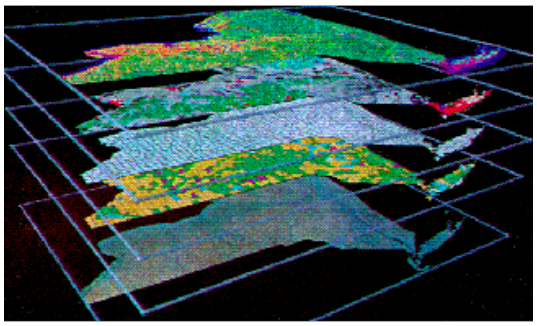

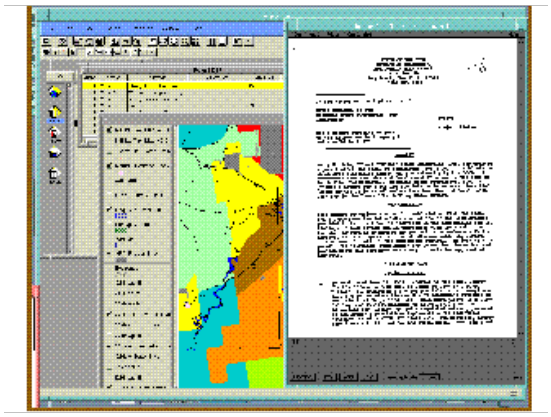

Geographic Information Systems:

Key to Competitiveness

THE NYS GEOGRAPHIC INFORMATION SYSTEMS COUNCIL

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Submitted to Governor George E. Pataki
and the New York State Legislature
by the New York State
Temporary Geographic Information
Systems Council

pursuant to Chapter 564 of the Laws of 1994
March 1996

Patricia A. Woodworth
Director of the Budget

Paul R. Fisk
Council Chair
Editor

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Acknowledgments

Many people gave much to this effort, Council members and non-members alike. The interest, enthusiasm and willingness to work of those involved never ceased to amaze me. GIS can spark such enthusiasm, for it is a powerful and exciting tool. GIS professionals may sometimes speak in terms of "polygons," "parcels" and "property centroids" - but underneath the techno jargon they're really talking people, places and improving public services and policy. Despite the fact that many of the members had participated in a variety of prior studies, work groups, legislative hearings and advisory councils, they all pitched in once more because they believed there was an important job still to be done.

Of the members of the Council, my special thanks to Tom Bodden, Manager of Research and Information for the NYS Association of Towns, for serving as Chair of the work group on Coordination, Users and Uses of GIS, and to Bob Brower, Cayuga County Planning Director, for assuming that role when illness prevented Tom from continuing. To Mike Courneen, Executive Vice President of Inteligis in Tonawanda, for chairing the work group on Legal and Financial Issues. And to Dr. Hugh Calkins, of the National Center for Geographic Information and Analysis at SUNY Buffalo, who chaired the work group on Standards and Technical Issues and who, with his own staff and Phil Cook and Paul Becker of the Erie County Water Authority, gave me and my staff an early demonstration of the value of GIS in so many endeavors in Western New York.

Council meetings were open and many interested individuals attended regularly, contributing significantly to the work of the Council. Over 200 additional GIS practitioners participated in the facilitated workshops held throughout New York State in conjunction with the complementary GIS project conducted by the Center for Technology in Government at the University at Albany.

Bob Freeman, Executive Director of the Committee on Open Government, gave generously of his experience and incisiveness in helping the Council and its staff understand the interpretations, strengths and weaknesses of the current Freedom of Information Law in New York.

Ron Brach, Lori Heithoff, Sue Bartle and Libby Egnor, of the Legislative Commission on Rural Resources and the staff behind Chapter 564, provided the periodic advice and encouragement that helped keep us on track.

Three State organizations concerned with the overall management of government's most valuable asset, information, agreed to coordinate their ongoing work with us so that their efforts would complement and contribute to those of the Council. We quite literally could not have done this in six months without them:

Terry Maxwell, Executive Director of the NYS Forum for Information Resource Management, with Meghan Kiernan and Rebecca Buchner, managed and analyzed the thousands of surveys required, shared the Forum's prior research, and provided staff support to the Technical work group.

The State Archives and Records Administration, those unsung heroes who ever remind us that information must be managed, mined and made available to realize its value, funded a complementary project to develop guidelines to assist local governments in planning and implementing GIS, and to continue the work of the CTG project on developing standards.

The Center for Technology in Government conducted a major parallel project, proposed by Department of Environmental Conservation (DEC), to examine the benefits of, and requirements for, sharing GIS data and expertise, with Ann DiCaterino developing a state-of-the-art Internet Web Site as a prototype Spatial Data Clearinghouse for New York. CTG's Dr. Sharon Dawes, Theresa Pardo and Kristine Kelly also contributed their considerable research, writing and group facilitation skills to the Council, without which we would never have completed our work in time.

Thanks to all those across the state who contributed graphics, and to the NYS Office of Real Property Services for assisting in allowing us to convey in color a taste of the power of GIS to "bring data to life."

Thanks to Nancy Tosta, of the Federal Geographic Data Committee, for her assistance and encouragement; and to Tom Donovan, formerly of DEC, who pushed the need for this for years, proposed the CTG project, and first taught me how to spell GIS.

And to John Ricci, Syed Saboor, Lisa Herman, Yvonne Mims and Karen Bonneau of my own Information Technology Management Unit staff at DoB for their research, writing and logistical support.

And, lastly, thanks to Governor Pataki and his senior staff for their interest in, and understanding of, the need to coordinate and harness the power of the new information technologies to improve services to the State's citizens, and for thus giving hope to the Council participants that their voices will be heard.

Paul R. Fisk
Council Chair

Cover Graphics Credits:

The top graphic was developed using resources of the Visualization Program, Center for Theory and Simulation in Science and Engineering at Cornell University. It represents five digital thematic overlays required by the NY Gap Analysis Project funded by the National Biological Survey: land cover types; soil associations; public land boundaries; bird species diversity and abundance; and elevation zones.

The second graphic was produced from the Town of Amherst and the Erie County Water Authority GIS data and shows the results of a database query to display property parcels with assessed values exceeding a certain amount, by type of land use.

The bottom graphic is from the prototype electronic reference desk developed for the Adirondack Park Agency through the Center for Technology in Government at SUNY Albany. It shows how imaged documents and other information associated with a property can be retrieved by "clicking" on a land parcel in a geographic information system.

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PRIVACY POLICY ACCESSIBILITY ABOUT CONTACT DISCLAIMER

Executive Summary

As the Temporary Geographic Information Systems Council held its last meeting, a major retailer was considering expanding into the Northeast from another region, and was evaluating possible sites in New York and other states for a new regional distribution center.

The firm contacted the State's Department of Economic Development for assistance in identifying potential sites that met its basic criteria: approximately x00 acres in size; configured approximately x,x00 feet by x,x00 feet; near major North/South and East/West highways and rail service ; "fully improved" or easily upgraded (for gas, electric, sewer and water); properly zoned; flat topography to minimize soil hauling; outside of any 100-year flood plain; Phase I and Phase II environmental assessments and soil boring data.

This sort of request for information is common in economic development, and these are precisely the types of questions that Geographic Information Systems (GIS) can be designed to answer. In other states that have taken steps to coordinate GIS on a statewide basis, and have established clearinghouses to track what data are available from what sources, these requests for information can be met relatively easily and quickly.

In New York, no formal coordination exists for GIS, and there is no fully operational data clearinghouse. State agencies struggled to assemble the information to fulfill this request, as much of the required data do not exist in digital form or are available only at the local level.

Economic development today has been variously described as "an information game," and "advancing as rapidly as most into a new era of information access and retrieval." Experts have warned "those hesitant to provide this level of service to their economic development prospect will fall behind their competition."

The Council concurs with the finding of the 1990 GIS study conducted by Syracuse and Cornell Universities and SUNY's College of Environmental Science and Forestry that:

"...limitations on the State's ability to access, integrate, and analyze geographic information quickly and accurately place the State at a competitive disadvantage in responding to public and private development initiatives and opportunities."

As one Council member expressed it, "The Pataki administration has taken bold steps to reduce taxes and lessen regulatory complexities, which are obstacles to economic development. A coordinated state-level GIS structure is the missing technological link."

Council Mission and Startup

The Temporary GIS Council was created to *...examine various technical and public policy issues relating to GIS and geographic information systems and analysis; to identify the structure, functions and powers of a state-level geographic information systems coordinating body; and to examine the role a state-level body could play in assisting in the development and implementation of local government geographic information systems.* The legislation creating the Council, Chapter 564 of the Laws of 1994, appears in Appendix . Under the statute, the Council was to prepare a report to the Governor and the Legislature that included:

An inventory and analysis of:	**Recommendations on:**
- GIS data and systems in use	- standards
- potential users of GIS	- GIS data as a marketable resource
- GIS in economic development	- legal ramifications of assuming a proprietary interest in data
- university and private sector roles	- changes to law to allow charging fees
- issues in:	

- records management,
- confidentiality and privacy
- security

The Council began deliberations in agreement with the legislative findings that *advances in computer technology have made the use of digital, computerized mapping a highly valuable tool to support governmental programs, and that geographic information systems are an increasingly important analytical tool to track trends, improve productivity and address service delivery issues not possible by conventional information systems.*

The Council also concurred with the conclusion of the CTG report on GIS, "Sharing the Costs, Sharing the Benefits," that ***the central GIS issue facing New York is how to organize and sustain a collaborative effort across all levels of government and with the private sector that will harness this powerful tool to improve governmental services, drive down costs, and stimulate economic***

development.

The Council operated from the additional premise that it would be unrealistic to expect significant new funding at this time, from any level of government, and that it would be self-defeating to predicate initial recommendations on such an expectation. However, local government Council members emphasized "no unfunded mandates." While desirable, and hopefully achievable in the future, "new money" is not necessarily required to make progress. Much can be accomplished by improving coordination and maximizing the use of existing resources. Our primary focus was on what could be done essentially within existing resources to make GIS itself, and coordination of GIS efforts, more affordable and effective.

The Nature and Importance of GIS

Geographic Information Systems are best known for their powerful mapping abilities that "bring data to life" and turn "data" into "information" and "understanding." For example, legislators who supported the bill to create this broad-based Temporary GIS Council, to have 57 members appointed by 28 separate appointing authorities, might wonder how that turned out. Did they achieve broad participation from across the state?

Data:

A manager from the 1970's might have responded, "I've got data on that, just look at this printout of Zip Codes."

ZIP Code Locations for Council Members and Other Deliberative Participants

Members	*12207*	*12233*	*12833*	*14150*	***Others***	*11201*	*12866*	*13903*
02117	*12210*	*12235*	*13021*	*14222*	*02906*	*11368*	*12977*	*14202*
10007	*12222*	*12237*	*13126*	*14260*	*10007*	*11368*	*13036*	*14614*
10021	*12223*	*12238*	*13145*	*14534*	*10007*	*12009*	*13045*	*14618*
10601	*12224*	*12242*	*13163*	*14608*	*10020*	*12157*	*13057*	*14618*
10603	*12230*	*12243*	*13202*	*14850*	*10021*	*12226*	*13063*	*80111*
10604	*12230*	*12245*	*13202*	*14853*	*10021*	*12226*	*13202*	
10924	*12230*	*12305*	*13210*	*14870*	*10027*	*12242*	*13202*	
11501	*12231*	*12306*	*13827*	*14904*	*10601*	*12481*	*13901*	
12180	*12232*	*12545*	*14075*	*20590*	*10605*			

Information:

A GIS-equipped manager today would say, "Let me show you."

NYS GIS IMAGE HERE

However, in order to understand the importance of geographic information systems, it is really necessary to discard your first impression of them*.*

Their colorful mapping capabilities make many people think that geographic information systems are simply computerized maps. ***They are not.*** *They are much more. Although they can and do make maps, and much of their output is displayed as maps, that is not their principal purpose.*

First and foremost, they are information integration systems. Being based on geography has proven to make them particularly powerful for many governmental and other uses.

Why do we say GIS is such a powerful approach to integrating information?

The flippant answer is "Because everything happens somewhere."

Commerce, potholes, crime, education, snow plowing, pollution, recreation, fires, poverty, floods, drug abuse, traffic jams, medical care, death and taxes all happen somewhere. Since all governments are charged with matters within a geographic region, most government associated data comes with a geographic component through which it can be organized, accessed and analyzed in a GIS.

Understanding where things happen is often key to delivering government services. Integrating information from diverse sources based on where things happen, or where things are, has proven to be a powerful way to plan and deliver public services more effectively and efficiently.

GIS is of particular importance and concern to local governments*, because virtually everything they do is tied to a place. Police and fire protection, ambulance dispatch, planning, zoning, building permits, sewer and water pipes, schools, health clinics, recreational facilities, traffic control devices, curbs, sidewalks, lighting and property taxes are all inextricably linked to particular places and geographic service areas. Geographic information systems can be used, and are being used in many places, to improve the efficiency and effectiveness of each*

of these services and more.

There is a tendency to discuss GIS applications in terms of their specific purposes (e.g. land use planning, infrastructure management, emergency response, etc.). But like the computer itself, they are really all-purpose, not single-purpose, tools.

GIS is an information integration vehicle with a tremendous range of uses. It becomes more powerful, and dramatically more cost effective, the more different types of information are available for integration.

Digital geographic information, once captured, can be used for many productive purposes. The key to effective GIS use is creating mechanisms to share that data.

An Illustration of the Potential of GIS

How information technologies in general, and GIS in particular, can be used to reduce regulatory red tape, improve customer service and increase government efficiency, was demonstrated in a recent project conducted with the Center for Technology in Government (CTG) and the Adirondack Park Agency (APA), regulator of 3.5 million acres of privately-owned land in the Park.

APA records are key to staff giving advice or making decisions about proposals to buy land, construct buildings, or other development projects as they strive to maintain the delicate balance between economic vitality and environmental quality in the region. APA's decisions, and the information required to make them, are important to landowners and developers, lawyers, realtors, researchers, Federal, State and local governments, and all the resident and recreational families in the park.

The APA maintains tens of thousands of records about real property, natural resources, and physical and civil infrastructure in filing cabinets, map trays, microfiche jackets, film canisters, boxes, closets and a few computerized databases. Organizing, finding, and using effectively so many different kinds of information has been a critical problem for the Agency and its customers. Collecting the information needed to give an answer or make a decision often consumes much more time than the analysis of the request, and it can take several days to respond to a phone inquiry, weeks to make a jurisdictional determination, and months to issue a permit.

IMAGE HERE The Center worked with APA to develop and evaluate a prototype system to combine records into an "electronic reference desk" that allows staff to point at a parcel displayed on an electronic map and retrieve legal documents, other maps, project plans and related information about the property. They may find the parcel by owner name, tax parcel ID, or simple map location. The prototype gathers into one place and format a wide variety of required information.

The project concluded that such a system could reduce response time for two-thirds of customer contacts by 99%. Other customer transactions could see response time improvements ranging from as little as 3% for highly technical major projects to 67% for local planning requests.

The benefits of a full system are projected to exceed costs and, with technology prices continuing to fall, the question for APA is not whether it should convert to a fully digital approach to geographic and document data, but when. APA adopted an evolutionary approach focused first on those aspects of the system that will yield short term productivity gains and improved responsiveness to customers, and the agency has begun to work cooperatively with local governments in the Park to share in the development of spatial data that benefits them all.

Major Findings

- *Geographic information systems are powerful analytical tools for improving public policy, program management, and service delivery.*
- *GIS applications support every kind of governmental purpose at all levels of government including:*
    -
    - *economic development*
    -
    - *environment and natural resources management education*
    -
    - *health, safety, and human services delivery*
    -
    - *infrastructure management*
    -
    - *comprehensive planning and zoning*
    -
    - *real property records management*
- *The Council's work confirms the recommendations of a number of previous studies that New York needs a formal mechanism to coordinate development and use of the increasingly powerful tools represented by geographic information systems.*
- *The geographic information needs of different policy areas overlap. For example: the boundaries of political subdivisions; the location of roads, rail lines, and rivers; and the shape, location, and ownership of land parcels are used in many different kinds of applications.*
- *Economic development applications, in particular, rely on the availability, accuracy, and completeness of a wide variety of spatial data. However, New York's ability to use information to attract and expand businesses in the state is impaired by the lack of a statewide strategy to*

use geographic information resources.

- *Since the most valuable, and most expensive, part of a GIS is the creation and maintenance of spatial data, sharing spatial data offers major benefits, including:*
  - *significant economies of scale*
  - *more powerful integrated applications*
  - *more affordable and widespread use of GIS tools*
- *Most government organizations are willing to share spatial data, but there are significant barriers to effective sharing. These include:*
  - *lack of awareness of existing data sets*
  - *lack of or inadequate metadata (information about data)*
  - *lack of uniform policies on access, cost recovery, revenue generation, and pricing*
  - *lack of uniform policies regarding data ownership, maintenance, and liability*
  - *lack of incentives for sharing*
  - *absence of tools and guidelines for sharing*
  - *absence of state-level leadership*
- *New York is already rich in geographic data resources, in isolated local coordination efforts, and in expertise in geographic information systems, but it lacks the ability to formally coordinate these resources for either cost-savings or strategic purposes, such as economic development.*
- *Current law is inadequate to guide management decisions regarding geographic data and GIS applications. Definitions and principles adopted in the 1960's need to be re-evaluated in light of new technologies and information principles. Current laws act as a barrier to establishing the large, coordinated GIS databases necessary to the growth and use of this powerful tool in New York.*

  The Freedom of Information law was originally developed to guarantee citizen access to records as a means of improving government accountability. However, FOIL and other laws now present barriers to the coordination necessary for GIS because

  - *FOIL does not distinguish between information requested for accountability purposes and information requested for commercial purposes. This prevents charging for information used for commercial purposes, which would reduce taxpayer costs; and*
  - *FOIL does not recognize copyright or contractual limitations, creating disincentives for public and private sector entities considering sharing data and resources.*
    - *Private entities are concerned that they will lose ownership of whatever data they contribute if it is pooled with publicly-produced data and becomes freely available to all.*
    - *Public organizations are concerned about making the major investment necessary in creating a GIS alone, simply because some potential partners who want the data, and might otherwise cooperate in creating it, may choose to wait until the product is complete and freely available.*
  - *Many public and private organizations are reluctant to share information out of concern for possible liability claims, particularly when information is used by others for purposes other than those for which it was collected.*
  - *Records management laws have multiple, often conflicting, definitions of what a "record" is.*
- *Existing laws dealing with privacy, security and confidentiality will adequately protect citizen rights, and the information assets of local and State government., if the statutes are understood and implemented vigilantly by public managers.*
- *The data standards necessary to promote sharing of spatial information are currently inadequate, and requirements for metadata are needed to facilitate sharing and long-term access to GIS data among all levels of government and the public. Hardware and software standards are expected to evolve from such industry organizations as the Open GIS Consortium.*

Major Recommendations

GIS Coordinating Body

The Council's primary recommendation is that a permanent GIS coordinating body be created to: foster an integrated statewide geographic information infrastructure; and facilitate the coordinated development and sharing of GIS in NYS.

Once organized, the highest priority task for the coordinating body should be to establish and oversee a permanent geographic information clearinghouse. The coordinating body and staff assigned would coordinate data development, maintenance and sharing by brokering partnerships, publishing standards and guidelines, and facilitating access to education, training and technical support and services. A complete description of the Council's vision of the coordinating body duties is found in Chapter 5: Coordinating GIS - Benefits and Barriers.

The Council recommends that the structure of the coordinating body reflect the broad range of interests in GIS and that state, regional, local, private, academic, non-profit, and grassroots organizations be represented, with particular emphasis on ensuring adequate local representation. The broad range of functional uses of GIS should also be reflected. The Council recommends fifteen as a reasonable number of members of the coordinating body, who would be supported by adequate full-time staff to perform the functions of the coordinating body.

Enabling legislation for the Council was prepared at a time when there was no formal statewide effort to coordinate information resources,

and thus contemplated an independent Council or Commission on GIS. In the current situation in New York, a GIS coordinating function may need to begin life attached to an operating agency and/or the Information Resource Management Task Force, and evolve within the broader IRM umbrella. Council members believe that GIS must ultimately be considered an important and integral part of any statewide Information Resource Management effort. Should legislation be developed to create such a permanent function in New York, the Council recommends that these GIS recommendations be incorporated in it.

Experience from other states suggests that statutory authorization for an ongoing coordination function maximizes the likelihood of long-term success, and the Council expressed the preference that ultimately such a body be authorized in law. Other forms of authorization, such as Executive Orders, have been used successfully as well, and are options to consider.

While Council members believe that adequate resources must be provided to support the efforts and responsibilities of the body if it is to be successful, they recognize current fiscal realities. Initial efforts, like those of the IRM Task Force, may need to begin by reassigning existing staff resources. The location of the clearinghouse function, and the existing resources of the agency responsible for its operation, will determine whether or not a small funding increment or redirection is required.

Standards

The Council found that it is not necessary for New York State to develop hardware and software standards, which are expected to evolve from such organizations as the Open GIS Consortium. However, the coordinating body should develop a set of requirements for metadata for state and local governments (linked to any Federal metadata standards in force) to facilitate data transfer and long-term access to GIS data. The coordinating body should continue to monitor the need for one or more standardized formats for the exchange of spatial data between state agencies, local governments, and the public.

A continuing state-level spatial data coordinating function will be needed to participate in the development of, and respond to, draft Federal theme standards expected to be released during 1996. This activity should involve all interested local and State agencies within New York and should encourage active review of the Federal standards as they are published.

Legal Issues

Freedom of Information Law

Those in support of charging for commercial use of government data argue that:

FOIL's purpose is to allow citizens to hold government accountable for its actions. Giving away publicly-produced data to be exploited for its commercial value does not contribute to the accountability of government.

The general public paid for the collection and organization of the information, therefore it should benefit from the sale of public information -- government should not subsidize a few private merchants. Proceeds from the sale of government information can be returned to the taxpayer through increased services and/or reduced taxes.

One trend in government is to shift costs away from the general tax base and toward user fees so that all taxpayers do not subsidize services used by a few.

Government's public service function does not necessarily limit its ability to act in an entrepreneurial manner -- in fact, as most organizations, it often responds best when challenged by outside forces.

Those in support of providing public information at little or no cost generally argue that:

The right of access to public information is fundamental to our representative democracy.

Government's role is to act only where the private sector can not or does not. Government-sanctioned monopolies are less efficient than private enterprise. Entering into the marketplace may divert agencies from their primary public service missions, and even encourage them to focus on developing information products in competition with the private sector. Access to public information at no more than marginal cost stimulates the market, fosters economic growth, and encourages wide access to government information, thus benefitting the public at large.

The Council recommends that FOIL be amended to declare that GIS records form another category for purposes of establishing a fee, as has been done in many other states. The Council supports the Committee on Open Government's proposal to recognize the commercial value of data and records, and recommends that FOIL be amended to:

permit local and State agencies to set fees for data to be used for commercial purposes at rates established and approved in advance, based on the commercial utility of the data;

permit agencies to retain fees, to be used to enhance public access to government information or to defray GIS costs; and,

permit agencies to release data subject to license agreements.

The Council supports statutory recognition of the right of governmental data owners to develop and enforce licensing agreements setting forth the terms and conditions of data use. Such licensing agreements could not, however, limit access to data used for the purposes of ensuring government accountability.

Limits On Liability

The Council recommends that GIS providers be exempt from liability for a variety of different kinds of records, such as parcel maps, deeds and as-built drawings, in order to guard against the potential legal ramifications of assuming a proprietary interest in data, much of which is not created for the purpose for which it may ultimately be used by others.

In order to create incentives for data sharing through public-public and public-private partnerships, liability for inaccurate, out-of-date or imperfect data needs to be contained. The Council recommends that the following limitations of liability should be recognized in statute with respect to GIS data:

disclaimers in data license agreements should be enforceable;

there should be no joint and several liability for pooled data for which there are cooperative agreements;

authors and contributors of spatial data should not be liable for consequential damages; and

GIS providers should not be liable for inaccuracies in data unless the provider received prior written notice of the defect and thereafter failed to correct the error within a reasonable time.

For Further Consideration: A Local Coordination Mechanism

In some regions of the State, counties, groups of counties, or regional planning boards have taken the lead in coordinating GIS activities. In many places, this has not happened. Some Council members sought to craft, and make available to localities on an optional basis, an organizational vehicle that would deal with the various barriers to cooperation previously discussed. The Council recommends that the Legislature and the coordinating body give further consideration to authorizing local coordination mechanisms, such as an Information Resource Management District.

Privacy, Confidentiality and Security

The coordinating body is encouraged to adopt and promulgate a Fair Practices and Use Model for GIS that includes a clear statement establishing the obligation of the individual agencies participating in GIS ventures to protect the confidentiality and privacy of data on individuals.

The coordinating body should perform ongoing assessments of the impact of the continuing deployment of GIS technology and systems on the confidentiality and privacy of data relating to individuals.

Given the extensive collaboration and multiple agency involvement in the construction of GIS systems, and the resultant difficulties a citizen would face in seeking administrative redress, the Council recommends that the coordinating body work with the Committee on Open Government regarding the need for assisting individuals with administrative appeal issues relating to:

Inappropriate collection of confidential or private data for GIS use

Investigation of complaints relating to abuse or misuse of confidential or private data in GIS systems or products

Providing assistance to individuals in purging or expunging inaccurate, outdated, or misleading data about the individual

The Council recommends that every organization providing or participating in a GIS system establish a system of internal controls and security procedures that protect against unwarranted physical or electronic access to the GIS data, systems, and hardware. The internal control system should include a minimum requirement for an annual vulnerability assessment that gauges exposures and risks, and provide for an action plan to avoid, moderate, or otherwise limits those risks and exposures.

Records Management

Consolidate current multiple definitions of a "record" into one useable definition that acknowledges the geographic component of the records created and stored in GIS, and, if appropriate, differentiates between "records" and "data" stored in an automated system.

The Council recommends that the coordinating body work with SARA to provide clear retention and disposition guidelines to local and state agencies.

Next Steps

In the complex and rapidly changing worlds of information technology and public policy, the Temporary GIS Council's main objective was not to attempt to find definitive answers that will stand forever to all the thorny questions of the day, but to explain the issues and options as clearly as we could and recommend immediate steps where possible, and paths to solutions over time where appropriate.

The Council's highest priority recommendations for actions necessary to realize the benefits of, and remove the barriers to, effective use of GIS in New York are to:

Create a permanent GIS coordinating body with specific goals, duties, and structure.

Establish a clearinghouse for spatial information.

Enact license agreement authority for local and State government.

Amend FOIL to authorize local and State agencies to set fees for commercial use of GIS data; and to use those fees to defray GIS costs and expand public access to GIS information.

Limit liability for spatial data providers.

There is much work left to be done that requires an ongoing coordination effort. For lack of a permanent coordinating body, this Council had to decline the invitation of the Federal Geographic Data Committee to join them and councils from other states in a nationwide effort to develop standards, a clearinghouse, and build a National Spatial Data Infrastructure. Telecommunications deregulation has kindled additional interest in public/private GIS partnerships as corporations seek to expand into new areas and businesses. And many issues were not even addressed by the Temporary Council in its brief active life, such as how to reconcile the overlapping yet differing requirements of local, State and Federal governments. Issues of scale, precision and accuracy, for example, are significant when sharing data among levels of government, or planning base maps.

Knowing the location of something within plus or minus 40 feet may be perfectly acceptable to someone examining statewide environmental issues. But the utility crew seeking the valve to shut down a broken water pipe needs to know more precisely where to look. As one Western New York water utility director put it, "Even if we did have a backhoe with a 40 foot wide bucket, you probably wouldn't want it digging in your front yard." Brooklynites whose homes and businesses were flooding from a broken water pipe one recent winter, and who watched helplessly while water crews spent nine frantic hours trying to locate the valve to turn off the water, might have summarized the issue even more succinctly.

Shortly after the Council convened, Governor Pataki launched an ongoing effort to develop, for the first time, an overall State strategic plan for Information Resource Management. The Governor's Task Force on Information Resource Management has asked the New York State Office of Real Property Services to create a special subcommittee on GIS to build on the work of the Temporary GIS Council and take a leadership role in establishing a statewide, integrated GIS initiative.

Council members hope that the Legislature and Executive will take these next steps down the path to competitiveness.

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Chapter 1

Background to Creating and Convening the Council

Putting New York on the Map

Home to producers of many high technology products, New York State has nevertheless been slow to coordinate use of one of the most powerful the geographic information system.

"Information technologies are often touted as the doorway to an efficient future for New York's state and local governments. The ability of the state to match its rhetoric with its practice is reflected in how it is implementing the use of a computerized mapping technique known as a geographic information system, or GIS, which can relate most legal, social, business, environmental and political aspects of life to a computer-generated map...

The technology is not a stationary doorway, however, but a process that requires constant growth and cooperation at all levels of government... Yet New York lags far behind other states in coordinating the many GIS applications already in place and addressing the contentious issues that surround the technology.

After several years of studies by various agencies... the Legislature created a temporary state GIS coordinating council.

State Sen. Charles Cook (R-Delhi), chairman of the Legislative Commission on Rural Resources, sponsored the Senate bill.

'Independently, a number of state and county agencies, not to mention the private sector, have bustled into developing GIS without always determining their own system's ability to link with [those of] other agencies,' he says. 'A lot of money can be saved, and improved data systems developed, by coordinating our application of this technology.'

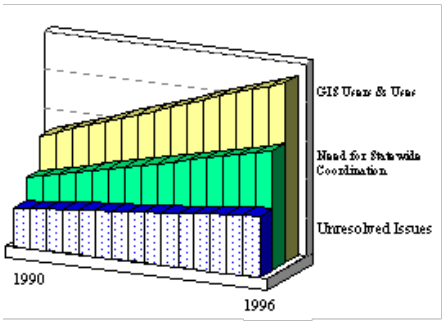
The executive director of the Commission, Ronald Brach, says, 'It's a big fiscal concern to leverage and maximize resources. We want to stop focusing on the current shortcomings related to GIS and move toward solutions.'

The hot buttons for GIS users and developers are, in large part, the charter of the temporary council. These buttons concern establishing a common way of handling and transferring information, determining whether the data is treated as a public record or as a marketable resource to commercial users, and potential changes to the Freedom of Information Law."

by W. Conard Holton in EMPIRE STATE REPORT, November, 1994

Many studies have concluded that New York State needs to create some mechanism to coordinate the use of the increasingly powerful and available analytic power of Geographic Information Systems. As more and more uses are developed, coordination of the creation and maintenance of the data on which systems are based becomes increasingly important to the efficient and effective use of GIS. With coordination, the same data can be used by many different people for many different purposes. If mechanisms for cooperation and sharing can be created, and the related technical and policy concerns can be resolved, then all levels of government will benefit from reduced costs and improved analytic capabilities.

1990 GIS Study



The New York State Science and Technology Foundation funded a major study that considered many of the same issues as the current Temporary GIS Council. Conducted jointly by Cornell and Syracuse Universities and the SUNY College of Environmental Science and Forestry, it brought together academic and governmental GIS experts to develop priorities and propose a plan of action. The 1990 "New York State Program in Geographic Information and Analysis Planning Grant Final Report" found, in part, that:

"Geographic information systems (GIS) constitute a powerful new technology that can address many of the information needs of decision makers in state and local governments. A computer-based GIS provides an electronic process for managing, integrating, and analyzing massive amounts of geographic information by combining locational features with descriptive data in a relational database management system. Properly employed, GIS and related techniques of geographic information analysis (GIA) can greatly facilitate the timely evaluation of policy issues and the comparison of policy alternatives. Applications of this technology will be of growing importance to the national competitiveness of New York State and to the effectiveness of all organizations responsible for environmental management, economic development, and public

service delivery...

Although substantial resources have been committed to support GIS-related development, too little attention has been given to planning interagency coordination and to data sharing among State agencies and other government units. In New York State, therefore, most geographic database systems are self-contained islands of information that are difficult to cross access or integrate. Thus, the agency generating the data tends to be the only one that can use it, even though other agencies may need the information to address statewide concerns... The resulting limitations on the State's ability to access, integrate, and analyze geographic information quickly and accurately place the State at a competitive disadvantage in responding to public and private development initiatives and opportunities."

Their recommendations for a "New York State Program in Geographic Information and Analysis (NYSPGIA)" focused on strategies for:

- Sharing geographic information by developing a GIS clearinghouse;
- Improving the education and training of GIS practitioners in New York by providing teaching laboratories, short courses, workshops, and summer institutes; and,
- Meeting the applied GIS research needs of New York State by establishing testbeds.

Eighteen of the GIS professionals who participated in the 1990 study are either members of the current GIS Council, active participants or interested observers. No State action was taken on the recommendations and the Temporary Council believes that the conclusions remain valid today.

Vision 2000

In 1993, the report of the Governor's Task Force on Filing and Recording, *"Public Records: Vision 2000,"* made a series of recommendations to improve and modernize the management of land records, including the need to relate land records to GIS and base recording systems on accepted records and information management principles.

