

The County of San Luis Obispo, California



Phase I: GIS Need Analysis External Organizations and Entities GIS Needs Analysis

Chapter 3: External Organizations and Entities Needs Analysis



Chapter Outline

Introduction

- Inter-local Agreement

External Organizations Interviewed for County Needs Analysis

- Air Pollution Control District (APCD)
- Cal Poly GIS Lab
- Caltrans
- City of Arroyo Grande
- City of Atascadero
- City of Grover Beach
- City of Morro Bay
- City of Paso Robles
- City of Pismo Beach
- City of San Luis Obispo
- Local Agency Formation Commission (LAFCO)
- San Luis Obispo Council of Governments (SLOCOG)
- State Board of Equalization

Other External Entities

- Engineering and Survey Firms
- GIS User Groups
- Private Sources of Data

Summary

Introduction

The level of success obtained through the implementation of GIS often relies heavily on the cooperation of other government agencies and private sector organizations. This is particularly true for the County of San Luis Obispo. There is a large amount of GIS data that currently exists for the County, both in the unincorporated and incorporated areas. Federal, state, regional and local government agencies, engineering and surveying firms, local utility companies, and private developers and data vendors all may possess data that could prove valuable to the County. Much of this information can be obtained at a nominal cost or free of charge. Many of these data layers have been developed over the years by other entities through their own GIS and related mapping projects. The County should continually monitor external sources for applicable data. There is a tremendous amount of synergy that can be developed when soliciting external entities and organization during the GIS implementation process.

Throughout the United States, Geographic Information Systems have served to break down not only the traditional barriers that exist between departments within an organization, but also barriers that have existed for years between other organizations. The technology serves as a catalyst for cooperation and will provide opportunities for inter-agency collaboration and cooperation. The most successful GIS programs have seized the opportunity for cooperation and data sharing, often highlighting this as one of the most important benefits derived from the implementation of GIS.

Establishing a good working relationship with other organizations early in the project is crucial. The County should inform these organizations about the data and expertise that the County is developing; in addition it should make these organizations aware of the mutual benefit derived from this effort. Establishing and maintaining mutually beneficial relationships with other organizations may facilitate and expedite data sharing as well as reduce costs.

Inter-local Agreement

One idea that is gaining in acceptance across the country is the creation of a joint GIS among county and city agencies that share geographical boundaries. The County of San Luis Obispo and the twelve external organizations identified in this chapter could enter into a formal Inter-local Agreement to fund a common GIS. Funding for this effort should be divided equally, based on population served, among the participating agencies.

The mission of this Inter-local GIS should incorporate the following ideals:

- Develop a common base map
- Promote sharing of resources
- Reduce redundancy of data collection and creation
- Provide a mechanism to maintain the base map and other data layers
- Encourage enterprise information management solutions
- Enhance decision making for public officials

Management of this Inter-local GIS project would be similar to other multi-jurisdictional agencies in the County, steered by an Executive Committee that is comprised of members at the Executive level of government (County Board Members, City Commissioners, etc). This Committee should be staffed by the Inter-local GIS Coordinator. The Committee should meet quarterly to review and institute policy and budget issues and receive project updates. The technical issues of the Inter-local GIS would be managed by a Steering Committee that would meet on a monthly basis, and be chaired by the GIS Coordinator. The Steering Committee's main function would be to review the technical implementation of the GIS and review project updates. Also they would be responsible for developing an agenda for the Executive Committee.

A true countywide GIS could be created of GIS professionals led by the GIS Coordinator, forming a sort of “GIS Central” that would provide support services to each of the principal partners. These services could include: system administration, database management, Internet/Intranet development and support, application design and support and map analysis expertise. A larger, user-oriented body called the GIS Development Team would meet monthly to review project updates, determine user needs, address user issues, and/or concerns with the GIS implementation, with subgroups meeting to address specific items such as land use, easements, census, GPS, and addressing. These subgroups analyze issues, develop solutions, and report back to the Development Team on their progress/findings during the monthly meetings.

Interviews by GTG with most external organizations and entities representatives indicated that they are interested in cooperating with the County in establishing a formal data sharing agreement, at the very least, and possibly entering into some sort of Inter-local Agreement as described above. In the long term, there may be potential for the establishment of a SDE geodatabase shared by the County and these external organizations—however, this is a long term goal that should be pursued after each entity has successfully addressed its own data production and data maintenance needs. Key advantages, based on cooperation between the County and these external organizations, include shared data, geo-spatial data standards, reduction of duplicate efforts for creation and maintenance of spatial data layers, and cost sharing.

External Organizations Interviewed for County Needs Analysis

The following organizations were interviewed as part of the Countywide Needs Analysis. Each section contains a brief description of the organizational structure, current GIS practices and procedures (governance of GIS), any data layers maintained by the organization and any data layer requirements from the county, and multi-tier GIS application use (which departments/divisions are using GIS, and to what extent).

Air Pollution Control District (APCD)



Section Outline

-  Agency Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Agency Structure

The San Luis Obispo County Air Pollution Control District ("APCD" or "District") is the local agency working to protect the health of over 245,000 County residents through the preservation of good air quality. By partnering with the local communities and businesses, APCD establishes regulations and programs to reduce air pollution and assist the County in reaching all outdoor air quality standards.

The mission for APCD encompasses the following goals:

- The realization and preservation of clean air for all; and
- To promote community and individual responsibility for air quality; and
- To provide quality and cost-effective services.

To carry out the mission, district staff monitors air quality, reviews land use projects, develops and enforces rules and regulations, issues permits, and creates a long-term Clean Air Plan for the County. APCD is the primary agency responsible for achieving clean air standards established by the California Air Resources Board and the U.S. Environmental Protection Agency (EPA).

The District works with government, industry, businesses and the public to reduce air pollution from stationary sources, such as power plants, corner gas stations and local dry cleaners. By involving all members of the community, the District works to preserve air quality at the local level.

Since motor vehicles contribute over half (1/2) of the air pollution in the County, the APCD also implements programs to promote alternative means of transportation, such as carpooling, telecommuting, and use of clean vehicle technologies. The District also promotes pedestrian and transit oriented design in new land developments.

The APCD provides service to the unincorporated areas of the County with approximately 25 full-time employees. The Department is organized as follows:

- **Administration** – Provides fiscal, administrative and clerical support for all District Staff..
- **Compliance and Monitoring** – Monitors the County's air quality through a network of monitoring stations which record pollutant levels 24 hours a day. Data collected is published in local newspapers and shared with the state Air Resources Board and the federal Environmental Protection Agency. Inspectors provide training to help business owners and conduct periodic inspections to ensure compliance with permit requirements; when necessary, APCD inspectors take enforcement action to secure compliance. Inspectors also investigate complaints regarding smoke, dust and nuisance odors.
- **Engineering** – Evaluates plans and issues permits for any new projects that cause air pollution. By working with permit applicants to minimize air contaminants, District engineers ensure compliance with all health-based federal, state, and local regulations.
- **Planning and Outreach** – Updates the Clean Air Plan, proposes emission control strategies, and reviews new residential and commercial developments in order to minimize air quality impacts. Planners also administer grant programs to fund emission reduction projects throughout the County. Outreach programs include press releases, events/workshops like Clean Air Month and National Bike Month, Professor O. Zone, and many other initiatives.



Governance of GIS

GIS management functions for the San Luis Obispo County Air Pollution Control District (APCD) are currently being directed by the in-house Air Quality Specialist (AQS) within the Planning and Outreach Division. The APCD has applied the use of GIS technology for a number of years, realizing that so many of their business workflows relate to a geographic context. With that in mind, the Air Quality Specialist uses GIS to create and maintain certain data layers, spatially analyze impacts on air quality by overlaying multiple data layers, and generate hard copy maps for various reports like the Clean Air Plan. APCD maintains one (1) license of ESRI ArcGIS Desktop 9.x ArcView software, and uses it on a limited basis to accomplish the above tasks. Training and experience are minor factors in limiting the use of GIS; reliable and accessible data from other County departments is a major impediment to widespread use of GIS at the APCD.



Figure 2: Monitoring Locations for the Nipomo Mesa Particulate Study

Map produced by APCD staff

All GIS data management and storage functions are being handled internally by the APCD as shapefiles on a centralized server. All APCD-specific GIS data layers such as Air Quality Monitoring Stations, Dry Cleaners, and Gasoline Dispensing Facilities are maintained on an as-needed basis. Other reference GIS data from the County is obtained through the Geographic Technology and Design Section within the Planning and Building Department. The AQS currently uses these base map GIS data layers as reference points for bearing locations of APCD-specific data intended for cartographic materials such as hard paper maps and Adobe PDF documents. Most APCD Staff use the existing GIS data for CEQA review, enforcement action, permitting and rule application as well as address matching and mail out notification. Just recently the APCD solidified a location on San Louis Obispo County's centralized GIS server, thereby allowing other County personnel occupying GIS desktop software to view and analyze the APCD-specific GIS data detailed above.

Important to note is that SLO APCD staff expressed major interest a Countywide GIS Inter-local Agreement as discussed in the introduction of this chapter. APCD creates and maintains highly beneficial GIS data layers that could be highly useful to many other governmental agencies. As such, it is highly recommended that SLO APCD be directly involved in the establishment of the GIS Inter-local Agreement system.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The San Luis Obispo County Air Pollution Control District (APCD) will benefit from access to several GIS data layers created by other external agencies and the County. In return, APCD would be willing to share its maintained layers within an Inter-local Agreement of data sharing. Personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers was identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

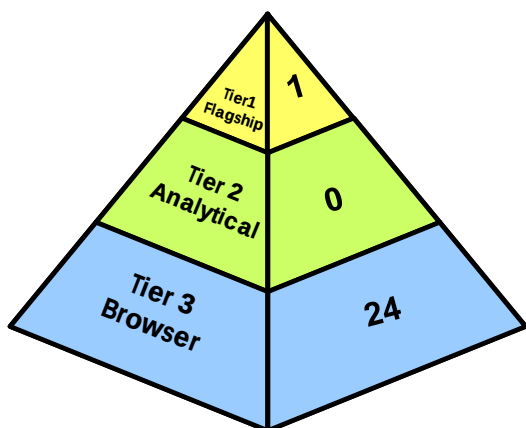
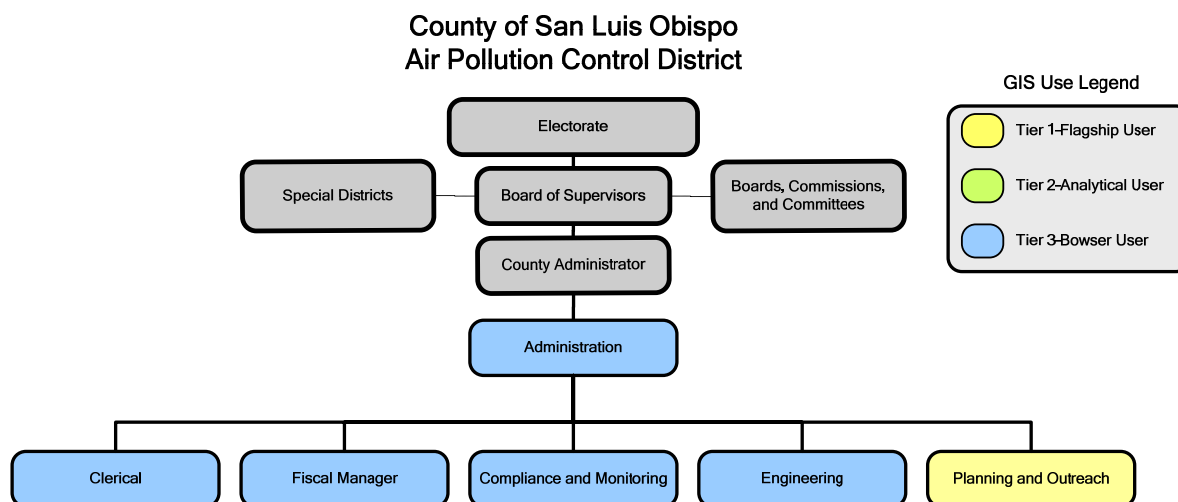
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
APCD Data			
Air Quality Monitoring Stations	Generate based on GPS x,y coordinates	APCD	Existing
Background Health Risk	Utilize existing data	APCD	Existing
Dry Cleaners	Utilize existing data	APCD	Existing
Gasoline Dispensing Facilities	Utilize existing data	APCD	Existing
High Traffic Roads (at least 50k vehicles/day)	Utilize existing data	APCD	Existing
Office Information System (OIS) Records	Generate based on GPS x,y coordinates	APCD	Recommended
Ports	Utilize existing data	APCD	Existing
Refineries	Utilize existing data	APCD	Existing
Schools, Daycare, and Senior Care Facilities	Utilize existing data	APCD	Existing

In addition to the layers the APCD maintains, APCD personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The following chart describes the current GIS application use by the San Luis Obispo Air Pollution Control District (APCD). It is color coded by the level of current GIS application use. A Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. As noted above, most of the GIS administrative work for SLO APCD like data layer management is done by the in-house Air Quality Specialist position within the Planning and Outreach Division; therefore, that position would be considered a Tier 1 – Flagship GIS User. For the remainder of SLO APCD staff, they are all deemed Tier 3 – Browser GIS Users.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

Section Outline

-  Agency Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Agency Structure

The GIS program for California Polytechnic University resides within the Geographic Information System Technology (GIST) Research Unit of the Landscape Architecture Department. GIST has been involved with applied research activities since the early 1980s in cooperation with the City of San Luis Obispo, County, and other agencies around the region.



The Department of Landscape Architecture is dedicated to providing the highest quality professional educational experience for its students. The Department recognizes that the profession of Landscape Architecture is changing and calling on professionals to play a more active leadership role in designing and managing numerous aspects of the environment. Through the faculty's commitment to excellence in teaching and to the core values of the profession, students develop an appreciation for lifelong learning and interdisciplinary approach to landscape architectural design.

The Department offers a program which:

- a) Emphasizes an understanding of natural and cultural systems in the process of site, community, urban, and regional design and planning; and
- b) Promotes a responsible, humanistic and sustainable approach to land planning and design; and
- c) Presents the Landscape Architect as a leader and integrator of information from allied disciplines, the arts, technology, and the natural and social sciences.



Governance of GIS

The Landscape Architecture Department has been involved in GIS technology since the early 1980s, with the GIST Lab established in 1987 to apply GIS



technology in exploration of environmental issues on the Central Coast of California. Project types and scales have varied over the years, but the central theme to apply GIS technology towards environmental issues has been maintained. Typical tasks for the GIST consist of data automation and distribution, partnerships with agencies located in the San Luis Obispo region, and exploration of the utilization of GIS and multimedia information. Depending on the number and intensity level of project work, the GIST employs anywhere from 2-5 staff dedicated to GIS activities. The undergraduate level of study for the Landscape Architecture Department stays consistently around 230, and most students must take GIS-oriented coursework.



Walter Bremer is the Cal Poly Professor in charge of directing the Geographic Information System Technology (GIST) Research Unit. Accordingly, Professor Bremer is responsible for courses utilizing computer technologies and regional landscape assessment using GIS, and is currently involved in various University and Department computing and teaching and learning activities. In support of his teaching, Professor Bremer is active on the central coast of California in the implementation of GIS technology to landscape scale planning activities.

Current projects for Cal Poly GIST include:

- Morro Bay National Estuary Program
- Monarch Butterfly Habitat Study
- Cal Poly Master Plan
- El Pomar Area Plan Update
- FGDC Clearinghouse Node

Cal Poly GIST has been at the forefront of establishing GIS users groups that represent all of San Luis Obispo County. The first group, San Luis Obispo GIS Consortium (SLOGIC), was launched with the intent of establishing a one-stop shop data clearinghouse for GIS agencies across the County. It succeeded in that the group brought GIS users throughout the County together for the first time. The group was hosted by Cal Poly GIST personnel, and the County was given a directive by the Board of Supervisors to foster a greater environment for GIS data sharing. However, with all the success, SLOGIC slowly dissipated due to lack of interest that is not uncommon for long-standing GIS user groups. A second smaller group, San Luis Obispo

GIS Users Group, has just recently been organized by the Caltrans GIS coordinator. The group typically meets quarterly with approximately 30 - 40 attendees, including local ESRI representatives.

An ArcIMS public site is also maintained by Cal Poly GIST intended to display informative GIS data and to increase public awareness of the Department and GIS industry as a whole. It depicts GIS data layers from multiple sources, but mainly San Luis Obispo area agencies like the County, City of San Luis Obispo, San Luis Obispo Council of Governments (SLOCOG), Local Agency Formation Commission (LAFCO), and Air Pollution Control District (APCD).

An important and unique component to the interaction between the Cal Poly GIST and San Luis Obispo County resides around the source of temporary labor. The County has a wonderful supply of seasonal interns at their disposal with the existence of the GIST. Of particular interest would be when the County initiates the recommended countywide address point and street centerline GIS data layer work. These two projects alone will necessitate a vast amount of time spent on field verification, thus benefitting from a relatively inexpensive intern labor pool provided by GIST students.

GIS Data Layer Inventory and Intergovernmental Data Sharing

The Geographic Information System Technology Research Unit (GIST) of Cal Poly will benefit from access to several GIS data layers created by other external agencies and the County. In relation, GIST would be willing to share its maintained layers within an Inter-local Agreement of data sharing. Professor Bremer expressed that access to the following GIS data layers would be beneficial. Access to many other Countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Community 2050 Data	Developed by GIST students and staff	GIS Department in ITD	Existing
Environmental Modeling Output	Developed by GIST students and staff	GIS Department in ITD	Existing
Landuse Modeling Output	Developed by GIST students and staff	GIS Department in ITD	Existing

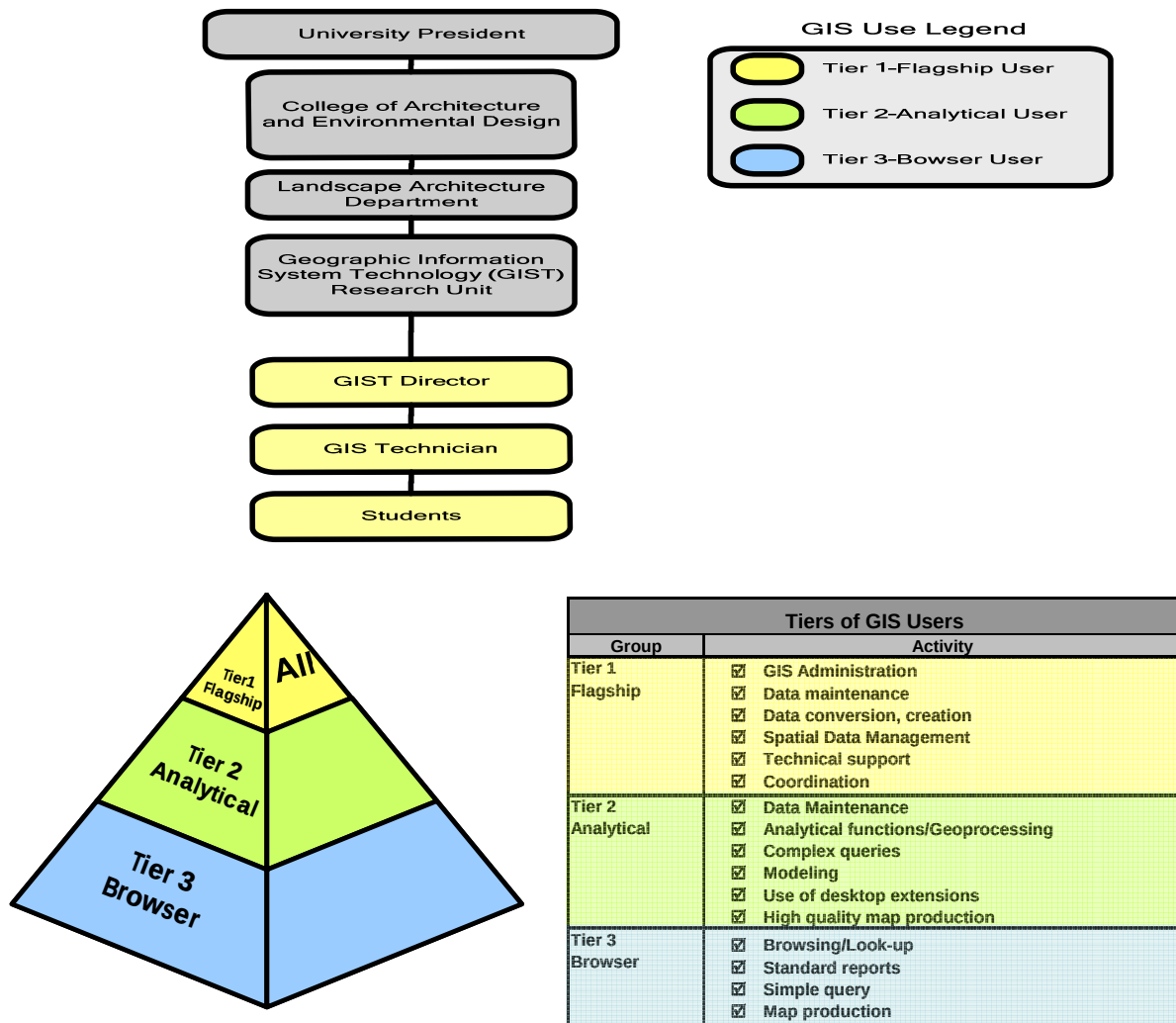
In addition to the layers Cal Poly maintains, Cal Poly personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by Cal Poly. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. As noted above, most of the GIS work done within Cal Poly reside in the GIST Research Unit. Virtually all of the work done by the GIST would be constituted as Tier 1 – Flagship GIS User level.

California Polytechnic State University





Section Outline

- Organizational Structure
 - Governance of GIS
 - Current GIS Data Layer Inventory and Intergovernmental Data Sharing
 - Multi-Tier GIS Application Use
-

Existing Conditions

Organizational Structure

California Department of Transportation is responsible for the development and maintenance of the highway system. Caltrans District 5 covers five counties including San Luis Obispo, Monterey, San Benito, Santa Barbara and Santa Cruz. District 5 manages approximately 600 employees.

Governance of GIS

There are 2 designated, full-time GIS personnel within the District to create and maintain GIS data, provide GIS services, and train staff, 7 staff perform high level analytical tasks using ESRI ArcMap and approximately 30 Browser level users that perform basic GIS tasks to support their workflows. Analytical users deal with determining where other activities occur in relation to location of activities involving Caltrans District 5. This can cover Encroachment Permits, Environmental Planning/Review, etc. Funding for data creation within Caltrans is usually project driven. Right of Way and some other maps are a problem because they are currently all paper-based maps and efforts are not being made to update or digitize these maps.

Within Caltrans there are 65 ArcView licenses, 30 Arc Info licenses; ArcIMS and ArcSDE are utilized at the headquarters. The Department maintains over 100 layers in which the majority is acquired and more than 50% are not frequently used. This Department is connected to Novell and Sun Servers using a high speed wide area network. Hardware and network connectivity are described as 'fast' and GIS software licenses are plentiful. However, there are an abundance of restrictive security issues when attempting to access file servers across the District and Department

Tier 1 users within the Department make it possible for anyone in the District to utilize GIS by providing access to software, data, training and other support. Marketing and promotion are used to increase usage of GIS in District functions and business processes. Although there are ongoing efforts made in the area of training, browser level users are sometimes reluctant to utilize GIS software to perform GIS tasks. These

users will create maps using Microstation, Graphics applications and Excel rather than employ GIS tools that are available to them. Based on a thorough analysis of this organization, staff and workflows, it is evident that currently, a major inhibitor of growth of GIS within Caltrans District 5 deals with the placement of its GIS data managers.



GIS Data Layer Inventory and Intergovernmental Data Sharing

Caltrans District 5 will benefit from access to several GIS data layers created by other external agencies and the County. Also, Caltrans District 5 would be willing to share its maintained layers within an Inter-local Agreement of data sharing, however some layers have restrictions on distribution due to data sharing agreements with outside contractors.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Caltrans Maintained Data			
Transportation			
Agricultural Border Inspection Stations	Utilize Existing Data	Caltrans District 5 GIS	Existing
Alternate Bike Routes	Utilize Existing Data	Caltrans District 5 GIS	Existing
Post-mile Calibration Points	Utilize Existing Data	Caltrans District 5 GIS	Existing
Culvert End Treatments	Utilize Existing Data	Caltrans District 5 GIS	Existing
Culvert Pipes	Utilize Existing Data	Caltrans District 5 GIS	Existing
Survey Control Points	Utilize Existing Data	Caltrans District 5 GIS	Existing
High Occupancy Vehicle Lanes	Utilize Existing Data	Caltrans District 5 GIS	Existing
Highway Performance Monitoring System	Utilize Existing Data	Caltrans District 5 GIS	Existing
Bridges – Off State Highway System	Utilize Existing Data	Caltrans District 5 GIS	Existing
Maintenance Facilities	Utilize Existing Data	Caltrans District 5 GIS	Existing
Park and Ride Lots	Utilize Existing Data	Caltrans District 5 GIS	Existing
Rest Areas	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Highway Shield Points	Utilize Existing Data	Caltrans District 5 GIS	Existing
SHOPP Projects	Utilize Existing Data	Caltrans District 5 GIS	Existing
STIP Projects	Utilize Existing Data	Caltrans District 5 GIS	Existing
Bridges on State Hwy System	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Highway Routes	Utilize Existing Data	Caltrans District 5 GIS	Existing

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
0.1 Postmile Points	Utilize Existing Data	Caltrans District 5 GIS	Existing
Summit Locations on State Hwy System	Utilize Existing Data	Caltrans District 5 GIS	Existing
Transportation Management Association Legislative Boundaries	Utilize Existing Data	Caltrans District 5 GIS	Existing
Traffic Operational Systems	Utilize Existing Data	Caltrans District 5 GIS	Existing
Travel Plaza	Utilize Existing Data	Caltrans District 5 GIS	Existing
Vista Points	Utilize Existing Data	Caltrans District 5 GIS	Existing
Road Base			
Local Streets and Roads	From TeleAtlas (formerly GDT) Restricted Distribution	TeleAtlas/Caltrans D5	Existing
Major Streets and Roads	From TeleAtlas (formerly GDT) Restricted Distribution	TeleAtlas/Caltrans D5	Existing
Roads-Geographic Data Technology	From TeleAtlas (formerly GDT) Restricted Distribution	TeleAtlas/Caltrans D5	Existing
Functionally Classified Roads	From TeleAtlas (formerly GDT) Restricted Distribution	TeleAtlas/Caltrans D5	Existing
USGS Roads – Digital Line Graphs	Utilize Existing Data	Caltrans District 5	Existing
Bus/Transit			
Amtrak Bus Stations	Utilize Existing Data	Caltrans District 5 GIS	Existing
Bus Terminals	Utilize Existing Data	Caltrans District 5 GIS	Existing
Fixed Route Bus System	Utilize Existing Data	Caltrans District 5 GIS	Existing
Rail and Ferry Feeder Bus Routes	Utilize Existing Data	Caltrans District 5 GIS	Existing
Commuter Ferry Routes and Terminals	Utilize Existing Data	Caltrans District 5 GIS	Existing
Rail			
Rail Lines	Utilize Existing Data	Caltrans District 5 GIS	Existing
Passenger Rail Stations	Utilize Existing Data	Caltrans District 5 GIS	Existing
Light Rail	Utilize Existing Data	Caltrans District 5 GIS	Existing
Freight/Ports			
Intermodal Freight Transfer Facilities	Utilize Existing Data	Caltrans District 5 GIS	Existing
Intermodal Transfer Facilities – Tanker Terminals	Utilize Existing Data	Caltrans District 5 GIS	Existing

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Commercial Vehicle Enforcement Facilities	Utilize Existing Data	Caltrans District 5 GIS	Existing
Truck Network	Utilize Existing Data	Caltrans District 5 GIS	Existing
Public and Private Ports	Utilize Existing Data	Caltrans District 5 GIS	Existing
Public and Private Port Boundaries	Utilize Existing Data	Caltrans District 5 GIS	Existing
Airport Boundaries	Utilize Existing Data	Caltrans District 5 GIS	Existing
Airport Runway	Utilize Existing Data	Caltrans District 5 GIS	Existing
Airports	Utilize Existing Data	Caltrans District 5 GIS	Existing
Other Infrastructure			
Aggregate Miles	Utilize Existing Data	Caltrans District 5 GIS	Existing
Dams within the Jurisdiction of California	Utilize Existing Data	Caltrans District 5 GIS	Existing
Health Care Facilities	Utilize Existing Data	Caltrans District 5 GIS	Existing
U.S. Weather Service Observation Stations	Utilize Existing Data	Caltrans District 5 GIS	Existing
Physical Environment			
Air Basins	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard – Carbon Monoxide	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard – Ozone	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard – Particulates	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard – Visibility Reducing Particulates	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard – Sulfate	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard –Nitrogen Dioxide	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard – Lead	Utilize Existing Data	Caltrans District 5 GIS	Existing
CA Air Quality Standard –Hydrogen Sulfide	Utilize Existing Data	Caltrans District 5 GIS	Existing
Federal Air Quality Standard – Carbon Monoxide	Utilize Existing Data	Caltrans District 5 GIS	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Federal Air Quality Standard –Ozone	Utilize Existing Data	Caltrans District 5 GIS	Existing
Federal Air Quality Standard for Particulate Matter	Utilize Existing Data	Caltrans District 5 GIS	Existing
Federal Air Quality Standard –Sulfur Dioxide	Utilize Existing Data	Caltrans District 5 GIS	Existing
Federal Air Quality Standard –Nitrogen Dioxide	Utilize Existing Data	Caltrans District 5 GIS	Existing
Soils and Vegetation			
Soils – Statsgo (generalized soils)	Utilize Existing Data	Caltrans District 5 GIS	Existing
Soils Ssurgo (detailed soils)	Utilize Existing Data	Caltrans District 5 GIS	Existing
National Land Cover Dataset	Utilize Existing Data	Caltrans District 5 GIS	Existing
National Land Cover Database	Utilize Existing Data	Caltrans District 5 GIS	Existing
Vegetation from CDF	Utilize Existing Data	Caltrans District 5 GIS	Existing
Hardwoods Range	Utilize Existing Data	Caltrans District 5 GIS	Existing
Coastal Redwoods Range	Utilize Existing Data	Caltrans District 5 GIS	Existing
UCSB GAP Vegetation	Utilize Existing Data	Caltrans District 5 GIS	Existing
“CALVEG” Vegetation	Utilize Existing Data	Caltrans District 5 GIS	Existing
Elevation			
500; Contour Intervals	Utilize Existing Data	Caltrans District 5 GIS	Existing
500' Contour Intervals – generalized	Utilize Existing Data	Caltrans District 5 GIS	Existing
Digital Elevation Models – 30 meter	Utilize Existing Data	Caltrans District 5 GIS	Existing
Digital Elevation Models – 10 meter	Utilize Existing Data	Caltrans District 5 GIS	Existing
Digital Elevation Models – 90 meter	Utilize Existing Data	Caltrans District 5 GIS	Existing
Shaded Relief – 30 meter	Utilize Existing Data	Caltrans District 5 GIS	Existing
Shaded Relief – 10 meter	Utilize Existing Data	Caltrans District 5 GIS	Existing
Hydro-graphy			
Major Hydrographic Features – selected Waterbodies	Utilize Existing Data	Caltrans District 5 GIS	Existing
Major Hydrographic Features – selected water courses	Utilize Existing Data	Caltrans District 5 GIS	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Hydrographic line work from Teale Data Center	Utilize Existing Data	Caltrans District 5 GIS	Existing
Hydrographic Features - all line work	Utilize Existing Data	Caltrans District 5 GIS	Existing
Hydrographic Features – all points	Utilize Existing Data	Caltrans District 5 GIS	Existing
Lakes – 1:500,000	Utilize Existing Data	Caltrans District 5 GIS	Existing
Rivers – 1:500,000	Utilize Existing Data	Caltrans District 5 GIS	Existing
National Wetlands Inventory	Utilize Existing Data	Caltrans District 5 GIS	Existing
California Watersheds (1:500,000)	Utilize Existing Data	Caltrans District 5 GIS	Existing
Hydrologic Basins (1:500,000)	Utilize Existing Data	Caltrans District 5 GIS	Existing
Groundwater Basins	Utilize Existing Data	Caltrans District 5 GIS	Existing
303d Impaired Waters	Utilize Existing Data	Caltrans District 5 GIS	Existing
Chinook Salmon ESU	Utilize Existing Data	Caltrans District 5 GIS	Existing
COHO Salmon ESU	Utilize Existing Data	Caltrans District 5 GIS	Existing
Steelhead Salmon ESU	Utilize Existing Data	Caltrans District 5 GIS	Existing
FEMA Q3 Flood Zones	Utilize Existing Data	Caltrans District 5 GIS	Existing
Mean Annual Precipitation 1900-1960	Utilize Existing Data	Caltrans District 5 GIS	Existing
Rain Contours Created from Raingage_99	Utilize Existing Data	Caltrans District 5 GIS	Existing
Rain gauge 1999	Utilize Existing Data	Caltrans District 5 GIS	Existing
Stream gauge 1999	Utilize Existing Data	Caltrans District 5 GIS	Existing
Stream gauge 2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
Offshore Islands	Utilize Existing Data	Caltrans District 5 GIS	Existing
1:24,000 Shoreline	Utilize Existing Data	Caltrans District 5 GIS	Existing
Political / Administrative Districts			
Air Districts (Air Resources Board)	Utilize Existing Data	Caltrans District 5 GIS	Existing
Congestion Management Agencies	Utilize Existing Data	Caltrans District 5 GIS	Existing
Counties – as polygons	Utilize Existing Data	Caltrans District 5 GIS	Existing

