakeholder groups in the State and even users outside the State interested in South Carolina geographic data.

Figure 1-2 is an organizational chart that gives a general picture of organizational relationships among the entities described above.

**Figure 1-2: General Organizational Relationships among
Proposed GIS Coordination Entities**



SECTION 2 STATEWIDE GIS WORK PROGRAM

2.1 INTRODUCTION

This section describes the details of the 5-year work program that covers all aspects of Statewide GIS development and coordination. The Work Elements described below focus on actions that must be taken to achieve results and accomplish the goals. In this section, the Work Elements are described, and priorities and responsibilities are assigned. The information presented here provides a basis for detailed planning and execution of work elements by CGI, the appointed GIS Coordinator, the proposed GIS Service Center, GIS leadership in user organizations, and other participants in Statewide GIS development and coordination.

2.2 STRATEGIC PLAN WORK ELEMENTS AND APPROACH

2.2.1 Priority Setting

General priorities are assigned to each Work Element as follows:

- **Very High**—Fundamental to the accomplishment of most strategic goals with planned completion or major progress by the end of Year 1
- **High**—Very important for accomplishing multiple strategic goals with planned completion or major progress by the end of Year 2
- **Moderate**—Significantly impacts one or more strategic goals with planned completion or major progress by the end of Year 3
- **Low**—Important but not essential for meeting strategic goals. Planned completion or major progress after Year 4 or later.

These are general categories meant to focus on initiation and completion of the Work Elements. In some cases, a priority category has been assigned and an “ongoing” label attached. “Ongoing” means that while initiation and results should be achieved consistent with the priority category, activities for the work element are recurring in nature throughout the plan period.

Table 2-1: Priority of Work Elements and Outcome/Products

Work Elements	Outcome/Product(s)	Priority
nl 1: Define and put in place an organizational structure and institutional relationships to support Statewide GIS coordination and use		
Create position for and hire GIS Coordinator	Highly qualified person hired into a clearly defined position in an "administrative home" with administrative support.	VERY HIGH
Define and document roles and relationships between CGI and SMAC	A mutually approved document, based on full consensus, that clarifies the roles of each body and their collaboration.	VERY HIGH
Enhance and improve relationship between CGI and IRC or appropriate high-level IT policy body	a) Streamlined and quicker process for IRC approval of CGI-approved standards and policies. b) Increased prominence and influence of IRC (or new IT Policy Body) in promotion and encouragement of IT coordination and integration.	HIGH
Define role and approve creation of State GIS Service Center	Clearly defined and approved role and function of the State GIS Service Center and assignment of its organizational location (i.e., University of South Carolina).	VERY HIGH
Create job descriptions and qualifications for GIS management and staff positions	a) Set of State government job descriptions and basic qualifications officially accepted. b) Sample job descriptions for use by local governments.	HIGH
Establish and staff GIS Coordination Office	Formally established GIS Office, at appropriate level in State government hierarchy, which includes the GIS Coordinator and 2 to 4 support staff.	HIGH
Create organizational structure and procedures for more effective Federal-State-COG-local collaboration	An administrative and procedural structure that enhances and encourages communication and collaboration between levels of government.	HIGH (ongoing)
Participate in national GIS programs and activities	a) Active participation in NSGIC. b) Active participation in FGDC-sponsored programs and activities. c) Work with neighboring states in GIS projects with regional significance.	VERY HIGH (ongoing)
nl 2: Create policies, procedures, and tools to encourage and enable joint GIS development and access and pursue joint projects		
Refine and document the process for policy creation and approval	A documented process that describes how policies are proposed and eventually approved.	HIGH
Formalize agenda/objectives for GIS policy and standards creation	List of formal policies and standards planned for preparation (see Appendix A for ideas) with projected dates.	VERY HIGH (ongoing)
Prepare principles and identify candidates for joint projects	(a) Documented set of principles guiding joint projects. (b) Initial list of candidate joint projects over the next 3 years.	VERY HIGH (ongoing)
Pursue collaboration and initiate joint projects	Sound plans and teams created and candidate joint projects initiated.	VERY HIGH (ongoing)
Create administrative instruments for multi-dept. and multi-agency project collaboration	Template Memoranda of Agreement, contracts, budget spreadsheets, and plans supporting joint project set-up and management.	HIGH

Table 2-1: Priority of Work Elements and Outcome/Products (continued)

Work Elements	Outcome/Product(s)	Priority
II 2: Create policies, procedures, and tools to encourage and enable joint GIS development and access and pursue joint projects (continued)		
Define policies for access to geographic data and value-added products	Definition of "data ownership" and specific rules and restrictions governing access and distribution of specific data sets.	HIGH
Define high-level policy governing public-private partnerships	Documented principles and legal or administrative rules governing joint projects or information sharing between government agencies and the private sector.	HIGH
Define high-level policy and legal environment governing the public sector sale of GIS products and services	(a) Definition of issues and resolution of questions regarding the sale of public sector information products and services. See Appendix B. (b) State government policy (potentially useful to local governments) defining terms of information sales. (c) Possibly a new State statute supporting information sales.	MODERATE
Create the process for support and review of project plans and procurements	Documented policy and procedure for CGI or GIS Coordinator role in reviewing and commenting on proposed plans for GIS projects by State Government agencies for the purpose of ensuring sound coordination and efficiency.	VERY HIGH (ongoing)
II): Explore and initiate Federal partnerships for GIS development and deployment	Identification of opportunities for joint GIS development with federal agencies delivering operational applications and data for State and local agencies.	HIGH
II 3: Build and maintain geographic data important for users Statewide		
Define critical GIS database standards that support compilation and update	List and explanation of geographic data standards for preparation (see Appendix A). This should include revisions and enhancements to specifications and standards guiding parcel map compilation.	VERY HIGH
Complete Statewide development of all "Very High" priority data layers	Data layers completed and ready for access by users (see Appendix C).	HIGH (ongoing)
Complete Statewide coverage of all "High Priority" data layers	Data layers completed and ready for access by users (see Appendix C).	MODERATE (ongoing)
Continue with development and maintenance of selected "Moderate Priority" and "Special" data layers	Selected data layers assigned a "Moderate" or "Special" Priority developed through joint funding or agency project budgets (see Appendix C).	MODERATE to LOW (ongoing)
Define long-term migration of existing legacy data for standards compliance	Documented issues, specifications, and operational plan for bringing legacy GIS data to standards compliance.	HIGH
Define data maintenance roles and responsibilities	Documented responsibilities (organizations and people) and procedures (sources, timing, process) for update of high and very high priority GIS data. See Appendix D for an initial identification of appropriate maintenance roles.	VERY HIGH

Table 2-1: Priority of Work Elements and Outcome/Products (continued)

