Appendix C: Geographic Information Systems (GIS) Enterprise Strategic Plan

A. Introduction

Objective

There is wide agreement within the County of Nevada that Geographic Information System (GIS) is a proven information technology system essential to delivering a broad spectrum of local government services. While the GIS Division has been functioning for over 10 years, the remaining question is how to improve the information systems and the organizational infrastructure necessary to support continuing successful enterprise implementation of geographic information. The objective of this report is to provide the County of Nevada and its data partners with a three-year strategy to effectively continue the implementation of the enterprise GIS.

Background and Activities Completed During Phase I

Over the past several years, the County of Nevada has made great strides in advancing the use of Geographic Information Systems (GIS) within the County. Aerial photographs for the entire county, database records, images and Computer Aided Design (CAD) drawings can all be incorporated into a GIS application via the assessor parcel number key field. Some of the most significant accomplishments are listed as follows:

- **Internet GIS (iGIS) Applications:** The creation of an inter and intranet based GIS application has brought GIS to virtually every desktop in the County as well as to the public through development of the iGIS application. This has given the public access to parcel level data, road information as well as planning information regarding zoning and the General Plan. This is an enormous step forward in supplying the public with data. It should prove to save time for County staff that currently answers questions over the phone or at the public counter. After eight years of data gathering and input, the GIS Division is a excellent example of how many departments have pooled their financial resources together and developed an enterprise system that uses shared data and shared applications that are useful across departmental lines.

- **GIS Kiosk:** A public GIS Kiosk has been installed in the lobby of the Rood building which provides a GIS mapping application and associated County data for the public's use. This application provides parcel information, including owner name and printing capability.

- **Parcels:** The creation of a continuous enterprise GIS polygon based parcel layer that was electronically submitted to the State Board of Equalization and used in the redistricting effort in 2000.

- **GIS Data Sharing Agreements:** The adoption of a GIS Data Sharing Agreement with the City of Grass Valley, Nevada Irrigation District and the Nevada Fire JPA. The GIS Agreement provides a cooperative arrangement for the coordination and sharing of GIS data between these organizations. Numerous County departments and other regional organizations have started implementing GIS.

These external GIS implementations highlight the importance of having an "enterprise" or enterprise strategy for the effective development, maintenance, coordination and deployment of GIS data and applications.

- **GPS:** The GIS division has purchased a Global Positioning System (GPS) unit through a State Office of Traffic Safety Grant. Other departments will have access to this unit. Departments such as the Assessor, Code Enforcement and Environmental Health will be utilizing GIS and GPS technology to augment their fieldwork. This will allow accurate mapping of facilities, hazard spills, hazard areas, buildings, and other information that needs to be gathered in the field.

- **Roads:** The County has completed the collection of the GPS (Global Positioning System) location of road centerlines as part of a pavement management effort and parcel map rectification. The completion of this effort has resulted in the best available GIS road "line-work" for County and State maintained roads along with major private roads.

- **Acquisition of USGS Orthoimagery and other color digital Photography:** In partnership with Federal agencies such as the United States Forest Service, the United States Geological Survey (USGS) and the NH2020 project, the County has acquired aerial photography for all of the County. We are in the process of updating the County's GIS black and white aerial photo library with color, 1.5 meter resolution Digital Ortho Quads (DOQ's).

- **Acquisition of USGS Digital Raster Graphics:** The USGS Digital Raster Graphics (DRGs) are scanned and registered topographic maps. Most County of Nevada staff are very familiar with USGS topographic maps. In fact, many departments currently rely on these paper maps during their normal course of business. Providing the DRGs to new GIS users delivesr a familiar reference layer in the GIS and eases the transition from paper systems to automated systems.

- **Use GIS to Support Census 2000 Redistricting:** The County of Nevada used desktop and professional GIS software to support the redistricting effort. **Nevada County was the first County in the State that completed their redistricting.**

- **Build Version 1.0 "County Road Atlas" :** An up-to-date County road atlas (in paper format) has been created to replace the Compass map book. A Web-based digital road atlas would serve many critical county uses.

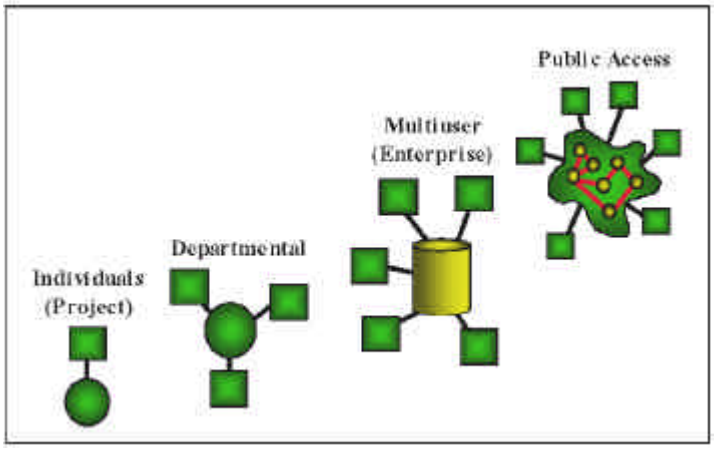
- **Professional GIS Capabilities for GIS Unit :** The BOS approved moving the GIS Division to IS. Two GIS Analysts and a GIS Technician have been hired and all staff have been in the Division for over a year. This allows greater opportunity for GIS integration with other departmental systems.

B. Enterprise GIS Vision

Scales of GIS Implementation

GIS is an information technology that can be implemented within an organization at different scales. A GIS can start simply and grow with the needs of an organization. GIS implementation is typically categorized into four scales that are described below:

Figure 1. Scales of GIS Implementation



Project GIS (Individuals)—Desktop GIS software on a stand-alone personal computer used for project-level mapping and analysis.

Departmental GIS —Multiple staff within a department using desktop GIS software for mapping and analysis on personal computers that are connected via a local area network.

Enterprise GIS (Multi-user) —Multiple departments across the organization collaborating to centrally store and distribute shared spatial datasets and applications.

Public Access GIS - The organization sharing appropriate spatial datasets and applications with other key organizations and the public using Internet-based technologies.

Nevada County took the route of starting with a small and simple GIS and growing it with the needs of the organization during the past 10 years. The County of Nevada's current scale of GIS implementation is at the Public Access level; most departments do not yet have a dedicated GIS staff person who is responsible for the data development and maintenance, i.e. a data liaison. Numerous departments have desktop GIS or CAD systems in place on a limited number of personal computers supporting project-specific needs.