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Counties – as lines	Utilize Existing Data	Caltrans District 5 GIS	Existing
Counties adjacent to D5	Utilize Existing Data	Caltrans District 5 GIS	Existing
Coastal Zone	Utilize Existing Data	Caltrans District 5 GIS	Existing
Caltrans Districts	Utilize Existing Data	Caltrans District 5 GIS	Existing
Caltrans Districts as lines	Utilize Existing Data	Caltrans District 5 GIS	Existing
Metropolitan Planning Organizations	Utilize Existing Data	Caltrans District 5 GIS	Existing
Regional Transportation Planning Agencies	Utilize Existing Data	Caltrans District 5 GIS	Existing
Regional Water Quality Control Board Boundaries	Utilize Existing Data	Caltrans District 5 GIS	Existing
Department of Fish and Game Regions	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Parks	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Assembly Districts – 2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Assembly Districts – 1990	Utilize Existing Data	Caltrans District 5 GIS	Existing
Congressional Districts – 2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
Congressional Districts – 1990	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Senate Districts -2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Senate Districts – 1990	Utilize Existing Data	Caltrans District 5 GIS	Existing
Board of Equalization Districts – 1990	Utilize Existing Data	Caltrans District 5 GIS	Existing
Cultural Geography			
Census Blocks – 2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
Census Block Groups – 2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
Census Tracts – 2000	Utilize Existing Data	Caltrans District 5 GIS	Existing
Cities (Federal Census Place Code Boundaries – 1990)	Utilize Existing Data	Caltrans District 5 GIS	Existing
U.S. Census Bureau Populated Places (Cities, Towns, CDPs)	Utilize Existing Data	Caltrans District 5 GIS	Existing
Urban Area Boundaries	Utilize Existing Data	Caltrans District 5 GIS	Existing
Urban Area Boundaries (dissolved)	Utilize Existing Data	Caltrans District 5 GIS	Existing

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Native American Reservations & Rancherias	Utilize Existing Data	Caltrans District 5 GIS	Existing
The Nature Conservancy Lands	Utilize Existing Data	Caltrans District 5 GIS	Existing
Prime Farmlands 2004 (Department of Conservation)	Utilize Existing Data	Caltrans District 5 GIS	Existing
General Plan Land use compiled by UC Davis (ICE)	Utilize Existing Data	Caltrans District 5 GIS	Existing
Points of Interest - Locations	Utilize Existing Data	Caltrans District 5 GIS	Existing
USGS Geographic Name Information System	Utilize Existing Data	Caltrans District 5 GIS	Existing
Land Ownership	Utilize Existing Data	Caltrans District 5 GIS	Existing
Public Lands	Utilize Existing Data	Caltrans District 5 GIS	Existing
Managed Areas and Land Ownership – 1.2m	Utilize Existing Data	Caltrans District 5 GIS	Existing
USGS 7.5 Minute Quad range Grid	Utilize Existing Data	Caltrans District 5 GIS	Existing
Place Name Locations	Utilize Existing Data	Caltrans District 5 GIS	Existing
Public Land Survey	Utilize Existing Data	Caltrans District 5 GIS	Existing
Public Land Survey – Townships only	Utilize Existing Data	Caltrans District 5 GIS	Existing
Public Land Survey – Land Grants only	Utilize Existing Data	Caltrans District 5 GIS	Existing
School Districts	Utilize Existing Data	Caltrans District 5 GIS	Existing
School Sites	Utilize Existing Data	Caltrans District 5 GIS	Existing
State Plane Zones (NAD 83 & NAD27)	Utilize Existing Data	Caltrans District 5 GIS	Existing
1994 us Post Office Zip Codes	Utilize Existing Data	Caltrans District 5 GIS	Existing
1992 US Post Office Zip Codes	Utilize Existing Data	Caltrans District 5 GIS	Existing
Aerial Photography			
Aerial Photography	Utilize Existing Data	Caltrans District 5 GIS	Existing
Digital Orthophoto Quads	Utilize Existing Data	Caltrans District 5 GIS	Existing
Shaded Relief	Utilize Existing Data	Caltrans District 5 GIS	Existing
SPOT 10 meter Pan Satellite Imagery	Utilize Existing Data	Caltrans District 5 GIS	Existing
SPOT Index	Utilize Existing Data	Caltrans District 5 GIS	Existing

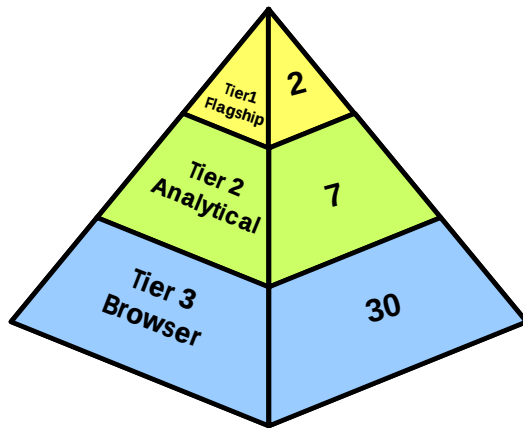
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Georeferenced Map Images			
Digital Raster Graphics (scanned USGS quad sheets)	Utilize Existing Data	Caltrans District 5 GIS	Existing
DRG Index	Utilize Existing Data	Caltrans District 5 GIS	Existing
California Road System Map Images	Utilize Existing Data	Caltrans District 5 GIS	Existing
CRS Index	Utilize Existing Data	Caltrans District 5 GIS	Existing

In addition to the layers that Caltrans District 5 maintains, the staff expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

In lieu of an organizational chart for Caltrans, this Needs Analysis only includes a pyramid of GIS users and a table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of Arroyo Grande



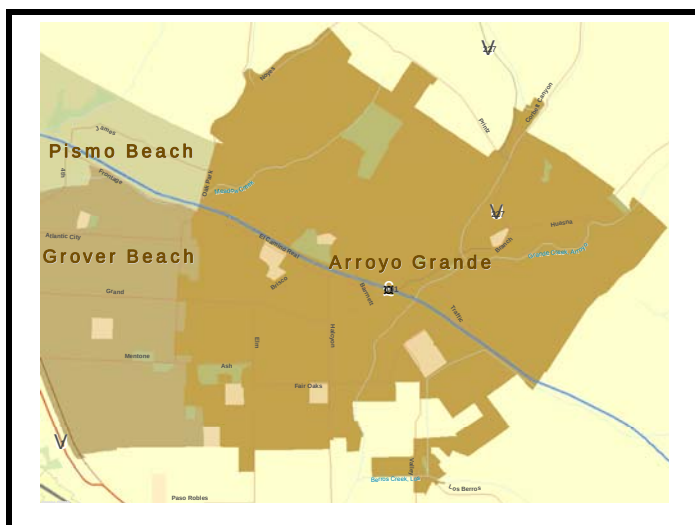
Section Outline

-  Agency Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions



Agency Structure



The City of Arroyo Grande is a full service, general law city incorporated in 1911, with a resident population of about 16,700. The City has an overall total area of approximately 5.45 square miles and is about 114 feet above sea level.

Arroyo Grande has a Council-Manager form of government. The City Council consists of five members elected at-large, on a non-partisan basis, who serve four-year overlapping terms. The mayor is directly elected and serves a two-

year term. The City Council establishes City policies, approves ordinances and resolutions, makes land use decisions, approves agreements and contracts, and hears appeals on decisions made by City staff or advisory committees. The City Manager is responsible for the administration of City affairs, and is assisted by the Administrative Services/City Clerk Department.

There are five members on each of the City's advisory bodies. All members must be qualified electors of the City of Arroyo Grande and are appointed by the City Council. Advisory bodies have the authority and duty to consider, advise and/or recommend to the City Council or City Manager regarding its area of interest. In all cases each advisory body elects its own chairperson, who serves for a period of one year. The chairperson is not authorized to serve for more than two consecutive terms on any one advisory body.

The City includes eight (8) departments:

- Administrative Services/City Clerk – responsible for managing the legislative history of the City and responsible for maintaining, disposing, and preserving official City documents and records in accordance with legal requirements.
- Building and Fire – provide fire protection, fire hazard inspections, neighborhood services, and other emergency services.
- City Manager – acts on behalf of the City Council to correlate and coordinate various municipal activities, compile data, prepare reports relating to the affairs of the City Government, and to generally act as the agent of the Council in discharge of administrative duties.
- Community Development – assists the community, City Council, and Planning Commission in preparing for the City's future growth and development, as well as review current development plans for consistency with local ordinances.
- Financial Services – maintains accounting records of all monetary transactions, involving cash receipts, accounts payable, payroll, utility billing, and business licensing.
- Park, Recreation & Facilities – provide recreation and leisure opportunities for all ages throughout the year.
- Police Department – strives to include all elements of the community in programs, decisions and methods which bring about the best in public safety.
- Public Works – responsible for the design, construction, and maintenance of the City's public facilities, as well as the review and approval of all subdivision construction plans.

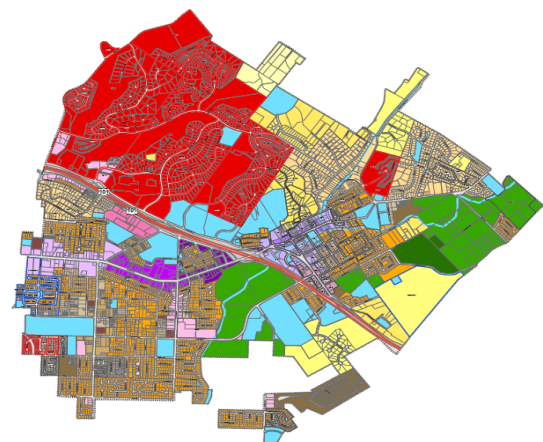


Governance of GIS

The City of Arroyo Grande's GIS functions are currently directed by the Community Development Department, but originated from within the Public Works Department. Three (3) GIS users exist within the City, including a Senior Planner and Associate Planner within Community Development and one position in Public Works. The City uses GIS regularly for GIS data layer creation and maintenance, as well as hard copy map production for governing bodies and general staff consumption. The City maintains three (3) single-use licenses of ArcView 9.x, and uses them on a routine basis to accomplish the above tasks.

Arroyo Grande Zoning Map

Adopted by the City Council on May 14, 1991; last revised on February 21, 2007



Zoning Districts										Overlays	
Agriculture	Residential Suburban	Multi-Family Apartment	Park Oaks Mixed-Use	Industrial Mixed-Use						Design Overlay	
Agriculture Preserve	Single Family	Mobile Home Park	Highway Mixed-Use	Office Mixed-Use						Planned Development	
Residential Estate	Village Residential	Senior Residential	Village Core Downtown	Regional Commercial						Specific Plan	
Residential Hillside	Patio Home Residential	Planned Development	Village Mixed Use	Public Facility							
Residential Rural	Multi-Family	Gateway Mixed-Use	Traffic Way Mixed-Use								

All GIS data management and storage functions are being handled by the Community Development Department as shapefiles within a centralized server. All base layers such as parcels and street centerlines are maintained on an as needed basis. The City of Arroyo Grande began managing their own parcel GIS data layer because County updates were not frequent enough, and the data accuracy was off in certain areas. In regards to the City's address GIS point layer, they were generated based on centroids of the County's parcel layer. Therefore, they are not a true representation of each situs address available out in the field due to multi-tenant parcels like apartment complexes and commercial developments. However, the County should still utilize the City's existing address GIS point layer as a starting point for the Arroyo Grande region of a countywide coverage.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of Arroyo Grande will benefit from access to several GIS data layers created by other external agencies and the County. In return, the City would also be willing to share its maintained layers within an Inter-local Agreement of data sharing. Personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers was identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

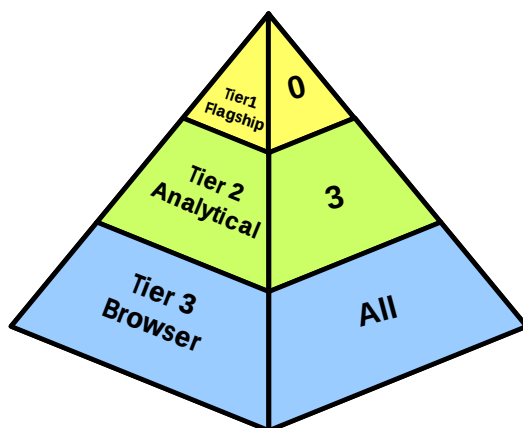
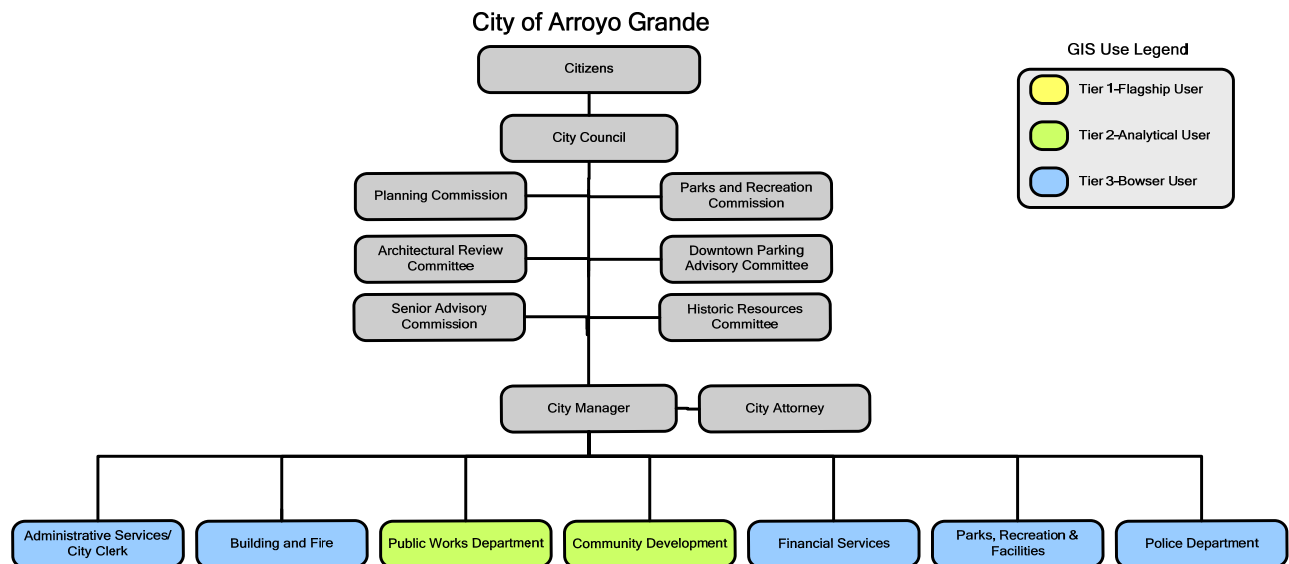
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Citywide Parcel Layer	Obtained from County, then maintained by City staff	City GIS	Existing
Citywide Address Points	Generated based on centroids of County parcels; maintained by City staff	City GIS	Existing
Citywide Street Centerlines	Utilize existing data (does not include address range information)	City GIS	Existing
Control Points	Developed by City staff	City GIS	Existing
Creeks/Drainageways	Developed by City staff	City GIS	Existing
Drainage Zones	Developed by City staff	City GIS	Existing
Landuse	Developed by City staff	City GIS	Existing
Parking Districts	Developed by City staff	City GIS	Existing
Zoning Districts	Developed by City staff	City GIS	Existing

In addition to the layers that City maintains, the staff expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The following chart describes the current GIS application use by the City of Arroyo Grande. It is color coded by the level of current GIS application use. A Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. As noted above, City staffs that are assigned GIS duties reside within both the Public Works and Community Development Departments. Although their duties could include functions that would be considered Tier 1 uses, they lack the formal training and expertise to perform these tasks on a regular basis.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of Atascadero

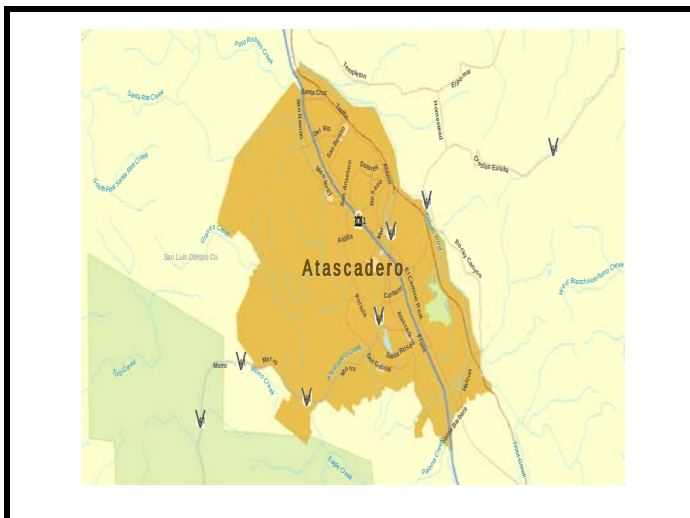


Section Outline

-  Organizational Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Organizational Structure



Atascadero is home to one of the County's largest employers, the Atascadero State Hospital, and is a growing center of tourism, commerce and employment in Northern San Luis Obispo County.

The City was incorporated in 1979. It is led by an elected five member council, with one council member (elected by the members themselves) serving as mayor on a rotational basis. The city's day-to-day operations are managed by a City Manager. Seven departments make up the

City's Administration - City Manager, Administrative Services, Community Development, Community Services, Public Works, Fire and Police - each working together to provide customer service to the public. Helping to shape the community, Atascadero also has a Planning Commission and a Parks and Recreation Commission. Both meet monthly and help to guide growth and development.

The City has a population of over 28,000.



Governance of GIS

Current GIS functions are led by a GIS Analyst that resides in the IT Department, under the direction of the Assistant City Manager. The City maintains one license of ArcEditor, seven concurrent licenses of ArcView, and two standalone licenses of ArcView. The GIS department is also in the process of moving toward SDE and ArcServer Enterprise-Basic. Browser level users throughout the City use ArcReader to view citywide GIS layers.

GIS functions that the City would like to incorporate include linking GIS data to all external SQL databases, like CAD, permitting, business licenses, and dial-a-ride. The City also would like to be included in any County-wide efforts to share accurate data and data layers. Currently the City pays \$100/month to access a private database of property sales. If this data could be obtained from the County's Assessor's Office as accurately and up-to-date as it currently does, this would save the City \$1200/year.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of Atascadero will benefit from access to several GIS data layers created by other external agencies and the County. Also, the City would be willing to share its maintained layers within an Inter-local Agreement of data sharing.

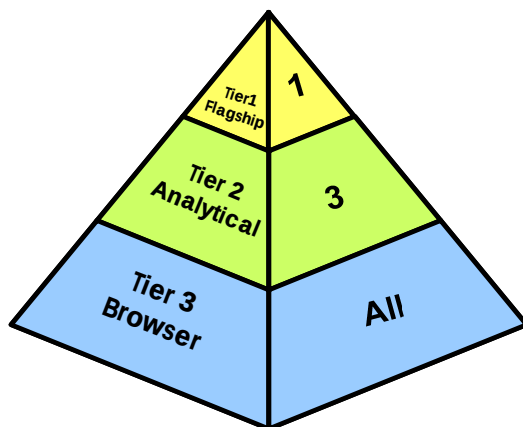
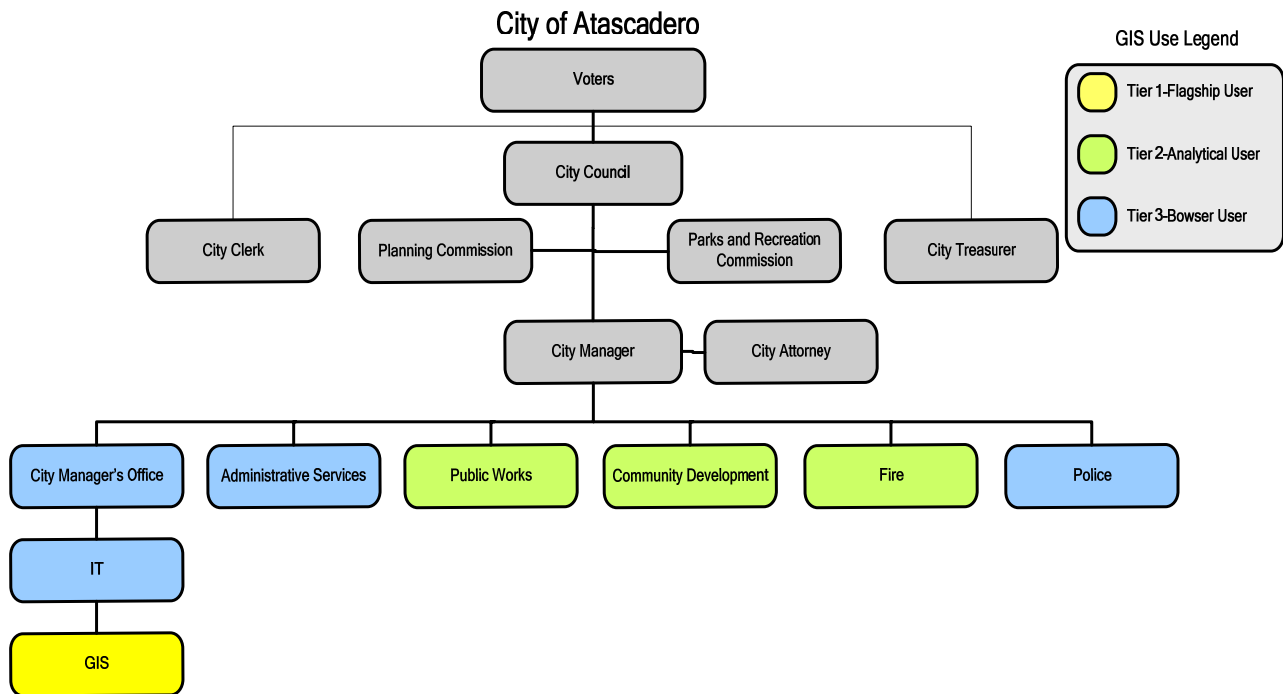
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Citywide Parcel Layer	Obtained from County, then maintained by GIS Department since 1989.	City GIS	Existing
Citywide Centerlines	City GIS Department	City GIS	Existing
6" Aerials	Countywide project - 2006	City GIS	Existing
Address Points	City GIS Department	City GIS	Existing

In addition to the layers the City maintains, City personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by the City of Atascadero. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of Grover Beach

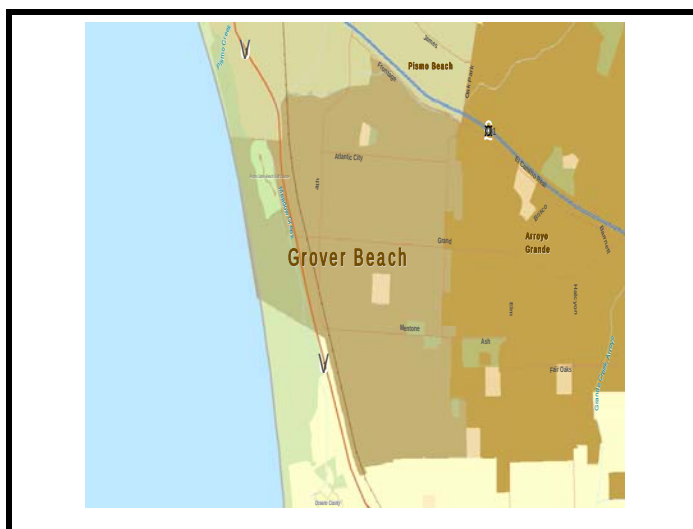


Section Outline

-  Organizational Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Organizational Structure



The City of Grover Beach maintains a Council-Manager form of government and is a general law city organized under California State statutes.

The City Council is comprised of five members elected at-large to represent the City. Each Council term is four years, with expiration occurring at staggered intervals. The City Council makes decisions, establishes policies and enacts laws on behalf of the voters for the betterment of Grover Beach. The City Council also acts as the

Improvement Agency for the City's adopted Redevelopment Plan. Currently, the Mayor is appointed by the Council and, per Resolution, the position is rotated each calendar year during the ceremonial portion of the Council agenda in December. The position of Mayor will become a directly elected two-year term at the November 2008 General Municipal Election.

The City Manager is the administrative head of city government. The City Manager is appointed by the City Council to enforce City laws, to direct the daily operations of the City government, to prepare the municipal budget and to implement the policies and programs initiated by the City Council. The City Manager is responsible to the City Council rather than to individual Council Members and directs and coordinates the

various departments (Police, Fire, Administrative Services, Community Development, and Parks and Recreation). The City Manager also serves as Executive Director for the City's Improvement Agency.

The City has a population of over 13,000.



Governance of GIS

Limited GIS functions are being directed from within the Community Development Department's Planning division. GIS functions comprise general data viewing by city employees via Google Earth. Any paper maps or digital map (.pdf format) creation and development are being contracted out to an outside engineering/consulting firm (Garing Taylor and Associates, CA).

City staff did express an interest in a GIS Intranet data browser, or a stand-alone application like Photomapper to view available countywide GIS layers.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of Grover Beach will benefit from access to several GIS data layers created by other external agencies and the County.

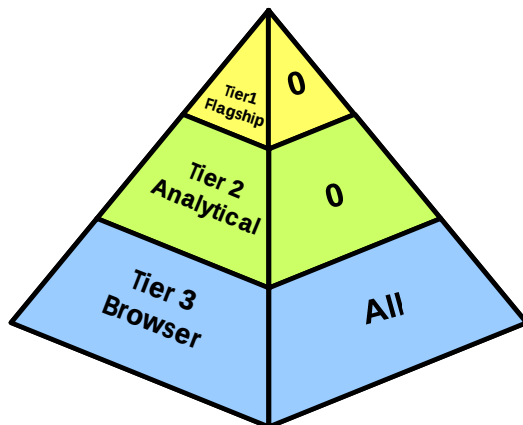
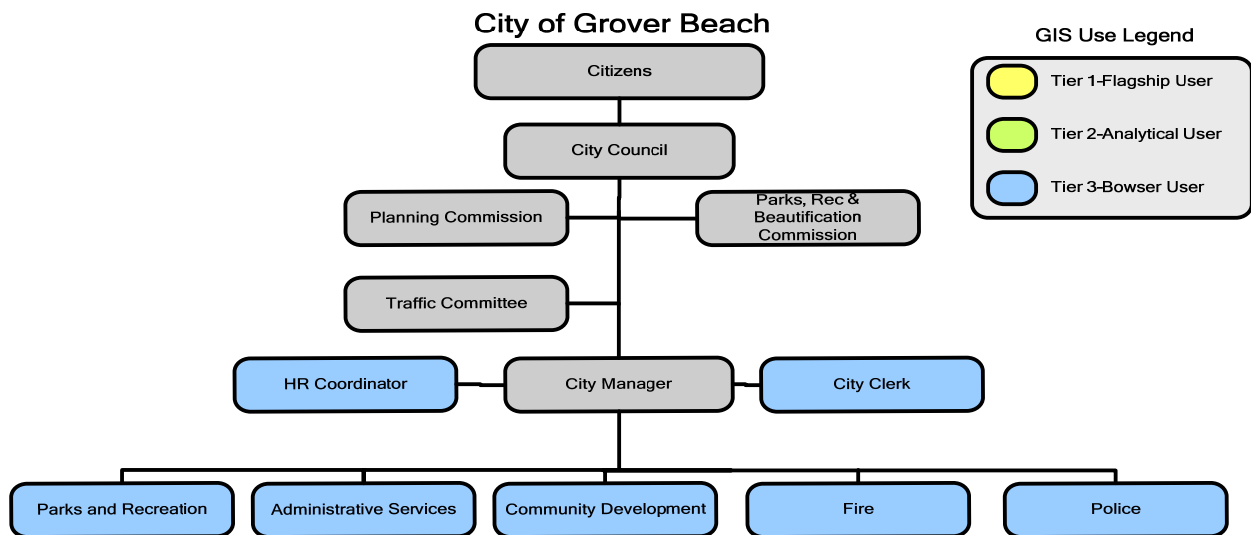
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
City Parks and Recreation data	Field data collection and data extracted from County parcel	County GIS Department in ITD, via Inter-local Agreement	Recommended

City personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by the City of Grover Beach. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of Morro Bay



Section Outline

-  Organizational Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Organizational Structure



The City of Morro Bay maintains a Council-Manager form of government and is a general law city organized under California State statutes. The City of Morro Bay is dedicated to the preservation and enhancement of the quality of life. The City shall be committed to this purpose and will provide a level of municipal service and safety consistent with and responsive to the needs of the public.

The City Manager's mission is to provide direct staff support, collectively and individually, to the

Mayor and City Council members and to manage the city organization in the delivery of public services. The Manager accomplishes this goal through policy enforcement, support, direction and supervision to all City departments (Finance, Harbor, Police, Public Services, Transit/Recycling, Fire, IT, Recreation and Parks, and Water Services).

The City has a population of over 10,000.

Governance of GIS

Current GIS functions are being directed from within the Public Services Department's Planning and Engineering divisions. The City maintains one license of ArcView 9.1 (which is rarely used due to lack of

training and experience) and a copy of the countywide Photomapper application to view Aerials and County data layers comprehensively. The City has contracted an outside consulting firm (Noble Systems, CA) to host its data via an Intranet web browser, via ArcIMS, that is available to all City employees via a secure login. The site is limited to data layers that have been updated by the City, and are generally not updated on a regular basis.

Some stated limitations to the current GIS include little interaction/integration between the Public Services Department and the Police and Fire Departments with regard to providing department specific GIS layers, low overall/citywide interest in GIS, and the lack of GIS training. There is high interest in a GIS-centric asset management software program.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of Morro Bay will benefit from access to several GIS data layers created by other external agencies and the County. Also, the City would be willing to share its maintained layers within an Inter-local Agreement of data sharing.

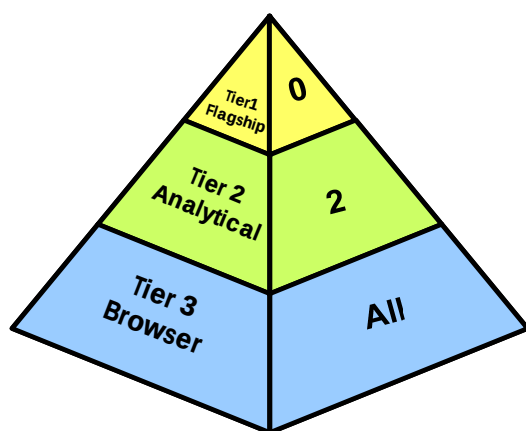
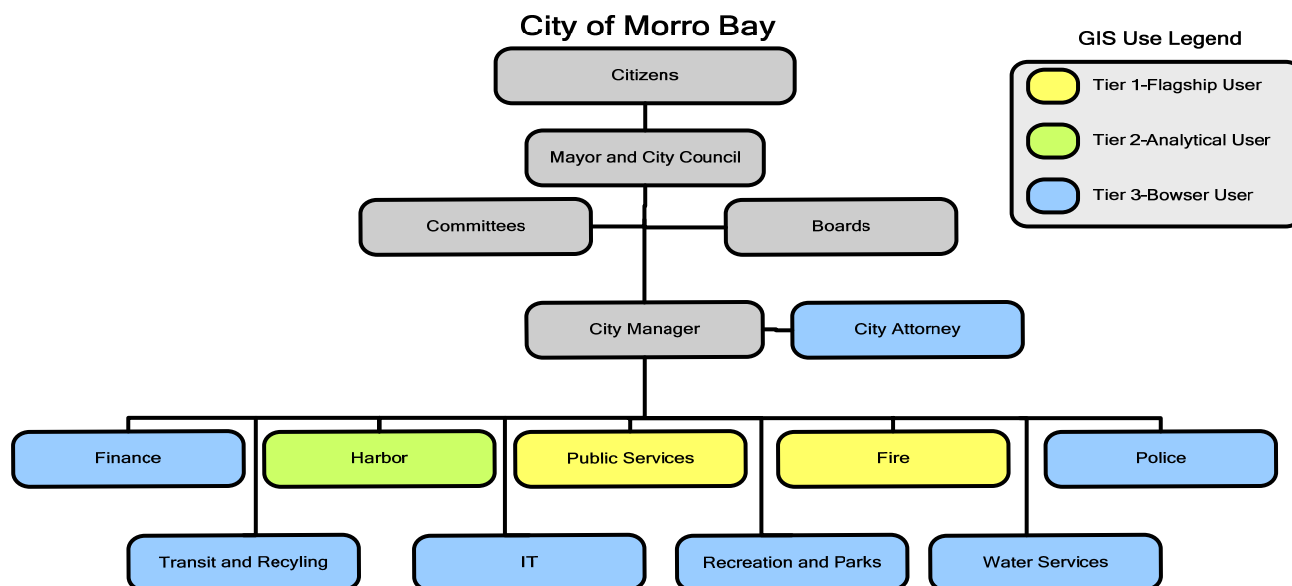
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Citywide Sewer/Water Features	Obtained from, and maintained by 3 rd party consultant	City GIS	Existing
Citywide Centerlines	Obtained from County then maintained by Public Services Department	City GIS	Existing
6" Aerials	Countywide project - 2006	City GIS	Existing
Address Points	Maintained by Public Services Department	City GIS	Existing
Planning and Zoning	Obtained from County then maintained by Public Services Department	City GIS	Existing

In addition to the layers the City maintains, City personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by the City of Morro Bay. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of Paso Robles

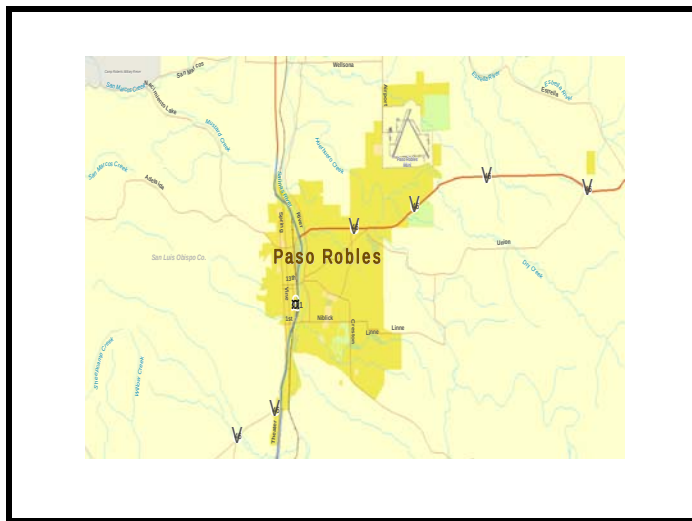


Section Outline

-  Organizational Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Organizational Structure



Paso Robles is strategically located at the confluence of State Highway 101 and State Highway 46 and continues to be the fastest growing city within San Luis Obispo County.