Work Elements	Outcome/Product(s)	Priority
nl 3: Build and maintain geographic data important for users Statewide (continued)		
Develop and deploy technical tools to support regular data update	Automated applications for regular GIS data update for high and very high priority data layers.	HIGH to MODERATE
Modify legacy GIS data for standards compliance	Creation of standards-compliant legacy data.	MODERATE to LOW
Accelerate Cooperative County Mapping program and complete digital parcel mapping for entire State	(a) Significant funding increase for parcel mapping projects. (b) Completed, standards-based parcel mapping for State with update procedures in place.	HIGH (ongoing)
2: Develop tools and establish procedures for update of county base map data	Technical tools and procedures in place at local governments (or designated data maintainer such as the COG) for updating centerline, address, and parcel data.	HIGH
1: Prepare metadata content standards and tools for metadata maintenance	(a) Content standards for geospatial metadata based on FGDC (see Appendix E). (b) Physical design for geospatial metadata. (c) Technical tools and procedures in place for regular update of metadata.	HIGH
2: Develop and maintain geospatial metadatabase	(a) Populated geospatial metadatabase for High and Very High Priority data. (b) Updated geospatial metadatabase as GIS data is updated.	HIGH
3: Develop digital plat and engineering plan submittal standards	(a) Standards document to be used by developers and engineering. (b) CAD templates to facilitate use of standards.	MODERATE
1: Continue to provide GIS and mapping development support to counties and all levels of government.	Technical assistance, training, review of specifications, and contractor oversight for survey control monumentation, digital orthoimagery compilation, and digital mapping. Includes ongoing work in County and State boundary survey work to reconcile problems and establish official boundaries.	HIGH (ongoing)
nl 4: Establish formal process and technical infrastructure for providing GIS data and services		
Approve role and "organizational home" of Service Center	Documented terms and agreement for creating and setting up Service Center.	VERY HIGH
Prepare 3-year implementation/operational plan for Service Center	Detailed implementation plan defining steps, timing, resources, responsibilities, and services for GIS Service Center over the next 3 years.	VERY HIGH
Design technical architecture and server configuration	Operational network and servers configured for Internet access.	VERY HIGH
Set up/Deploy Initial Service Center Operations	Assigned staff and procedures and initiated Service Center operations.	HIGH
Build and deploy expanded Service Center capabilities	Augmented and improved Service Center services according to implementation plan.	MODERATE (ongoing)

Table 2-1: Priority of Work Elements and Outcome/Products (continued)

Work Elements	Outcome/Product(s)	Priority
4: Establish formal process and technical infrastructure for providing GIS data and services (continued)		
Develop tools for metadata access and query and allow access to geospatial metadata	(a) Applications for query and access to geospatial metadata. (b) NSDI Clearinghouse Node.	HIGH (ongoing)
Define important GIS-related software standards	Specification standards or guidelines that support GIS-related software procurements.	HIGH
Monitor and Track Service Center use	(a) Ongoing tracking on volume of use, type of requests, and quality of service. (b) Annual "audit" and summary report on services provided, plan accomplishments, and upcoming activities.	HIGH (ongoing)
Evaluate and enable integration with critical external databases	(a) Identify critical external databases and integration concerns (see Appendix F). (b) Applications set up to enable integration.	MODERATE
3: Design and develop Tier A GIS applications for Service Center	(a) Identification of Tier A applications for Service Center deployment (see Appendix G). (b) Develop Tier A applications for Service Center deployment.	HIGH
1: Provide support and help coordinate migration from current GIS software/data environments	(a) Identification of user installations that will require migration. (b) Template data models and data migration strategies. (c) Assistance in software procurement and general technical support. (d) General support in migration work.	MODERATE (ongoing)
2: Support Statewide network enhancements and information access	Appropriate participation and support for upgrades to the State's computing network that may benefit GIS access.	MODERATE (ongoing)
5: Establish, manage, and provide outreach and educational programs and services		
Communicate Strategic Plan and report on progress	(a) Plan and executive summary distributed to key parties. (b) Initial presentations to target groups to promote and garner support. (c) Regular reports on progress during execution of plan.	VERY HIGH (ongoing)
Identify, advocate for, and provide information to users about GIS technical training opportunities	(a) Directory of GIS trainers and training programs. (b) Set up automated clearinghouse for GIS training announcements. (c) Support for GIS software training (e.g., ESRI software) through University or GIS Service Center.	HIGH

Table 2-1: Priority of Work Elements and Outcome/Products (continued)

Work Elements	Outcome/Product(s)	Priority
II 5: Establish, manage, and provide outreach and educational programs and services (continued)		
Provide basic material, information, and support for new GIS start-up efforts	(a) Standard packet(s) aimed at particular stakeholder groups that discusses GIS technology and defines a path and resources to access to get started. Includes clear identification of support offered by the GIS Coordinator, CGI, current user organizations, and other parties. (b) General support and answering of questions by GIS Coordinator and staff and CGI members to stimulate and support new start-ups.	MODERATE
Examine, participate in, and encourage GIS-related certification initiatives	Become involved in certification discussions sponsored by academic and professional associates (URISA, ASPRS, UCGIS) and adopt formal recommendations for professional and educational certification, including recent "surveyor bill."	MODERATE
Provide special recognition for organization and individual accomplishments	(a) Statewide GIS program awards program. (b) Regular recognition of individuals and CGI meetings. (c) Submittal of applications for national awards.	HIGH (ongoing)
Plan and conduct annual GIS conference with a goal for professional networking and education	Successful annual GIS conference and effective coordination with SMAC.	HIGH (ongoing)
Prepare high-level GIS educational materials geared toward non-technical audiences	(a) High-level guide explaining GIS technology and its uses. (b) Presentation materials. (c) Briefings with senior officials. (d) Participation in State conferences and programs to explain the role of GIS technology.	VERY HIGH
Include State GIS leaders in local user group activities	Participation in local meetings by GIS Coordinator and State government members of CGI.	HIGH
Prepare important technical documentation and provide to the GIS user community	Updated technical documents available to all stakeholders.	HIGH (ongoing)
Establish effective liaisons with senior officials to sustain GIS support	Sustained support from senior officials in agencies, the Governor's Office, and industry associations. Participation in appropriate senior management briefings and planning sessions.	VERY HIGH (ongoing)
II 6: Explore and pursue effective partnerships and funding strategies to support GIS initiatives		
Prepare multi-year budget projection and identify possible sources	A 3- to 5-year budget that lays out general costs for major GIS coordination and development activities.	VERY HIGH (ongoing)
Allocate funds for remaining FY 2001	Identification and allocation of funds to support the GIS coordination program for the remaining current Fiscal Year.	VERY HIGH
Prepare and approve budget for FY 2002	Preparation and submittal of budget for FY 2002.	HIGH

Table 2-1: Priority of Work Elements and Outcome/Products (continued)

Work Elements	Outcome/Product(s)	Priority
II 6: Explore and pursue effective partnerships and funding strategies to support GIS initiatives (continued)		
Identify candidate grant opportunities and actively pursue	Identified programs, grant applications, and successful grant allocations.	HIGH (ongoing)
Explore and propose options for special funding sources	Identification and proposal for securing non-traditional funding for GIS coordination and statewide development activities.	HIGH (ongoing)

2.3 TIMING AND RESPONSIBILITIES

Successfully accomplishing the stated GIS coordination goals will require involvement from all stakeholders with leadership provided by CGI and the GIS Coordinator.

Table 2-2 summarizes responsibilities for major parties and stakeholder organizations that will have a role in South Carolina's statewide GIS coordination effort. The following roles/responsibilities categories for each GISCC work element are assigned:

- Oversight/Approval—Implies senior management authority to oversee or approve actions.
- Lead Responsibility—The designated party or parties are responsible for initiating, managing, and delegating participation; for monitoring work; reporting on progress; and completing a task.
- Support/Participation—Indicates that the designated party actively participates in the work of a task or provides other types of technical or administrative support.
- Review and Comment—Implies a peripheral involvement in review and suggestions about the outcome or interim results of a task.

Figure 2-1 gives an initial picture of the recommended timing for all work elements.

