

State of New Hampshire



Geographic Information System (GIS) Strategic Plan

October 10, 2007

Prepared by:



The development of this document was funded by the Federal Geographic Data Committee (FGDC) through a National Spatial Data Infrastructure (NSDI) Cooperative Assistance Program (CAP) Grant in Fiscal Year 2006, Award Number 06HQAG0119, as part of the Fifty States Initiative. It was developed by Applied Geographics, Inc. (AppGeo) in collaboration with the New Hampshire GIS Strategic Planning Advisory Committee.

Foreword

New Hampshire initiated this project by forming a **GIS Strategic Planning Advisory Committee** (GSPAC), composed of a diverse set of stakeholders chosen from the broader GIS Advisory Committee. The GSPAC was led by Ken Gallagher from the New Hampshire Office of Energy and Planning (OEP). Mr. Gallagher also serves as the Coordinator for the statewide GIS Advisory Committee, which was chartered 20 years ago by the Council on Resources and Development (CORD). The GSPAC members are:

State Agency Representatives:

- Ken Gallagher, Chair, NH Office of Energy and Planning
- Dennis Fowler, NH Department of Transportation
- Janet Horne, NH Department of Health and Human Services
- Rick Chormann, NH Department of Environmental Services
- Rebecca Bolton, NH Office of Information Technology

Academic Representative:

- Fay Rubin, University of New Hampshire, GRANIT

Federal Agency Representative:

- Lynn Bjorklund, USGS

Regional Planning Commission Representative

- Tara Bamford, North Country Council (formerly with Upper Valley Lake Sunapee Regional Planning Commission)

Local Government Representative

- John Vogl, Town of Londonderry

This project was funded in part by the Federal Geographic Data Committee (FGDC), through a National Spatial Data Infrastructure (NSDI) Cooperative Assistance Program (CAP) Grant in Fiscal Year 2006, Award Number 06HQAG0119, as part of the Fifty States Initiative. Following a competitive procurement, Applied Geographics, Inc. (AppGeo), of Boston, Massachusetts, was selected to assist the GSPAC in its planning efforts. The project resulted in both a Strategic Plan and a Business Plan to advance statewide spatial data infrastructure and services in the State of New Hampshire.

Copyright Notice

The GIS Strategic Plan document is the Property of the State of New Hampshire and its subdivisions. All permitted copies shall be reproduced with all titles, logos, copyright notices, trademark notices, and legends included in the original materials.

Table of Contents

1	Executive Summary	3
2	GIS Strategic Planning Methodology	5
2.1	Overview	5
2.2	Project Initiation	5
2.3	Information Gathering and Stakeholder Input	6
2.4	Strategizing and Report Authoring.....	7
3	Current GIS Situation in New Hampshire.....	8
3.1	Overview	8
3.2	Major Users & Stakeholders.....	13
3.3	Strengths, Weaknesses, Opportunities and Threats.....	15
3.3.1	Strengths	15
3.3.2	Weaknesses.....	16
3.3.3	Opportunities.....	18
3.3.4	Threats.....	20
4	Vision and Goals for Enterprise GIS in New Hampshire.....	22
5	Requirements for Enterprise GIS in New Hampshire.....	27
5.1	Introduction.....	27
5.2	Data Requirements	27
5.3	Technology Requirements.....	30
5.4	Resource Requirements.....	31
5.5	Standards	31
5.6	Organizational Needs.....	32
5.6.1	Executive Support.....	32
5.6.2	Coordination and Oversight Procedures	32
5.6.3	Policy	33
5.6.4	Staffing.....	33
5.6.5	Budget Requirements.....	33
5.6.6	Outreach and Community Development	34
5.6.7	Assessing Risk	34
6	Implementation Program: Timeline, Sequencing & Dependencies ...	35

1 Executive Summary

Background & Process

During 2006 New Hampshire was awarded a competitive Cooperative Assistance Program (CAP) grant by the United States Geological Survey (USGS) to support the development of a New Hampshire Geographic Information System (GIS) Strategic Plan. The CAP grants seek to stimulate the development of coordinated GIS efforts at the state level as a necessary precursor to better national level coordination. This vision of national level coordination is embodied in the multi-agency Federal Geographic Data Committee's (FGDC) National Spatial Data Infrastructure (NSDI) initiative.

Aside from the national interest in improved GIS coordination, New Hampshire has recognized a critical self-interest in increasing GIS coordination to enhance and extend GIS application, to improve GIS efficiency, and to eliminate existing redundancies. This study assesses the current GIS landscape in New Hampshire and presents a feasible set of recommendations for moving New Hampshire's GIS forward.

From the outset this planning process sought to be inclusive of all GIS stakeholders in New Hampshire: state government, regional and local government, federal agency field offices, academia and the private sector. The project was overseen by a broad-based Steering Committee composed of stakeholders from all levels of government and from academia. Further, the study was designed to gather specific input from all stakeholder groups, principally through two workshops that gathered direct input from 69 individuals across 11 sectors. As such, the findings and recommendations from this report represent a broad consensus on what is required to enhance GIS use in New Hampshire.

Findings

The following summarizes the state of GIS in New Hampshire as well as identified shortcomings and opportunities for improvement:

- New Hampshire has a **long history** with GIS technology dating to the mid-1980's, and the state has benefited from many notable successes with the technology. It has been shown to be a vital tool to state government that is used on a daily basis for transportation planning, environmental protection, economic development and to enhance public safety.
- Over the past two decades, New Hampshire state and local agencies have made **significant investments** in geospatial technologies, and the state must now pursue opportunities to leverage and strengthen those investments.
- GIS coordination in New Hampshire is lacking. While there are many good faith efforts to coordinate activity, unlike every other New England state¹ there is no formalized, central GIS office that spearheads coordination. As a result, there have been instances of redundant activity and structural inefficiency, for example in data sharing.
- New Hampshire state government and the University of New Hampshire have maintained a long and productive association that has resulted in the GRANIT System, a data clearinghouse that provides public access to and distribution of GIS data. While GRANIT serves as a platform to build on, it must be officially recognized and properly supported to be most effective.
- There are some notable gaps in the State's GIS data assets. For example, high quality elevation data are lacking, and the statewide town boundary layer is inadequate for local use.

¹ Connecticut does not currently have a state GIS office but it is in the final stages of establishing one.

- The adoption of GIS technology at the local level has increased significantly in recent years, with a minimum of 111 communities presently engaged in some level of GIS activity. Despite this success, many smaller communities that would benefit from the technology find it out of reach and are seeking help.
- While formal GIS coordination efforts are lacking, there is broad based recognition of the importance of better coordination and a willingness to work towards that goal.

Key Recommendations

This study generated numerous specific recommendations aimed at improving the GIS coordination that will lead to broader application of the technology, improved efficiency, and reduced redundancy. There is widespread agreement that the first recommendation is the most important and a necessary precursor for the additional recommendations.

- 1. Establish a State GIS Office and create a Geographic Information Officer (GIO) position.** This will be a small office, initially staffed by only the GIO. The office will lead a concerted, focused effort to coordinate and consolidate state GIS data development activities, provide GIS technical resources, plan for technical infrastructure for Enterprise GIS, set state GIS standards, and reduce duplication of effort.
- 2. Formalize GRANIT's role of serving as the state's GIS repository.** GRANIT has been functioning as the de facto statewide GIS data clearinghouse for many years. This role should be formalized via legislative recognition, which will help to solidify and focus efforts to make the current clearinghouse the authorized repository for all state GIS data. Such action will also serve to officially identify GRANIT as the state's node in the overall National Spatial Data Infrastructure (NSDI) and help to make New Hampshire eligible for further federal grant funding that is aimed at constructing NSDI.
- 3. Increase outreach to regional and local government to foster municipal GIS development and use.** The UNH Cooperative Extension Geospatial Technologies Training Center is an important resource for GIS users in New Hampshire, but there is still a large unmet need for GIS educational and technical support aimed at municipal government. This need could be met with a modest but concerted effort to make technical assistance and educational resources, perhaps meted out by the RPCs in addition to UNH Cooperative Extension, more readily available to municipalities. Such efforts will help both to increase technological equity among municipalities and to catalyze the development of local data sets (e.g. parcels) that the state would benefit from.
- 4. Address largest geospatial data gaps:** There should be targeted investments in improving key, broadly used data sets that are either currently unavailable or are inadequate for important uses. Identified priorities include: accelerating the statewide aerial photography program overseen by DOT, improving the accuracy of the town boundary data set and developing elevation data that is suitable for flood planning and response.

What comes next?

This plan identifies key needs and proposes a series of activities that can move New Hampshire's geospatial data management capabilities forward. This plan also aligns New Hampshire with the federal NSDI vision thereby making the state eligible for future funding to support the implementation of this plan. The most critical element of the proposed program is the establishment of a New Hampshire GIS Office and the creation of the Geographic Information Officer (GIO) position. Moving forward on these recommendations will best position New Hampshire to fully capitalize on its existing investments and to resolve existing redundancies and inefficiencies.

2 GIS Strategic Planning Methodology

2.1 Overview

During 2006 New Hampshire was awarded a Cooperative Assistance Program (CAP) grant by the United States Geological Survey (USGS) to support the development of a state Geographic Information System (GIS) Strategic Plan. The federal CAP grants are aimed at stimulating the development of coordinated GIS efforts at the state level as a necessary precursor to better national level coordination. This vision of national level coordination is embodied in the multi-agency Federal Geographic Data Committee's (FGDC) National Spatial Data Infrastructure (NSDI) initiative.

Aside from the national interest in improved GIS coordination, New Hampshire has recognized a critical self interest in increasing GIS coordination to both eliminate existing redundancies and to enhance GIS efficiency. This study assesses the current GIS landscape in New Hampshire and presents a feasible set of recommendations for moving New Hampshire's GIS forward.