The City of Paso Robles was incorporated in 1889 and operates under the Council-Manager form of local government. Four councilmen are elected on a non-partisan basis, at large for four-year terms with two councilmen elected every two years. The Mayor is elected at large every two years. The Council appoints the City

Attorney and City Manager. The City Clerk and City Treasurer are both elected at large for four-year terms. The City provides a full range of services including police and fire protection, library and recreation services, public works including maintenance of all City facilities, streets, parks, airport, and utility operations (sewer, water, and landfill), transit, and development and planning services.

The City has a population of over 29,000.



Governance of GIS

Current GIS functions are being directed from within the IT Department. The GIS Coordinator is a single person position that receives limited technical support from 6 full-time staff members from within IT. GIS functions currently center around the data building process. Once core datasets are in place more robust functions such as spatial analysis for land use, crime and fire prevention, locating businesses, and water/sewer master planning will be performed. Current mapping activities include water/sewer atlas maps, fire run books, dispatch map display, land use and zoning, airport flight path, noise and safety zones, orthophoto target placement and orthophoto acquisition, and new parcel mapping and centerline roads rectified to orthophotos. Many prior and some current GIS efforts (remapping of parcel base maps and centerline roads) have been managed by engineering consulting firms.

The City maintains one license of ArcEditor, ArcView, Spatial Analyst, ArcPublisher, AutoCAD Map 3D 2007, Trimble GPS Pathfinder Office and TerraSync, and Permits Plus and uses these licenses to accomplish the above tasks. In the near future the City may be moving towards an ArcSDE and ArcServer environment. City staff also expressed interest in having direct real-time access to the County Assessor database.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of Paso Robles will benefit from access to several GIS data layers created by other external agencies and the County. Also, the City would be willing to share its maintained layers within an Inter-local Agreement of data sharing.

The City of Paso Robles is in the process of rebuilding the city's parcel and road centerline data to properly align with their high resolution orthophotography, and was intending to maintain that data from that point on, but if a County-based organization is willing to take over the creation and/or maintenance of those key datasets as part of a countywide effort, the City would certainly be willing to assist in that effort.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Citywide Parcel Layer	Obtained from County consultant, now maintained by GIS staff.	City GIS	Existing, new data under construction
Citywide Centerlines (NAVTEQ)	NAVTEQ	City GIS	Existing, new data under construction
6" Aerials	City project - 2005 Countywide project - 2007	City or County GIS	Existing
Address Points	Created by City staff	City GIS	Recommended
Countywide DEM	Intermap Technologies	County GIS	Existing

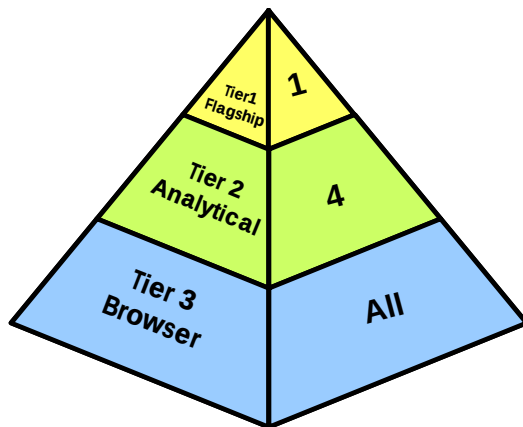
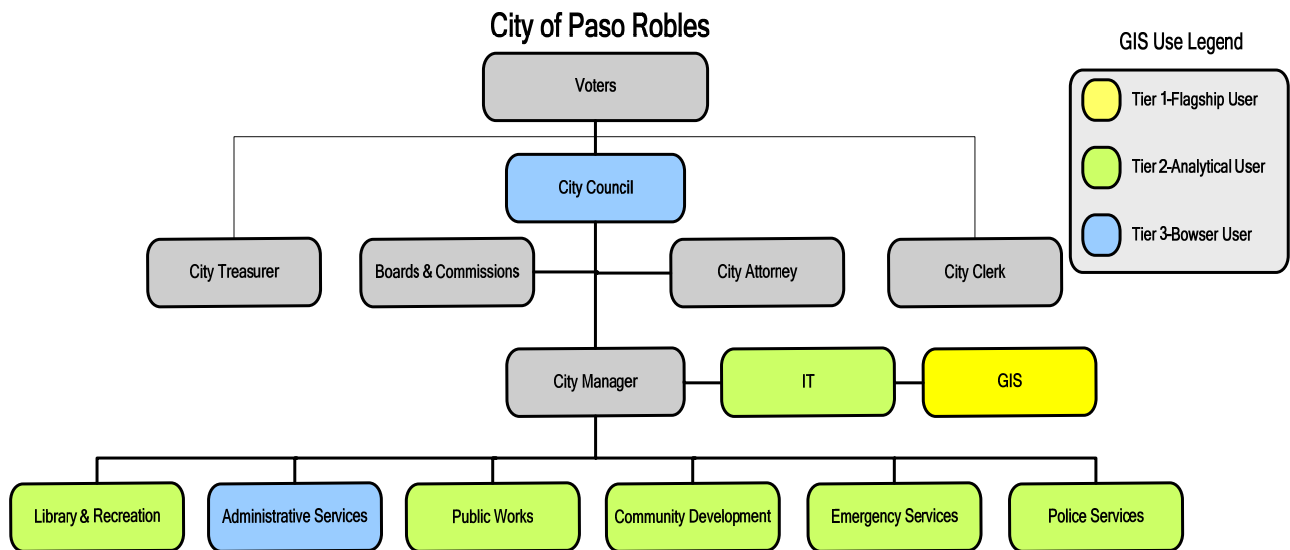
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
USGS 7.5 Min Quads	Tif format	USGS	Existing
County Clerk/Recorder record maps	Tif format	County Clerk Record's Office	Existing
Aerial horizontal control	Point layer	City GIS	Existing
Aerial photo grid	Polygon	City GIS	Existing
Land Use Designations	Polygon	City GIS	Existing
Zoning (incomplete)	Polygon	City GIS	Existing
Zoning Subareas	Polygon	City GIS	Existing
City-owned properties	Polygon	City GIS	Existing
Weed abatement properties	Polygon	City GIS	Existing
Salinas River properties	Polygon	City GIS	Existing
Fire Runbook grid	Polygon	City GIS	Existing
Fire Districts	Polygon	City GIS	Existing
Fire Stations	Polygon	City GIS	Existing
Police Reporting Districts	Polygon	City GIS	Existing
Airport Safety Zones	Polygon	City GIS	Existing
Airport Property boundary	Polygon	City GIS	Existing
Airport Flight Paths	Polygon	City GIS	Existing
City Limit	Polygon	City GIS	Existing
Sphere of Influence	Polygon	City GIS	Existing
USGS Blueline Streams	Polyline	USGS	Existing
Sex Offender parcels & buffers (previous)	Polyline	City GIS	Existing
Prescription Trails,	GPS start/finish - Polyline and Point	City GIS	Existing
Water Infrastructure	Point, Polyline, Polygon, Image	City GIS	Existing
Wastewater Infrastructure	Point, Polyline, Polygon, Image	City GIS	Existing
Stormwater Infrastructure	Point, Polyline, Polygon, Image	City GIS	Existing
Caltrans ROW maps	TIF	Caltrans	Existing

In addition to the layers the City maintains, City personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by the City of Paso Robles. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of Pismo Beach

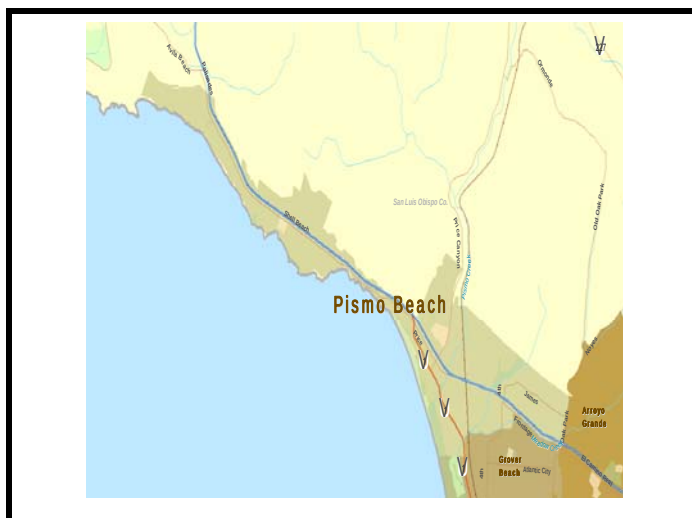


Section Outline

-  Organizational Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Organizational Structure



The City of Pismo Beach is a full service, general law city located along six miles of the Pacific Ocean in San Luis Obispo County. The City's commercial base is primarily tourism-oriented, with a significant number of hotels, motels and restaurants. The largest source of revenue for the City is the Transient Occupancy Tax.

Pismo Beach has a Council-Manager form of government. The City Council is comprised of a Mayor directly elected for a two-year term, and four Council Members generally elected to

staggered four-year terms. The City Manager is responsible for the administration of City affairs, and is assisted by an administrative team, which includes the City Attorney (who is a contract Attorney) and department heads for Administrative Services, City Clerk, Public Works, Community Development, Police and Fire.

The City has a population of over 8,000.



Governance of GIS

Current GIS functions are being directed from within the Public Works Department's Engineering division and the Community Development Department's Planning division. GIS functions are somewhat limited to the production of paper maps for council meetings and general data viewing by city employees. The City maintains two licenses of ArcView 3.2, and uses these licenses on a limited basis to accomplish the above tasks. Lack of training and experience were identified as major factors in the limited use of GIS.

All GIS data management and storage functions are being handled by an outside engineering/consulting firm (Applied Geodetics, CA). All base layers such as parcels and street centerlines are maintained on an as needed basis. It was noted during the interview process that there are some major flaws with most datasets. This can be attributed to no formal data management policies currently in place.

Currently the Engineering and Planning departments have a one time request in the 2007-2008 budget for \$30,000 to set-up the City's GIS database program. It was expressed in the interview process that the City would consider using these funds to participate in a Countywide GIS Inter-local Agreement as discussed in the introduction of this chapter.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of Pismo Beach will benefit from access to several GIS data layers created by other external agencies and the County. Also, the City would be willing to share its maintained layers within an Inter-local Agreement of data sharing.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Citywide Parcel Layer	Obtained from County, then maintained by Consultant	City GIS	Existing
Citywide Centerlines	Obtained from County, then maintained by Consultant	City GIS	Existing
6" Aerials	Countywide project - 2006	City GIS	Existing
Zoning	Obtained from County, then maintained by Consultant	City GIS	Existing
Planning	Obtained from County, then maintained by Consultant	City GIS	Existing
Sewer/Water	Consultant	City GIS	Existing

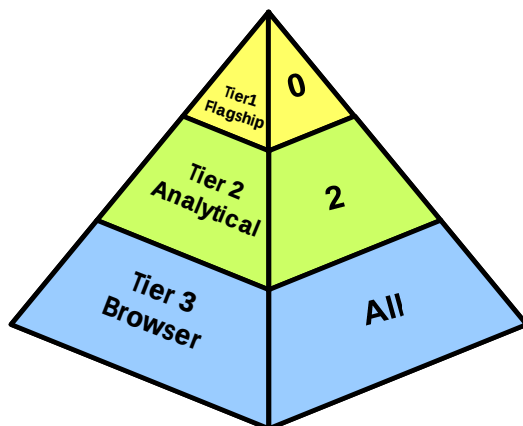
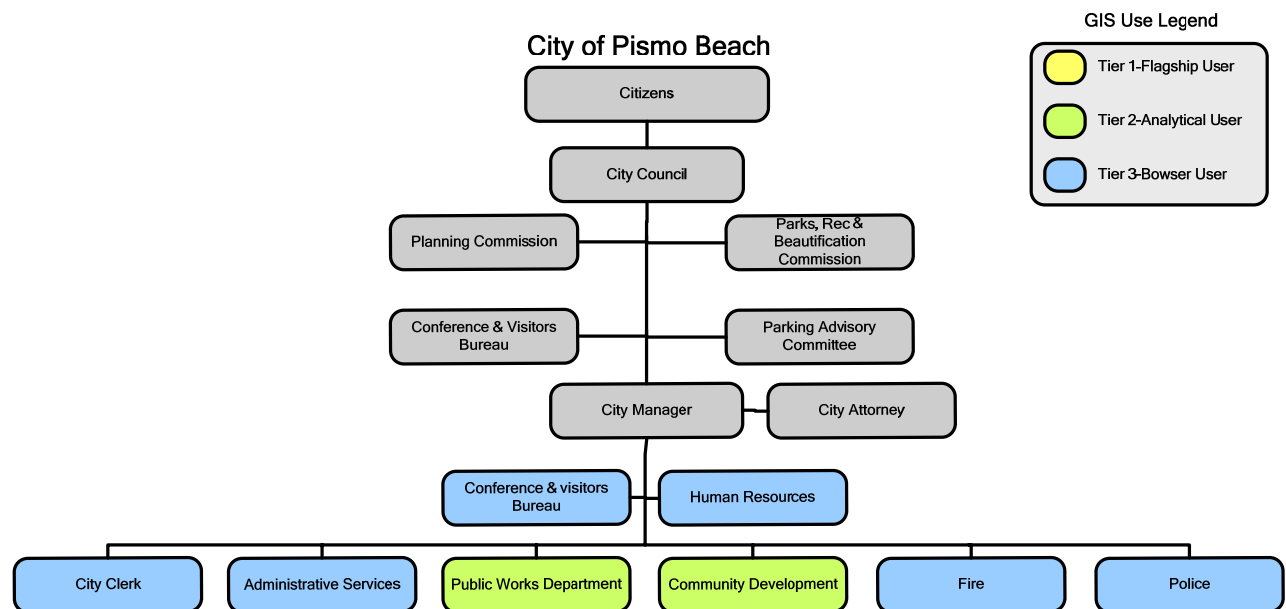
In addition to the layers the City maintains, City personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by the City of Pismo Beach. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.

As noted above, City staff that are assigned GIS duties reside in the Public Works and Community Development Departments. Although their duties could include functions that would be considered Tier 1 uses, they lack the formal training and expertise to perform these tasks on a regular basis.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

City of San Luis Obispo

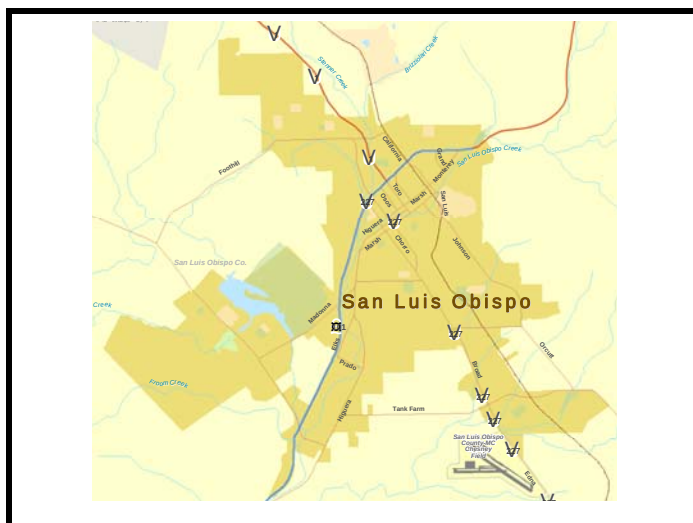


Section Outline

-  Agency Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Agency Structure



The City of San Luis Obispo represents a Charter City. The City Charter could be considered the City's "Constitution," and any changes must be approved by the voting public. While the City was first incorporated in 1856, the City did not become a Charter City until 1876. The City's Charter has been amended several times since its adoption. It was last comprehensively updated in 1955, and the most recent amendments were approved by the voters in November of 1996, with amendments adopted through November 5, 2002.

As set forth in the City Charter, the City of San Luis Obispo operates under the "Council-Mayor-Administrative Officer" form of government. The City Council has the authority to make and enforce all laws and regulations with respect to municipal affairs, subject only to the limitations of the City Charter and the State Constitution.

The elected officers of the City are the Mayor and four Council Members. Council Members are elected at-large and serve overlapping, four-year terms. The Mayor is also elected at-large for a two year term, and serves as an equal member of the Council. These terms provide for three vacancies at each City election, which is held in November of even-numbered years. In addition, the Council appoints the City Administrative Officer (CAO) and the City Attorney. All other department heads are appointed by the CAO.

The City of San Luis Obispo government is comprised of ten (10) departments with appointed professionals:

- Administrative Department
- City Attorney
- City Clerk
- Finance & Information Technology
- Fire Department
- Human Resources
- Parks and Recreation
- Police Department
- Public Works
- Utilities

The City of San Luis Obispo signifies the largest incorporated area within the County, with an approximate population of over 44,000. It also serves as the County Seat for San Luis Obispo County.

Governance of GIS

The City of San Luis Obispo's GIS management functions currently reside in the GIS Coordinator (referred to as Geographic Information Services) within the Public Works Department's Administrative Services Division. GIS use within the City was established in 1995 with shapefiles as the main GIS database format located in a dedicated GIS server. Currently, the most widely



Interactive Maps:

Loading time will vary depend on your internet access speed.

Disclaimer:

The purpose of these application are to provide easy access and visual display of mapped information within the City of San Luis Obispo. Every reasonable effort has been made to ensure the accuracy and currency of the data and associate maps provided. The data is provided in an "AS IS" state with no warranty as to accuracy or completeness by either the City of San Luis Obispo or any of its employees, expressed or implied. The user of these applications should not rely on the data provided herein for any reason. Information on this site is not intended to constitute advice nor is it to be used as a substitute for specific advice from a licensed professional. The City of San Luis Obispo shall assume no liability for any errors, omissions, or inaccuracies in the information provided regardless of how caused. Further the City of San Luis Obispo shall assume no liability for any decisions made or actions taken or not taken by the user of the applications in reliance upon any information or data furnished hereunder.

If you have read and understood this disclaimer and wish to continue, please proceed by clicking one of the following links.

Parcel Information and Map:

	City of San Luis Obispo Parcel Viewer Look up parcel information by business name, address or parcel number. Then view a map of the selected parcel or customize your own map by adding data layers including an Aerial Photo, Historic Districts, FEMA Flood Zones, and Zoning Information.

	Zoning and General City Information Find the zoning designation of a parcel or lookup general city information including transit hubs, schools an aerial photo and more.
	SLO County Demographics Population, Housing and Income information from the Year 2000 U.S. Census. Includes Census Tracts, Zip Code Areas and Streets for San Luis Obispo County
	City of San Luis Obispo Un-Reinforced Masonry Commercial properties constructed of un-reinforced masonry and status (Strengthened, Partially Strengthened, Un-Reinforced)
	City of San Luis Obispo Recreational Opportunities Hiking, biking, and other outdoor activities near the City of San Luis Obispo
	Downtown Points of Interest

SLO GIS has multiple ArcIMS-based public GIS portals

costs. Sharing of GIS server hardware and software related to a full-scale ESRI ArcGIS Server implementation could drastically cut down on heavy expenses that are often incurred. It is highly recommended that exploratory discussions should transpire immediately between

used GIS application is a Land use program which is a customized application using Visual FoxPro and MapObjects. The City is currently planning to upgrade the Land use application with ArcGIS Server technology Two (2) ESRI ArcGIS Desktop 9.x ArcInfo and ten (10) floating ArcView licenses are used as data authoring software, and advanced spatial analysis functionality can be completed through valuable extensions like 3D Analyst, Spatial Analyst, and Network Analyst. In addition to ESRI products, Leica Geosystems's ERDAS IMAGINE, LizardTech's GeoExpress, Trimble's Pathfinder Office, and myriads of smaller open source applications are used by GIS staff. For the public, ArcIMS was used to create several online interactive applications.

An identified initiative for the City of San Luis Obispo is a GIS staff recommendation and report for migrating to ESRI's latest platform, ArcGIS Server (AGS). If the City succeeds in solidifying the funding for their migration to AGS, a strategic partnership should be evaluated between the County and City to perhaps cut down on server hardware and ESRI licensing



GIS officials of both the County and City of San Luis Obispo.

The City currently employs five (4) dedicated GIS staff:

- GIS Supervisor
- Three (3) GIS Specialists
- One (1) IT dedicated contract developer (not a regular City employee)

The Division's program goals consist of the following:

- Developing and implementing an accurate, comprehensive, and up-to-date GIS
- Providing quick and easy access to GIS information with reasonable security
- Promoting use of GIS to expedite work process

The major activities within the GIS Coordinator include:

- GIS Data Management and Maintenance
- GIS Applications Development and Analysis
- GIS Training and Assistance
- Cartography and Presentation

All City workstations are automatically mapped to a dedicated GIS drive (known as "x" drive). All of the base GIS data are stored in this dedicated GIS drive as shapefiles. A folder within this GIS drive is provided for all other users to store their project specific GIS data. This provides a very convenient location for GIS data sharing between departments. The City is currently planning to implement an enterprise geodatabase to replace the shapefiles for better management and data sharing. . All base layers such as parcels and street centerlines are maintained on at least a weekly basis. The City of San Luis Obispo began managing their own parcel GIS data layer because County updates were not frequent enough, and the data accuracy was off in a number of areas. The City's large amount of highly accurate basemap data layers like parcels and street centerlines represent a solid foundation for the County to build upon in creating countywide datasets.

Important to note is that City of San Luis Obispo GIS staff expressed major interest a Countywide GIS Inter-local Agreement as discussed in the introduction of this chapter. The City creates and maintains highly beneficial GIS data layers that could be highly useful to many other governmental agencies. As such, it is highly recommended that the City of San Luis Obispo be directly involved in the establishment of the GIS Inter-local Agreement system.



GIS Data Layer Inventory and Intergovernmental Data Sharing

The City of San Luis Obispo will benefit from access to several GIS data layers created by other external agencies and the County. In return, the City would also be willing to share its maintained layers within an

Inter-local Agreement of data sharing. Personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers was identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
City Maintained Data			
Airport Area	Developed by City staff	City GIS	Existing
Airport Runways	Developed by City staff	City GIS	Existing
Airport Safety Zones	Developed by City staff	City GIS	Existing
Annexation	Developed by City staff	City GIS	Existing
Benchmarks	Developed by City staff	City GIS	Existing
Bicycle Transportation	Developed by City staff	City GIS	Existing
Bike Racks	Developed by City staff	City GIS	Existing
Bridges	Developed by City staff	City GIS	Existing
Building Footprints	Developed by City staff	City GIS	Existing
Bus Routes	Developed by City staff	City GIS	Existing
City Arts	Developed by City staff	City GIS	Existing
City Limits	Developed by City staff	City GIS	Existing
City Owned Parcels	Developed by City staff	City GIS	Existing
City Reference Grid	Developed by City staff	City GIS	Existing
Citywide Address Points	Generated based on centroids of County parcels; maintained by City staff	City GIS	Existing
Citywide Aerial Photography (3" resolution)	Contracted out to private party every off year of County's bi-annual 6" flyovers	City GIS	Existing
Citywide LIDAR	Developed by City staff	City GIS	Existing
Citywide Parcel Layer	Obtained from County, then maintained by City staff	City GIS	Existing
Citywide Street Centerlines	Utilize existing data (does not include address range information)	City GIS	Existing
Citywide Vegetation	Developed by City staff	City GIS	Existing
Commercial Fire Zones	Developed by City staff	City GIS	Existing
Communication Conduit Lines/Boxes	Developed by City staff	City GIS	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Contours (2M interval)	Developed by City staff	City GIS	Existing
Creek Walk	Developed by City staff	City GIS	Existing
Creeks	Developed by City staff	City GIS	Existing
Downtown Association	Developed by City staff	City GIS	Existing
Downtown Core	Developed by City staff	City GIS	Existing
Easement	Developed by City staff	City GIS	Existing
Fire Stations	Developed by City staff	City GIS	Existing
Flood zones	Developed by City staff	City GIS	Existing
General Plan/ Landuse	Developed by City staff	City GIS	Existing
Government Owned Parcels	Developed by City staff	City GIS	Existing
Greenbelt Boundary	Developed by City staff	City GIS	Existing
Heritage Trees	Developed by City staff	City GIS	Existing
Highway 101 Paveout	Developed by City staff	City GIS	Existing
Highway 101 Centerlines	Developed by City staff	City GIS	Existing
Historic Districts	Developed by City staff	City GIS	Existing
Horizontal Control Points	Developed by City staff	City GIS	Existing
Hospitals	Developed by City staff	City GIS	Existing
Laguna Lake	Developed by City staff	City GIS	Existing
Open Space/Open Space Easement	Developed by City staff	City GIS	Existing
Parking District	Developed by City staff	City GIS	Existing
Parking meters	Developed by City staff	City GIS	Existing
Pavement Management	Developed by City staff	City GIS	Existing
Railroad	Developed by City staff	City GIS	Existing
Railroad Rights-of-Way	Developed by City staff	City GIS	Existing
Rare and Endangered Species	Developed by City staff	City GIS	Existing
Sales Tax Area	Developed by City staff	City GIS	Existing
School District	Developed by City staff	City GIS	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Sewer Utility	Developed by City staff	City GIS	Existing
Sidewalk not built	Developed by City staff	City GIS	Existing
Sidewalk Ramps	Developed by City staff	City GIS	Existing
Slope Grid	Developed by City staff	City GIS	Existing
Special Set Backs	Developed by City staff	City GIS	Existing
Specific Plan Area	Developed by City staff	City GIS	Existing
SSURGO	NRCS	NRCS download	Existing
Storm Drain Utility	Developed by City staff	City GIS	Existing
Street intersects	Developed by City staff	City GIS	Existing
Street Lights	Developed by City staff	City GIS	Existing
Strom Patrol Zones	Developed by City staff	City GIS	Existing
Surface flow	Developed by City staff	City GIS	Existing
Traffic Circulation	Developed by City staff	City GIS	Existing
Traffic Signals	Developed by City staff	City GIS	Existing
Traffic Volumes	Developed by City staff	City GIS	Existing
Trails	Developed by City staff	City GIS	Existing
Truck Routes	Developed by City staff	City GIS	Existing
Truck Routes	Developed by City staff	City GIS	Existing
Un-reinforced Masonry Buildings	Developed by City staff	City GIS	Existing
Urban Reserve Line	Developed by City staff	City GIS	Existing
Urban Trees	Developed by City staff	City GIS	Existing
Utility Fee Area	Developed by City staff	City GIS	Existing
Waste Collection Days Zones	Developed by City staff	City GIS	Existing
Water Pressure zones	Developed by City staff	City GIS	Existing
Water Utility	Developed by City staff	City GIS	Existing
Watershed	Developed by City staff	City GIS	Existing
Watersheds	Developed by City staff	City GIS	Existing

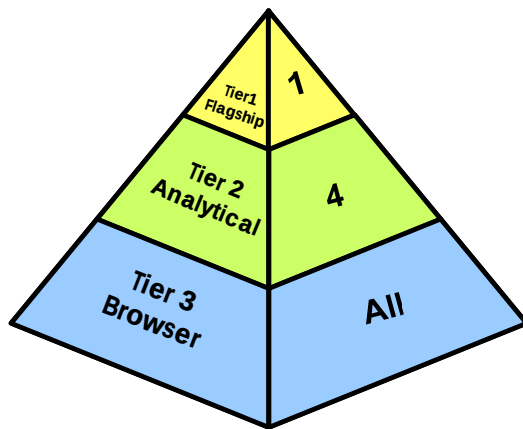
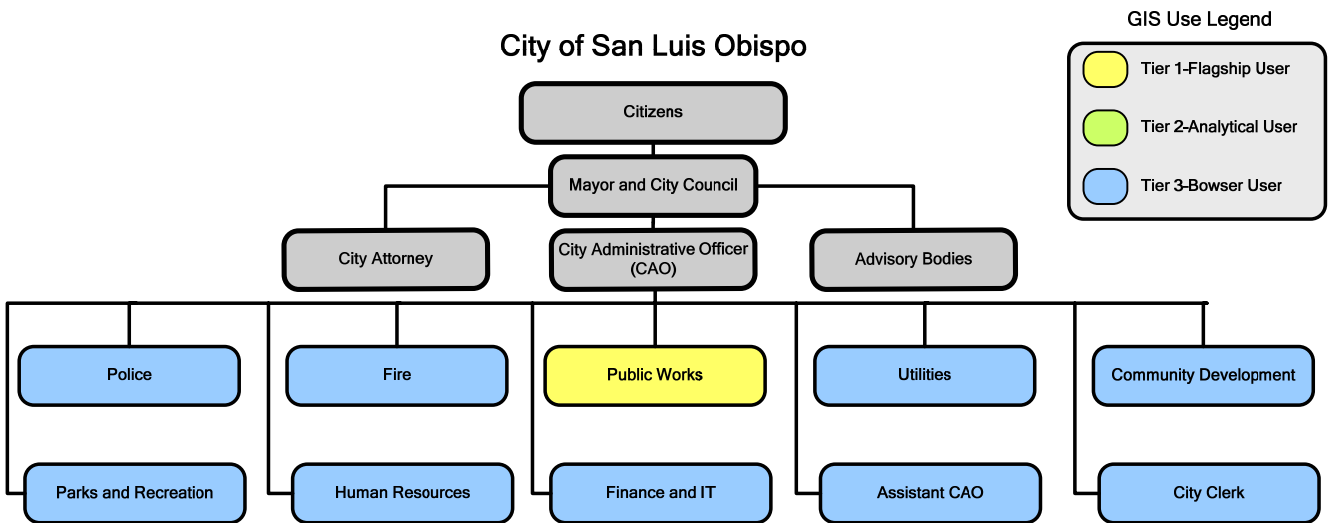
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Wildland Fire Interface	Developed by City staff	City GIS	Existing
Zoning Districts	Developed by City staff	City GIS	Existing

In addition to the layers the City maintains, City personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The following chart describes the current GIS application use by the City of San Luis Obispo. It is color coded by the level of current GIS application use. A Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. As noted above, most of the GIS administrative work for the City like data layer management is done by the GIS Coordinator within the GIS Coordinator (referred to as Geographic Information Services) of Public Works; therefore, that position is considered a Tier 1 – Flagship GIS User. Through their advanced mapping and spatial analysis duties, the remaining four (4) dedicated GIS staff members are considered Tier 2 – Analytical GIS Users. All other City staff is deemed Tier 3 – Browser GIS Users.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☒ GIS Administration ☒ Data maintenance ☒ Data conversion, creation ☒ Spatial Data Management ☒ Technical support ☒ Coordination
Tier 2 Analytical	☒ Data Maintenance ☒ Analytical functions/Geoprocessing ☒ Complex queries ☒ Modeling ☒ Use of desktop extensions ☒ High quality map production
Tier 3 Browser	☒ Browsing/Look-up ☒ Standard reports ☒ Simple query ☒ Map production

Local Agency Formation Commission (LAFCO)



Section Outline

-  Agency Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Agency Structure

Local Agency Formation Commissions (LAFCOs) were created to help organize, manage, and regulate the provision of public services to development. In California there are 58 LAFCOs working with nearly 4,000 governmental agencies in 58 counties, 500+ cities, and 3,000+ special districts. LAFCOs were proposed in 1963 in response to the post-World War II land development boom that generated a proliferation of new urban-based infrastructure and local governmental agencies providing public services to California's fast growing communities. The results of this development boom became clearer as more of California's agricultural land was converted to urban-based landuses. This often premature and unplanned development pattern created inefficient and highly expensive public service systems using smaller scaled units of local government. A number of State laws were passed to help manage this situation, the most recent being the Cortese-Knox-Hertzberg Act of 2000 (CKH Act).

The CKH Act empowered LAFCOs to "approve or disapprove with or without amendment, wholly, partially, or conditionally" proposals concerning the physical formation of cities and special districts, as well as other jurisdictional changes of local government agencies. The CKH Act made significant changes to LAFCOs' policies, procedures, and operations. It streamlined and clarified procedures and strengthened LAFCOs' power and role to prevent urban sprawl and protect open space. It includes many changes related to making LAFCOs more balanced and independent in representation and operation, making LAFCOs more accountable and visible to the public and enhancing communication amongst other LAFCOs and local governmental agencies.

LAFCO is required to review proposals for boundary changes or governmental reorganizations of cities and special districts, including:

1. The formation of special districts and cities; and/or
2. The annexation and detachment of territory to cities and special districts

In addition, LAFCO is required to calculate a sphere of influence (SOI) for each local government agency within San Luis Obispo County. An SOI represents a 20-year growth plan for the probable physical extent and service area of a particular agency. After legal adoption, SOIs are used by LAFCO as significant factors in review of boundary change proposals. This review process centers around their impact on existing agricultural lands.