21st Century Fund Bill

The 21st Century Fund legislation was an effort of the (then) Division of Equalization and Assessment, the Local Government Records Advisory Council and many other statewide organizations to set up a dedicated ongoing fund to develop a comprehensive GIS system at the local government level in New York State. Although the legislation was not passed, the efforts of this group and of others were instrumental in developing and establishing support for the legislation that created the Temporary GIS Council.

Legislative hearings and Chapter 564, L.1994

In 1993 and 1994 the Legislative Commission on Rural Resources and the Senate Local Government Committee held meetings and hearings on the need to resolve GIS issues, at which many of the current Temporary Council members and interested participants testified. These hearings led to the development and enactment of Chapter 564 of the Laws of 1994 establishing the Temporary GIS Council to report to the Governor and the Legislature recommendations for improved coordination of GIS.

In Anticipation of Convening the Council

The Temporary GIS Council was delayed in starting due to the lengthy appointments process for 57 members to be named by 28 separate appointing authorities, the change of administration, and the extended 1995 budget adoption and end-of-session activities. However, in anticipation of convening the Council, the Division of the Budget asked three organizations interested in Information Resource Management in general, and in GIS, to coordinate their work with us and to shape their own efforts with an eye toward tasks laid down for the Council.

NYS Forum for Information Resource Management Reports

In 1992, the Forum produced a "white paper" on GIS, noting the potential utility of the tool for a wide range of governmental functions and concluding that standards and policies were needed to share GIS resources effectively.

In 1994, the Forum published the briefing paper "Geographic Information Systems: Issues, Activities and Resources" that updated the status of GIS activities at the local, state and Federal levels as a resource for the Council's deliberations and volunteered to conduct the survey of technology, users and uses required by Chapter 564, L. 1994.

Center for Technology in Government:
GIS Cooperative Project

The New York State GIS Cooperative Project, initiated by the NYS Department of Environmental Conservation, was designed to address some of the same issues that would confront the Council. The project demonstrated the depth and variety of existing human, technical, and data resources in New York State. It showed the extent to which spatial data needs overlap among key policy and applications areas and examined how data sharing strategies can reduce the cost and increase the value of geographic information systems at every level of government and in the private sector. Existing local and regional coordination efforts were identified, as were the formal coordination activities of the Federal government and other states. The project identified and examined existing barriers to data sharing and coordination and developed specific recommendations for overcoming those barriers. Finally, the project created a new spatial data resource for New York State--the NYS Spatial Data Clearinghouse, one of the recommendations of the 1990 NY State Program in Geographic Information and Analysis report.

State Archives and Records Administration:
Local Government GIS Demonstration Project

The State Archives and Records Administration, through its interest in improving records management practices in local government, has become increasingly active in trying to partially fill the void in GIS coordination. As more and more local governments began to establish geographic information systems, SARA published "An Introduction to Geographic Information Systems: A Reader for Local Governments" and has funded more than a dozen GIS-related projects through its Local Government Records Management Improvement Fund since 1991.

In 1995, SARA entered into a contract with the National Center for Geographic Information and Analysis at SUNY Buffalo and the Erie County Water Authority to assist in improving records management practices for geographic information systems in local government. The project will develop procedures and guidelines to assist local governments in planning their GIS activities. The project is:

- Preparing guideline documents describing the methods and procedures useful in GIS planning;
- Preparing a draft spatial data standard for New York State;
- Developing spatial database planning and metadata generation software; and,
- Preparing records management and retention guidelines for GIS data for use by SARA.

These three projects coordinated their efforts and shared their findings and recommendations with the Temporary GIS Council. Their assistance has been invaluable.

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Chapter 2

Some Basic Concepts in GIS

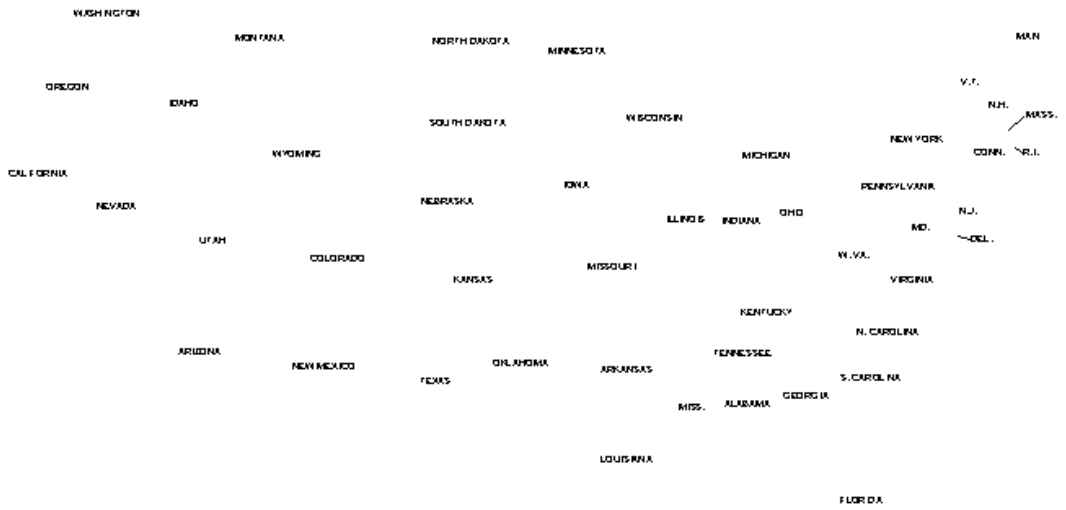
To understand why GIS is important, we must understand the power of GIS as an information integration and analysis tool. And to understand that, we must first understand some of the basic concepts behind GIS

While Geographic Information Systems can be quite sophisticated analytic tools, they are based on some fundamental concepts that we all use every day in viewing and understanding the world around us. Much of the visual and intellectual "data" we collect we turn into "information" and "understanding" by virtue of the spatial relationships among the data.

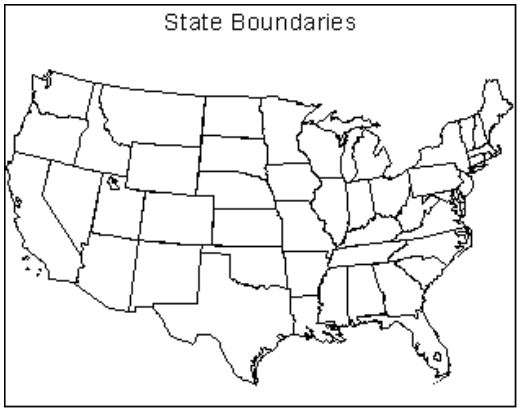
For example, the concept of "the United States of America" is, in part, a geographic one. A list of the 48 contiguous states gives us some data about that concept, but not much understanding.

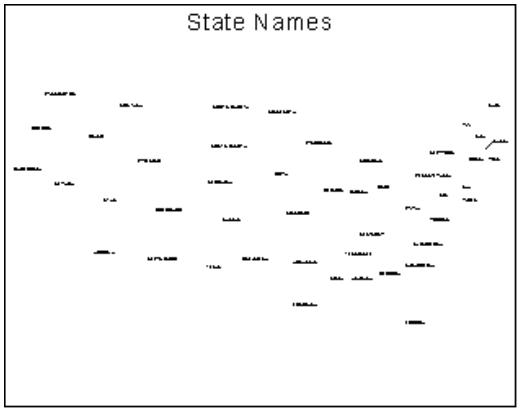
Alabama	Georgia	Maine	Nebraska	Ohio	Texas
Arizona	Idaho	Maryland	Nevada	Oklahoma	Utah
Arkansas	Illinois	Massachusetts	New Hampshire	Oregon	Vermont
California	Indiana	Michigan	New Jersey	Pennsylvania	Virginia
Colorado	Iowa	Minnesota	New Mexico	Rhode Island	Washington
Connecticut	Kansas	Mississippi	New York	South Carolina	West Virginia
Delaware	Kentucky	Missouri	North Carolina	South Dakota	Wisconsin
Florida	Louisiana	Montana	North Dakota	Tennessee	Wyoming

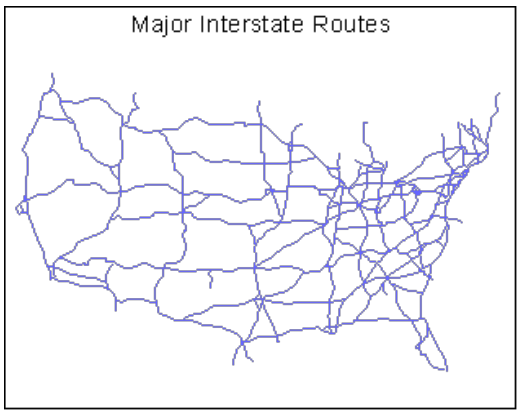
We know that there are spatial relationships among the states, and are more accustomed to viewing those relationships, with the names of the states arranged in their appropriate places.

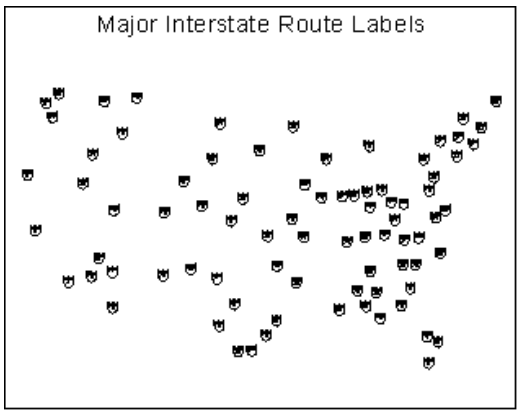


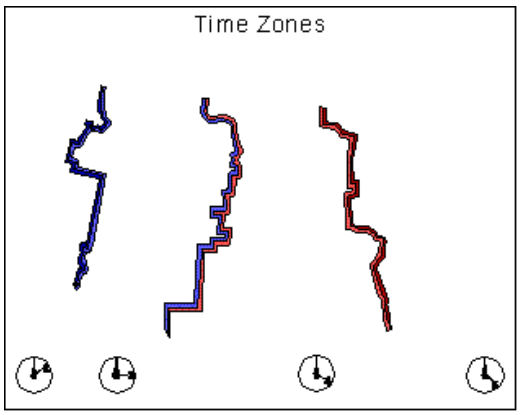
Different features of the US, and their spatial relationships, can be captured separately in a computer, then combined as needed to produce maps for different purposes.

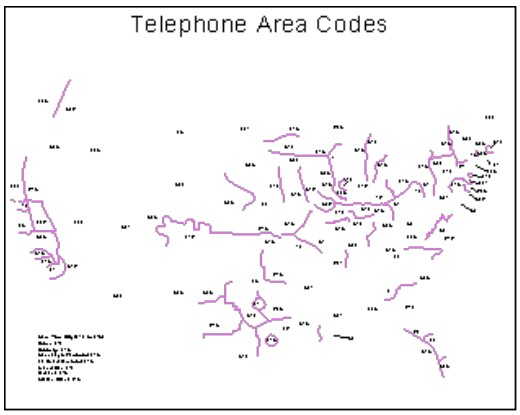




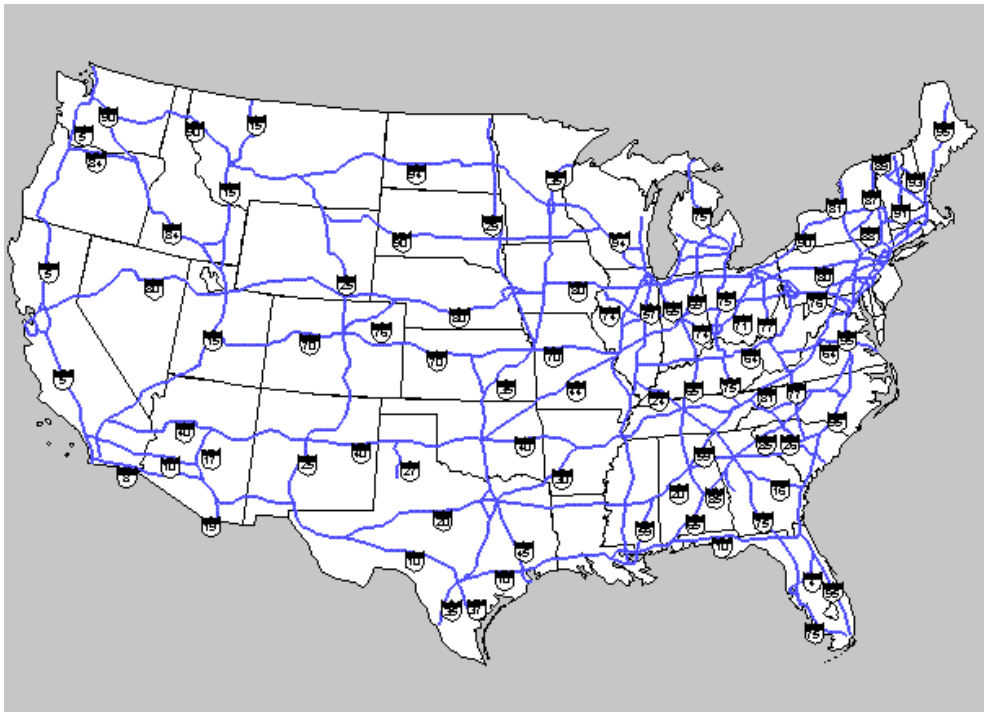




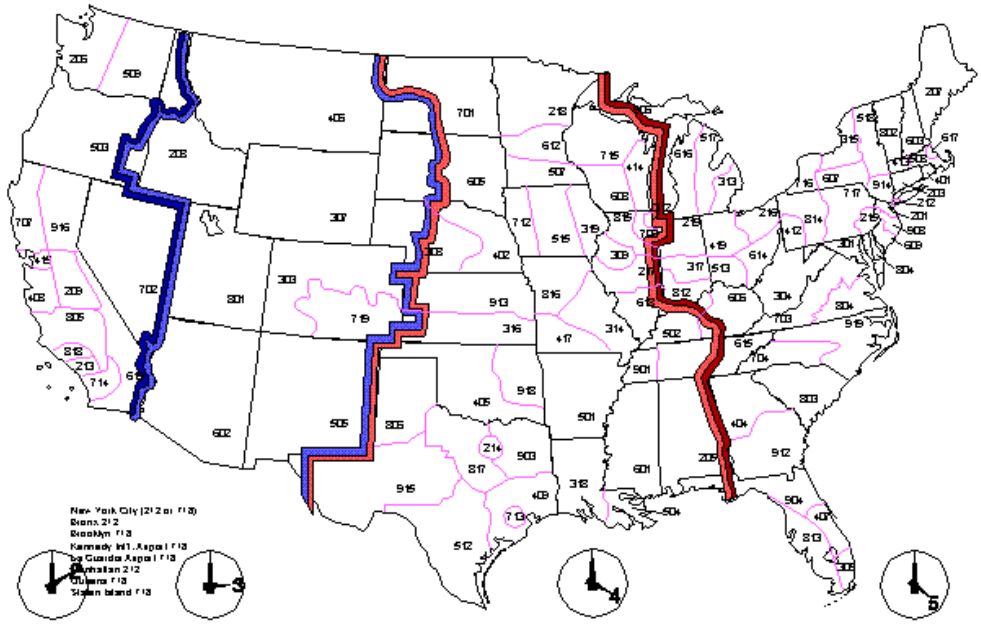




Those desiring to "see the USA" may be most interested in the interstate highway system.

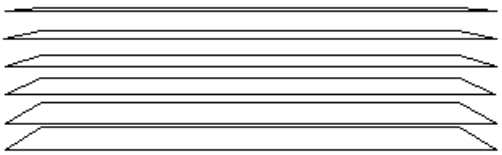


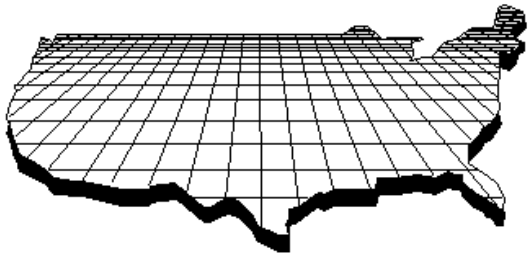
Someone making long distance phone calls might be more interested in time zones and area codes.



In GIS terms, these six different types of information may be thought of as six "layers" of data that can be superimposed on a "base map" as needed to create maps for particular purposes.

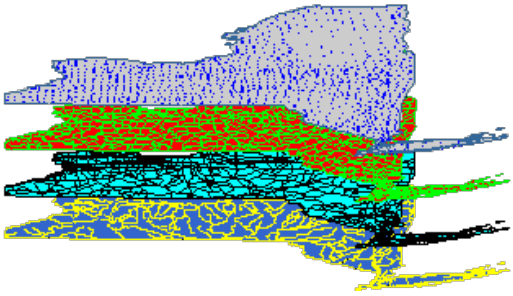
Telephone Area Codes
Time Zones
Major Interstate Route Labels
Major Interstate Routes
State Names
State Boundaries





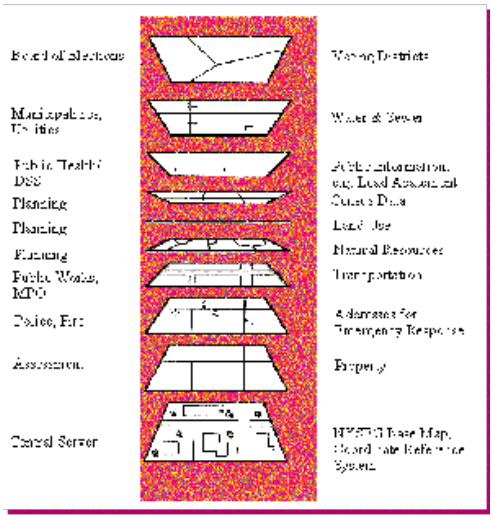
Base Map

Local, State and Federal agencies maintain a wide variety of layers of data in New York. Once the basic geographic information is put into a form a computer can understand, the information can be used for an infinite number of purposes.



Courtesy NYS Office of Real Property Services

Geographic Information System
As Conceptualized in Tompkins County



Courtesy Tompkins County Planning Department

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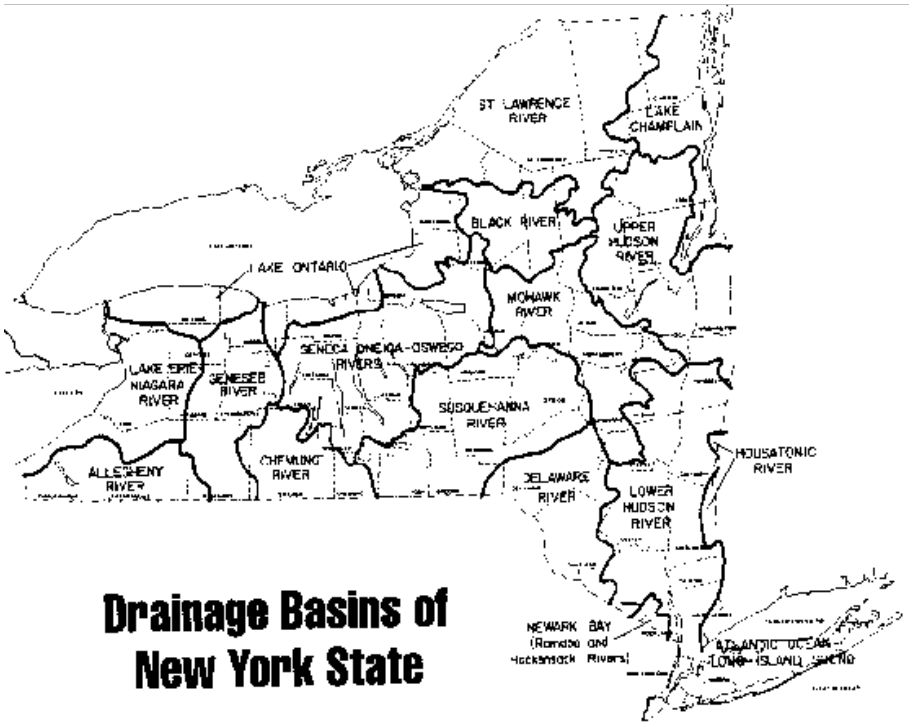
Even if Geographic Information Systems were only computerized mapping machines, they would still be useful, for we require maps for many purposes, showing many different types of information.

Automating maps is useful by itself because the people who work with maps (engineers, surveyors, cartographers, tax assessors, construction inspectors, etc.) are able to eliminate much of the redundant activity in their mapping and sketching work. Once a map is automated, the only thing a human has to do to revise it is to put down the revisions themselves. The unchanged elements, which now typically have to be copied and reproduced, are there already in the computer.

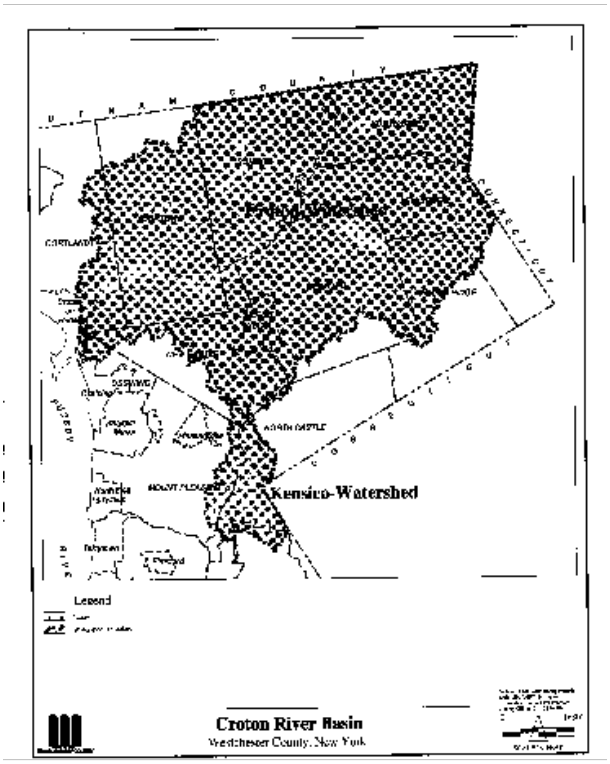
Rochester reported that updating land use maps that used to take a planner a full year can now be done in less than two hours. The Capital District Regional Planning Board reports that pre-GIS 1970's land use updates that took two to three years and cost about a half million dollars can now be produced in less than a year for about a third the cost. The Erie County Water Authority estimates that 70% of the effort involved in producing a revised map is eliminated by automated mapping.

Some maps need to show the entire state, to display such things as drainage basins.



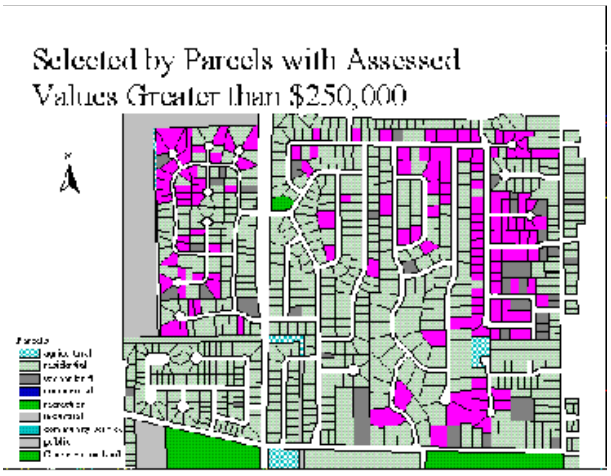
Courtesy NYS Department of Environmental Conservation

Or the boundaries of a particular watershed may be displayed.



Courtesy Westchester County GIS

Others maps are prepared to answer specific questions from developers or others.



Courtesy Town of Amherst & Erie County Water Authority

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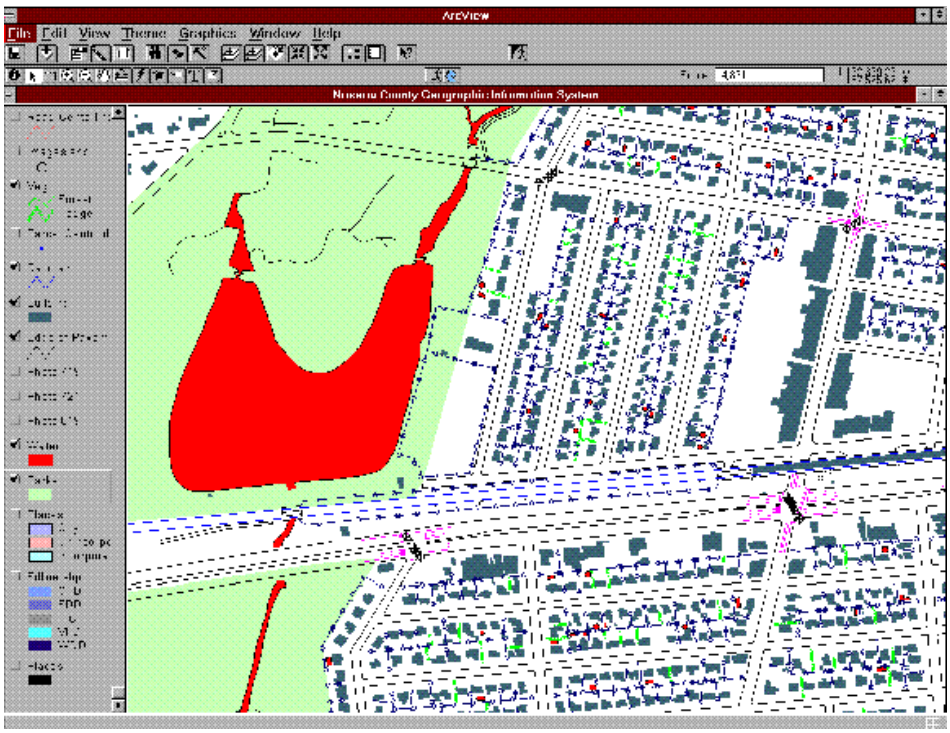
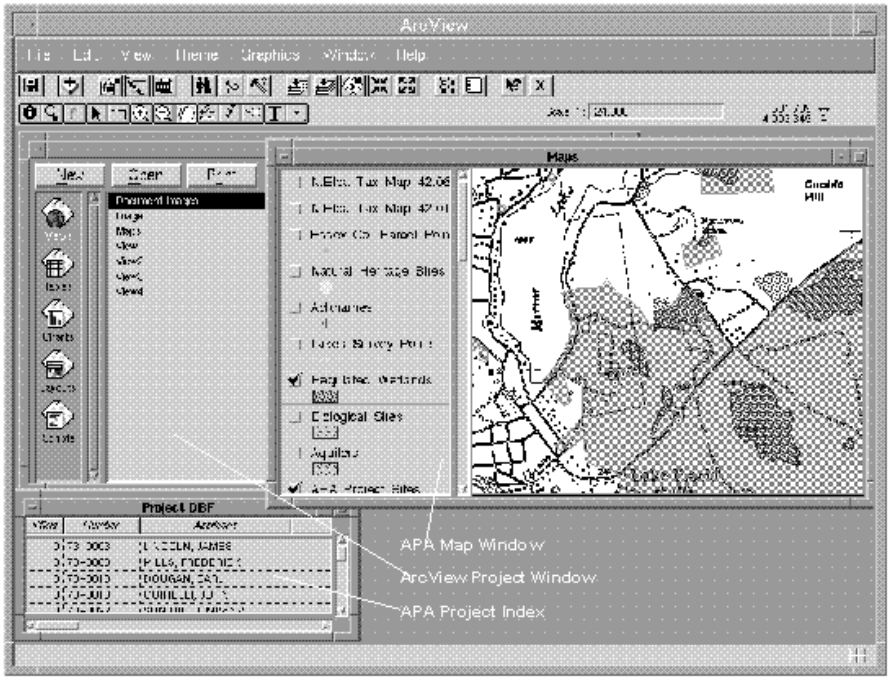
This figure illustrates the level of detail which can be captured and displayed using modern GIS software. Some of the features shown below include bodies of water, buildings, streets, pavement markings, traffic signals, railroad tracks, and stations. In all, sixty-four different features have been captured in the Nassau County GIS system.



Courtesy Nassau County GIS

Once such information is available in a GIS, it can be used by many public and private organizations, for many purposes. Within Nassau County, for example, over 100 organizations share spatial data.

Geographic Information Systems can link computerized mapping and display capabilities with virtually any type of database imaginable. One common feature is the capability to "click" on a map feature and retrieve information associated with that point in space.



Courtesy Adirondack Park Agency and the Center for Technology in Government

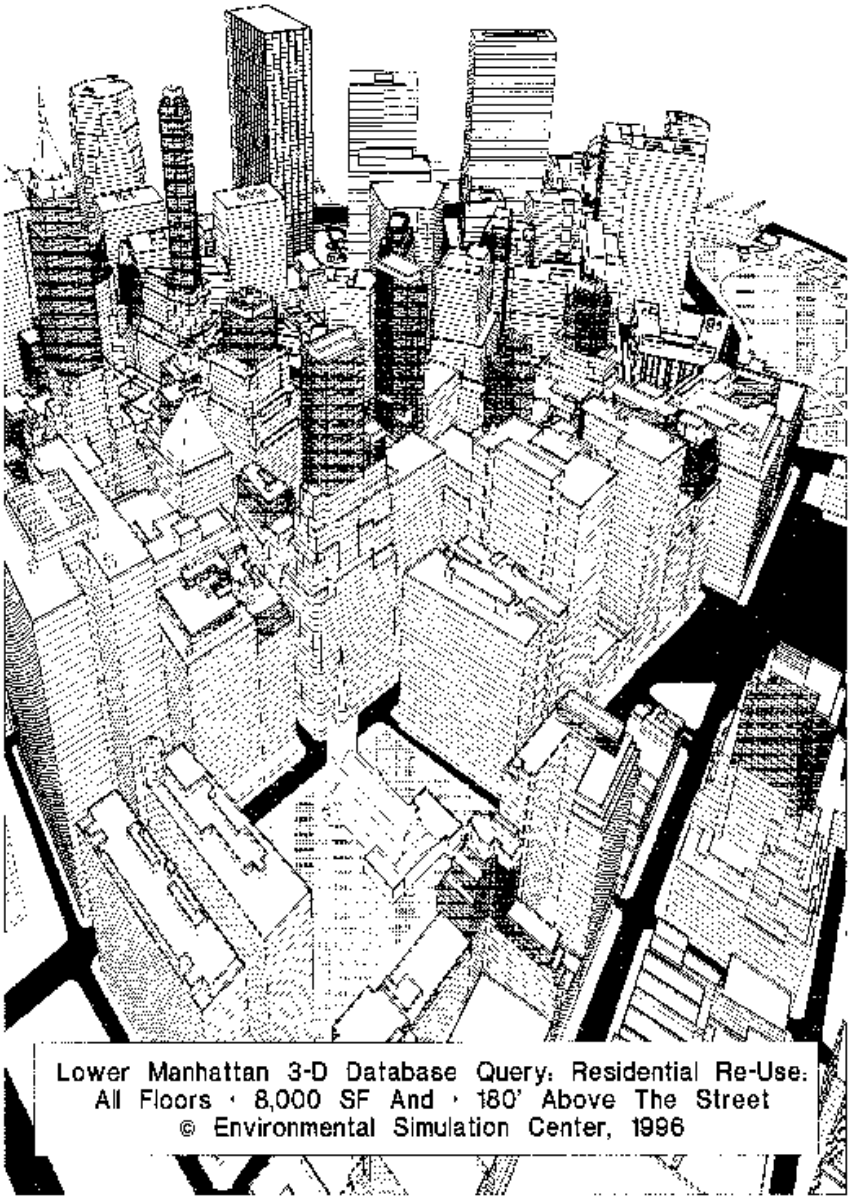
Geographic information systems can integrate information from a wide range of sources and make it accessible through the common denominator of location.

Much is happening at the frontiers of GIS research and development. New ways to apply GIS to solving public problems are constantly emerging. New York is fortunate to have several academic institutions across the state with particular strengths in GIS. Programs at SUNY Buffalo, Cornell, Syracuse, SUNY ESF, SUNY Albany, and CUNY are discussed in the section on university roles.

One interesting advanced GIS example came to our attention from New York City, where people have to think more vertically than in the rest of the State.

The Environmental Simulation Center at the New School for Social Research has developed three-dimensional GIS databases- from real property records and other sources- for neighborhood planning and development in various parts of New York City. Their biggest project is a 3-D simulation of lower Manhattan which has already been used to suggest residential conversion of office towers.

The graphic below depicts part of a 3-D database query to identify, for possible residential re-use, building floors of less than 8,000 square feet that are more than 180 feet above street level.



Courtesy New School for Social Research

Geographic Information Systems can be constructed to be able to answer such questions as:

Show me all the vacant parcels of land in the county over four acres in size, zoned light industrial, within four miles of an interstate exit, and with sewer and water service available.

Given the drainage in the New York City watershed, what agricultural lands will be most important to reducing contamination from runoff?

How many potential customers with given demographic characteristics live within a 20-mile radius of this proposed business location?

Given the storm surge projected from the coming hurricane, what coastal areas may be flooded and require evacuation?

Show me residential locations of these types of cancers and known points of air, land or water chemical contamination of these types.