The State of New Hampshire followed a methodology for completing this Strategic Plan that comprised three key phases:

1. Project initiation
2. Information gathering and stakeholder input
3. Strategizing and report authoring

These three phases are consistent with the guidance provided by the National States Geographic Information Council (NSGIC)/Federal Geographic Data Committee (FGDC) Strategic Planning Process Guide. Each phase is described in further detail below.

2.2 Project Initiation

The New Hampshire GIS Advisory Committee, a subcommittee of the state Council on Resources and Development, initiated this project by forming a **GIS Strategic Planning Advisory Committee (GSPAC)** composed of a diverse set of stakeholders. This GSPAC was chaired by Ken Gallagher, Principal Planner, New Hampshire Office of Energy and Planning, who serves as the chair of the GIS Advisory Committee. The GSPAC members are:

State Agency Representatives:

- Ken Gallagher, Chair, NH Office of Energy and Planning
- Dennis Fowler, NH Department of Transportation
- Janet Horne, NH Department of Health and Human Services
- Rick Chormann, NH Department of Environmental Services
- Rebecca Bolton, NH Office of Information Technology

Academic Representative:

- Fay Rubin, University of New Hampshire, GRANIT

Federal Agency Representative:

- Lynn Bjorklund, US Geological Survey

Regional Planning Commission Representative

- Tara Bamford, North Country Council (formerly with Upper Valley Lake Sunapee Regional Planning Commission)

Local Government Representative

- John Vogl, Town of Londonderry

Upon receipt of the USGS Cooperative Agreements Partnerships (CAP) grant in April of 2006, one of the first tasks of the GSPAC was to identify a consultant to facilitate the strategic planning process and to assist in drafting the plan. Following a competitive procurement, Applied Geographics, Inc. (AppGeo), of Boston, Massachusetts was selected to assist the GSPAC. In July, a kickoff meeting attended by the GSPAC and AppGeo project staff was held to formally initiate the strategic planning effort.

2.3 Information Gathering and Stakeholder Input

In order to create a plan that incorporated input from the diverse community of stakeholders in NH, the GSPAC designed a process that included two formal information-gathering activities:

1. GIS Strategic Planning Workshops with broad stakeholder participation
2. Formal interviews with five “key GIS stakeholders” identified by the GSPAC

GIS Strategic Planning Workshops:

Two workshops were hosted in different regions of the state in an effort to maximize stakeholder participation. The first workshop was held in Concord on September 11, 2006, and was attended by 51 people. The second workshop was held in Plymouth on September 20, 2006, and was attended by 18 people. These sessions were designed to provide participants with an overview of the state’s strategic planning effort and how it will position the state to contribute to federal initiatives, including the emerging National Spatial Data Infrastructure (NSDI). Most importantly, the workshops enabled New Hampshire GIS stakeholders to provide input to the GSPAC on what is currently working well with respect to GIS in the state, what needs to be improved, and what might be done to enhance and extend GIS capabilities and effectiveness at all levels in New Hampshire. See Appendix 1 for the workshop announcement(s).

Stakeholder Interviews:

Following the workshops, detailed interviews were conducted with “key GIS stakeholders” who are either responsible for maintaining core GIS data sets and/or are involved with significant pieces of New Hampshire’s technical GIS infrastructure. The interviewees included:

1. Fay Rubin, University of New Hampshire, GRANIT
2. Dennis Fowler, NH Department of Transportation
3. Rick Chormann, George Hastings, Graham Chantler, Ellen D’Amico, and Mike Stanley, NH Department of Environmental Services

4. Peter Denuette, Department of Safety, Bureau of Emergency Communications and Lieutenant Mark Liebl, Department of Safety, Division of State Police
5. Municipal GIS Focus Group composed of: John Vogl (Londonderry), Sara Marchant (Milford), Doug Rathburn (Derry) and Angelo Marino (Nashua)

The interviews were designed to inventory in detail key pieces of New Hampshire's existing GIS infrastructure. They also provided an opportunity to further explore specific issues and recommendations raised at the GIS Strategic Planning Workshops.

2.4 Strategizing and Report Authoring

Following the completion of the information gathering phase, the GSPAC conducted monthly meetings from November, 2006 through March, 2007 to formulate an overall vision for New Hampshire's GIS and a strategy for realizing that vision. To begin the visioning process, findings from the workshops and interviews were organized into a series of overarching strengths, weaknesses, opportunities and threats (SWOT) that is described in Section 3.3. These overarching issues were considered drivers that impacted the formulation of the vision, as presented in Section 4. Once it was broadly defined, there was an iterative process of refining the vision, filling in the details and developing a full consensus among the GSPAC members. To facilitate this iterative process, various sections of the report were drafted and reviewed by the GSPAC between the monthly committee meetings.

3 Current GIS Situation in New Hampshire

3.1 Overview

The State of New Hampshire has a long and successful track record of deploying geographic information system (GIS) technology to support a wide variety of policy and planning issues. Many state agencies, including the Office of Energy and Planning, Department of Transportation, Department of Health and Human Services, Department of Environmental Services, Fish and Game Department, and Department of Safety, have been using GIS for almost twenty years. Over the same period, the University of New Hampshire has developed and served geospatial data to these agencies as well as other constituents in the state through the GRANIT System. Other New Hampshire stakeholders, such as municipalities and regional planning commissions, have been active users of GIS for well over a decade. Indeed, the GIS stakeholders in NH are a diverse group as represented by the 69 people and dozens of organizations that participated in the strategic planning workshops conducted as part of this process. The following details workshop participants by type of organization:

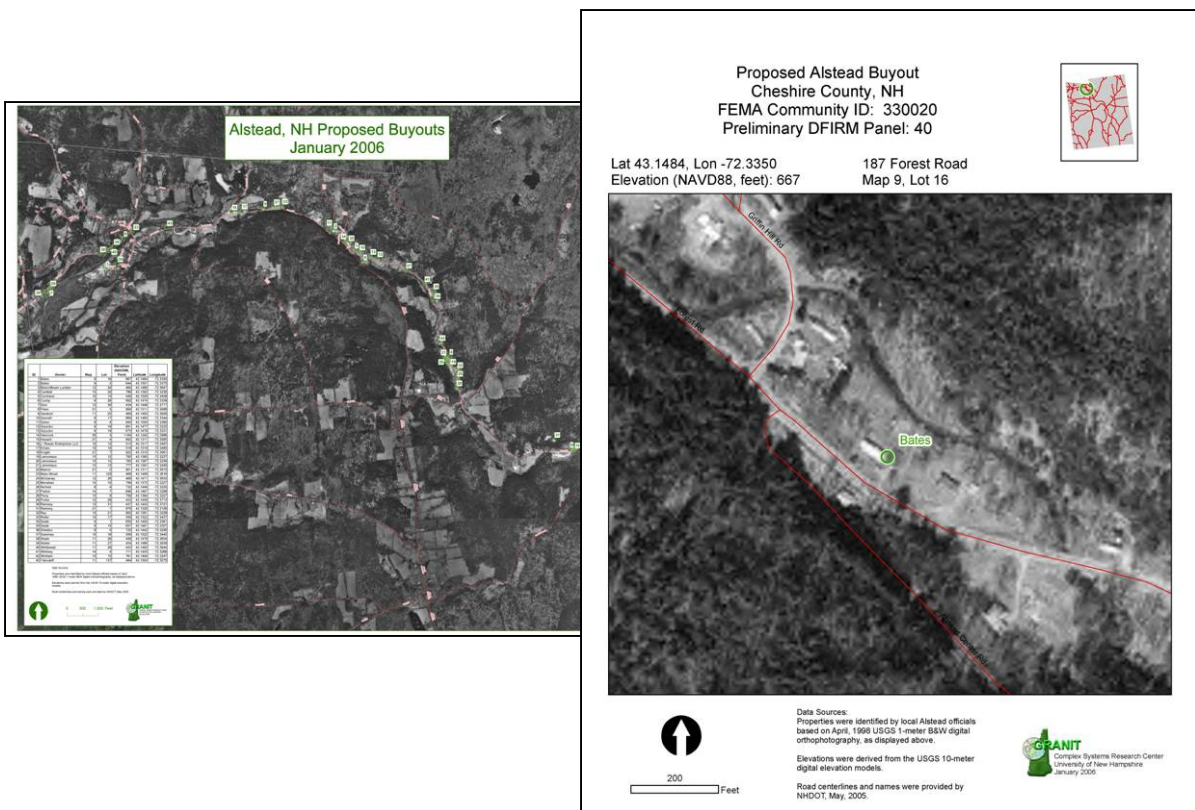
State Agencies	19
Federal Agencies	1
Municipalities	15
Regional Planning Commissions	3
Universities	9
Professional Organizations	2
Military	1
Utilities	1
Not-for-profit	2
Private Sector	14
Unknown	2
TOTAL	69

The number of participants in the workshops is only one of several metrics available to document the widespread interest in geospatial technologies in the state. Others include:

- In the fall of 2006, GRANIT coordinated a survey to assess municipal GIS usage in the state. Results indicated that 112 towns (48% of the 234 incorporated places) currently have in-house GIS capability. Further, 155 towns (66%) maintain digital tax parcel data, and rely on either in-house staff or service providers to manage that data set. Additionally, of the 109 respondents who indicated that they do not presently use GIS, over 50% identified a need for access to geospatial capabilities.
- Since March of 2000, GRANIT has served 800 unique geospatial data customers, filling over 1500 data requests via ftp and CD/DVD. These numbers represent only a small segment of the demand, as most GIS users fulfill their data needs by accessing GRANIT's online data distribution system.