Table 2-2: Roles and Responsibilities

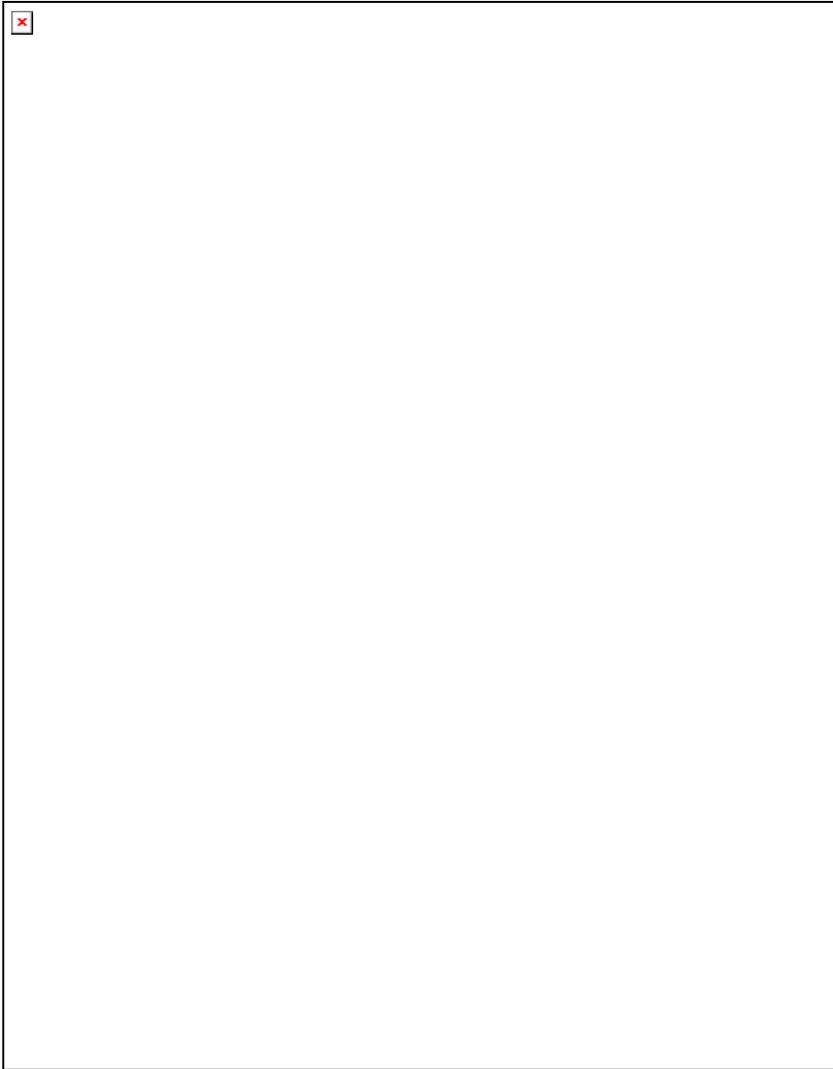


Table 2-2: Roles and Responsibilities (continued)



Figure 2-1: Recommended Timing for all Work Elements

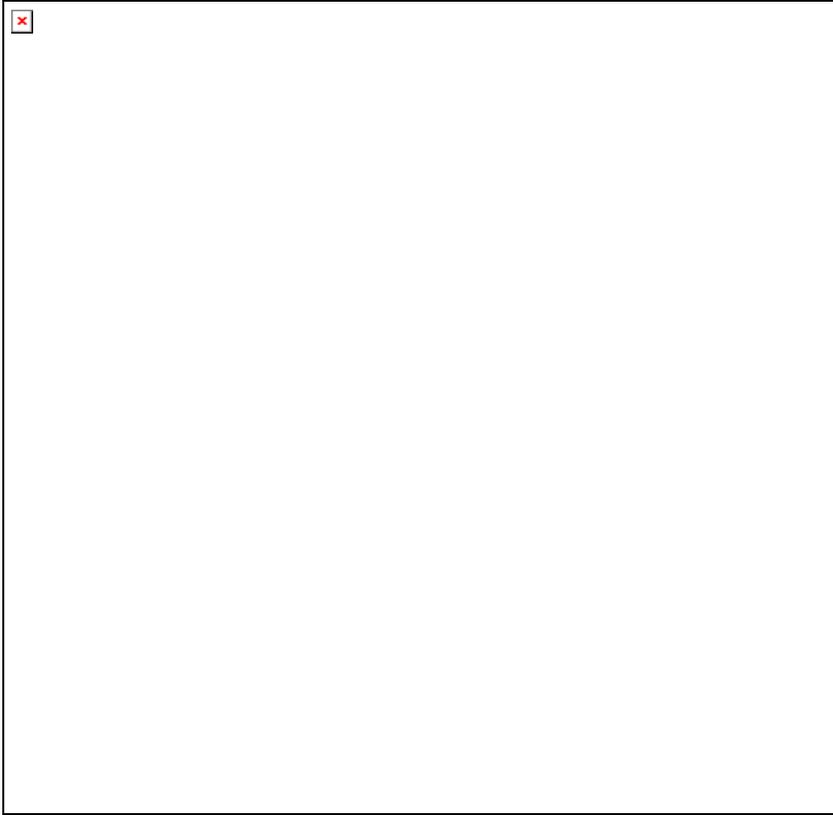
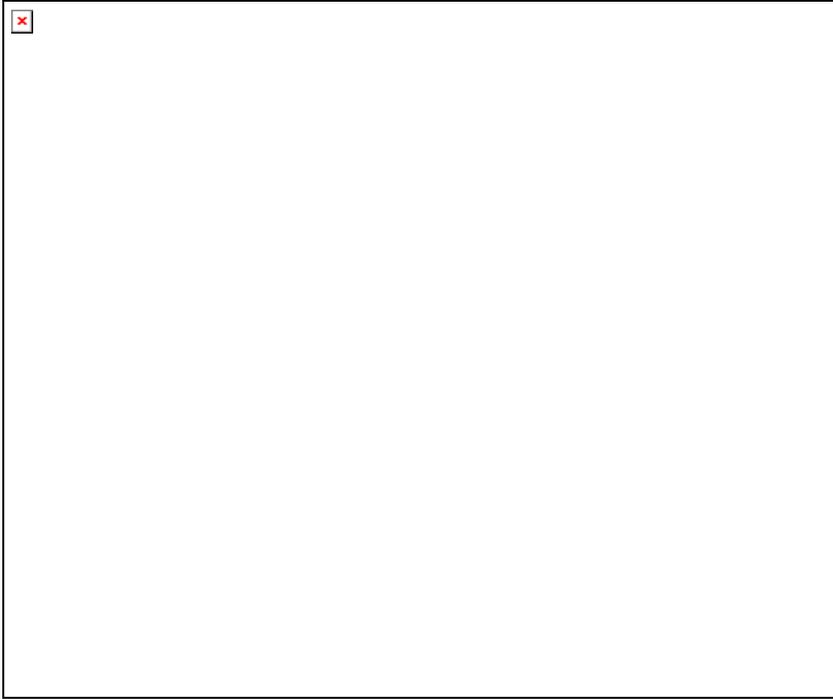


Figure 2-1: Recommended Timing for all Work Elements (continued)



2.4 BUDGET

2.4.1 Summary of Proposed Budget

Realizing the benefits of GIS technology through better coordination and resource sharing will require some investment in people and systems. Accomplishing the goals of this plan is particularly dependent on putting in place a GIS Coordinator and eventually a Coordination Office, a GIS Service Center, and other resources to support and promote a coordinated GIS program for South Carolina. This plan does not make specific assumptions about the source of all funding. The cost projections in Table 2-3 cover staffing and operational costs for GIS coordination and a GIS Service Center. Not included here are costs for GIS database development or GIS development projects that may be undertaken by individual user agencies.

It is assumed that the State Legislature will appropriate a considerable sum to support GIS coordination, and the GIS Service Center and State agencies that use GIS will contribute funds and/or tangible support. It is also assumed that CGI and the GIS Coordinator will actively explore and secure funding from other sources to support GIS coordination activities. These other sources may include:

- Federal grants
- Partnerships with and support from private companies that will be users of State GIS resources
- Special fees on local property transactions supporting GIS development (approach used in Wisconsin and Oregon)
- User fees for electronic access (supporting proposed electronic portal legislation).