Show me all the road intersections without stoplights in this township where there have been personal injury accidents in the past four years, highlighting any fatality scenes in red.

What is the most efficient and cost-effective routing for school buses in this district, given where children of various grade levels reside and the times of day at which certain grades must be transported?

These questions only begin to give the flavor of the analytic power that can be generated by a sophisticated Geographic Information System.

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Chapter 3

GIS as an Economic Development Tool

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(a) an inventory and analysis of the following:

(iv) the use of geographic information systems as an economic development tool...

"Economic Development is becoming more of an information business, or information game, where people demand detailed data on a broader range of topics."

Office for Research and Communications
South Carolina Department of Commerce

"Fueled by the need for limited doses of targeted information on a widely diverse range of subjects, the economic development field is advancing as rapidly as most into a new era of information access and retrieval... the competitive pace is being set by those availing themselves of new opportunities."

J. Curry, "Information for Developers: Cost, Value, Need"
in Economic Development Review, 3, 1985

"Economic development is dependent on quality, accurate information from many sources... The company or consultant is likely to request information on Superfund sites, wetlands delineation, water/sewer and other infrastructure, utilities costs, labor availability, and many other pertinent needs... If much of this information could be accessed quickly by the developer, weeks, sometimes months, of delay in siting could be eliminated. GIS technology can provide this information-handling capability to the developer's desktop, allowing the developer to provide accurate and current data immediately...

...It is the belief of this writer that the early users of GIS for economic development purposes will benefit greatly during the coming information age and that those hesitant to provide this level of service to their economic development prospect will fall behind their competition."

--Scott L. Millar, "Establishment of a GIS in a County Development Office"
in Economic Development Review, Winter, 1995

"George Robertson, president of the Schenectady Economic Development Corp., ... notes that a company's most important criterion when seeking to build or locate in the region usually has nothing to do with the quality-of-life issues so dear to civic boosters. Rather, it's getting a suitable piece of real estate.

'People get hung up on the frosting, the quality of life stuff, and they tend to think that's most important, when, in fact, the number one thing we need is to locate the right piece of land.'"

Albany Times Union, December 17, 1995

Information is a vital resource that can be put to work to achieve economic growth. While other states are leveraging their information resources in support of economic development activities, New York State lacks the comprehensive statewide information infrastructure and tools necessary to do this effectively.

In short, New York State is at a competitive disadvantage in responding to requests from developers for information that would encourage economic growth.

In New York, no formal coordination process exists for GIS, and there is no fully operational data clearinghouse. New York State agencies struggle to assemble the information to fulfill requests, as the State has no comprehensive digital data on utility access, zoning maps are available only at the local level (and are usually in paper form), flood plain maps do not exist in digital form, adequately detailed topographic data does not exist in digital form for most of the State, and soils data requires significant processing of large data files.

GIS offers enormous potential to support economic development and planning activities. These systems can be used to support analyses

related to business expansion as well as the formulation of effective public policies to support this expansion. A GIS can be used to identify sites, locate customers and suppliers, and minimize transportation and shipping costs.

GIS can be used to develop and evaluate public policy decisions related to business expansion. The following are examples (Drummond, 1995) of activities which support policy development:

- Identify current and emerging clusters of globally competitive industries
- Determine the best locations for new investments in public infrastructure
- Develop fair, effective incentive programs to encourage job creation in distressed areas
- Target education and training programs to support vital industries
- Organize networks of small business for joint marketing and purchasing

In a 1994 report explaining the rationale for GIS coordination in the State, the Arkansas Mapping and Land Records Modernization Advisory Board outlined the various uses of spatial data by private sector entities. As shown in the table below, digital spatial data can be used by many different types of private sector entities in order to increase efficiencies in operations, select optimal sites for location or expansion, and potentially create competitive advantages. The availability of and access to spatial data may therefore influence the competitive advantage that businesses within New York State have vis a vis those businesses in other states or nations.

Economic Impact of Land Records on Private Sector Economic Development

Public Utilities	• Map transmission facilities including data on land ownership, construction configuration, facilities characteristics, etc. • Used to schedule maintenance, respond to emergencies, and for sales and marketing purposes.
Retail	• Target trade areas • Locate new store • Store-specific product stocking plans
Transportation	• Delivery and trucking companies are developing optimal routing systems to minimize travel time and costs and to maximize loading • In-vehicle navigation
Farming, forestry, and agribusiness	• Management of forest lands
Banking	• In response to federal regulations, banks are using GIS to assess the distribution of loans to support community reinvestment analyses and reports. • Target marketing • Strategic planning • Growth and development trends • Deposit structure changes • Identify geographic changes in household finance and composition
Real Estate	• Site selection analyses • Identification of characteristics of properties (e.g. school districts) • Assess neighborhood trends in market prices • Client presentations
Health Care	• Site locations for offices and clinics • Optimal routes for emergency vehicles • Positioning emergency vehicles
Improved ability to respond to federal requirements	• Respond to federal environmental regulations associated with development

As the Center for Technology in Government noted in its report, "Sharing the Costs, Sharing the Benefits: The New York State GIS

Cooperative Project:"

"The absence of a geographically-oriented information infrastructure also precludes the state from adopting a proactive approach to development. Such an approach would include an inventory of existing businesses in the State, their locations, and their inputs and outputs; maintaining an inventory of existing sites for development, including the work force characteristics of these areas, other associated socio-demographic factors, resource availability, and infrastructure limitations. This kind of data resource would allow economic development agencies to identify those industry types that would be most competitive in a given region and help them carry out targeted marketing to business. While other states, such as South Carolina, have comprehensive statewide GIS containing the information that businesses demand, New York State continues to lag behind, reacting to specific requests rather than aggressively mining that information for strategic opportunities. New York will not become competitive as a state without developing a comprehensive ability to use information strategically."

Economic Development GIS in Other States

A related study by the Center for Technology in Government (Kelly, 1995) found that many other states have developed comprehensive GIS to support economic development activities at the state and local levels. These systems, often combined with other presentation technologies, are being used to identify sites for new or expanding businesses and to enhance marketing activities.

Alabama's Resource Center (ARC) which supports its economic development programs, includes a 75-seat auditorium, guest offices, a dining room, and a helipad which utilizes touch-sensitive TV monitors to navigate through databases, photographs, maps, and other graphics describing available sites and buildings in Alabama. The Resource Center includes a GIS which is used to create customer maps and provides zooming and searching capabilities. The ARC's data and multimedia are accessible via a telecommunications network in four satellite offices and the databases are accessible to 20 local economic development offices as well as the Alabama Development Office and power company project managers.

The Georgia Resource Center in Atlanta boasts an amphitheater with three large video screens on which demographic and other data, as well as geographic and property features can be displayed simultaneously. It also includes a GIS system which allows for the production of three-dimensional graphics and animation to visually represent a prospect's new facility on a particular site including such features as truck access, rail, landscaping, and parking. The system also allows for the enhancement of photos to demonstrate how an existing building could be modified for a particular project.

The South Carolina Department of Commerce has also developed a multimedia presentation center featuring an extensive GIS. The GIS contains more than 30 different databases including information on available properties. The system allows a user to derive anything from the number of college-educated workers to the number of suppliers of plastics within a specified drive time from a potential site.

The Massachusetts Alliance for Economic Development has developed a SiteFinder system which incorporates mapping software allowing for a variety of geographic manipulations and queries (Ebisch, 1995).

In short, many other states are utilizing GIS to respond rapidly to inquiries from prospects and to readily create visual demonstrations of a site's overall suitability. These systems are being utilized to enhance marketing capabilities and to more effectively allocate resources to encourage statewide and regional development. GIS combined with multi-media presentation technologies are being used to provide comprehensive information for site selection. Many states have the additional capability of providing access to this information on laptop computers, and over telecommunications lines. Several states are also offering this information over the World-Wide Web, reaching audiences all over the world.

Economic Development GIS in New York State

Several regional groups in New York State have recognized the value of this technology in support of economic development activities. The Adirondack Park Agency (APA), recognizing the need to work cooperatively with local governments within the Park has been developing partnerships with town and county governments to resource share in the development of digital tax map data. Additionally, the Park Agency is reaching out to these local entities to provide information on tools such as GIS as well as the availability of data resources from APA, other State and federal agencies, and the private sector that can be used to support bottom-up community development.

The Saratoga Economic Development Corporation, (SEDC) in cooperation with Niagara Mohawk, Saratoga County, and the New York State Adirondack Park Agency, has begun to develop a GIS to support regional economic development activities. Their strategic approach includes the development of a GIS containing digital tax map data for Saratoga and surrounding counties, socio-demographic data, available sites for industrial development, as well as an inventory of existing businesses so that economies can be realized in new business development. Additionally, SEDC will be better able to analyze the benefits of potential infrastructure improvements on the regional economy. SEDC has successfully utilized a GIS to identify appropriate sites for an industrial park in the town of Corinth using such criteria as minimum acreage, proximity to rail lines, soil type, proximity to wetlands and water sources, land classification, and power capacity.

In the Western region of the State, the Greater Buffalo Partnership, the largest employer organization in the Western New York/Southern Ontario Region, is also currently developing a fully functional GIS as part of their Information Central Initiative. The targeted uses for the information infrastructure include:

- Economic development activities such as assisting relocating firms and executives to the area and attracting business to the existing base in the area;
- Assisting businesses and the not-for-profit sector with demographic analyses; and,
- Providing "thought leadership" in the GIS field to enhance efficiency and effectiveness in the public sector.

The Capital District Regional Planning Commission (CDRPC) is a non-profit organization whose primary mission is to study the needs and conditions of the Capital Region and to formulate and implement plans and recommendations which promote sound and coordinated development. CDRPC also provides local technical assistance and serves as a regional data bank and information center. CDRPC is using GIS to support a number of activities and plans to implement a more comprehensive system in the near future. The system currently in place, has enabled CDRPC to work cooperatively with the State Department of Economic Development as well as other local and regional economic development organizations in compiling information requested by businesses considering locating in the region. Additionally, CDRPC has used the GIS to compile demographic information in support of marketing activities for industrial parks in the region. The GIS has enabled the rapid integration and analysis of information which would have been infeasible under a manual process. Additionally, the agency used a GIS in support of a Groundwater/Wellhead Protection Program for Southern Saratoga County. The agency, recognizing the need to integrate environmental considerations into regional economic development activities, is in the process of expanding their GIS capabilities to include more comprehensive and diverse regional information which they intend to share with local governments and State and regional planners and economic developers.

Several economic development activities in New York City are also being supported through the use of GIS. The Environmental Simulation Center at the New School for Social Research has developed a three-dimensional databases for neighborhood planning and development in various parts of New York City. The Staten Island (SI) Economic Development Corporation, aligned with the SI Borough President's Office has selected a developer for a GIS specifically for use in support of economic development activities for the Island.

For these groups, customized and targeted marketing studies and other activities that were infeasible or not cost-justifiable under the manual process can be generated quickly and routinely. These organizations will be able to provide comprehensive information to businesses considering locating in New York State. Additionally, they will have the tools to adopt strategic planning initiatives which will benefit the citizens within their respective regions and the State as a whole through increased tax revenues.

While pockets of activities to support the use of GIS in regional economic development endeavors are emerging, no statewide plan has been implemented. Therefore, New York State's ability to comprehensively and effectively use information to attract and expand business in the State has been hindered. As policy-makers work toward making the State more business-friendly through tax reductions and decreases in the complexity of the regulatory environment, they can improve the State's competitive position by seizing the opportunity to effectively develop and utilize vital information resources.

Continue | **Table of Contents**

Chapter 4
Uses and Users of GIS

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(a) an inventory and analysis of the following:

(iii) potential users of state and local geographic information systems services;.

GIS Everybody's Favorite Tool
Governments never seem to run out of new uses
for geographic information systems

Computerized maps displaying roads, property boundaries and utility lines in colorful graphical form have become the lifeblood of government planning....

The use of GIS technology is expanding rapidly and creatively from the early days when engineers and planners first took department data and turned it into digital maps to assist public works agencies with road repairs or planning and environmental departments with land and water management. Many additional agencies are getting their hands on maps created for existing GIS systems and tailoring them for their needs.

Digital mapping is taking hold in law enforcement, emergency response, social services, education, revenue departments and more. "Every year we probably kick out 15 or 20 new uses," says Hank Garie, GIS program director for New Jersey's Department of Environmental Protection. ***"It's only limited by your imagination."***

Interest in GIS technology is booming because most of what governments do has a geographic component, and GIS makes it easier and quicker to work with the information. ***Computerized mapping brings data to life.*** *Information from various agencies can be overlaid in a way that going back and forth between paper documents or separate computer screens could never duplicate.*

Geographic Technology in Government: An Observer's Perspective

"GIS practitioners have become integral to government. They have used the technology to devise creative approaches to vexing problems..."

"From the technician in charge of a municipal GIS for a small town in Illinois to the NASA scientist tracking the spread of malaria on the other side of the world, ***GIS uses have become as varied as the problems themselves... and seem limited only by the creativity of the GIS practitioner..."***

Robert B. Hoch in GIS World, August 1995

Uses of GIS

GIS is regarded as the best technology to understand and solve problems associated with data whose common attributes are related to space and geography. Experts estimate that up to 80% of the data used by government agencies has a spatial dimension. These data can pertain to neighborhoods, people, physical infrastructure, land parcels, political boundaries and a host of other topics. GIS spatial analysis and display capabilities allow a holistically organized view of a community and its citizens because they provide the ability to overlay and analyze interrelationships among these disparate data. This holistic view makes it possible to design and deliver more effective and efficient services.

Geographic information systems are multi-purpose tools. They have the power to integrate information from a wide variety of sources to make it more useful for more purposes. They are most useful and cost effective when viewed as a common data resource and analytic tool that can be brought to bear on problem solving in ways limited only by the imagination and creativity of the user. However, to illustrate their range of uses, the Council grouped GIS applications into seven broad functional categories:

Economic Development
Environment and Natural Resources Management
Education
Health, Safety, and Human Services
Infrastructure Management

Comprehensive Planning and Zoning
Real Property Records Management

Economic development having been discussed in the previous chapter of the report, this chapter discusses the types of uses and users of GIS in the remaining functional areas.

Environment and Natural Resources Management

Geographic information analysis allows planners and policy makers to understand the environmental effects of their policy choices. Since environmental concerns do not stop a the county line, the information needed to assess them must be shared among different jurisdictions and agencies. GIS is used in New York to support such environmental management activities as managing forests, watersheds, wildlife habitats and wetlands, as well as monitoring various sources of pollution.

The NYS Adirondack Park Agency, the New York State Departments of Environmental Conservation and the New York State Office of Parks and Recreation all use GIS to support their agency's programmatic operations.

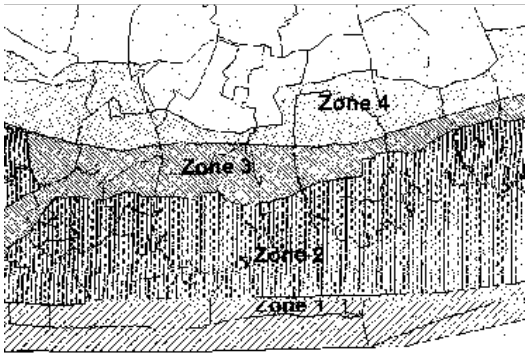
The Department of Environmental Conservation (DEC) has developed a GIS to support the identification and remediation of hazardous waste spills, including the capacity for identifying and notifying property owners within affected areas. DEC is also developing statewide maps to be used in studying flooding and in pollution control, more fully described in Appendix IV.

GIS will support the New York City Watershed Agreement, a landmark conservation effort bringing together upstate and urban interests to protect New York City's drinking water announced by Governor Pataki and officials from New York City and affected communities in November, 1995. The plan is intended to avert the need to build a multi-billion dollar filtration plant and to promote nonpolluting economic development in those areas surrounding New York City's 19 upstate reservoirs. Under this agreement, New York City will increase by three-fold its land holdings within the drainage basins that feed its reservoirs and will spend $350 million on projects that support environmental protection projects for the communities in these basins.

New York City has developed a GIS to improve analysis and decision-making by utilizing multi-faceted spatial data pertaining to water quality, infrastructure, topography and land uses in the watershed. In order to acquire accurate and current information regarding the exact location and ownership of land parcels within its watershed areas, the City entered into a partnership with the NYS Office of Real Property Services to coordinate the conversion of tax maps in the eight counties that contain watershed parcels.

Environmental information, when shared, can be used for many other purposes. The Federal Emergency Management Administration (FEMA), for example, prepares maps of flood prone areas that are used by many public and private agencies for land use planning, evacuation planning, and establishing flood insurance rates.

Nassau County and FEMA developed GIS data on potential flooding areas for the South shore of Long Island. Nassau County's own Emergency Management Office overlaid police and fire district boundaries and elevation data to develop a series of evacuation zones for different intensities of hurricanes and other coastal storms, as shown below.



Courtesy Nassau County GIS

Health, Safety, and Human Services

Geographic information systems allow policy makers, analysts, and program managers to promote the health, safety, and welfare of individuals, families, and communities. GIS is regarded as the best technology to understand and solve problems associated with data whose common attributes are related to space and geography. These data can pertain to neighborhoods, people, physical infrastructure, land parcels, political boundaries and a host of other topics. GIS spatial analysis and display capabilities allow a holistically organized view of a community and its citizens because they provide the ability to overlay and analyze interrelationships among these disparate data. This holistic view makes it possible to design and deliver more effective and efficient services.

- Public health objectives served by GIS include epidemiology, facilities siting, needs assessments and health services planning.
- Public safety objectives served by GIS include police and fire protection, emergency medical services, and disaster mitigation and management.
- Public welfare objectives include neighborhood development, service directories and referral services, and policy analysis and program evaluation.

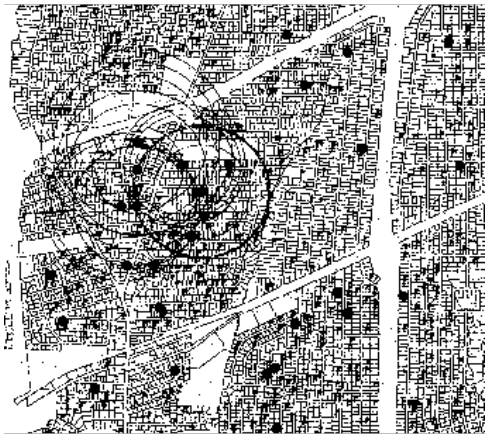
Providers and users of GIS data for health, safety, and human services applications span a wide range of organizations. Within Nassau County, for example, two dozen or more government organizations provide or use spatial data. Similar users exist in other counties and at the state, town, city, village, and special district levels of government. In addition, there are many private, academic, and nonprofit data users and data providers.

One of the most compelling reasons for geographic information systems is evident in the field of disaster preparedness and response. Emergency-911 systems that dispatch emergency services to the site of an accident, fire, or other emergency all rely on GIS. Major events, such as hurricanes, and hazardous chemical spills, require the integrated response of many different kinds of emergency services that may be delivered by different political subdivisions or levels of government. An integrated GIS system allows these organizations to respond as a

team to a dynamic and dangerous situation.

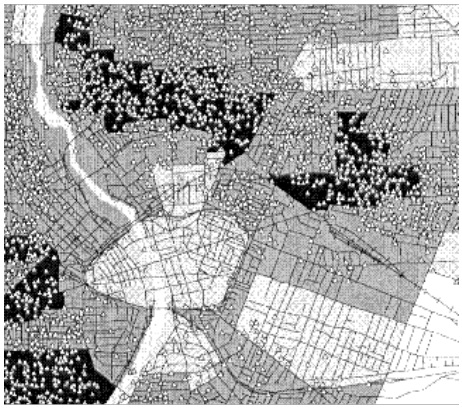
One example of how GIS supports public health is the Primary and Preventive Care GIS sponsored by the New York State Health Department. PPCGIS provides dial-in access to a continuously updated repository of data that is relevant to health services planning, research, and evaluation. It provides data manipulation, mapping, and analytic capabilities for health care planners, researchers, insurers, program evaluators, and health care providers. PPCGIS includes such data layers as population estimates, socioeconomic indicators, hospital utilization data, teen pregnancy data, deaths, service providers, hospital market areas, school districts and political boundaries. With these data sets and analytical tools, users can identify high need areas within their communities, compare need with service availability, and discover geographic patterns and relationships that reveal usage patterns and community needs for primary, preventive and managed care services.

Geographic information systems are being used to look for potential clusters of breast cancer incidence on Long Island.



Courtesy Linda Timander, Hunter College (CUNY)

And for analyzing data on levels of lead found in children's blood tests to determine areas of the State where children may be at greater risk of exposure to lead.



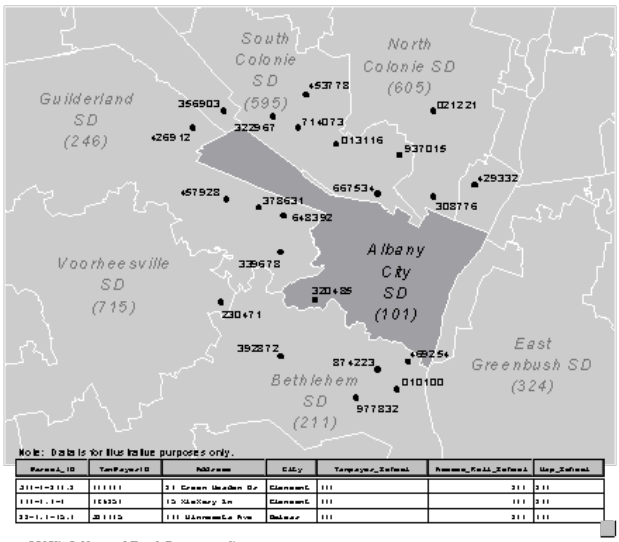
Courtesy NYS Department of Health

Education

Geo-spatial data can enhance learning and educational use of GIS is an important side benefit to geo-spatial data collected for other purposes. The ability to demonstrate placement of factual data, such as demographic or civic information, helps a wide range of learners in a variety of age groups and classes. Statewide coordination and the information provided by a Clearinghouse would give teachers easy access to at least public domain geo-spatial information for classroom use. Public and school libraries already exist as premiere communications channels for other types of classroom support. A Clearinghouse would provide a new tool for teachers without increased costs.

In addition, schools can use GIS for such things as forecasting enrollments, optimizing bus routing and other planning and customer service needs. There is another GIS example in education that is pertinent at this time of year, having to do with that box on State income tax forms that asks for a school district code, and how GIS helps ensure that the billions of dollars of State school aid go to the right school district.

State aid for education is based, in part, on the relative personal income wealth in school districts. Income wealth is attributed to districts based on the school district of residence codes reported by taxpayers. However, school codes reported by taxpayers are often incorrect. This misattribution of reported income can result in less than equitable distribution of State aid to schools. In tax year 1992 and tax year 1993 combined, aid formulas were applied to the approximately $523 Billion in total adjusted gross personal income to allocate approximately $19.7 Billion in State aid for education. By using GIS technology along with other computerized methods, approximately $33 Billion in personal income was identified as misattributed (or unattributed) by taxpayers and was correctly attributed in time for State aid calculations.



Courtesy NYS Office of Real Property Services

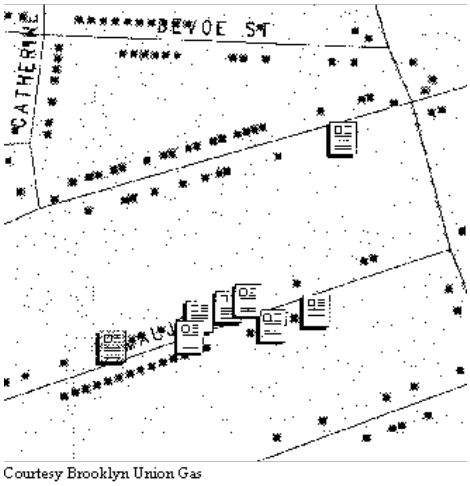
Infrastructure Management

The planning, design, construction, operation and maintenance of the infrastructure on which the State's economy depends can be managed most effectively through the use of GIS and more efficiently through a coordinated effort. The State's infrastructure; highways, railways, waterways, water and sewer systems, electric, gas, telephone and telecommunications systems, are the foundation of the State's economic development potential. The first Interim Report on New York's Infrastructure prepared by the New York State Assembly Infrastructure Task Force in 1983 recognized the need for increased coordination in planning and executing infrastructure management programs in order to "use the resources that are available in the most intelligent manner possible."

Across New York infrastructure systems are under the jurisdiction of Federal, State, County, City, Town and/or Village governments, special district administration and/or private corporations, many if not all sharing common "corridors." The 1983 report recommended that "The Governor and the Legislature should work cooperatively to establish an infrastructure database that would be available not only to both members of the State government for State Capital planning and budgeting purposes but also to local governments for use in their capital planning and budgeting activities." Coordinated, state-wide GIS data would facilitate creation of this database and would be used to assess infrastructure conditions and needs for, among other things, the state's 110,000 miles of roads, 17,800 bridges, 1800 community water supply systems and 573 wastewater treatment systems.

Utilities, for example, can use GIS to plan and manage their physical infrastructure and customer service operations.

The example on the left illustrates how Brooklyn Union Gas uses GIS to plot and schedule work orders.



Courtesy Brooklyn Union Gas

Comprehensive Planning and Zoning

Comprehensive planning and zoning are essentially the processes by which we balance economic development with environmental protection, and by which we develop strategies for wise use and conservation of our natural resources. In comprehensive planning, a unit of government makes a thorough analysis of all its natural, cultural, and socio-economic characteristics and features, then uses this data to design programs and policies to attract, accommodate, and guide future development and growth.

GIS is essential to the effective inventory and analysis of community assets required for Comprehensive Planing and Zoning. The resulting products are adaptable and can be updated, and in some cases GIS is the only way to maintain data which is temporal. Simulation models are made possible (e.g. growth, build-out, water quality, economic, emergency response time) and common "fields" provide links between separate data sets. Intricate community dynamics can be explored. In addition, GIS facilitates the evaluation of policy effectiveness.

Project Review

Proposed development projects are reviewed by governmental bodies against an established set of performance criteria before permits are issued. Project review may value a subdivision, planned unit development, or commercial or industrial activity. Most project reviews will fall under the auspices of local zoning, site plan review, or subdivision regulations. This may require close coordination with the county and/or state government under requirements of the New York State Environmental Quality Review (SEQR) Act.

Facility Siting

Facility siting involves both public and private sector decision-making regarding the appropriate location for a particular facility whether it be a school, fire station, manufacturing plant, office building or waste disposal site. Because facility siting generally involves a permitting process and/or SEQR review, multiple state and local agencies may be involved. Facility siting is essentially an economic and environmental decision-making process. The quality, scope, cost and accessibility of information will to a large degree determine the quality of the decision. A comprehensive GIS database makes siting information more accessible and cost-effective, and can dramatically improve the quality and scope of information which is readily available.

Zoning Administration

Zoning administration is day to day management and implementation of a zoning ordinance or local law. This includes providing information to the public regarding zoning for a particular parcel of property or general area of a community, as well as maintaining records affecting a parcel of property such as existing land use, non-conforming status, and variance, site plan or special permit applications approved or denied.

Real Property Records Management

Property information is considered the foundation of municipal information. Property data, at the level of discrete parcels, contains the geographic matrix- cadastral maps and addresses- for the collection of most other data. In a Wisconsin study of data transactions, parcel-related data was by far the most frequently exchanged type of data. "This is the building block of land-related data systems for local governments and private businesses." (Miller, 1993 p. 79)

GIS can better manage property data for the public, lower response time for retrieval, facilitate reproduction, ease maintenance, and increase productivity of staff.

GIS can make property data readily accessible for economic development; allow property data to be the information base for many other uses; and can allow access to property data for such interested parties as banks, insurance agencies, real estate brokers and investors, title companies and, multiple listing services.

Property information is at the crux of municipal information systems, the intersection of private rights and public needs. It is the basis of maintaining, protecting and taxing property, and of planning, zoning, new infrastructure and the distribution of many municipal services. This information contains features, found in almost every jurisdiction, which combine to increase its resource value.

Ownership data associate property with people and locations. This is the basis of communication regarding property. Property ledgers or computer generated output are convenient sources of mailing lists for political, cultural and economic concerns. In countries where a population register exists, rather than a census, ownership data is a link to demographic information.

Improvement data detail the built-up assets of a jurisdiction. This is its most important source of tangible wealth and second only to its population as a resource. It is the basis of an inventory of all facilities.

Land use and building use data describe the activities that occur on different parcels and thus link economic use to specific places. Such information is invaluable to planners.

Complete coverage of an entire jurisdiction is inherent in property information. While other agencies and private enterprises may collect similar information, they usually do so only for a subarea or special project.

Maps enable all of the above data to be displayed with respect to the geography of a jurisdiction. They link property data with any data that has location. Maps delimiting property ownership are often the initial source of a jurisdiction's geographic information system.

Archives extend property information in time. Old maps and photographs, data on land ownership and improvements, deeds and legal instruments all document the past. In North America, property archives are often those with the oldest information and the most complete coverage in space and time. (Eichenbaum, 1993)

Overlapping Information Needs

The important programmatic areas described above depend on the implementation and use of GIS and the availability of and access to information needed to support these systems. While some of the information requirements to serve these different application areas are divergent, there is also an enormous amount of overlap among them. Much of the data needed to support economic development activities are the same as those required for disaster preparedness and mitigation and environmental conservation activities, as well as a host of other programmatic activities.

GIS technology is being used in support of a number of application areas critical to New York State. GIS offers the capability of integrating diverse data sets and conducting modeling and analysis activities infeasible or extremely resource intensive under manual processes. Much of the data created to support one application area can be used in support of other programmatic areas. The benefits of the technology and the data in particular, can be maximized through increased coordination of GIS-related activities.

Every level of government can use GIS to plan and deliver services more efficiently and effectively. Additional potential developers, partners and end users for information systems include such broad classes of organizations as:

- Private Enterprise
- Consultants
- Trade Associations
- Professional Associations
- Universities
- Utilities
- Sportsman Groups
- Environmental organizations
- Professional Organizations
- Professional Surveyors Engineers
- Business Organizations
- Banks

Civic Organizations
Intra-Municipal Agencies
State and Provincial Agencies
Regional Organizations
Federal or National Agencies

Insurance Companies
Real Estate Brokers
Title Companies
Multiple Listing Services

Nassau County, for example has an extensive multi-participant program encompassing over 100 partners as shown in the following table.

CATEGORY	SIGNED	IN PROCESS	TOTAL
Towns	2	1	3
Cities	1	1	2
Villages	16	11	27
Water Districts	5	3	8
Sewer Districts	0	1	1
Fire Districts	6	0	6
Police Districts	0	1	1
School Districts	0	1	1
Educational	1	0	1
State Agencies	5	3	8
Federal Agencies	2	4	6
Utilities	0	2	2
Consultants	65	11	76
Private	0	2	2
Third Party Licenses	4	0	4
TOTAL	**107**	**41**	**148**

An extensive analysis of GIS uses and data types was conducted recently in New York City by Urban Logic, Inc. The chart below was developed from that analysis and shows the overlapping needs for the same types of data for various functional uses of GIS.

GIS Data Types by Functional Use

Data Types	**Functional Uses**											
	Business Development (Industry Clusters, Economic Development Zones, Foreign Trade Analyses)	Facilities Inventory	Service Boundary Creation and Modification	Tracking of Programs	Inspection and Licenses	Site Suitability Analysis	Map Making	Funding (Qualifying for grants/ Justifying Budgets)	Transit and Traffic Management	Dispatching (Network Analysis, Routing)	Demographic Studies	Taxation
Streets	X	X	X		X	X	X		X	X	X	X
Building (Dimensions and characteristics)	X	X			X	X	X	X		X		X
Service Areas	X	X	X	X	X	X	X	X	X	X	X	
Administration Districts	X		X	X	X		X	X	X	X	X	X
Transportation (Mass Transit)	X		X			X	X	X	X	X		
Infrastructure:												
Electric	X	X	X			X	X	X	X	X		X
Gas	X	X	X			X	X	X				X
Water	X	X	X			X	X	X				X

Sewer	X	X	X			X	X	X					X
Telecommuni-cations	X	X	X			X	X	X		X			X
Natural Resources	X	X				X	X	X		X			
Zoning (Land Use Zoning)	X	X	X		X	X	X	X	X				X
Environmental Hazards	X	X		X	X	X	X	X	X	X			
Demographic Data	X		X	X		X	X	X	X	X	X	X	
Title Land Ownership	X	X	X		X		X	X		X	X	X	

In short, the effective creation, maintenance, and sharing of data sets across government entities will serve a variety of vital purposes within the State. These overlapping information needs can only be effectively met through increased coordination among information users and information creators.