Through legislative efforts, the State of California empowers LAFCOs to achieve the following objectives:

- *Encourage the Orderly Formation of Local Governmental Agencies*
Agency boundaries are often unrelated to one another and sometimes overlap at random, often leading to higher service costs to taxpayers and general confusion regarding service area boundaries. LAFCOs' decisions strive to balance the competing needs in California for affordable housing, economic opportunity, and conservation of natural resources.
- *Preserve Agricultural Land Resources*
By guiding development toward vacant urban land and away from agricultural land, LAFCO assists with the preservation of valuable agricultural resources. The CKH Act strongly discourages the use of prime agriculture land for development. The definition of prime agriculture land is found in the CKH Act.
- *Discourage Urban Sprawl*
Urban sprawl can best be described as irregular and disorganized growth occurring without apparent design or plan. This pattern of development is characterized by the inefficient manner of delivering public service systems (e.g. police, fire, water, and sanitation), in conjunction with the unnecessary loss of agricultural resources. By discouraging sprawl, LAFCO limits the misuse of land resources and promotes a more efficient system of local governmental agencies.

The San Luis Obispo LAFCO Commission (SLO LAFCO) is a governing body comprised of seven (7) regular members:

- ✓ Two (2) County Board of Supervisors
- ✓ Two (2) City Council Members
- ✓ Two (2) Special District Members
- ✓ One (1) Public Member

Additionally, four (4) Alternate Commissioners are required, which include one (1) County Board of Supervisor, one (1) City Council Member, one (1) Special District Member, and one (1) Public Member.

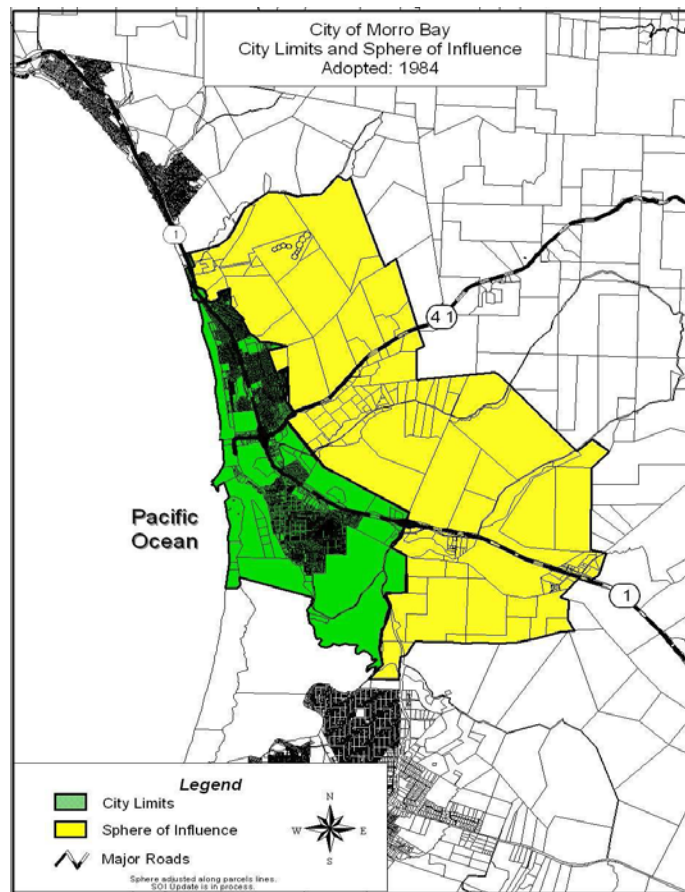
The mission statement for the SLO LAFCO reads as follows:

“The San Luis Obispo Local Agency Formation Commission (LAFCO) is committed to serving the residents of San Luis Obispo County and the State of California by discouraging urban sprawl and encouraging the orderly formation and development of local agencies based upon local conditions and circumstances.”



Governance of GIS

GIS management functions for the San Luis Obispo County Local Agency Formation Commission (SLO LAFCO) are currently being directed by the in-house Deputy Executive Officer position. SLO LAFCO just recently initiated GIS technology, realizing that so many of their business workflows relate to a geographic context. With that in mind, the Deputy Executive Officer uses GIS to create and maintain certain data layers, spatially analyze new jurisdictional boundary change proposals (typically annexations or deannexations), and generate hard copy maps for various reports like the annual “Directory of Local Agencies” document. SLO LAFCO maintains one (1) license of ESRI ArcGIS Desktop 9.x ArcView software, and uses it on a limited basis to accomplish the above tasks. Lack of training and experience were identified as major factors in limiting the use of GIS.



Typical map graphic within a Directory of Local Agencies document

All GIS data management and storage functions are being handled internally by the Deputy Executive Officer position. All LAFCO-specific GIS data layers such as Community Services Districts (CSDs), County Service Areas (CSAs), and Sphere of Influence (SOI) are maintained on an as-needed basis. It was noted during the interview process that there are some major flaws with most datasets that can be attributed to a lack of formal ESRI-certified GIS training. With proper professional training, staff will facilitate a better understanding of how to strategically create and maintain LAFCO-specific GIS data layers based on other layers. Case in point would be to base Community Services Districts (CSDs) more on the Assessor's countywide parcels layer, rather than digitizing the features without any underlining reference. As a result, the CSDs would become more accurate, thus enhancing the spatial analysis between the two datasets.

Important to note is that SLO LAFCO staff expressed major interest a Countywide GIS Inter-local Agreement as discussed in the introduction of this chapter. LAFCO creates and maintains highly beneficial GIS data layers centered around jurisdictional boundaries that could be highly useful to many other governmental agencies. As such, it is highly recommended that SLO LAFCO be directly involved in the establishment of the GIS Inter-local Agreement system.



GIS Data Layer Inventory and Intergovernmental Data Sharing

San Luis Obispo County Local Agency Formation Commission (LAFCO) will benefit from access to several GIS data layers created by other external agencies and the County. In relation, LAFCO would be willing to share its maintained layers within an Inter-local Agreement of data sharing. Personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers was identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

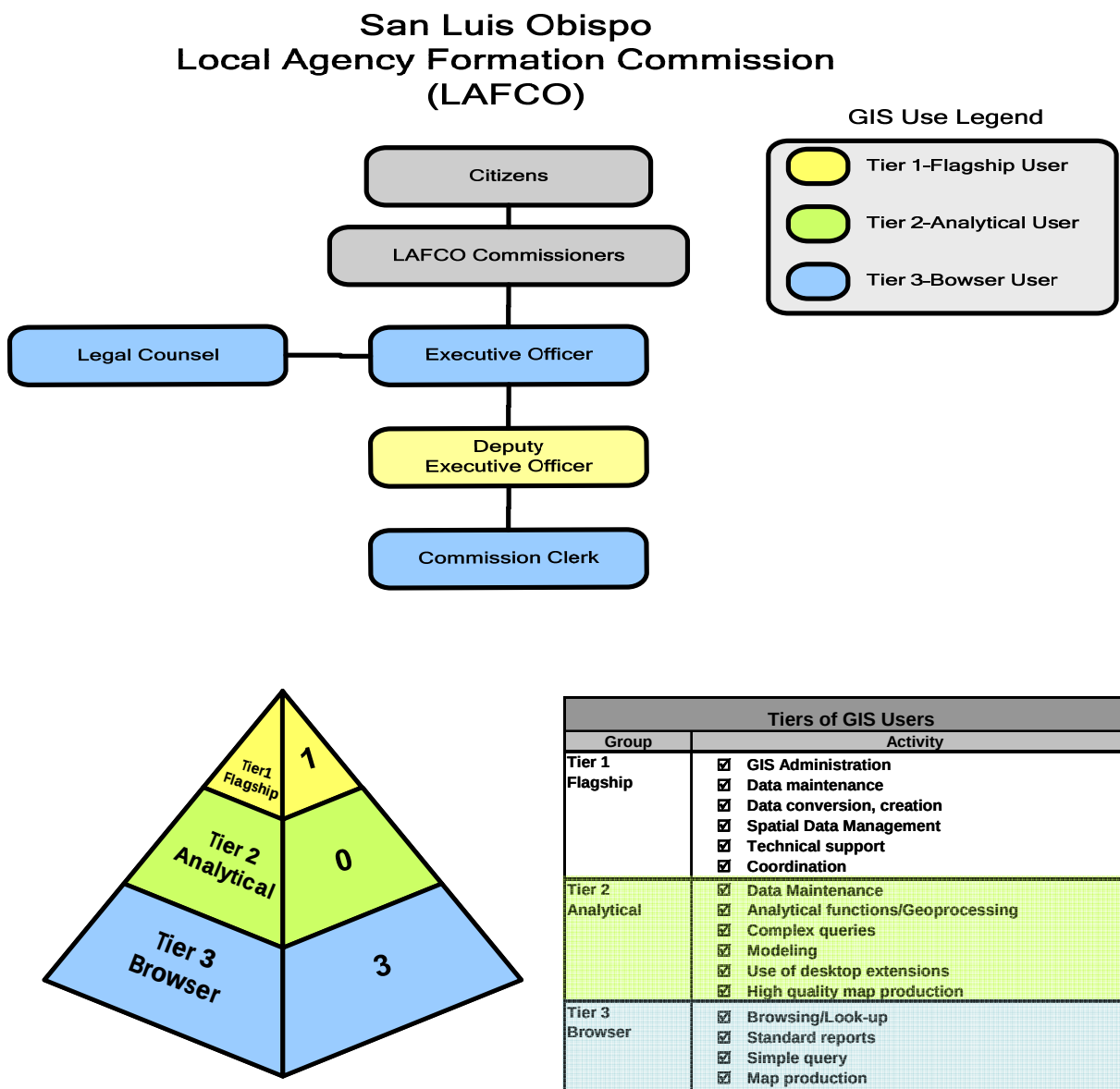
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
SLO LAFCO Maintained Data			
Cemetery Districts	Developed by SLO LAFCO staff	GIS Department in ITD	Existing
Community Services Districts (CSDs)	Developed by SLO LAFCO staff	GIS Department in ITD	Existing
County Service Areas (CSAs)	Developed by SLO LAFCO staff	GIS Department in ITD	Existing
Special Districts	Developed by SLO LAFCO staff	GIS Department in ITD	Existing
Spheres of Influence (SOIs)	Developed by SLO LAFCO staff	GIS Department in ITD	Existing

In addition to the layers LAFCO maintains, LAFCO personnel expressed that access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The following chart describes the current GIS application use by the San Luis Obispo Local Agency Formation Commission (LAFCO). It is color coded by the level of current GIS application use. A Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. As noted above, most of the GIS administrative work for SLO LAFCO like data layer management is done by the in-house Deputy Executive Officer position; therefore, that position would be considered a Tier 1 – Flagship GIS User. For the remainder of SLO LAFCO staff, they should all be deemed Tier 3 – Browser GIS Users.



San Luis Obispo Council of Governments (SLOCOG)



Section Outline

-  Organizational Structure
-  Governance of GIS
-  Current GIS Data Layer Inventory and Intergovernmental Data Sharing
-  Multi-Tier GIS Application Use

Existing Conditions

Organizational Structure

The San Luis Obispo Council of Governments (SLOCOG) is an association of local governments in the San Luis Obispo County Region. Its members include all 7 cities (Arroyo Grande, Atascadero, Grover Beach, Morro Bay, Paso Robles, Pismo Beach, & San Luis Obispo) as well as unincorporated areas of San Luis Obispo County. The central purpose of SLOCOG is to examine common regional problems and suggest solutions. SLOCOG provides transportation planning and funding for the region, and serves as a forum for the study and resolution of regional issues. In addition to preparing the region's long-range transportation plan, SLOCOG plans public transit as well as alternative methods of transportation.

SLOCOG was formed in 1968 through a Joint Powers Agreement (JPA) among the incorporated cities and the County of San Luis Obispo. The SLOCOG Board consists of twelve delegates; five members from the County Board of Supervisors and one representative from each of the seven cities in the region.

SLOCOG is also the designated Regional Transportation Planning Agency, Metropolitan Planning Agency, Regional Census Data Affiliate, Scenic Byway Organization, and Service Authority for Freeways and Expressways.

SLOCOG works in coordination with other transportation agencies in the region that include its member jurisdictions as well as: San Luis Obispo Regional Transit Authority (RTA), the Air Pollution Control District (APCD), and the California Department of Transportation (Caltrans).



Governance of GIS

As a regional planning organization, SLOCOG relies heavily upon accurate local data for the majority of its GIS data needs. The one Tier 1 user and three Tier 2 users use this GIS data for mapping, spatial analysis, future and current traffic analysis, long range regional planning, resource planning and land use planning. Rarely does SLOCOG create data as an organization. SLOCOG maintains four licenses of ArcView 9.2, GlobalMapper (3D mapping), Photomapper (Aerials with ESRI's Shapefiles), TransCAD (transportation modeling) and SQL Server DB (ad hoc reporting).

SLOCOG staff members did express an interest in access to the County's permit tracking system for current and future regional growth analysis. Another need identified was that SLOCOG staff members need to have direct access to County GIS data, as the current method of receiving data updates can result in outdated data, and therefore outdated analysis.



GIS Data Layer Inventory and Intergovernmental Data Sharing

SLOCOG will benefit from access to several GIS data layers created by other external agencies and the County. Also, SLOCOG would be willing to share its maintained layers within an Inter-local Agreement of data sharing.

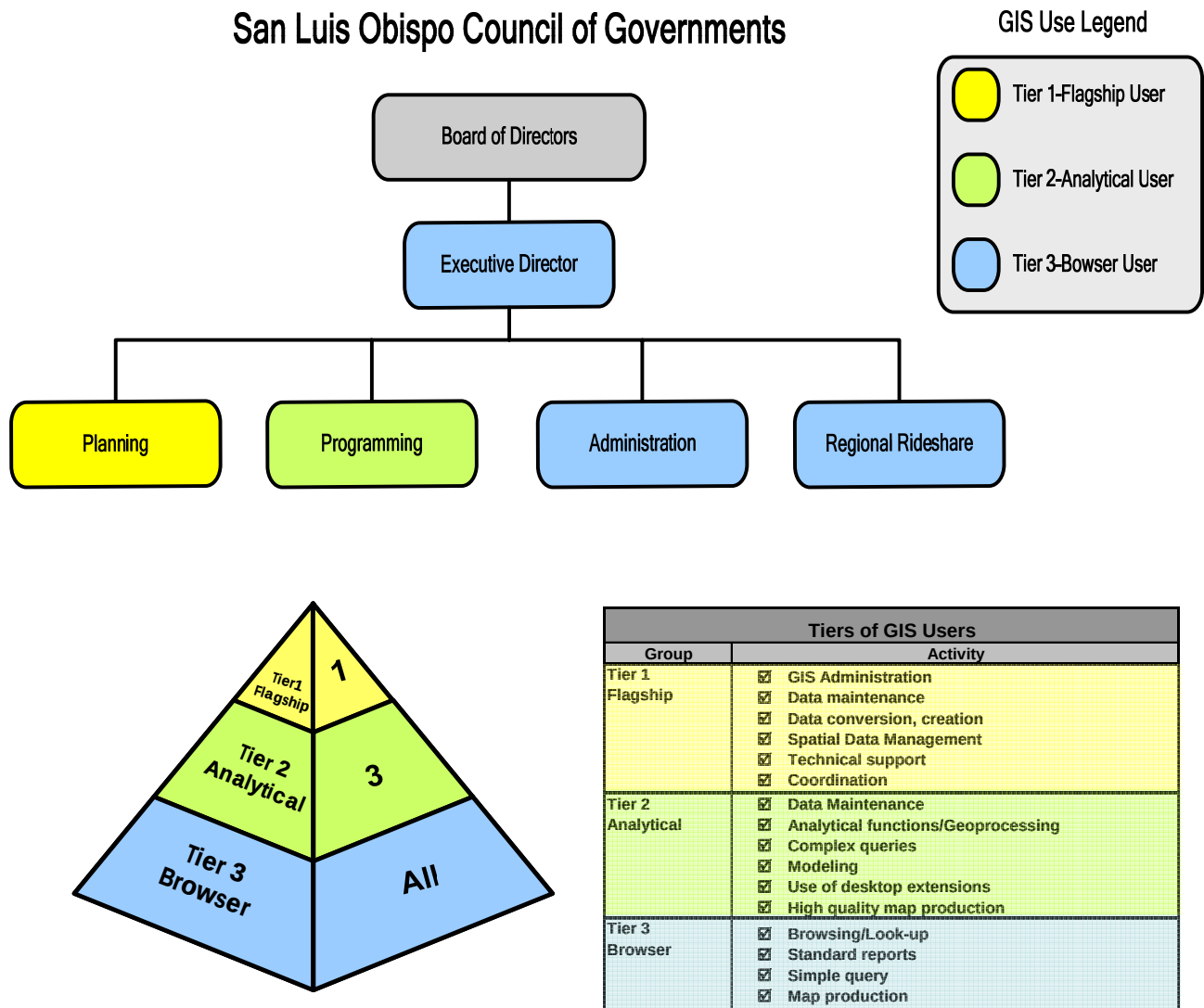
<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
SLOCOG Maintained Data			
Transit Layer	Use Existing data	SLOCOG	Existing
Planned Transportation Network (Roads and Bicycle)	Use Existing data	SLOCOG	Existing
Programmed Transportation Network (Roads and Bicycle)	Use Existing data	SLOCOG	Existing
6" Aerials	Countywide project - 2006	GIS Department in County ITD	Existing

In addition to the layers SLOCOG maintains, personnel expressed that direct access to the following GIS data layers would be beneficial. Access to many other countywide layers were identified during the interview process and a complete list of available data layers can be found in Chapter 11: Master Data List.

<i>Data Layer</i>	<i>Creation Methodology</i>	<i>Recommended Update Division or Individual</i>	<i>Existing or Recommended?</i>
Countywide Base Data			
Countywide Address Points	Some address points have been created by CAL Fire. This layer needs to be comprehensive and completed. Details on the creation of this data layer can be found in Chapter 13 of the Implementation Plan.	Planning in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has created a partial layer
Countywide Street Centerlines	Multiple versions exist at the County. CAL Fire has the most complete and accurate layer.	Public Works in conjunction with the GIS Coordinator in ITD	Recommended – CAL Fire has the best version of this layer currently.
Parcel Layer	Based on new plats and COGO (Coordinate Geometry) from control points	Assessor's Office	Existing but needs to be recreated at a higher accuracy.
Countywide Aerial Ortho-photography	2003 & 2007 Countywide project, currently managed by Planning and Building	GIS Coordinator in ITD	Existing
Points of Interest	Built from combination of other existing data (including Department data)	GIS Coordinator in ITD	Recommended

Multi-Tier GIS Application Use

The organizational chart below graphically depicts the current GIS application use by SLOCOG. Following the organizational chart is a pyramid and table that outlines the “Tiers of GIS Use” within the organization. All are color coded by the level of current GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



State Board of Equalization



Section Outline

 Organizational Structure

 Governance of GIS

Existing Conditions

Organizational Structure

California's State Board of Equalization (BOE) collects taxes and fees that provide more than 34 percent of the annual revenue for state government and essential funding for counties, cities, and special districts. In fiscal year 2005-06, Board-administered taxes and fees produced \$52.98 billion for education, public safety, transportation, housing, health services, social services, and natural resource management.

The Board administers the state's sales and use, fuel, alcohol, tobacco, and other taxes and collects fees that fund specific state programs. More than one million businesses are registered with the agency. In addition to administering key revenue programs, the Board plays a significant role in California property tax assessment and administration. It also acts as the appellate body for franchise and personal income tax appeals.

Although county government has the primary responsibility for local property tax assessment, the State has both a public policy interest and a financial interest in promoting fair and equitable assessments throughout California. The public policy interest arises from the impact of property taxes on taxpayers and the inherently subjective nature of the assessment process. The financial interest comes from the fact that more than one-half of all property tax revenue is used to fund public schools and the State is required to backfill any shortfalls from that property tax funding.

In addition, the BOE provides guidance to the 58 county assessors, who are charged with establishing values for approximately 12 million properties each year, and monitors the adequacy of their assessment practices. The Tax Area Services Section is responsible for maintaining all property tax-rate area maps and for maintaining special revenue district boundaries.

Under its Constitutional mandate, the BOE oversees the assessment practices of the state's 58 county assessors, who are charged with establishing values for approximately 12 million properties each year. In addition, the Board assesses the property of regulated railroads and specified public utilities, and assesses and collects the private railroad car tax and timber yield tax.

Governance of GIS and Intergovernmental Data Sharing

The BOE requires updated parcel information from individual counties to support its responsibility for determining Tax Rate Areas (TRA's) and preparing Tax Rate Area Maps. A Tax Rate Area is a specific area of land within which there is a unique combination of tax levies yielding a given composite tax rate. The BOE does not produce any digital map data directly; it only performs tax analyses on map data sent from the San Luis Obispo County Assessor's Office to determine the Tax Rate Area and subsequently produce Tax Rate Area maps.

Currently the Assessor's office is providing 225 paper maps to the Board and in return the Board provides the Assessor's Office with paper Tax Rate Area maps. A large Return on Investment (i.e. increased bond ratings) could be realized by the County if the Assessor's Office were to provide a digital parcel layer to the BOE, in return, the BOE would provide a digital Tax Rate Area layer (for more information, see the Assessor's Office section in Chapter 2).

Other External Entities

Engineering and Surveying Firms

Most civil engineering, land development, and survey firms have automated their subdivision plat and mapping capabilities, utilizing a computer-aided drafting (CAD) package (usually Microstation or AutoCAD) for highly detailed plat and construction drawings. CAD data primitives (lines, arcs, and points) are highly compatible with GIS features, sharing many common topological relationships.

Nearly all CAD applications can export map data to the digital exchange format (DXF) and, in the case of Microstation, Design (DGN) files. GIS applications can often import digital data directly from the CAD package's native format. DXF files can be read directly by the GIS applications being recommended for the County of San Luis Obispo. These files can remain in DXF format or converted to a GIS format. The County of San Luis Obispo should establish a formal protocol that requires the delivery of electronic drawings files by development, engineering, and survey firms as a compliment to paper maps. Subsequently, new and proposed development data may be incorporated into the County of San Luis Obispo's GIS. Most regional civil engineering and land development firms create subdivision plats and construction drawings in GIS-supported CAD formats fully capable of meeting this requirement.

The one key to making the transfer of spatial data from a private survey or engineering firm is to create a digital standard for all plat submissions. Below are a few items the County should consider when receiving data from private firms:

- Make sure the file is delivered in a known, defined coordinate space. If a ground-to grid reprojection is needed, require scaled factors, lines of origin and false eastings or northings to ensure proper transformation of coordinates.
- Create a list of acceptable naming devices to make tracking digital submissions less arbitrary. Including data, firm, area, etc. can help manage the many files the County manages.
- Include a layer description list to ensure features are names intuitively and precisely. CAD data can be imported into a GIS with varying degrees of value depending on spatial accuracy and layer naming/annotation use.

GIS User Groups

California/Hawaii/Nevada/Guam ESRI Regional Users Group

Contact: Chuck Johnson, Regional GIS Program Manager
Telephone: (916) 978-5266
Email: cbjohnson@mp.usbr.gov
Web Site: <http://www.cahinv.org/>

San Luis Obispo GIS Users Group

Contact: Andy Richardson
Telephone: (805) 549-3571
Email: Andy.Richardson@dot.ca.gov
Web Site: <http://gisug.calpoly.edu/>



It is recommended that the County of San Luis Obispo become more active in the above ESRI user's groups. This is a great way to share ideas and expertise with other GIS users in the state and in the local area.

ESRI International User Group-Annual Meeting

www.esri.com

The largest, worldwide, gathering of GIS professionals, meets in San Diego each summer. Open to users of ArcGIS software, current in annual maintenance payments, who receive free admission based on the number and type of licenses held. ESRI provides extensive new product information and software development updates, real-world application seminars and success stories.

Private Sources - Free and Low-Cost GIS Data

ESRI

ESRI has developed a web site called ArcData Online (www.arcdataonline) that has a variety of geographic data available. After you register, you will gain access to both free and commercial data sets that may be licensed and downloaded. An example of some of the free data includes census TIGER data.

- Alternate Street Names
- Census Block Demographics (2000)
- Census Block Group Demographics (2000)
- Census Block Groups
- Census Blocks
- Census Tract Demographics (2000)
- Census Tracts
- Census Transportation Areas
- Congressional Districts
- County (1990 Boundaries)
- County (2000 Boundaries)
- Key to Geographic Locations
- Land and Water Outlines
- Landmark Areas
- Landmark Points
- Line Features
- Line Features, Railroads
- Line Features, Ridges/Fences
- Line Features, Streams
- Line Features, Streets
- Line Features, Utility Lines
- Minor Civil Divisions (1990)
- Minor Civil Divisions (2000)
- Places (1990)
- Places (2000)
- School Districts, Unified
- Traffic Analysis Zones
- Urban Areas
- Urban and Rural Outlines
- Voting Districts (1990)
- Water Bodies

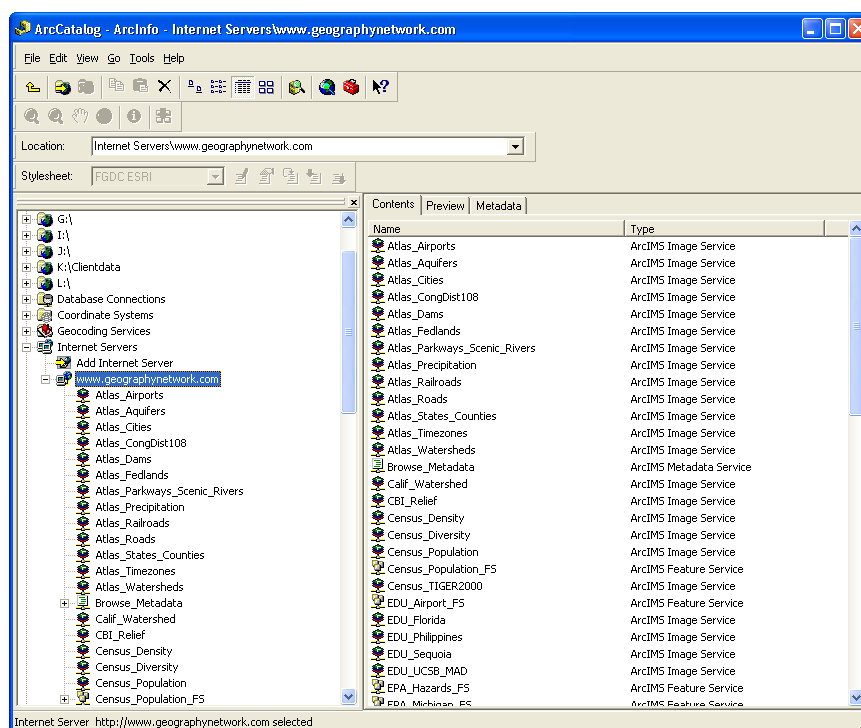
Some other datasets that are available through the ESRI site for free or at a low cost include:

- US Road Data
- US Digital Imagery
- US Flood Data
- US Environmental Data

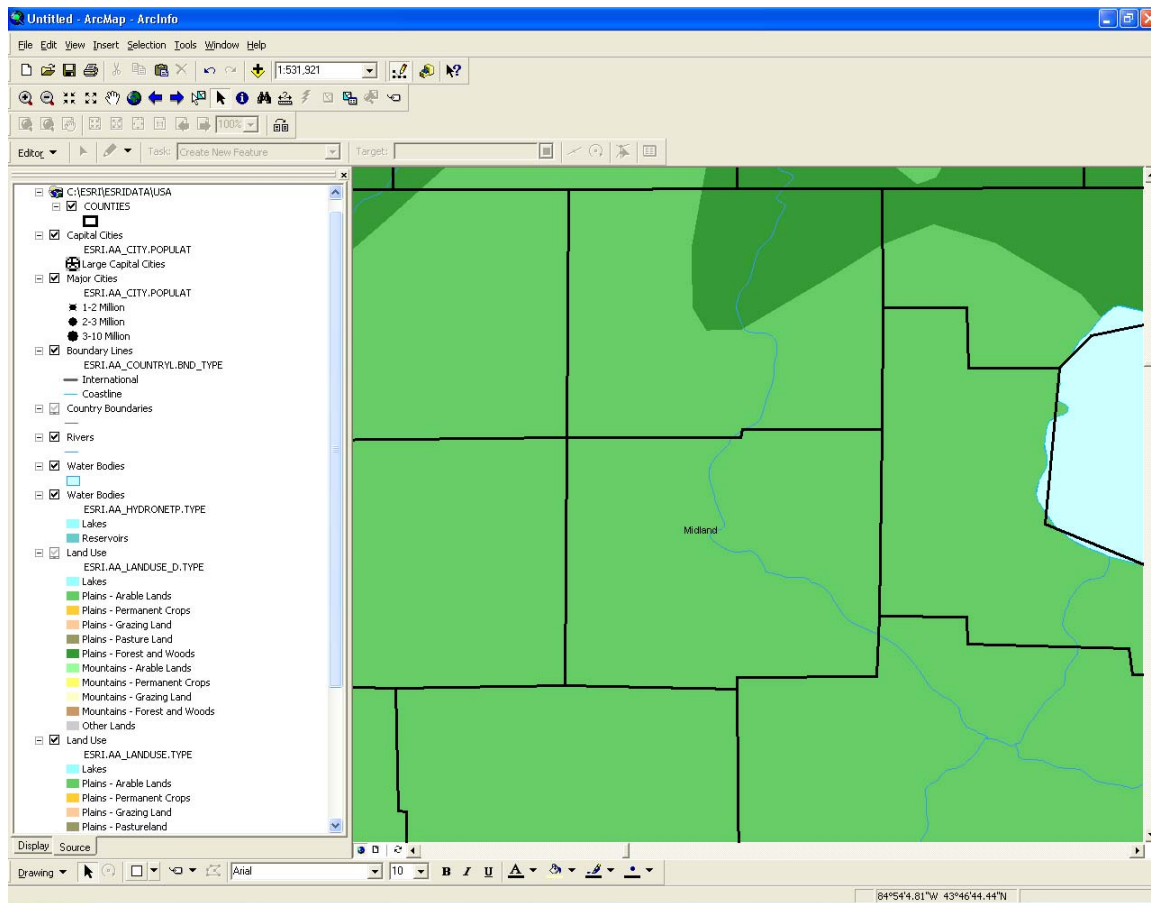
The Geography Network (www.geographynetwork.com)

The Geography Network is a global network of geographic information users and providers. It provides the infrastructure needed to enable the sharing of geographic information between data providers, service providers, and users around the world. The Internet is used to deliver geographic content to the user's browser and desktop. Through the Geography Network, you can access many types of geographic content including live maps, downloadable data, and more advanced services.

The Geography Network content is distributed at many locations around the world, providing you access to the latest information available directly from the source. Along with the use of ArcGIS 9 the geography network allows direct connection to the data with out any downloading required.



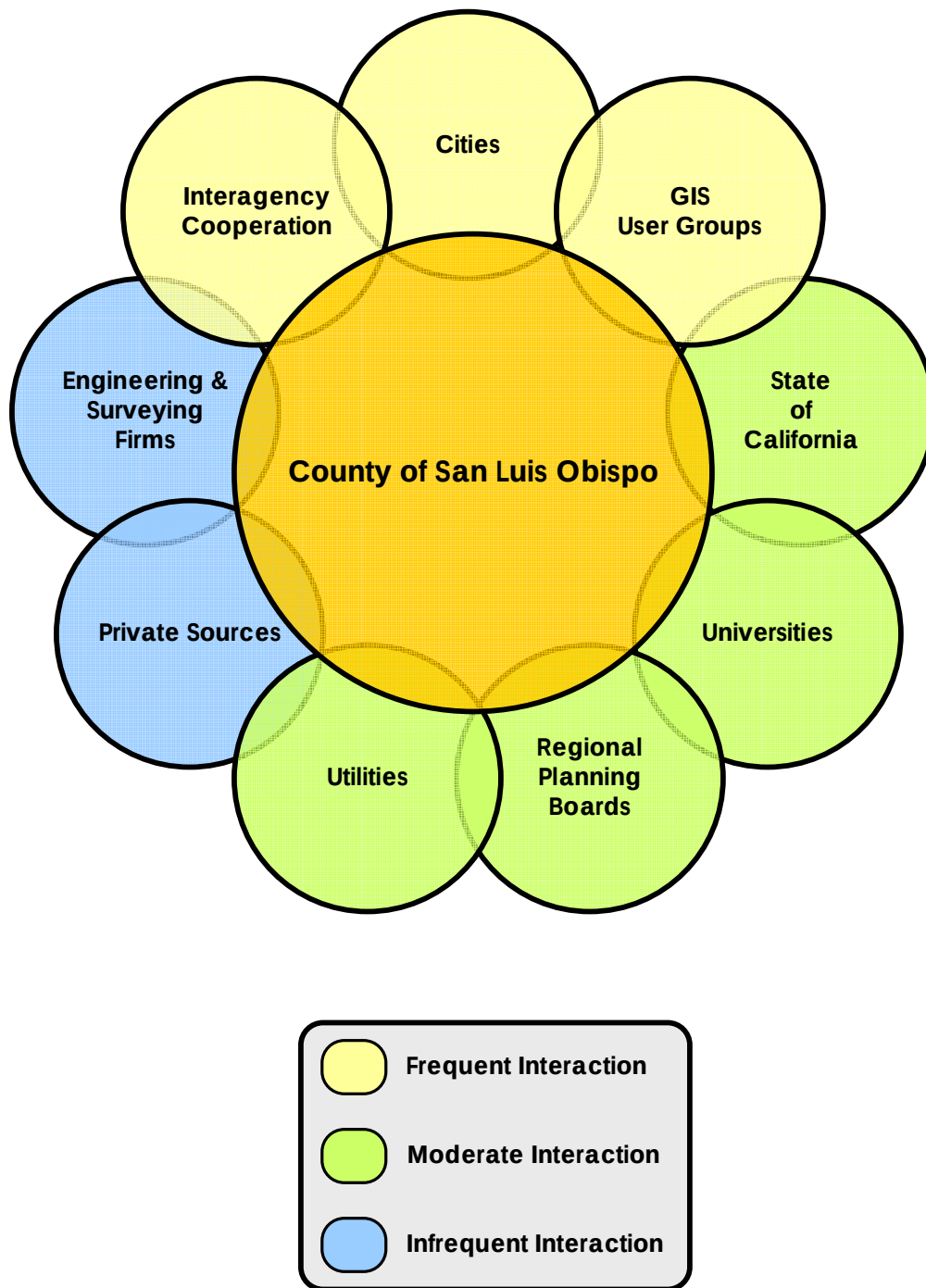
ArcGIS Live Connection to Geography Network Datasets in ArcCatalog



ArcGIS Live Connection to Geography Network Datasets in ArcMap

Summary

The County of San Luis Obispo's GIS implementation is multi-faceted, and its interaction with external organizations and entities will have a significant impact on this implementation. The County has the opportunity to foster greater communication and understanding with these organizations and entities about its GIS mission and objectives. In addition, as the County of San Luis Obispo's GIS utilization and expertise continue to improve, the County can lead and/or contribute to local and regional efforts aimed at improved data sharing, formal data standards, data processing and maintenance workflows, and spatial analysis. It should be noted that these entities are inherently inter-related, and existing interaction among these entities may be leveraged to establish interaction that focuses on GIS.