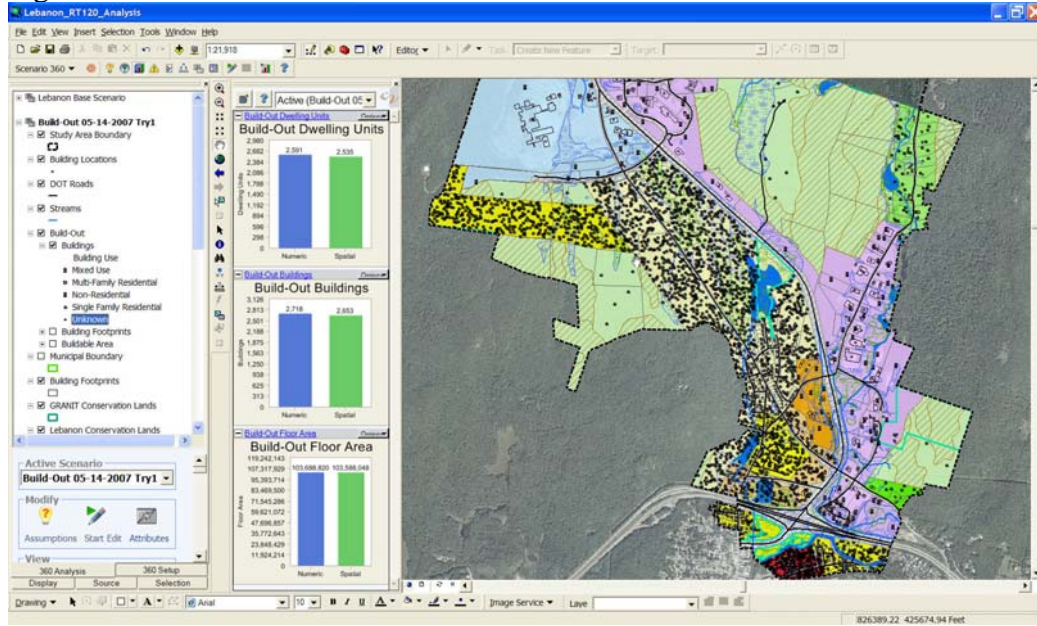
This level of participation is indicative of New Hampshire's long history with the technology and a wide body of GIS success stories that include:

- State Use of GIS to Support Flood Response:** GIS was used extensively in responding to the severe flooding in southwestern New Hampshire in the fall of 2005. Among the products generated were regional maps displaying properties impacted by flood inundation for use at public information sessions, and a series of maps (see below) that documented each property seeking federal buyout assistance, as required by the federal applications. In addition, an interactive web site was rapidly deployed to display the locations of bridges and roads that were closed during and immediately after the flood event.

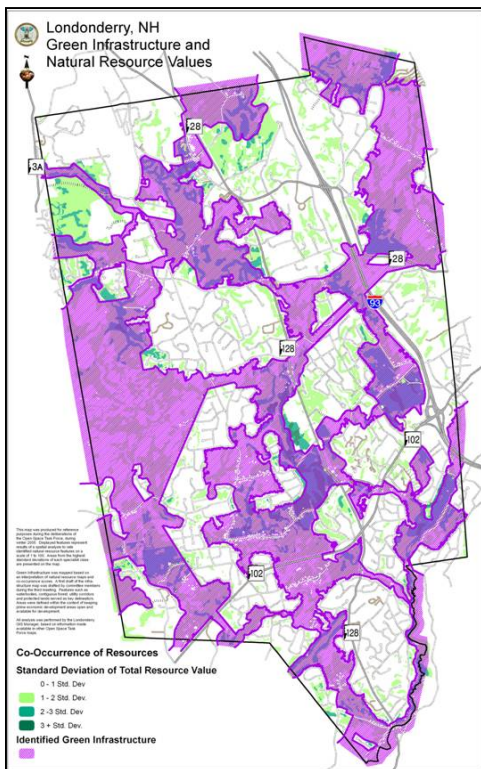


- Regional Use of GIS for Community Development and for Land Use Mapping and Build-out Analysis:** With funding from the NH Community Development Finance Authority (CDFA), all 9 of the state's regional planning commissions mapped the locations of employers, housing, child care, and transit routes to enable a more comprehensive look at community development assets and gaps. The GIS maps also enabled those associated with each of these key components of economic development to begin a dialog about common goals. GIS has also been applied to performing regional build-out analyses. The result

of such build-out analyses is a determination of the volume of new development that is allowed under current zoning. This is critical for determining the volume of local services (e.g. schools, sanitation, public safety) that may need to be available. The following figure shows the volume of lots created as part of a regional build-out for the Lebanon area.



Build-out analysis for Route 120/Lebanon-Hanover corridor study.



- Local Government Use of GIS for Natural Resource Planning:** Londonderry has successfully applied its GIS to support diverse natural resource planning activities. This work, performed by in-house GIS personnel, has led to the development of a prioritized list of open space acquisition targets, enhanced public participation in the prioritization process, including coordination with the Society for the Protection of NH Forests, and focused efforts to fund the identified acquisition targets.

The image to the left presents one of the products of the Open Space Task Force illustrating green infrastructure and high priority natural resource areas.

Even with these types of historic GIS successes, there remain several significant gaps and inefficiencies in New Hampshire’s GIS data and infrastructure. It is increasingly important that continued progress be made to fill these gaps and add new capabilities that will streamline the delivery of GIS services to state government as well as other stakeholders. The National States Geographic Information Council (NSGIC) has issued a series of “nine criteria for successful state GIS programs”. While recognizing that these represent meaningful indicators of success in many locations, New Hampshire asserts that alternative approaches may be appropriate given the unique characteristics of this state. Still, the New Hampshire GSPAC believes that it is useful to review where the state stands based on these criteria as a general indicator of the current level of GIS coordination. As described below, New Hampshire currently only fully meets one of the nine criteria, while partially meeting four others:

	NSGIC Criterion	New Hampshire Score
1	A full-time, paid coordinator position is designated and has the authority to implement the state’s business and strategic plans	DOES NOT MEET: New Hampshire does not have a full time coordinator.
2	A clearly defined authority exists for statewide coordination of geospatial information technologies and data production	DOES NOT MEET: There is no clearly defined geospatial coordinating body.
3	The statewide coordination office has a formal relationship with the State’s Chief Information Office (CIO)	PARTIALLY MEETS: While there is no GIS Coordination Office, the Office of Information Technology (OIT) participates in the GIS Advisory Committee and an OIT representative sits on the GIS Strategic Plan Advisory Committee.
4	A champion (politician, or executive decision-maker) is aware and involved in the process of geospatial coordination	DOES NOT MEET: There is no political or executive level champion for GIS.
5	Responsibilities for developing the National Spatial Data Infrastructure and a State Clearinghouse are assigned	MEETS: GRANIT is currently fulfilling NSDI responsibilities.
6	The ability exists to work and coordinate with local governments, academia, and the private sector	PARTIALLY MEETS: While there is no formal coordination mechanism between the State and local government and other stakeholders, there is considerable informal coordination that regularly takes place.
7	Sustainable funding sources exist to meet project needs	PARTIALLY MEETS: Sustainable funding exists within some state agencies for departmental efforts. There is no sustainable funding for statewide coordination.
8	GIS Coordinators have the authority to enter into contracts and become capable of receiving and expending funds.	PARTIALLY MEETS: There is no statewide coordinator to engage in this activity. However, individual state agencies and GRANIT have been effective at collaborating and exchanging funds with various partners.

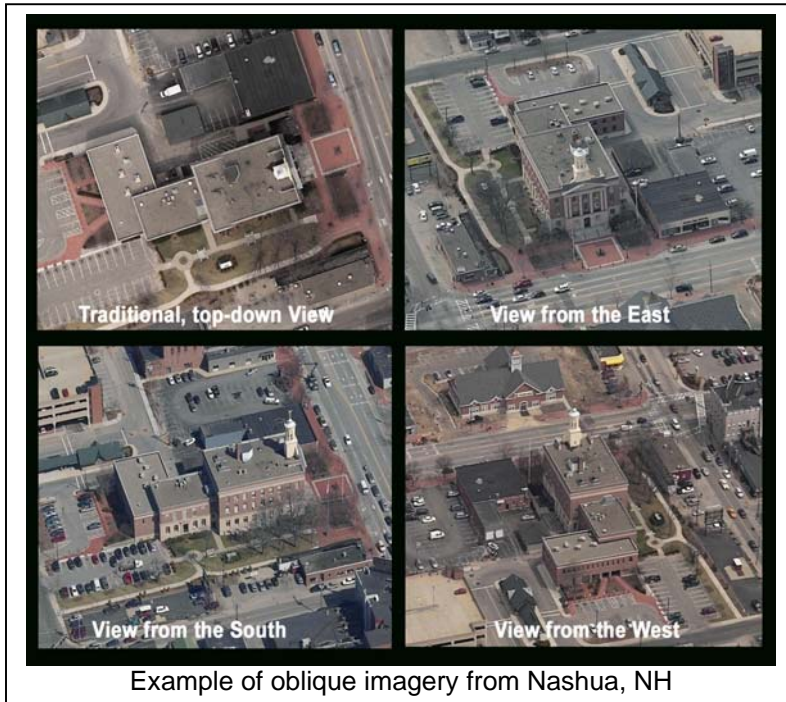
9	The Federal government works through the statewide coordinating authority	DOES NOT MEET: There is no statewide coordinating authority. The Federal Government works through individual state agencies and/or GRANIT.
---	---	---

These relatively poor “grades” are largely explained by the fact that New Hampshire’s GIS has “grown up” in an organic and only loosely coordinated fashion and with a surprising lack of financial support for long-term, strategic investments. It is also indicative of the fact that New Hampshire has no clear position that is responsible for GIS coordination in the state (i.e. criterion #1).