Enterprise GIS

An enterprise GIS implementation is really a collaboration of project, departmental, enterprise, and public access GIS implementations. Key spatial data layers such as parcels, roads, streams, public land survey, photos and so forth are created and maintained by GIS Division staff. These key spatial layers are then stored in a central repository for efficient distribution across the enterprise and to data partners and the public.

An example of the power of an integrated enterprise GIS is the ability to use it to obtain a comprehensive understanding of a particular location. Each County department typically maintains information tied to parcel number or street address. The GIS provides the key link to consolidating departmental datasets into a single view. This would allow an emergency response officer to be able to see contact information for the parcel owner from the Assessor, the presence of hazardous materials from Environmental Health, a premises alert from the Sheriff's Office, planned road closures from DOTS, and, numerous other pieces of key cross-organizational information that could improve the emergency response action.

An enterprise GIS extends beyond the enterprise to reflect the fact that counties must interact with a tremendous number of outside organizations during the course of delivering services. Many of these organizations actively use GIS and would be willing GIS data partners; others would realize workflow benefits in having easy access to the central enterprise GIS and place fewer demands on limited County resources. The County of Nevada has already taken action to formalize its relationship with key GIS data partnerships by entering into a data sharing agreement with the Nevada Irrigation District, the City of Grass Valley and the Nevada County Fire JPA. Expanding the data sharing agreements in the future to include additional second tier data partners would further reduce the county costs of building additional spatial datasets and increase overall collaboration that could result in broad regional benefits.

It has been impossible for Nevada County to have the necessary funding, staff, data, applications etc. ready at a single point in time to do a "complete" GIS implementation. In fact, like most information technologies, even after the initial GIS implementation, technological advances and changing organizational requirements required that the Geographic Information System further evolve over time to meet these changing opportunities and needs.

GIS Implementation Components

There are six principal components that were considered in the GIS implementation in Nevada County:

1. **Applications**—The way in which GIS is integrated within the day-to-day workflow of an organization. It is through these applications that the benefits of GIS are realized. The ability to use data developed in other systems creates a powerful and useful GIS.

2. **People**—GIS technology is of limited value without the people who use the system and apply it to real-world problems. The GIS Division currently has two GIS Analysts and a GIS Technician. Departmental GIS users range from technically knowledgeable users to those who use it to perform simple inquiries for their everyday work.

3. **Management**—A successful GIS operates according to an established set of policies and business rules that are unique to a given organization. It is also necessary to specify how these policies will be developed and modified through time. The GIS Analyst II currently serves as the lead GIS staff member.
4. **GIS Software**—Provides the functions and tools needed to store, analyze, and display geographic information. Nevada County uses ESRI's suite of software including ArcInfo, ArcView and ArcIMS.

5. **Data**—Possibly the most important component of a GIS. Geographic data and related tabular

data has been collected, entered or updated in-house, shared with other agencies, or purchased from commercial data providers, and developed with contractors. The GIS currently has over 75 layers of geographic data that takes approximately 20 GB of data on our Win 2K server. The most current list of GIS layers can be found on the County GIS website at: http://www.mynevadacounty.com/gis

6. **Hardware/Network**—The computers on which a GIS operates. GIS software in Nevada County runs on two Windows 2000 servers accessed by numerous desktop computers used in stand-alone or networked configurations.

Overview of Strategy

The primary objectives of this report and overview of the enterprise plan for the next three years are:

- Develop and enhance the Enterprise GIS Vision
- Integrate GIS technology with E-Government Initiatives
- Establish County-wide standards
- Formalize the GIS Business Solutions Team (BST)
- Further eliminate duplicity in data development within County departments
- Formalize and strengthen partnerships with external agencies
- Launch a comprehensive marketing and training program
- Plan for future enterprise data and application development

C. GIS Data Coordination

GIS Framework Data Coordination Conceptual Approach

The basic concept for coordinating data creation, maintenance, and use among the various organizations in a multi-participant GIS has been developed by the Federal Geographic Data Committee (FGDC) and is known as the National Spatial Data Infrastructure (NSDI). At the heart of NSDI are standards for documenting and sharing key spatial data layers referred to as "Framework Data." Framework data is created and maintained at the highest-possible level of accuracy and is made available along with documentation about the data (also known as metadata) through a network of clearinghouses located throughout the country. Framework data in Nevada County include:

- Geodetic control
- Cadastral (public land survey and land parcels)
- Governmental units (census/demographics and jurisdictions)
- Orthophotography
- Transportation
- Hydrography

Although, the FGDC has provided substantial standards for data sharing and metadata publication, the issue of creating and maintaining framework datasets has been left up to the local agencies to coordinate. Nevada County has assumed a leadership role in providing the coordination that is needed to develop and maintain framework data layers through local and regional partnerships. The County will use the coming year to further document datasets and develop standards and procedures for data sharing.

GIS Data Partnerships

Common spatial datasets such as parcels, roads, streams, etc. are of value to not only county departments, but also to external agencies and organizations. Initiatives to cooperatively develop and share a common regional spatial dataset eliminate costly redundancy and facilitate communication between organizations. The County of Nevada has already officially recognized the importance of data partners by entering into a data sharing agreement with the City of Grass Valley, Nevada County Fire JPA, and the Nevada Irrigation District. The GIS data agreement provides a cooperative arrangement for the coordination and sharing of GIS data. It is anticipated that the GIS agreement will be expanded over time to include additional formal data partners.

In addition to the primary data partners, there are numerous other organizations such as federal and state agencies, utilities, private timber companies and conservation groups that maintain robust spatial datasets within the county. A number of these second tier potential data partners were active participants in the enterprise GIS implementation planning process including the U.S. Forest Service and the California Department of Forestry and Fire Protection and Nevada Irrigation District.

The County and its formal data partners would benefit from developing data sharing arrangements with these and other potential second tier partners. While the County has successfully developed an enterprise parcel and roads layer, there are still numerous other framework and other important spatial data sets that need to be developed. Instead of building duplicate data sets, the County can further collaborate with other organizations to jointly develop data sets and divert resources into GIS analysis and application development.

GIS Data Accuracy

Spatial or positional data accuracy is the degree to which information on a map or in a digital database matches true or accepted locations. Determining an appropriate level of accuracy for GIS data sets is a complex undertaking. It is recognized that the spatial accuracy of various data sets that will be used in

the enterprise GIS will vary according to original source information and available time frames and budgets for development and maintenance of the data. Accuracy varies both within and across spatial data sets due to the large enterprise extent that they cover.