Survey of Public Sector GIS Users and Uses

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(a) an inventory and analysis of the following:

(i) the types of geographic information system data available from state, local and federal agencies operating in New York state, data compatibility, and current networking capabilities;

(ii) the types of hardware and software being used by state, local and federal agencies operating in New York state;

In support of the Temporary Council, the New York State Forum for Information Resource Management conducted a survey of GIS use in New York State. Three-hundred twenty Federal, State and local government organizations and utilities were identified as using, or interested in, GIS through: A presurvey mailed to 4800 local governments, school districts, public authorities and other local governmental bodies; condensation of 12 mailing lists; and, contacts provided by Council members.

Of the 320 organizations contacted, 164 (51%) responded. The information gathered from the respondents included:

- GIS is used for a variety of purposes by state and local governments. The most common categories of use are Environment and Natural Resource planning and monitoring (52% of respondents) and Comprehensive Zoning and Planning (47% of respondents). GIS is also commonly used for Economic Development, Infrastructure Management, and Real Property Management.

- Only 19% of respondents used GIS for a single purpose; 59% of all users have adapted the tool for 3 or more categories of use.

- Seventy one percent of respondents share their datasets with other public agencies, while 48% share with private sector organizations. 17% sell datasets to the public sector, while 27% sell their information to the private sector.

- Only 28% of respondents who sell or share datasets have legal agreements in place with partners regarding liability or resale of data.

- Narrative responses to questions regarding the benefits and impediments to GIS use both within organizations and between organizations identified clear issues. The most often cited benefit to internal GIS use was its ability to support analysis, planning and information presentation, leading to more efficient use of resources. The chief impediment to use was lack of funding and available staff resources. The key benefit to statewide GIS coordination was seen as the potential for a decrease in the duplication of effort among organizations, promoting better use of scarce resources. The chief intergovernmental impediment was seen as bureaucratic and political constraints, followed by funding constraints and the lack of standard platforms.

- Seventy two percent of respondents expressed interest in participating in efforts to test Federal Digital Geospatial Metadata Standards, with the goal of developing usable and effective standards for New York State.

- Use of particular hardware and software platforms seemed to be converging on a handful of *de facto* standards.

A full report of the survey results appears in Appendix II.

University, Private and Other Sector Roles in GIS

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(a) an inventory and analysis of the following:

(v) the role of university and private sector resources within New York state as they pertain to geographic information services.

University Roles in GIS

Overview of Academic GIS Programs in New York State

Contributions to statewide geographic information systems programs by academic institutions are quite variable throughout the nation. In most states, there is an institution of higher education that has a program focusing on geographic information and analysis needs. A profile of academic institutions in New York State with such programs was presented in a report to the New York State Science and Technology Foundation by Syracuse University (Jensen, et. al. 1990) and updated in this report in Appendix III. These academic programs based in New York State have progressed and expanded significantly in the past five years, and they are in a much stronger position to advance our knowledge of geographic information systems and technology for the direct benefit of New York's citizens.

The knowledge generated by the respective research programs is conveyed to society through teaching and publishing programs. The teaching programs take many forms, from the undergraduate classroom lecture to the professional-level workshop and consultation delivered by cooperative extension and adult education specialists. Their GIS expertise is also contributed to other levels of the state's educational system. In addition to teaching and advising, they publish research-based findings using media that are freely available to the public through our library systems. Such publications include scientific and trade journals, conference proceedings, videos, satellite teleconferences, and the Internet. There are tremendous opportunities given the emerging quality of New York's information resource management infrastructure to disseminate research-based knowledge in geographic information and technology to all sectors of society in New York State in a timely and efficient manner.

University faculty recognize as one of their guiding principles their responsibility to provide service to the public. They network and consult with the larger community, either *pro bono* or fee-based, on all aspects of geographic information systems. Enriching the community through research, teaching, and public service activities is the ultimate goal of the academically-based programs in geographic information and analysis.

Supporting a Statewide GIS Program

There are several areas in which universities can contribute to a statewide program in geographic information systems. Specific activities in these areas will be determined by the interests and expertise of staff in a given academic institution, and by the degree to which such activities advance their programs and fulfill obligations to their respective institutions. We envision GIS scientific and technical contributions from the academic sector in the following areas:

1. Development of improved spatial data processing and analysis methods in environmental assessment, economic development, information resources management, and human services programs.

2. Integration of geospatial data in a broad spectrum of spatial decision support systems used to evaluate environmental quality, develop local and state-level economies, serve communities, and manage infrastructure.

3. Quantification of the use, societal benefit, and limitations of geospatial data for meeting the information needs of professionals in the public and private sector of New York.

4. Contribution to GIS-related curricula for students enrolled in institutions of higher education and for professionals seeking to enhance skills, knowledge, and abilities in the use of geographic information and technology for career advancement or changes.

5. Publication of guidebooks, instructional videos, teleconferences, and other outlets to update the geographic information systems community in the state on recent advances in the technology and applications that have significantly advanced the state's goals.

6. Contribution to metadata standards to: ensure access to spatial data and information; minimize duplication of effort; and facilitate data development, transfer, and understanding.

Private Sector Roles in GIS

Private sector firms can play any or all of three different roles in geographic information systems: suppliers of GIS services to the public and other sectors; users of GIS services from others; and potential partners with the public and other sectors in joint endeavors.

As suppliers of GIS services, private sector firms provide a wide range of hardware, software, data, consulting and training services to the public and other sectors. Governments beginning GIS planning efforts often rely on private sector services for advice and assistance in starting to work with unfamiliar technologies. From database design, data translation and programming to training in GIS concepts, hardware and software, private firms are frequently called upon to assist governments in GIS efforts. As a result, many firms develop familiarity with public sector needs and activities, sharing that information with other clients and user groups, and influencing the design of new GIS products.

Private sector GIS firms are concerned that any State government efforts to provide centralized technical assistance and guidance to local governments not become State-subsidized competition to their own businesses, and that publicly funded GIS data remain available for widespread use at no or nominal cost.

As users of GIS services, private sector firms represent a rapidly growing segment of the GIS market. Geographic information systems are used by companies with large infrastructure management needs (public utilities, pipeline companies, extremely large warehousing operations, large building management companies, etc.), by companies with large tracts of land to manage (large farming operations, timber companies, mining companies, etc.), by companies with large transportation and routing needs, and by companies which need to interface with government in order to meet complex regulatory requirements (e.g. to contain pollution problems, to regulate extraction, etc.).

Private sector marketing efforts increasingly use GIS in all types of businesses. There is a growing segment of GIS known as "Business Geographics" that caters to the needs of business for demographic and other data used in advanced marketing strategies. Such strategic use of GIS by businesses pursuing improvements to their bottom lines creates both opportunities and impediments in terms of potential public and private sector cooperative relationships to further develop GIS in a given area.

While many private sector firms are interested in public sector data products, they also see their GIS operations as being of increasing importance to their own competitiveness. Many businesses are thus reluctant to share GIS data and resources without assurances that their own proprietary interests will not be compromised by such sharing. As discussed elsewhere in this report, such concerns that data shared with the public sector can become instantly and freely available to competitors through Freedom of Information laws have been a barrier to joint GIS ventures.

Possible liability for data that is shared and made publicly available is another significant concern of private firms, as discussed elsewhere, and a barrier to public/private cooperation.

Utilities and Not-for-Profit Organizations and GIS

Although not specifically mentioned in Chapter 564, the Council agreed that both utility companies and not-for-profit organizations represent significant segments of the GIS community that must be considered in any discussion.

Utilities, whether investor-owned or publicly operated, share many of the same GIS needs and concerns as any governmental jurisdiction. Many utilities are serious and sophisticated GIS users who manage their infrastructure and operations through GIS. Utilities by their very nature cover large geographic areas and need detailed geographic information to install, monitor, repair and upgrade their various telephone, electric, gas, water and sewer lines, pipes, valves and switches. Their distribution facilities typically parallel public transportation routes and their geographic data needs are similar to public transportation and other agencies for detailed locations of streets, curbs, sidewalks, property boundaries, rights-of-way and soil, slope and other data. They need demographic and economic development data for the same planning, marketing and customer service reasons as any other business or government.

Utilities would be natural partners for cooperative GIS development. The GIS benefits of increased efficiency are the same for them as for government, as are the reductions in cost from sharing basic data collection and maintenance. Some utilities have entered into cooperative GIS relationships with governments in some areas. Others have been deterred from doing so by the same data ownership, FOIL and liability barriers discussed elsewhere.

Not-for-profit organizations are increasingly both users and suppliers of GIS data and services. As providers of charitable and quasi-governmental services to the public, non-profit organizations have GIS needs that are similar to those of government. Their resources are often even more constrained than those of local governments, and non-profits could benefit from shared GIS data and services.

In some areas, not-for-profit organizations have been created to provide GIS services to governments in a region, or to act as coordinators and facilitators of public/public or public/private partnerships.

Libraries of all types help citizens and businesses, as well as educators and other professionals, locate and obtain a wide variety of information. Some libraries, such as the New York State Library, have active GIS operations. Libraries exist as information conduits - GIS is no exception. Libraries also reach into every size community and could ensure statewide access to geo-spatial metadata.

The Temporary GIS Council recognizes the significant roles that both utilities and not-for-profit organizations can play in GIS and recommends elsewhere in this report that these sectors be represented in any statewide coordinating efforts.

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Chapter 5
Coordinating GIS:
Benefits and Barriers

CHAPTER 564 OF THE LAWS OF 1994

§ 1. The legislature finds that advances in computer technology have made the use of digital, computerized mapping a highly valuable tool to support governmental programs. **Over the past decade, numerous state agencies have invested large sums in software and hardware for geographic information systems (GIS), as well as in adapting data for their systems. While the development of these mapping programs has a direct relationship to mandated agency responsibilities, the purchasing of hardware and software, and the development of geographically based data are functions which should be coordinated within and among state agencies.**

The legislature also finds that federal, state, county, and local geographic information system activities represent a significant investment in the information infrastructure which can be fostered through open communication between and among all levels of government...

§ 2. A temporary geographic information systems council is hereby established for the purpose of evaluating and making recommendations to the governor and the legislature on the development of a state-level geographic information systems coordinating body, to examine various technical and public policy issues relating to geographic information systems, **and to assess the potential costs and benefits associated with coordinating or integrating geographic information systems within New York state.**

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(c) recommendations relating to the creation of a state-level geographic information systems and analysis coordinating entity, including the structure, goals, powers, duties, and funding of such coordinating body, as well as the role a state-level body would play in assisting in the development and implementation of county and local government geographic information systems.

Most of the spatial data collection efforts within New York State have been conducted in a decentralized and uncoordinated manner. As a result, data creation has been duplicated unnecessarily and opportunities for information sharing both within the State and between the State and the Federal government have been hindered.

New York State already has a vast array of spatial data, GIS expertise, and localized coordination efforts. The value of these resources could be substantially leveraged by a policy-driven coordination effort at the State level.

Benefits: The Basic Economics of GIS

The cost of creating a Geographic Information System can vary widely, from a few thousand dollars for a stand-alone, personal computer-based system that looks at only a small amount of data, to tens of millions of dollars for comprehensive, detailed and accurate coverage of a wide geographic area.

Developing a GIS involves investment in computer hardware, computer software, geographic data, procedures and trained staff. The acquisition of the computer hardware and software are often viewed as the most expensive activity in a GIS program, but research has demonstrated that developing the geographic database can account for 60% to 80% of the GIS development costs. Continuing costs for operation and maintenance are also dominated by the data costs.

Some GIS users are interested in using only a few types of data, such as municipal boundaries and roads, or census demographics, for a given area. Others need detailed and accurate information on every property parcel, street, utility pole and pipe, fire hydrant and traffic light. Costs in the first case would be minimal. The cost to develop such data from scratch in the second case could be in the millions of dollars.

These costs obviously vary by whether suitable data already exist and can be acquired, and at what cost; whether existing data need to be converted or digitized; or whether digital data must be created from scratch by going out and physically determining the precise location of each item of interest. Digitizing and physically collecting new data tend to be relatively labor-intensive, and thus relatively expensive.

As a nine-county Genesee/Finger Lakes standards working group put it in a recent report, "Sharing of digital maps is where the real productivity gains will be made. Sharing should be promoted, if for no other reason than to digitize the same data only one time--the Digitize-it-Only-Once-Stupid (DIGIOOS) principle."

As shown in the previous chapter on Uses and Users, the information needs of different GIS applications overlap. For example, roads, political boundaries, tax parcels, and census data contribute to scores of GIS applications. Consequently, sharing data can yield considerable efficiencies and costs for GIS application development can be lowered if organizations reuse data sets that already exist.

For example, by becoming one of the Nassau County GIS multi-participants, the Village of Garden City received base GIS data at no cost from the County's license agreement. As a result of this cooperation the Village achieved two major goals:

- A full basemap of Village became available in six months instead of the originally projected three years.
- Costs were reduced by almost fifty percent.

At the other end of the state, the Town of Amherst (in Erie County) received a contractor estimate for creation of the original database of

$250,000. This same data, if licensed from the Erie County Water Authority, would have cost approximately $120,000. Alternatively, it was proposed that the data could be made available to the Town for an even lower cost if the Town would provide for the maintenance of the database.

Lower costs would not only benefit those already employing GIS, but would also allow more organizations to afford GIS tools and applications.

Sharing existing data is obviously the most straightforward way to reduce costs. Sharing is not just cost effective - it can prevent serious mistakes. Emergency planners in one community (in another state) who began sharing data and modeling techniques with Federal agencies discovered that a key shelter building on which their disaster response plans relied could well be under water when needed.

Barriers to Information Sharing and Coordination

In anticipation of the work of the Temporary GIS Council, and at the request of the Division of the Budget, the Center for Technology in Government undertook a major project proposed by the Department of Environmental Conservation to investigate the benefits and barriers to developing cooperative GIS efforts. Their report, "Sharing the Costs, Sharing the Benefits: The NYS GIS Cooperative Project" dealt with most of the fundamental issues of concern to the Council, and is excerpted below.

The CTG project reported that data sharing is not as easy or as pervasive as one might think. Availability, pricing, and ownership are common stumbling blocks. In some cases, data sharing is limited by the use for which the data were originally created. The scale or accuracy of data required by one organization may not be sufficient for use by another. Nevertheless, many data sets could be used by multiple organizations.

The CTG project identified seven management and policy factors which hinder the sharing of spatial data:

- Lack of awareness of existing data sets
- Lack of or inadequate metadata (information about data)
- Lack of uniform policies on access, cost recovery, revenue generation, and pricing
- Lack of uniform policies regarding data ownership, maintenance, and liability
- Lack of incentives for sharing
- Absence of tools and guidelines for sharing
- Absence of state-level leadership

Lack of awareness of existing data sets

Perhaps the most obvious barrier to the sharing of digital spatial data is a lack of awareness of the existence of specific data sets. For example, the State Emergency Management Office has geographically referenced all of the nursing facilities in New York State based on data provided by the New York State Department of Health. This data is of obvious value to a number of state and local government agencies, some of which may have conducted this same geocoding process. Lack of awareness may also preclude an organization from implementing a system or an application because the costs associated with spatial data creation may make the project seem infeasible. Unnecessary data duplication means scarce resources are spent multiple times on the same activity, while other needed work goes undone for lack of funds.

While this barrier was noted most often in the context of inter-organizational data sharing, it exists even within single organizations. A bureau or division within an agency may create a specific data set to support its particular programmatic need and neglect to identify and inform others within the organization who may also benefit from the use of that data. In many cases, units within an organization are completely unaware of the data holdings of their entire agency. If this lack of communication is evident within organizations, it is even more problematic across government agencies. Currently, there is no statewide mechanism in place which identifies either data sets already held by state and local agencies or those in the process of being created.

Lack of or inadequate metadata

Even when people know a certain data set exists, sharing is not simple or easy. In order to use another's data, a potential user must have specific descriptive details about its characteristics. These details, called metadata, help determine the suitability for use in a specific application. Metadata is often called "information about information." It helps a prospective user decide if a particular data set will be suitable in a new application. For example, a particular scale or level of accuracy may be important for the intended use of the data. For a time-sensitive application, the potential user may need to know precisely when the data was created and how often it is updated. If details like these are unavailable, both the data seeker and the data holder need to spend time communicating these specific characteristics. Worse, if the creator of a data set should leave the organization, critical descriptive information about the data set may leave as well.

This issue, like lack of awareness, occurs both within single organizations and between organizations. The absence of metadata, failure to understand the need for metadata, and inadequate metadata all hinder information sharing. Moreover, since metadata can be difficult and time consuming to create and maintain, data holders need tools to help them create the metadata associated with their data resources.

Lack of uniform policies on access, cost recovery, revenue generation, and pricing

Another barrier to the sharing of spatial data is the lack of clear statewide policies related to data dissemination. Since the creation or conversion of spatial data is costly, some organizations want to recover these costs by charging requesters for their use. Others prefer to disseminate their data at no charge or, at most, for the marginal cost of reproduction. In some cases the same agency will provide data free

of charge to one requester while charging another a fee for the same data.

The State's Freedom of Information Law (FOIL) was noted as a particular barrier to the sharing of spatial information. The legislative declaration which introduces the law bases the statute on the people's right to know about government processes and right to review the information on which policies or determinations are made. Many agencies believe that requesters seek spatial data sets solely for their commercial value, and not for any open government or policy review purposes. These requests can be time consuming to process. Yet, under the generally accepted interpretation of FOIL, public organizations are unable to charge more than the actual cost of reproduction for any government "record."

If information needs to be extracted, reformatted, or reconstituted in order for it to be useful to the information seeker, a new "record" would need to be created and charging for its creation may be permissible under the law. However, no clear guidelines exist for determining when these costs can be recovered and how they should be calculated.

Lack of uniform policies on data ownership, maintenance, and liability

Another barrier to sharing is the lack of clear policies on the transfer of data and what happens to it after it leaves the hands of the original creator. For example, if one organization creates a data set and distributes it to another which then modifies or adds value to the data, it is no longer clear who is the "owner" of the modified data set. Nor is it clear whether the modifier should be able to disseminate that modified data set since it also contains information created by the originator.

Any modification of an original data set raises the additional issue of whether the modified data should be automatically transferred back to the original creator, and further, which party should maintain that modified data set. In some cases, a data requester sells the data (with or without adding value). In these cases, should the original data supplier share in the revenue?

The issue of liability was also identified as a barrier to information sharing. There are several important questions in this area. If an original data set is modified or updated by the originator, what obligations exist to ensure that outside users are apprised of the changes? Is the creator of shared data liable for uses or misuses of the data? Are policies and procedures needed to assign responsibility when an individual or organization uses a data set created by another and is somehow harmed or harms others because of the accuracy or the currency of that data? Since there are no clear policies within that State which address these issues, many agencies are reluctant to transfer or share their data.

Lack of incentives for sharing

Sharing data both within an organization and across organizations requires an expenditure of resources. The resources devoted to data dissemination activities are seldom an explicit budget item. Instead, they generally come at the expense of an organization's ongoing programmatic responsibilities. Further, little or no benefit accrues to an agency as a result of information dissemination activities. Given the potential for liability for misuses of data, the lack of polices to encourage or support sharing, and the scarcity of agency resources to pay for dissemination, it follows that agencies have little to gain from publicizing their data holdings and thereby increasing external demand for their data.

Absence of tools and guidelines for sharing

Many states have created mechanisms, policies, and processes which facilitate the sharing of spatial data--mechanisms that are absent in New York State. For example, many agencies have investigated the benefits of aerial photography, but few have the resources to support this method of data collection as their individual needs represent only a small part of the full data set that could be generated from a statewide database. At present, no one organization has the authority or the funds to organize a statewide effort of this kind. Tax maps are another example where partnership arrangements would produce a data layer of immense value to many public and private organizations. However, since the tax maps "belong" to the counties, only those counties with enough money can create them on their own.

Absence of state-level leadership

Many of the barriers to sharing discussed above are the result of the state's past failure to provide effective leadership or guidance with respect to GIS activities. Costly data creation and system development activities continue to be conducted in an uncoordinated manner. To date, data creation and application development have continued without central oversight and in the absence of a statewide strategy. This situation is not only costly, it puts New York at a distinct disadvantage when compared with other states.

Need for a Coordinating Body

The CTG project report proposed "An Action Agenda for a Statewide GIS Coordinating Body" based on regional meetings involving more than 200 members of the GIS community that enumerated many coordination issues and gathered perceptions of the need for a GIS coordinating body in New York State. They also identified issues to be addressed by a coordinating body and reached a high degree of consensus about what such an organization should do:

- *Sponsor a statewide data clearinghouse*
- *Develop policies for data development including data quality*
- *Adopt standards for metadata, data transfer, and other purposes*
- *Develop policies on data access and data security*
- *Provide for multi-organizational communication and coordination*

- *Sponsor a formal education program*
- *Develop and support cooperative funding strategies*
- *Act as a formal liaison between the state and the federal government*
- *Provide a contract or proposal review service*

Approaches to GIS Coordination

GIS development in local government typically occurs within a single agency, frequently a city or county government, less so a town or village. Special purpose agencies, such as a water authority, are also developing GISs. A well organized GIS development program within an agency usually involves cooperation among several departments, usually with the project leadership coming from one department (engineering, public works, planning, etc.). Less frequent is coordination among multiple agencies with interest in the same geographic area, although the benefits of coordination realized in single agencies are also achievable in multi-agency efforts. In New York State, a few metropolitan areas are proceeding with coordinated GIS programs but there is potential for more coordination and greater benefits.

Local governments, in conducting their daily business, already share data and information. The most commonly shared data are the tax map and associated property information files. Many local government functions concern individual properties directly (ownership) or are linked to a property (residence or business activity). Typically, one government agency is assigned the responsibility of assembling and maintaining information about properties in its jurisdiction and shares this data, in both map and tabular form, with other jurisdictions and businesses having interest in the area.

This sharing of data reduces the cost to each individual jurisdiction using the data. Also, smaller jurisdictions, i.e., villages, who could not afford to assemble the information by themselves, can access the data provided by the larger jurisdictions. The same principles apply to GISs. Data collected and assembled in a GIS can be shared with anyone with interest in the area.

What is different in the GIS environment is that a GIS database must be planned and coordinated from the beginning of the GIS development process to ensure that a multitude of needs can be met. Also, the legal and financial aspects of sharing data, which have evolved over time for paper systems, should be addressed and resolved in the GIS planning stages. Of paramount importance is public access to governmental information. In a paper environment, where documents are "eye-readable" it is fairly easy to provide copies to interested parties, either free or at minimal cost. In a GIS, information is digitally coded and requires sophisticated technology to be useable. This means that the technology must also be available to the public, businesses, etc.

If coordinated planning and agreement on appropriate base maps do not take place at the beginning of GIS development, problems in sharing data will occur later. For example, coincident line problems arise when two geographic layers are overlaid and lines such as shorelines, rivers, civil divisions, etc., do not lie on top of one another. The non-coincident lines are both aesthetically displeasing and a data processing nightmare. This problem is caused by different suppliers of data using different base layer data. There are a number of municipal boundary layers available for New York State from various state agencies and, in addition, many users have digitized their own boundaries. This plethora of slightly different data from different sources can result in many lost person hours. The problem is not restricted to civil division layers. The same problem can occur when using hydrologic and transportation layers, for example.

A GIS coordinating body could designate preferred (not standard) layers for a number of themes (civil divisions, hydrology, the road network, for example) at different scales to reduce the impact of this problem. The designation of preferred layers would mean that the coordinating body recommends that these layers be used if possible to avoid this problem, but does not ***require*** *that they be used. With this designation, others would tend to use these coverages and the problems of non-coincident lines would be reduced. It should be recognized that even these preferred layers will change with time due to improvement in technology and changes in the objects being depicted. However, the reduction in time needed to repair combined layers will still be greatly reduced.*

Closely related to the sharing and access issues is the matter of financing a GIS. Despite the fact that the cost of information technology has been dropping in recent years, a GIS can still be a major expenditure, mostly for the database (as noted above). Mechanisms for distributing this cost to all users of the information do not exist. Under the Freedom of Information laws, the public has access to all government information for minimal cost, usually the cost of making copies to meet the request.

There are no formal procedures for governments to cooperate and share the costs associated with the construction and maintenance of the database. One of the larger jurisdictions in a region usually takes the initiative in building a GIS and thereby becomes the "lead" agency in that region, if only by default. The lead agency usually incurs all of the GIS development cost. In some cases, several agencies join together and develop a GIS program. Such leadership provides an opportunity for smaller local governments to join in a cooperative effort and gain the benefits of a GIS that they could not otherwise afford.

In other instances, there is no formal cooperation. There are instances where one or more of the larger governmental units have declined or refused to cooperate in a GIS program believing that, after the database is completed, they can acquire it from the developer at no cost under the Freedom of Information regulations. While this may save the requesting agency money in the short term, it undermines the ability of the lead GIS agency to maintain the GIS database.

Cooperation among local governments, and hopefully the private sector, is necessary to develop an effective, long term GIS program in any region. Individual government agencies can rarely afford to do it alone, and certainly cannot justify the added costs of failure to cooperate.

Ongoing State, regional, and local coordination efforts in New York

There are many different formal and informal coordination activities in New York State developed to facilitate the sharing of GIS data, knowledge, and applications at the regional and local levels.

Nassau County, for example, has implemented a formal partnership agreement under which the County licenses the use of its data to its various partners.

There is now an official New York City GIS steering committee, chaired from the Mayor's Office of Operations, that is preparing for a photographic flyover of NYC this Spring which will be used to develop the digital physical base map of New York City.

A smaller, less formal partnership arrangement exists between Saratoga Economic Development Corporation, Niagara Mohawk's Department of Economic Development, the Saratoga County Real Property Office, and the NYS Adirondack Park Agency. These partners pooled resources and expertise to convert Saratoga County tax maps to electronic form.

Individual GIS professionals in New York are working together in informal user groups and professional associations. *These regional groups have produced directories of geographic data; have discussed standards, hardware, and software issues; coordinated base map development; and generally facilitated networking and information sharing.*

There are GIS user groups operating in New York City, Long Island, the Capital District, Utica-Rome, Central New York, the Southern Tier (both Central and East), and the nine-county Genesee/Fingerlakes region.

The Multi-County GIS Cooperative, a consortium of local and regional user groups, plays an active role in influencing statewide GIS development to promote coordination, public access, and regulations sensitive to county and local governments.

Professional associations such as the Urban & Regional Information Systems Association (URISA) play an important role in the development of GIS expertise as well. These groups may focus on cartographers, planners, or other similar professions.

Much GIS expertise already resides in individual government organizations in New York State including the NYS Department of Environmental Conservation (DEC), NYS Office of Real Property Services (ORPS), and the NYS Department of Transportation (DOT). Many other state agencies including the NYS Health Department (DOH), the Adirondack Park Agency (APA), and the State Emergency Management Office (SEMO) have also developed considerable GIS expertise. Many individual counties, cities, and other local governments are also benefiting from geographic information systems and spatial data resources.

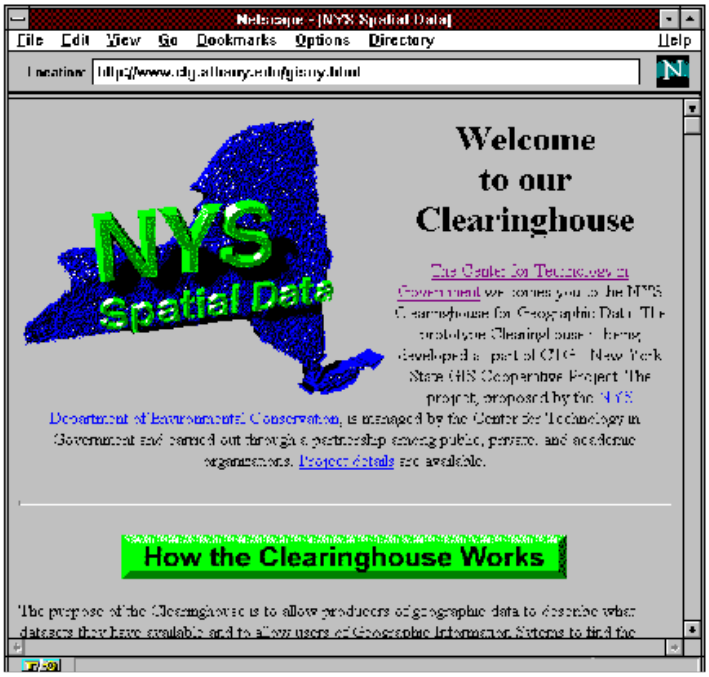
These ongoing coordination activities are described more fully in Appendix IV.

New York's Newest GIS Resource:

The Prototype NY State Spatial Data Clearinghouse

CTG developed the NYS Spatial Data Clearinghouse in concert with Federal initiatives to facilitate the exchange of spatial data among members of the GIS community. The prototype NYS Clearinghouse, available on the Internet, provides a mechanism for potential users of NYS spatial data to determine what data sets are already available or under development. This means of improving data access and sharing can lower the cost and increase the use of these data throughout New York. Users who access the Clearinghouse may review collections of metadata submitted by many different organizations. Once a data set of interest is identified, information is provided on how to obtain the data files. For some data files, an option for immediate on-line transfer is also available. The NYS Spatial Data Clearinghouse is a new production-quality information resource for New York State and will be among the first state clearinghouses to be formally linked to the National Spatial Data Clearinghouse. It not only provides a vehicle for data sharing, but it also demonstrates the use of the Internet as an effective tool for government-wide communication.

Council members believe that making this prototype Clearinghouse a fully operational, ongoing mechanism for sharing GIS information is one of the most important steps required to improve GIS in New York.



Courtesy Center for Technology in Government

GIS coordination in other states

Nearly every other state has a mechanism in place to support GIS coordination. *A survey conducted by the National States Geographic Information Council (NSGIC) showed that, as of 1994, only five states, Alabama, California, Missouri, South Carolina, and New York State were without a formal or ad-hoc coordinating body for GIS. (NSGIC, 1994). More recent data indicates that these states, too, have begun to address GIS coordination issues (Warnecke, 1995). State government coordination efforts range from small voluntary organizations to those supported by both legislation and executive order. Annual budgets for these coordinating bodies range up to $1 million.*

> *The NSGIC survey shows that state coordinating bodies focus mainly on four areas: coordination and communication among government organizations; GIS-related policy making; planning and strategies for GIS development; and resolution of technical issues. Their formal mission statements may include such specific goals as the development and management of GIS databases, the development of standards, and oversight of GIS expenditures. Twenty-two of these bodies distribute electronic data as part of their operations.*

Federal coordination efforts/NSDI

The Federal government has created a comprehensive national initiative focused on the value of spatial data. *The Federal government has begun to address GIS issues with the establishment of the National Spatial Data Infrastructure (NSDI). According to The Federal Geographic Data Committee(FGDC), the NSDI is "a set of policies, standards, materials, technologies, people and procedures, as well as spatial data, that provide a foundation for more efficient collection, management, and use of data. The goal is better access to higher quality spatial data at lower costs to all. The NSDI requires cooperation and interaction among various levels of government, the private sector, and academia." The major components of the NSDI are:*

> *- Standards to facilitate data collection, documentation, access, and transfer*
>
> *- A basic framework of digital spatial data that meets the minimum needs of large numbers of data users over any given geographic area*
>
> *- A clearinghouse to serve, search, query, find, access, and use spatial data*
>
> *- Education and training in the collection, management, and use of spatial data.*
>
> *While the NSDI is managed at the federal level under the leadership of the FGDC, many state and local governments, as well as academic and private sector organizations, have joined the effort to promote better access to spatial information, to increase communication and cooperation within the GIS community, and to eliminate costly data redundancy. The efforts of all of these organizations together form the NSDI.*
>
> *The National Spatial Data Clearinghouse (NSDC), an Internet-based tool to facilitate search and retrieval of spatial data sets, is a key part of the NSDI. A number of federal agencies and state governments have built spatial data clearinghouses on the Internet that can be accessed from the NSDI home page. (The URL for the NSDI home page is http://fgdc.er.usgs.gov).*

Recommendations

GIS Coordination Body

The Council recommends that a permanent GIS coordinating body be created with the following goals, duties and powers.

Goals

- *Foster an integrated statewide geographic information infrastructure composed of people, technology, data, and organizations.*
- *Advance the coordinated development of GIS in NYS as a decision making and operational tool to efficiently serve the needs of the State's citizens.*
- *Promote data development, dissemination and sharing.*

Duties and Powers

- *Establish and oversee a spatial data clearinghouse and GIS Resource Center, with global communications, to facilitate access to spatial information and GIS technical support and services.*
- *Coordinate data development, maintenance, and sharing by brokering partnerships, publishing standards, coordinating development and funding of large scale databases, adopting statewide geodetic monumentation (reference points), and working with SARA on long term preservation and access to digital GIS data.*
- *Facilitate coordination and communication among GIS users, and education and training.*
- *Establish, and publish, non-binding content and accuracy standards, or "preferred practices," for GIS*
- *Recommend consistent public sector data sharing policies.*
- *Establish guidelines for agency data collection planning to facilitate GIS applications.*
- *Keep abreast of, and participate in, Federal GIS coordination and standards efforts.*
- *Designate preferred statewide reference data sets for minor civil divisions, roads, hydrography, etc.*
- *Issue advisory opinions regarding data custody and maintenance or any other subject matter addressed by the previously enumerated powers.*
- *Monitor the development of GIS technology and uses for potential privacy threats and promote fair information practices, working with the Committee on Open Government to ensure adequate procedures for citizen redress of any misuse or abuse of confidential data and for correcting inaccurate data.*
- *Submit biennial reports to the Governor and Legislature that include activities, accomplishments, recommendations for strategic use of geographic information and such other recommendations as may be appropriate.*
- *Conduct periodic self evaluation.*

The Council further recommends that the coordinating body have the legal authority to accomplish the tasks assigned. However, it understands that the location of the body, and its potential affiliation with an existing organization already empowered to conduct normal business, will govern what additional powers may need to be granted.