Table 2-3: Projected Budget for Items Necessary to Support GIS Coordination Program

Budget Item	Explanation	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total
Salary and Benefits for GIS Coordinator	Includes full salary and standard benefit package for this senior position initially assigned to the Budget and Control Board. Includes salary increase each year.	\$110,000	\$114,000	\$118,000	\$122,000	\$127,000	\$591,000
Overhead and Travel Costs for GIS Coordinator and Coordination Office	Assumes costs for in-state travel for coordination activities and costs for two national conferences for GIS Coordinator and professional development for support staff.	\$12,000	\$18,000	\$22,000	\$24,000	\$26,000	\$102,000
Administrative Support Staff for GIS Coordinator	Through Year 1, administrative support will be provided through in-kind contribution from home agency (Budget and Control Board). Starting in Year 2, one administrative assistant should be assigned to the GIS Coordination Office.	N/A	\$30,000	\$31,000	\$32,000	\$33,000	\$126,000
Technical Support Staff for GIS Coordination Office	Through Year 1, CGI members and their assigned staff will provide technical support for the GIS Coordinator on a contributory basis. One technical person will be hired in Year 2 and one additional person will be hired in Year 3. Estimated salary and benefits for these positions are provided.	N/A	\$55,000	\$112,000	\$118,000	\$122,000	\$407,000
Operational and Administrative Costs for Committee on Geographic Information	This covers any direct office expenditures, including furniture and supplies, computers and office equipment, and any other office expenses assigned to the GIS program. Until FY 2002-2003, it is assumed that the Budget and Control Board will assume these costs.	N/A	N/A	\$18,000	\$20,000	\$22,000	\$60,000
Establishment of GIS Service Center	Initial costs for hardware, software, set-up, and other start-up costs. Office space and supplies provided in-kind by University of South Carolina	\$460,000	\$35,000				\$495,000
Ongoing Operation and Enhancement of GIS Service Center	Upgrades to hardware and software, communication services, staff support, and management oversight. It is expected that some costs will be covered through grants, in-kind support from other agencies, and fees for certain services.	\$105,000	\$140,000	\$155,000	\$170,000	\$180,000	\$750,000
Independent GIS Consulting to Support State GIS Coordination	Covers anticipated fees for consulting support in statewide GIS program development and operation. Includes assistance in the development of standards, design and creation of the clearinghouse, development of administrative policies, development of training programs, and other work items that make effective use of consulting services.	\$50,000	\$50,000	\$55,000	\$55,000	\$60,000	\$270,000
Contracted Tier A Application Development	Covers the cost of services or in-house staff assigned for the development and deployment of Tier A and B applications (high-priority general access applications and multi-Dept applications). These funds may need to be augmented with matching funds from agencies depending on the scope of application development and support.	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$200,000
TOTAL		\$777,000	\$482,000	\$551,000	\$581,000	\$610,000	\$3,001,000

For comparison purposes, a recent survey has gathered staffing expenditures for statewide GIS coordination offices and State offices established for clearinghouse or technical support operations. Unless specifically cited, the budget figures in Table 2-4 below cover only staff costs, office overhead and expenses, and GIS hardware and software supporting coordination efforts and clearinghouse activities—not costs of special GIS data conversion or consulting fees for special project work.

Table 2-4: Summary of Annual Budgets for State GIS Program Coordination and Clearinghouse/Support Units (FY 2000-2001)

State	GIS Office Staff ¹	GIS Office Budget	Clearinghouse/ Technical Support Center Staff	Clearinghouse/ Technical Support Center Budget	TOTAL BUDGET
Georgia	No formal office currently established	N/A	6	\$380,500	\$380,500
Kentucky	6	\$1,420,000	No separate clearinghouse or support office	N/A	\$1,420,000
North Carolina	3	\$500,000	20	\$4,500,000 ³	\$5,000,000
Ohio	3	\$393,000	2	\$260,000	\$653,000
Tennessee	2	\$289,500	No separate clearinghouse or support office	N/A	\$289,500
Virginia	4	\$600,000	No separate clearinghouse or support office	N/A	\$600,000
West Virginia	12	\$350,000	9	\$500,000	\$850,000

¹Includes Director plus technical/administrative support personnel involved in state GIS coordination and management

²Does not take into account administrative support staff time contributed by home agency

³Does include support for data compilation/maintenance activities paid through agency receipts for users

APPENDIX A

**APPENDIX A
OVERVIEW OF GIS-RELATED STANDARDS AND STATUS OF
GIS-RELATED STANDARDS DEVELOPMENT AND PLANS**

APPENDIX A OVERVIEW OF GIS-RELATED STANDARDS AND STATUS OF GIS-RELATED STANDARDS DEVELOPMENT AND PLANS

This appendix provides an overview of GIS-related standards issues and summarizes GIS standards activities being carried out by working groups of the Committee on Geographic Information's Standards Subcommittee.

OVERVIEW OF GIS STANDARDS ISSUES AND THEIR IMPACT

Standards that establish a basis for sharing of information resources impact all levels of GIS from computer hardware and networks to the way in which databases and GIS-generated products are designed. Wisely crafted standards can help facilitate the sharing of information and computer resources **within** an organization and **between** organizations. Standards are not an end in themselves but a foundation to help make information systems and databases easier to use and maintain.

The value of wisely chosen standards for geographic information users is reflected in three primary themes:

1. **Portability**, with the concept of 'interchangeable' parts implies an ability to use and move data, software, and custom applications among multiple computers and operating system environments without re-tooling or reformatting
2. **Interoperability and information access** impacting computers and networks, and users' ability to connect and retrieve information from multiple systems
3. **Maintainability** addresses the use of standards to promote long-term and efficient updating and upgrading, and effective use of computer systems and databases.

At a practical level, the adoption and use of standards can save money and time in the way geographic information is accessed and used. Standards also help support the efficient and non-redundant creation and maintenance of data with a high level of quality and consistency that can improve its value in decision-making.

Many organizations are now actively involved in developing and promoting general computing standards and standards specific to the geographic information technology industry. Government organizations establish and enforce standards for more consistent communication among agencies and international bodies, and with multinational representation, seek to encourage communication standards globally. Several independent professional associations and industry consortia are also heavily involved in the standards movement. In many cases, organizations in the categories described below work together on formal standards development and standards approval.

Federal Government Organizations—The federal government has assigned authority to a number of groups for the establishment of information technology standards that impact GIS. Examples include the National Institute of Standards and Technology (NIST) which addresses all types of standards, including information system standards, and the Federal Geographic Data Committee (FGDC) that has specific responsibility over various geographic data format, data classification, metadata, and data exchange standards.

Independent Standards Bodies—These formal standards bodies work on a consensus-building process to adopt and promote formal standards. They include representation from government agencies, professional organizations, and private companies. Independent standards bodies have open policies for membership (with rules for participation) and formal committee structures and procedures for standards development, review, and approval. Examples include the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the International Organization for Standardization (ISO). Standards that these groups approve have a great influence on the development of computer products (hardware, network, software) from the information technology industry.

Industry Consortia and Trade Associations—These are formal or informal associations predominantly made up of information systems product or service companies, with missions for joint definition, development, and promotion of standards-based products for their customer base. Many of these organizations, some with limited life spans, are created to address specific market niches and demands. Examples include the Open Group (formerly X/Open), the Object Management Group (OMG), and the OpenGIS Consortium (OGIS Consortium). OGIS has a particular focus on providing a model and encouraging GIS software companies to support data and software architectures that enable portability and an open GIS computing environment.

Professional Organizations—These include a range of professional organizations and associations with missions involving education, interaction between their members, and review of proposed standards, for example, the Urban and Regional Information Systems Association (URISA), the International Association of Assessing Officers (IAAO), and the American Society of Photogrammetry and Remote Sensing (ASPRS). In some cases, professional associations formally participate in government and independent standards bodies.

Standards of importance to geographic information users range from the details of computer hardware and networks to the design of databases and map products. Standards may be categorized into low-level and high-level categories (URISA 1998).

The low-level standards cover detailed technical concerns in the following categories:

- Hardware and physical connection standards
- Network communication and management standards
- Operating system software standards.