One approach to choosing a spatial data accuracy level involves evaluating the potential applications and decisions that will ultimately be supported by the data, and selecting the *highest* level of accuracy (typically 1- to 2-foot accuracy for local government applications). Although it is certainly desirable to have a GIS database with the highest possible accuracy, because of the large physical extent of Nevada County, it was cost prohibitive to develop data sets at such a high level of accuracy. The cost to create a base map with 1- to 2-foot spatial accuracy for the County of Nevada could easily exceed $1 million. An alternative approach, and the one that has been implemented for the County of Nevada, is to determine the *minimum* level of spatial accuracy to support a set of applications that provide immediate benefits. As benefits from the use of GIS are derived, additional investments for improving data quality can be made over time. This approach also provides for modest initial investments in spatial data while leveraging existing data sources.

Accuracy will typically vary within the same dataset as it is improved over time. For example, as new subdivisions are developed, improvements in surveying technologies result in more accurate representations of the parcel layer for the recently divided lots.

Managing a spatial data set with differing levels of accuracy can be challenging, but it highlights the importance of good documentation or metadata. Keeping metadata on how the spatial data set was created and updated over time is essential to understanding the limitations and proper uses of the data. The task for the coming year is to complete metadata for all layers in the system.

To track accuracy levels within a spatial data set, features such as road segments or property lines can be attributed with an accuracy code. Accuracy codes that might be used are as follows:

Accuracy Level	Accuracy Code	Accuracy Description
1	CM	Centimeter Accuracy
2	SM	Sub-Meter Accuracy
3	12K	Derived from 1:12,000 scale
4	24K	Derived from 1:24,000 scale
5	100K	Derived from 1:100,000 scale

The use of accuracy codes within a spatial data set will provide users with a clear understanding of the accuracy of the features within the specific location they are viewing. It is important to point out that data produced by others may not be adequate for County purposes. For example, many state and federal GIS datasets are at a macro scale that may be useful for a regional perspective but may not be suitable for site-specific analysis. Site-specific analysis will probably require additional data collection efforts to improve the data within the study area.

GIS Data Standards and Metadata

An important role for the GIS Technical Business Solutions Team (BST) is to establish data standards. The following are preliminary recommendations for key data standards:

Coordinate System—A standard coordinate system is essential for the efficient use and distribution of

spatial data across county departments and agencies. The County of Nevada uses the State Plane Coordinate System (CA Zone II), North American Datum of 1983 coordinate system.

GIS Metadata—GIS metadata is information about the GIS dataset. Each GIS dataset to be available in the enterprise Spatial Data Warehouse should be fully documented. The County should adopt a GIS metadata standard. At a minimum, each data layer should have the following information:

Dataset name
Brief description
Dataset accuracy
Source information
Geographic feature type
Data dictionary of codes used
Date of last update
Contact information
Known limitations/disclaimer

It is also recommended that this metadata be maintained on-line in a format. The metadata catalog allows users to browse the catalog and determine the applicability of a particular data set for meeting a particular mapping or spatial analysis need.

Tabular Data Key Fields—The link between spatial and tabular datasets is important for GIS application development. The format of the assessor's parcel number (APN) and street address (situs) are typically the most important fields to standardize. The APN field format follows the same format as the Assessor's property information system in TAZ, the main Unix server in the County. The situs is maintained by the GIS Division and is formatted to facilitate GIS address matching or geocoding. The GIS department currently maintains the situs address for all parcels, and generates new addresses within the unincorporated areas of the County.

Digital Submission Standards—To facilitate data exchange and incorporation of cooperator data into the GIS Data Warehouse, digital standards and procedures need to be established. Digital submission standards will reduce the cost of assembling data into a common enterprise data structure that will help keep published datasets current. This is an effort that will require coordination with the Assessor, Recorder and Building department within the County. The potential to provide map data faster and less expensively will assist all land development departments.