Structure

The Council recommends that the structure of the coordinating body reflect the broad range of interests in GIS and that state, regional, local, private, academic, non-profit, and grassroots organizations be represented, with particular emphasis on ensuring adequate local representation In addition, the range of functional uses of GIS should be considered in establishing broad representation. Ideally, members should possess expertise in at least one of the following areas: GIS; computer technology; data management; information policy; or facilitation of lateral coordination efforts

The Council recommends fifteen as a reasonable number of part-time members of the coordinating body, who would be supported by adequate full-time staff to perform the functions of the coordinating body. Members would be selected with the following grid in mind, the goal being to maximize both organizational and functional representation.

Coordinating Body Representation Matrix

Functional use	*state*	*county, regional*	*city, town, village*	*academic*	*private*	*utilities*	*Not-for-Profit*
Economic Development							
Environment & Natural Resources							
Education							
Health, Safety & Human Services							
Infrastructure Management							
Comprehensive Planning & Zoning							
Real Property Records Management							

Members and staff would form committees to handle issues deemed relevant by the coordinating body, with committees open to membership and participation by outside interested parties to broaden input and the involvement of various segments of the GIS community. In addition, the Council would need to ensure adequate liaison with Federal efforts at the national level in Washington and with regional Federal agency GIS activities.

The Council understands that the original legislation was prepared at a time when there was no formal statewide effort to coordinate information resources, and thus contemplated an independent Council or Commission on GIS.

Experience from other states suggests that statutory authorization for an ongoing coordination function maximizes the likelihood of long-term success, and the Council expressed the preference that ultimately such a body be authorized in law. Other forms of authorization, such as Executive Orders, have been used successfully as well, and are options to consider.

Council members believe that GIS must ultimately be considered an important and integral part of any statewide Information Resource Management effort. Should legislation be developed to create such a permanent function in New York, the Council recommends that these GIS recommendations be incorporated.

In the current situation in New York, a GIS coordinating function may need to begin life attached to an operating agency and/or the Information Resource Management Task Force, and evolve within the broader IRM umbrella.

Funding

While Council members believe that adequate resources must be provided to support the efforts and responsibilities of the coordinating body if it is to be successful, they recognize current fiscal realities. Initial efforts, like those of the IRM Task Force, may need to begin by reassigning existing staff resources. The location of the clearinghouse function, and the existing resources of the agency responsible for its operation, will determine whether or not a small funding increment or redirection is required.

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Chapter 6

Standards and Guidelines for Sharing GIS Data

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(b) recommendations which address the public policy implications of making data accessible to the public. Such recommendations shall address the following issues:

(I) the development of protocols which address content, format, data element definition, accuracy, spatial scale and other items, in order to facilitate the handling and transfer of information among federal, state, and local entities, educational institutions, not-for-profit corporations, businesses and individuals;

Sharing resources (data, information and money) between organizations that do not share a single management structure requires the development of mutual goals and a common language (definitions, sampling methodologies, and formats). These commonalities do not develop spontaneously, but develop only through the concerted effort of many individuals and organizations.

Historically, organizations have been motivated to address issues related to a lack of commonness for economic reasons. When this occurred, individuals and organizations with vested interest agreed upon a common or "standard" way of implementing a program. Some examples of familiar standards are measurement, railroad gauges, time zones, shoe sizing, and language. In the world of information resource management, and particularly in the geographic information community, we are discovering the imperatives of creating mutually beneficial commonalities. We are, as in all other areas of standards development, being driven by economic forces.

At federal, state, and local levels, the geographic information community has been organizing to share information. One of the first tasks that these efforts have to address is the development of standards. The process of creating, adopting, establishing, maintaining, and enforcing standards is very challenging, particularly considering some of the esoteric topics that the geographic information community must address. Most organizations do not have the resources to develop standards, and experience has shown that they would prefer to adopt established standards or guidelines...

... A ranking of survey responses indicates the following top five needs in order of importance:

- *cataloging and documenting data;*
- *producing consistent and geometrically accurate base data;*
- *developing standards for data that are critical for permitting and policy decisions;*
- *standardizing on consistent methodologies for the physical exchange of data; and*
- *dealing with policy issues related to public access.*

National States Geographic Information Council
Standards Committee's Survey of State Standards, 1995.

Developing Standards for Spatial Data and Metadata

Spatial data standards are needed in order to facilitate the exchange of spatial data between geographic information systems. We refer to data as "spatial" because the common factor is a geographic reference (a reference in space) which allows the data to be accessed through a GIS. In order to accomplish the goal of facilitating data exchange, spatial data standards should provide:

- Definitions of terms for spatial objects or features included in GIS;
- A structure (or format) for the exchange of spatial data;
- A method for describing the accuracy and lineage of the data; and
- The definition of metadata (the data that describes the spatial data).

The primary purpose for spatial data standards is to facilitate data sharing and exchange, thus the focus only on data issues. The Council concluded that It is not necessary to develop standards for GIS hardware or software at this time. as these standards are expected to evolve

from groups such as the Open GIS Consortium, a non-profit trade association formed to implement the Open Geodata Interoperability Specification.

The Current Status of Standards

At present, spatial data standards exist only at the Federal government level. Under the Federal Geographic Data Committee, three standards documents have been prepared:

The Spatial Data Transfer Standard (SDTS - FIPS 173)

This standard defines a method for the exchange of spatial data between different GIS software systems. It also contains definitions of terms for the spatial objects of interest to Federal government agencies.

Content Standards for Digital Geospatial Metadata (proposed)

This standard defines the content for digital geospatial metadata, the information about spatial data that would be entered into a clearinghouse or repository to form a catalog of spatial data available to other users.

Cadastral Standards for the National Spatial Data Infrastructure (draft)

This is a draft standard for cadastral (land ownership) data, one of twelve theme standards documents under preparation.

The Federal Geographic Data Committee has also established a National Spatial Data Infrastructure (NSDI) for the purpose of coordinating geographic data acquisition and access. The mechanism for this will be a National Spatial Data Clearinghouse, a distributed network of geospatial data producers, managers, and users linked electronically. It is envisioned that this network of clearinghouses would contain information about available spatial data. Potential users would search this clearinghouse to find data of interest, access the metadata for a description of data of interest, and could acquire the data from the distributing agency. Spatial data may be deposited directly with a clearinghouse or retained by the originator.

The Federal effort towards standards development started in 1981 and The National Spatial Data Infrastructure and Federal spatial data standards are still evolving at this time. The remaining subject area (theme) standards reports are scheduled for release during the Spring of 1996 (themes are: base cartographic, bathymetric, cultural and demographic, geodetic, geologic, ground transportation, international boundaries, soils, vegetation, water, and wetlands). The table below shows the current status of federal spatial data standards development.

Implementation of the Federal geospatial data standards is through Executive Order 12906 signed by the President on April 11, 1994. The FGDC is directed to " ...seek to involve State, local, and tribal governments in the development and implementation of the initiatives continued in this order." The Order provides that:

"Federal agencies collecting or producing geospatial data, either directly or indirectly (e.g. through grants, partnerships, or contracts with other entities) shall ensure, prior to obligating funds for such activities, that data will be collected in a manner that meets all relevant standards adopted through the FGDC process."

Status of Federal Geographic Data Committee Standards

Currently in development:	Completed public review:
National Spatial Data Accuracy Standard	Cadastral Content Standard
Standards for Digital Orthoimagery	Federal Domain of Values for Data Content Standard
Draft Standards for Digital Elevation Data	Cadastral Collection Standard (Cadastral)
Hydrographic and Bathymetric Accuracy Standard	Clearinghouse Metadata Profile (Cadastral)
Standards for Geodetic Control Networks	Classification of Wetlands and Deepwater Habitats of the United States
Transportation Network Profile for Spatial Data Transfer Standard	
Transportation-related Spatial Feature Dictionary	
Soils Data Transfer Standard	
Vegetation Classification Standards	
River Reach Standards and Spatial Feature Dictionary	
Facility ID Code	
Content Standard for Cultural and Demographic Data Metadata	

Source: Federal Geographic Data Committee

Geospatial Data Standards Activities in New York

At present, there is no formal structure within New York State for either participating in the development of Federal geospatial data standards or for studying, recommending or adopting State geospatial data standards. There are three activities that have been conducting a partial review of the

The *Center for Technology in Government GIS Cooperative Project*

This project, in cooperation with the Department of Environmental Conservation, conducted a review of the standard and implemented a prototype clearinghouse for New York State agencies. The project was completed in October 1995, however there is currently no provision for the continuation of the prototype clearinghouse.

Local Government GIS Demonstration Project, Erie County Water Authority and the National Center for Geographic Information and Analysis, SUNY - Buffalo

This project. funded by Local Government Records Services at the State Archives and Records Administration, is continuing the review process started by CTG and will further review the metadata content standards from the perspective of local government. Recommendations for local government participation in the NSDI clearinghouse will be included in the final report scheduled for release in June 1996.

New York State Temporary GIS Council (this report).

A definitive recommendation for New York State geospatial data standards cannot be made at this time for three reasons:

- The Federal Geographic Data Committee theme standards are not complete and will continue to evolve through 1996;
- The FGDC Content Standard for Geospatial Metadata has not been completely reviewed for applicability to either state or locally generated geospatial data; and
- The ability of local governments to participate in theme standards, metadata standards, and the state and national clearinghouses has not been determined.

The exchange of spatial data between all GIS users and the deposition of spatial data in the appropriate archives can be facilitated by one or more standard spatial data formats. The existing Federal Spatial Data Transfer Standard (SDTS) is one such format. SDTS is a very flexible, but also very complex, spatial data format which requires sophisticated computer software in order to be usable. At present, this software does not exist. Any standard format, other than SDTS, proposed for use in New York State as a standard would likewise require complex, and expensive, software. This situation, along with the fact that GIS technology is changing very rapidly and will continue to do so, makes it unwise to invest State or local government resources in a standard at this time. Historically, GIS vendors have responded to many user requirements by incorporating changes in their software to allow exchange between users and GIS systems. The GIS vendor community is just now beginning to respond to the need for standardized exchange formats and is likely to continue to do so. Therefore, it is not recommended that the coordinating body develop or adopt any spatial data transfer standard but rather that the coordinating body:

-- Continue to monitor the need for spatial data exchange standards and the vendor response to these needs; and,

-- Develop a set of requirements for metadata for State and local governments (linked to any Federal metadata standards in force) to facilitate data transfer and long-term access to GIS data.

Recommendations

- The coordinating body should establish the NYS Geospatial Data and Metadata Clearinghouse based on the needs of all interested parties within New York. This clearinghouse should:
  - Implement metadata standards adopted by the coordinating body;
  - Develop a quality assurance procedure for metadata entries;
  - Validate the availability of the spatial data described by metadata entries;
  - Provide a feedback mechanism for user reports on data quality; and
  - Provide direct access to the spatial data when appropriate.
- A continuing state-level spatial data coordinating function will be needed to participate in the development of, and respond to, Federal draft theme standards expected to be released during 1996. This activity should facilitate the involvement of all interested local and state agencies within New York and should encourage active review of the Federal standards as they are published.
- The coordinating body should continue to monitor the need for one or more standardized formats for the exchange of spatial data between State agencies, local governments, and the public.
- The coordinating body should work with State and local government agencies to develop strategies for the long-term storage of digital spatial data that meet record retention schedules published by the State Archives and Records Administration.

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Chapter 7

FOIL and other Legal Issues in GIS

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(b) recommendations which address the public policy implications of making data accessible to the public. Such recommendations shall address the following issues:

(ii) treatment of data generated by a geographic information system as a public service available to private citizens and/or as a marketable resource to commercial users;
(iii) changes to the freedom of information law or other laws to allow the charging of fees for the development, reproduction and distribution of data; and an analysis of the legal ramifications of assuming a proprietary interest in data;.

These issues were the most challenging ones before the Council. The lack of clear and uniform understanding and policies on data access, cost recovery, revenue generation, pricing, data ownership, data maintenance, potential liability and institutionalized mechanisms for sharing the costs and benefits of geographic information systems has been a source of concern and intense debate in the GIS community for some time.

While Council members were well aware of the issues raised in the Center for Technology in Government report, there was intense additional discussion of the complex interplay between those issues, and of the barriers they presented to successful sharing of efforts.

It quickly became apparent, for example, that the issue of amending the current Freedom of Information Law to permit charging fees for the commercial use of public GIS databases was by no means the only point of contention with FOIL. No one expected to generate dramatic revenues in that way, and such charges have certainly not produced windfalls for the many other jurisdictions that permit them. Rather, much of the discussion centered on how the current FOIL can act as a deterrent to the public/public and public/private partnerships necessary to make GIS more cost effective and widely available.

This section of the report discusses these issues, their interplay, and the rationale for the Council's recommendations.

The Freedom of Information Law and Charging for Commercial Use of GIS Data

Committee on Open Government Position

The Council's discussion of the issue of charging fees for the commercial use of GIS data began with a review of the "1995 Report to the Governor and the Legislature" of the Committee on Open Government (COG). The following is an extract of the COG report section dealing with this subject:

FEES FOR RECORDS USED AS A COMMERCIAL COMMODITY

Early in 1991, the executive director of the Committee was invited to a meeting of the Subcommittee on Access to Electronic Records of the Local Government Records Advisory Council. Discussion at the meeting led to and focused upon the possibility of assessing fees under the Freedom of Information Law based upon the commercial value of records. That meeting led to others with representatives of local government, the Division of the Budget and the Office of Counsel to the Governor. The result was the development of a program bill recommended by Governor Cuomo and introduced in 1991 by Assemblyman Steven Sanders (A. 7581) and Senator Caesar Trunzo (S. 5968). The same legislation was included in a mandate relief bill and introduced separately by Assembly persons Colman, Sanders, Hochberg, John and Pretlow (A. 8210-A) and Senator Goodman (S. 7469).

The bill is creative, if not revolutionary, for it is based upon a recognition that government information is increasingly obtained and used as commodity, and because, under circumstances specified in the legislation, it would authorize agencies to assess fees based upon the commercial utility of records.

By way of background, as government databases have grown and the utility of information has increased, a variety of new issues has arisen concerning the disclosure of government information. Until recently, users of government records were often incapable of obtaining large amounts of information that could be digested and analyzed quickly. With the proliferation of

electronic information systems, it is now possible to acquire vast amounts of data quickly and easily and to use the information more efficiently and creatively than a short time ago.

Government generally creates databases, often at substantial cost, for its own use, and without regard to the potential commercial utility of the data to others. Nevertheless, it is clear that the number of requests for information that is used for commercial purposes is increasing. Some have contended that when information is acquired from government and is used for profit-making purposes, the government should have the ability to charge more than the law now allows or reap some of the profits. Those contentions, in our view, are inconsistent with the Freedom of Information Law as it currently exists... Further, agencies would develop information systems for their own purposes even if no access law had ever been enacted.

The standards for assessing fees under the Freedom of Information Law are clear and simple. Unless a different statute provides to the contrary, an agency may charge up to twenty-five cents per photocopy when it reproduces records up to nine by fourteen inches; for other records, i.e., those that cannot be photocopied, an agency may charge based upon the actual cost of reproduction [see Freedom of Information Law, 87(1)(b)(iii)]. Some have contended that the "actual cost" standard, which enables commercial (and other) users of the Freedom of Information Law to obtain vast amounts of information at minimal cost, represents something of a subsidy for commercial users that is paid by taxpayers. The legislation would remove the subsidy and authorize agencies to charge based on the fair market value of the information...

When records are of general interest or utility to the public, or when they bear upon the accountability of government, we believe that the existing fee structure (or that proposed earlier in the report) should be applicable as the basis for the assessment of fees. Nevertheless, in cases in which information held by government is requested primarily as a means of developing profit for commercial entities and is used as a commodity, rather than as a check on government accountability, consideration should be given to charging for the information in conjunction with its commercial value. **Based on discussions with agency officials over the course of years, it has become clear that commercial entities often obtain valuable records pursuant to the Freedom of Information Law, at minimal cost, and use or resell the records for profits that may be substantial** (emphasis added).

In terms of public policy, so long as legislation does not diminish rights of access or serve as a roadblock to the accountability of government, but rather recognizes the value on government information that is sought for a commercial use, agencies should have the ability to determine the fair market value of records and establish fees accordingly.

By means of example, when the Health Department prepares records concerning nursing homes' compliance with applicable laws, those records would involve a matter of public interest and would clearly relate to government accountability. Those kinds of records would not qualify for the establishment of a fee envisioned by the legislation. Nevertheless, in order to communicate with nursing homes, the Health Department has likely developed a mailing list of those entities. When used outside of government, that kind of list ordinarily would have only commercial utility; it would be used by medical suppliers, etc. That kind of record would qualify for the establishment of a fee based upon its fair market value.

It is emphasized that a determination to establish such fees would be based upon the nature of a record and that the fee must be established prior to a request for a record. Consequently, agencies could not merely charge higher fees because a record is sought for commercial purposes.

As the legislation would apply to local governments, to simplify the process, the bill grants the ability to those governments to establish new fees for certain kinds of records that are common to many of them (i.e., real property assessment records, voter registration lists, geographical information data). With respect to other records not specifically identified, prior to the establishment of such a fee, a local government would be required to seek an advisory opinion from the Committee and enact a local law. A state agency would be required to seek initial approval from the Committee to establish the fee, followed by approval concerning the amount of the fee from the Director of the Budget.

To maintain the integrity of the Freedom of Information Law and its general intent, a fee based upon the fair market value of records would not be charged when the records are requested by another governmental entity, a member of the news media engaged in news gathering, for purposes of bona fide research, by the subject of the record, or for "any other purpose unrelated to profit-making, commercial or similar activity."

The Committee believes that the legislation, the text of which follows this discussion, preserves the thrust and intent of the Freedom of Information Law while concurrently recognizing government's fiscal pressures and the reality that government information is often used as a valuable commercial commodity ... the Committee is recommending that the "commercial utility" standard be replaced with "fair market value."

The full text of the Committee's recommended statutory changes appears as Appendix V of this report.

In addition to the points discussed above, the proposed legislation provides that a "local government agency may establish fees... when the records... are requested in whole or in substantial part". This would appropriately limit commercial rate fees to requests for a large data grouping, such as a GIS database layer, or most or all of an entire database.

The proposal also provides that "(f)ees established... shall be reasonable" and based on "...the fair market value of (the) records... and the following factors...shall be considered" in determining the fair market value:

- the demand for the records;
- the commercial use or uses of the records;
- the ability to obtain the same or similar records outside of government;
- the volume of information contained in the records;
- the utility of records as mailing lists;
- the profit or revenue that may be generated by use of the records outside of government;
- the means by which agencies store, disseminate or reproduce the records;
- whether records are used directly by the recipient or may be resold or distributed in whole or in part;
- the nature of competition between a recipient of records and others involved in similar activity;
- the actual cost of producing or reproducing records; and
- such other factors as may be relevant.

It is also important to note that, while the COG proposal allows County Clerks and State agencies to collect fees, it does not speak to the intended use of the revenue at the local level, where the local government presumably would decide whether or not to reinvest the receipts in the operations that generated them. In another section of the COG proposal pertaining to other fees for reproducing records, the Comptroller is directed to refund state agency appropriations in the amount of the fees collected, which funds are to be used by the agency "for the purpose of enhancing its ability to comply with and give effect to "the Freedom of Information Law.

Charging for Commercial Use of GIS Data in Other States

The issue of data ownership in GIS development is not new and has already been addressed in many other jurisdictions. Many other states have modified open records statutes to allow for charging fees for geographic data that is to be used for commercial purposes. The following table (extracted from: "A Survey of Open Records Laws in Relation to Recovery of Database Development Costs: An End in Search of a Means", Peterson Dando, Lori, *Marketing Geographic Information, Issues and Guidelines*, URISA, 1993) shows how 20 states have modified open record laws in various ways.

A Sampling of State Open Records Laws Relating to GIS:

State	Fees	Other
Alaska	For electronic services and products, may charge actual costs and a portion of the costs of development and maintenance.	When offering on-line access for a fee, agency must also provide a public terminal at no charge.
Arizona	Can charge market value if public record is requested for a commercial purpose.	N/A
California	For "property characteristics information", may charge fee related to the actual cost of developing and providing the information. Development cost may include overhead, personnel, supplies, material, office, storage, and computer costs.	N/A
Colorado	Fee not to exceed the actual cost for manipulating data in response to a specific request for a record in a form not used by the agency. Fees based on the actual incremental costs, including development and maintenance costs can be charged for electronic services and products	Statute specifically authorizing the state to obtain and enforce copyright on public records, except that it does not apply to "writings which are merely lists or other compilations".
Connecticut	Special fees for computer-stored records; such fees may include hourly salary, and charges for computer time. Any municipality may by ordinance impose a reasonable fee for the use of its GIS.	No public agency may enter into a contract if such contract impairs the right of public access to records stored on a computer system.
Florida	Allows a fee to be charged for electronic access which includes the direct and indirect costs of providing such access.	A special service charge may be added for requests which require extensive use of information technology resources.
Illinois	N/A	State FOIA is not intended to be used for the furthering of a commercial enterprise or to disrupt the work of a public body.
Iowa	GIS legislation allows government body to establish reasonable rates for	GIS legislation which permits a

	retrieval of specified records.	government body to restrict access or use of a geographic data base except under terms and conditions acceptable to the government body.
Kansas	Fees are not to exceed actual cost, including staff time and computer services.	N/A
Kentucky	A public agency may impose a reasonable fee for the creation of non-standard services and products available through a database or GIS.	Exempts a database or GIS from public disclosure if such disclosure is for a commercial purpose.
Maine	Office of Geographic Information Systems may levy appropriate charges for use of GIS services.	GIS data are subject to licensing agreements and are only available upon payment of fees pursuant to statute.
Minnesota	For requests which involve the receipt of information that has commercial value and is a substantial and discreet portion of a formula, pattern, compilation, program, device, method, technique, process, data base or system developed with a significant expenditure of public funds, a reasonable fee related to the actual development costs may be charged.	N/A
New Mexico	Upon payment of a reasonable fee, information contained in a database can be disclosed in printed form. A fee may be charged for access or use of the database for any private or non-public use.	In order to obtain a copy of a database in computer or printed form, a person must agree to not make unauthorized copies of the database and not to use the database for any political or commercial purpose, unless the use is approved by the agency.
Oklahoma	If the request is solely for a commercial purpose, then a reasonable fee may be charged.	N/A
Oregon	Reasonable fees based on the market or competitive bids may be imposed for geographic data that have commercial value.	Statutes classify geographic databases as confidential and exempts them from the requirement of public disclosure.
South Carolina	N/A	Exemption for trade secrets includes work products produced for sale or resale, and paid subscriber information.
Tennessee	For request of a record which has commercial value and requires the reproduction of a computer generated map or other geographic data, a reasonable fee may be assessed, but not against individuals who request records for themselves.	N/A
Utah	N/A	A government entity which offers a copyrighted or patented record for sale may control the access, duplication, and distribution of the material.
Virginia	A pro rata per acre basis for the cost of creating topographical maps which encompass a contiguous area greater than fifty acres.	N/A
Wisconsin	N/A	"Records" does not include materials to which access is limited by copyright, patent or bequest or published materials, in possession of an authority, which are available for sale.

The right to obtain copy does not apply to a record which has been or will be promptly published with copies offered for sale or distribution.

Arguments For and Against Charging for Commercial Use of Data

The Council recognizes that there is significant debate on whether or not governments should charge for commercial use of government information. There is a large body of literature on the pros and cons of cost recovery versus open access to public information. The arguments on either side of the debate generally fit under the topics of: the nature of government; the purpose of FOI laws; and economically, who should benefit from the efforts of government. This section briefly outlines the major issues.

Those in support of charging for commercial use of government data argue that:

- FOIL's purpose is to allow citizens to hold government accountable for its actions. Giving away publicly-produced data to be exploited for its commercial value does not contribute to the accountability of government.
- The general public paid for the collection and organization of the information, therefore it should benefit from the sale of public information -- government should not subsidize a few private merchants. Proceeds from the sale of government information can be returned to the taxpayer through increased services and/or reduced taxes.
- One trend in government is to shift costs away from the general tax base and toward user fees so that all taxpayers do not subsidize services used by a few.
- Government's public service function does not necessarily limit its ability to act in an entrepreneurial manner -- in fact, as most organizations, it often responds best when challenged by outside forces.

Those in support of providing public information at little or no cost generally argue that:

- The right of access to public information is fundamental to our representative democracy.
- Government's role is to act only where the private sector can not or does not. Government-sanctioned monopolies are less efficient than private enterprise. Entering into the marketplace may divert agencies from their primary public service missions, and even encourage them to focus on developing information products in competition with the private sector.
- Access to public information at no more than marginal cost stimulates the market, fosters economic growth, and encourages wide access to government information, thus benefitting the public at large.

Charging for Commercial Use of GIS Data (GIS Council)

Although Council members were not completely unanimous in their views, most believe that granting governments the legal option to recover some portion of their GIS costs by charging a fee for data to be used for commercial purposes is necessary and desirable. Experience in other jurisdictions has shown that the sale of GIS information is not a large revenue producer and does not pay for the full cost of development or maintenance. However, the ability to charge for commercial use of the information would give localities and State agencies a way to recoup some costs, and/or to further support the GIS itself. Revenues from commercial uses could be used to enhance the public's "right to know" by improving access to information through public terminals to on-line systems, or to subsidize further efficiencies in GIS systems. In addition, charging fees to commercial users is consistent with, and strengthens, the cooperative license agreements described below.

Recommendations:

The Council supports the approach recommended by the Committee on Open Government that recognizes the commercial value of data and records and would permit charges for commercial use of government GIS information.

The Council recommends that the Freedom of Information Law be amended to declare that GIS records form another category for purposes of establishing a fee, and recommends that FOIL be altered to permit local governments and state agencies to charge for data to be used for commercial purposes at a rate established and approved in advance based on the commercial utility of the data. Further, the Council recommends that the revenue gained through these fees return to the local government body or state agency to defray the costs of GIS development and maintenance, and the expansion of public access to government information.

FOIL and Confusion About Ownership of Data

While cooperative sharing of data and resources can be achieved, current law creates some uncertainties and disincentives to cooperation. One of the major barriers to a coordinated GIS effort in New York is the uncertainty faced by governments concerning their rights to data ownership.

Many, if not most, local governments are too small to fund a GIS alone and need to pool resources in order to enter the GIS field. Even where local governments have adequate funding, it makes no sense for overlapping entities to duplicate efforts.

Local governments face high startup costs for GIS development. Aerial flyovers, "digitizing" maps (i.e. reducing them to a form that allows them to be displayed on a computer screen), and converting data from existing paper records to computer databases, can add up to a significant expenditure. This may not be possible for a small, single local government unless there is participation by overlapping entities, such as a county, sewer or water district, or other non-profit or even for-profit organizations willing to share the cost.

Unfortunately, the current FOIL statute creates a disincentive to any of these entities to begin the process. Some governments may conclude that it is easier and cheaper to wait for someone else to create the system, and then obtain the data for free (except for copying charges) under FOIL.

Current FOIL laws create a second barrier to GIS development. Even if one local government or entity "goes first", that local government is going to have significant continuing maintenance costs to keep data current. For example, on any one parcel of land there may be changes to any of the following: streets, sidewalks, lighting, waterlines, sewers, gas, electric, phone, or other utility lines. Additionally, buildings on the parcel may be added, enlarged, or demolished. There may also be non-physical changes, such as zoning changes, or changes in a variety of district lines.

As explained at the outset, the GIS tool operates most powerfully and cost effectively for both the public and private sector the more data that is shared.

One of the ways GIS progresses in other states is through cooperative agreements. The local government that "goes first" obtains a commitment, in exchange for the original data, that participating parties will take the responsibility to update the layers of data that pertain to them. For example, the electric company would update utility line changes; the planning department would update zoning changes, etc. Some updating costs, such as the need to redo aerial photography every few years, are then shared expenses. In New York, however, some parties are reluctant to enter into even these "maintenance" agreements because they can simply wait and obtain the data for free if someone else must, or will, bear the cost of maintaining the data. Others who have not contributed anything have free access to the work product as well.

A third barrier created by FOIL is the disincentive it creates for non-public participants. Private entities are concerned that if they enter into a public/private consortium they will lose ownership of whatever data they contribute if it is pooled with public data. It may become "public" data and thus freely available under FOIL. Since the data has economic value to them, that value is in danger of dropping to zero if they pool data and resources with a public entity.

Data ownership issues thus have had a depressing effect on attempts at cooperative agreements. There is a disincentive to be the one to go first; parties are encouraged to wait until a mature system is up and running (and paid for), and there is no incentive to join a cooperative at a later stage. The result is that GIS development is limited to whatever mutual interests bring the initial parties together. There is only a slight prospect of growth in the number of cooperating parties, and there is a constant threat of dissolution.

License agreements, combined with copyright protection, represent a potential solution to this dilemma. The typical device for transferring software or data in the private sector is a licensing agreement. Licensing agreements have also become popular in the public sector, and typically a local government will distribute its GIS data subject to a license agreement that places some restrictions on the reuse of the data. Common license terms include:

- A recognition of the supplier's copyright
- Limitation on dissemination and reuse
- A derivative products clause
- Liability limitations
- Source citation
- Limitations on reuse without update (i.e. a requirement that data be turned in and replaced for current data within a stated time frame)
- Requirements for familiarization with data quality issues prior to use
- Requirement to report all apparent errors and to produce corrections (if such are made)
- Return of licensee-created data

Although license agreements are an integral part of cooperative GIS efforts, there is no express statutory authorization for them. Moreover, the status of New York law is unclear as to the enforceability of license and copyright agreements if met with a direct challenge under the Freedom of Information Law.

Recommendation:

The Council recommends that the Legislature grant express statutory authority to local and State government agencies to enter into cooperative GIS agreements that contain enforceable license agreements.

Concern About Liability

The great strength of GIS is its ability to take large quantities of data, integrate it, and create new value for its owners and operators from the recombination of these data elements. However, even within a single enterprise, data elements so combined are of widely disparate quality. They are assembled under varying circumstances, entered into databases under widely varying conditions of rigor (and with varying accuracy), and maintained according to widely varying standards (if any).

Within a single entity, a GIS operator may be able to just step across the hall to become fully informed about the quality of a data set. In such cases, quality issues can be quickly and easily communicated to the employees. However, quality issues may not be formally documented.

In multiparty GIS consortia, in interagency and intergovernmental GIS projects, and even in interdepartmental GIS projects in large organizations, communication may be less perfect. There is greater organizational complexity, physical distance and the number of people who need to understand the limitations of the data is greater. The data problems may not be clearly recognized, and decision errors may well result from inappropriate or uninformed reliance on the data.

The perception of potential data liability problems creates a reluctance both **within** the organization and **among** organizations to share certain categories of data. Some organizations have been unwilling to join in cooperative GIS efforts simply because of their concern over potential liability.

Data created for one purpose may be unsuited for another purpose. Data quality problems that do not affect the original purpose may create dangerous situations when data are used for another purpose by someone who does not understand the limitations of the data.

To illustrate the problem, utility companies commonly have records of their buried facilities which may be 100 years or more old. The location of these facilities was typically originally established in relationship to landmarks which may no longer exist. The very roads, curbs and surrounding houses may have been relocated, reconstructed, raised or lowered. The company may literally not know where the buried facilities actually are. It is usually the practice within the company to use existing charts to **begin** a search process (perhaps using mine detectors, sonar devices and the like, or sighting along service connections, listening and probing to form a conclusion as to where the conduit is). A lay person looking at a map might assume that the buried facility (phone line, electric conduit, gas pipe, waterline) **must be** precisely where it appears to be on the map. Such a person might naively rely upon that apparent location, and inadvertently cause tens or hundreds of thousands of dollars worth of damage by excavating in the wrong place. Such a person might then conclude that, having caused the damage, it would be nice to have someone else pay for it, and sue the data provider and/or all the members of a consortium.

Losing HBO when a cable line is cut may seem like a minor inconvenience, but New Yorkers have seen thousands of lives put at risk, major airports shut down and air traffic around the world disrupted when air controller communications were cut.

The Council reviewed the application of the "landowner liability" concept applicable to property owners, and the "prior written notice" requirement that protects municipal governments from tort claims for road and sidewalk damage. Under New York law, property owners are liable for property defects only when they affirmatively created the condition or had actual or constructive notice of the defect. This concept has a logical application to GIS data. Much of the data will be based on records that may be very old, were created for purposes more limited than that of a remote user, and may include structures that are underground and therefore not visible. Unless the data supplier has notice -- written, actual, or constructive -- it would be virtually impossible for a GIS provider to know there is a discrepancy in need of correction. Users should, therefore, be required to verify spatial data in the field and liability should attach only if the GIS provider receives written notice of the discrepancy or otherwise knew or had reason to know that the data were incorrect.