Low-level standards are vitally important for the interoperability of computer systems and they provide the basic computing and communication infrastructure for all system integration and information sharing. Development of hardware and software products that comply with these low-level standards is the domain of the computer industry.

High-level standards deal primarily with the database design, data exchange, and presentation topics listed below:

- User interface standards
- Data format/Data exchange standards
- Programming and application development standards
- User design standards.

Designers and developers of geographic information systems generally have a great deal of influence over the shape of high-level standards and how they are applied in their organizations. The process of database design, establishing procedures for data exchange, and the development of custom applications require wise decisions about standards to encourage consistency and information standards.

Table A-1: Taxonomy of Computing Standards with Selected Examples

TYPE OF STANDARD	EXPLANATION AND EXAMPLES
Hardware and Physical Connection Standards	
Cabling and couplers	Cabling types (e.g., twisted wire, coaxial, fiber optic), physical couplers, and connectors.
Electrical interfaces	Voltage and frequency standards.
Computer hardware design	Processor chips, internal bus, memory architecture.
Storage media format	Physical format for data storage on tapes, magnetic disks, and optical storage media.
Network Communication and Management Standards	
Local area network protocols	Protocols supporting communication on network connecting devices in close proximity over direct cabling schemes (Ethernet, Fast Ethernet, Asynchronous Transfer Mode).
Wide area network protocols	Protocols supporting communication among widely spaced devices using remote communication media (Frame Relay, Integrated Services Digital Network (ISDN), Asynchronous Transfer Mode (ATM), Digital Subscriber Line (DSL), and emerging wireless communication standards).
Communication protocol suites and models	ISO Open Systems Interconnect Model, TCP/IP protocols and services that are the basis for products and system implementation.

Table A-1: Taxonomy of Computing Standards with Selected Examples (continued)

TYPE OF STANDARD	EXPLANATION AND EXAMPLES
Network Communication and Management Standards (continued)	
Integrated data communications	Digital communication standards to support data, voice, and other communication channels on integrated networks. Current trend is for integration of all media services through emerging Internet protocols and services.
Operating System Software Standards	
Operating systems	Industry standard operating systems allowing more flexible networking and interoperability of applications. Microsoft Windows, including Windows 98, Windows NT, and Windows 2000, is the de facto standard. Different vendor implementations of UNIX and the growing popularity of Linux on the server side are factors. On the low end, a number of competing operating systems (e.g., Palm OS, Windows CE) are supporting small hand-held computers and personal digital assistant devices.
Distributed network management	Capabilities and software products to provide effective monitoring and administration of networks. Products based on such standards as Desktop Management Interface Profile, X.500 directory services standards, the Common Management Information Protocol (CMIP), and the Simple Network Management Protocol (SNMP).
Object management architectures	Standards and compliant products for object management and communication (CORBA, DCOM).
Query languages	Standard query languages allow a consistent interface to different databases (e.g., SQL) and some industry trends for development of a common geographic macro language (GML).
High-level application development languages	Trend is for the adoption of industry standard languages such as Visual Basic or C++ for GIS application development and customizing in an object-oriented environment.
User Interface Standards	
Industry Standard Graphic User Interfaces	Standard GUI packaged with the operating system or off-the-shelf application. MOTIF (Unix) and Microsoft Windows as basic standards.
Custom Application GUI design	Need for consistency within organizations for custom interface look-and-feel.
Data Format and Architecture Standards	
Spatial data formats and exchange (vector)	De-facto industry and government graphic data standards (SIF, DXF, DLG, etc.) and formal intermediate exchange formats for GIS (vector profiles of SDTS, DIGEST).
Spatial data formats and exchange (raster)	Standard file formats and compression approaches for raster image and raster document data, including TIFF, CCITT, JPEG, GIF, and MrSID. SDTS raster profile for raster data exchange.
Attribute data exchange and access	Exchange of attribute data among disparate systems and interactive access supported by standards such as ODBC and SQL.
RDBMS-based Spatial Data Repository GIS Software	Trend toward building enterprise GIS databases and applications based on RDBMS spatial repository products (e.g., Oracle Spatial, ESRI's SDE "middleware") to manage all spatial data in an RDBMS and to provide effective server-based processing with easy client access.

Table A-1: Taxonomy of Computing Standards with Selected Examples (continued)

TYPE OF STANDARD	EXPLANATION AND EXAMPLES
Data Format and Architecture Standards (continued)	
Interoperability and transparent spatial data access	Open GIS specification for interoperability. Products from GIS software vendors allowing transparent access to other vendor formats.
Presentation Access Standards	
Display and plotting interfaces	Standard interfaces and libraries describing primitives for communication and output on display and plotting devices (Graphic Kernel System, Plot 10).
Graphical user interfaces	Standard interface environments for interactive user access with the Windows standards.
Programming and Application Development Standards	
Open application development tools	Industry standard tools with access to GIS functions at an executable level (Visual Basic, Delphi).
SQL spatial extensions	Work in ANSI and ISO toward approval of SQL/MM Spatial.
Internet and intranet applications	Increasing use of Internet for spatial data queries through standard Web Browsers; considerable use of Microsoft's ActiveX and industry standard Java to enable Web-based applications. Increasing use of XML as a basis for more effective Web-based applications and interaction with GIS databases.
User Design Standards	
Data schemas	Attribute data file parameters such as field length, format, and other characteristics of data elements. Data schemas impact such widely used database types as addresses, street centerlines, parcel characteristics, etc.
Data coding and classification	Classification and coding schemes for data elements providing consistent reference by multiple users (e.g., standard land use or zoning codes). National or state standards issued by government organizations or professional associations may be available for certain types of geographic data. Subcommittees of the Federal Geographic Data Committee (FGDC) have completed or are working on classification and coding schemes for some data categories, including Land Cover, Vegetation, Wetlands, Facility Coding, Address Content, and others.
Map design	Consistent selections of feature content by layer; placement of annotation; and use of symbols, line types, shading, and color. Map design standards are often the domain of government organizations like the U.S. Geological Survey or professional associations like the International Association of Assessing Officers (IAAO) and the American Waterworks Association.
Map accuracy	Standards for evaluating and assigning horizontal and vertical accuracy to maps to support map compilation, field data collection, and geographic data update. FGDC's Subcommittee on Base Cartographic Data has issued the National Standard for Spatial Data Accuracy (NSSDA), and the Geodetic Control Subcommittee has developed standards for horizontal and vertical control.

Table A-1: Taxonomy of Computing Standards with Selected Examples (continued)

TYPE OF STANDARD	EXPLANATION AND EXAMPLES
User Design Standards (continued)	
Geospatial metadata	Guidelines for rating and storing information about the content, format sources, lineage, quality, and accessibility of geographic databases to support user queries, effective use of data, and proper maintenance of data. FGDC's <i>Content Standard for Geospatial Metadata</i> is used as a basis for most metadata programs.

With a view on the low-level and high-level standards discussed above, the IRC, CGI, SMAC, and all user organizations in the State should follow the general rules given below in defining a set of practical standards that will make sense in the long term:

1. Establish general hardware, operating system, and network standards that are compatible with overall information systems in user organizations that will guide purchases of industry products and system interoperability and integration. Set these low-level system standards in a flexible enough way to avoid constraining system development and acquisition of technology.
2. Develop system procurement rules and standards that comply with the low-level standards. Regularly update procurement specifications as industry product advances occur.
3. Select geographic information software products that comply fully with accepted operating system standards and support application development standards adopted by the organization.
4. With a firm understanding of data requirements, spend adequate time on a database design process and involve users and potential users of the system. Design data formats and classification systems that comply with accepted standards in all appropriate cases. Consider accepted schemes that are already in place and being used (from government organizations, FGDC, and applicable professional associations).
5. Look closely at current and future requirements for exchange of data among all users in the State (State agencies and other stakeholder groups). Assume that the interest in outside data exchange and access will grow in the future, and take into account software, data format, and metadata standards that will facilitate this. Concentrate on an Internet-based environment to facilitate exchange.
6. Make decisions about the application development environment and tools that will be de facto standards in the organization.