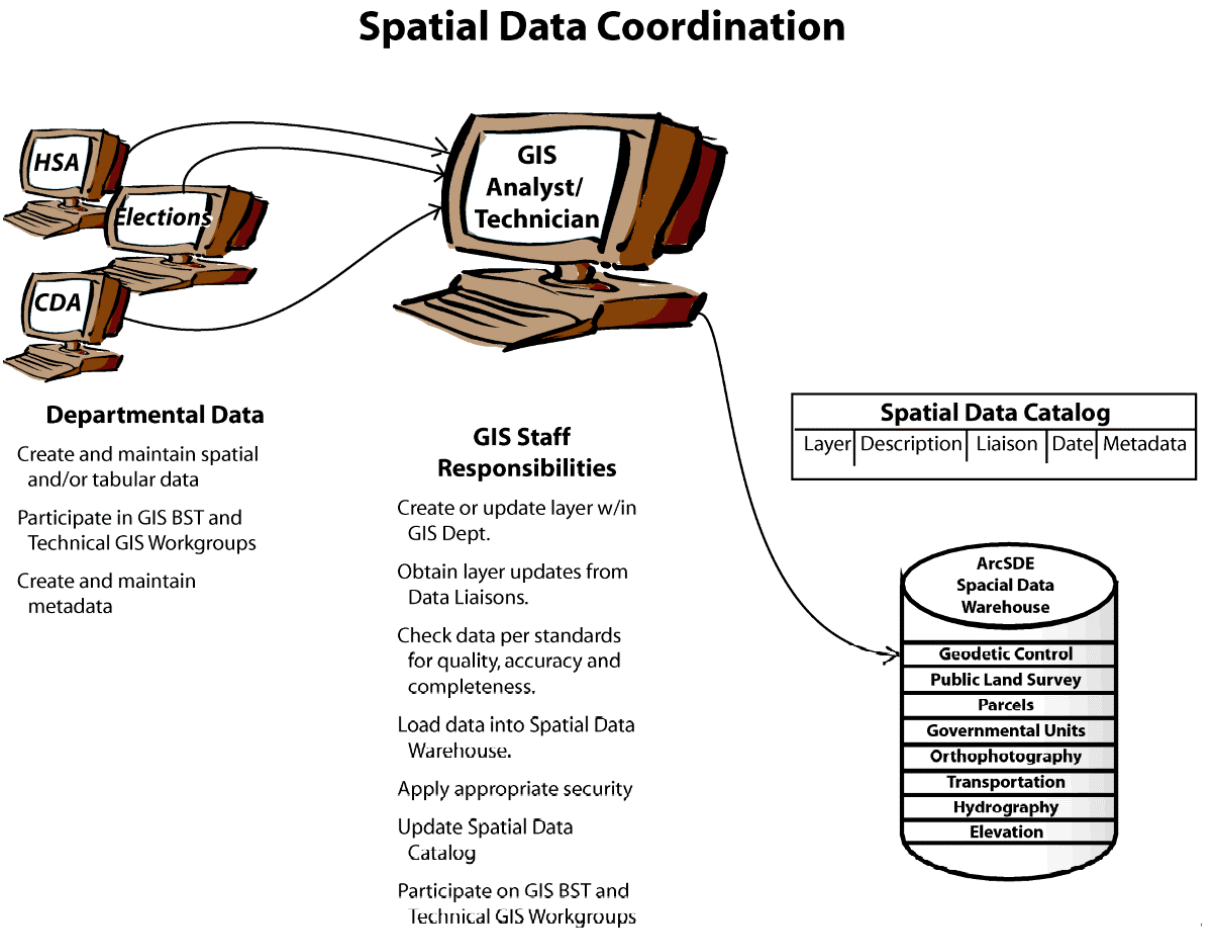
GIS Data Maintenance

In a multi-participant GIS, it is important to establish formal responsibilities for the creation and maintenance of GIS datasets that will be broadly distributed and used. To avoid redundant efforts, a Data Liaison should be identified for each dataset that is locally maintained. For example, the Data Liaison for the parcel layer would be the mapping expert(s) in the Assessor's office.

Initially, the responsibility for data creation and maintenance for many of the layers has rested with the GIS staff but as GIS expertise and capabilities increase, more of the data responsibilities which include creating and maintaining metadata will be with the department liaisons most familiar with the datasets

Figure 2 shows the flow of GIS information between the department GIS Data Liaisons and the GIS Analyst. At regular intervals, the GIS Data Liaison sends the GIS data and metadata to the GIS Analyst. The GIS Analyst checks the data and loads the data into the centralized Spatial Data Warehouse for further distribution. The GIS Coordinator also updates the central Spatial Data Catalog.

Figure 2 Spatial Data Coordination



The three main components of GIS Data Coordination are reviewed as follows:

Departmental Data Liaison (Decentralized)—Data Liaisons are the departmental experts with GIS capabilities and create and maintain GIS data that relate to their department and activities. Expertise using ArcInfo 8 software will be required. Initial departments most likely to take on the Data Liaison role would be the Assessor, DOTS and Planning.

GIS Analysts/Technicians (Centralized)—The GIS Analysts, Technicians and the Applications Manager are the catalysts for the enterprise GIS. The senior GIS Analyst will maintain the master list of enterprise GIS layers and data liaison responsibilities. The GIS Analyst checks spatial data from departmental Liaisons per the standards set. The GIS Analyst loads the spatial datasets into the Spatial Data Warehouse and maintains and publishes a Spatial Data Catalog and metadata. The GIS Analyst and Applications Manager works closely with outside data partner organizations.

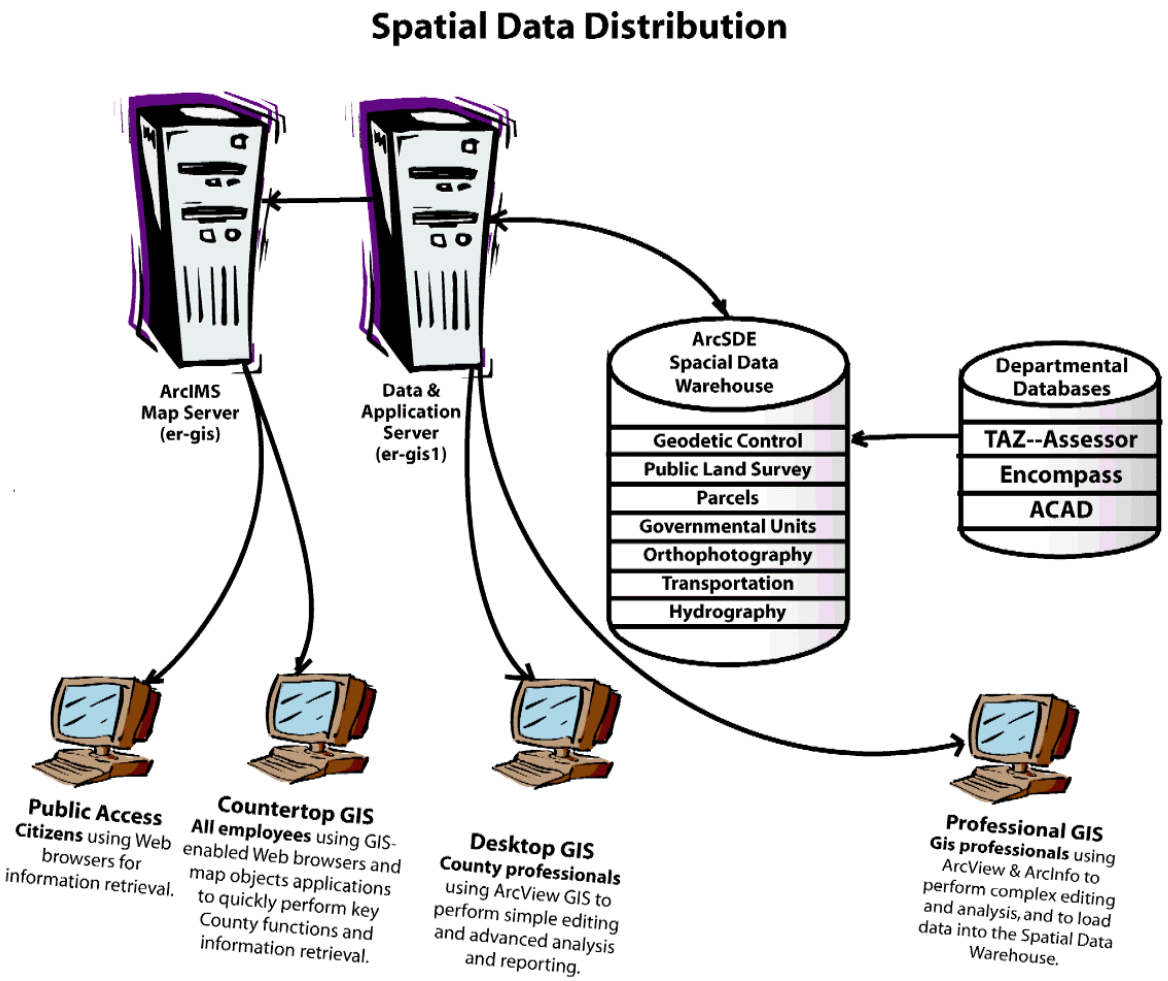
Spatial Data Warehouse (Centralized)—The central GIS Data Server uses ArcSDE (Spatial Database Engine) to store the enterprise GIS layers in Microsoft SQL Server. The warehouse serves "raw" GIS layers to web-based applications as well as to professional and desktop GIS users.