The County of San Luis Obispo's Typical Interaction with External Entities

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Seven Keys to a Successful GIS



Chapter 4: Seven Keys to a Successful GIS

Chapter Outline

Introduction

Key Number One - Have a Well Thought Out Enterprise Strategic Plan

Key Number Two - Have an Independent GIS Coordinator

Key Number Three - Show Success Quickly and Frequently

Key Number Four - Explain the Uses of the Technology Frequently

Key Number Five - Make it Useful and Easy to Use

Key Number Six - Delegate – Don't Do All the Work

Key Number Seven - Be Able to Explain and Quantify Costs vs. Benefits

Conclusion

Introduction

Growth in the use of Geographic Information Systems (GIS) technology over the past few years has been phenomenal. Organizations in the public and private sectors have been adopting the technology in droves. More often than not, however, these implementations have been less than successful. Too many organizations are spending millions of dollars on data, hardware, and software but getting very little return on investment. Is the technology to blame? Are traditional organizations standing in the way of progress? What can be done to reverse the trend toward failure? These are questions being asked frequently throughout the GIS community.

Meanwhile, in some organizations, this powerful new technology has revolutionized daily operations. Is there a common thread that successful organizations share? Fortunately, there is. In visiting and reviewing hundreds of GIS implementations nationwide, Geographic Technologies Group, Inc. has seen a few common elements surface in all successful GIS operations. These elements can be defined as seven keys to success. The absence of one or more of these keys will greatly reduce the effectiveness of an enterprise-wide GIS.

Adhering to the "Seven Keys to a Successful GIS" is critical and will make or break a project.

GIS implementation has the capability of completely changing the way a local government does business. Properly implemented, GIS will have a positive effect on how all services are delivered and how all employees perform their jobs. The twenty-first century will see GIS and information processing serving as the backbone for all local government activities. Implementation of a technology of this magnitude must not be taken lightly or implemented cavalierly.

What Is a Successful Enterprise-Wide GIS?

If reports from local governments are taken at face value, it would seem that no GIS implementation has failed. A local government that has invested in a GIS will almost always characterize it as successful. However, when pressed to qualify or quantify the success of the system, many can identify little benefit. Too often a GIS becomes an expensive mapping system fully implemented in only one department. Although mapping is an important part of a GIS, it is only one capability of GIS technology.

A truly successful GIS implementation harnesses the analytical power of the technology. An organization may have a wealth of compiled data but may not have an effective way of distributing or using it. The successful GIS breaks down barriers between departments and uses a combination of off-the-shelf and customized GIS applications to enable staff with varying levels of skills to use the technology to manipulate data.

The successful GIS breaks down barriers between departments and organizations.

For example, the City of Wilson, North Carolina, has more than 250 layers of GIS data. Trained personnel in each department maintain their own GIS layers. The data are available throughout all departments in the city. Products such as ArcView from ESRI are used in conjunction with customized applications written to perform a specific set of tasks - crime analysis in the police department, floodway management in planning, and pavement management in Public Works.

Thus, the defining characteristic of a successful GIS implementation is participation and use by all departments of the GIS technology. For instance, before a building permit can be issued, an inspector needs to know the location of gas, sewer, water, and electric lines; and information about historic properties, floodways, watersheds, zoning districts, etc. A GIS can pull this information into one easy-to-use interface for the inspector, but each department must maintain pertinent data in the GIS. Each missing layer of information makes the GIS less effective.

GIS is a unifying technology. Implemented properly, it will break down traditional barriers between departments. For example, the Louisville (Kentucky) Development Authority has a GIS that uses data from a variety of municipal departments (zoning, historic properties, sewer, water, tax parcels) for neighborhood development.

To summarize, a GIS needs to be viewed as another tool available to each employee. It should not be hoarded by one division or department but should be fully integrated, as are word processors, into all departments.

Key Number 1:



Have a Well Thought Out Enterprise Strategic Plan

Many GIS projects have failed due to a lack of planning and foresight. Many municipalities and counties have looked at GIS as just another computer program and have given as much thought to its implementation as they would a new word processor. These organizations' lack of insight has yielded them an unfruitful GIS and has cost their taxpayers dearly.

Successful cities and counties have recognized the potential of GIS and have harnessed its power by laying out a well thought out implementation plan. Any organization embarking on GIS should consider some of the key ingredients:

- A Steering Committee – *political strength*
- Top-Down Leadership – *secure funding*
- A GIS Champion – *at the policy level*
- A Technical Committee – *interdepartmental success*
- GIS Users Group – *open forum*
- An Independent GIS Coordinator and Staff – *serving all departments*
- Departmental GIS – *everybody responsible for own databases*
- Technical Standards – *accuracy and compatibility*
- GIS Staff development – *expanding staff roles*
- Systems Integration – *linkage and accessibility*
- Common Spatial Data – *interagency cooperation*
- Unified Approach – *a comprehensive departmental understanding*

We have all heard, “A failure to plan is a plan to fail.” This is never truer than with the implementation of GIS. Many organizations have been implementing GIS with little forethought. A typical scenario goes as follows. A department head attends a conference and sees an impressive GIS demonstration. This department head returns home and begins to stimulate interest in a local GIS. Funds are allocated, hardware and software are ordered, and a GIS is born—but without a detailed Enterprise Strategic Plan. This is a recipe for failure.

The Enterprise Strategic Plan: The County of San Luis Obispo contracted with the Geographic Technologies Group, Inc. to study and identify GIS needs and uses. This study will serve as an Enterprise Strategic Plan to guide the GIS implementation.

A good GIS implementation study and Enterprise Strategic Plan should address:

- Staffing (found in Chapter 5 of this document)
- Data needs (found in Chapters 11 and 13 of this document)
- Data acquisition and creation options (found in Chapter 13 of this document)
- Training and education (found in Chapter 8 of this document)
- Relationships with other organizations (found in Chapter 3 of this document)
- Hardware and software (found in Chapters 7 and 9 of this document)
- Infrastructure needs (found in Chapters 7 and 9 of this document)
- The role of the GIS within the organization (found in Chapter 5 of this document)
- Costs and benefits (found in Chapter 14 of this document)
- A five-year implementation schedule (found in Chapter 16 of this document)

A detailed, step-by-step process should be outlined for each of these issues. For instance, the plan for training and education should detail which classes each person needs to attend and when, what should be taught in-house, what training should be out-sourced, the benefit of each course, costs, and a list of trainers available to teach the classes. This plan should be specific.

Updating the plan. Keep the Enterprise Strategic Plan updated. Successful, mature GIS implementations continue to be guided by a Enterprise Strategic Plan. It is wise to update the GIS plan every year.

Conduct Surveys of GIS users anonymously to determine staff perceptions of its usefulness. No GIS is successful unless staff, throughout the organization, recognizes the usefulness of the technology and consider it an indispensable tool in their own arsenal.

Sharing the plan. The Enterprise Strategic Plan is of limited usefulness unless it is shared with all involved parties. Organization leaders, elected officials, and other pertinent staff should have a copy of the Enterprise Strategic Plan. It will serve as a guide for everyone using the technology and will invigorate the project. If the staff of one department sees how other departments are using the GIS, they will be more apt to make sure that their own department is not left behind.

Within the County, this document should be relied on to direct the day-to-day implementation of the technology, especially for the first year. However, this study should be looked upon as a living document that will evolve to incorporate the invariable changes that occur in local government. Also, new and emerging technologies will need to be considered as the phases of implementation unfold. It is therefore important to regularly update your master implementation plan. The County should update the plan on an annual basis.

A copy of the implementation plan should be given to all parties. These parties should be consulted for input into the plan. It is a good idea to get each department and participating organization to sign off on the plan, especially those parts that relate to them. This will serve a two-fold purpose. First, each department/organization will see that they are an integral part of the GIS implementation team and have a vested interest in its success. Secondly, each department/organization will have a good idea about the direction of the implementation.

Key Number 2:



Have an Independent GIS Coordinator

In the last section we looked at the importance of having an Enterprise Strategic Plan for the GIS program. This Enterprise Strategic Plan should clearly define the goals of the GIS project over a five-year period. Without this type of guidance, a GIS program can become like a rudderless ship, adrift and going nowhere. The Enterprise Strategic Plan serves as the rudder of the ship. However, the ship also needs a knowledgeable captain on board. All of the most successful GIS programs have a full-time project leader. Having this person or persons is the *most* important of the seven keys to GIS success because leadership can make or break the project.

The project leader is often referred to as the GIS Coordinator, GIS Coordinator, or GIS Director. Alternatively, project leadership can come from the combination of existing staff and an outside consultant. However this leadership is structured, you must have access to people with the technical savvy to run diverse operating systems, networks, and GIS software and the people skills to coordinate, sell, champion, teach, and referee the implementation of this revolutionizing technology.

Why a Full-Time Coordinator?

Do we really need a new position to run our GIS? Can't we just use our existing staff? In which department should we put our GIS Coordinator? How much should we pay? These questions are not to be answered lightly. Organizations have spent millions of dollars on GIS just to see the project fail because these questions were not addressed properly.

GIS projects are inherently complex. Decisions have to be made about hardware, software, networking, data standards, data sharing, data security, database design, data maintenance, data creation, priorities of data layers, training, programming, etc. Managing these tasks is the role of the GIS Coordinator and it is a time consuming task.

Where to Locate the GIS Coordinator?

It seems natural to put the GIS Coordinator in the department that seems to need GIS the most. When the GIS Coordinator is in a user department, that department invariably gets much better treatment than other departments. The GIS Coordinator is faced with a dilemma: “Do I work on the project that will please my boss, or do I spend my time helping other departments?” More often than not, the Coordinator will satisfy the boss. For example, a GIS Coordinator in the Planning Department will develop a comfort level with planning issues and will tend to gravitate to GIS activities that further planning goals. Other departments will soon feel isolated, grow resentful, and begin to lose interest in the GIS project. Support for the project as a whole will begin to erode. Instead of breaking down traditional barriers, this model tends to erect new ones.

For these reasons, the GIS Coordinator should be independent. Typically, the GIS Coordinator should be placed in one of three places.

- A division of Information Technology
- An independent department
- A position directly under the supervision of the County Administrator

It will be the recommendation of this Needs Analysis and Strategic Implementation Plan to locate and staff the County’s GIS Coordinator in the Information Technology Department (ITD), in order to operate independently within a department that interacts equally with all other departments and offices. (Further details can be found in Chapter 5: *Organizational Structure and Staffing*). The GIS Coordinator will be instrumental in spearheading the GIS effort. It is necessary for the GIS Coordinator to serve as the management GIS liaison/project champion.

Characteristics of an Effective GIS Coordinator

The ultimate success of an organization’s GIS will rest squarely on the shoulders of the GIS Coordinator. The successful GIS Coordinator must be several things:

Technically proficient but not intimidating. Today’s GIS Coordinator must understand a diverse range of technological issues—computer networking; operating systems, such as: Windows XP, WindowsNT/2000, Windows Vista and Linux; data exchange with midrange and mainframe computers; various GIS software; computer programming in different scripting languages; data conversion, etc. If the Coordinator does not have a tight grasp on the technology, the GIS will languish.

It is important that the GIS Coordinator not only know the technology but also to be able to share this knowledge with staff. The GIS Coordinator must determine each user's level of expertise and relate the technology in terms that each user can understand. The GIS Coordinator must also avoid confusing and frustrating users, or antagonizing them by engaging in technical one-upmanship.

A geographer. It is said that 95 percent of everything done in local government has a geographic component. The GIS Coordinator must understand geography and be familiar with proper mapping techniques and geographic constructs. A formal background in geography is desirable. An extremely competent computer person may fail as a GIS Coordinator because he or she does not understand geography.

A salesperson. "Be everywhere, do everything, and never fail to astonish the users." This spin-off of the Macy's department store motto makes a good motto for the GIS Coordinator. The GIS Coordinator has to become the champion of GIS in the organization. Whenever new technology is adopted, there will be skeptics. It is up to the Coordinator to quiet the skeptics and tout the benefits of GIS to the organization. The Coordinator should make sure that every department knows what GIS can do for it. Newsletters, presentations, informal conversations, and magazine articles should be used to educate users about the technology. It is important that the Coordinator has good people skills and be able to articulate the benefits of GIS. A good GIS salesman can quiet even the harshest of critics.

A diplomat. Diplomacy has been defined as the art of letting someone else have your own way. GIS will change the way your organization works. Whenever a revolutionary technology such as GIS is adopted, change will occur. Old, inefficient ways of doing business have to be evaluated and sometimes jettisoned. Often, this will not go over well with some staff. It is critical to be diplomatic in these situations. The Coordinator needs to make sure that no one feels alienated. If possible, it is best to prompt users into coming up with ideas on how to change their operation using a GIS instead of coming in and trying to force change.

To build a fully functional GIS, the Coordinator will have to ensure that all departments get involved and that data are shared between departments. Inevitably, departments will disagree on how GIS should be implemented. Such issues can drive a wedge between departments, and many organizations never get through this stage. It is up to the diplomatic GIS Coordinator to see that these issues are resolved in a manner acceptable to all parties. In Wilson, North Carolina, potentially divisive issues relating to accuracy

and cost of data to the public arose between departments. These important issues were met head on and resolved by gathering all involved parties before problems could occur. With the help of the Coordinator, the users came up with a mutually acceptable agreement.

What Should be Included in a Job Description?

A good job description for a GIS Coordinator should cover at least four areas:

General definition of the job. This section gives a brief overview of the position, where it will be located, who will be supervised, etc.

Typical tasks: This section will discuss specific tasks that are required, such as:

- Responsibility for the installation, maintenance, and upgrade of hardware and its operating systems (be specific about the hardware and software decided upon in your implementation plan).
- Provision of training for users in the organization.
- Establishment of database standards.
- Develop of plans and procedures for effective integration or transfer of GIS data from various sources into usable databases.
- Establishment of mapping standards.
- Maintenance of data security and integrity.
- Primary contact for user problems and vendor support.

Knowledge, skills, abilities. This section discusses the technical knowledge that the Coordinator needs to bring to the position. Specific software, programming, hardware, and database capabilities need to be covered.

Education and experience: This section talks about formal education and experience and could read as follows: “Any combination of education and experience, equivalent to graduation from an accredited college or university in computer science, geography, or related field and considerable experience in the use of geographic information systems.”

Key Number 3:



Show Success Quickly and Frequently

In the two previous sections, we analyzed the importance of having an Enterprise Strategic Plan and the critical need for an independent GIS Coordinator. The Enterprise Strategic Plan clearly defines the goals of

the GIS project, while the GIS Coordinator is instrumental in seeing that the goals are met. The Enterprise Strategic Plan serves as the rudder of the GIS ship and the GIS Coordinator is its captain.

A successful voyage requires that the ship leave port. Loading the ship with good for a GIS is the data creation phase. Data creation is necessary but should be viewed as a means of enabling GIS applications and products. Some projects have placed too much emphasis on the completion of GIS data at the expense of GIS products and, as a result, have never gotten under way.

Ironically, the initial phases of a GIS implementation are the most expensive and least glamorous. The most expensive component of a GIS is the creation of data. Some GIS project leaders have insisted that a host of GIS databases be fully completed before products are generated. Others have demanded that the GIS databases be excessively accurate before deployment —sometimes to within a millimeter when a few feet would suffice. Both of these scenarios kill the momentum of a GIS project. Months can turn into years as these databases are created. But if no products are being produced, leaders in an organization begin to question their investment in a GIS.

The ultimate success of a GIS is often decided in the first year of the project. There is a honeymoon period of a few months, but after that, decision-makers, under pressure to run government more like a business, need to see results. Products must be generated. Benefits must be quantifiable. Even successful GIS implementations can lose their momentum if staff rests on past successes.

Use Existing Data

Using existing digital data is a good way to get quick results from a GIS investment. A first step for any GIS should be to determine what useful data already exist. A local government may be able to create as many as 30 GIS layers from existing digital data.

Almost all engineering firms and surveyors compile data in a digital format that can be used in a GIS. Digital data for all areas of the United States and the world are becoming more plentiful every day. Almost all federal agencies and many state agencies are creating GIS data and offering this information to local governments for a relatively low cost, or free through the Internet. Private companies create digital GIS data to sell or for their own uses. The Federal Geographic Data Committee (FGDC) coordinates the sharing of geographic data, maps, and online services through an online portal, www.geodata.gov that searches metadata held within the NSDI Clearinghouse Network.

A few issues need to be considered when a local government acquires data. Scale and age of the data, format of the data, and transfer media can all affect usefulness.

Scale. Federal and state data are often created for national and/or regional studies. Therefore, the positional accuracy of the data may not have been a high priority. There has been a national push for metadata (i.e., information documenting the source, scale, accuracy, etc., of digital data), and many federal and state agencies have been meticulous in their efforts to document the scale of their digital data. However, it is the responsibility of a local government to determine whether the scale and accuracy of available data are suitable for local needs.

Once data layers are in a GIS, they can be displayed at any scale, so it is important to make sure that the scale and accuracy of acquired data are not abused. If data collected at a 1:100,000 scale are displayed at a scale of 1:1,000, unsuspecting users will assume, incorrectly, that the displayed data are accurate. This can be a dangerous and costly assumption when the data are used in life-and-death situations or to support financial decisions. The solution is to carefully document the scale, accuracy, and source of all data entered into the GIS. This information should be included on printed maps and distributed with all data transactions.

Age. You need to find out when data were compiled and whether they are obsolete. Most city and county governments deal with rapidly changing populations and infrastructure. Data that are a few years old are usually of little value for local government operations.

Format. If you find that useful digital data exist, the next question should be: In what format are the data available? Few standards exist in the GIS industry: different GIS software packages use different data formats. Therefore, you must determine what data formats your GIS software can interpret and which are preferable. Although some leading GIS software packages can interpret a plethora of data formats, many of these formats require additional manipulation of data to make them usable. **It is recommended that the County continue to utilize Environmental Systems Research Institute (ESRI) products for their GIS (more information on this recommendation can be found in Chapter 9: *Enterprise Wide Applications*).**

Sometimes you don't have a choice. Many federal agencies distribute data in formats created specifically for their own projects. Also, federal agencies feel compelled to provide data in a generic format so as not to favor one software company over another. This is often to the detriment of the user community. For instance, the U.S. Bureau of the Census creates extremely valuable GIS-ready databases from the census, but in an effort to distribute their data in a vendor-neutral format, they have created data files that are cumbersome and difficult for the average user to interpret. Modern GIS software, such as ArcGIS 9, is fully capable of converting most spatial data formats into optimal data formats.

Transfer media. Once you have found useful data in a usable format, the next question is: How am I going to get this data into my computer? No standards exist for data transfer. Until recently, most geographic information systems resided on UNIX-based computers. A variety of transfer media were available for most UNIX-based systems: diskette drives, CD-ROM drives, 8-mm tape drives, or 4-mm (DAT) tape drives. Now GIS technology is moving rapidly to the personal computer. No standards exist here, either. Many people use CD-ROM and ZIP drives to transfer their data from PC to PC. Increasingly, GIS data are being transferred via the Internet. This eliminates any concern about compatibility of tape drives, but many organizations are not yet Internet-savvy, and much information is not available over the Internet. **The County should adopt the County's internal network as the transfer media of choice, where possible. Large datasets may be burned to CD-RWs or DVDs (if available) and distributed between departments. (See Chapter 12: - Data Standards and Transfer Mechanisms).**

Showcase Your Progress

Many GIS Coordinators make the mistake of assuming that building the GIS database is too mundane an accomplishment to share with others. They forget that in an organization that is just beginning to use computers extensively and has been using only paper maps, digital plotting of maps is a noteworthy event. People are amazed as they watch a map of their city or county being electronically created. Digital mapping is commonplace to a GIS Coordinator, but to staff new to the technology, it is an impressive capability.

Share your new maps with others. Print maps that show the creation of new GIS layers. Take these maps to staff meetings and to the different departments, and let them see the results of the data entry process. They will be more patient if they see steady progress.

Show Success Continually

An organization that has a mature, successful GIS has to guard against staff complacency and myopia. Traditional GIS staffing structures do not allow much room for growth and advancement. Routines are established, and the desire to find innovative uses of the technology can wane. GIS staff may find themselves doing the same kind of tasks over and over.

It is important to allow GIS staff to work on a variety of projects. This keeps the job interesting, broadens staff perspective and experience, and fosters innovative uses of the technology. Staff becomes more creative and more effective. New uses of the technology should be showcased and shared with the rest of the organization. If the GIS is to continue to be useful to the organization, all staff must continually be reminded about the powerful tool they have available to them. If months go by and no new GIS products and uses are shared, staff begins to lose interest in the system.

The success of a GIS project is often determined within the first year. Many people within the organization will get their first look at the GIS in year one and will be looking for some tangible results. Presentation should be made to staff. It is crucial that the GIS team show even modest results. It is a good idea to produce maps showing the progress of the project. As base maps are created for the GIS, maps of the area should be printed and shared.

The GIS team should always strive to deliver what the users ask for. However, if they absolutely cannot deliver they should explain why it isn't possible. The success of an organization-wide GIS depends on participation and adoption by all departments. Therefore, the early perception of GIS as a useful tool is imperative.

Key Number 4



Explain the Uses of the Technology Frequently

In the last section we looked at the importance of producing products early in the life of a GIS. Support for a GIS is product-driven. Early results show an organization that the investment in the technology is worthwhile. Also, we examined the need to continually develop new and innovative uses of the technology. Early success will soon be forgotten if not followed by a continual stream of new products.

This section focuses on the connection between the delivery of successful GIS products and the recognition within the organization of specific needs and uses for the GIS. GIS projects are not successful unless they meet a specific need or solve a specific problem. A fully integrated GIS is considered a tool by all departments in an organization. For a department to consider GIS as a problem-solving tool, an education process has to occur. Lack of knowledge about the capabilities of GIS is one of the major reasons that the technology is underutilized in some organizations. It is critical to the project's success that the GIS Coordinator and other GIS staff explain the capabilities of GIS frequently in a variety of venues.

Users need information about how the technology is being used specifically in their field.

Although formal GIS hardware and software training is important, it is often less than effective for educating an organization about the usefulness of GIS. Users need information about how the technology is being used specifically in their field. Software training focuses on software functionality, usually in generic terms. Trainees who attend software classes can get a good understanding of how to make the software operate but still not understand how they can apply it to their own tasks.

There are many teaching methods, in addition to formal training, that need to be used throughout the life of a GIS project to educate an organization about the potential uses of GIS technology. The education process is

continual. Like all other technologies in the computer age, GIS is changing rapidly. New functionality is being released every few months. GIS technology has moved to the desktop. A few years ago a high dollar workstation was required to run a GIS. Today anyone with a relatively new personal computer can harness the power of a GIS.

The old paradigm of training an elite few GIS gurus is giving way to the need to train a majority of the organization. The user friendliness of GIS technology has increased dramatically. Easy-to-use, point-and-click, menu-driven interfaces are being implemented on PCs throughout organizations. Now most if not all employees must be aware of an installed GIS and what it can do. In this section, we will take a look at the various methods of educating your organization about GIS.

GIS Steering Committee

The current GIS Steering Committee (expanded to include all departments) should be utilized to guide the overall use of GIS throughout the organization (recommendation found in Chapter 5: *Organizational Structure and Staffing*). Optimally, this Committee is formed before the first piece of hardware or software is ordered. The Steering Committee should consist of upper management and high-level GIS staff. A person from each major department or division within the organization should be on the committee. This Committee ensures that the GIS is being implemented throughout the organization and that the departments in greatest need are phased in first.

A GIS Steering Committee provides the critical high-level commitment to the investment in GIS. Each member will gain an understanding of the technology and feel some ownership in the project. These high-level allies will be indispensable during budgeting, and each will serve as a champion of the technology within his or her own department. They will see the benefits of the technology and push for its implementation. At the onset of the GIS implementation, this committee should meet at least every two months. As the project matures, twice a year should suffice.

Formal Training

Technical training on GIS hardware and software is critical, but hardware training is becoming less of an issue as the UNIX workstations that were the main platform of the GIS industry throughout most of the 1990s gives way to the personal computer. Hardware maintenance and upkeep is falling to the traditional personal computer support services group, usually in the data processing department. The GIS user will only require training on the GIS software he or she will be using.

Over the years, GIS software has evolved into three distinct tiers each requiring different levels of training and licensing (See Chapter 8: *GIS Training and Education* and Chapter 9: *Enterprise Wide Applications* for a further breakdown of training and licensing issues).

Tier 1—Flagship GIS. Tier 1 is the full flagship GIS product for the GIS power user. When a special project requires the use of a tier 1 GIS product, depending on the editing level of the user, ArcInfo or ArcEditor 9.x should be used. These software applications have all of the functionality afforded by GIS. The cost of ArcInfo is approximately \$7,300, and ArcEditor is approximately \$5,700. Training at this level is usually acquired from a GIS software company, ESRI, or from authorized vendors. A two-day overview of ArcEditor 9.x will cost approximately \$900 per student and then followed by an advanced level three-day course costing approximately \$1,350 per student (discounts are available for group training).

Tier 2—Desktop GIS. The second tier is the desktop GIS product. This product delivers many of the often-used functions of the flagship product. The desktop GIS products recommended for the County are ArcEditor or ArcView 9.x. This software will run on a standard personal computer (650 MHz Pentium or higher, 256 MB RAM). This level of software is robust, provides much GIS functionality, requires at least a moderate level of computer expertise, and requires the user to make many decisions about how to derive a product. ArcView 9.x has the same user-interface as ArcEditor 9.x, but with less functionality. The cost of ArcView 9.x is approximately \$2,800 for a concurrent license. Because they share a common interface, training for both ArcEditor 9.x and ArcView 9.x can be conducted concurrently, under the umbrella of ArcGIS. A two-day overview of ArcView will cost approximately \$900 per student and then followed by an advanced level three-day course costing approximately \$1,350 per student (discounts are available for group training).

Tier 3 - Customized GIS. The third tier of GIS has just recently arrived on the market. GIS technology has steadily moved to a more open environment. This means that standard programming languages, like Microsoft Visual Basic (VB), can be used to create customized GIS interfaces that are project specific. This tier is the easiest to use. The interface is designed to perform a specific task. Intuitive push buttons and menus are used to make the application foolproof. An hour-long training session for one of these interfaces should suffice. A good user's manual or online training could substitute for formal training.

A programmer has to write the customized interface for a particular task. Many products are being developed to meet the needs of local government. Organizations have the option of hiring a programmer to create these interfaces, purchasing off-the-shelf products, or contracting with a GIS consulting firm to create custom interfaces.

An organization-wide GIS will require that all three tiers of GIS software be deployed, depending on the user and purpose.

Newsletters

An invaluable tool for educating an organization about GIS is a newsletter. The newsletter should have articles describing how the GIS *is* being used within the organization, how it *can* be used within an organization, and how other organizations are using the technology. This will give users ideas about how they can use the technology. Highlighting successful uses of GIS within the organization will make non-users ask how they can benefit. Also, a newsletter gives users recognition for their hard work and ingenuity. Others want to create a noteworthy project of their own so that they, too, can receive some notoriety.

In addition, the lead GIS person should share with staff throughout the organization pertinent articles from magazines, trade journals, and newspapers detailing the uses of GIS technology for all aspects of local government.

Users Group

A GIS Users Group should be formed in by County GIS using departments (expansion of current GIS Project Team as an example). The group should meet at least once a quarter. A users group is an excellent way for users to share their expertise and experiences. All users of GIS should attend these meetings. Each meeting should address the following topics:

- Current projects - Each department/ division should share the details of any GIS projects that are being worked on. Maps and data should be brought to show others.
- Upcoming projects - Upcoming projects should be discussed. Ideas on how best to accomplish the projects should be shared.
- Industry trends - New software releases, new hardware, and networking issues should all be discussed. This forum allows all users to stay abreast of the latest technology.
- New databases or changes to existing databases
- Upcoming GIS conferences and/or training
- A brief technical session - A user might conduct a brief how-to seminar on an aspect of GIS.
- Organizational and staffing issues
- Joint project initiatives
- New funding sources
- Other issues.

A users group will provide an excellent opportunity for communication among all GIS users in the area. It is a good venue for users to share their successes and failures. Duplication of effort will be minimized, and sharing of ideas and data will be optimized.

National Conferences

National GIS conferences are an excellent venue for staff to expand their base of knowledge. Major vendors conduct conferences, with sessions ranging from very technical to general. Software-specific training sessions, access to technical staff, and hands-on demonstrations make these conferences invaluable.

Others are not specific to any one software company: all software companies are invited to show their products. GIS experiences from all over the world are shared in various presentation formats, and technical workshops are usually offered. These conferences give an excellent overview of the GIS industry as a whole. A variety of GIS conferences are held nationally. Some conferences are software specific or industry specific. There is one major national GIS conference that covers the industry as a whole while trying to focus on issues pertinent to local government. The conference is:

ESRI International User Conference

August 4-8, 2008

San Diego, California

(<http://www.esri.com>)

One-on-One Meetings

The GIS Coordinator should meet periodically with department and division heads to discuss current uses and potential uses of the technology. Candid evaluations of progress will serve to keep GIS on track for each department.

Revisit the Enterprise Strategic Plan

It is critical to keep the GIS Enterprise Strategic Plan updated. Successful, mature GIS implementations still need the guidance of an overall Enterprise Strategic Plan. It is wise for GIS staff to conduct or contract a new GIS study every three to five years to evaluate the current status of the GIS and make recommendations for the next three- to five-year time frame. The updated document should be distributed throughout the organization. By highlighting successes and failures, an updated plan can spur on a department that is lagging behind. **The County should update their document annually.**

Key Number 5:



Make it Useful and Easy to Use

The easier a GIS is to use, the more it will be used. There are many options available to make a GIS user friendly. In fact, GIS information can be delivered throughout the organization via the Intranet and to the entire community via the Internet.

The first GIS programs had to have a few gurus on staff just to get off the ground and couldn't be accessed at all by most employees. However, GIS software developers were constrained by the hardware from making GIS applications more accessible. Until just recently personal computers did not have the processor speed to run a robust GIS package. GIS applications could only be run on expensive Unix-based workstations. With much more powerful and affordable hardware now available, the user interface can be customized to meet any need. Applications can be written to address specific tasks.

Given the current state of technology, a GIS should be deployed in three tiers throughout an organization (see Key 4 above and Chapter 9: Enterprise Wide Applications).

ArcGIS is a scalable system of software designed to meet all Tier 1 and Tier 2 needs. Three different levels of ArcGIS are available: 1) ArcInfo, 2) ArcEditor, and 3) ArcView. Although licensed separately, ArcGIS is a scalable set of software with the same underlying executables and user interface. ArcInfo, ArcEditor, and ArcView can all be customized using VB, C, and many other popular programming languages within the ArcObjects object model.

Counties like Columbia County, Georgia, are deploying a GIS using all three tiers and concentrating on custom applications. Columbia County will be deploying a "generic data browser" that will allow citizens, elected officials, and anyone with a personal computer to access a wealth of information.

The interface for open GIS applications is very specific. The user has very few decisions to make and can get to data contained in the GIS quickly and efficiently. Narrow applications can be written for each department. For instance, in Boynton Beach, Florida, one application is being written to allow employees to track and query citizen calls and complaints through an easy-to-use interface.

The open programming interface opens the GIS door for any application developer in any industry. No longer is GIS development the domain of an elite few GIS gurus. Now any programmer adept at a standard programming language can embed GIS functionality in applications to be used by anyone throughout the organization.

The Internet and Intranets

As part of this push to open GIS, GIS software companies have developed tools that allow organizations to put their GIS data on the Internet. Cities and counties throughout the U.S. and the world are deploying GIS applications on the web, giving citizens access to the investment made in data. All local governments will soon feel the pressure to put GIS data on the web if they have not felt it already. The County, via a third party consultant, has deployed a web interface that gives citizens access to a variety of data layers

A local government that has an intranet can deploy applications to be used by everyone on the network. **County GIS staff should be using these new tools for GIS deployment and should be moving geographic-based data to employees and citizens alike (see Chapter 9: *Enterprise Wide Applications*).**

Key Number 6:



Delegate - Don't Do All the Work

Thus far we have examined the necessity of creating a Enterprise Strategic Plan, appointing an independent GIS Coordinator, showing results early and often, explaining the capabilities of the technology, and making GIS useful and easy to use. All of these are important for the success of an enterprise-wide system. Many organizations address these issues but ignore the critical issues of staffing and workloads associated with the implementation of GIS. Too many organizations have made the mistake of thinking that existing staff can integrate GIS into their daily routine without the leadership of a GIS Coordinator or a consultant. As we noted in Key #2, the absence of GIS leadership makes the creation of an enterprise-wide GIS a veritable impossibility. However, the presence of a GIS leader, no matter how talented, does not ensure the viability of GIS throughout the organization. All too often the GIS leader is seen as the only person that needs to be doing GIS for the organization. In order for the enterprise-wide GIS to flourish the organization must realize that some GIS responsibilities must be delegated to existing staff.