7. Set up a sensible and ongoing program for standards-compliant metadata capture and maintenance, and use these standards in a program for data access and data maintenance by users. Use the FGDC *Content Standard for Geospatial Metadata* as a basis.

STATUS OF GIS STANDARDS DEVELOPMENT BY CGI

The current process for standards preparation and approval relies on the CGI Working Groups to prepare a draft standard (based on an appropriate level of research and peer review and comment) and to obtain approval by CGI. It is then submitted for IRC approval. Table A-2 lists the status of current CGI standards initiatives. In some cases, topic-specific working groups have been set up to develop standards (e.g., Transportation Features, Hydrologic Features).

Table A-2: Status and Plans for GIS Standards and Policy Development by CGI

Standard	Description and Status
Addressing	Approved by CGI, IRC approval pending
Transportation Features	Draft in review
Cadastral	Drafting under way
Hydrologic Features	Drafting under way
Geodetic Control	Drafting under way

APPENDIX B

APPENDIX B
LEGAL AND POLICY ISSUES IMPACTING DISTRIBUTION AND SALE OF GEOGRAPHIC INFORMATION AND PRODUCTS

APPENDIX B
LEGAL AND POLICY ISSUES IMPACTING DISTRIBUTION AND SALE OF GEOGRAPHIC INFORMATION AND PRODUCTS

As public agencies in South Carolina increase their level of outside distribution of geographic data and possibly products derived from GIS, concerns about legal and policy issues impacting this distribution must be resolved. While some agencies have examined important legal and policy questions, the questions themselves are not fully resolved. To explore these questions in more detail, several broad assumptions can be made:

1. Legal and policy questions surrounding access and distribution of geographic information and products also relate to access and distribution to all public records maintained in electronic form.
2. Different users of geographic information may desire this information in different forms such as—a) raw data provided in batch form (possibly with periodic updates) that they will use with their own software to derive information, b) on-line access to requested data or response to simple queries, c) data that has first been “massaged” or restructured from its original form (the form in which it is maintained by the custodian agency) to better meet the needs of a particular user, and d) products generated from a GIS (like custom maps).
3. There is an interest by all parties in the State to make geographic data and products accessible to as many users as possible regardless of the original source or current maintainer of the data.
4. The legal foundation governing access to and distribution of public information is the 1998 State Open Records Law (Title 30, Chapter 4). While this gives general direction and requires that “Public Records” be accessible upon request, it does not give specific answers to many questions about public information distribution.
5. Many public agencies, including State and local agencies, are interested in selling data, or information products derived from GIS, as a means for some cost recovery for either the original or planned investments in system development or ongoing maintenance costs. The legal and market implications of public information sales are not completely clear.
6. It will be best if State Government takes the lead in answering questions about public information sale and distribution (including geographic information and products) and issue guidelines, and perhaps prepares new or revised statutes applicable to all public agencies in South Carolina.

Key questions that should be resolved in order to build effective programs in South Carolina for the distribution of public information include:

- Does the State's Freedom of Information Act apply to electronic data, as well as clear public records (traditionally managed as hard copy forms and documents)?
- Do the terms allowing the charging of fees for distribution allow some cost recovery for GIS data and products? If so, should all requesters be charged, including private businesses that may access data for commercial use or to make a profit from re-selling data or derived products?
- Should public agencies in South Carolina take on responsibilities for generating, on request from outside parties, custom data sets or derived products from GIS?
- How should public agencies avoid a real or perceived competition with the private sector in their distribution or sale of data or derived products? Should any "value-added reselling" of public information be the private sector's responsibility (perhaps with royalties to the public agency)?
- What liability exposure do public agencies have in the event of claims of damages from users of public information (given or sold to the claimant)? What legal steps are necessary to protect the public agency from such claims?
- Should public agencies treat any geographic information they maintain as proprietary? Does copyright apply to electronic data and, if so, does this afford protection from illegal re-use?
- What privacy concerns are important to the public agencies and users? Are particular data subject to legal restrictions on access and, if so, how is this managed by public agencies?
- What internal administrative tools and procedures must be put in place to set up, manage, and track an electronic information distribution program, and what capital and human resources are required to run it?
- Is the Internet the best means to distribute electronic data and products? How does E-commerce technology impact the possible sale of GIS data and products? NOTE: A new piece of state legislation on Electronic Commerce referred to as the South Carolina Access Network (SCAN), authored by the Budget and Control Board, is in the process of being finalized. While this legislation does not directly address all of the important legal and policy questions, it does provide a framework for distributing electronic information via the Internet. It makes reference to "premium services" with accompanying charges and opportunities for cost recovery and revenue generation. This legislation will undoubtedly have an impact on GIS activities and the operations of the recommended State GIS Service Center.

APPENDIX C

APPENDIX C
SUMMARY OF GIS DATA THEME PRIORITY

APPENDIX C
SUMMARY OF GIS DATA THEME PRIORITY

This appendix contains reformatted excerpts from the August 2000 *GIS Needs Assessment* report. It identifies GIS database layers in different categories of priority. Refer to Section 6 of the report for more details. 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:

- **Very High**—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.
- **High**—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.
- **Moderate**—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.
- **Low**—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.
- **Special**—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).

High and Very High Priority Data Themes

GIS Data Theme	Source/Status
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
Evacuation Routes	Local authorities that develop plans for communities and are responsible for the operation of those plans digitize evacuation routes.
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.
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.
Orthoimagery—Large-scale	The State Geodetic Survey runs a program to assist counties with the

| development of 1:4,800 and larger scale digital ortho production. |

High and Very High Priority Data Themes (continued)

GIS Data Theme	Source/Status
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.
Sites with Special Significance	These types of locations will come from various sources, including local authorities; records of social programs that track the elderly, the mentally and physically disabled, and others with special needs; and other databases that will cover these sites.
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, the Department of Motor Vehicles, and the State Transport Police.
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.
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.
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.
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).
Transportation—Local Streets	The ORS Digital Cartography Unit is compiling street centerlines for E-911.
Transportation—Major Roads and Highways	Available as DLG data from the DNR GIS Data Clearinghouse, as well as the USC Data Clearinghouse.
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.

Moderate and Special Priority Data Themes

GIS Data Theme	Source/Status
Air and Water Monitoring Sites and Data	DHEC maintains these data.
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).
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.
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, the Forestry Commission, and others). Other building plans in CAD or paper format may be available from local authorities that approve building permits.
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.
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.
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.
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.
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.
Engineering Drawings	CAD drawings and documents created to support proposed and approved projects.
Fire Management Data	The Forestry Commission collects and stores these data through their Computer Aided Dispatch system for forest fire response.
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.
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.
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.
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.
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.

Moderate and Special Priority Data Themes (continued)

GIS Data Theme	Source/Status
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.
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 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.
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.
Local Park and Recreational Facilities	Local authorities will have maps and, in some cases, digital map data depicting park locations.
Local Project Areas	Local projects are administered by local authorities, which all record their data differently.
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.
Mining Sites and Quarry Operations	These data will need to be digitized from existing maps.
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.
Other Special Districts	Depends on the type of district.
Planimetric Features	A mixture of planimetric data is available throughout the State. Local governments and utilities have been involved in the development of planimetric data at various scales and at various times.
Plat Drawings	Local governments (Assessor, Clerk, or Recorder Offices) maintain approved plat drawings (usually in hard copy form but sometimes in digital CAD format).
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.
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.
Railroad Lines and Facilities	Railroad data are available as DLGs from the DNR GIS Data Clearinghouse.
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.
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.