D. GIS Data Distribution

An enterprise GIS requires a central library to store the shared GIS datasets as well as a mechanism for distributing this data to a large and diverse audience of users. This function requires large-scale information systems technologies that are implemented within the Information Systems Department. Figure 3 illustrates the near term plan for the creation, storage, distribution and use of GIS data throughout the county.

Figure 3. Spatial Data Distribution

Spatial Data Distribution Figure

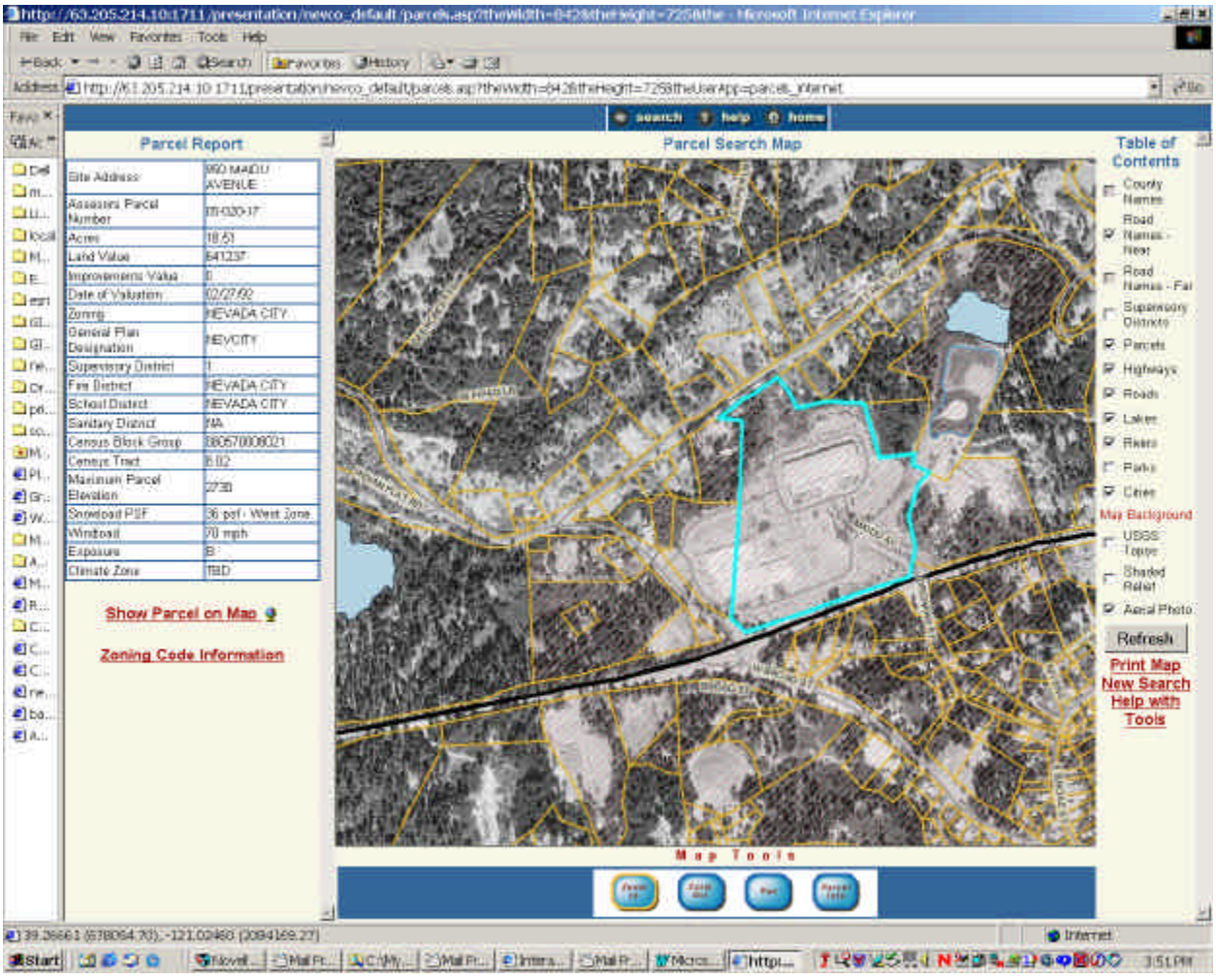


A Data Liaison using professional level GIS software maintains GIS data and metadata for a specific layer or layers related to their department. The Data Liaison provides a regular update of the GIS data and metadata to the GIS Analyst. The GIS Analyst checks the GIS data and metadata and loads the information into the centralized Spatial Data Warehouse. The Spatial Data Warehouse is composed of a GIS Data Server, a Relational Database Management System (RDBMS) and the gateway , ESRI ArcSDE, to efficiently store the spatial data in the tabular RDBMS. The GIS Analyst may require the assistance of a Database Administrator (DBA) to maintain the GIS servers and the SQL server software.

Once in the Spatial Data Warehouse, users of professional and desktop GIS software clients can directly access the GIS data. The GIS data in the Spatial Data Warehouse is in a "raw" form without symbolization, labels, color, or classification. Users of professional and desktop GIS software clients must be proficient at incorporating this "raw" GIS data into their projects.

The primary mechanism for distributing GIS data to casual countertop and public access users is through the use of Web-based technologies. A Web-based GIS application has been developed using in-house staff, to provide quick access and viewing of spatial data. A user makes a simple request from a Web browser to the Web Server. Given the popularity of Web browsers, the Web-based GIS applications has shown the potential of reaching broad audiences on the County's Intranet as well as across the Internet. A key advantage of Web-based GIS applications is that the user will be able to use geographic information without possessing GIS expertise or specialized GIS software. It is also much easier to manage and implement as opposed to desktop applications running a network or server based application.