Thus, while New Hampshire has made steady progress in GIS development, the lack of stronger coordination now impedes further progress and leads to both inefficiency and redundancy of effort as well as missed opportunities. The following presents selected geospatial **opportunities that were missed** due to a lack of formal statewide GIS coordination:

- Local parcel data is in mixed formats and often not available to state agencies.** Approximately 66% of New Hampshire communities maintain local parcel maps in a GIS environment with links to digital CAMA databases that house ownership, property and structure characteristics. More advanced communities maintain the databases in-house while others contract with consulting firms or the Regional Planning Commissions. Parcel data are an invaluable asset and would greatly aid many state programs ranging from natural resource planning and open space acquisition to public safety and emergency preparedness to transportation planning and abutter identification. While all communities are required to maintain tax maps, the format of the maps and underlying data as well as the distribution policies vary widely. Thus, this lack of standardization is a major barrier to comprehensive and effective sharing of data and prevents the state from capitalizing on parcel data utilization.
- Lost opportunity to have RPCs provide support to local government recipients of free GIS software:** In 2001, the New Hampshire state government provided a free laptop PC and a copy of ArcView software to every municipality in New Hampshire. While this initiative was successful in spurring GIS activity at the local level, many communities did not successfully use the resources, and over time, GIS use atrophied even in communities that used the software successfully. This pattern is understandable knowing the challenges involved in learning and maintaining a complex software environment within small town government. However, New Hampshire had access to a pool of skilled RPC-based GIS practitioners with strong existing ties to local government that could have provided these municipalities with valuable assistance in using and maintaining the software. Had there been better interagency and intergovernmental GIS coordination at the time, might the program have taken a different form, with the RPCs actively involved in helping communities more successfully exploit their gift from the State?

- **Geospatial imagery products developed for Hillsborough and Rockingham counties with homeland security grant funding cannot be shared with state government agencies.** In 2006, the City of Nashua was successful in securing grant funding from the Department of Justice to develop neighborhood level oblique imagery for every community in the two county region. Oblique imagery provides a rich complement to traditional GIS planimetric and orthophoto products by allowing a multi-perspective sideways look at the landscape.



Example of oblique imagery from Nashua, NH

The company providing the imagery, Pictometry International, provides the data on a license basis that prevents unauthorized data sharing. In spite of some efforts initiated by Nashua to partner with state agencies, the State did not participate in this purchase and thus does not have the appropriate license for using these valuable data. Had there been a better coordinated state geospatial community perhaps the partnering opportunity would have been exploited, or at a minimum, the State's interests could have been represented during the license negotiation. For example, in

Massachusetts, the earlier development of GIS linework for roads as part of a coordinated statewide orthophoto project had clearly established within the Massachusetts Highway Department (MHD) a precedent for sharing GIS data across the entire government enterprise. As a result, MHD purchased an enterprise model for the licensing and distribution of the Pictometry data through regional planning agencies (RPAs) and through MassGIS. This enterprise licensing model enabled all state agencies, as well as every RPA, city, and town in the state, to gain access to the Pictometry images.

This report presents a strategic vision for improving GIS coordination in New Hampshire and enhancing the State's GIS assets. The sections below describe the existing GIS conditions for several of the major GIS stakeholders in New Hampshire.

3.2 Major Users & Stakeholders

This plan identified six key stakeholders and conducted in-depth interviews to uncover further details of these important programs. A brief overview of each program is found below, and further details emanating from interviews are cataloged in Appendix 2.

- **GRANIT:** The NH Geographically Referenced Analysis and Information Transfer System, or GRANIT, is managed by the Complex Systems Research Center (CSRC), Institute for the Study of Earth, Oceans, and Space, at the University of New Hampshire in Durham. GRANIT was initiated in the early 1980's and has evolved to act as the de facto statewide clearinghouse for GIS data. GRANIT distributes New Hampshire's geospatial data to the public and also maintains a publicly accessible data viewer (the GRANIT Data Mapper). GRANIT also participates in a variety of GIS project activities with numerous state agencies.
- **New Hampshire Department of Transportation (DOT):** The DOT has been engaged with CAD and GIS technologies since the mid-1980's and currently has GIS users in each of its 8 operational districts. The DOT uses GIS for transportation network data management, asset data management, flood damage mapping, guard rail replacement and sign management, as encouraged by the Federal government.
- **New Hampshire Department of Environmental Services (DES):** The DES has also been engaged with CAD and GIS technologies since the mid-1980's and over that time has built numerous environmental data sets and has integrated GIS activity into a variety of environmental programs. Examples of the 28 core data sets that the agency maintains include: NH Hydrography Dataset (NHHD), watershed boundaries, registered water withdrawals and returns, public water supply sources, remediation sites, hazardous materials storage, above ground storage tanks (AST) and underground storage tanks (UST).
- **New Hampshire Department of Safety: Division of Emergency Services, Bureau of Emergency Communications (NHBEC) and State Police Division:** The main GIS function in the Public Safety arena is the administration of the State's E911 program. The GIS has been thoroughly applied to support the comprehensive mapping of all streets and addresses within New Hampshire to support the E911 system. The E911 GIS Team acts as the de facto GIS focal point for all of the Dept. of Safety, and NHBEC personnel represent GIS technology at the State Emergency Operations Center (EOC) when it is activated. While the State Police have had a long-standing interest in GIS, they have not presently been able to move forward with GIS implementation.
- **Regional Planning Commissions:** In 1989, through a special act of the legislature, the State provided one-time funding for GIS hardware, software and training to each of the nine RPCs. This investment successfully launched the RPCs into the role of regional GIS service centers that provide some level of GIS access to every community in the state. The RPC GIS work typically focuses on data development for state agencies and towns, as well as regional planning projects, provision of paper maps to cities and towns, and the development of methodologies for integrating GIS analysis into local and regional planning projects. Areas of planning enhanced by GIS have included land use planning, watershed management, natural resource protection, hazard mitigation, economic development, and transportation.

- **Representative Municipal GIS Programs:** Representatives of four New Hampshire municipalities, with varying levels of GIS activity, including the Town of Londonderry, Town of Milford, Town of Derry, and the City of Nashua participated in the detailed interview that represented municipal GIS in the state. Municipal programs throughout the state can be characterized as diverse. In general, communities might be characterized as “advanced” (have existing programs with maintenance plans and responsibilities), “less advanced” (have dedicated staff but limited resources) or “startup” (new program focused on developing initial data layers). Ultimately, more and more municipalities are investing in the technology, and as described above approximately 66% of the communities in New Hampshire maintain electronic parcel maps.

3.3 Strengths, Weaknesses, Opportunities and Threats

The overall vision for the State GIS presented in Section 4 has been greatly influenced by an evaluation of the **strengths** and **weaknesses** of current GIS operations as well as an assessment of the **opportunities** and **threats** that the stakeholder community perceives. In short, New Hampshire would like to:

- Leverage its *strengths*
- Adapt existing practices and expand capabilities to address *weaknesses*
- Seize *opportunities* that are present to make progress and to fulfill unmet needs
- Understand the *threats* so that the plan properly manages the risks they present

The following sections catalog and categorize the strengths, weaknesses, opportunities and threats that were most influential in shaping the overall direction of the strategic vision. Most of these observations were gathered during stakeholder workshops and interviews as well as during the deliberations of the GSPAC. A more comprehensive enumeration of the strengths, weaknesses, opportunities and threats discussed at the workshops and interviews is found in Appendix 1.

3.3.1 Strengths

- **All levels of New Hampshire government – state, regional, local – have made significant investments and commitments to GIS technology:** GIS is thriving at the state, regional and local levels of government. As documented earlier, state agencies such as DES, DOT, OEP, HHS, Fish & Game, and Safety have mature and active GIS programs. Every RPC has an active GIS program with dedicated staff, and many of the larger and more urban communities have successful local GIS operations. As such, there is a dedicated constituency that is actively working with geospatial technologies and would capitalize on any strategic investments made.
- **New Hampshire GRANIT is widely recognized as an effective and vital resource:** The New Hampshire Geographically Referenced Analysis and Information Transfer System is the de-facto public-facing GIS representative for the State. Housed within the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire, GRANIT provides on-line access to metadata catalogs, data download and data viewing. GRANIT also provides data development, data management and

project-based GIS and image processing support to a wide group of collaborators. Stakeholders gave GRANIT very high marks for effectiveness. Numerous entities reported that GRANIT resources are essential for supporting their day to day activities and that they accessed GRANIT on at least a monthly basis.

- **A consensus exists for stronger GIS coordination in New Hampshire:** While formal roles and authority are lacking in New Hampshire, many GIS stakeholders are engaged in informal coordinating activities and are committed to improved coordination. For example, while the GIS Advisory Committee has no authority, its bi-monthly meetings are well attended by a variety of stakeholders. Similarly, several of the independent state agencies that have strong GIS programs – e.g. DES, DOT, OEP, etc. – coordinate their activities to some degree, albeit on an informal basis. While these autonomous operations have been effective, there is an overall understanding of the importance of better coordination and the improved efficiencies it can yield, and a willingness to participate in activities that will enhance statewide GIS coordination.
- **Regional Planning Commissions (RPCs) help disseminate GIS data and services:** Through the regional planning commissions, all communities in the state - many of which do not yet have the ability to use GIS technology in-house - have the benefit of GIS data developed with state and federal funding sources to apply to local needs. These communities also have access to cost effective GIS services for local data development, map production, and analysis. In addition, the RPCs play a vital role by acting as Regional Service Centers, thereby helping to bridge the gap between the State and municipal GIS program activities.
- **New Hampshire has exercised its bulk purchasing power for GIS software:** New Hampshire has a blanket contract with GIS industry leader ESRI that provides discounted GIS software purchase and maintenance rates. In addition to state government entities, any city or town can take advantage of these discounts. These purchasing vehicles help to lower the barriers to entry for new participants, and further contracts of this nature should be pursued with other software suppliers as well as GIS data and equipment providers.

3.3.2 Weaknesses

- **Lack of awareness of GIS status and resources:** While GRANIT received high marks and many GIS stakeholders use their resources, there remain large pockets of stakeholders who are unaware of what is currently available and of the overall status of GIS within the state. For instance, it appeared that several GIS stakeholders (particularly smaller municipalities) learned about GRANIT's freely available web-based GIS viewers at the stakeholder meetings conducted as part of this project. Without a strong, active coordinating function, it has been more difficult for New Hampshire to “get the word” out about GIS developments. With GIS activities ongoing at GRANIT and a variety of independent state agencies, as well as regional planning commissions, it is difficult to gain an overall picture of GIS development status in New Hampshire.