Recommendations:

The Council recommends that GIS providers be exempt from liability for a variety of different kinds of records, such as parcel maps, deeds and as-built drawings, in order to guard against the potential legal ramifications of assuming a proprietary interest in data, much of which is not created for the purpose for which it may ultimately used by others.

In order to create incentives for data sharing through public-private partnerships, liability for inaccurate, out-of-date or imperfect data needs to be contained. The Council recommends that the following limitations of liability should be recognized in statute with respect to GIS data:

- disclaimers in data license agreements should be enforceable;
- there should be no joint and several liability for pooled data for which there are cooperative agreements;
- authors and contributors of spatial data should not be liable for consequential damages; and
- GIS providers should not be liable for inaccuracies in data unless the provider received prior written notice of the defect and thereafter failed to correct the error within reasonable time.

For Further Consideration:

Helping Local Governments Help Themselves by Authorizing Local Coordinating Mechanisms

In some regions of the State, counties, groups of counties, or regional planning boards have taken the lead in coordinating GIS activities. In many places, this has not happened. Some Council members sought to craft, and make available to localities on an optional basis, an organizational vehicle

that would deal with the various barriers to cooperation previously discussed.

At present, the adoption of GIS by many local governments is happening on a piecemeal basis, mostly by individual departments or single agencies. While such adoption may meet the basic information needs of single departments or agencies, this approach is not coordinated, is relatively expensive, and does not provide consistent information over a large enough area to support strategic activities such as an economic development program.

Basic geospatial information is tied to a local area; therefore it is important to a state GIS policy that sound, complete, and well-managed GIS systems be maintained at the local level. Such systems should include public and private sector information to make the local database economical and as complete as possible. However, local government resources are scarce; sharing costs and information in building databases is key to the building of GIS services locally. The sale of GIS information and products will not produce enough revenue to adequately defray local system costs -- costs which would otherwise have to be fully borne by taxpayers could be substantially reduced through cooperative arrangements. Today, however, initiating and managing ongoing partnerships -- whether public/public or public/private -- is hindered by history and statute (for example, protection of license agreements is essential if public/private partnerships are to be fostered as a means of sharing GIS costs at the local level).

The most significant benefits from GIS are: improved efficiency in providing information to citizens and other users; increased effectiveness in managing public infrastructure (water, sewer, roads, etc.); and overall community growth and improvement through effective strategic decision-making (economic development programs or addressing special problems such as the New York City watershed issue). Using a community's information resource for strategic decision-making requires that the information be highly organized and coordinated over a significant area or region, more organization than would be required for infrastructure management, which itself requires more organization than simple information provision to citizens. Progressively higher levels of organization and coordination maximizes the potential benefits from a regional GIS. The Council recommended a vision of statewide coordination, standards, data clearinghouses and improvements in statute. These statewide goals may not be fully achieved unless local GIS users organize in an efficient enterprise to support them on a continuing basis.

In a State that has created thousands of separate units of government, from statewide, county and municipal levels down through districts for schools, sewers, water, streets, and even curbs and lighting, no one can raise the possibility of recommending yet another type of special purpose district without trepidation. However, local governments lack an appropriate legal vehicle to cooperatively create and manage information. Many now conclude that such an option should be permitted. Such a vehicle need not impose any new taxes, nor make budgetary demands on the State, but could assist local governments in helping themselves.

The Information Resource Management (IRM) District would be a mechanism for structuring, administering, and funding ***a GIS cooperative*** at the local level. Loosely modeled on special improvement districts, such IRM Districts would have limited financing powers. A District could be created by the local governing body of a county, a first class city, or by several such local governing bodies acting in concert. To assist in financing approved GIS projects, IRM Districts would have the debt-issuing authority of special districts, but no taxing power. Bonded debt of a District would be supported by contracts with participating organizations to purchase the information products and services of the cooperative. Establishing the IRM District concept would address, at the local level, barriers to cooperative GIS development and operation. Membership would be voluntary, but carry with it clear incentives to join, such as the power to license data use and reuse, subject to public access rules for governmental accountability. Members would share in the information and resources of the cooperative. The non-profit IRM District could have the authority to set limited user fees based on project cost and competitive market prices for similar products and services. The District fee structure would be subject to outside review and approval.

The Council was unable to explore this concept in sufficient depth in the time available to make a firm and detailed recommendation. However, the Council concluded that the topic merits further consideration by the coordinating body and the Legislature. Appendix VI contains a more complete discussion of the rationale for, and possible structure of, an Information Resource Management District as one option for local coordination efforts.

Recommendation:

The Council recommends that a successor coordinating body, and the legislature, give further consideration to authorizing locally-based coordination mechanisms in law.

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PRIVACY POLICY ACCESSIBILITY ABOUT CONTACT DISCLAIMER

Chapter 8

Confidentiality, Privacy and Security

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(b) **recommendations which address the public policy implications of making data accessible to the public.** Such recommendations shall address the following issues:

(ii) treatment of data generated by a geographic information system as a public service available to private citizens and/or as a marketable resource to commercial users;

(iii) changes to the freedom of information law or other laws to allow the charging of fees for the development, reproduction and distribution of data; and an analysis of the legal ramifications of assuming a proprietary interest in data;.

While the general availability of Geographic Information Systems is a relatively recent phenomenon, concerns for how the development and distribution of technology would affect issues of privacy and confidentiality are rather long standing. As observed by the US Privacy Protection Study Commission nearly two decades ago, "The real danger is the gradual erosion of individual liberties through the automation, integration, and interconnection of many small, separate record-keeping systems, each of which alone may seem innocuous, even benevolent, and wholly justifiable."(1)

Confidentiality, privacy, and security continue to be legitimate concerns in the development of any technology dealing with the replication and distribution of data. There are a number of recent developments in the application of technology that heighten those concerns. These include the increasing ease of distribution and delivery of data, the expanded use of open network architecture, the growth of public networks, the increasing processing power of low cost desktop platforms, and the availability of powerful analytical software.

Rapid development of networks and information processing by computer now makes it possible for large quantities of personal information to be acquired, exchanged, stored, and matched very quickly. As a result, a market for computer-matched personal data has expanded rapidly, and a private-sector information industry has grown around the demand for such data.(2) Members and participants of the GIS Council faced the challenge of addressing both the opportunities accompanying that growing demand and the obligations for responsible management and protection of data relating to individuals.

The historical context is important not only in the understanding of the impact of the technology curve in enabling more efficient use of data, but also in considering the adequacy of existing legal principles governing access to, distribution of, and privacy of information relating to individuals. The Federal Office of Technology Assessment observed that "Laws evolve in the context of the mores of the culture, business practices, and technologies of the time. The laws currently governing commercial transactions, data privacy, and intellectual property were largely developed for a time when telegraphs, typewriters, and mimeographs were the commonly used office technologies and business was conducted with paper documents sent by mail. Technologies and business practices have dramatically changed, but the law has been slower to adapt. Computers, electronic networks, and information systems are now used to routinely process, store, and transmit digital data in most commercial fields. Changes in communication and information technologies are particularly significant in ....electronic commerce, privacy...and digital libraries."(3)

Over the last quarter century, Freedom Of Information Laws have dramatically altered the culture of government record keeping processes, and the availability of records to the public. Concurrently, societal concerns for privacy and confidentiality have had to be accommodated. As the Center for Public Interest Law summarized the issue, "Government records are public in order to ensure the free flow of information in a democratic society. The challenge to policy makers is to balance the public's right to information with the individual's right to privacy... Consumers should be aware of the growing public policy debate over the availability of computerized government records. While such records have always been public, computerization is making them easier to gather and compile. Direct marketers, employers, private investigators, law enforcement officers and other government agencies are finding new ways to use this information. As the nation's 'information superhighway' is developed, allowing quicker and easier access to immense amounts of data, this debate will only intensify. The issue of online access to public records will be an increasingly significant privacy concern as we move into the information age."(4)

Over the last two decades, technology has facilitated more efficient access to data generally, and has contributed to the widespread distribution and availability of information about individuals in particular. This development has created a significant potential for misuse and

abuse. Credit rating organizations and insurance clearinghouses have amassed and employ huge databases on individuals and these organizations have had to deal with the emerging liability implications of disclosing erroneous information. Government faces the same challenges, and is being required to adhere to the same, if not more rigorous, standards of operation as the commercial entities.

GIS is a powerful data integrating technology that brings together geographic information with data. The early use of GIS technology was centered on land and resources, not individuals or the personal attributes linking the individuals to land or resources. Therefore, the privacy implications of the technology were not readily apparent. However, GIS is increasingly being applied to public health, criminal justice, and social service areas. All of these fields involve inherently personal data which raise a multiplicity of privacy issues.

Privacy, Confidentiality and Security Concepts

Government's collective knowledge of its citizens is derived from its unique role in recording vital events, administering justice, granting permits, licensing individuals and professions, conducting tests, collecting taxes and fees, delivering services and entitlements. The conjunction of all this personal information in government hands is an accident of accumulation, a necessary, but daunting, byproduct of the governmental role in today's society, creating a need for special care and stewardship.

The State Legislature has declared in statute that personal privacy is a fundamental right guaranteed by the Constitution of the United States.(5) Concerns over privacy, confidentiality and security are driven by the recognition of that inherent prerogative.

Under the New York Public Officers Law, government has the obligation to limit the data it collects to that which is required to fulfill its mission, and to avoid the unnecessary collection of data that could result in an invasion of a citizen's privacy(6). An agency creating, maintaining, using, or disseminating records of identifiable personal data must assure the reliability of the data for its intended use and must take reasonable precautions to prevent misuses of the data.(7) Government-collected data that constitutes, represents, infers, or conveys confidential or private information about citizens, either directly or indirectly, must be secured and protected from unwarranted disclosure and distribution.(8)

Privacy is the individual's right to limit who can see what kinds of information about themselves. It is a personal and often statutory right. Informational privacy is the ability of an individual to control the use and dissemination of information that relates to themselves. Privacy is not an absolute right. It must be balanced with competing values and interest, including First Amendment rights, law enforcement interests, and business or economic interests in information.(9)

Confidentiality is the working concept that permits the use of private information by authorized users. Confidentiality tools enable the protected use of private information by authorized users for legitimate purposes.

Security is the larger environment and set of rules that operate to assure confidentiality, which in turn protects the individual's right to privacy.

Organizations collecting and distributing data need to assure a proper measure of protection for individual privacy while satisfying the organizational and societal needs for efficient use of the data. Confidentiality, privacy, and security concerns are not unique to GIS systems; they apply equally to the larger field of Information Resource Management. However, existing statutory, regulatory, and administrative provisions governing confidentiality, privacy, and security mostly predate the emergence of GIS technology and systems. Organizations contributing to, or participating in, GIS cooperative activities need to reassess the relevance and adequacy of their existing controls over, and protection for, data in light of the increased vulnerability attaching to GIS use of the data.

Privacy issues

An individual's privacy can be at risk in a GIS system indirectly through the release or distribution of highly detailed specifications of geographic information (such as detailed living accommodations for a parcel/property) or directly by release or distribution of demographic or other identifying data for one, or a small number of individuals (income, medical history, financial information, education, race, etc). Data about individuals can be personally identifiable or it can be anonymous. Identifiable information allow others to easily recognize a specific person. Anonymous information makes the discovery of the individual's identity difficult if not impossible. Identifying information is by its nature linkable, over time and across data series. Anonymous information can be linkable (using a unique confidential identifier) or non-linkable (blinded).

Because GIS systems typically rely on the consolidation or amalgamation of a number of disparate data sources, individuals will find it difficult to pursue issues relating to individual privacy with the owner/operator of the GIS system exclusively. Often the data source is completely external to the organization providing the GIS services. Resolution of privacy concerns or disputes will most likely have to occur at the original source of data collection, putting a greater emphasis on the need for those organizations to address these issues at the time of data collection.

Techniques for Ensuring Privacy and Confidentiality

The disaggregation of data and information to a low level of geographic units increases the risk that private information will not, or cannot, be kept confidential. The greater the level of granularity of the descriptors, the greater the likelihood that the identity of a person and/or private information about an individual may be disclosed. Private information can be protected from unwarranted disclosure by:

Informed Consent for Personally Identifiable Information

Full and complete notice to the individual contributing the information as to how the data will be used. Such a notification permits "informed consent", whereby the individual permits the use of private information for the specified (and only the specified) purpose. This additional level of protection is warranted because individuals can be harmed by the disclosure of personally identifiable information.

Filtering of Data

Selective release of data, or "masking" of data to obscure identifying material while retaining the inherent information value (e.g. releasing month and year of birth while withholding the day). Unit record data which is masked or obscured is not likely to expose an individual to harm, therefore informed consent is not usually required. Notifying the individuals about the prospective release of masked data is appropriate.

Aggregate versus unit record data

Aggregation of individual data prior to release to a level of summary that hides or obscures small cell sizes (e.g. aggregating data on individual addresses to census blocks, disabling the ability to pinpoint the exact address for a particular data item).

Authentication of uses

Releasing private information only to authenticated users, who have agreed that the information will only be used for an approved purpose, not redisclosed, and no attempt will be made to discover the identity of an individual.

Other Statutes Protecting Privacy

Privacy and confidentiality statutes that can affect information included in and provided by a GIS extend from the global FOIL and Personal Privacy statutes to the specific statutory requirements of individual agencies (Public Health Law) to the requirements of other political jurisdictions (Federal, municipal). A list of major statutes or regulations that may restrict access to or disclosure of State government records is included in the Appendix VII. The requirements of these statutes (and related regulations) will continue to act as a threshold barrier to the agencies holding the data, prohibiting the release of data which is protected.

SECURITY ISSUES

The security environment in a computer-based system protects both the system and the information contained there from unauthorized access and misuse of the data within an organization. A well designed security system should incorporate:

- A written agency-wide policy on data management, data access, and data release(10);
- The use of informed consent when personally identifiable information will be released;
- Vigorous criteria for release of data, protecting data subjects and validating uses;
- Encryption/Unique Identifiers where unit record data is essential and record matching or longitudinal studies are necessary;
- Prohibitions on external access to production systems, using separate platforms for external users;
- Authentication - user id and password protections; and
- An annual assessment of vulnerability(11).

GIS applications are often operated on stand alone workstations or personal computers in program units other than centralized data processing operations. These applications often do not come under the security controls and procedures in force in a centralized data processing environment. Therefore, GIS applications may be at increased risk from unauthorized access and misuse of data. This situation puts responsibility for security on the shoulders of GIS practitioners. The inherent power and utility of GIS systems has led to dependence on such systems for essential and mission critical operations, especially in governmental areas such as public protection and land use applications. The nature of the critical dependencies on GIS system for such activities reinforces the need to assure that adequate disaster recovery and back up procedures are implemented and maintained. GIS systems typically require substantial investments for development and implementation. While the return on those investments is typically realized by a variety of users including external organizations, the architects of the GIS systems are obliged to safeguard the investment through prudent security and backup practices.

Concerns for physical security over GIS data are not dissimilar from any other computer based application. Assuring adequate security over the data, programs, and systems therefore requires a traditional approach that starts with a sound system of organizational internal controls. The rapidly evolving nature of the technology environment and GIS require regular assessments of the effectiveness and relevance of installed systems of internal control.

Recommendations

The emergence of GIS does not demand radical revision to statutes and regulations that deal with the intentional disclosure of private information. All of the operative provisions can and should be accommodated before any organization makes the decision to include its data in a GIS that will have external distribution. What is required is the due diligence consideration of the extent to which GIS as a technology increases the probability of inadvertent disclosures of private information through the synergy of matching data sets and efficient data handling tools. Mindful that the underlying concerns for privacy, confidentiality, and security of information are not unique to GIS systems, the Council prefers to avoid advocating additional and essentially redundant requirements with a narrowly drawn focus on one form of technology. Instead, the Council, recognizes that the necessary protection must flow from the threshold decisions and mainline operations of the agencies which collect data on individuals and make it available to

GIS systems. It is with a full sense of reliance on those organizations acting prudently in the conduct of their own business that the Council offers the following recommendations:

- The GIS coordinating body is encouraged to adopt and promulgate a **Fair Practices and Use Model for GIS** that includes a clear statement establishing the obligation of the individual agencies participating in GIS ventures to protect the confidentiality and privacy of data on individuals.
- The coordinating body should perform ongoing assessments of the impact of the continuing deployment of GIS technology and systems on the confidentiality and privacy of data relating to individuals.
- Given the extensive collaboration and multiple agency involvement in the construction of GIS systems and the resultant difficulties a citizen would face in seeking administrative redress, the Council recommends that the coordinating body consult periodically with the Committee on Open Government regarding the need for assisting individuals with administrative appeal issues relating to :
    - Inappropriate collection of confidential or private data for GIS use;
    - Investigation of complaints relating to abuse or misuse of confidential or private data in GIS systems or products; and/or
    - Providing assistance to individuals in purging or expunging inaccurate, outdated, or misleading data about the individual.
- The Council recommends that every organization providing or participating in a GIS system establish a system of internal controls and security procedures that protect against unwarranted physical or electronic access to the GIS data, systems, and hardware. The internal control system should include a minimum requirement for an annual vulnerability assessment that gauges exposures and risks, and provide for an action plan to avoid, moderate, or otherwise limits those risks and exposures.

Endnotes:

1. U.S. Privacy Protection Study Commission, 1977.
2. Information Security and Privacy in Network Environments. Washington, D.C.: Office of Technology Assessment (OTA), September 1994.
3. Information Security and Privacy in Network Environments, OTA, September 15, 1994.
4. Privacy Rights Clearinghouse Fact Sheet No. 11, Center for Public Interest Law.
5. L. 1980, c. 677, § 1.
6. Public Officers Law, Article 6-A, § 94 (1)(a).
7. Public Officers Law, Article 6-A, § 94 (1)(h). Also see: Information Security and Privacy in Network Environments, OTA, September 15, 1994.
8. Public Officers Law, § 94 (1)(h). Executive Law, § 950 (1)(c).
9. Toward an Information Bill of Rights and Responsibilities, The ASPEN Institute, Edited by Charles M. Firestone and Jorge Reina Schement, 1995, ISBN Paper, 0-89843-172-7. (The proposed Bill Of Rights And Responsibilities is included in APPENDIX 2)
10. Public Officers Law, § 94 (1)(g).
11. As required by the NYS Governmental Accountability, Audit and Internal Control Act of 1987, (L. 1987, c.814).

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Chapter 9
Records Management

CHAPTER 564 OF THE LAWS OF 1994

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature... Such report shall include, but not be limited to:

(b) recommendations which address the public policy implications of making data accessible to the public. Such recommendations shall address the following issues:

(iv) the maintenance of government records in electronic or digital formats in the context of records management requirements;

Records management requirements for State and local government records in New York are established in the Regulations of the Commissioner of Education (8 NYCRR 185 for local government and 8 NYCRR Part 188 for State government). The State Archives and Records Administration in the State Education Department is the lead agency for establishing records management requirements and helping State and local governments develop effective records management programs and practices. Records management regulations establish specific requirements and procedures for the retention and disposition of records. State records may not be destroyed without a records disposition authorization issued by the Commissioner of Education after review by the Attorney General and the State Comptroller. Local government records are retained and disposed of in compliance with retention and disposition schedules prepared by the State Archives and Records Administration and issued as regulations of the Commissioner of Education. Many records in GISs will have lengthy retention requirements because they document transactions with lasting impacts, such as real property transactions, infrastructure construction and changes in land use. GISs also support research on a wide range of subjects, many of which analyze change over long periods of time.

The State Archives and Records Administration also has responsibility for ensuring the long-term preservation of and access to the records of State government that have enduring value because of their legal, fiscal, administrative or research value. This responsibility is fulfilled through the operation of the State Archives facility and through advice and assistance to agencies to help them care for and preserve records of enduring value that remain in agency custody. This responsibility includes records in digital format. New York State and local governments do not have an infrastructure, systematic maintenance programs, or adopted data format and documentation standards to ensure that records in digital format remain available, understandable and useable for as long as needed to meet long-term retention requirements. The State Archives has had an active program to preserve and make available records in digital format since 1990, but has not had experience with preserving and making available software.

Issues

State agencies and local governments have clear guidance on what records they must keep and how long they must keep them. However, they are often confused as to exactly what constitutes a "record" for the purpose of applying that guidance. The records management regulations referenced above, and their supporting legislation in the Arts and Cultural Affairs Law, contain separate definitions of what constitutes a "record." In addition other laws, such as the Freedom of Information Law (FOIL) and the Personal Privacy Protection Law (PPPL) contain definitions of a "record." These multiple definitions lead to confusion between information retained solely as information and information retained as the official evidence or "record" of a transaction. The legal definitions provided are also sufficiently broad so that, without additional guidance and clarification, they are difficult to use in a complex software-dependent environment such as that in a GIS.

Because a variety of GIS software packages have been used in creating and maintaining GIS data in New York, the data formats are many and varied. The issue of format is significant in data sharing and cooperative efforts, in accessibility of the data, and in archiving, where new versions of software products may eventually be unable to "read" data stored in old formats. Questions arise over whether multiple format versions of the same piece of data must all be retained as records or whether only the most current version must be retained. Questions also arise over what additional information that describes a piece of data and supports its accuracy and authenticity (metadata) also constitute a record. In addition, there are no commonly accepted standards that allow software-dependent data and its related metadata to be transferred from one generation of hardware and software to another. The Council recommends elsewhere in this report that a future GIS coordinating body work with SARA to promote retention of GIS records in formats that will be accessible by future users.

There is a lack of standards at both the state and local levels for the creation, storage, and maintenance of GIS data. Records management legislation should use standardized definitions of a record, and should attempt to address the unique characteristics of GIS data when referring to "records."

New York's current legal and financial environment provides little in the way of specific guidance or tangible assistance to state agencies and local governments implementing GIS and dealing with the records management issues associated with this technology.

Recommendations

Consolidate current multiple definitions of a "record" into one useable definition that acknowledges the geographic component of the records created and stored in GIS, and, if appropriate, differentiates between "records" and "data" stored in an automated system.

Provide clear retention and disposition guidelines to state agencies and local governments regarding what records/data/information they must retain, for how long, and by what methods. This includes identifying and scheduling specific records created and stored in GIS.

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Chapter 10

Summary of Recommendations

GIS Coordination Body

The Council recommends that a permanent GIS coordinating body be created with the following goals, duties and powers.

Goals

- Foster an integrated statewide geographic information infrastructure composed of people, technology, data, and organizations.
- Advance the coordinated development of GIS in NYS as a decision making and operational tool to efficiently serve the needs of the State's citizens.
- Promote data development, dissemination and sharing.

Duties and Powers

- Establish and oversee a spatial data clearinghouse and GIS Resource Center, with global communications, to facilitate access to spatial information and GIS technical support and services.
- Coordinate data development, maintenance, and sharing by brokering partnerships, publishing standards, coordinating development and funding of large scale databases, adopting statewide geodetic monumentation (reference points), and working with SARA on long term preservation and access to digital GIS data.
- Facilitate coordination and communication among GIS users, and education and training.
- Establish, and publish, non-binding content and accuracy standards, or "preferred practices," for GIS
- Recommend consistent public sector data sharing policies.
- Establish guidelines for agency data collection planning to facilitate GIS applications.
- Keep abreast of, and participate in, Federal GIS coordination and standards efforts.
- Designate preferred statewide reference data sets for minor civil divisions, roads, hydrography, etc.
- Issue advisory opinions regarding data custody and maintenance or any other subject matter addressed by the previously enumerated powers.
- Monitor the development of GIS technology and uses for potential privacy threats and promote fair information practices, working with the Committee on Open Government to ensure adequate procedures for citizen redress of any misuse or abuse of confidential data and for correcting inaccurate data.
- Submit biennial reports to the Governor and Legislature that include activities, accomplishments, recommendations for strategic use of geographic information and such other recommendations as may be appropriate.
- Conduct periodic self evaluation.

The Council further recommends that the coordinating body have the legal authority to accomplish the tasks assigned. However, it understands that the location of the body, and its potential affiliation with an existing organization already empowered to conduct normal business, will govern what additional powers may need to be granted.

Structure

The Council recommends that the structure of the coordinating body reflect the broad range of interests in GIS and that state, regional, local, private, academic, non-profit, and grassroots organizations be represented, with particular emphasis on ensuring adequate local representation. In addition, the range of functional uses of GIS should be considered in establishing broad representation. Ideally, members should possess expertise in at least one of the following areas: GIS; computer technology; data management; information policy; or multi-organizational coordination.

The Council recommends fifteen as a reasonable number of part-time members of the coordinating body, who would be supported by adequate full-time staff to perform the functions of the coordinating body. Members would be selected in a fashion that would maximize both organizational and functional representation, as illustrated by a matrix contained in Chapter 5, *Coordinating GIS: Benefits and Barriers*.

Members and staff would form committees to handle issues deemed relevant by the coordinating body, with committees open to membership and participation by outside interested parties to broaden input and involvement of various segments of the GIS community.

Enabling legislation for the Council was prepared at a time when there was no formal statewide effort to coordinate information resources, and thus contemplated an independent Council or Commission on GIS. In the current situation in New York, a GIS coordinating function may need to begin life attached to an operating agency and/or the Information Resource Management Task Force, and evolve within the broader IRM umbrella. Council members believe that GIS must ultimately be considered an important and integral part of any statewide Information Resource Management effort. Should legislation be developed to create such a permanent function in New York, the Council recommends that these GIS recommendations be incorporated in it.

Experience from other states suggests that statutory authorization for an ongoing coordination function maximizes the likelihood of long-term success, and the Council expressed the preference that ultimately such a body be authorized in law. Other forms of authorization, such as Executive Orders, have been used successfully as well, and are options to consider.

Funding

While Council members believe that adequate resources must be provided to support the efforts and responsibilities of the body if it is to be successful, they recognize current fiscal realities. Initial efforts, like those of the IRM Task Force, may need to begin by reassigning existing staff resources. The location of the clearinghouse function, and the existing resources of the agency responsible for its operation, will determine whether or not a small funding increment or redirection is required.

Standards

Hardware and Software

It is not necessary for New York State to develop standards for GIS hardware and software. GIS hardware and software standards are expected to evolve from such organizations as the Open GIS Consortium, a non-profit trade association formed to implement the Open Geodata Interoperability Specification.

Data, Metadata and Records Management

A continuing state-level spatial data coordinating function will be needed to participate in the development of, and respond to, draft Federal theme standards expected to be released during 1996. The Council recommends that the coordinating body facilitate the involvement of all interested local and State agencies within New York and should encourage active review of the Federal standards as they are published.

The Council further recommends that the coordinating body:

- Develop a set of requirements for metadata for state and local governments (linked to any federal metadata standards in force) to facilitate data transfer and long-term access to GIS data;
- Monitor the need for one or more standardized formats for the exchange of spatial data between state agencies, local governments, and the public;
- Work with state and local government agencies to develop strategies for the long-term storage of digital spatial data that meet record retention schedules published by the State Archives and Records Administration; and
- Establish a NYS Geospatial Data and Metadata Clearinghouse, based on the needs of all interested parties within New York, to:

- Implement metadata standards adopted by the coordinating body;

- Develop a quality assurance procedure for metadata entries;

- Validate the availability of the spatial data described by metadata entries;

- Provide a feedback mechanism for user reports on data quality; and

- Provide direct access to the spatial data when appropriate.

Legal Issues

Freedom of Information Law

The Council recommends that FOIL be amended to declare that GIS records form another category for purposes of establishing a fee, as has been done in many other states. The Council supports the Committee on Open Government's proposal to recognize the commercial value of data and records, and recommends that FOIL be amended to:

- permit local governments and state agencies to set fees for data to be used for commercial purposes at a rate established and approved in advance based on the commercial utility of the data;
- provide for the return of revenue gained through these fees to the local government body or state agency to defray the costs of GIS development and maintenance, and the expansion of public access to government information; and
- permit agencies to release data subject to license agreements.

The Council supports statutory recognition of the right of governmental data owners to develop and enforce licensing agreements setting forth the terms and conditions of data use. Such licensing agreements may not, however, limit access to data used for the purposes of ensuring government accountability.

Limits On Liability

The Council recommends that GIS providers be exempt from liability for a variety of different kinds of records, such as parcel maps, deeds and as-built drawings, in order to guard against the potential legal ramifications of assuming a proprietary interest in data, much of which is not created for the purpose for which it is ultimately used by others.

In order to create incentives for data sharing through public-public and public-private partnerships, liability for inaccurate, out-of-date or

imperfect data needs to be contained. The Council recommends that the following limitations of liability be recognized in statute with respect to GIS data:

- disclaimers in data license agreements should be enforceable;
- there should be no joint and several liability for pooled data for which there are cooperative agreements;
- authors and contributors of spatial data should not be liable for consequential damages; and
- GIS providers should not be liable for inaccuracies in data unless the provider received prior written notice of the defect and thereafter failed to correct the error within a reasonable time.

For Further Consideration: A Local Coordination Mechanism

In some regions of the State, counties, groups of counties, or regional planning boards have taken the lead in coordinating GIS activities. In many places, this has not happened. Some Council members sought to craft, and make available to localities on an optional basis, an organizational vehicle that would deal with the various barriers to cooperation previously discussed. The Council recommends that the Legislature and the coordinating body give further consideration to authorizing local coordination mechanisms, such as an Information Resource Management District.

Privacy, Confidentiality and Security

The coordinating body is encouraged to adopt and promulgate a Fair Practices and Use Model for GIS that includes a clear statement establishing the obligation of the individual agencies participating in GIS ventures to protect the confidentiality and privacy of data on individuals.

The coordinating body should perform ongoing assessments of the impact of the continuing deployment of GIS technology and systems on the confidentiality and privacy of data relating to individuals.

Given the extensive collaboration and multiple agency involvement in the construction of GIS systems and the resultant difficulties a citizen would face in seeking administrative redress, the Council recommends that the coordinating body work with the Committee on Open Government regarding the need for assisting individuals with administrative appeal issues relating to:

- Inappropriate collection of confidential or private data for GIS use

- Investigation of complaints relating to abuse or misuse of confidential or private data in GIS systems or products

- Providing assistance to individuals in purging or expunging inaccurate, outdated, or misleading data about the individual

The Council recommends that every organization providing or participating in a GIS system establish a system of internal controls and security procedures that protect against unwarranted physical or electronic access to the GIS data, systems, and hardware. The internal control system should include a minimum requirement for an annual vulnerability assessment that gauges exposures and risks, and provide for an action plan to avoid, moderate, or otherwise limits those risks and exposures.

Records Management

The Council recommends that the Legislature consolidate current multiple definitions of a "record" into one useable definition that acknowledges the geographic component of the records created and stored in GIS, and, if appropriate, differentiates between "records" and "data" stored in an automated system.

The Council recommends that the coordinating body work with SARA to provide clear retention and disposition guidelines to state agencies and local governments regarding what records/data/information they must retain, for how long, and by what methods. Such guidelines would include identifying and scheduling specific records created and stored in GIS.

A company that cannot change the way it thinks about information technology cannot reengineer. A company that equates technology with automation cannot reengineer. A company that looks for problems first and then seeks technology solutions for them cannot reengineer...

To recognize the power inherent in modern information technology and to visualize its application requires that companies use a form of thinking that businesspeople usually don't learn and with which they may feel uncomfortable. Most executives and managers know how to think deductively. That is, they are good at defining a problem or problems, then seeking and evaluating different solutions to it. But applying information technology to business reengineering demands inductive thinking the ability to first recognize a powerful solution and then seek the problems it might solve, problems the company probably doesn't even know that it has...

One of the hardest parts of reengineering lies in recognizing the new, unfamiliar capabilities of technology instead of its familiar ones.

Even Thomas J. Watson, Sr., the founder of IBM, fell victim to this common shortsightedness when he proclaimed that the worldwide demand for data-processing computers would come to fewer than fifty machines.

A lack of inductive thinking about technology is not a new problem, nor one confined to laypeople. Early on, many people thought the greatest potential for the telephone lay in reducing the loneliness of the farmer's wife. Thomas Edison once said he thought the value of the phonograph, which he invented, was its capability to allow "dying gentlemen" to record their last wishes. Marconi, the developer of the radio, viewed it as a wireless telegraph that would operate point to point; he didn't recognize its potential as a broadcast medium. The real power of xerography was completely missed by no less a company than IBM...

Breakthrough technology makes feasible activities and actions of which people have not yet dreamed. The challenge that most corporations fail to meet is recognizing the business possibilities that lie latent in the technology... The real power of technology is not that it can make old processes work better, but that it enables organizations to break old rules and create new ways of working that is, to reengineer.