Figure 4. Screen view of iGIS application implemented in Nevada County



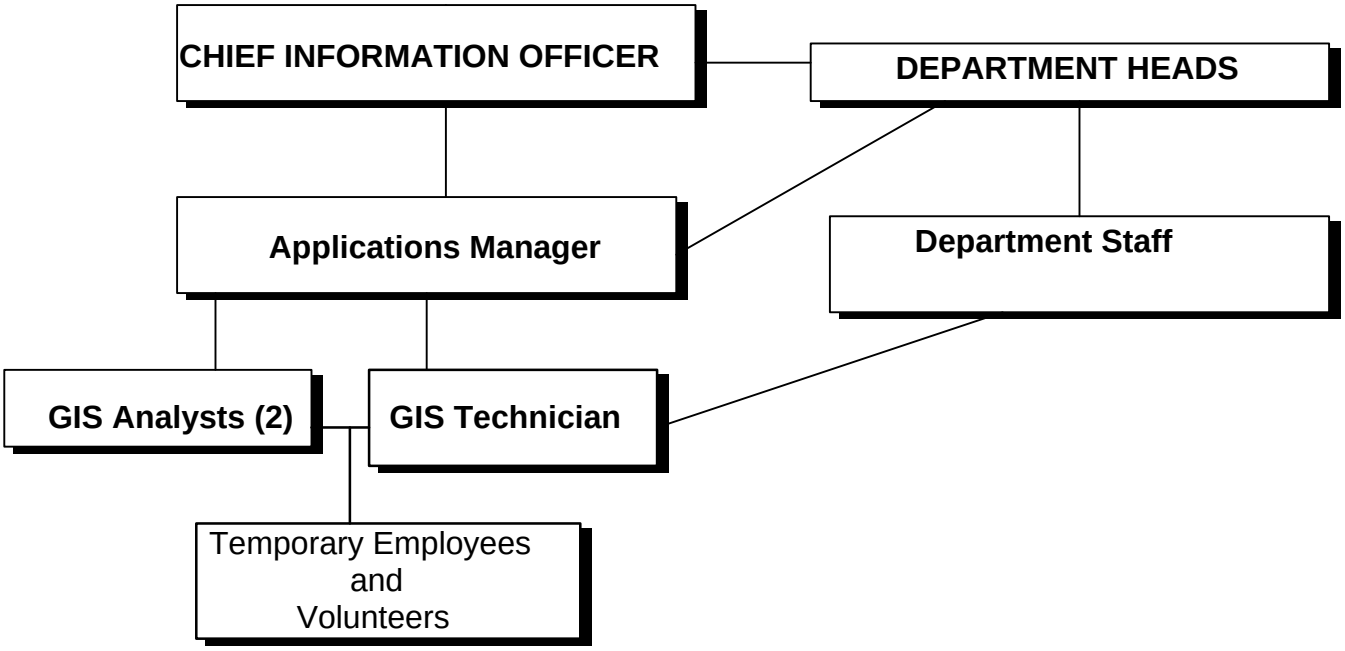
E. GIS Governance and Coordination

Enterprise Organization

The development, maintenance and use of GIS in the County of Nevada should be guided by the policy and business needs of the County. County departments and agencies, as well as other organizations (public, private, and non-profit) that operate in the County, have a common interest in coordinating efforts to meet their diverse agency needs. Other sections of this document discuss the benefits of coordinating GIS development and maintenance across various County departments.

Over the past year, the County of Nevada has introduced some key organizational changes that will be important to the successful integration of GIS into County workflow. The Board of Supervisors approved moving the GIS Division under the Information Systems Department under the direction of the Chief Information Officer (CIO). The GIS Unit has been staffed with two GIS Analysts and a GIS Technician. These organizational changes are consistent with the overall direction of this GIS Implementation Strategy. Figure 5 below shows the organizational structure for GIS activities already in place within the County.

Figure 6. County of Nevada GIS Organizational Structure and BST members

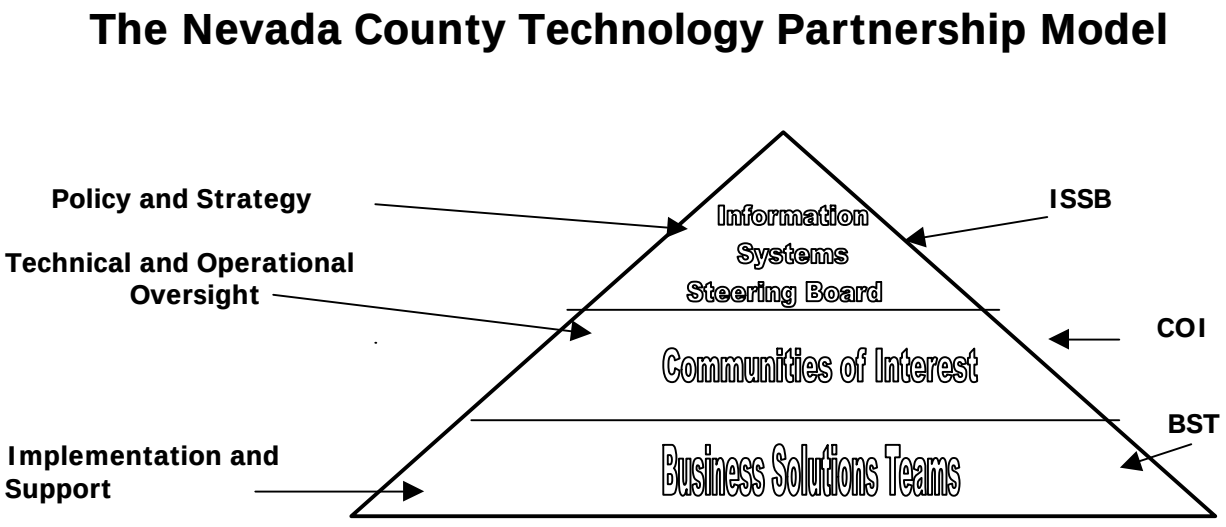


The success of the enterprise GIS implementation will be largely determined by the active participation by representatives from all of the County departments and external organizations that have been participating to date. The large number of County departments and external organizations involved in the enterprise GIS implementation will require effective top-level governance. The County of Nevada is fortunate to have already established an initial GIS governance structure.

Enterprise GIS Governance and Coordination

The GIS Business Solutions Team (BST) is composed of GIS Coordinators, GIS technical users, Departmental representatives from within the County as well as from the participating organizations. The GIS BST will develop common standards for spatial data and metadata along with procedures for updating, storing and distributing the geographic information, technical forums to develop standards and address technical issues, while providing coordination and direction for the development of the GIS. The role of this BST is also to address the common uses of GIS and shared geographic information. Specifically, the GIS BST should identify, prioritize, coordinate and seek funding sources to achieve solutions that are common among organizations In turn, representatives of the GIS BST from the various member organizations need to be responsible to their organizations to manage and implement data and applications that will meet their policy and business needs.