You Cannot Do It Alone

It's a typical day in the GIS center: Planning needs the zoning map updated as soon as possible. Public Works wants a program written for stormwater modeling. The new personal computers have arrived and must be networked and given GIS capabilities. The attributes for the tax parcel database need updating. The Sheriff's department has asked for help to create maps and do some analysis on a rash of criminal activity. Four new subdivisions have been approved, which means a host of GIS layers must be updated. CAL FIRE-San Luis Obispo County Fire wants to know where to locate their new fire station. Elected officials are demanding updated district maps for the upcoming elections. A local surveying firm needs a few GIS layers converted to a CAD format. Citizens are lined up at the door wanting maps from the new mapping system.

Clearly, the workload has become unmanageable for one person. The answer is to distribute responsibilities throughout the organization.

One person cannot create and maintain an organizational wide GIS alone. One person may be able to create a rudimentary GIS that functions reasonably well for one department with other departments deriving minor benefits. However, a fully functional GIS pervades the entire organization. Every staff person should utilize GIS data and products. Some staff will need GIS more than others.

Many organizations have erroneously looked upon the GIS Coordinator or a consultant as the sole GIS provider. Local government has traditionally been very regimented. Utilities took care of water and sewer, Finance took care of billing, Planning took care of zoning, etc. Everyone had their own tasks and there was very little overlap. Even IT was given the specific task of keeping the computers and computer programs running. IT often became one of the most isolated groups. GIS cannot function properly if forced to fit into this traditional structure. GIS is a unifying technology that has at its core, cooperation by departments throughout the organization. GIS penetrates traditional barriers as departments rely on each other for up-to-date information and the sharing of expertise.

Make Sure That Each Department Has GIS Expertise

Each department that will be utilizing GIS frequently (more than once a month) will need to train staff. This training can be conducted in-house and/or it may be done in formal training sessions. It is imperative that each department develops their own expertise. GIS should be seen as another tool for existing staff to utilize to assist in their daily tasks. It should be looked upon as an indispensable tool, like a word processor or a spreadsheet. It will be the responsibility of the GIS Coordinator to get the proper level of GIS tools to each staff person. There are a variety of GIS software products available that range in user sophistication from the GIS novice to the GIS expert (see Key 4 and Key 5 for discussion on the three tiers of GIS). Appropriately deployed, these products will allow GIS work to be conducted and GIS products to be produced by each department. Some departments will embrace the technology immediately and train staff accordingly. Other departments will hold out and try to push their own GIS work and needs onto other departments or the GIS Coordinator. There comes a time when these resisting departments must operate on their own. It may require the GIS Coordinator to draw a line in the sand and let the offending department director know that any further GIS work for the department will require its staff's participation. The Coordinator must make it clear that he or she serves all departments equally. Doing all project work for one department severely limits service to other departments.

Utilize Existing Staff

It is not reasonable to think that each department could or should hire their own GIS staff person. Therefore, it is imperative to utilize existing staff to do the GIS work. The initial outcry from many departments is that their staff is already overworked and cannot possibly do any more. There may or may not be any truth in this assertion. Regardless, it is important to point out that after the initial time investment in learning the software that productivity should increase and decision-making should improve. GIS technology should be sold to these departments in terms of how it can save time, lives, and money. GIS should be presented as an indispensable tool that staff must utilize to do their job properly.

Key Number 7



Be Able to Explain and Quantify Costs vs. Benefits

No matter how well the first six keys have been adhered to, the GIS ship will be called back to port if those funding the project don't think it's worth the time and effort. Every GIS project must be viewed in light of how it will save the organization time, lives, or money. Christopher Columbus's voyage almost never was. They had to convince the decision makers that his undertaking would pay off with tangible rewards. The job facing a GIS project Coordinator is no different. Organization leaders, department heads, and elected officials demand that the value of each project be analyzed and quantified. Elected officials don't want to hear the nebulous assertion that a GIS will save the organization money. They want to see specific examples of how it will save money and they want to know how much. If a GIS is presented as a time saver, its proponents must be able to give specific examples and say how much time the technology will save on specific tasks. They must be able to explain how the GIS can save lives.

The GIS project leader is responsible for differentiating between what is "neat" and what is necessary. Hard questions need to be addressed. Why are we doing this? What current processes will a GIS application enhance or replace? What are the costs (database creation, programming, etc.) associated with the project? Who will actually use the output? What staff will be needed? These questions must be addressed again for each new project. It is good to evaluate all projects under the microscope of usefulness. Always be prepared to answer questions about why the GIS is a good investment.

This section provides a few examples of how GIS technology is saving time, lives, and money for local government (also see Chapter 14: *The County's Return on Investment*).

Saving Time

Public access tax application—Wayne County, North Carolina: Tax offices across the country are bombarded daily with questions from the public. Wayne County, North Carolina, is no exception. Citizens, realtors, lawyers, and county staff need pertinent information and maps of selected tax parcels (properties). Providing this information is a time consuming task for county employees. However, Wayne County has recently implemented a GIS application that allows a visitor at the public tax counter to look up a property by a variety of attributes, such as owner, address, or PIN (parcel identification number). Pertinent tax information and an area map are presented on the screen and easily printed. David Ward, Wayne County assessor, says that this application saves county staff many hours a week.

Configuring voting precincts—Wayne County, North Carolina. Wayne County's voters have been voting in 20 precincts for many years. Because of growth and shifts in population, the number of registered voters per precinct is highly unbalanced: in a recent election, a few precincts had more than 6,000 voters at the polls while others had only a few hundred. Many voters had to wait in line for up to three hours to vote. Wayne County has rectified this problem by using its GIS to create ten new precincts and reconfigure existing precincts. Now a maximum of 2,000 voters are assigned to a given precinct. This GIS application saves citizens time and frustration and encourages them to vote.

Welfare reform—Forsyth County, North Carolina. Forsyth County, North Carolina, Department of Social Services (DSS) is implementing GIS tools to track the location of day care centers and potential employers. DSS staff can enter the address of a welfare recipient seeking employment and within seconds identify bus routes, potential employers, and day care centers that are suitable for the applicant. This GIS tool saves vast amounts of time for DSS staff and allows them to serve clients in a way previously impossible.

Other timesaving examples:

- Oakland, California, provides tax data and maps on the Internet.
- Bellevue, Washington, uses a GIS to automate the process of notifying property owners before beginning street improvement projects.
- *Goldsboro, North Carolina, uses a GIS to create letters of notification to property owners within 300 feet of a rezoning. Creating the letters, which used to take approximately three hours, now takes five minutes.*

Saving Lives

Hazard mitigation—Morehead City, North Carolina. Morehead City, North Carolina, has frequently felt the wrath of hurricanes, but planning for such natural disasters is an inexact science. Where development should be allowed? How much time do we need for an evacuation? What areas will be

flooded by a hurricane? How do we best locate infrastructure after a storm? These are all questions that staff at Morehead City have to grapple with. Linda Staab, planning director for Morehead City, recognized the usefulness of GIS technology for answering these questions. With funding from CAMA (Coastal Area Management Act), Linda spearheaded the development of over 75 GIS data layers for all the communities in Carteret County. Twelve agencies have access to this GIS data, GIS software, and customized applications for emergency preparedness and hazard mitigation.

Crime analysis—North Carolina Governor’s Crime Commission. There has been much speculation about the correlation between night crime and the location of streetlights. Many believe that areas that are well lit experience less crime. Using GIS technology, the North Carolina Governor’s Crime Commission worked with local communities to study the issue. One study showed that 82 percent of night crime occurred in non-lit areas. Armed with this information, a community can begin to justify the need for more streetlights in crime-ridden areas.

Fighting Crime – Pittsburgh, Pennsylvania. Fighting crime has traditionally been a reactive effort. Officers are seldom equipped with the information needed to head off crime as it surfaces. However, GIS technology is allowing the Pittsburgh police department (and many other departments around the world) to be much more proactive. Digital mapping is available to all officers in the department. Hot spots can be identified and mapped. For example, a GIS can analyze all types of crime for a specific geographic area (beat, response zone, etc.). If a significant increase in crime has occurred, an automated program can print maps and data or fax the data to the appropriate people.

Emergency dispatch—Kennebunk, Maine. Kennebunk, Maine, has a permanent population of 10,000 but the number of residents increases significantly during the summer months. Emergency calls are frequent and a GIS is used to handle them in a fluid and expeditious manner. The GIS is used to display a caller’s location and view the surrounding area. Also, the optimal path from the police or fire station is displayed to speed the arrival of help.

Other life-saving examples:

- Montreal, Quebec, uses its GIS to dispatch the closest ambulance.
- Greenville, South Carolina, uses its GIS for emergency evacuation.
- Los Angeles, California, uses a GIS for optimal response to earthquake damage.
- Salinas, California, uses a GIS to track gangs and gang-related crime.

Saving Money

Mapping flood zones and reducing insurance costs - Carteret County, North Carolina. Mike Adderton, Emergency Services Director for the coastal Carteret County, is a strong proponent of using GIS to save citizens money. He uses a GIS to map flood zones in conjunction with properties. As a result, the emergency services staff and local planning departments can notify property owners of their proximity to flood zones and their need for flood insurance. By mapping and managing flood hazards, the county expects to reduce flood insurance rates for the county, thus saving citizens money.

Relocating fire stations—Wilson, North Carolina. Wilson, North Carolina's fire department has a mandate to arrive at a fire within four minutes. In the early 1990s, city leaders recognized that the existing configuration of five fire stations could no longer provide this level of service to growing areas of the city. They assumed that a sixth fire station would have to be built. However, Randy Godwin, assistant fire chief, used the city's GIS to study the problem. Godwin and the GIS staff ran 40 scenarios in which some of the five existing fire stations were relocated and/or a sixth fire station was added. In each scenario, the GIS generated a four-minute driving distance from each fire station. It was found that the existing fire station configuration could provide four-minute service to only 85 percent of the city. However, relocating two fire stations brought 99 percent of the city's residents within the four-minute service areas and obviated the need for a sixth fire station. The city did not need to buy new pumper trucks and fire equipment, or staff a new fire station. City Coordinator Ed Wyatt noted that this one project saved the city more than two million dollars over a five-year period.

Economic development - Carson, California. Carson, California is not only saving money with its GIS but it is using the GIS to attract money by locating optimal sites for interested businesses or industries. Staff input parameters for desired size, zoning, cost, and other characteristics. Used in conjunction with census data, business license records, assessor records, and other GIS layers, the system's ability to make matches between business needs and available properties puts Carson on the cutting edge for business recruitment.

Other money-saving examples:

- San Diego, California, uses a GIS to plan new routes for public transportation.
- Albuquerque, New Mexico, uses its GIS to coordinate improvements to storm drains, streets, and parks.
- Birmingham, Alabama, uses a GIS to identify sites for potential industrial redevelopment.

Conclusion

Examples of how GIS technology is saving time, lives, and money are as numerous as GIS sites themselves. Case studies abound in GIS magazines and trade journals. GIS project Coordinators should study these

examples to find pertinent uses for their organizations. Be ready to quantify benefits when called upon. Guard against using a broad brush or speaking in generalities. Elected officials and organization leaders will demand to know what the quantifiable benefits of the technology are for your organization and if those benefits outweigh the costs.

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Organizational Structure and Staffing (Countywide Governance Model)

Chapter 5: Organizational Structure and Staffing (Countywide Governance Model)



Chapter Outline

Introduction

Enterprise-wide Organizational Models

County of San Luis Obispo GIS Organizational Structure

GIS Enterprise Staffing

Functional Areas

Hiring vs. Retraining

Position Classes

Salary Structures

GIS Organizational Structure Recommendations

GIS Coordinator Position in ITD

GIS Staffing Recommendations throughout the Organization

Model GIS Job Descriptions

GIS Steering Committee and Users Group

External Organizations

GIS Newsletter

Governance Model Case Studies

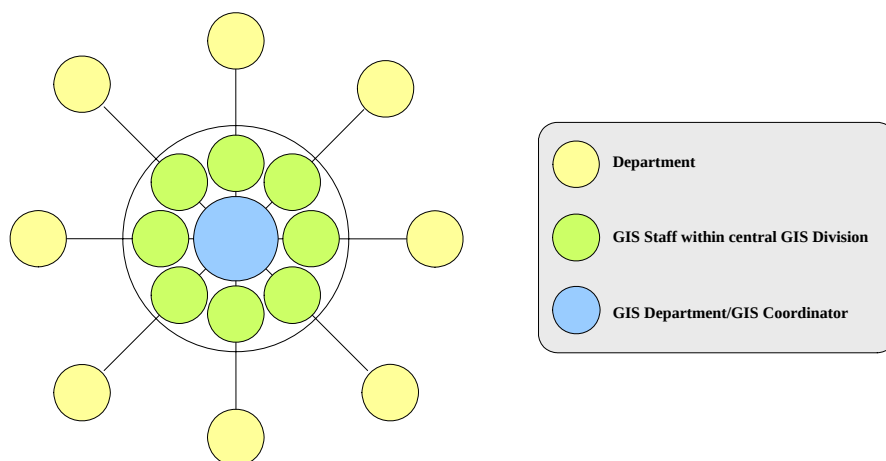
Introduction

Essential to the success of the County of San Luis Obispo's enterprise-wide GIS effort will be how GIS fits best within the current County organization. Proper governance of this enterprise-wide GIS will improve organizational effectiveness and efficiency, as well as generate a positive Return on Investment (ROI) that can be realized by both internal staff and the public. GIS implementation is largely a social and political process which has to be nurtured, cajoled, imposed, and controlled. A management strategy with supporting technical competence rather than purely technology driven is the basis for a successful governance model. GIS tools should not be simply expected to succeed because of their inherent potential, but rather a consequence of the strategies implemented by County leaders and key decision makers.

Enterprise-wide Organizational Models

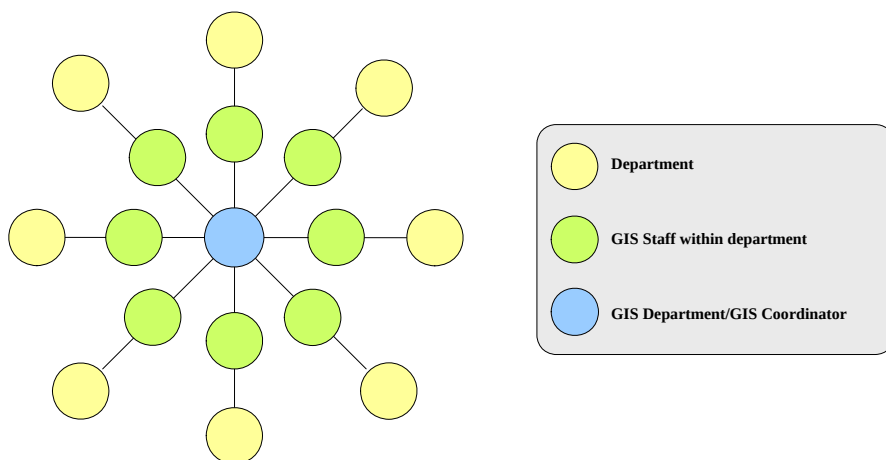
There are two primary organizational structures used to implement enterprise-wide GIS within organizations throughout the United States. The first type is a **centralized** structure. A centralized organizational structure maintains a central department or division that is responsible for all GIS services. In this type of structure GIS often has its own dedicated department or it is a division of an Information Technology (IT) or Technology Services department. The GIS department/division employs a cadre of management, analysts, technicians, and programmers tasked with hardware, software, application development, planning, and training. Data are

created and maintained by this group, or outsourced to contractors. All other participants are characterized as end-users, with only the capability to view, query, and analyze spatial data.



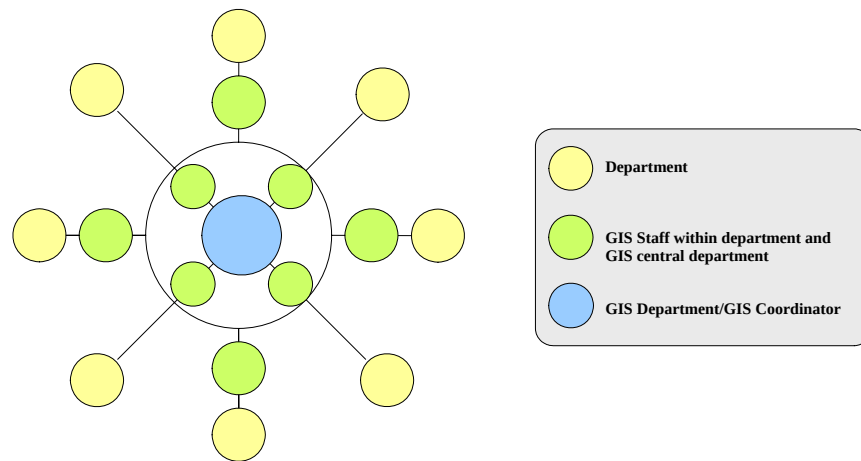
Centralized GIS Organizational Structure

The second type is a **decentralized** structure. A decentralized organizational structure divides GIS responsibilities throughout various departments. Decentralized organizational structures may still have a GIS section/division, operating independently or under the jurisdiction of another department. This approach divides system and data maintenance between the GIS section/division and departmental end-users. During their course of daily business, users update an enterprise database (e.g., using ArcEditor to edit data). All users share responsibility for maintaining the GIS, and users within each department maintain specific data according to their thematic disciplines and specialties. This type of organizational structure enables the GIS section/division to focus on hardware and software maintenance, data exchange and distribution, application/data design and development, user training and support, community extension, and technology innovation, instead of devoting time to the creation and maintenance of data.



Decentralized GIS Organizational Structure

Many local governments utilize a **hybrid** GIS organizational structure, based on centralized and decentralized organizational structures. This type of structure provides the benefits of both organizational structures in scenarios where full implementation of either organizational structure cannot be readily attained.



Hybrid GIS Organizational Structure

Definitions Summary of Organizational Structures

Centralized Organizational Structure:

All GIS tasks except data viewing and analysis are handled by a central GIS department or division. All GIS staff are located within the central GIS department or division.

Decentralized Organizational Structure:

GIS data updating and maintenance responsibilities are assigned to individual GIS-participating departments. Departments have their own GIS staff members.

Hybrid Organizational Structure:

GIS tasks may be handled centrally or at department level, depending on needs and available GIS staff at individual departments.

The table below summarizes the findings of twelve case studies. **The table illustrates that the preferred and recommended model for the management and governance of the San Luis Obispo County Enterprise GIS is the “hybrid” model.**

Organization	Key GIS Department	Governance Model
Athens-Clarke County, GA	Planning Department	Hybrid
City of Tampa, FL	IT Department	Hybrid
City of Charleston, SC	IT Department/Public Works Department/Utilities Department	Decentralized
City of Norfolk, VA	Public Works/Planning Department	Hybrid
City of Columbia, SC	IT Department	Hybrid
City of Baltimore, MD	IT Department	Hybrid
City of Charlotte/Mecklenburg County, NC	IT Department	Decentralized
City of Wilmington, NC	IT Department	Hybrid
City of Raleigh, NC	IT Department	Hybrid
City of Chesapeake, VA	IT Department	Hybrid
City of Hampton, VA	Engineering Department/Public Works Department	Hybrid
City of Roanoke, VA	IT Department	Hybrid
City of Orlando, FL	IT Department	Hybrid
City of Annapolis, MD	IT Department	Hybrid

Additionally, this table indicates that the Information Technology (IT) Department is the predominant choice for overseeing an enterprise-wide GIS initiative. There are exceptions to this pattern that indicate some organizations rely heavily on the Public Works Department or the Planning Department to spearhead their GIS initiative. However, GIS is becoming more technologically complex and thus IT centric.

County of San Luis Obispo GIS Organizational Structure

All of the County departments/divisions/offices will utilize GIS in various capacities. The utilization of GIS in the departments/divisions/offices will vary from consistent daily use to sporadic use every few weeks or months. In addition, the knowledge and understanding of GIS technology is also variable within and among these entities, such that there are GIS users from each functionality tier (i.e., Flagship user, Analytical user, and/or Browser user).

The heaviest GIS use, as identified in this document, will continue to be the Agricultural Commissioner, Planning and Building, Public Works, CAL FIRE-San Luis Obispo County Fire, Health Agency, the Assessor's Office, and within ITD with the recommended GIS Coordinator. However, all County departments will have access to GIS applications and data. The table below illustrates the County of San Luis Obispo's current utilization of GIS. It illustrates the current utilization of GIS by some departments, and the overall lack of current utilization by other departments.

Existing County of San Luis Obispo GIS User Profiles

County Department/Division	User Profile					
Administrative Office / Board of Supervisors	0	1	2	3	4	5
Agricultural Commissioner	0	1	2	3	4	5
Assessor's Office	0	1	2	3	4	5
CAL FIRE	0	1	2	3	4	5
Clerk Recorder's Office	0	1	2	3	4	5
Office of the District Attorney	0	1	2	3	4	5
Farm Advisor	0	1	2	3	4	5
General Services	0	1	2	3	4	5
Health Agency	0	1	2	3	4	5
Human Resources / Risk Management	0	1	2	3	4	5
Information Technology	0	1	2	3	4	5
Library	0	1	2	3	4	5
Office of Emergency Services	0	1	2	3	4	5
Planning and Building	0	1	2	3	4	5
Probation	0	1	2	3	4	5
Public Works	0	1	2	3	4	5
Sheriff - Coroner	0	1	2	3	4	5
Social Services	0	1	2	3	4	5
Treasurer / Tax Collector / Public Administrator	0	1	2	3	4	5
0 No/Little GIS Use						
5 Maximum Utilization of GIS Technology						

The basic context for GIS use within the County, as a whole, has incorporated mapping and limited spatial analysis. Each department has identified the need for a holistic coordination effort aimed at managing an integrated enterprise GIS. Assessment and evaluation of the existing GIS organizational structure and staffing is critical for establishing a viable and successful GIS Coordination effort.

Based on departmental interviews and information gathering, GTG has determined that the County currently has a loosely defined **decentralized** GIS organizational structure. This decentralized structure is based on a considerable amount of enterprise GIS work being performed by a few dedicated departmental personnel in multiple departments, and no formal GIS organization. Implementing an enterprise GIS at the County will require development of a formal organizational structure. This organizational structure is adequate to meet a limited set of GIS needs; however, this structure will benefit from the addition of strategic resources.

GIS Enterprise Staffing

Staffing issues will be critical to the success of the County of San Luis Obispo's enterprise-wide GIS effort. Staffing can also be a complex and frustrating issue. Budgetary and political realities within local governments place restraints on what can be accomplished. Ideal staffing structures are sometimes difficult to attain. Nonetheless, there are fundamental steps that the County can take to ensure a proper staffing foundation, which can be improved upon as time and necessity dictate.

The size of a local government organization plays a significant role in staffing issues. Based on this variability in needs, this document focuses on staffing issues related to counties similar in size to San Luis Obispo, whenever possible.

Functional Areas

There are six functional areas in which most GIS positions can be classified: *coordination, system support, application design, database support, user support, and production/data collection*. Not all organizations will have staff members in every functional area, and often individual staff members will have responsibilities in two or more functional areas. Individual job descriptions are provided later in this document. The County already has its own mapping job classification structure in place, and staff has submitted updated GIS job descriptions for review by Human Resources. Therefore, careful consideration will be needed when considering employees of a particular functional area to the proper job classifications.

Coordination: It is vital to the success of the County's GIS effort to have a GIS Coordinator. The GIS Coordinator is responsible for all resource and project coordination as well as the effective day-to-day operation of all GIS aspects. This includes hardware and software issues, database design and maintenance, technical support, and management of

the GIS support staff. A GIS Coordinator must have the technical savvy to run diverse operating systems, networks, and GIS software and the people skills to coordinate, sell, champion, teach, and referee the implementation of GIS.

System Support: System Support staff provides the necessary support to ensure that all GIS software, hardware, networks, and databases are properly implemented and working. Technical support for all GIS end-users is the responsibility of System Support staff. Systems Support within the County will be provided primarily by ITD; additional support should be provided by the GIS Coordinator who will ensure proper system knowledge transfer and training recommendations for existing ITD personnel.

Application Development (especially web or service based applications): Many larger organizations have their own GIS application development staff. Packages such as ESRI's ArcObjects allow for custom application development to suit individual department and enterprise-wide needs. Flagship and desktop GIS packages such as ESRI's ArcGIS allow customization of design and functionality. Recently, the development of a GIS-enabled web site has become an important goal for many jurisdictions. Primarily developed with ESRI's ArcGIS Server, these GIS-based web applications require staff for its creation and maintenance.

It is recommended that the GIS Coordinator determine if any application development efforts can be implemented in-house. Given the application development resources available to the County, it is expected that many application development initiatives will be outsourced on a project basis to qualified application development consultants or vendors. Equally important, the GIS Coordinator should ensure that out-of-the-box functionality or off-the-shelf applications will *not* meet the needs of user groups prior to making the decision to outsource development.

Database Support: Most GIS packages are designed to operate from commercial relational database management systems (RDBMS), such as Oracle, MS SQL Server, or MS Access. ESRI's ArcGIS uses a geodatabase model for data storage, retrieval, and editing from an RDBMS. This allows for the preferred creation of a central GIS data repository. It is imperative that knowledgeable staff are employed to implement and maintain the effective operation of the central GIS data repository. If a local government is already using a specific RDBMS enterprise-wide, it makes sense to use that same RDBMS for its GIS, as it ensures compatibility and easier integration.

Additional responsibilities of database support are the enforcement of GIS data structure and metadata standards (see Chapter 12: *Data Standards and Transfer Mechanisms*) for GIS-participating departments. Database support tasks can be conducted by the recommended Database Analyst (DBA) in ITD, or in the event a DBA is not staffed, the County's existing ITD staff in conjunction with the GIS Coordinator and outside consultants (as-needed) should establish a logical and physical model for a centralized geodatabase repository. Access to the repository should be based on network permissions and can be coordinated within ITD. Data permissions can be set within the data repository at the GIS Coordinator's discretion.

User Support: This is a very broad category, and encompasses both GIS-core staff and various departmental staff, depending on organizational structure. Generally, GIS Analyst, Technicians, and Specialists fall under the user support category. These staff members provide enterprise GIS activity support as well as support to departments beyond what existing staff requires. These staff members are very important during the first year of the enterprise GIS implementation. The quick success of the GIS will be greatly determined by the accuracy and usability of the analysis that is performed on the data collected during the first year.

A successful GIS effort must be results-oriented. Therefore, the expertise and quality of analysis conducted by user support staff are vital. It is recommended that the GIS Coordinator provide user support for those departments that he/she deems appropriate. As GIS usage grows throughout the County, the County may wish to hire additional GIS resources, such as GIS Analysts or Technicians on a department by department basis, or continue to utilize external consultants on a contractual basis to meet future GIS user support demand. The GIS Coordinator should have the system knowledge to tactically implement the user requests, and/or streamline and configure GIS workflows to meet the analytical needs of GIS users.

Data Collection/Production: A great deal of time and effort is spent by most organizations to develop accurate and effective GIS datasets. This data must be maintained properly for it to retain its usefulness. This is primarily the role of GIS Technicians, but could incorporate a portion of job duties of a department's in-house GIS "Flagship User". As GIS develops within an organization, new data will be collected and will need to be converted to adhere to data standards. Specific tasks such as digitizing, scanning, and metadata creation are also the responsibility of GIS Technicians, or GIS "Flagship Users".

It is recommended that additional data collection, production, and maintenance for new GIS datasets be coordinated by the GIS Coordinator; however, as personnel are trained and gain the relevant knowledge for data collection and production, some departments may engage in collection, production, and maintenance of datasets specific to their own needs (with guidelines from the GIS Steering Committee and GIS Coordinator).

An additional source of data collection and production could be provided by a formal internship program, interns could be provided by local Universities. Intern qualifications will have to be carefully screened to fulfill this role and ensure data accuracy and reliability. In some instances an external resource should be retained to collect and develop field data.

Hiring vs. Retraining

A fundamental question encountered by organizations during implementation of an enterprise-wide GIS is: “When should we hire additional GIS staff, and when should we retrain existing staff to handle GIS responsibilities?” The answer to this, in large part, depends on the existing status of GIS within each individual organization. Some counties, typically larger counties, will require GIS staff in several functional areas (outlined in the previous section).

There are two general categories for the hiring or retraining of staff. The first is core GIS staff. As outlined previously in this chapter, even decentralized GIS organizational structures require core GIS staff to handle non-department specific GIS issues. Many of the responsibilities of core GIS staff require specific knowledge of GIS and IT issues.

Staffing issues in GIS-participating departments are more complex when compared to core GIS staff. A primary reason for implementing an enterprise-wide GIS is to facilitate and improve existing business processes. A large organization utilizing enterprise-wide GIS will have more end-users of GIS than specific GIS staff. The majority of staff within GIS-participating departments will primarily utilize GIS data browsers. Although, basic GIS data browsing and querying require limited training, the functionality required for advanced spatial analysis, using robust applications such as ArcEditor or ArcView, is much more complex.

Individual departments will need to have staff with appropriate knowledge to effectively operate these applications. In general, it is easier to hire a professional for the required business function (such as engineer or planner), and train them in GIS, than it is to hire a GIS-trained staff member and train them for the required business function. In addition, professionals will have more intimate knowledge of the specific objectives and goals that they wish to accomplish.

As GIS within individual departments grows, it may be found that existing staff cannot handle all of the desired GIS analyses; under these circumstances, the hiring of additional GIS-specific staff should be assessed.

Position Classes

County departments need the flexibility to staff GIS positions at various levels of responsibility. Within each level of classification such as supervisory, analytical, and technical; there can be several specific position titles. One effective method is to differentiate position classes within position titles. For example, the general position “GIS Analyst” can be differentiated into “Supervising GIS Analyst” and/or “GIS Analyst I, II, or III”. Additionally, there can be two classes of “GIS Technician”, such as “GIS Technician I and GIS Technician II”. These position titles are only given as examples to fit the flow of this document, assigning specific titles should be at the discretion of the County and should be determined by current policies and procedures.

The reason for creating position classes is two-fold. First, it allows for greater flexibility. As GIS technology grows, and use within the County expands, job responsibilities may change. Position classes will accommodate any changes needed to adapt to changing responsibilities. Second, position classes allow for mobility and career potential. As specific staff members demonstrate initiative and capability, it is advantageous for an organization to offer upward mobility as an incentive to existing staff members to perform well and learn as much as possible.

Salary Structures

Equitable and consistent salaries for GIS staff and professional staff with GIS skills are important for the success of the County of San Luis Obispo’s GIS endeavor. Enterprise-wide GIS implementation can only be as successful as the people that supervise and operate it. Attracting and retaining qualified staff are inherently tied to the compensation that the County is willing to provide. It should be noted that public sector GIS salaries traditionally have been less than those obtainable in the private sector; accordingly, every effort must be made to make the County an attractive place to work.

Salaries primarily depend on two factors: market conditions and skill sets. Although every organization is unique, the County must ensure that salaries for GIS staff are in line with other organizations of equal size and structure. As aforementioned, it is expected that public sector jobs will offer less compensation than the private sector; however, the difference in compensation cannot be too great if the County expects to hire and retain qualified GIS staff.

Different functional areas require positions with varying skill sets. The GIS Coordinator is the most important position to the success of the County of San Luis Obispo’s GIS effort. It requires a broad knowledge of both GIS technical expertise and management skills. Proper compensation for this position should be of the

highest priority. Frequent turnover in this position can have disastrous consequences to the overall success of the GIS effort.

System Support, Application Development, and Database Support positions require personnel with advanced technical capabilities. These positions require knowledge of hardware specifications, networks, programming, and database administration. These same skills are also easily transferable to the IT sector, where salaries are consistently higher, both in the public and private sector. Salaries for these positions must be reasonably competitive with public sector IT positions.

User Support positions are occupied by full-time GIS Analysts and GIS Coordinators, as well as professionals with GIS skills. Full-time GIS Analysts and GIS Coordinators typically have bachelor's degrees at a minimum, and often they have graduate degrees. In many cases, GIS is not their only skill set – they learned it in addition to another field of study. Salaries must be in line with professional jobs in their area of focus. For example, a GIS Analyst in Public Works should receive a similar salary to an engineer in Public Works with similar education and work experience.

Department-specific professional staff positions that require GIS usage need to be addressed separately. Once GIS has been effectively integrated into the business processes of individual departments, employees with GIS skills become more valuable. Applicants with GIS skills should receive higher compensation than comparable candidates without GIS skills. Additional compensation should be dependent on the time and finances required to train an employee without previous GIS skills. It should be noted that time spent training is time that employees are not spending on their required job responsibilities. Current professional staff members that learn required GIS skills should also be appropriately compensated. Existing employees may be hesitant to take the time to learn these skills, as it will detract from their job responsibilities in the short-term. However, if GIS is effectively integrated into business processes, the amount of time spent training will be recouped by more efficient work facilitated by GIS. Additionally, employees become more marketable when they acquire new skill sets. In order to retain qualified staff that attains new marketable skills, it is prudent to appropriately compensate them.

Production/Data Collection positions can be difficult to properly staff. These positions (primarily filled by GIS Technicians) are primarily at the lower end of the GIS hierarchy. Nonetheless, qualified GIS Technicians are essential to GIS efforts. The work of a GIS Technician can be repetitive and uninteresting at times. The key to ensuring job satisfaction is to assign a variety of responsibilities, so that less satisfying tasks are interspersed with more challenging tasks. Effective production and data collection work requires knowledgeable employees. Although the manual tasks of digitizing, scanning, or GPS data collection are not terribly difficult during the actual performance of the task, prerequisite knowledge for proper setup, techniques, and post-processing is important. The County should utilize university students as interns or in

co-op positions (cooperative partnership positions) to supplement the work performed by the GIS Coordinator and GIS Technicians. This is mutually beneficial, as university students with GIS education have the background knowledge to successfully complete tasks, yet they are willing to accept lower salaries in return for gaining experience.