- **Existing duplication of effort and redundancy:** Without a centralized state government GIS server infrastructure, by necessity multiple state agencies undertake inefficient and redundant GIS data management and processing. For example, rather than accessing a single statewide GIS data warehouse, each department maintains its own data servers loaded largely with the same set of base layers that are available from GRANIT. If a data set gets updated, each entity must obtain the updated data and load it onto their servers. In some cases, multiple entities are managing different copies of very similar data sets. For example, both DOT and Safety manage different versions of the street centerlines.
- **Many important data sets are not reliably and readily available to general GIS users:** There are numerous weaknesses in the New Hampshire geospatial data holdings, including:
 - ***Inadequate quality in core data layers:*** New Hampshire’s core databases are built on the medium-scale 1”:2,000’ USGS topographic quadrangle base map. While useful for statewide analyses, some fundamental layers such as town boundaries require both accuracy and linework reliability improvements to be adequate for larger-scale applications. Another example of a data layer that has insufficient accuracy for many intended uses is statewide elevation data.
 - ***Data exist but are undiscoverable:*** A good deal of New Hampshire’s data – particularly agency data sets – is not documented with metadata. Without this important component, the data cannot be archived in GRANIT and discovered using the GRANIT clearinghouse tools. As such, it is very difficult to reliably determine whether a particular data set currently exists, and if it does, whether it has appropriate quality for intended uses. This has led to numerous instances of redundant data development.
 - ***Data exist but are not generally available:*** The most prominent example of this issue is the New Hampshire Bureau of Emergency Communications (NHBECC) road centerline data set, comprising street segments with address ranges, maintained by the Department of Safety. There is wide demand for access to these data through the GRANIT database, where it would be readily accessible to all State agencies and the general public. While NHBECC has made their centerline data available to the Department of Transportation, and the resulting DOT centerline data has then been submitted to GRANIT, the address ranges compiled by NHBECC have never been made available. The Department of Safety is restricted by law (RSA 106-H:14) to releasing the data only on a case-by-case basis; however, the Department has indicated a willingness to include address range data in future, regular updates to the Department of Transportation. Due to the fundamental importance of street centerlines and address ranges for a wide variety of uses, this plan supports efforts by the Department of Safety to make reasonable accommodations whereby a subset of their data is made more broadly available. In several other states, address range information derived from E911 programs is broadly available to partner agencies and the general public through statewide GIS web sites. It is hoped that in New Hampshire this type of distribution, from which the State would benefit by realizing the full value of its investment in collecting and maintaining these data sets, will also be made

available. Note that there are several private sector data sources where address listing and address range data can be procured for public use. However, all are expensive and none as current and comprehensive as the NHBEC data.

- **Municipal GIS adoption is uneven and there are GIS “haves” and “have nots”:** Due to New Hampshire’s diverse geography and the concentration of population into a relatively small number of larger cities and towns, there is not widespread adoption of municipal GIS across the state. In general, larger communities such as Nashua, Manchester, Concord and Londonderry, have mature, advanced systems and full-time staff, while many smaller communities have nothing or they rely on GIS support from other organizations such as RPCs. The reasons and constraints for limited municipal adoption cited by stakeholders included:
 - Limited financial resources
 - Limited GIS technical pool
 - Limited or non-existent broadband access for many areas of the state

This lack of municipal GIS capacity makes it more challenging for the state to leverage local GIS activity into statewide progress. This “weakness” presents new opportunities for leveraging the activities of the RPCs to promote further GIS progress in New Hampshire.

- **Statewide GIS standards are lacking:** While GRANIT successfully implements the FGDC metadata standard for their data clearinghouse, the State provides little further guidance to other GIS stakeholders on data standards that will help insure that New Hampshire’s GIS assets are of the highest quality and are well documented. A draft parcel data standard has been developed that municipalities can voluntarily adopt, and finalizing this standard will be the focus of a newly-created subcommittee of the GIS Advisory Committee. But additional standards are recommended, and would make it easier for the State to harvest local data sets to begin the process of assembling regional and statewide data layers from the contributions of the municipalities. In addition, when State funding is used to create data sets, mandatory use of relevant standards to ensure that a high-quality product is generated can become a condition of the funding. Many local and regional GIS stakeholders expressed an interest in the State providing this type of guidance and did not view it as a nuisance or a threat.

3.3.3 Opportunities

There are clearly significant opportunities to improve New Hampshire’s GIS. Indeed, almost every weakness mentioned above implies several opportunities for advancement. That said, the following identifies only immediate, overarching leveraging opportunities that have impacted the direction of the Vision and Goals section of this document.

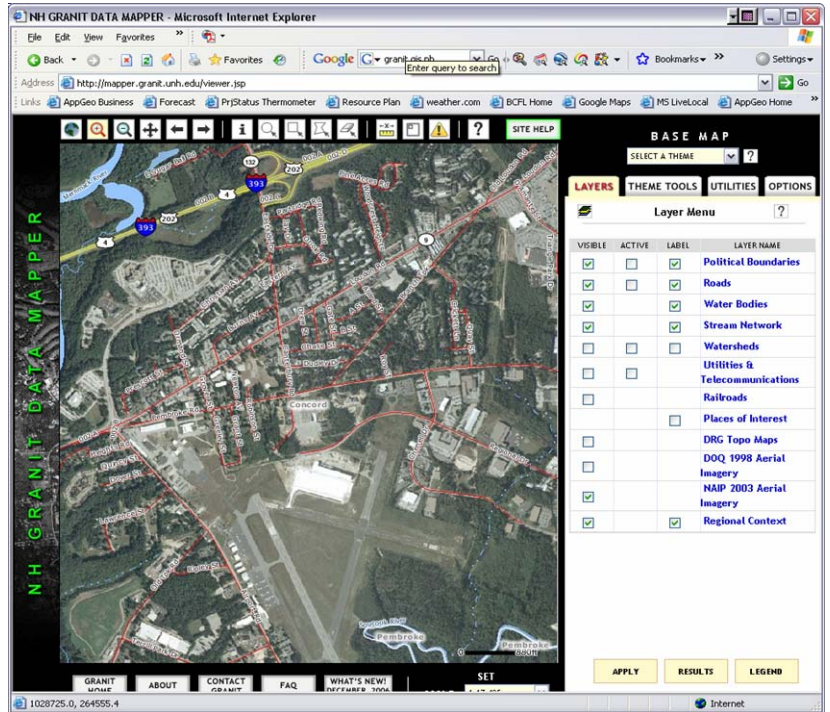
- **Strong collaborative attitude and support for increased coordination among existing state GIS programs:** As described earlier, there are numerous, successful and independent state GIS programs within individual agencies. Rather than viewing increased coordination of GIS activities as a potential threat, these GIS program managers unanimously view further coordination as a benefit. This collaborative attitude can streamline the process of realizing change.

- **Offer by the UNH Institute for the Study of Earth, Oceans, and Space to house GIS Coordinator:** The University of New Hampshire has offered the use of its existing facilities to house the new position of statewide GIS Coordinator at no cost. The salary of this individual would need to be covered by the State, but this offer includes the following benefits:
 - Office space
 - Administrative support
 - Required hardware and access to GIS software
 - Physical proximity to GRANIT

- **Existing, supportive constituency for increased inter-governmental GIS coordination and increased geospatial service availability:** As described above and as witnessed during the stakeholder workshops, there are many GIS stakeholder groups that would like to see the State offer additional services that would add value to both the State and the stakeholders themselves. These services include:
 - Standards for data sets, such as finalizing the parcel standard, or activities, such as submitting electronic plans to communities.
 - Active GIS coordination and information dissemination, such as hosting an index of municipal GIS deployments and hosting educational resources that can help communities “get started” with GIS.
 - Helping to bridge the gap between the municipal “GIS haves” and “GIS have-nots” by supporting regional entities (e.g. RPCs) that work directly with municipalities to start/grow their GIS.
 - Providing enhanced on-line access to the State’s GIS assets to provide “starter functionality” without, or with only minimal, investments by the municipality. Enhanced access would involve both creating new web-GIS viewers that might be focused on the “municipal outlook” and also creating additional on-line tools that are aimed at specific issues such as build-out analysis or critical infrastructure visualization.

- **Further opportunities for increased coordination and collaboration between the GIS community and Public Safety/Emergency Management community:** Given the importance and high profile of public safety and homeland security issues, particularly in the post-9/11 era, many states have forged productive working relationships between the “public safety community” and the “GIS community”. In states such as Connecticut, homeland security funding has been leveraged towards investments in the state’s overall GIS infrastructure and enterprise architecture. Indeed, there are many opportunities for state public safety activities to be aided by strong state geospatial infrastructures, and many DHS homeland security grants list geospatial investments as “eligible uses” of grant moneys. Historically, in New Hampshire there have not been strong ties between the GIS and public safety communities, and thus there are opportunities for enhanced coordination and collaboration, and potentially shared investment on activities of mutual interest such as:
 - Critical infrastructure and sensitive population mapping

- Access to high-quality statewide orthophoto and oblique imagery
 - Geo-enabled field applications
- **Potential of general web services for leveraging existing and future investments:** Currently, the State, via GRANIT, makes much of its GIS data available on-line via web-GIS data viewers. For example, the GRANIT Data Mapper illustrated below provides a rich GIS data viewing experience. In addition to viewers, New Hampshire has the opportunity to develop and publish general GIS web services that would enable other entities to implement their own viewers utilizing the State's GIS data clearinghouse and infrastructure. For instance, individual state departments, RPCs, municipalities and even the private sector could read and incorporate such web services into their own GIS web sites. In addition, such web services can be used to share data with collaborators, including the federal government or neighboring states, with minimal effort. These web services would effectively broaden GIS data use without the State being responsible for creating and maintaining additional applications. Increasingly there is industry support of open standards (e.g. Open GIS Consortium standards) for such web services, and this has both increased the technical feasibility and lowered the cost of this type of approach. By increasing the community of people who can develop applications that utilize the State's GIS infrastructure, the State helps to maximize the return on its GIS data investments.
 - **Follow-up to Department of Transportation purchase of ArcView GIS software for community use:** In 2001 the state government purchased ArcView version 3.2 GIS software and provided a laptop computer as well as GIS training to each community in the state. This provided baseline GIS exposure to all municipalities. While the software is now outdated by new versions, and some of those trained when the software was distributed have now left, there remains an opportunity and basis for following up with the communities that participated. At a minimum, this exercise can provide some valuable lessons learned about efforts to catalyze local GIS activity.