Figure 6. Overview of Workflow between GIS BSTs and County Technology Partnership Model



F. Phased Implementation Plan

Nevada County has used an incremental or phased approach to implementing GIS. This paced approach provides for a gradual acceptance and understanding of how the technology can be used most effectively. This approach has also allowed for a phased investment process. This type of approach provides for incremental improvements and avoids unrealistic expectations and demands that often accompany large procurements. The table below outlines future implementation plans of the Enterprise GIS in Nevada County.

Phase II (2003- 2004)	Phase III (2004- 2006)
1. Complete GIS Implementation Planning Process	1. Implement Direct Edits/Versioning in GIS Data Warehouse
2. Continue to Formalize GIS Business (BST)	2. Integration of GIS w/ Departmental Databases
3. Explore New Data Partnerships	3. Publish Spatial Data on "Geography Network" or In-House Developed Equivalent
4. Finalize Standards	4. Digital Submission Standards
5. Review/Modify GIS Implementation Plan	5. Advanced GIS Spatial Analysis & Modeling
6. Refine Spatial Data Library	6. Wireless Access to GIS for Mobile Staff
7. Begin Spatial Data Catalog and Metadata	7. Web-based Applications w/ GIS Components to Support 24-Hour Virtual Front Counter
8. Deploy GIS Data Warehouse Technology	8. Real-Time Emergency Response Dispatch System w/ GIS Components
9. Improve Control	
10. Update & Improve Parcels	
11. Acquire New Enterprise Orthoimagery through Cooperative Buying Pool	
12. Preliminary Geo database Schema	
13. Resolve Problems with Addressing Data	
14. Attribute Roads with Address Ranges	
15. Subscription Web-based Property Information Applications for Public Internet Users	
16. Simple Web-based Applications for Various Departments	
17. Professional GIS Capabilities for "Data Producer" Departments	
18. Conduct Ongoing GIS Awareness Workshops	

Many of the activities and applications in later phases are dependent upon the successful completion of activities in earlier phases. For example, in order to deploy the "Real-time Emergency Response Dispatch System" the "Attribute Roads with Address Ranges" in Phase II will need to be completed.

Phase I – Enterprise GIS Infrastructure Completed (Years 2000 - 2002)

The primary focus of this phase was to create the foundation for the enterprise GIS. This included both the pre-requisite technology systems and the people systems. Departments have been using GIS for simple mapping and viewing of available spatial data for several years. Key GIS datasets and systems to support the effective use of GIS within County departments have been completed during this phase. A centralized GIS Data Warehouse and GIS Map Server provides a robust means of distributing spatial data across the County network and also to the public via the Internet. Departments have enough GIS tools, expertise and spatial datasets available to noticeably improve work processes. Phase I is now complete.

Phase II - Planning (Year 2003)

1. **Complete GIS Implementation Planning Process:** The current Enterprise GIS Implementation Plan should be completed and widely distributed among the relevant county entities and collaborators. As the implementation progresses, it is expected that a number of new participants will join the effort.

2. **Continue to Formalize GIS Business (BST):** The GIS Policy BST should begin meeting on a regular basis to develop initial spatial data standards and begin identifying "Data Liaisons". Initially, the GIS BST should meet on a quarterly basis to stay abreast of the implementation activities. As time progresses it may be more practical to address highly technical matters by the smaller, more focused GIS Technical work group. Issues that may be addressed by the Technical work group include:

   Data Standards
   Geodetic Control
   Cadastral Mapping
   Transportation Layer Integration
   Governmental Units
   Setting Spatial and Metadata Standards

3. **Explore New Data Partnerships:** The County of Nevada already has some valuable formal and informal data partners. The direct benefit of establishing data partnerships is that it reduces and spreads the cost of GIS. Data partnerships help to develop collaboration with organizations that the County does business with resulting in more effective delivery of services to County citizens.

4. **Finalize Standards:** The GIS BST should finalize spatial and metadata standards. The standards should be widely distributed with a primary focus on those departments that have data liaison responsibilities. The GIS Analyst needs to ensure that spatial data stored on the GIS Data Server (GIS library) adheres to these standards.

5. **Review/Modify GIS Implementation Plan:** Planning is an ongoing process, and the GIS staff, GIS BST and GIS Technical workgroups should review and modify their plans as necessary

6. **Preliminary GeoDatabase Schema:** The GIS data model is undergoing a dramatic transformation from "primitive" or "simple" features (points, lines, polygons) to an object-oriented model referred to as a geodatabase. The County of Nevada should stay abreast of industry consortiums that are working to standardize geodatabases for framework layers such as parcels, roads and streams, etc. The County should begin to implement the geodatabase schema (design) for future County use.

GIS Library

7. **Refine the Spatial Data Library:** One of the most valuable elements in an enterprise GIS is providing participant access to a central "GIS Library". GIS Analysts should begin to develop and document a logical directory structure and make the current GIS data sets more readily available.
8. **Begin Spatial Data Catalog and Metadata Documentation:** In order to find items in the "GIS Library", a simple catalog should be created which lists the spatial dataset name, description, location on the Data Server, version and a reference to the metadata (additional documentation) for the layer.

9. **Deploy GIS Data Warehouse Technology:** The Nevada County Information Systems Department currently has a centralized computer server to store GIS data. Currently, this GIS Data Server is able

to serve file-based spatial datasets on the County Local Area Network (LAN). The GIS Division, with assistance from IS, should more fully utilize the Relational Database Management System (RDBMS) comprised of MS SQL and ArcSDE on the GIS Data Server. These hardware and software technologies are collectively referred to as a GIS Data Warehouse. Developing and implementing a strong security scheme will allow departments to confidently store sensitive data in this centralized location.

Data

10. **Improve Control:** County efforts with the Bureau of Land Management (BLM) Geographic Coordinate Database and local surveyors will facilitate regular improvements to the Public Land Survey System layer. Other GIS layers that are dependent on this layer can then be improved.

11. **Update & Improve Parcels:** The County has completed a county-wide, seamless polygon based layer for parcels with each parcel attributed with its associated Assessors database data. Future key GIS applications will depend on a robust and well-maintained enterprise parcel layer. The County of Nevada should develop the in-house capabilities and procedures necessary to maintain and improve the parcel layer. This would involve developing procedures and applications for automatically loading the CAD created parcels from the Assessor's office directly into the Enterprise GIS. It is essential to devote appropriate resources to maintain and improve parcels on a regular basis. As the underlying control improves (Public Land Survey System), the County will also be able to improve the spatial accuracy of the parcel layer.