GIS Organizational Structure Recommendations

GTG recommends that the County move from its current decentralized structure and utilize and implement a **hybrid** organizational structure for its ongoing GIS effort. Interviews during the Needs Analysis portion of this plan served to identify a consensus among department staff for the need to staff a GIS Coordinator position along with several key GIS positions throughout the County.

A GIS Coordinator can identify, pursue, and foster strategic objectives that will allow the County to meet its short-term and long-term GIS goals and objectives. And additional staff will provide Countywide GIS data development and analytical tasks to the departments/divisions in which they are assigned. The GIS Steering Committee will work with the GIS Coordinator to strategically implement the enterprise GIS. The GIS Coordinator will work with the GIS Steering Committee to provide leadership and management in support of the County's long term GIS vision. The GIS Coordinator will initially support the basic implementation of the enterprise GIS in accordance with the County's GIS Strategic Implementation Plan; focusing on data development/conversion efforts, application connectivity, and centralized data management. As the basic system infrastructure is established the GIS Coordinator will assist and guide departments/Line of Business with their day-to-day, tactical GIS tasks.

It is recommended that the County staff a GIS Coordinator in **Year One** of the Implementation Plan to help support initiatives identified in this plan from the beginning of the implementation cycle. The position of GIS Coordinator will be responsible for supporting the County's enterprise-wide implementation of GIS by providing technical expertise, application development services, user support, data creation and maintenance for some departments, and developing map products. .

Organizationally, the GIS Coordinator position can operate in one of the following capacities:

1. Option 1 - In the Information Technology Department (ITD), as a Coordinator/Manager reporting directly to the ITD Chief Information Officer, and the GIS Steering Committee. In this scenario it is recommended that the GIS Coordinator report findings and key issues to the County Administration, at least in report form.
2. Option 2 – In the County Administrative Office, as a Coordinator reporting directly to the County Administrator and the Board of Supervisors. In this scenario it is recommended that the GIS Coordinator work closely with ITD in regards to all aspects of the GIS implementation.

3. Option 3 – In a heavy GIS using department such as Planning and Building, Public Works or the Assessor's Office. In this scenario the GIS Coordinator will need to keep County Management appraised of GIS progress and work closely with ITD to insure seamless integration.

Variables	ITD	CA/BOS	Other
Must be Allowed to be Autonomous - Serve all Departments Equally			
Needs Unfettered Access to Other Technical Staff			
Needs Quick Access to Decision Makers			
Needs to Spend More Time with Heavy Using Departments	 	 	
Needs Equal Access to Key Personnel in GIS Using Departments			
Must have Ability to Make Strategic Decisions for Countywide Issues			

ITD = Information Technology Department

CA/BOS = County Administration, Board of Supervisors

Other = Other Departments such as Public Works or Planning and Building

Based on the above table and experience, placing the GIS Coordinator in a GIS using department has more negatives than positives and therefore should be an option of last resort. Having the GIS Coordinator reside in ITD or within the County Administration Office provides San Luis Obispo County with balanced, unbiased approach to implementing an enterprise GIS. Both scenarios should work for the County; however, based on industry trends, the GIS Coordinator is found to reside most often within an ITD like department. This is especially true now due to the ever increasing complexity of the backend tools that have been incorporated into the latest GIS technology. The remainder of this document is developed presupposing that the GIS Coordinator will reside in ITD. However, if the County decides that the GIS Coordinator should reside within the County Administration's Office the following information will still apply.

GIS Coordinator Position in ITD

The GIS Coordinator within ITD would report directly to the CIO of ITD. ITD provides planning, direction, coordination and oversight of Countywide operations; as a focal point for the County's departments and strategic and tactical technology operations, the Department has visibility and exposure to the majority of existing and potential GIS users. In addition, ITD has frequent access and interaction with surrounding cities and other regional organizations that utilize GIS and potentially could provide the County with GIS data, such as LAFCO, SLOCOG, and other State, and Federal agencies.

Inclusion of a GIS Coordinator in ITD would provide a comprehensive foundation for coordination of efforts across departments as well as with other local organizations. In such a structure, the GIS Coordinator would work in a more independent capacity, with direction from and supervision by ITD and the IT-ESC, to efficiently and comprehensively expand GIS use across the enterprise.

Key advantages of the GIS Coordinator position in ITD include:

- Coordination of GIS efforts with Countywide goals and objectives
- Full integration with ITD services staff
- Administrative hierarchy is maintained by the ITD CIO
- Visibility into general support issues that may be complementary to GIS
- Close cooperation with all departments and external entities
- Independent prioritization of GIS projects and tasks (County Administrator/BOS and IT-ESC will have direct contact for prioritizing projects)
- Facilitated and timely transition of knowledge and protocols to other staff that will use GIS

Disadvantages of the GIS Coordinator position in the ITD Department are:

- GIS Coordinator may be too focused on tactical objectives and consequently may not have adequate time/resources to address strategic objectives.
- GIS Coordinator may lack sufficient access to political clout necessary for enterprise GIS implementation (requires more management involvement at IT-ESC level).
- Funding risks with implementing this position into a department that is under the General Fund

GIS Coordinator Responsibilities

Data content and metadata standards should be created and enforced by the GIS Coordinator. A central data repository (centralized GIS servers) should be created for all GIS data. This is especially effective with ESRI's ArcGIS software, which is designed to operate from centralized GIS servers, utilizing the geodatabase model.

The GIS Coordinator, in conjunction with other personnel that will serve as "GIS liaisons" from several departments, will be responsible for managing and coordinating data creation and maintenance of department-specific data layers, as well as establishing data integrity checks for critical enterprise layers.

Based on the resources available to the County, it is recommended that the GIS Coordinator serve as a project Coordinator for data development efforts. In addition, the GIS Coordinator will need to

provide data editing support for some departments. Additionally, the GIS Coordinator will facilitate the exchange of data with external entities that participate in mutually beneficial data sharing.

The GIS Coordinator will serve as the lead resource for identifying, evaluating, and procuring GIS applications for department-specific functions, as well as the County in general. It is recommended that the GIS Coordinator work in conjunction with the ITD CIO and ITD support staff with regard to application support and large-scale installations. The GIS Coordinator should ensure that application maintenance agreements be maintained between the County and the application provider. Other departments such as Public Works will play a vital role in data collection and data management efforts.

GIS-participating departments should have visibility, access, and significant input to the GIS Coordinator's application evaluation, as well as some authority to recommend new GIS applications for their own use. The GIS Coordinator will review all requests for compatibility and applicability with ITD personnel.

The GIS Coordinator should implement three levels of departmental support, depending upon the current level of GIS use and internal capabilities per department (these levels of support correlate to tiers of GIS utilization - GIS user tiers).

Level 1 – GIS Coordinator provides minimal support for department/division/office GIS activities, system and application support. The GIS Coordinator is used primarily for strategic and procedural support. Currently, this includes Agricultural Commissioner, Planning and Building, CAL FIRE-San Luis Obispo County Fire, and the Assessor's Office. As GIS becomes mainstream and more users are trained and become proficient, there exist the possibility of additional Tier 1 users in Public Works, Social Services, and ITD.

Level 2 – GIS Coordinator provides partial support for department GIS activities. A Level 2 department will do some data maintenance, but the GIS Coordinator will provide advanced support; the GIS Coordinator will also be responsible for advanced spatial analysis, geodatabase development (where/when applicable), and application development (e.g. SDE integration, GIS browser configuration, mobile application development). By the end of the first year of implementation, the District Attorney's Office, Probation Department, Health Agency, Clerk-Recorder, and General Services will receive Level 2 support.

Level 3 – GIS Coordinator provides all support for department/division/office GIS activities. The GIS Coordinator is responsible for data maintenance, complex data analysis, and

cartographic products. Most of the non-technical departments will require continued support from the GIS Coordinator. The Public Defender, Sheriff-Coroner, OES, Veterans Services, Library, Farm Advisor, Treasurer-Tax Collector-Public Administrator, and Human Resources are examples of level 3 users.

Over the course of the five year GIS implementation, each department/division should strive to achieve a lower level of support from the GIS Coordinator. Current departments that will rely very heavily on the GIS Coordinator (Level 3) should work towards a lower level (Level 2) of support status as GIS develops and is incorporated into their respective business processes. Level 1 support status will not be achieved until GIS users in a particular department are trained and use GIS tools on a regular basis. The first few years of implementation will be focused on enterprise initiatives that support the dissemination of GIS technology to the department level, so therefore, more users will have the ability to lower their support status as the County reaches full GIS implementation.

The GIS Coordinator should provide training and technical support for all enterprise-wide GIS applications. All GIS software training should be coordinated through the GIS Coordinator to ensure maximum efficiency and effectiveness at a minimum cost. In some instances the GIS Coordinator should organize and lead classes (e.g. new browser configurations or features). Additionally, the GIS Coordinator should document application configurations specific to personnel needs (e.g. modifications to out-of-box functions) so that self guided training and reference materials exist for all GIS supported workflows.

Not every department/division/office at the County that wants to utilize GIS is able to hire or convert staff to effectively handle the tasks of data analysis and data maintenance. The GIS Coordinator should continue to assist these departments with their GIS needs. However, as usage of GIS grows, the GIS Coordinator must encourage these departments to provide the necessary resources to handle the data maintenance responsibilities.

In conclusion, the way that GIS fits within departments and organizations is essential to the success of this enterprise effort. The County should implement and utilize a hybrid organizational structure. Having a GIS Coordinator is an important factor in regard to a successful GIS implementation. The GIS Coordinator should be utilized to direct the overall GIS efforts of the organization. The GIS Coordinator will provide technical expertise, training, and direction for all County staff. Working in conjunction with ITD, the GIS Coordinator can provide sound and sophisticated technical GIS services for the County. However, each department should continue to develop its own expertise and utilize GIS in its daily routine as the County's GIS implementation progresses.

GIS Staffing Recommendations throughout the Organization

Based on the departmental GIS Needs Analysis, an in-depth staffing analysis has been undertaken to ascertain the additional level of staffing effort necessary of each identified department within the County to initiate an enterprise-wide GIS effectively. The supplementary staffing identified in the chart below is in addition to the existing Tier 1 and Tier 2 users performing GIS duties throughout the organization today (or in some cases it could be a matter of realignment from part-time GIS status to full-time GIS responsibilities). The need for these positions has been identified in departments that do not have specific full-time dedicated staff to perform functional GIS duties within that department. In some cases these recommended positions may replace part-time staff members with full-time GIS positions. These additional positions will only serve to make the current GIS related positions play that more of an important role, especially the existing positions that serve in a supervisory role. GTG will make recommendations in Chapter 16: *Five Year Phased Implementation Plan*, as to the ideal and model recommended staffing level of these positions, as well as provide alternatives.

The initial reaction of many staff when implementing a new technology is that it will add significantly to their workload. In some cases this is true. However, in many cases GIS will yield a net reduction in effort required of existing staff. GIS staffing in some County departments are part-time positions and could benefit from additional resources. While some departments have existing GIS staff that perform a wide variety of GIS functions. The need for additional staffing can be addressed in a variety of ways, including:

- Create new positions and hire qualified personnel
Most departments will be able to utilize existing staff to meet their GIS needs. In some areas, new positions are essential to the long-term success of an enterprise GIS. If additional funds become available, it would be viewed as a strong recommendation to also create additional positions that are outlined also recommended.
- Realign existing personnel's roles and responsibilities into more specific GIS positions
Another possible model for the establishment of the recommended additional positions is to realign existing staff to perform the recommended GIS duties on a full-time basis. These positions could be department staff not functioning in a current GIS role (based on knowledge, skills, and abilities).
- Assign duties to existing staff, along with their current workload
In theory, some of these positions could be staffed by existing staff. The best scenario for this option would be to use part-time GIS staff to perform the necessary task until resources could be made available for full-time staff.

Each contributing department will be responsible for ensuring that their respective personnel work in conjunction with the GIS Coordinator and current GIS staff to meet GIS goals and objectives, as well as to follow GIS-related regulations and procedures. The following table summarizes the additional staff needs identified in Chapter 2: *Departmental GIS Needs Analysis*:

Staff Position	Department	Ideal Year of Staffing*	Notes
GIS Coordinator	ITD	1	Countywide GIS coordination.
GIS Data Base Analyst	ITD	2	Database administrator solely dedicated to GIS
GIS Analyst	ITD	4	As GIS usage grows at the County, there will be a much larger need for expanded support and technical assistance requiring additional staff.
GIS Analyst	Public Works	1	Manage department data, and data sharing efforts.
GIS Analyst	Social Services	3	Used to manage department shift to an ESRI platform, away from MapInfo.
GIS Technician	Public Works, X2	2,4	Day-to-day data collection and assistance with any outsourcing of GIS data collection, map production and support. Once initial data collection efforts are complete, one position could be shifted to different assignments.
GIS Technician	General Services, (Parks)	3	Users will perform analysis on data layers such as overlay, proximity, and clustering to utilize GIS to perform calculations and make assumptions from spatial data relationships.
GIS Technician	Social Services	4	Day-to-day GIS production.
GIS Technician	Clerk-Recorder	5	Needed for maintenance of department-specific data intended for cartographic materials used on a regular basis.
GIS Technician	General Services, (Building Services)	5	Same duties as Tech in Parks, could be a shared resource for the entire Department.
GIS Technician	District Attorney	5	Courtroom map display production, can rely on the GIS Coordinator until funding is available to staff department position.
GIS Technician	Probation	5	Possible shared position with other Public Protection Functional Groups (Sheriff, Public Defender, DA, etc). Needed for Crime Analysis, PIN mapping and detailed routing and spatial analysis.

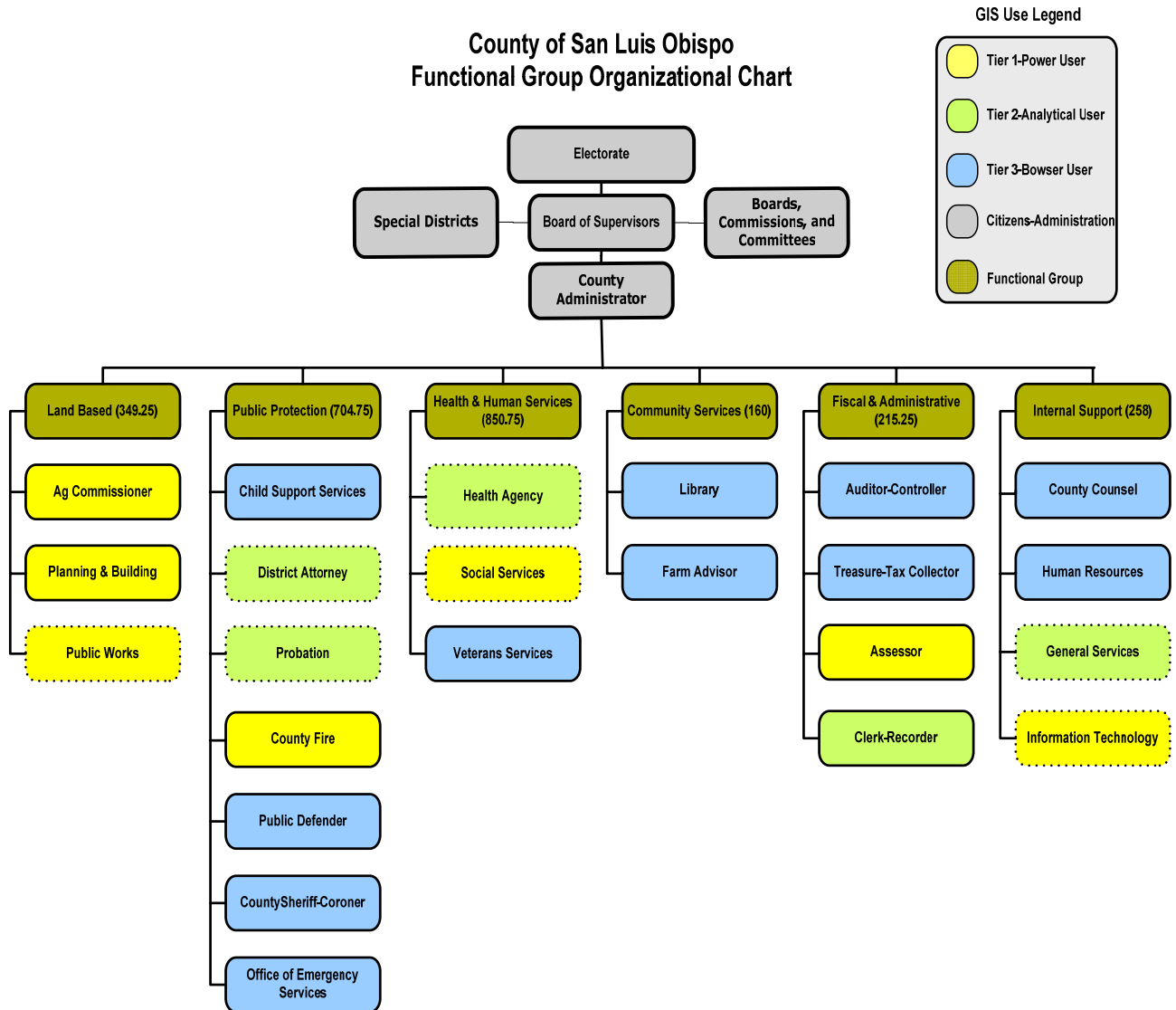
*GTG will make recommendations in Chapter 16: *Five Year Phased Implementation Plan*, as to the ideal recommended staffing level of these positions, as well as provide alternatives. Each department with recommended positions should also prioritize staffing levels.

The following table summarizes existing and optional recommended staff with some level of GIS responsibilities:

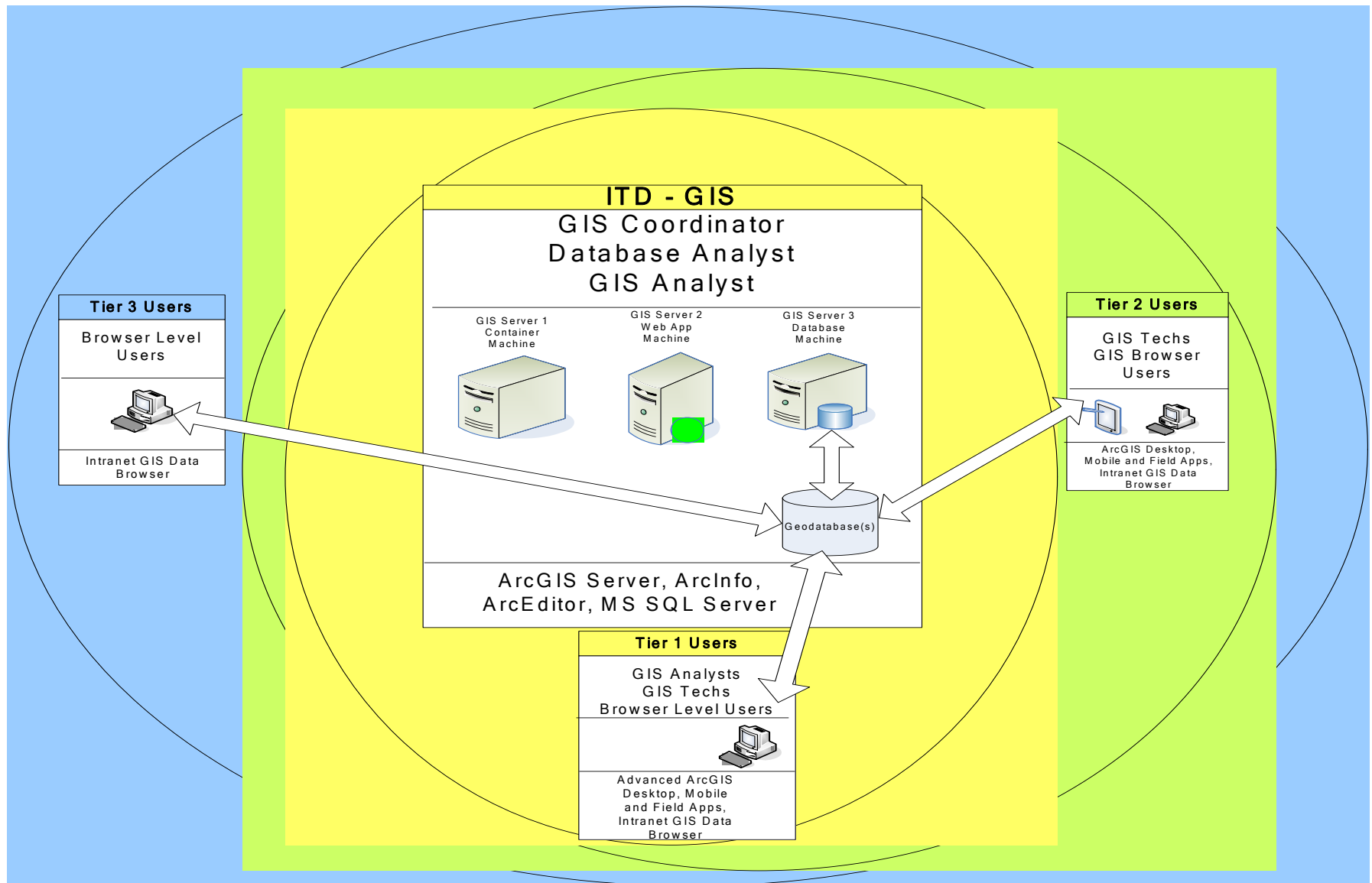
Department	New (optional)		Existing		Total (combination of optional positions and existing)
	Tier 1	Tier 2	Tier 1	Tier 2	
Administrative Office / Board of Supervisors	0	0	0	0	0
Agricultural Commissioner	0	0	1	3	4
Assessor's Office	0	0	5	0	5
CAL FIRE	0	0	3	1	4
Clerk Recorder's Office	0	1	0	0	1
Office of the District Attorney	0	1	0	0	1
Farm Advisor	0	0	0	0	0
General Services	0	2	0	0	2
Health Agency	0	0	0	2	2
Human Resources / Risk Management	0	0	0	0	0
Information Technology	3	0	0	0	3
Library	0	0	0	0	0
Office of Emergency Services	0	0	0	0	0
Planning and Building	0	0	4	3	7
Probation	0	1	0	0	1
Public Works	1	2	0	0	3
Sheriff - Coroner	0	0	0	0	0

Department	New (optional)		Existing		Total (combination of optional positions and existing)
	<i>Tier 1</i>	<i>Tier 2</i>	<i>Tier 1</i>	<i>Tier 2</i>	
Social Services	1	1	0	0	2
Treasure / Tax Collector / Public Administrator	0	0	0	0	0
Totals:	5	8	13	9	35

The organizational chart below graphically depicts the current GIS application use by the County as an organization (defined by functional groups). All are color coded by the level of GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS, or “Power” user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. **A dotted line around a Division or Section represents recommended new GIS usage that did not exist on a full-time basis before this Needs Analysis.** Numbers in parentheses represents 2007-2008 CAO recommended positions



The graphic below graphically depicts a very general GIS System Design as it relates to the Governance model discussed in this chapter. At the center of this graphic is the recommended GIS Coordinator in ITD and its use of ESRI ArcGIS Server technology. The Tiered GIS users are outside of the GIS Division but rely very heavily on management, coordination, and technical expertise of the GIS Division.



Model GIS Job Descriptions (to be used to augment current job descriptions of GIS staff in County Departments already performing these roles and recommend additional staff).

GIS Coordinator

Nature of Position: This position requires a broad range of management, business, and technical skills to guide the successful implementation of an enterprise GIS within the County. The GIS Coordinator has overall responsibility for ensuring that key GIS work elements – hardware, software, networks, databases, and staff resources – are managed, maintained, and enhanced to meet agreed-upon County requirements.

Oversee all enterprise GIS operations including database management and administration, data structure and metadata development, system administration, GIS software selection, implementation and user support, GIS project management, budgeting, marketing, and training. The GIS Coordinator should be expected to spend 40% of their available time focused on tactical and operational implementation of GIS components for Countywide and department initiatives (e.g. analysis, mapping, application configuration and deployment, and geodatabase development). Sixty per cent (60%) of their available time should be spent on strategic and program management ensuring the enterprise GIS goals and implementation schedule is maintained (e.g. project management, guiding internal resources, managing external consultants).

Education: Bachelor's Degree required in Geography, Computer Science, Earth Science, Engineering, Planning, or related discipline and minimum 3 years experience in GIS project management for local governments and 2 years experience GIS development and maintenance, or an equivalent combination of education and experience. Master's Degree in Geography preferred.

Skills: Experience with government GIS applications, especially in business areas such as planning, public utilities, transportation, police, fire, EMS, and County base map creation and maintenance. Experience developing schedules and managing complex information technology projects. Familiarity with business process analysis as it relates to GIS. Active participation in professional GIS, mapping, and/or surveying organizations and activities. Excellent verbal, written, and interpersonal communication skills. Ability to communicate technical information in a non-technical manner. Ability to lead and motivate work teams.

Computer Skills: Experience with ESRI's ArcGIS suite of products in a Windows environment and Autodesk AutoCAD applications and architecture. Experience in database administration, relational

database design, development, and implementation. Working knowledge of ArcSDE, ArcGIS Server, and ArcGIS modeling and analysis is required.

Nature of Contact with Other People: The GIS Coordinator will act as the geographic information expert for the County. The GIS Coordinator provides oral and written progress reports and updates to superiors and oversight committees. The position requires an extensive amount of communication at all levels of the County government and external organizations.

Salary: TBD, commensurate with experience and based on County HR policies.

GIS Database Administrator (DBA)

Nature of Position: The GIS Database Administrator (DBA) position works with minimal direction to perform advanced, complex GIS and related database design and analysis. The work is performed under the direction of the GIS Coordinator, but leeway is granted for the exercise of independent judgment and initiative. The position makes critical decisions in developing and integrating spatial technologies, designing spatial databases and developing GIS deployment strategies. This position is required to maintain advanced technical knowledge in current applications and theory and maintain skill in the use of developmental tools. The position may be called upon to provide technical support to other County department's GIS staff.

The GIS DBA is distinguished from a GIS Analyst or Technician in that incumbents in the Administrator class set up databases while those in the latter class are responsible for creating and maintaining GIS datasets that are contained within those spatial databases. The GIS DBA is further distinguished from other GIS positions in that it is a unique technical position that demands extensive technical background in the development and integration of spatial technologies. The GIS DBA position is distinguished from the GIS Coordinator in that the latter position is responsible for supervising professional and technical staff with overall responsibility for the quality and accuracy of the County's geospatial data and the delivery of appropriate products suitable for use by all City departments.

Education: Bachelor's Degree in Geography, GIS, Computer Science, Earth Sciences, or related discipline.

Skills: This position is highly technical in nature and requires a candidate with existing GIS and preferable general IT database management skills in order to perform tasks efficiently; software design and development skills are required as well. Familiarity with geodatabase design, implementation, maintenance, and management. In addition the main tasks for the GIS DBA is to

provide design, development, modification, analysis, documentation, testing, and tuning of underlining Database Management System (DBMS) for the County's GIS. Typically provides the structural coordination of vector data, raster data, and metadata. Manages database security, including integrity, backup, recovery, access, and changes. Monitors use and optimizes database and functional DBMS performance. Interfaces with application developers, systems administrator, technical support organizations, and end users. Investigates and resolves operational problems. Develops tools and processes to support the overall DBMS administration function for the organization. Individual should be responsible for coordinating with the consumption and distribution of spatial services with other government agencies.

Establish priorities and effectively coordinate multiple projects; work effectively within industry standard structured application development process; work independently and maintain productivity with minimal supervision; encompass communicative skills that effectively convey technical material to audiences with varying familiarity with the subject matter. Use pragmatic problem solving skills and sound judgment when diagnosing and resolving database and application problems. Establish and maintain effective work relationships with co-workers, contractors, vendors, other agencies and the public. Proficiency with spreadsheets and tabular data desirable. Understanding of GIS in County/local governments is highly desirable.

Computer Skills: Proficiency with DBMS and general techniques are essential. Additional skills include ESRI GIS software object-oriented GIS application development, ArcIMS customization, and database programming, as well as GIS data conversion and GPS data collection skills. Detailed understanding of enterprise-wide GIS applications and environments is desirable. · Must have the ability to use a computer and associated software in order to perform the essential functions of the position.

Relevant Experience: Typically four (4) years of professional experience that includes software development using structured methods and programming techniques, to include data and systems analysis, data conversion, corrections and testing; maintenance and design of GIS systems; and familiarity with C++, Visual Basic, AML, Avenue, HTML, CFML, Javascript, VBscript and programming SQL for MS SQL Server sufficient to use the applications to run and improve the current GIS program. An understanding of common spatial data models required to support County functional areas, as well as public sector experience is desired.

Personnel Supervised: None.

Salary: TBD, commensurate with experience and based on County HR policies.

GIS Analyst

Nature of Position: GIS application support and project oversight, spatial data layer creation and conversion, geodatabase management and administration, data analysis, map production, GPS data collection, user support, and specific GIS project management.

Education: Bachelor's Degree in Geography, GIS, Computer Science, Earth Sciences, or related discipline.

Skills: This position is highly technical in nature and requires a candidate with existing GIS and GPS knowledge and skills in order to perform tasks efficiently; software design and development skills are required as well. Familiarity with geodatabase design, implementation, maintenance, and management. Familiarity with geographic projections and cartographic principles, as demonstrated through coursework or work experience. Working knowledge of how to edit GIS data, including geodatabases, shapefiles, and CAD files, and knowledge of how to perform logical queries of the database. Proficiency with spreadsheets and tabular data desirable. Understanding of GIS in County/local governments is highly desirable.

Computer Skills: Proficiency with ESRI software, particularly ArcGIS, is essential. Additional skills include object-oriented GIS application development, Arc GIS Server customization, and database programming, as well as GIS data conversion and GPS data collection skills. Detailed understanding of enterprise-wide GIS applications and environments is desirable.

Relevant Experience: Two years of experience with GIS and GPS concepts; two years of experience with GIS application development, specifically with ESRI software. One year of experience with enterprise geodatabases, preferably with ArcSDE and SQL Server.

Personnel Supervised: Under the current County step classification system, a GIS Analyst could be tasked with supervision responsibilities. If this becomes the case, that particular GIS Analyst would be staffed at a higher "step" and/or salary.

Salary: TBD, commensurate with experience and based on County HR policies.

GIS Technician

Nature of Position: GPS data collection, spatial data layer creation and conversion data analysis, map production, and specific GIS project management.

Education: Bachelor's Degree in Geography, GIS, Engineering, Earth Sciences, or related discipline, or education/experience combination.

Skills: This position is highly technical in nature and requires a candidate with existing GIS and GPS knowledge and skills in order to perform tasks efficiently. Familiarity with geographic projections and cartographic principles, as demonstrated through coursework or work experience.

Working knowledge of geodatabases, coverages, and shapefiles, and how to perform logical queries of spatial data. Proficiency with spreadsheets and tabular data is desirable. Understanding of utility and transportation infrastructure is also highly desirable.

Computer Skills: Proficiency with ESRI software, particularly ArcGIS, is essential, as well as GIS data conversion and GPS data collection skills.

Relevant Experience: One year of experience with GIS and GPS concepts and applications. (Coursework and special projects which emphasize GIS and GPS may be counted towards this experience requirement).

Personnel Supervised: None.

Salary: TBD, commensurate with experience and based on County HR policies.

GIS Steering Committee and Users Group

Continued use of a GIS Steering Committee for the County

The County should continue with the current structured GIS Steering Committee. The GIS Steering Committee should be relied upon to guide GIS implementation development for the County. The GIS Steering Committee should meet on a monthly basis; however, as critical strategic issues are resolved, it may need to meet less often. The County should ensure that its GIS Steering Committee consists of upper management and high-level GIS staff. A management-level employee from each major County department should be on the committee. This committee ensures that GIS is implemented effectively throughout the organization and that enterprise-wide goals and objectives are being met.

The GIS Steering Committee provides critical, high-level commitment to investment in GIS. Each member of the committee will gain an understanding of the technology and feel some ownership for the County's GIS Implementation. These high-level participants will be indispensable during budgeting, and each will serve as a champion for GIS within his or her own department. Committee members will see the benefits of GIS, subsequently lobbying for greater utilization of the technology.

Continued use of a GIS Users Group (current GIS Project Team)

The County should continue with the current structured GIS Project Team. The GIS Users Group should include GIS-utilizing staff from all departments with identified GIS needs. The GIS Coordinator should lead this group. A GIS Users Group meeting provides an excellent opportunity for communication between all GIS users. It is a good venue for users to share their successes and failures. Duplication of efforts will be minimized and sharing of ideas and data will be optimized. A GIS Users Group is also a great platform for internal training initiatives.

External Organizations

The level of success obtained through the implementation of GIS often relies heavily on the cooperation of other government agencies and private sector organizations. This is particularly true for the County. There is a large amount of GIS data that currently exists for the County, both in the unincorporated and incorporated areas. Federal, state, regional and local government agencies, engineering and surveying firms, local utility companies, and private developers and data vendors all may possess data that could prove valuable to the County. Much of this information can be obtained at a nominal cost or free of charge. Many of these data layers have been developed over the years by other entities through their own GIS and related mapping projects. The County should continually monitor external sources for applicable data. There is a tremendous amount of synergy that can be developed when soliciting external entities and organization during the GIS implementation process.

Throughout the United States, Geographic Information Systems have served to break down not only the traditional barriers that exist between departments within an organization, but also barriers that have existed for years between other organizations. The technology serves as a catalyst for cooperation and will provide opportunities for inter-agency collaboration and cooperation. The most successful GIS programs have seized the opportunity for cooperation and data sharing, often highlighting this as one of the most important benefits derived from the implementation of GIS.