Michael Hammer and James Champy, "Reengineering the Corporation," 1993

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Appendix I: Chapter 564, L. 1994

GEOGRAPHIC INFORMATION SYSTEMS--TEMPORARY STATE COORDINATING COUNCIL

CHAPTER 564 OF THE LAWS OF 1994

AN ACT to create a temporary state coordinating council on geographic information systems and providing for the repeal of such provisions upon expiration thereof

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

§ 1. The legislature finds that advances in computer technology have made the use of digital, computerized mapping a highly valuable tool to support governmental programs. Over the past decade, numerous state agencies have invested large sums in software and hardware for geographic information systems (GIS), as well as in adapting data for their systems. While the development of these mapping programs has a direct relationship to mandated agency responsibilities, the purchasing of hardware and software, and the development of geographically based data are functions which should be coordinated within and among state agencies.

The legislature also finds that federal, state, county, and local geographic information system activities represent a significant investment in the information infrastructure which can be fostered through open communication between and among all levels of government.

The legislature additionally finds that increasing numbers of local, county and regional planning and economic development agencies are using digital cartography in a wide range of applications in the exercise of their duties. Geographic information systems are an increasingly important analytical tool to track trends, improve productivity and address service delivery issues not possible by conventional information systems.

The legislature hereby declares that a temporary geographic information systems council should be formed to examine various technical and public policy issues relating to GIS and geographic information systems and analysis; to identify the structure, functions and powers of a state-level geographic information systems coordinating body; and to examine the role a state-level body could play in assisting in the development and implementation of local government geographic information systems.

§ 2. A temporary geographic information systems council is hereby established for the purpose of evaluating and making recommendations to the governor and the legislature on the development of a state-level geographic information systems coordinating body, to examine various technical and public policy issues relating to geographic information systems, and to assess the potential costs and benefits associated with coordinating or integrating geographic information systems within New York state.

§ 3. A temporary geographic information systems council shall consist of the director of the division of budget, the commissioners of the departments of agriculture and markets, economic development, environmental conservation, education, health, public service, state, transportation, the office of parks, recreation, and historic preservation, and the directors of the division of equalization and assessment, state archives and records administration, and geological survey, or their representatives. In addition, the governor, president pro tem of the Senate, minority leader of the senate, speaker of the assembly shall each make the following appointments: two representatives from county government; one representative from a regional planning board; one representative from a city, village, or town government; and two representatives from the professional or business sector and one other representative of their choice. Ex officio members of the council shall include a representative of the United States Bureau of the Census; the United States geological survey; the United States department of agriculture; the United States environmental protection agency; the United States department of transportation; as well as a representative from the state university of New York at Buffalo; the state university of New York at Albany, the state university of New York college of environmental science and forestry and Cornell university. The director of the division of the budget or his or her representative shall act as the chairperson for the council. Members of the council shall serve without compensation.

§ 4. The council shall develop and issue a report of findings and recommendations to the governor and the legislature on or before one year after this act has become a law. After such report is issued the council shall cease to exist. Such report shall include, but not be limited to:

(a) an inventory and analysis of the following:

(i) the types of geographic information system data available from state, local and federal agencies operating in New York state, data compatibility, and current networking capabilities;

(ii) the types of hardware and software being used by state, local and federal agencies operating in New York state;

(iii) potential users of state and local geographic information systems services;

(iv) the use of geographic information systems as an economic development tool; and

(v) the role of university and private sector resources within New York state as they pertain to geographic information services.

(b) recommendations which address the public policy implications of making data accessible to the public. Such recommendations shall address the following issues:

(i) the development of protocols which address content, format, data element definition, accuracy, spatial scale and other items, in order to facilitate the handling and transfer of information among federal, state, and local entities, educational institutions, not-for-profit corporations, businesses and individuals;

(ii) treatment of data generated by a geographic information system as a public service available to private citizens and/or as a marketable resource to commercial users;

(iii) changes to the freedom of information law or other laws to allow the charging of fees for the development, reproduction and distribution of data; and an analysis of the legal ramifications of assuming a proprietary interest in data;

(iv) the maintenance of government records in electronic or digital formats in the context of records management requirements;

(v) confidentiality and privacy issues, as well as computer security.

(c) recommendations relating to the creation of a state-level geographic information systems and analysis coordinating entity, including the structure, goals, powers, duties, and funding of such coordinating body, as well as the role a state-level body would play in assisting in the development and implementation of county and local government geographic information systems.

§ 5. This act shall take effect on the sixtieth day after it shall have become a law, and shall expire and be deemed repealed one year after such effective date.

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Appendix II: Survey of GIS Users

Not available online

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Appendix III:

University GIS Programs in New York

While most states have one or two institutions of higher learning with programs in the information resource management of geographically based information and analysis, New York has several such institutions in the university system. There are excellent programs, accessible to citizens across the state, located in Buffalo, Ithaca, New York City, Syracuse and Albany. Brief descriptions of these university programs follow:

University at Buffalo/SUNY

SUNY at Buffalo has one of the strongest GIS/cartography programs in the nation, offering educational programs at all levels, bachelor through doctorate. At the undergraduate level, the program leads to a formal Certificate in Geographic Information Systems and Cartography. Graduate students pursue a program of study emphasizing the theoretical and conceptual aspects of GIS as well as practical training with a variety of mapping and GIS software. Students study and work with a diverse group of faculty whose research interests include spatial modeling, decision support systems, visualization, remote sensing, application of cognitive languages in querying spatial databases, environmental modeling and the application of GIS to a broad range of problems.

Research activities are conducted within the National Center for Geographic Information and Analysis (NCGIA). The NCGIA is a consortium comprised of the University of California at Santa Barbara, the State University of New York at Buffalo, and the University of Maine, with funding from the National Science Foundation. The NCGIA conducts basic research on geographic analysis using GIS. Although GIS technology helps us solve many problems, it also reveals to us problems which may be even more difficult to answer: problems relating to inadequacies in geographic data, errors and uncertainties, and the lack of effective methods for spatial decision making. NCGIA research gives particular emphasis to removing the impediments which have stood in the way of GIS being developed for even more widespread use and benefit to society and the environment.

SUNY at Buffalo and the NCGIA are leading an effort to form the University Consortium for Geographic Information Science (UCGIS). This consortium hopes to bring together the major university GIS program across the nation to define and direct national research programs in GIS and geographic science. The Collective efforts of over 40 faculty members of SUNY at Buffalo are contributing to the UCGIS research program development.

Cornell University

The Cornell University program in GIS is diverse, with several academic units devoting considerable resources to research, teaching, and extension activities in domestic and international arenas. Campus-wide GIS coordination is provided by the Cornell Laboratory for Environmental Applications of Remote Sensing (CLEARS). The mission of CLEARS is to advance the development, understanding, and use of spatial data and related technologies to meet the information needs of environmental assessment and sustainable development programs. The collaborative program objectives for 1995 to 1998 include:

- Enhancing the derivation of information from maps, aerial and satellite imagery, and other remotely sensed data;
- Disseminating knowledge of map and image understanding and spatial data processing, analysis and management; and
- Establishing an environmental data and information analysis facility for the study and visualization of maps, aerial photographs and tellite data, geographic databases, and other forms of spatial data.

Interdisciplinary research projects address relevant issues that focus on assessing the distribution and diversity of environmental resources, mapping land use dynamics in temperate and tropical ecosystems; modeling and visualizing nutrient and pollutant transport at watershed scale; characterizing plant stress using spectrometric methods; and developing spectral-temporal vegetation classification and mapping algorithms using digital imagery from Earth-orbiting sensor systems and spatial topographic, climatic, and soil survey databases.

Collaborative research and educational programs are routinely conducted with relevant academic units across several colleges, departments, and centers, including, but not limited to, the Colleges of Agriculture and Life Sciences, Engineering, Veterinary Medicine, and Architecture, Art, and Planning; Boyce Thompson Institute for Plant Research; Mann Library; and the Center for Theory and Simulation in Science and Engineering. Two courses are taught in GIS at the undergraduate and graduate level in addition to cooperative extension workshops and short courses offered as needed. External research and educational programs are also conducted with relevant units of local, state, and Federal government; non-government organizations and academic institutions; and the private sector.

Syracuse University

As a comprehensive program, Syracuse University offers one of the broadest approaches to GIS in New York State. Within the Department of Geography, students may specialize in one of the several areas including spatial statistics, visualization and animation, and environmental or urban geographical modeling. The strong social science focus of the Department encourages the integration of GIS and GIA into pubic policy analysis. Those students specifically interested in public policy and GIS may pursue appropriate course work in the Maxwell School of Citizenship and Public Affairs.

Additionally, the School of Information Studies at Syracuse provides formal course work in information systems management and theory, and SUNY/CES&F enables students to pursue further GIS-related work in environmental applications of GIS, remote sensing (photogrammetry and digital image processing), and surveying. Syracuse University's Geographic Information and Analysis Laboratory is well equipped for research in all aspects of advanced GIA and maintains selected GIS, spatial analysis, and visualization software. This facility serves as a GIS teaching laboratory, which supports the educational program as well as professional workshops and institutes. In its totality, the Syracuse University Program in GIS, including those faculty and resources at SUNY/CES&F, is among the strongest and most diverse in the United States.

SUNY College of Environmental Science and Forestry - (Syracuse)

SUNY/ESF specializes in the application of Geospatial Modeling and Analysis (GMA) and GIS and mapping technologies to education and research in resources and environmental management, environmental policy, landscape architecture, planning, and biology, particularly plant and animal ecology. Faculty from Forestry, Environmental Resources and Forest Engineering, Landscape Architecture, Environmental Studies, and Environmental and Forest Biology are participants in a college wide GIS planning and GMA/GIS oversight organization. A GMA certificate is to ESF graduate students and requires a minimum of 5 courses in GMA and GIS. In addition to the 6 GIS specific courses offered on campus students can take courses in remote sensing, global positioning systems, photogrammetry, surveying and related courses at Syracuse University. The college has three major facilities for instruction and research in these technologies: The Mapping Sciences Laboratory operated by the Faculty of Environmental Resources and Forest Engineering, The Laboratory for Applied GIS operated by the Faculty of Forestry, and the Adirondack Ecological Center in Newcomb, NY.

> In addition to the regular undergraduate and graduate courses in GMA and GIS the college also offers a number of Short Courses with a duration of 2.5 to 5 days in these areas. The Laboratory for Applied GIS is a repository for the digital data for the area of the state North of the Mohawk River collected under the auspices of the Northern Forest Lands Study.

Hunter College (CUNY)

The Department of Geology and Geography operates the Spatial Analysis and Remote Sensing Laboratory (SPARS), a state-of-the art teaching and research laboratory dedicated to Geographic Information Science. The department has nine faculty members who teach GIS or GIS-related courses including cartography, remote sensing and spatial analysis. These courses are generally available to registered undergraduate and graduate students of the college. The department offers special GIS short courses for state and local agencies which include Introduction to GIS, GRASS, TransCAD and ArcInfo. The SPARS Laboratory is equipped with 60 Unix workstations with the appropriate output devices and a sizable PC laboratory equipped with Pentium and 486 machines and licenses for most GIS software packages which permits the teaching of large numbers of students. The laboratory was also established to permit government users to conceptualize their GIS problems with faculty and staff assistance and to test hardware and software platforms with their applications before making large scale investments.

University at Albany / SUNY

The program at Albany, like most GIS programs, is situated within the Department of Geography and Planning. Facilities include the Department's GIS Remote Sensing Laboratory with several software and hardware combinations. One faculty member is fully dedicated to digital cartography and GIS and several others are actively involved in the Program. Albany's program is also strong in remote sensing. The GIS curricula center on the undergraduate and graduate Certificates in Geographic Information Systems and Spatial Analysis, but undergraduate and graduate students can also concentrate in GIS in the BA, MA and MRP degrees. Location in the Albany area provides special opportunities to participate in State, regional, and local agencies that employ GIS, as well as many private firms. SUNY Albany offers ten courses in GIS, remote sensing, digital cartography and CADD at the undergraduate level and seven at the graduate level. The program has produced many undergraduates who have continued on to advanced degrees with a GIS emphasis. Albany MA and MRP graduates with GIS backgrounds regularly find a range of career opportunities.

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Appendix IV: Local, Regional and State Coordination Efforts in New York

Both formal and informal regional and local coordination programs are active within New York State. A number of different models have been developed within New York State to facilitate the sharing of GIS data, knowledge, and applications at the regional and local levels.

Nassau County, for example, has implemented a formal partnership agreement under which the County licenses the use of its data to its various partners. At present the program includes 107 licensed partners, including five state agencies (four in New York and one in New Jersey) plus many police and fire districts, villages, towns, and municipalities. Any consultants working for the County or its partners may use the data free of charge for the purposes of the client's project only. In addition, the municipal partners within the County may purchase hardware, software, or other products and services under the County's pricing agreement with vendors. As a requirement of the licensing agreement, any changes to the data must be returned to the County. Additional layers created by the multi-participants are returned to the County at no cost to become part of the overall GIS, however ownership, and the right to redistribute these additional layers remains with the multi-participant.

There is now an official New York City GIS steering committee, chaired from the Mayor's Office of Operations, that is preparing for a flyover of NYC this Spring which will be used to develop the digital physical base map of New York City.

A smaller, less formal partnership arrangement exists between Saratoga Economic Development Corporation, Niagara Mohawk's Department of Economic Development, the Saratoga County Real Property Office, and the NYS Adirondack Park Agency. These partners pooled resources and expertise to convert Saratoga County tax maps to electronic form. This valuable data layer can now be used by all the partners for a variety of applications. The success of this partnership led the Adirondack Park Agency and Niagara Mohawk to seek similar arrangements in other counties.

Users Groups and Professional Associations

Individual GIS professionals in New York are working together in informal user groups and professional associations. As the natural outcome of a desire to work together, twelve informal regional coordinating efforts and user groups have developed across New York State. These regional groups have produced directories of geographic data; they have discussed standards, hardware, and software issues; coordinated base map development; and generally facilitated networking and information sharing.

The Long Island GIS Users Group (LIGIS) is an example of a regional users groups with over 250 members representing Nassau and Suffolk County GIS users from the governmental, academic, and private sectors. The group meets on a regular basis and also cooperates with GISMO, the NYC user group.

GISMO, a network of GIS professionals in New York City, advocates for GIS coordination and facilitates the distribution of data among city agencies.

The nine-county Genesee/Fingerlakes Regional Planning Council has an active Geographic Information Sharing/Special Interest Group (GIS/SIG).

The Capital Region has both ArcInfo and MapInfo users groups and there are GIS users groups in Central New York, the Southern Tier (both Central and East), and Utica-Rome

The Multi-County GIS Cooperative, a consortium of local and regional user groups, plays an active role in influencing statewide GIS development to assure coordination, public access, and regulations sensitive to county and local governments.

Professional associations play an important role in the development of GIS expertise as well. These groups may focus on cartographers, planners, or other similar professions. The Urban & Regional Information Systems Association (URISA), for example, is a formal nonprofit educational association of information users, providers, and evaluators. URISA's annual national conference is widely attended and recognized as one of the best sources of information about GIS development, use, and evaluation.

Much GIS expertise already resides in individual government organizations in New York State. The New York State government organizations most experienced in the use of GIS include the NYS Department of Environmental Conservation (DEC), NYS Office of Real Property Services (ORPS), and the NYS Department of Transportation (DOT). Many other state agencies including the NYS Health Department (DOH), the Adirondack Park Agency (APA), and the State Emergency Management Office (SEMO) have also developed considerable GIS expertise. Counties, cities, and other local governments are also benefiting from geographic information systems and spatial data resources.

New York State Agency Cooperation

The New York State Department of Environmental Conservation is currently in the process of developing geographic Information System that envisions the use of a three dimensional color infrared electronic map at 1:24,000 scale on which critical natural resources and environmental resources information can be put. The basic geographic layers that are essential to the effort are the hydrography including streams, lakes

and ponds and wetlands, hypsography or contours and land cover and land use. The production of the land cover information is extremely expensive. It entails the development of aerial photography, which is ortho-corrected to make it locationally accurate, and then, this product is digitized. The result is a Digital Orthophoto Quarter Quadrangle (DOQ).

Because of the expense scale and complexity of developing the DOQ's, DEC brought together 14 State agencies to work with USGS to pursue the project cooperatively. USGS leads a national consortium of federal agencies that cost share aerial overflights through the National Aerial Photography Program (NAPP). The New York State NAPP Steering Committee, made up of the 14 agencies provided guidance to USGS on the specifications. The color infrared, leaf-off photography was flown in the Spring of 1994 and 1995. Nearly all of the state is completed. It is expected that the remaining areas will be flown this Spring. The photography will be the basis for the development of the DOQ's. However, the cost of their development is approximately $5,000,000.

Because no one agency had enough funding to finance this expenditure, and because each agency would use the information that DOQ's provide, formal agreements were established through memoranda of understanding among DEC and 13 of the 14 agencies. In addition, DEC reached agreement with USGS to reduce the cost sharing to 50%-50% arrangement from the 75% to the state for the color infrared product. Also, the Department reached agreement with other federal agencies to cover the expenses, most prominently among them are the Natural Resources Conservation Service and Consolidated Farm Service Agency in the U.S. Department of Agriculture, the U.S. Environmental Protection Agency. The Department also developed a high resolution Digital Elevation Model (DEM) that USGS accepted and will be used as one of the building blocks for the DOQ's. It also helped pay for the non-federal share.

The result of this state and federal cooperative effort will be to produce a digital base map that federal and state agencies will use to manage their programs' responsibilities. Obviously, a commonly used electronic geography on which federal and state programmatic attributes can be plotted will provide more effective problem solving and efficient use of scarce dollars. The color infrared DOQ's will be the first in the country at 1:12,000 scale that meet USGS National Map Accuracy Standards. The high resolution DEM is also the first in the country and will allow natural resources and environmental impact assessment to be done more accurately and efficiently.

Other Coordination Efforts

The State Archives and Records Administration: Local Government GIS Demonstration Project described earlier will produce procedures and guidelines for assisting local governments in planning GIS activities.

The GIS planning methods and procedures will be published as a set of SARA technical reports and will cover the following topics:

Manager's Overview	Pilot Study and Benchmark Tests
Needs Assessment	GIS Database Construction
Conceptual Design of a GIS	GIS Hardware and Software Procurement
Survey of Available Data	GIS System Integration
Survey of GIS Software	Application Development
Database Planning and Design	Use and Maintenance of GIS System

These documents will describe the steps necessary to complete each phase of GIS development, will identify and describe appropriate methods for each step, and will present examples of completed GIS planning documents. The software to be developed will support the database activities in the GIS planning process.

The second major activity is to continue development on a New York State geospatial data and metadata standard. The Federal Content Standard for Geospatial Metadata has been under review by the Center for Technology in Government at SUNY-Albany where a process has been developed for ascertaining the appropriateness of this standard for use by state agencies and local governments. Due to the Federal schedule for completing the twelve theme standards, this activity will not be completed by the end of this project (June 1996). A recommendation for continued development of a state geospatial data standard will be prepared.

Genesee and Fingerlakes Regional Planning Council GIS/SIG

In conjunction with development of the G/FL Regional Directory, reports on "Procedures for Sharing Digital Map Information" and "Options for Organizational Structure to Address Regional Data Sharing Issues" were developed that would be of interest to a statewide coordinating body. They could provide a starting point for developing statewide procedures for sharing data. The reports discuss most of the same issues confronting the rest of the State and their findings are similar to those of the Temporary GIS Council.

Selected findings of the Genesee/Fingerlakes standards working group include:

- Digital mapping is the future--whether CADD, GIS, AM/FM or whatever-- and we must begin to build the digital base maps for future generations now.

- Sharing of digital maps is where the real productivity gains will be made. Sharing should be promoted, it for no other reason than to digitize the same data only one time-the Digitize-It-Only-Once-Stupid (DIGIOOS) principle.

- While digital mapping is still in its infancy in the Rochester region, many digital map products already exist, and sharing of this data should be promoted.

- As expected, most digital maps in our region are internal, single purpose maps that are not produced with sharing in mind.

- The Rochester area is presently following a "sharing mechanism" approach rather than a consolidated or consortium approach to obtaining digital data. That is, each agency is digitizing its own data rather than creating a consortium to digitize it. And this is OK as long as the same layer is not digitized more than one time.

- Few digital maps have a common coordinate system, and in a few cases, the coordinate system is not even known.

- A data definition dictionary, sometimes called a meta-data file, is needed to clearly define the data when digital maps are shared.

A long-term interest in a more formal regional public/private consortium to operate a clearinghouse, and possibly even maintain data, was expressed in these reports.

The Erie County Water Authority Proposed an Enterprise-based GIS Within the Freedom of Information Law

In 1994, the Erie County Water Authority asked Assemblyman Pordum and Senator Volker to file a bill on their behalf to authorize the Authority to operate a GIS consortium on an enterprise basis within the confines of the Freedom of Information Law.

Assembly bill A1349A/ Senate bill S753A authorizes the geographic information system enterprise to charge customers without regard to governmental or commercial purpose at rates based on their proportionate share of total use (including some cost recovery for construction costs). In return for this permission, the Authority would have been required to waive its normal-course-of-business protection from FOIL requests which required additional value added work to fulfill and would have placed the Authority's rates under the review of the Committee on Open Government. Media and research requests and other requests made for public accountability reasons would have been exempt from all charges. Charges could not exceed costs. Cost recovery for construction would have been subject to normal amortization rules and could not have been charged after the amortization period.

In addition, any hard copy generated by the GIS system would subsequently be treated as a record and would be available at the copying charges specified in FOIL.

The bill passed the Assembly and died in the Senate. The bill was not refiled in 1995 due to the legislative consensus to activate the Temporary Council.

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PRIVACY POLICY ACCESSIBILITY ABOUT CONTACT DISCLAIMER

Appendix V:

Committee on Open Government Proposed Legislation on Fees for Records Used as a Commercial Commodity

Legislative findings. As government information systems have grown and as government increasingly uses electronic systems to maintain information, it has become possible for the public to acquire vast amounts of data quickly and easily, resulting in a variety of new uses and applications of public records. Concurrently, government records are increasingly being used for commercial or profit-making purposes.

When accessible records are of general interest to the public or relate to the accountability of government, they should remain available to the public at minimal cost. Nevertheless, when government records are primarily used as a commodity for commercial purposes, the legislature hereby finds that, in appropriate circumstances, agencies should have the ability to assess fees for the production of records consistent with the fair market value of the records.

Certain records having fair market value are common to local government agencies, and, with respect to those records, those agencies may establish fees based upon the criteria described herein. State agencies may, by means of the procedure described herein, seek to establish fees for the production of certain records based upon the fair market value of the records.

With the enactment of this act, the legislature reaffirms its intent to ensure governmental accountability and recognizes that the public should continue to enjoy maximum access to records, while preserving the capacity of government to withhold records in accordance with this act.

Section 87 of the public officers law is amended by adding a new subdivision 1-b to read as follows:

1-b. Fees for records used for commercial purposes

(a) Notwithstanding any other provisions of this section:

i. A local government agency may establish fees for production of the following collections or series of records based upon the commercial utility of such records when the records can be made available by law and are requested in whole or in substantial part:

(1) real property assessment and tax records including, but not limited to, tax rolls, tax maps and real property sales data maintained pursuant to articles five, nine and fourteen of the real property tax law;

(2) voter registration applications, lists of registered voters and enrollment lists of registered voters maintained pursuant to article five of the election law, and registers of voters maintained pursuant to section twenty-six hundred six of the education law;

(3) income execution files maintained pursuant to section fifty-two hundred thirty-one of the civil practice law and rules;

(4) building permits and certificates of occupancy;

(5) computerized systems used to input, manage, analyze and display geographical information;

ii. (1) In addition to the records described in subparagraph I of this paragraph, a county, city, town or village may, by local law, and any other local government agency, may, by resolution, provide that fees based upon the fair market value of other records may be charged by the local government agency only after seeking and receiving an advisory opinion from the committee on open government as to whether charging such fees for such records is appropriate.

(2) If a law or resolution permitted by clause one of this subparagraph is adopted, the local government agency shall provide a copy of the law or resolution to the committee on open government and a listing of the records described in that law or resolution. The law or resolution and listing shall be made available by the local government agency to any person requesting the information for a fee not to exceed twenty-five cents per page.

iii. A state agency may seek approval from the committee on open government to establish fees for production of records based on the commercial utility of such records to private, non-governmental entities.

(b) A local government agency may provide for fees pursuant to subparagraph ii of paragraph (a) of this subdivision and the committee on open government may grant approval for fees pursuant to subparagraph iii

of paragraph (a) of this subdivision only when:

i. the record may be made publicly available pursuant to this article or any other provision of law;

ii. the purpose of disclosure to applicants for the record is generally unrelated or tangentially related to the accountability of government or to public health, safety or welfare; and

iii. the utility of the record to non-governmental entities is primarily commercial.

(c) After the committee on open government approves a state agency's request to establish fees pursuant to paragraph (b) of this subdivision, the state agency may establish fees based on the fair market value of the record, subject to approval by the director of the budget.

(d) The pendency of an application for such approval by a state agency shall not affect any request for records made prior to the submission of such application.

(e) When a request is made for a record for which the establishment of a fee has been approved, an agency may inquire as to the intended use of the record and may require that an applicant for the record certify in writing as to the intended use of the record. In addition, when appropriate, an agency may seek information relating to criteria described in paragraph (k) of this subdivision.

(f) Fees established by agencies pursuant to this subdivision shall be reasonable.

(g) An agency shall make a schedule of fees established pursuant to this section available to any person or entity without charge.

(h) No fee established by this subdivision shall be assessed when records are made available:

i. to a governmental entity;

ii. to a member of the news media for news gathering purposes;

iii. for purposes of bona fide academic or other research unrelated to commercial utility of the records;

iv. to a nonprofit entity as described in section 503(c)(3) or (4) of the internal revenue code;

v. for any other purpose unrelated to profit-making, commercial or similar activity; or

vi. to a person who is the subject of a records or records.

(i) Notwithstanding any other provision of law, each state agency is hereby authorized and directed to deposit with the comptroller any moneys obtained by payment of fees assessed for providing records pursuant to this subdivision. The director of the budget may require state agencies to prepare an accounting of fees collected pursuant to this subdivision.

(j) The committee on open government shall:

i. promulgate regulations to implement the provisions of this subdivision and provide advice and guidance as deemed appropriate;

ii. following its approval to permit a state agency to establish a fee pursuant to this section, publish a notice in the state register concerning such approval;

iii. in its report to the governor and the state legislature required to be made pursuant to subdivision one of section eighty-nine of this article, cumulatively identify records for which fees have been approved pursuant to this subdivision; and

iv. be authorized to conduct research and studies, with the cooperation of agencies, regarding the commercial use of records and fees.

(k) In determining the fair market value of records and the establishment of fees for the reproduction of such records, the following factors, where appropriate, shall be considered:

i. the demand for the records;

ii. the commercial use or uses of the records;

iii. the ability to obtain the same or similar records outside of government;

iv. the volume of information contained in the records;

v. the utility of records as mailing lists;

vi. the profit or revenue that may be generated by use of the records outside of government;

vii. the means by which agencies store, disseminate or reproduce the records;

viii. whether records are used directly by the recipient or may be resold or distributed in whole or in part;

ix. the nature of competition between a recipient of records and others involved in similar activity;

x. the actual cost of producing or reproducing records; and

xi. such other factors as may be relevant.

The opening paragraph of section 8021 of the civil practice law and rules, as amended by chapter 784 of the laws of 1983, is amended to read as follows:

Whenever a county clerk renders a service other than in his or her capacity as clerk of the supreme or a county court, or other than in an action pending in a court of which he or she is clerk, he or she is entitled to the fees specified in this section, unless otherwise authorized to charge fees pursuant to subdivision one-b of section eighty-seven of the public officers law, payable in advance.

This act shall take effect on the thirtieth day after it shall have become law.

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Appendix VI: For Further Consideration:

Helping Local Governments Cooperate

As part of the State Archives and Records Administration Local Government GIS project, the process of drafting the guidelines for GIS development included meeting with several GIS interest groups across the state. While these meetings were primarily focused on reviewing technical procedures, a broader discussion was held on problems associated with developing GIS in local governments. These meetings identified several impediments to local development of GIS:

1. Inability to coordinate GIS development between local governments within a region;

2. Inability to recognize and formalize leadership for local government GIS efforts within a region;

3. Inability to secure and concentrate the resources necessary to build multi-purpose local government GIS;

4. Lack of data standards for local government data, including a lack of direction as to who should be responsible for different data categories (e.g., parcels, roads, etc.);

5. Lack of common technical procedures for the development of GIS; and

6. Lack of general knowledge among local government officials as to other GIS activities and the availability of non-financial resources.

Items five and six are being addressed within the SARA Local Government GIS Demonstration Project. Action on the remaining items to empower one or more local governments to initiate and coordinate GIS on a county-wide or regional level is needed. The Council recommends that the coordinating body and the Legislature give further consideration to authorizing in law locally-based coordination mechanisms such as the Information Resource Management (IRM) District concept outlined below.

Facilitating GIS Development in Local Government

Local governments collect, maintain and use large amounts of information to manage their activities and to provide services to its citizens. Availability of this information resource is critical to the effective and efficient management of public services. Information processing has been estimated to take between one-third to one-half of all staff time spent within local government. Most of the information collected and used by local government has a spatial component or reference as an important part of the information. Space, or location, is one of the major ways of organizing and integrating most of the information of interest to local government. Historically, maps have provided the base for organizing local government information resources. These map bases are now being replaced by geographic information systems. A GIS is more than a digital map, it provides the organizing structure for the information resource and enhances the utility of the information for a wide variety of uses, both within the governmental agencies and to citizens, the private sector and other governmental units. The most significant benefits from GIS are: improved efficiency in providing information to citizens and other users; increased effectiveness in managing public infrastructure (water, sewer, roads, etc.); and overall community growth and improvement through effective strategic decision-making (economic development programs or addressing special problems such as the New York City watershed issue).

Using a community's information resource for strategic decision-making requires that the information be highly organized and coordinated over a significant area or region, more organization than would be required for infrastructure management, which itself requires more organization than simple information provision to citizens. Progressively higher levels of organization and coordination maximize the potential benefits from a regional GIS.

At present, the adoption of GIS by local governments is happening on a piecemeal basis, mostly by individual departments or single agencies. While such adoption may meet the basic low level information needs of single departments or agencies, this approach is not coordinated, is expensive and does not provide consistent information over a large enough area to support strategic activities such as an economic development program.

There are significant impediments to the development of GIS which cannot be resolved by local government itself. The three statewide GIS studies (GIS Cooperative Project by the Center for Technology in Government at SUNY - Albany, the Local Government GIS Demonstration

Project by the Erie County Water Authority and the National Center for Geographic Information and Analysis at SUNY - Buffalo, and the Government-Related Geographic Information Systems (GIS) in New York State Survey conducted by the NYS Forum for Information Resource Management) contributing to this report all identified the following major impediments to the development of GIS in local government:

1. Lack of an organizational mechanism to coordinate GIS development and effectively share data, including resolving data ownership, access and cost-recovery issues;

2. Lack of a framework for establishing leadership for local government GIS in many regions;

3. Lack of any means to raise and coordinate funds for GIS data development and maintenance; and

4. Lack of spatial and metadata standards, including a means for designating responsibility for the development and maintenance of standards.

While the range of uses of geographic information is fairly well understood, the current problem is to establish one or more organizational mechanisms at the local governmental level which would be capable of achieving organization and coordination over a suitable area (probably county or multi-county regions). Many believe that GIS will be most cost effective if regions in the state adopt an ***enterprise approach to information resource development***, as has been done in the private sector.

The path of adoption of automated technologies by major corporations begun in the 1960's needs to be duplicated in local government. Within firms, ***computer systems*** were initially developed by single departments servicing their own needs (purchasing, ordering, personnel, production control, etc.). Computer systems designed to serve the needs of a single department were not capable of integrating information from several departments and thus were not useful for management needs of the firm. Over time, individual departmental computer systems were replaced by ***management information systems***, which integrated the data into an information resource for the entire firm. These management information systems provided information on the firm's operations and served to promote efficiency, but could not provide information for strategic decision-making about the firm's activities. To meet this higher order need, ***executive information systems*** have been developed, which integrate the information resource of the firm with information about the environment and markets within which the firm operates. Thus, the whole information resource of the firm is available to support ***strategic decision-making to improve competitiveness.***

GIS in most local governments in New York State is currently at the individual computer systems level. Single departments, and occasionally single agencies, are developing GIS to meet selected needs. While these systems can promote efficient operation of their parent departments, they do not effectively contribute to the broader needs of local government. For example, a GIS to support economic development programs must provide consistent and coordinated information across a whole region or, ideally, the entire state. The fragmented nature of local government is a significant barrier. Across the state, many agencies have GIS programs, but lack coordination between local governments and with state agencies. Upstate, many village and town governments, too small to develop GIS on their own, are seeking potential partners to join a GIS program, while in Western New York duplication of effort among several major agencies is taking place. No single organizational structure will meet the diverse needs across the state.