12. **Acquire New Enterprise Orthoimagery through Cooperative Buying Pool:** The County's formal and informal data partners should enter into a cooperative cost sharing arrangement to acquire updated orthoimagery for the entire county. With new satellite technologies providing cost effective imagery, the buying pool should consider a plan to update the imagery on an annual basis. Higher resolution aerial imagery may be required for more developed areas of the County.

13. **Resolve Problems with Addressing Data:** Address data is integral to the operations of many County departments and applications. Therefore it is critical for the County to have a consistent, accurate system of assigning and maintaining address information within all County databases. Having consistent, accurate addressing allows for the mapping of this information using a GIS capability referred to as geocoding. In geocoding (also referred to as address matching), an electronic point can be automatically placed on the GIS map based on the house number, street and community name. An example of the importance of consistent and accurate data would be an application that would route emergency response vehicles to an incident based on an address. The County is developing and will maintain a single addressing database that contains official road names, valid addresses and community/city names that all departments and agencies can share.

14. **Attribute Roads with Address Ranges:** The initial GPS capture of roads provides quality framework layer line work but the road segments do not include address ranges. In order to use the GIS for future emergency-response routing applications, the road segments are being attributed with address ranges. This effort is time-consuming and more resources need to be allocated for this task in the coming year.

Applications

15. **Subscription Web-based Property Information Applications for Public Internet Users:** The GIS Division and the Assessor's Office should jointly develop and deploy a suite of Web-based property information applications for public Internet users. Issues of security and data confidentiality will need to be addressed. These applications would not only target members of the public but could be served using a subscription service to businesses such as real estate and title companies. These applications would increase the revenue base to fund the development of the software or upgrade of hardware needed.

16. **Simple Web-based Applications for Various Departments:**

- Polling place locator application for public internet users for Elections
- Tax auction application linked to the parcel database for the Tax Collector
- County maintained roads information for DOTS
- Crime locator for the Sheriff
- An interface with CRM
- Well and Hazardous materials locator for Environmental Health
- Environmental constraints for Planning

Staff

17. **Professional GIS Capabilities for "Data Producer" Departments:** In addition to the GIS Division in the Information Systems Department, County departments with data liaison responsibilities over key framework layers, such as parcels, will also need to develop and support professional GIS capabilities. The Assessor's Office and the Planning Department will need additional hardware, software and training to become proficient at the professional GIS level. These departments will create and maintain some key county spatial datasets to be used by all departments and data partners.

18. **Conduct Ongoing GIS Awareness Workshops:** GIS is not a new technology to the County of Nevada, and different departments will have different rates of adoption. The GIS BST should conduct periodic workshops to demonstrate the uses and benefits of GIS to broader audiences, both internal and external to the County structure.

Phase III – Applications and Analysis (Years 2004 - 2006)

1. **Implement Versioning /Direct Edits in GIS Data Warehouse:** The Information Systems Department should implement advanced features of the GIS Data Warehouse such as versioning and direct editing. GIS Data Warehouse technology is transaction-based and can be configured to allow versioning. Versioning would allow users to rollback the spatial dataset to an earlier point in time which would be useful for land records management datasets such as parcels. Another advanced feature is the direct editing of spatial data. "Data Producer" departments should have the ability to directly edit the datasets for which they are responsible eliminating the GIS Division, in the middle.

2. **Integration of GIS w/ Departmental Databases:** The majority of GIS applications will depend on the integration of spatial data sets with existing departmental tabular databases. The GIS Division needs to work with various county departments and third party vendors to understand the data structure and to develop efficient techniques for accessing these systems. The initial integration may require a process that requires manual updates. These other systems would include the Tax Collector's system, CDA Encompass system, and the Assessors parcel system.

3. **Publish Spatial Data on "Geography Network" or In-House Developed Equivalent:** There will be increasing demands on the County for distributing spatial data. The County should evaluate the feasibility of publishing its spatial data in live GIS catalogs on the Internet. As a user of ESRI enterprise software such as ArcIMS, the County of Nevada will be well positioned to publish its data in one such live GIS catalog, the Geography Network. Publishing spatial data on the Internet will provide citizens easy access to key County and regional geographic datasets and applications eliminating the need for manual service.

4. **Digital Submission Standards**—To facilitate data exchange and incorporation of external data into the GIS Data Warehouse, digital standards and procedures need to be established. Digital submission standards will reduce the cost of assembling data into a common enterprise data structure that will help keep published datasets current. This is an effort that will require coordination with the Assessor, Recorder, and Building departments within the County. The potential to provide map data faster, and less expensively, will assist all land development departments these requests.

5. **Advanced GIS Spatial Analysis & Modeling:** Desktop and professional GIS software is capable of complex spatial analysis and modeling. As internal GIS knowledge and skills increase and high quality spatial data becomes available, the County of Nevada will be in a position to perform more high-end spatial analyses. This advanced analysis capability will probably be limited to the staff in the GIS Division.

6. **Wireless Access to GIS for Mobile Staff :** Virtually every County department has staff that spends a significant amount of time in the field collecting data or delivering services. Tremendous advances in mobile computing will allow the County to extend its GIS datasets and applications to employees in the field. This could include use of Personal Data Assistants (PDA's), wireless and other technologies.

7. **Web-based Applications w/ GIS Components to Support 24-Hour Virtual Front Counter:** The increasing popularity of the World Wide Web as a platform for doing business (e-commerce) can be extended to County services. The County has implemented an e-government initiative of conducting as much business as possible on the Web. The concept of a virtual front counter that citizens could visit 24 hours per day has tremendous benefits. GIS datasets and Web-based GIS functionality would be key components of the virtual front counter.

8. **Real-Time Emergency Response Dispatch System w/ GIS Components:** The County should work with local emergency response organizations to develop a dispatch system that routes and tracks emergency response vehicles. Geotechnologies such as GPS and GIS would be key components in this application. The ability to implement this emergency response application will depend on the County's ability to successfully resolve inaccuracies and inconsistencies in the County's addressing and road naming data sets. This will require working closely with the Sheriff's Abbey system.

G. Enterprise GIS Potential Participant Contacts

Organization Contacts-County Departments

Department of Transportation and Sanitation
Planning
Assessor
Sheriff
Elections
Building Inspections
Recreation
Environmental Health
Mental Health
Administration
Probation
Transit

Organization Contacts: Non-County Departments

City of Grass Valley
City of Nevada City
Town of Truckee
National Forest Service
California Department of Forestry
Sierra Economic Development District/Sierra Planning Organization
Nevada Irrigation District
Nevada Fire JPA
Nevada County Superintendent of Schools
Truckee/Tahoe Sanitary District
Truckee Tahoe PUD
Nevada County Land Trust
Placer County