Moderate and Special Priority Data Themes (continued)

GIS Data Theme	Source/Status
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.
Significant Plant or Animal Habitats	As part of the GAP analysis program, DNR is identifying plant and animal habitats throughout the State.
Small-scale Land Use	These data are available through the DNR GIS Data Clearinghouse. These data layers are available to portions of the State, but land use characterization has not occurred in some areas.
Soils	The DNR GIS Data Clearinghouse contains digital County Soil Survey data (SSURGO) delineating mapped soil units.
Special Fee or Tax Rate Areas	Local governments that have digital parcel data may have delineated these types of special areas.
State Project Areas	No comprehensive database of construction or development projects administered by all State agencies exists. The Office of General Services of the Budget & Control Board 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.
Subdivision Boundaries	Subdivision boundaries will be derived from a digital parcel data layer, or they can be compiled directly from locally recorded subdivision plats.
Taxing Districts	Derived and created digitally by the overlay and combination of other selected district layers.
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.
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.
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.
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.
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.
Watersheds	No record of State digital watershed data is known to exist. The Natural Resource Conservation Service maintains digital watershed data.
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 quads has not yet been funded.

APPENDIX D

**APPENDIX D
INITIAL IDENTIFICATION OF
GIS DATA MAINTENANCE RESPONSIBILITIES
FOR HIGH AND VERY HIGH PRIORITY DATA THEMES**

**APPENDIX D
INITIAL IDENTIFICATION OF
GIS DATA MAINTENANCE RESPONSIBILITIES
FOR HIGH AND VERY HIGH PRIORITY DATA THEMES**

This appendix shows initial ideas on agency responsibilities for maintaining those GIS data themes designated as High or Very High priority in the *GIS Needs Assessment*. More information about these data themes and data update approaches are presented in that needs assessment report. This information is presented here as a first step to define data custodian responsibilities in more detail.

For data themes that will be managed or will be accessed through the State GIS Service Center (many or all of the themes listed below), 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.

High and Very High GIS Data Theme	Ideal Update Frequency	Organization with Primary Data Custodian Role*
Areas at Risk	Annually	Local government agencies Emergency Preparedness Division
Assessment Parcels	As changes occur	County Assessor offices
Census Geography and Demographic Characteristics	Decennial Census and updated projections by Census Bureau	U.S. Census Bureau through ORSS
Community Amenities	Annually	Department of Commerce
Critical Emergency Facilities	Annually	Department of Commerce Local Government Agencies Emergency Preparedness Division
Designated Environmental Areas	Annually	DNR
Digital Raster Graphics (DRGs)	Rarely	U.S. Geological Survey through DNR
Elevation—USGS DEM	Rarely	U.S. Geological Survey through DNR
Emergency Reference Data	Annually	DNR Department of Commerce Emergency Preparedness Division
Emergency Supply Points	Annually	Department of Commerce Emergency Preparedness Division
Emergency Evacuation Routes	Annually	Local Government Agencies Emergency Preparedness Division DOT
	Ideal Update Frequency	Organization with Primary Data Custodian Role*

| High and Very High GIS |

|

|

High and Very High GIS Data Theme		
Flood Zones and Flood Control Facilities	As new data is provided	FEMA
Governmental Jurisdictions	Rarely	ORSS with support from DOT
Orthoimagery—DOQQ	2- to 5-year reflight for areas of change	U.S. Geological Survey through DNR
Orthoimagery—Large-scale	2- to 5-year reflight for areas of change	ORSS—Geodetic Survey Local Government Agencies or COG
Sites with Special Significance	Annually	Department of Commerce Local Government Agencies Emergency Preparedness Division
State Administrative Districts	Rarely	Individual State Agencies
State and Federal Election Districts	Rarely	ORSS
State and Federal Park and Recreational Facilities	Annually	Dept. of Parks, Recreation, and Tourism
Surface Hydrology	Rarely	U.S. Geological Survey through DNR
Survey Control Monuments	Project-driven	ORSS—Geodetic Survey
Transportation—Major Roads and Highways	Quarterly	DOT and ORSS
Transportation—Local Streets	Monthly	Local government agency or COG if assigned data update role
Utility Service Areas	Rarely	Utility Company or Public Utility authority through the Public Service Commission

*Key to organization abbreviations used:

- DNR—South Carolina Dept. of Natural Resources
- ORSS—Office of Research and Statistical Services of the Budget and Control Board
- DOT—South Carolina Department of Transportation
- FEMA—U.S. Federal Emergency Management Agency
- COG—Council of Government

APPENDIX E

APPENDIX E
GEOSPATIAL METADATA STANDARDS FROM
THE FEDERAL GEOGRAPHIC DATA COMMITTEE

APPENDIX E
GEOSPATIAL METADATA STANDARDS FROM
THE FEDERAL GEOGRAPHIC DATA COMMITTEE

With the diverse sources from which spatial databases are built, it is extremely important to maintain information about the content, quality, source, and lineage (history of use and changes) of the data. There has been considerable activity in the development of metadatabases—tabular databases that hold information about spatial databases to support—a) queries about the availability of data, b) decisions on the suitability of the data for a particular application, and c) programs for data maintenance. A consistent, standards-based program for the capture and maintenance of metadata provides a basis for more effective use and maintenance of GIS data over time. Geospatial metadata provides the following advantages to an organization charged with managing a large amount of geographic data:

- Provides documentation of existing internal geospatial data resources within an organization (*inventory*)
- Permits structured search and comparison of held spatial data by others (*advertising*)
- Establishes a basis for an effective and consistent data update program (*maintenance*)

Provides end-users with adequate information to take the data and use it in an appropriate context in GIS applications (*proper use and liability*).

- As described below, the Federal Geographic Data Committee (FGDC) has approved the “Content Standard for GeoSpatial Metadata” to address these requirements for spatial “datasets.” A dataset may be a full GIS database, a digital map database, or a tabular database of geographically related information. The FGDC’s *Content Standard for Geospatial Metadata*, organized into the following seven main sections, defines metadata elements and their logical format and domains. Three other supporting sections (Citation Information, Time Period Information, and Contact Information) are logically associated with these main sections.
 - Section 1: Identification Information—Overall description, key words, spatial domain, status, and other basic information about the spatial datasets.
 - Section 2: Data Quality Information—Covers metadata about the graphic integrity of the data, positional and attribute accuracy, data completeness, source and lineage information, and other aspects of spatial dataset quality.
 - Section 3: Spatial Data Organization Information—Used for GIS and digital map datasets to describe methods of spatial reference and the format of the map data.
 - Section 4: Spatial Data Reference Information—Describes coordinate systems, map projections, and datum that applies to the dataset.
 - Section 5: Entity and Attribute Information—Contains detailed information about the attribute data in a spatial data set, including attribute names, data type and format, range and list domains, units of measure and resolution, and other specific attribute description information.
 - Section 6: Distribution Information—Provides contact information and details about distribution format, access, and procedures for requesting/ordering data.
 - Section 7: Metadata Reference Information—Includes background reference information about the metadatabase, including its currentness, custodian in charge, version information, and other reference information.

Description of the FGDC’s Content Standard for Digital Geospatial Metadata (CSDGM)

Objectives

The objectives of the standard are to provide a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements.

Scope

The Federal Geographic Data Committee (FGDC), under Executive Order 12906, “Coordinating Geographic Data Acquisition and Access—The National Spatial Data Infrastructure,” is charged with “Coordinating Geographic Data Acquisition and Access” and overseeing the “development of a National Spatial Data Infrastructure (NSDI).” The FGDC’s *Content Standard for Geospatial Metadata* is the data documentation standard referenced in the executive order. Federal agencies are required to apply this standard, but many State and local agencies have adopted it as a basis for compiling and maintaining metadata.