The problem in New York State is how to encourage GIS development in local, regional and state government such that the information resource of local agencies is available for management and strategic decision-making activities. Unlike the corporate example where a chief executive officer and board of directors has the authority and access to resources to develop integrated information systems, there is no mechanism to effectively coordinate local, regional, and state GIS activities. To develop the corporate equivalent of management and executive information systems for local governments, enabling legislation is required to foster the creation of regional information cooperatives using GIS as the organizing base.

The key issues for the formation of a regional information cooperative are ***leadership, membership or participation, and funding***. Significant monies are currently being invested by state and local agencies in collecting and storing information. These monies need to be redirected toward cooperative regional GIS development and supplemented for developing the structure for information integration. Any solution needs to address at least the following specific items:

1. Provide authorization for a local government agency, or a consortium of agencies, to organize a regional GIS cooperative (single or multi-county) for the purpose of creating and maintaining a regional GIS database; this cooperative could then be recognized by the state GIS coordinating body;

2. Authorize the regional GIS cooperative to be the repository for the GIS database, to require the cooperative to respond to Freedom of Information requests for government accountability, and to authorize the cooperative to license any other uses of the GIS database.

3. Create membership status for cooperating local governments where the condition of membership is support for the creation and/or maintenance of the GIS database and each member has unrestricted use of the database.

4. Authorize the cooperative to raise capital funds (tax exempt) with bonds to be repaid by member subscriptions.

In some regions of the State, counties, groups of counties, or regional planning boards have taken the lead in coordinating GIS activities. However, in many places, this has not happened. Some Council members believe that a new organizational vehicle, or increased authority for existing organizations, is needed to deal with the various barriers to cooperation previously discussed. In a state with a plethora of governmental units, no one can recommend yet another type of special purpose district without trepidation. However, we lack an appropriate legal vehicle for local governments to cooperatively create and manage information. Many now conclude that such an option should be permitted. Such a vehicle need not impose any new taxes, nor make budgetary demands on the State, but could assist local governments in helping themselves. One option designed to achieve these objectives was presented to the Council - the Local Information Resource Management District.

Local Information Resource Management Districts

The Information Resource Management (IRM) District would be a mechanism for structuring, administering, and funding ***a GIS cooperative at the local level.*** *Loosely modeled on special improvement districts, such IRM Districts would have limited financing powers. A District could be created by the local governing body of a county, a first class city, or by several such local governing bodies acting in concert. To assist in financing approved GIS projects, IRM Districts would have the debt-issuing authority of special districts, but no taxing power. Bonded debt of a district would be supported by contracts with participating organizations to purchase the information products and services of the cooperative. Establishing the IRM District concept would address, at the local level, barriers to cooperative GIS development and operation. Membership would be voluntary, but carry with it clear incentives to join, such as the power to license data use and reuse, subject to public access rules for governmental accountability. Members would share in the information and resources of the cooperative. The non-profit IRM District would have the authority to set limited user fees based on project cost and competitive market prices for similar products and services. The District fee structure would be subject to outside review and approval.*

Local needs for GIS vary across the state. Urban, suburban, and rural areas all have differing requirements for scale, detail level, and system update cycles. The general notion is that within at least a county (or multi-county area, where appropriate) there should be a locally-appropriate, coordinated system. Keyed to this system would be a set of maps and GIS data files from public and private sources that can be used by all sectors of the economy. The result would be multi-layered spatial data set built on an established grid and maintained using common data quality standards by the various public and private data contributors and key users who agree to abide by those standards. A local governing body is proposed to develop a plan that assures meaningful public access to the data and tools to use the data while charging for commercial use and reuse of cooperatively constructed GIS data sets.

Where the District Concept fits within a Coordinated Statewide Structure:

The New York State Temporary GIS Council (the Temporary Council) identified four areas to cost-effectively improve GIS development and utilization in all sectors of the economy and at all levels of government:

1. *State coordinating body to establish standards and serve as a resource of technical expertise for local government, not-for-profits, and businesses;*

2. *Clearinghouse for access to spatial data and metadata;*

3. *Local planning and information exchange; and*

4. *The need for mechanisms to pool resources.*

The Information Resource Management District (IRM District) is an evolutionary proposal that provides a fundamental mechanism where data needs, resources, systems and users come together. Like the movement of other government programs for transportation, health care, human services and education, the IRM District puts responsibility for planning and satisfying local information resource needs back to the community. Statewide goals of data quality, public access, privacy, security and fiscal responsibility over public funds are incorporated into locally developed IRM plans through an adequate review process. Without coordination, the public and private sectors in New York State will spend untold millions of dollars on the development and maintenance of GIS systems, often duplicating the work of other GIS holders. The IRM District Proposal creates a framework for these separate investments to be identified and pooled in a structure where government partners serve as anchors, enhancing cooperation among various sectors of the economy while fostering commercial uses. The principal benefits and incentives to join an IRM District would be:

1. *The IRM District concept provides for pooled investment in data consolidation, paperwork reduction and other efficiencies. Economies of scale would be realized by collecting, qualifying and maintaining essential data correctly once on behalf of multiple users for various programs and businesses in the public and private sector. The combined District information would be less expensive to create and maintain for each participating organization. The data layers could also be of higher quality, more accurate and more up to date than the current practice of mis-*

mapping and redundant mapping of facilities, programs, infrastructure, schools and other features.

2. *The establishment of an IRM District, and participation in it, would be voluntary. The concept may be unnecessary for existing data partnerships or counties where cooperative efforts exist. Information resource management district membership would be voluntary. The incentives that come to members of an IRM District, could include funding support of approved GIS projects and the ready resale of their data.*

3. *Limits on liability that make data partnerships problematic would be removed. In the main body of this report, the Temporary Council endorsed limitations on liability for spatial data distributed through GIS. These recommendations are realized in the District proposal. In order to create incentives for data sharing through local public-private partnerships, liability for erroneous, out of date or inappropriate data is checked.*

4. *The concept provides a methodology for financing without taxing authority. Bonding for projects embodied in the Districts Approved Plan would be authorized and permitted to be secured by user commitments to pay fees, supply data, update data and the hardware, software and data supporting this enterprise approach. These financings could carry tax-exempt interest, with credit ratings that combine strong credit-worthy government, utility and other parties. The public finance markets and local fiscal rating requirements will, as a practical matter, determine whether the debt can be secured only by project revenues, or needs to be general obligations of the public sector members of the District. The funds borrowed by the District would be readvanced to finance the building of information assets that would be licensed by participants in the information cooperative.*

5. *Most spatial data is local. A statewide map series can be constructed by means of assembling local GIS data that is based on data generated locally and maintained to federal and state standards.*

6. *The concept provides a flexible mechanism for future strategic information resource management at the local level. While the proposal focuses on GIS and the sharing of spatial data, the IRM District could achieve other technology coordination and implementation strategies for telecommunications, fiber optic cable and other new technologies where standardization and exchange of information is desirable.*

7. *Provision is made for assuring meaningful public access. Approved plans would include appropriate and innovative ways to make better information services available for querying by the public. Commercial and governmental users of information would have the option to buy the data by entering into cost sharing licenses or buying as the need arises.*

8. *The proposal could be implemented today using existing or future agencies. The Temporary Council recommended that New York organize a coordinating body for GIS statewide, as in most other states. Until such time as a Coordinating Body is established, the District proposal could fit into the existing coordinating functions of State Government: For example, State Archives and Records Administration (SARA) could review aspects of the plans that concern records management, the Committee on Open Government could review the plans for meaningful public access and reasonable pricing for information products and services, and the Empire State Development Corporation could help the Districts with financing and economic development strategies for making government more accessible. A new level of local institutions may be unnecessary to the extent that present institutions have shown a track record of successfully coordinating public and private initiatives. For instance, because of the impact of GIS on economic development planning for communities, Regional Planning Boards might be natural homes for the personnel and mission required for IRM District coordination.*

Administration of Information Resource Management District:

Each IRM District would organize a District Board to coordinate and improve the development of GIS resources within the District. The Board's powers would include the underwriting of projects pursued in accordance with their Approved Plan, and the guarantee of indebtedness secured by pledges of revenues from the members forming a special purpose entity (non-profit) organized as either a Public-Public Partnership, or a Public-Private Partnership.

A Board could enter into information exchange agreements with District members. Membership in a District could be tiered as follows:

1. *Full Members - these would likely include government agencies (federal, state and local), utilities (energy, telephony & environmental/recycling), media, consulting engineers, real estate developers, construction companies, insurance companies, banks and human services providers. Full membership would be required for those who propose to join in GIS capital projects that implement the approved plan. Full membership might include unlimited access to district data and software, an annual users fee, and a commitment to not buy third-party data that represents the FOILed product of government members data for at least two years after discontinuing Full Membership.*

2. *Research Members - these would include academic, university and non-profit groups who generate new data or agree to use and correct data.*

3. *The Public At Large*

Each Board should represent a cross-section of public and private priorities for GIS locally, in order to develop and administer a master planning process for GIS resources. Plans that further GIS development objectives, as promulgated by federal committees, industry practices and common local experience, would be reviewed by the state coordinating body. Approved plans that embody specific photogrammetric, conversion, training or other project activities related to creating a long-term GIS resource would be eligible for financing through bonds issued by the IRM District. Approved plans would cover at least the following GIS development objectives: data and metadata standards to be used for base mapping activity and modalities to enhance public access, an aspect meant to improve access traditionally afforded by copying records. (Among the methods that might be considered are: primary and secondary schools; institutions of higher learning; life-long learning programs; public libraries; community and public advocacy groups; automated telephone/faxback or mailback systems; the Internet; and kiosks.)

The Board could also borrow and lend money (at tax exempt rates applicable to Improvement Districts) for projects that comply with the District strategic information resource plan. It could also authorize cost sharing arrangements among members so that each member has the incentive not to "break ranks" and instead to stay the course of cooperative data policy development. Intergovernmental cost sharing requirements would apply so that information made available by one governmental unit to another is appropriately licensed, reuse and distribution rights clarified, and compensation or bartered services delivered. The Board would deal with the state GIS coordinating body to monitor, apply for and manage grants at the federal, state and foundation level for which projects might reasonably be expected to qualify.

The private sector could also reap the rewards of IRM District cooperatives. Utilities serving the area of an IRM District could be encouraged to participate in Joint Information Resource Management Activities to streamline compliance with Labor Law/One Call street digging notification, and achieve reduced costs for building and maintaining infrastructure in a deregulated era. Other businesses that are heavy users/handlers of information (like real estate developers) could also see their costs of communicating information and proposals to the government made more efficient. Incentives could be created for all sectors. A bounty could be created to encourage rooting out data redundancy or other information resource waste and abuse. (For example: after an IRM District has been in existence for some time, the first person who establishes that the data has value beyond the agency or that it is readily available from other sources within the IRM District at the same or better quality might be paid a percentage of savings that accrue to the agency.)

The District would have the authority to borrow by issuing IRM bonds, similar to Industrial Revenue Bonds, which are authorized borrowings on behalf of capital projects. Such projects could include database conversion and construction, or others that comply with the transitional and long-term goals of their approved plans. These borrowings would be secured by pledges of user fees and other income generated from the sale of information products and services, and by the hardware, databases and other capitalizable assets created with the funding. Where advisable to obtain or maintain a suitable rating for the IRM bonds, the participating agencies would be authorized to guaranty their obligation to purchase information products or services created with the funding where such information products or services replaced in whole or in part the development, enhancement or renovation of an existing agency information system, whether manual or computer-based.

The IRM District idea would support State and local goals in economic development by: making state, county and local governments more accessible to the citizenry, and coordinated through strategic investment and common approaches to information products and services; reducing the paperwork burden on local businesses, citizens and improving the responsiveness of government by developing more accurate and useful information; Empire State Development Corporation would be aided in its effort to advance the economic development opportunities for high technology firms locating in New York, where these firms could compete for contracts to design, build or maintain information products or services covered by an approved plan or financed with IRM Bonds.

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Appendix VII:

Statutory Restrictions on Records Access and Disclosure

The State Archives and Records Administration compiled this list of major statutes or regulations that may restrict access to or disclosure of State government records, along with comments where appropriate. The emphasis is on restrictions applying to records of more than one agency. The degree and nature of the restrictions under the cited statutes vary greatly.

1. **General Statutes on Records Access**

   Public Officers Law: Art. 6 [FOIL]; Art. 6-A (Personal Privacy Protection Law [PPPL])

2. **Privileged Communications** - "Privileged" communications are those which can not be introduced as evidence in proceedings before a court or administrative body.

   Civil Practice Law & Rules (CPLR) Art. 31 (Disclosure)

   This article contains rules regarding pre-trial discovery proceedings, by which material evidence is disclosed and facts ascertained. Records not subject to the discovery process may be accessible under FOIL, and *vice versa*. Specific rules are as follows:

   Rule 3101(b) -- Privileged matter

   This rule states that "upon objection by a party privileged matter shall not be obtainable." This refers to certain types of professional-client communications, discussed below.

   Rule 3101(c) -- Attorney work product

   This rule states that "the work product of an attorney shall not be obtainable." Attorney "work product" refers to notes, drafts, reports to clients, investigative reports, and other documents pertaining to a pending case.

   Rule 3101(d) -- Litigation materials

   Certain materials prepared for litigation are subject to discovery under certain circumstances, except that "mental impressions, conclusions, opinions or legal theories of an attorney" are not disclosable.

   CPLR Art. 45 (Evidence)

   This article makes a wide variety of "confidential communications" privileged, and therefore exempt from disclosure during pre-trial discovery or during the trial itself. Following are selected rules:

   Rule 4503(a) -- Attorney-client

   This rule strictly bars disclosure of any privileged attorney-client communications by the attorney or by any other person. "Privileged communications" are limited to professional communications between an attorney and a client, to which other persons are not privy. (Hence it should not apply to copies of court papers, public statements, or published materials.) The attorney-client privilege rule applies not only to pre-trial discovery, trials, and other hearings and proceedings, but also to any other unauthorized disclosure by a government employee or agency.

   Rule 4504 -- Physician, dentist, nurse

   Rule 4505 -- Clergy

   Rule 4507 -- Psychologist

   Rule 4508 -- Social worker

   Medical or personal information conveyed in confidence by a patient or client to a qualified professional in any of the categories listed above may not be disclosed and offered as evidence, unless the privilege is waived by the patient or client. Hospital records as such are not privileged.

3. **Investigative Records**

Executive Law §63.8 (special Attorney General investigations)

Bars disclosure of names of witnesses or of information obtained in special inquiry made at Governor's direction "into matters concerning the public peace, public safety, and public justice." Applies also to Executive Law Sect. 6 (Moreland Act) commissions investigating state agencies.

Civil Rights Law §73.8 (investigative commission witness material)

Bars disclosure of witness identification, interview, and private testimony before a special investigative commission, unless the commission provides otherwise.

Criminal Procedure Law §190.25.4(a) (grand jury proceedings)

Makes grand jury proceedings secret and bars disclosure except to prosecutors and law enforcement officers. Witnesses may, however, disclose their own testimony.

4. **Judicial Records**

Criminal Procedure Law (CPL) §160.50.1(c) (criminal case dismissals and acquittals to be sealed)

CPL §390.50 (pre-sentencing reports and copies thereof confidential)

CPL §720.35 (files on youthful offenders to be sealed)

Domestic Relations Law (DRL) §114 (adoption records to be sealed)

DRL §§235.1, 235.5 (files and decrees in matrimonial actions confidential for 100 years after filing)

Family Court Act (FCA) §166 (records of proceedings are confidential)

FCA §375.1.1 (files on juvenile delinquency proceedings terminated in favor of respondent to be sealed)

5. **Patient, Client, and Inmate Records**

Correction Law §29.3 (corrections and parole records)

Empowers the Commissioner of Correctional Services to "make rules as to the privacy of records, statistics and other information collected, obtained and maintained" by the department and the State Board of Parole.

Executive Law §259-k (Division of Parole)

Empowers State Board of Parole to make rules to maintain confidentiality of its records.

Mental Hygiene Law §33.13 (c) (patient or client clinical records)

Empowers the commissioner to release patient or client clinical record and other identifying information to "qualified researchers upon the approval of the institutional review board or other committee specially constituted for the approval of research projects at the facility, provided that the researcher shall in no event disclose information tending to identify a patient or client." Applies to the Office of Mental Health, Office of Mental Retardation, Division of Alcoholism & Alcohol Abuse, and Division of Substance Abuse Services.

Education Law §1007 (vocational rehabilitation client records)

Strictly limits access to records of services provided to vocational rehabilitation clients.

6. **Public Health Records**

Various sections of the Public Health Law restrict access to reports and/or records of cases of Alzheimer's disease, birth defects, cancer, HIV/AIDS, and tuberculosis. Also restricted are birth, marriage, and death records; various categories of hospital information and reports (§2805-m); and records of controlled substances and users thereof (§§3371-3372).

7. **Other Records Access Restrictions** (examples)

Banking Law §§13(4), 36(10), 560(4) (banking institution examination reports)

Civil Rights Law §50-a (police personnel performance evaluation records)

Civil Service Law §205.4 (records of Public Employment Relations Board [PERB] resolution of disputes arising in course of collective negotiations)

Environmental Conservation Law §17-0805 (protects proprietary information in State Pollutant Discharge Elimination System [SPDES])

Insurance Law §1504(c) (insurance company reports and examinations)

Archeological site data (see 9 NYCRR §427.8)

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Appendix VIII: Glossary of GIS Terms

(Excerpted from 1993 Report of the California State Geographic Information Task Force)

Accuracy

1. If applied to paper maps or map databases, degree of conformity with a standard or accepted value. Accuracy relates to the quality of a result and is distinguished from precision.[5]

2. If applied to data collection devices such as digitizers, degree of obtaining the correct value.[6]

AM/FM

See automated mapping/facilities management.[6]

Attribute

1. A numeric, text, or image data field in a relational data base table that describes a spatial feature such as a point, line, node, area or cell.[2]

2. A characteristic of a geographic feature described by numbers or characters,typically stored in tabular format, and linked to the feature by an identifier. For example, attributes of a well (represented by a point) might include depth, pump type, location, and gallons per minute.[6]

Automated mapping/facilities management (AM/FM)

A GIS technology focused on the specific segment of the market concerned with specialized infrastructure and geographic facility information applications and management, such as roads, pipes, and wires.[6]

Base Map

A map showing planimetric, topographic, geological, political, and/or cadastral information that may appear in many different types of maps. The base map information is drawn with other types of changing thematic information. Base map information may be as simple as major political boundaries, major hydrographic data, or major roads. The changing thematic information may be bus routes, population distribution, or caribou migration routes.[6]

Buffer

A zone of a given distance around a physical entity such as a point, line, or polygon.

CAD

See computer-aided design or drafting.[6]

Cadastre

A record of interests in land, encompassing both the nature and extent of interests . Generally, this means maps and other descriptions of land parcels as well as the identification of who owns certain legal rights to the land (such as ownership, liens, easements, mortgages, and other legal interests). Cadastral information often includes other descriptive information about land parcels.[3]

Centroid

The "center of gravity" or mathematically exact center of an irregular shaped polygon; often given as an x, y coordinate of a parcel of land.[5]

Computer-aided design or drafting (CAD)

A group of computer software packages for creating graphic documents.[6]

Computer-aided engineering (CAE)

The integration of computer graphics with engineering techniques to facilitate and optimize the analysis, design, construction, nondestructive testing, operation, and maintenance of physical systems.[5]

Computer-aided mapping (CAM)

The application of computer technology to automate the map compliation and drafting process. Not to be confused with the older usage, computer-aided manufacturing; usually associated with CAD, as in CAD/CAM.[5]

Conversion

1. The translation of data from one format to another (e.g., TIGER to DXF; a map to digital files).[6]

2. Data conversion when transferring data from one system to another (E.g., SUN to IBM).[6]

3. See data automation.[6]

Coordinate

The position of point is space in respect to a Cartesian coordinate system (x, y and/or z values). In GIS, a coordinate often represents locations on the earth's surface relative to other locations.[6]

Coordinate system

The system used to measure horizontal and vertical distances on a planimetric map. In a GIS, it is the system whose units and characteristics are defined by a map projection. A common coordinate system is used to spatially register geographic data for the same area. See map projection.[6]

Data dictionary

A coded catalog of all data types, or a list of items giving data names and structures. May be on-line (referred to as an automated data dictionary), in which case the codes for the data types are carried in the database. Also referred to as DD/D for data dictionary/directory.[2]

Data Model

1. A generalized, user-defined view of the data related to applications.[6]

2. A formal method for arranging data to mimic the behavior of the real world entities they represent. Fully developed data models describe data types, integrity rules for the data types, and operations on the data types. Some data models are triangulated irregular networks, images, and georelational or relational models for tabular data.[2]

Database

Usually a computerized file or series of files of information, maps, diagrams, listings, location records, abstracts, or references on a particular subject or subjects organized by data sets and governed by a scheme of organization. "Hierarchical" and "relational" define two popular structural schemes in use in a GIS.[5] For example, a GIS database includes data about the spatial location and shape of geographic entities as well as their attributes.[6]

Database management system (DBMS)

1. The software for managing and manipulating the whole GIS including the graphic and tabular data.

2. Often used to describe the software for managing (e.g., input, verify, store, retrieve, query, and manipulate) the tabular information. Many GISs use a DBMS made by another software vendor, and the GIS interfaces with that software.[6]

Digital elevation model (DEM)

1. A raster storage method developed by the US Geological Survey (USGS) for elevation data.[6]

2. The format of the USGS Elevation data sets.

Digital exchange format (DXF)

1. ASCII text files defined by Autodesk, Inc. (Sausalito, CA) at first for CAD, now showing up in third-party GIS software.[5]

2. An intermediate file format for exchanging data from one software package to another, neither of which has a direct translation for the other but where both can read and convert DXF data files into their format. This often saves time and preserves accuracy of the data by not reautomating the original.[6]

Digital line graph (DLG)

1. In reference to data, the geographic and tabular data files obtained from the USGS for exchange of cartographic and associated tabular data files. Many non-DLG data may be formatted in DLG format.[6]

2. In reference to data, the formal standards developed and published by the USGS for exchange of cartographic and associated tabular data files. Many non-DLG data may be formatted in DLG format.[6]

Digital map

A machine-readable representation of a geographic phenomenon stored for display or analysis by a digital computer; contrast with analog map.[4]

Digital terrain model (DTM)

A computer graphics software technique for converting point elevation data into a terrain model displaced as a contour map, sometimes as a three-dimensional "hill and valley" grid view pf the ground surface.[5]

Digitize

A means of converting or encoding map data that are represented in analog form into digital information of x and y coordinates.[6]

Digitizer

A device used to capture planar coordinate data, usually as x and y coordinates, from existing analogmaps for digital use within a computerized program such as a GIS. Also called a digitizing table.[6]

Dime

See geographic base file/dual independent map encoding.[6]

Edge match

An editing procedure to ensure that all features crossing adjacent map sheets have the same edge locations, attribute descriptions, and feature classes.[6]

Format

1. The pattern in which data are systematically arranged for use on a computer.[6]

2. A file format is the specific design of how information is organized in the file. For example, DLG, DEM, and TIGER are geographic data sets in particular formats that are available for many parts of the United States.[6]

GBF/DIME

See Geographic base file/dual independent map encoding.[6]

Geocode

The process of identifying a location as one or more x, y coordinates from another location description such as an address. For example, an address for a student can be matched against a TIGER street network to locate the student's home.[2]

Geographic base file/dual independent map encoding (GBF/DIME)

A data exchange format developed by the US Census Bureau to convey information about block-face/street address ranges related to 1980 census tracts. These files provide a schematic map of a city's streets, address ranges, and geostatistical codes relating to the Census Bureau's tabular statistical data. See also TIGER, created for the 1990 census.[6]

Geographic data

The composite locations and descriptions of geographic entities.[6]

Geographic database

Efficiently stored and organized spatial data and possibly related descriptive data.[6]

Geographic information retrieval and Analysis (GIRAS)

Data files from the US Geological survey. GIRAS files contain information for areas in the continental United States, including attributes for land use, land cover, political units, hydrologic units, census and county subdivisions, federal landownership, and state landownership. These data sets are available to the public in both analog and digital form.[6]

Geographic information system (GIS)

An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. Certain complex spatial operations are possible with a GIS that would be very difficult, time-consuming, or impractical otherwise.[2]

Geographic object

A user-defined geographic phenomenon that can be modeled or represented using geographic data sets. Examples include streets, sewer lines, manhole covers, accidents, lot lines, and parcels.[2]

Geographical Resource Analysis Support System (GRASS)

1. A public-domain raster GIS modeling product of the US Army Corps of Engineers Construction Engineering Research Laboratory.[6]

2. A raster data format that can be used as an exchange format between two GISs.[6]

Georeference

To establish the relationship between page coordinates on a paper map or manuscript and known real-world coordinates.[2]

GIRAS

See geographic information retrieval and analysis.[6]

Grid Data

1. One of many data structures commonly used to represent geographic entities. A raster-based data structure composed of square cells of equal size arranged in columns and rows. The value of each cell, or group of cells, represents the entity value.[6]

2. A set of regularly spaced reference lines on the earth's surface, a display screen, a map, or any other object.[6]

3. A distribution system for electricity and telephones.[6]

Image

A graphic representation or description of an object that is typically produced by an optical or electronic device. Common examples include remotely sensed data such as satellite data, scanned data, and photographs. An image is stored as a raster data set of binary or integer values representing the intensity of reflected light, heat, or another range of values on the electromagnetic spectrum. Remotely sensed images are digital representations of the earth.[2]

Index

A specialized lookup table or structure within a database and used by an RDBMS or GIS to speed searches for tabular or geographic data.[6]

Infrastructure

The fabric of human improvements to natural settings that permits a community, neighborhood, town, city metropolis, region, state, etc., to function.[6]

Initial graphics exchange specification (IGES)

An interim standard format for exchanging graphics data among computer systems.[1]

Integrated terrain unit mapping (ITUM)

The process of adjusting terrain unit boundaries so that there is increased coincidence between the boundaries of interdependent terrain variables such as hydrography, geology, physiography, soils, and vegetation units. Often, when this is performed, one layer or unit of geographical/descriptive information will contain more than one central theme.[6]

Intelligent infrastructure

The result of automating infrastructure information management using modern computer image and graphics technology integrated with advanced database management systems; used for spatially linked and network facilities and land records systems. In addition, intelligent infrastructure systems manage work processes that deal with design, construction, operation, and maintenance of infrastructure elements.[5]

Layer

A logical set of thematic data, usually organized by subject matter.[6]

Map projection

A mathematical model for converting locations on the earth's surface from spherical to planar coordinates, allowing flat maps to depict three dimensional features. Some map projections preserve the integrity of shape; others preserve accuracy of area, distance, or direction.[2]

Map units

The coordinate units in which the geographic data are stored, such as inches, feet, or meters or degrees, minutes and seconds.[6]

Plane-coordinate system

A system for determining location in which two groups of straight lines intersect at right angles and have as a point of origin a selected perpendicular intersection.[4]

Planimetric map

A large-scale map with all features projected perpendicularly onto a horizontal datum plane so that horizontal distances can be measured on the map with accuracy.[4]

PLSS

See public land survey system.[3]

Point

1. A single x, y coordinate that represents a geographic feature too small to be displayed as a line or area--for example, the location of a mountain peak or a building location on a small-scale map.[2]

2. Some GIS systems also use a pont to identify the interior of a polygon.[6]

Polygon

A vector representation of an enclosed region, described by a sequential list of vertices or mathematical functions.[6]

Precision

1. If applied to paper maps or map data bases, it means exactness and accuracy of definition and correctness of arrangement.[5]

2. If applied to data collection devices such as digitizers, it is the exactness of the determined value (.e., the number 134.98988 is more precise than the number 134.9).[6]

3. The number of significant digits used to store numbers.[6]

Public land survey system (PLSS)

A rectangular survey system that utilizes 6-mile-square townships as its basic survey unit. The location of townships is controlled by baselines and meridians running parallel to latitude and longitude lines. Townships are defined by range lines running parallel (north-south)

to meridians and township lines running parallel (east-west) to baselines. The PLSS was established in the United States by the Land Ordinance of 1785.[3]

Quadrangle

A four-sided region, usually bounded by a pair of meridians and a pair of parallels.[4]

Raster data

Machine-readable data that represent values usually stored for maps or images and organized sequentially by rows and columns. Each "cell" must be rectangular but not necessarily square, as with grid data.[6]

RDBMS

See relational database management systems.[2]

Rectify

The process by which an image or grid is converted from image coordinates to real-world coordinates. Rectification typically involves rotation and scaling of grid cells, and thus requires resampling of values.[2]

Relational database management system (RDBMS)

A database management system with the ability to access data organized in tabular files that may be related together by common field (item). An RDBMS has the capability to recombine the data items from different files, thus providing powerful tools for data usage.[2]

Resolution

1. The accuracy at which the location and shape of map features can be depicted for a given map scale. For example, at a map scale of 1:63,360 (1 inch=1 mile), it is difficult to represent areas smaller than 1/10 of a mile wide or 1/10 of a mile in length because they are only 1/10-inch wide or long on the map. In a larger scale map, there is less reduction, so feature resolution more closely matches real world features. As map scale decreases, resolution also diminishes because feature boundaries must be smoothed, simplified, or not shown at all.[6]

2. The size of the smallest feature that can be represented in a surface.[6]

3. The number of points in x and y in a grid (e.g., the resolution of a USGS one-degree DEM is 1.201 x 1.201 mesh points).[2]

Rubber-sheet

A procedure to adjust the entities of a geographic data set in a non-uniform manner. From- and to- coordinates are used to define the adjustment.[6]

Scale

The relationship between a distance on a map and the corresponding distance on the earth. Often used in the form 1:24,000, which means that one unit of measurement on the map equals 24,000 of the same units on the earth's surface.[6]

Scanning

Also referred to as automated digitizing or scan digitizing. A process by which information originally in hard copy format (paper print, mylar transparencies, microfilm aperture cards) can be rapidly converted to digital raster form (pixels) using optical readers.[5]

Spatial index

A means of accelerating the drawing, spatial selection, and entity identification by generating geographic-based indexes. Usually based on an internal sequential numbering system.[6]

Spatial model

Analytical procedures applied with a GIS. There are three categories of spatial modeling functions that can be applied to geographic data objects within a GIS: (1) geometric models (such as calculation of Euclidian distance between objects, buffer generation area, and perimeter calculation); (2) coincidence models (such as a polygon overlay); and (3) adjacency models (pathfinding, redistricting, and allocation). All three model categories support operations on geographic data objects such as points, lines, polygons, TINs, and grids. Functions are organized in a sequence of steps to derive the desired information for analysis.[2]

Surface

A representation of geographic information as a set of continuous data in which the map features are not spatially discrete, that is, there is an infinite set of values between any two locations. There are no clear or well-defined breaks between possible values of the geographic feature. Surfaces can be represented by models built from regularly or irregularly spaced sample points on the surface.[2]

Surface model

Digital abstraction or approximation of a surface. Because a surface contains an infinite number of points, some subset of points must be used to represent the surface. Each model contains a formalized data structure, rules and x, y, z point measurements that can be used to represent a surface.[2]

Template

1. A geographic data set containing boundaries, such as landwater boundaries, for use as a starting place in automating other geographic data sets. Templates saves time and increase the precision of spatial overlays.[6]

2. A map containing neatlines, north arrow, logos and similar map elements for a common map series, but lacking the central information that makes one map unique from another.[6]

3. An empty tabular data file containing only item definitions.[6]

Thematic map

A map that illustrates one subject or topic either quantitatively or qualitatively.[4]

Theme

A collection of logically organized geographic objects defined by the user. Examples include streets, wells, soils, and streams.[6]

TIGER

See Topologically Integrated Geographic Encoding and Reference data.[6]

Topographic map

A map of land-source features including drainage lines, roads, landmarks, and usually relief, or elevation.[4]

Topologically Integrated Geographic Encoding and Referencing data (TIGER)

A format used by the US Census Bureau to support census programs and surveys. It is being used for the 1990 census. TIGER files contain street address ranges along lines and census tract/block boundaries. These descriptive data can be used to associate address information and census/demographic data to coverage features.[2]

Topology

The spatial relationships between connecting or adjacent coverage features (e.g., arcs, nodes, polygons, and points). For example, the topology of an arc includes its from- and to- nodes and its left and right polygons. Topological relationships are built from simple elements into complex elements: points (simplest elements), arcs (sets of connected points), areas (sets of connected arcs), and routes (sets of sections) that are arcs or portions of arcs). Redundant data (coordinates) are eliminated because an arc may represent a linear feature, part of the boundary of an area feature, or both. Topology is useful in GIS because many spatial modeling operations don't require coordinates, only topological information. For example, to find an optimal path between two points requires a list of which arcs connect to each other and the cost of traversing along each arc in each direction. Coordinates are only necessary to draw the path after it is calculated.[2]

Transformation

The process of converting data from one coordinate system to another through translation, rotation, and scaling.

Vector data

A coordinate-based data structure commonly used to represent map features. Each linear feature is represented as a list of ordered x, y coordinates. Attributes are associated with the feature (as opposed to a raster data structure, which associates attributes with a grid cell). Traditional vector data structures include double-digitized polygons and arc-node models.[2]

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