3.3.4 Threats

- **Lack of sustainable funding for GIS coordination:** Currently there is no centralized, sustainable funding for state GIS coordination efforts. Rather, individual state departments have their own operational funds allocated to GIS, and these are

supplemented by additional grants from the federal government and other entities. Similarly, the public-facing GRANIT system at UNH is supported by \$70,000 of annual funding from OEP and other creative grant and project-related funding sources. Without the creation of a coordinating body and position, and appropriate sustainable funding, the State will be unable to increase statewide coordination of geospatial activities and will continue to suffer from structural inefficiency, duplication of effort, and an inability to increase capabilities by capitalizing on new technologies.

- **Lack of awareness of GIS activities at the legislative level and no senior-level champion that advocates on behalf of GIS issues and funding:** While GIS use is widespread and there have been numerous GIS success stories, there has not been a strong and consistent voice advocating on behalf of GIS within the legislature or at the executive level. This is an enormous impediment to establishing a sustainable level of funding for statewide GIS operations and for the continued maturation of GIS activities within the state. In some ways, GIS has been a victim of its own success, as decision makers have become accustomed to seeing GIS products while not understanding the challenges GIS practitioners face nor seeing the gaps that exist in the State's data and technical infrastructures.
- **Resistance to widespread sharing of geospatial data:** Many municipalities indicated a resistance to sharing local large-scale data with the State. At the State level, RSA 106-H:14 has prevented the Department of Safety from sharing street centerline and address range data with others, except on a case-by-case basis. (The department does recognize the broad general benefit in having accurate road centerline and address range data available to the public through GRANIT, and is willing to work with the Department of Transportation to reach this goal, while preserving confidentiality.) In all situations where general data sharing does not presently occur, there would be a benefit in looking for solutions that would protect the interests of the data providers (e.g., privacy protection, data ownership concerns, liability) while enabling the data to be shared effectively to the overall benefit of the state. These issues are not unique to New Hampshire and there are numerous models for addressing them.
- **Problem of technical staff turnover:** Time and again, GIS stakeholders both in municipal government and within state government reported that the loss of trained personnel is a significant threat and barrier to further progress. To address this concern, there is an existing effort spearheaded by DOT aimed at creating a series of GIS-specific job titles within state government. It is hoped that creating these GIS titles will provide both an appropriately competitive pay scale and career path for GIS professionals to follow within state government.

4 Vision and Goals for Enterprise GIS in New Hampshire

New Hampshire GIS Mission Statement

The mission of the State of New Hampshire's GIS program is to promote the efficient use of New Hampshire's diverse resources by utilizing geographically related information in an effective way and by providing geographic information and corresponding tools to state agencies and the general public.

Programmatic Goals

In order to capitalize on existing strengths and opportunities and address existing weaknesses and threats, New Hampshire's GIS vision includes the following programmatic goals:

1. Create a GIS office and Geospatial Information Officer (GIO) position

New Hampshire will establish a GIO position similar to those found in New York, Massachusetts, Pennsylvania, Virginia and Wisconsin (albeit not always with that same title) and this position will head a State GIS office. This position should be a full-time state government position with a sustainable funding source. Since the GIO position will have both inter-departmental and inter-governmental coordinating responsibilities it is envisioned to be organizationally situated parallel to the Chief Information Officer and reporting directly to the Governor's office.

Initially, this will be a small office, perhaps only staffed by the GIO. The office will launch a concerted, focused effort to coordinate and consolidate state GIS data development activities, to provide GIS technical resources, and to reduce duplication of effort. In addition, the GIS office will initiate and oversee efforts at creating and/or enhancing statewide standardization of data, including developing data standards. In time, these efforts may include the development and management of an enterprise GIS architecture that would house a comprehensive statewide GIS data clearinghouse and provide direct state agency access to this resource. When the enterprise architecture is developed it is likely that the GIS Office will require a small technical staff to help manage and administer this communal technology. Last, the GIS office and GIO position would be identified as New Hampshire's main contact with federal initiatives for data coordination and data sharing, for example, participation in NSDI.

While this office would be organizationally situated under the Governor's office, it could be physically situated in one of two potential locations. First, the University of New Hampshire, which also houses GRANIT, has volunteered to provide a physical office as well as clerical and computer support for housing a State GIS office. However, it may be important to physically locate the GIO in Concord, and thus State office space would be required to house the office. A second option is to house the GIO within the Office of Energy and Planning, as they are currently the lead coordinating agency for GIS in the state and have indicated a willingness to do so. It is also potentially feasible to initiate the office out of Durham, and then have it move to Concord at a later time when it is more established.

The GIS office will play a central role in catalyzing and overseeing several of the additional programmatic goals that are described below (i.e. numbers 2-5).

2. Legislatively recognize GRANIT as the focal point for a New Hampshire Spatial Data Infrastructure (NH-SDI)

For many years GRANIT has been functioning as the de facto statewide GIS data clearinghouse. The GRANIT team recognizes the opportunity to build a statewide GIS data infrastructure, and has the technology and personnel required to fulfill this function. This role should be formalized via some type of legislative recognition as this will help to focus efforts aimed at expanding the current clearinghouse to act as a New Hampshire Spatial Data Infrastructure (NH-SDI). Such action will also serve to formally identify GRANIT as the State's node in the overall National Spatial Data Infrastructure (NSDI).

Focusing effort on expanding the current clearinghouse into a more robust NH-SDI is important from a number of perspectives, including appropriate representation of the State in federal initiatives. The current federal vision includes a series of standards-compliant state SDIs that work in concert to feed critical data sets into the NSDI, which in turn will drive a variety of vital federal GIS initiatives ranging from emergency response to environmental protection to demographic analysis and support of census taking. The federal government is prioritizing this initiative and has made resources available to the states to help realize the vision, including the funding that supported the creation of this study. Ultimately, New Hampshire's interests will be best served when the federal government is basing its decisions and resource allocations on the most accurate geospatial data for New Hampshire.

Many of the elements of an effective NH-SDI will help address structural inefficiencies and duplication of effort currently present in New Hampshire. Thus, with GRANIT focused on building and maintaining an NH-SDI, the State receives the dual benefits of a greatly improved infrastructure to facilitate and enhance internal uses of GIS technology and a stronger ability to effectively participate in the federal vision of an NSDI.

A fully constructed NH-SDI will include the following elements:

- All existing geospatial data for New Hampshire assembled in a unified data warehouse, based on the following priorities:
 - Initially, existing state and federal data resources
 - Over time, local/municipal data resources
 - As required, relevant data from neighboring states
- Establishment of “confederated” architecture for data maintenance. This means that individual state departments would remain as the “custodians” of the data, and would manage the regular changes to the data (e.g. new roads that are added). However, these custodians would regularly provide their data to the repository, perhaps in an automated replicated fashion, so that the updated data are made immediately available to all GIS users.
- Establishment of a robust high-speed means of accessing both the metadata and data contained within the repository. This includes:
 - Direct network access for agency users of GIS software (e.g. ArcView)

- Direct access to a metadata repository that allows data discovery through user queries
- Web services that can be accessed by agency browser-based applications
- Web services for a subset of publicly available data that can be accessed by the general public and third party web applications
- Establishment of end-user tools for viewing and working with the State’s GIS data assets. These tools may include general purpose web-GIS viewers for public access to the data as well as the development of web services that provide GIS functionality such as geocoding to end users.

3. Increase awareness of GIS and what it can do, especially with state legislators

In order to gain the support necessary to create and sustain a GIS office and GIO position, it will be increasingly important that the role of GIS in numerous state policy and decision-making arenas is better understood. Building on the contents of this plan, there should be a concerted GIS marketing campaign aimed at informing elected officials and key government decision makers of the value of GIS as well as the existing strengths and weaknesses of the State’s GIS operations. This marketing effort can be addressed at issues such as:

- Identifying the number and breadth of GIS stakeholders, as well as engaging them to help lobby for support.
- Identifying the number and breadth of policy issues that GIS has been used to support, including but not limited to:
 - Land use planning and growth management
 - Public safety and flood response and mitigation
 - Transportation planning (e.g. I-93 widening)
- Identifying the GIS resources that are in place, as well as those that are lacking and are in need of development.
- Identifying and explaining federal and other funding opportunities that are available to support geospatial initiatives, as well as the funding criteria that include having a well-coordinated GIS office.

4. Expand support that is offered to local and regional GIS stakeholders

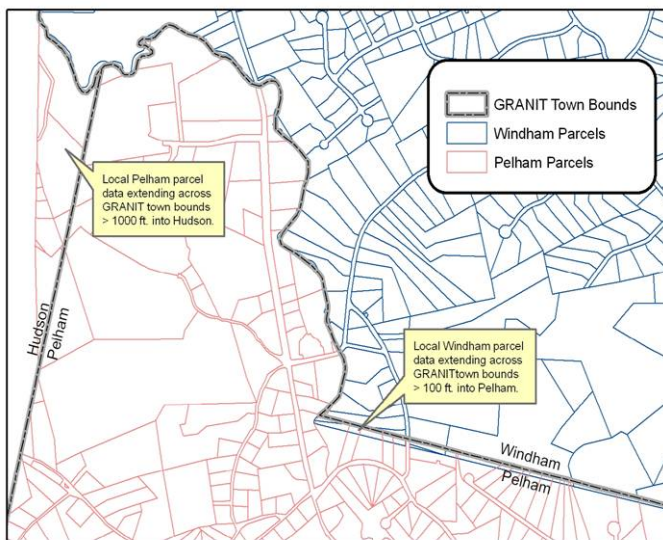
Recognizing that there are unmet needs for GIS in rural New Hampshire, and that these unmet needs will lead to potential holes in the statewide data fabric for layers such as parcels or zoning, it is envisioned that the State GIS office and GIO will help to catalyze further municipal GIS activity in a variety of ways. These include:

- Providing ongoing GIS educational opportunities through the UNH Cooperative Extension Geospatial Technologies Training Center, aimed at municipal GIS stakeholders on both technical and GIS planning (e.g. “how to get started with GIS in your town”) topics.
- Developing and encouraging the adoption of state standards.