The standard was developed from the perspective of defining the information required by a prospective user to determine the availability of a set of geospatial data, to determine the fitness of the geospatial data set for an intended use, to determine the means of accessing the geospatial data set, and to successfully transfer the geospatial data set. As such, the standard establishes the names of data elements and compound elements to be used for these purposes, the definitions of these data elements and compound elements, and information about the values that are to be provided for the data elements. The standard does not specify the means by which this information is organized in a computer system or in a data transfer, nor the means by which this information is transmitted, communicated, or presented to the user.

In addition to use by the Federal Government, the FGDC invites and encourages organizations and persons from State, local, and tribal governments; the private sector; and non-profit organizations to use the standard to document their geospatial data.

More detailed information about the FGDC metadata standards may be accessed by visiting the Web site—www.fgdc.gov. Users may download the approved standard and explanatory material about it, find documentation and status information about metadata profiles (specific, topical, implementations of the standard), and obtain other useful information.

APPENDIX F

APPENDIX F
STATE GOVERNMENT EXTERNAL DATABASES AND GIS INTEGRATION

APPENDIX F
STATE GOVERNMENT EXTERNAL DATABASES AND GIS INTEGRATION

SYSTEM INTEGRATION ISSUES

Many GIS applications will require access to data that does not reside directly on the system platform on which the GIS operates or in databases directly managed by the GIS software package being used. This brings up the concept of “core GIS” versus “external” data:

- Core GIS Data—Map feature and attribute information that is stored and managed as an integrated database on the GIS platform or network.
- External Databases—Tabular files or other automated data (e.g., document images) stored and managed on a system different from the GIS platform (e.g., mainframe or PC). These external databases contain data elements acting as indexes (parcel number, address, facility ID, etc.) to link them to the core GIS database.

Core GIS data includes the map features and associated attributes that uniquely identify the feature (e.g., unique number for a main segment) and a basic set of attributes that characterize the feature (e.g., main diameter, material, length). External data covers all other data that may reside on other systems but which can become linked to the GIS on the basis of a common data element (e.g., County or district ID#, street address, parcel ID#).

GIS and external database integration involves enabling GIS and non-GIS applications so that they can easily use data from different sources—ideally without the need for redundant data update and storage. Some common scenarios under which integration between GIS and external systems is important include the following:

- GIS as viewer for external data (e.g., parcel data from external CAMA system; permit data from tracking system; water quality monitoring information)
- GIS to support data update and maintenance (e.g., map update for pavement management system; GIS use in field for data gathering)
- GIS integration with external modeling and analysis applications (e.g., processing and export of data to pipe system flow modeling or transportation modeling package and import for display of results).

The core data can be accessed through the GIS if there are data elements that serve as unique identifiers. This concept of linking core and external data is shown in the following figure.



Approach 1—Batch File Transfer

This approach is based on extracting and copying data from the external database and importing (and dublicately storing) the data on the GIS' database management system. This approach involves some straightforward programming to select and extract the data from the core database and to create a "flat-file" database table (often in ASCII format) for importing and loading to the GIS (usually into a relational database that the GIS supports). This approach is effective, technically unsophisticated, and is not dependent on high-speed data communications between the two systems which may be a problem in cases where the GIS and the external system are on two different geographically separated sites. A routine batch transfer could be to set up through manual transport of a tape or disk, or it could be done through slow- or medium-speed communication lines. The obvious disadvantage of this approach is the time delay in transferring data, the potential problems in having multiple sets of the same data "out-of-synch," and the necessity to oversee a scheduled transfer process. In some cases where these are not major obstacles, the batch file transfer approach is most appropriate.

Approach 2—Interactive Exchange

In many cases, it is desirable to set up an interactive link between the GIS and the external system to allow a GIS application or user query to automatically and transparently access the external data. This approach does not involve any copying or batch transfer of data. This approach is more technically sophisticated than the batch file transfer approach and is dependent on a high-speed and reliable physical connection between the two systems. GIS applications could be developed that would access external data directly so that after a link was initialized, it would appear to the user that the external data was locally resident on the GIS.

Approach 1, the batch file transfer, may be employed for some GIS applications. For example, it is the appropriate way to integrate GIS with external analysis models. To enable Approach 2 (Interactive Exchange), the following technical considerations must be addressed:

- High-speed physical connection—To ensure the effectiveness of interactive exchange, a high-speed (preferably 100 megabits per second or greater) connection must exist between the two systems.
- Network communication protocol—A network protocol governs the way that bits of data are packaged and transmitted through the network. Data "packets" hold information about the location (address) of the destination of a transmission, information useful for error checking, other control information, and message content. All hardware devices and operating systems on the network must recognize the protocols being used. Depending on the specific GIS hardware and software selected, special network interface cards for workstations, special workstation emulation software, or protocol conversion hardware and software may be required. The NT server will control network traffic and tools for configuring and monitoring network operations, user access, and security.
- Application and Database Connectivity—This technical concern impacts the application software being used and the way in which specific data elements are accessed by a user or GIS application. While it is possible to write custom programs to support interactive database access, it is much more effective to employ accepted industry standards to the extent possible. For example, Open Database Connectivity (ODBC) is a Microsoft Corp. middleware product that has become an industry standard supporting direct database connectivity.

SOME STATE GOVERNMENT DATABASES THAT SHOULD BE CONSIDERED FOR INTEGRATION WITH GIS

Table F-1 summarizes some of the main geographically related databases maintained by State agencies for which there are opportunities for integration with GIS. The *GIS Needs Assessment* provides more details about these external systems.

Table F-1: Candidate External Systems or Databases for Integration with GIS

External Database or System	State Agency
SPANFM (State facilities management and tracking on mainframe)	State Budget and Control Board—Office of General Services—State Building and Property Services
SPIRES (mainframe system) for tracking capital projects	State Budget and Control Board—Office of General Services—State Building and Property Services
South Carolina Master Client database (Oracle)	State Budget and Control Board—Office of Research and Statistical Services
Census 2000 demographic data	State Budget and Control Board—Office of Research and Statistical Services and other agencies
Oracle, Access	Department of Commerce
EDULOG system (for tracking student populations and busing)	Department of Education
Voter Registration Database (address-based mainframe system)	Elections Commission
I-Steps (air emissions database)	Department of Health and Environmental Control (DHEC)—Bureau of Air Quality
Environmental Facility Information System (EFIS) (Oracle-based)	Department of Health and Environmental Control—Information Technology
Vital Statistics (Mainframe database with birth/death data, health facilities)	Department of Health and Environmental Control—Division of Biostatistics
Crash and Ticket Tracking System (planned for Oracle)	Department of Public Safety
Computer Assisted Mass Appraisal (CAMA) (Oracle-based system to be used by counties)	Department of Revenue and County Assessors
Cultural Resources Databases (National Register Sites and cultural resource inventory data)	South Carolina Institute of Archeology and Anthropology and the Department of Archives and History
South Carolina Incident Based Reporting System (SCIBRS) (mainframe-based crime incident data)	State Law Enforcement Division
Highway Facilities and Project Databases: <ul style="list-style-type: none"> • Highway Pavement Management System (HPMS) • Traffic Counts • Maintenance Management • Bridge Management (Oracle-based systems to be integrated with a linear reference system)	Department of Transportation—Planning Division—Data Services Division

APPENDIX G

APPENDIX G
GIS APPLICATION FRAMEWORK

APPENDIX G

GIS APPLICATION FRAMEWORK

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 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 or 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 encompasses the following important elements that are part of the GIS conceptual design:

- 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 are discussed in more detail in the *GIS Needs Assessment* report (August 25, 2000). The three-tiered application environment, the foundation for the application framework, is explained in Table G-1. 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 G-1: 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 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 development, 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.
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	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	The agency will have full responsibility for deployment, support, and maintenance of the applications.

specific to a specific organization that joint development and multi-organizational use is not feasible.	strongly encouraged but not mandated.	
--	---------------------------------------	--

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.

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.

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.

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.

A more detailed description of candidate applications is provided in the August 25, 2000, *GIS Needs Assessment* report.