- Sponsoring/supporting the continued development of the regional planning commissions as regional GIS service centers to provide direct support to both larger communities using GIS and smaller communities that are unable to sustain GIS programs on their own.

5. Develop data to fill identified data gaps

There are a number of data sets that the GIS stakeholder community has identified that are not currently available, are out of date, or are only available at small scales and are not appropriate for intended uses. With a focused GIS office, longer-term initiatives aimed at filling these gaps, while capitalizing on available federal funding sources, can commence. The following describes important data gaps identified by the stakeholder community and the GSPAC. Further effort will be required to prioritize these initiatives if, and when, funding becomes available to address these present shortcomings:



- **Definitive town boundaries:** The existing town boundaries were automated from the United States Geological Survey (USGS) topographic quadrangle sheets. These data are not based on town survey markers, nor were they input using the legal descriptions of the town boundaries, and regular users of this data set understand that there are numerous known instances where the town boundaries are inaccurate. These data are in need of a major accuracy improvement initiative.

The image to the left illustrates the

discrepancies introduced when large-scale, local data sets are viewed in concert with the medium-scale town boundary data layer. (Note: An ongoing municipal pilot project involving UNH, DOT, town representatives, and members of the NH Land Surveyors Association is presently exploring a host of issues related to this topic.)

- **High-quality topography:** Currently, the available statewide topographic data is a 30-meter resolution digital elevation model, with some areas of the state available at a 10-meter resolution. Unlike many other states that have 10-foot, 5-foot, or increasingly even 2-foot contours available statewide, New Hampshire does not even have a 10-foot contour elevation data layer (partly because the USGS topographic quadrangles for New Hampshire do not provide statewide coverage for 10 foot contours). Due to the importance of these data for applications ranging from flood response planning/mitigation to land use planning to natural resource protection, it is important that New Hampshire undertake an effort to produce higher quality statewide topography. Importantly, there are some federal funding opportunities within the USGS and National Resource

Conservation Service (NRCS) that can be used to support the development of statewide topographic data sets.

- **High-quality imagery:** In 2005 and 2006, the NH-DOT acquired medium-scale, detailed orthophotography for approximately 40% of the state. The imagery has a scale of 1" = 400' and a pixel resolution of 1 foot. Unfortunately, the project was terminated in the spring of 2007 due to a lack of sufficient funding. It is critical that this program be completed with 100% statewide coverage as soon as possible, and potentially on an accelerated basis. In addition, it is important that appropriate plans be put in place for a regular update of this imagery, particularly in the regions of the state that are undergoing the most development. As with topography, there are several federal funding sources, e.g. USGS's "Imagery for the Nation" initiative, which may be accessed to help support this type of data development.
- **Parcels:** Parcels represent a fundamental data layer that both displays land ownership, including differentiation between private and public ownership, and provides an accurate location for addresses. Generally, parcel data are developed and managed at a local level, but they can be collected and aggregated at both regional and statewide levels. While developing parcels on a statewide basis would be a prohibitively expensive undertaking, the State can begin efforts to collect and assemble regional parcels where they are available. This will involve close coordination with local GIS stakeholders and an ability to answer their concerns about protecting their proprietary interests in the parcel data. But given the power and importance of these data it remains a worthwhile undertaking. In neighboring states, such as Maine and Massachusetts, state government has provided grants to communities to provide "starter funding" so that they can initiate parcel development, and a condition of that funding is that the parcel data must be provided back to the state. Such innovative approaches can be a cost effective way to broaden statewide parcel coverage and are worth exploring.
- **Drainage infrastructure:** Due to the importance of flood control and management, illustrated by the severe flooding experienced in 2005, 2006, and early 2007, drainage infrastructure data – dams, culverts, drainage system outfalls, etc. – is increasingly valuable. The Department of Safety has used GPS to locate some culverts along the interstate highways, but further effort is needed to create a comprehensive inventory of significant drainage structures so that they are available to support flood planning and mitigation work in combination with existing FEMA floodplain data and the digital drainage network represented by the NH Hydrography Dataset.
- **Street centerlines and address ranges:** There is an acute need for a generally available, improved street centerline and address range data set. Whether by finding a way of clarifying privacy restrictions on existing data sets or by developing/acquiring an alternative data set, access to street centerlines with address ranges remains a priority gap to fill.

5 Requirements for Enterprise GIS in New Hampshire

5.1 Introduction

As described above in Section 3, New Hampshire has extensive GIS infrastructure – both data and technical – in place at various levels of government. In addition, the State supports the GRANIT system, which provides a working repository for much of the State’s data as well as an on-line means for public access to GIS data.

While many of the components necessary for a state spatial data infrastructure are in place there remain several gaps that must be filled. These include:

- Lack of cohesion between state government GIS programs. Activity is focused at the departmental level, and there is neither a central GIS office to facilitate sharing nor a technical infrastructure in place to enable it.
- Lack of formal, broad and regimented sharing and collaboration between state government and GRANIT. Some data sets never make it to GRANIT, and there is not an infrastructure to allow automated, on-line synchronization between State databases and GRANIT.
- Lack of formal coordination between state government and local government GIS efforts. While some collaboration and coordination takes place on an ad hoc basis it is not widespread nor is there State guidance – for instance, data standards – aimed at helping local GIS programs actively engage with State efforts.
- Major gaps in GIS data still exist. As documented above, even though there is a statewide orthophoto effort underway, statewide orthophotos will not be available for at least another three years, and at that time the data will be 4 years old. Similarly, data sets as fundamental as municipal boundaries and elevation have significant shortcomings and are in need of improvement.

The sections below provide a succinct “do-list” of specific activities that will help fill these gaps and move New Hampshire towards the realization of the vision and goals set forth in Section 4.

5.2 Data Requirements

The following describes the highest priority data development and refinement priorities in New Hampshire in the order of priority determined by the GIS Strategic Planning Advisory Committee:

1. **Completion/acceleration of the statewide orthophotos**
 - Given the cancellation in 2007 of the DOT orthophoto program there are currently no plans to complete the statewide orthophotos beyond the 40% of the state that already exists.
 - The original schedule to complete the state over 5 years resulted from the fact that funding was coming exclusively from DOT. With the cancellation of this program DOT and GRANIT have entered into discussions about GRANIT

taking on the task of identifying alternative funding sources from other agencies and/or available grants. If alternative funding became available it would be highly desirable to accelerate this program so that all imagery and processing could be completed within a 1-2 year period, and so that New Hampshire can join all of its neighboring states in having a high-quality statewide orthophoto resource.

- New Hampshire will further investigate participation in the USGS Imagery for the Nation (IFTN) program and the attendant funding that may be available through such participation.
- Due to the fundamental and multi-purpose nature of orthophoto imagery such acceleration is considered the highest priority for data improvements.
 - Equally, once completed, it is important for New Hampshire to plan for regular updates to this data layer, and IFTN may provide further opportunities for this.

2. Improvements to statewide town boundaries layer

- The current town boundaries data set was derived from USGS topographic quadrangles, and the New Hampshire GIS community is well aware of numerous boundary errors in this data set.
- Improving the data layer requires research into official boundary descriptions as well as potential field work to accurately record the location of boundary markers.
 - GRANIT is currently involved in a pilot study for 3 contiguous towns along the I-93 corridor where this type of accurate boundary mapping is taking place. This pilot should provide valuable information validating the need for this work, methods for completing it as well as information on the level of effort necessary to finish the work on a statewide basis.
- Due to the fundamental nature of the town boundary data set and the importance of properly understanding which infrastructure and which natural resources are in each community, correcting these flaws was considered the second highest data improvement priority.

3. Standardized statewide road centerline data with enhanced attributes

- Currently, there are three separate road centerline data sets – the NHBEC data set, the DOT data set, and a USGS-derived data set - that are in use by the New Hampshire GIS community. Two of the sets (NHBEC and DOT) continue to receive maintenance and updates for currency. In addition, many cities and towns have their own road centerline data sets.
- As documented earlier, the road centerline and address range data collected and managed by the Department of Safety are not generally available to the GIS user community due to data sensitivity concerns and a legislative restriction on distribution (RSA 106:H-14).
- We recommend that the State standardize on a single road centerline network for geographic positioning, street naming and address ranges, derived from the

DOT street geometry with regular NHBEC input. Multiple agencies could then attach/link their own attribute data sets to this core geometry.

- Thus, the third priority for data initiatives are administrative efforts aimed at working with the Departments of Safety and Transportation to develop and implement protocols to merge the road geometries that both agencies have collected, thereby eliminating duplication of effort and providing data that could be made accessible to the public while meeting NHBEC's privacy and sensitivity concerns.

4. Aggregation of local parcel data to begin the process of assembling statewide parcels

- Many state agencies would benefit if parcel data developed by communities were available for use in various State GIS efforts.
- Efforts should begin to collect and consolidate those existing data.
- The State will need to develop a series of parcel data standards that can provide guidance to communities that embark on parcel automation and that also serves as a model that will allow the State to aggregate disparate community data sets into regional coverage. States such as Massachusetts and Maine have existing parcel standards that could serve as a base for a New Hampshire standard.
- Local community interests in their parcel data will need to be protected as the State begins collecting these data and making them available to state agency users and potentially other groups.
- Beginning this effort was considered the fourth priority due to the importance of parcel data and due to the fact that major, expensive data development efforts are *not* required. Rather, this is an exercise in creating standards, improving coordination and collecting existing data.
 - Regional entities such as the RPCs can play a vital role in helping to promote the standards and to collect and aggregate parcel data at a regional level.

5. Development of improved elevation data

- Elevation data are critical to a wide variety of applications, such as floodplain delineation. New Hampshire's current elevation data is lacking in quality, as there is not even a statewide 10 foot contour data set.
- Ideally, New Hampshire would have access to statewide topography data with better than a 5 foot contour interval, as flood plain delineation requires 4 foot contours for most areas and 2 foot contours in flat areas.
- Improving New Hampshire's elevation data will be a large and expensive undertaking, and consequently it received the fifth priority for data development initiatives.
 - As a first and affordable step, it is recommended that New Hampshire undertake a planning exercise to determine the specific requirements for

elevation data and to determine the best methods (e.g. LIDAR, DEM/DEM, etc.) for developing the data and at what cost.

6. Development of improved drainage infrastructure data

- Drainage infrastructure is extremely important for flood prevention and response planning. Drainage infrastructure data development would include the accurate mapping of dams, culverts, ditches, retention ponds and bridges.
 - Developing high-quality drainage infrastructure would involve coordinating this mapping with existing mapping efforts for the national hydrography data set (i.e. all streams, rivers and water bodies).
- As with elevation, this type of statewide mapping will be a large and relatively expensive effort, and consequently it received a lower sixth priority.
- As a first and affordable step, it is recommended that New Hampshire undertake a planning exercise to determine the specific requirements for drainage data and to determine the best methods (e.g. GPS-based collection) for developing the data and at what cost.

5.3 Technology Requirements

1. New Hampshire has a requirement to deploy technology to support a comprehensive geospatial data repository for shared use by state government agencies and other stakeholders. The repository should support the following:
 - All state government agencies have on-line, real-time access to the best available data layers
 - Real time “thick client” access for desktop software (e.g. ArcView)
 - Web services access for web based applications
 - Serve as New Hampshire’s GIS clearinghouse for federal programs such as The National Map and NSDI
 - Provide the general public web-based applications (e.g. the GRANIT Data Mapper) to New Hampshire’s public data assets, as well as web services access to data
 - Web services could potentially be deployed via open standards and/or specifications such as the Open GIS Consortium (OGC) Web Map Specification (WMS)
2. The New Hampshire repository will be primarily a storehouse for data and a gateway for providing access to the State’s data assets:
 - State agencies will remain custodians of individual layers, and these agencies will update the repository on a regular basis, perhaps using automated methods
 - All data may not physically reside in one repository, and the New Hampshire repository may in fact be a “virtual repository” composed of several federated database servers

- The repository must be constructed with appropriate security and authentication mechanisms to allow differential access for different classes of users.
3. There are two primary technical options for constructing the repository. The following describes these options as well as the opportunities and constraints of each:
- Expansion of GRANIT’s current data clearinghouse functions to include the full suite of capabilities described above
 - Leverages GRANIT’s existing technology and database administration expertise
 - Would require adequate network bandwidth so that a Durham based repository could deliver adequate desktop data access
 - Would require adequate funding support for expanded responsibility
 - Development of a data repository infrastructure in Concord
 - Location of facility would need to be identified
 - Staffing for the facility would need to be identified/funded
 - Proximity to agency users may provide networking bandwidth and support benefits

5.4 Resource Requirements

Establishing a New Hampshire GIS Office and the NH-SDI would be a major undertaking and would required the collaborative efforts of numerous existing GIS stakeholders. The following provides a high-level overview of the minimum staff and monetary resources that would be required:

1. Staff involvement from state agencies that would participate in the NH-SDI (e.g. DOT, HHS, OEP, DES, etc.)
2. Staff involvement from GRANIT
3. Staff involvement from the newly created State GIS Office (see below)
4. Funding to support the creation of new State GIS Office staff (i.e. the GIO), data improvements and consulting support
5. Specialized consultant staff support for: enterprise system architecting, repository and database design, and web services design and implementation

5.5 Standards

There are two distinct areas where New Hampshire needs to move forward on GIS data standards:

1. There should be more structured buy-in and implementation of relevant federal standards, such as the FGDC metadata standards. The State should also expect that there will be additional federal standards guidance, for example in the arena of critical infrastructure data schemas.

2. New Hampshire should anticipate the need to develop and promote appropriate New Hampshire-specific data standards, for example for municipal parcel data. Several other New England states (e.g. Massachusetts, Maine and Rhode Island) have issued their own parcel standards, and they can provide a useful model for New Hampshire to follow.

5.6 Organizational Needs

5.6.1 Executive Support

Due to the financial and staff resource requirements described above, it will be imperative that New Hampshire have senior level executive support for the NH-SDI initiative. This involves:

1. **Explicit effort to recruit a vocal, senior level Champion for a NH-SSDI**
 - Candidates might include:
 - Legislative leader
 - Senior state government official (e.g. CIO, department head from a major GIS user department)
 - Following the completion of this study there should be active efforts aimed at educating GIS stakeholders and the decision makers on the findings and frank discussion of the need for a champion.
2. **Expedited creation of the State GIS Office and the appointment of a GIO**
 - Efforts should be focused on creating the GIS Office and the GIO position, as most other activities are dependent on the existence of this office and its role in coordinating efforts.
 - In addition, this office will become a strong advocate for promoting the overall NH-SDI program.

5.6.2 Coordination and Oversight Procedures

1. Ownership of the Enterprise GIS initiative should be by the newly formed State GIS Office.
 - All state agencies that are actively engaged in GIS should identify a “departmental GIS lead”. The departmental GIS lead will be the agency’s authoritative voice on GIS coordination matters and will be the newly formed GIO’s primary point of contact with each agency.
2. A **State GIS Council** (an oversight committee for the New Hampshire Enterprise GIS initiative) should be formalized. This council would serve as a “Board of Directors” to the State GIS Office’s lead of the Enterprise GIS Initiative.
 - Members would include state agency heads (or their designees, who would be a high-level agency GIS lead), GRANIT, and ex officio members representing the regional planning commissions and the municipalities.

- Additional ex officio members may be added, such as from federal government, non-governmental organizations, and academia, although it may be decided to keep the council focused on State government GIS activities.
 - The existing GIS Advisory Committee should continue to meet and should be reconstituted as a broad-based New Hampshire **Technical Advisory Group** with leadership and coordination from the GIO.
3. Further formalization of the relationship between state government GIS efforts and GRANIT efforts at UNH is required. GRANIT’s long-term role should be clarified and appropriate, sustainable funding allocated to the fulfillment of that role.

5.6.3 Policy

There are two general areas where new policies should be considered:

1. Statewide Policy Aimed at a Better Coordinated State GIS Program

Examples might include:

- Formal legislative recognition that the new State GIS Office is the official coordinating body for geospatial activity in New Hampshire
- Legislative action to enable data sharing of the State’s NHBEC road centerline/address range databases.

2. GIS Oriented Policy that Might Emanate from the GIO

An example might include:

- Creating a requirement that if any State money (e.g. in the form of grants) is used to create GIS data, then those data must adhere to state GIS standards and they must be shareable with the State.

5.6.4 Staffing

Staffing for the NH Enterprise GIS Initiative would come from three sources:

1. Primary project staffing would come from the State GIO Office
 - Initially via the person filling the GIO position
 - Later from additional technical staff who would help build and manage the technical infrastructure and GIS repository
2. Active participation from state government departmental GIS leads (see 5.6.2)
3. Active participation and assistance from GRANIT program management and technical staff

5.6.5 Budget Requirements

Please see the “Business Plan: For a Geospatial Information Officer” for details on the business case and the budget.

5.6.6 Outreach and Community Development

Outreach and GIS community development will be achieved via three primary mechanisms:

1. Formalization of a State GIS Council (as discussed in section 5.6.2) provides explicit opportunities for involvement from the broader GIS stakeholder community.
2. Leverage the already broad-based GIS Advisory Committee and the attendee list
3. Leverage GRANIT's user lists

Together, these three resources would provide access to the hundreds of individuals who are actively engaged in GIS technology in New Hampshire. These "users" need to be informed of the New Hampshire Enterprise GIS Vision and engaged in the process of advocating for and working towards implementation.

5.6.7 Assessing Risk

There are two major risks that are linked:

1. **Lack of funding support in tight budgetary times:** The overall New Hampshire budget is under pressure and there are limited opportunities for new investment. No matter what, this type of initiative will involve some level of budgetary support. Although there will be long-term savings and efficiencies, in the short term this initiative needs to be catalyzed with funding. Without some new funding there is a significant risk that there will be an inability to move forward with the recommendations made in this plan.
2. **Lack of support for the near-term creation of a State GIO Position:** As described above, most of the implementation activities are dependent on the establishment of this position. The GIO office provides the personnel to both embark on more active coordination and to manage an initiative of this magnitude. Without a person actively engaged in working towards implementation, there is a significant risk that progress will not be made in the short term. There is a newfound consensus on this vision, and there now needs to be investment and action, spearheaded by the new GIS Office and GIO position.

6 Implementation Program: Timeline, Sequencing & Dependencies

The phased timeline presented on the following page presents a reasonable scenario for how New Hampshire could proceed through a series of linked projects to realize the goals of this plan. This timeline aims to highlight the sequencing that might be required as well as the dependencies between different project elements.

Ultimately, the details of implementation will be further refined through the preparation of specific business plans for major project elements. An initial Business Plan for the creation of the state GIS Office and the GIO position is being prepared in parallel with this Strategic Plan. This Business Plan will lay out a specific program and budget for creating this office while also providing “business case” justification for making the required investments.

As such, it is important to recognize that the timeline contains only planning-level detail. Over time, and as details emerge, the specific sequencing and duration of individual project elements will become clearer and can be adjusted. Thus, it is critical that this implementation timeline be viewed as a working document that will adapt and evolve in response to decisions that are made, opportunities that arise and new requirements and priorities that may emerge.