Establishing a good working relationship with other organizations early in the project is crucial. The County should inform these organizations about the data and expertise that the County is developing; in addition it should make these organizations aware of the mutual benefit derived from this effort. Establishing and

maintaining mutually beneficial relationships with other organizations may facilitate and expedite data sharing as well as reduce costs.

Inter-local Agreement

One idea that is gaining in acceptance across the country is the creation of a joint GIS among county and city agencies that share geographical boundaries. The County and the twelve external organizations identified in Chapter Two could enter into a formal Inter-local Agreement to fund a common GIS. Funding for this effort should be divided equally, based on population served, among the participating agencies.

The mission of this Inter-local GIS should incorporate the following ideals:

- Develop a common base map
- Promote sharing of resources
- Reduce redundancy of data collection and creation
- Provide a mechanism to maintain the base map and other data layers
- Encourage enterprise information management solutions
- Enhance decision making for public officials

Management of this Inter-local GIS project would be similar to other multi-jurisdictional agencies in the County, steered by an Executive Committee that is comprised of members at the Executive level of government (County Board Members, City Commissioners, etc). This Committee should be staffed by the Inter-local GIS Coordinator. The Committee should meet quarterly to review and institute policy and budget issues and receive project updates. The technical issues of the Inter-local GIS would be managed by a Steering Committee that would meet on a monthly basis, and be chaired by the GIS Coordinator. The Steering Committee's main function would be to review the technical implementation of the GIS and review project updates. Also they would be responsible for developing an agenda for the Executive Committee.

A true countywide GIS could be created of GIS professionals led by the GIS Coordinator, forming a sort of "GIS Central" that would provide support services to each of the principal partners. These services could include: system administration, database management, Internet/Intranet development and support, application design and support and map analysis expertise. A larger, user-oriented body called the GIS Development Team would meet monthly to review project updates, determine user needs, address user issues, and/or concerns with the GIS implementation, with subgroups meeting to address specific items such as land use, easements, census, GPS, and addressing.

These subgroups analyze issues, develop solutions, and report back to the Development Team on their progress/findings during the monthly meetings.

Interviews by GTG with most external organizations and entities representatives indicated that they are interested in cooperating with the County in establishing a formal data sharing agreement, at the very least, and possibly entering into some sort of Inter-local Agreement as described above. In the long term, there may be potential for the establishment of a SDE geodatabase shared by the County and these external organizations—however, this is a long term goal that should be pursued after each entity has successfully addressed its own data production and data maintenance needs. Key advantages, based on cooperation between the County and these external organizations, include shared data, geo-spatial data standards, reduction of duplicate efforts for creation and maintenance of spatial data layers, and cost sharing.

GIS Newsletter

In addition to GIS Steering Committee and GIS Users Groups, it will be beneficial for the County to create a quarterly GIS Newsletter. Development of a GIS Newsletter should be supervised by the GIS Coordinator, but there also must be contributions from each department that utilizes GIS on a regular basis. A GIS Newsletter will help foster communication between departments and help build support for increased GIS use across the entire enterprise.



Sample GIS Newsletter (Courtesy of County of Salisbury, NC)

(Complete newsletter available at:

<http://gis.salisburync.gov/newsletter/october2003.PDF>)

Governance Model Case Studies

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Athens-Clarke County, GA 	Mary Martin GIS Administrator 706-613-3515	Enterprise-wide-GIS under the planning department. Data housed on GIS server. Successful implementation of enterprise-wide GIS. Review and financial backing by commissioners and mayor were important parts of the City's success	Public Works Bob Faucett Land Developer Coordinator 706-613-3440	PW uses the aerial photography for storm water issues, and centerline mapping. All data creation, editing and maintenance is done by PW dept. Policy and Technical committees helped the departments work together.	Yes. Committee consists of mayor and commissioners. Served primarily as a review board and approved funding. Matrix model.
			Kyle Hendrix Assistant Fire Chief 706-613-3360	The Fire Department uses fire hydrant locations, water mains and 3 mile response files. There is live data available on the Chief's computer and static data available at the various stations. One person within the fire department oversees the GIS and coordinates with other departments	

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Tampa, FL 	David Frame Senior Programmer/ Analyst 813-274-8401	The city is in the planning stages of enterprise-wide GIS. It will be located under the strategic planning and IT department.	Public Works Dallas Pryor Civil Drafting Supervisor 813-274-8580	GIS implementation is in the early stages. Currently they are using GIS for road mapping, and event mapping (evacuation routing etc.) Too early to comment on success but people are realizing the value of GIS	Yes. Committee was formed to assess department needs. No authoritative power, simply assessing needs. Beginning to define a Matrix model.
			Planning Dept. Allen Baker Research Analyst 813-274-8487	Planning Department currently uses GIS for demographic mapping, neighborhood mapping.	
Charleston, SC 	Tracy McKee GIS Director 843-724-3769	The city has enterprise-wide GIS located in the planning and neighborhoods department. A Unified database warehouse is used. GIS implementation has been very successful.	Planning Department Phillip Overcash, Planner 843-724-3787	Data is created and Maintained for the planning department. Zoning, Mapping and addressing are primary tasks. Implementation has been slow but successful.	No steering committee or review board. No clearly recognizable model. Most likely a Distributed - Matrix model.
Norfolk, VA 	Charlie Kennedy GIS Tech 757-664-6743	GIS is implemented in the IT, public works and utilities departments. Success has been fair but could have been improved with more Unified oversight.			No steering committee or review board. Distributed model.

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Columbia, SC 	Phillip Clouss GIS Applications Tech 803-545-3338	City is in the process of implementing enterprise-wide GIS. There is a Unified data warehouse. Implementation has been very successful.	Kim Fowler 803-545-3780 Senior Administrator for Public Works	PW Dept uses to route sanitation routes, street sweepers. Editing can be done by PW on certain layers. Overall very happy with how GIS is working.	No steering committee or review board. Implementing a Matrix model.
			Skip Hudson Planning 803-545-3222	Planning Dept. database maintains real property ownership, Annexation and historic preservation. GIS is successful with the staff using however financial backing from elected official would be outstanding.	
Baltimore, MD 	Miranda Brunett GIS Analyst 410-396-4106	GIS is used throughout this city and located in the IT department. Processes have been very successful.			No steering committee or review board. No clearly recognizable model. Most likely a Matrix.
Charlotte, NC /Mecklenburg County 	Andy Goretti GIS Division Manager 704-336-4918	GIS has been implemented in the city and county. GIS falls under the IT department. The County has a Central data warehouse; the city does not. The city has had some issues in its success.			Steering committee was formed for the city's implementation for policy and procedures only. County had none. No authoritative power was provided for the committee. Clearly a complex Matrix model with distributed components.

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Wilmington, NC 	Jim Sahlie GIS Coordinator 910-341-5826	GIS is used throughout most city departments. GIS is located in IT department. There is a central data warehouse. Implementation has been very successful.			Yes; ad hoc committee was formed for oversight more than guidance and funding approval. Matrix model.
Raleigh, NC 	JJ Walters GIS Tech 919-516-2526	The city has an enterprise-wide GIS under the IT department. There are multiple sites for data. Success has been moderate.			No steering committee or review board. No official model adopted; informal modal typically distributed.
Chesapeake, VA 	Paul Paris GIS Administrator 757-382-6391	The city has an enterprise-wide GIS located in the IT department using a Unified data warehouse. Very successful.	Bob Wethering Public Works 757-382-6101	Public Works uses GIS for creation of Maps, sanitation routing. The data warehoused by the IT department but PW is responsible for creating and maintaining their data. Not the best system but they have learned to work around it.	No steering committee or review board. No official model adopted; data structure suggest Matrix
Hampton, VA 	Jonah Adkins GIS Specialist 757-727-6881	Implemented throughout the city, GIS is located in the engineering and public works departments. Data centrally warehoused. Very successful.	Allen Lambert Public Works 757-727-6372	Public Works department creates edits and maintains their Departmental specific data.	No steering committee or review board. No official model adopted; data structure and location suggests distributed-Matrix model.
Roanoke, VA 	Tracy Leet GIS Coordinator 540-853-2144	Steering committee had a minimal effect on success.			Steering committee. Matrix model.

City/County	GIS Contact	GIS Remarks	Department Contact	Department Remarks	GIS Governance
Orlando, FL 	Mark Hooker GIS Manager 407-246-3060	Located in IT department, GIS is integrated throughout the city. GIS has been used for 15 years but is still not where it should be. Has been successful for the most part.	Allen Owler, Director Public Works 407-246-3623	PW uses electronic mapping for utilities political boundaries and zoning. Data is centrally warehoused, and maintained by IT group. Some editing is allowed outside of IT.	IT Dept steering committee. Maturity of the system and integrated use suggest the evolution of a Matrix model.
Annapolis, MD 	Paul Thorn IT Manager 410-295-7806	In the early stages of implementing GIS in the IT department; GIS does have a Unified data warehouse.			Yes. Steering committee has been formed to guide general policy and procedures. No other authority has been given. Migrating to a well-defined Matrix model

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Enterprise GAP Analysis

Chapter 6: Enterprise Gap Analysis



Chapter Outline

Introduction

Summary of Findings

Existing

Desired

Priority

Major Components

Introduction

This Chapter provides an enterprise level overview analysis of the existing status and desired status with regard to the County's move towards an Enterprise-wide GIS. Based on the departmental Needs Analyses (see Chapter 2), as well as components of the GIS Conceptual System Design, this analysis is included to provide a centralized set of summary tables that the County can use to prioritize and assess strategic and tactical efforts and initiatives in its phased GIS implementation over the next five years.

Summary of Findings

In Chapter 2 each department and/or division was evaluated on seventeen (17) GIS-specific components. These identified components form the baseline for this Gap Analysis. Each GIS component was evaluated on three elements:

- Existing – Does the GIS component currently exist within department/division?
- Desired – Is the GIS component deemed desirable?
- Priority – High, medium or low need

Existing

Each of the eighteen participating departments/divisions was asked about existing GIS circumstances and current GIS usage. Based on this interview process and the “User Needs Questionnaire and Interview Guide” that staff completed prior to the formal interviews, the follow results were determined (brief description follows each component):

- Only 4 out of the 17 (24%) components exist in a majority of the departments/divisions.

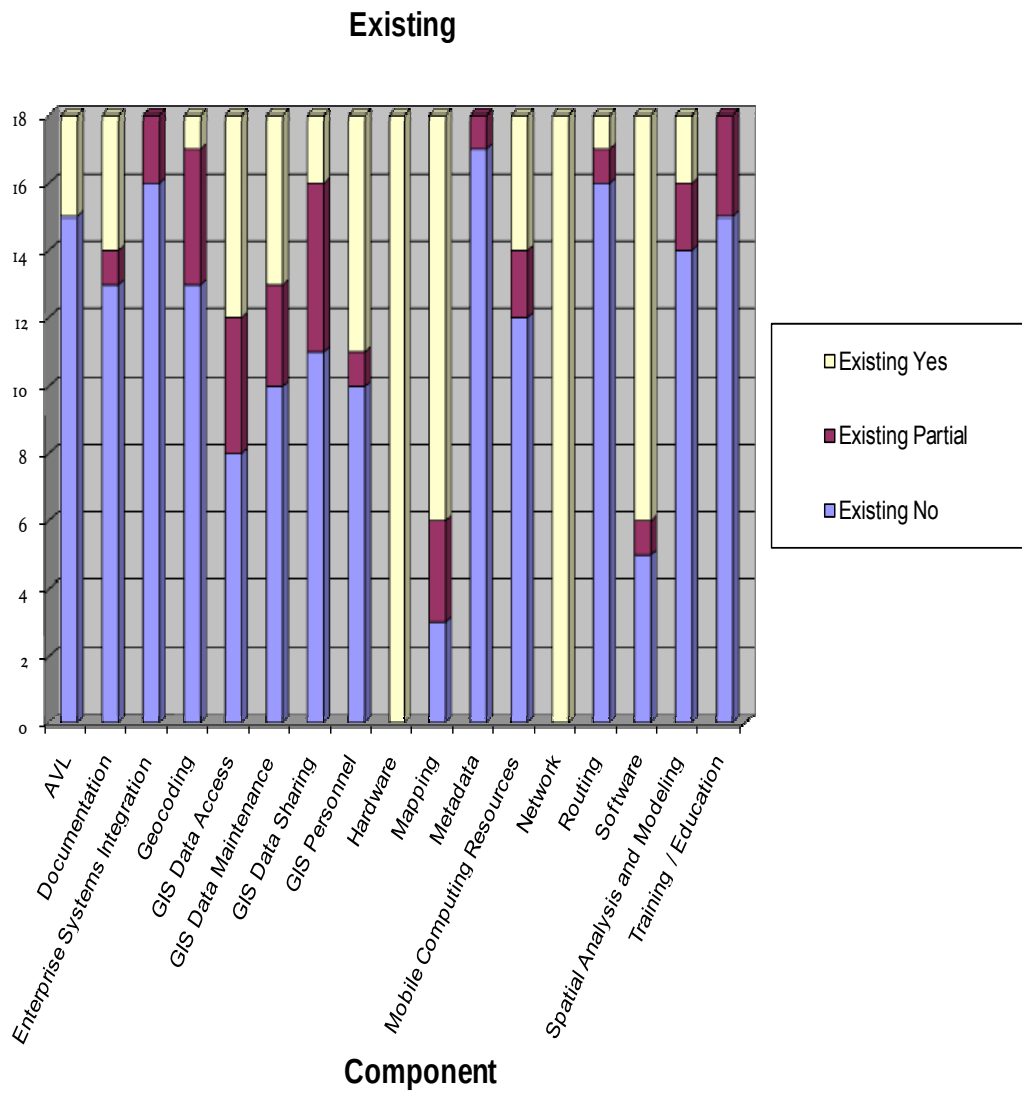
These were:

- o Hardware (PC's, Servers, Printers, etc)
- o Mapping (ability to map data spatially)
- o Network (connectivity)
- o Software (GIS related applications)

- 13 out of the 17 (76%) components do not or only partially exist in a majority of the departments/divisions. These were:

- o Automatic Vehicle Location (AVL) (hardware, software, communication infrastructure to locate County vehicles while in the field)
- o Documentation (process and procedures)
- o Enterprise Systems Integration (ability to integrated existing databases with GIS)
- o Geocoding (address matching of tabular data)
- o GIS Data Access (ability to access GIS data)
- o GIS Data Maintenance (ability to maintain GIS data)
- o GIS Data Sharing (sharing GIS across multiple platforms)
- o GIS Personnel (staff used to accomplish GIS related task)
- o Metadata (data about GIS data)
- o Mobile Computing Resources (field access to GIS data)
- o Routing (ability to direct vehicles in the field)
- o Spatial Analysis and Modeling (analyze GIS data)
- o Training / Education (for specific applications and personnel)

The following table graphically illustrates the above findings (number of departments - 18 vs. identified components -17):

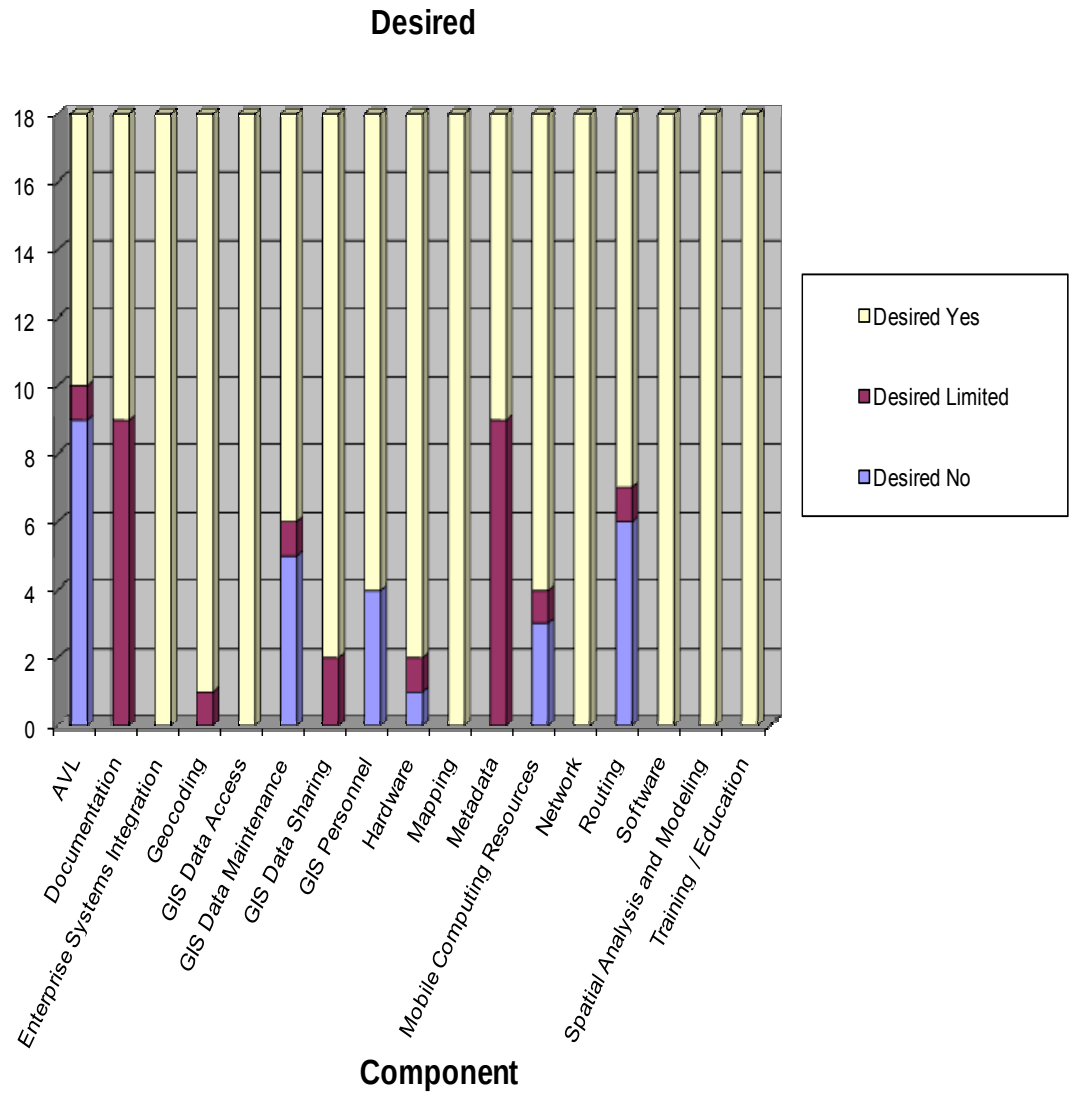


Desired

Once the existence of the seventeen (17) GIS components was determined, focus was then placed on how desirable they were based on the Needs Analysis.

- 10 out of the 17 (59%) components are fully (or nearly) desired by a majority of the departments/divisions:
 - o Enterprise Systems Integration
 - o Geocoding
 - o GIS Data Access
 - o GIS Data Sharing
 - o Mapping
 - o Mobile Computing Resources
 - o Network
 - o Software
 - o Spatial Analysis and Modeling
 - o Training and Education
- 6 out of the 17 (35%) components have limited to full desirability by a majority of the departments/divisions:
 - o Documentation
 - o GIS Data Maintenance
 - o GIS Personnel
 - o Hardware
 - o Metadata
 - o Routing
- 1 out of the 17 (6%) components was evenly split between desirability with 9 departments with no desire, 1 department with limited desire and 8 departments with positive desirability:
 - o AVL

The following table graphically illustrates the above (number of departments - 18 vs. identified components -17):



Priority

The future framework for this prioritization will be established by the County GIS Executive Steering Committee, which will review and assess departmental and enterprise goals and objectives on a regular basis. In addition, a GIS Plan of Action is provided in Chapter 17 as a recommended baseline for sequence and priority of tasks and activities, such that County stakeholders will be able to quickly and efficiently implement various components of the GIS Conceptual Design.

Prioritization was developed by GTG based on the Needs Analysis interviews and responses by each County department (as found in Chapter Two). The number of departments that identified a component as high, medium or low determined that components enterprise priority. It should also be noted that since this is an enterprise analysis and a specific need might be determined to be low, medium, or high for the enterprise, this does not mean that a specific department does not have a different set of priorities.

These priorities can be categorized at three levels:

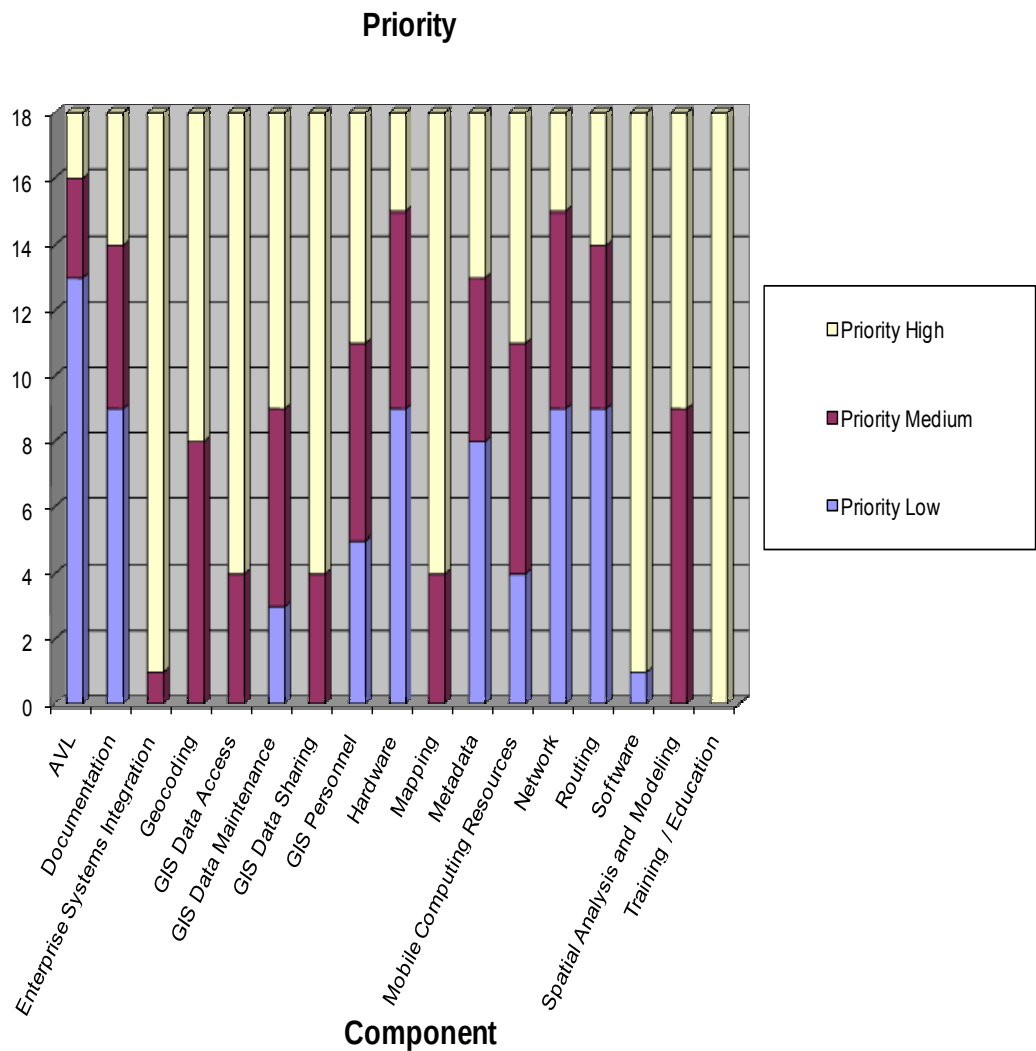
- Low – Need can be met after higher needs are accomplished.
- Medium – Secondarily important to higher departmental needs.
- High – Takes precedent over other needs.

The seventeen (17) GIS components were evenly spread across the three above categorizations:

- Low
 - o AVL (13 Low, 3 Medium, and 2 High)
 - o Documentation (9 Low, 5 Medium, and 4 High)
 - o Hardware – Desktop (9 Low, 6 Medium, and 3 High)
 - o Metadata (8 Low, 5 Medium, and 5 High)
 - o Network (9 Low, 6 Medium, and 3 High)
 - o Routing (9 Low, 5 Medium, and 4 High)
- Medium
 - o GIS Data Maintenance (3 Low, 6 Medium, and 9 High)
 - o Mobile Computing Resources (4 Low, 7 Medium, and 7 High)
- High
 - o Spatial Analysis and Modeling (0 Low, 9 Medium, and 9 High)
 - o Geocoding (0 Low, 8 Medium, and 10 High)
 - o Enterprise System Integration (0 Low, 1 Medium, and 17 High)
 - o GIS Data Access (0 Low, 4 Medium, and 14 High)
 - o GIS Data Sharing (0 Low, 4 Medium, and 14 High)

- o GIS Personnel (5 Low, 6 Medium, and 7 High)
- o Hardware – Servers (Enterprise)
- o Mapping (0 Low, 4 Medium, and 14 High)
- o Software (1 Low, 0 Medium, and 17 High)
- o Training / Education (0 Low, 0 Medium, and 18 High)

The following table graphically illustrates the above findings (number of departments - 18 vs. identified components -17):



Major Components

Certain major components in highly successful governmental GIS programs have repeatedly been proven as critical factors in implementation. This Enterprise Gap Analysis section provides beneficial information representing these major GIS components in relation to the County's Enterprise GIS, including:

- Data
- Procedures/Standards
- Hardware/Software
- Staff/Organizational Structure

The following matrices in the proceeding pages provide a specific Gap analysis for each of these major GIS components.

Data

Component	Existing	Desired	Priority	Notes	Document Reference
GIS Data Access	Limited	Yes	High	At present, data is maintained on a County server almost exclusively in shapefile format. The County will need to centralize, standardize, and distribute GIS data to all departments that will utilize GIS. This can be accomplished through development of an ArcGIS Server (AGS) based platform and general browser based GIS applications.	Chapter 2 Chapter 10 Chapter 7 Chapter 13 Chapter 14
GIS Data Maintenance	Limited	Limited	Medium	The GIS Coordinator within ITD should serve as the primary resource for GIS data maintenance; procedures and a data maintenance protocol will be needed to ensure that GIS data is maintained in a standardized and consistent fashion. At present, some of the County's base map GIS layers have accuracy, spatial integrity, and temporal currentness issues. The County will need to quickly and effectively address its base map layer needs. Upon successful recreation and/or rectification of these layers, the County will be able to generate derivative data sets from these base map layers.	Chapter 2 Chapter 10 Chapter 13 Chapter 14

Component	Existing	Desired	Priority	Notes	Document Reference
Enterprise System Integration	Very Limited	Yes	High	At present the County currently maintains legacy enterprise database systems in a majority of departments with little or no integration with GIS. Integration into these database systems will make mapping and spatial analysis possible. The County will need to continue investing in spatially-enabled enterprise database systems to allow departments to share and distribute data with other departments in an effective and efficient manner. Centralized data servers and data sharing are critical to the enterprise-wide success of this project.	Chapter 2 Chapter 10 Chapter 14
Geocoding	No	Yes	Medium	Geocoding, also referred to as "address-matching", refers to the process of matching non-GIS tabular data with some form of geographic components like address or parcel ID to a GIS feature (address point, street centerline, or parcel layer). Comprehensive, Countywide geocoding will enable applications such as AVL, routing, dispatch, database integration, and legacy database mapping. Geocoding is required for the above system integration.	Chapter 2 Chapter 10



Procedures/Standards

Component	Existing	Desired	Priority	Notes	Document Reference
Documentation	Very Limited	Yes	Low	Some documentation on GIS data processing and workflows exists in the Planning & Building Department. Modifications to the workflow and data ownership are necessary to accomplish enterprise-wide needs. Data update workflows and data dissemination workflows will need to be refined and well documented. The recommended GIS Coordinator in ITD should work on the documentation of routine GIS data creation and update procedures.	Chapter 2 Chapter 10 Chapter 13 Chapter 14

Component	Existing	Desired	Priority	Notes	Document Reference
GIS Data Sharing	Very Limited	Yes	High	The County should standardize its data sharing/exchange procedures and implement formal data sharing agreements (also referred to as “data licensing agreements”) with local and regional organizations/agencies with which it will regularly share data. It is recommended that the County develop and formalize data sharing agreements with relevant local and regional organizations. In addition, the County will need to develop internal data sharing procedures. These procedures and standards should be administered by the GIS Coordinator in conjunction with the GIS Steering Committee. Internal and external stakeholders will benefit through the implementation of a centralized GIS data environment that will allow various tiers of applications and users to access cross-functional and inter-departmental data.	Chapter 2 Chapter 10 Chapter 13 Chapter 14
Mapping	Yes	Yes	High	The County heavily relies on Photomapper as its main map viewing project locating tool. The County’s mapping capabilities will need to be significantly increased through the use of various GIS applications, incorporation of additional GIS data layers, and adequate training for staff to enable individuals to generate their own maps. Mapping procedures and standards will be developed and administered by the GIS Coordinator.	Chapter 2 Chapter 4 Chapter 9 Chapter 13 Chapter 14
Spatial Analysis and Modeling	Very Limited	Yes	Medium	At present, the County does not readily utilize the spatial analysis capabilities of GIS. Only those departments with trained experienced GIS users utilizing the latest desktop GIS software have these capabilities. With training and distribution of a tiered set of GIS applications, users from various departments will have the ability to conduct various types of spatial analysis. Spatial Analysis procedures and standards will be developed and administered by the GIS Coordinator.	Chapter 2 Chapter 4 Chapter 13 Chapter 14

Component	Existing	Desired	Priority	Notes	Document Reference
Metadata	Very Limited	Yes	Low	The majority of finalized GIS data that resides in the Planning and Building folder on the GIS server has metadata created with the ESRI ArcCatalog metadata wizard. Formal, standardized metadata needs to be developed for all GIS data layers and would be handled in conjunction with the recommended GIS Coordinator within ITD. The FGDC Metadata Standard is recommended as the primary metadata standard for the County.	Chapter 12



Hardware/Network/Software

Component	Existing	Desired	Priority	Notes	Document Reference
AVL	Yes	Very Limited	Low	CAL FIRE and Sheriff, indicated a high priority for (or currently deploy) AVL-enabled vehicles to assist with emergency operations, routing, and community assistance. AVL hardware will need to include GPS receivers and a telecommunications link to a centralized server. Other departments list AVL lower on their priority list.	Chapter 2 Chapter 7
Hardware	Yes	Limited	Low	PCs The County has networked PCs in all major departments. All GIS user PCs will need to be audited, evaluated, and upgraded to ensure that they meet the minimum hardware recommendations for Level 2 Computers. The County will need to procure additional PCs for the recommended GIS Coordinator, as well as any additional technical staff that will utilize Level 1 Computers. Servers At present, the County maintains several servers for file serving as well as enterprise systems (legacy). Three additional servers are recommended for the County, to act as dedicated GIS servers (see Chapter 7). Printers The County has adequate networked and personal printers for the County's GIS implementation. Additional color laser printers may be needed in the future, as utilization of the GIS for mapping and analysis may increase demand for printing of maps.	Chapter 2 Chapter 7

Component	Existing	Desired	Priority	Notes	Document Reference
Hardware (con't)	Yes	Limited	Low	Plotters The County has plotters available in a variety of departments. Additional plotters may be needed as departmental GIS usage increases, therefore an inventory of plotters should be completed by the GIS Coordinator and new plotters should be assigned/purchased where deemed necessary. GPS The County maintains multiple GPS units. The recommended GIS Coordinator should take an inventory of available resources, and develop a sharing plan for data creation needs.	Chapter 2 Chapter 7
Mobile Computing Resources	No	Yes	Medium	Mobile GIS Data Viewer Departments with field personnel will benefit from use of mobile GIS data viewers that will enable staff to view, map, and analyze GIS data in the field. A critical base layer is the street centerline layer. Street centerlines need to be updated and maintained for accurate representation. Laptops Based on the recommendations provided in Chapter 2, the County will need to procure additional mobile computing resources, including ruggedized notebook computers and hand-held computers. Wireless Network Additional bandwidth, capabilities, and protocols will be needed in the long term to enable field crews with wireless network access as well as AVL with a telecommunications protocol.	Chapter 2 Chapter 4 Chapter 7
Network	Yes	Yes	Low	LAN The County's ITD should continually look at upgrading and redeveloping the network to ensure that it conforms with the latest industry standards and specifications. That being said, there are still a few County satellite offices that use a T1 line for network connectivity. In the long-term, a viable solution should be identified and developed to correct this serious bottleneck that dramatically restricts GIS browser applications and data sharing at County satellite offices. Intranet The Intranet will enable the use of Intranet GIS data viewers as well as other server-based applications. Internet The Internet will be valuable for data sharing, data access, and the provision of an Internet GIS data viewer for the public.	Chapter 2 Chapter 7

Component	Existing	Desired	Priority	Notes	Document Reference
Routing	No	Limited	Low	GIS based routing is currently not implemented in the County (small exception in General Services). CAL FIRE has implemented routing software, but due to the incomplete and inaccurate street centerline GIS layer the ability to utilize routing to its fullest capacity is not currently being realized (same would apply to the Sheriff). Vehicle routing can significantly reduce cost related to fuel consumption and routine vehicle maintenance over time from inefficient routing practices.	Chapter 2
Software	Yes	Yes	High	Tier 1 and 2 GIS Software At present multiple departments utilize ESRI desktop GIS software applications. The County will implement a hybrid approach to providing GIS applications to stakeholders. Some of these users can be migrated to an Intranet GIS Data Browser application, while others will need to be upgrade to more robust ESRI desktop GIS software.	Chapter 2 Chapter 4 Chapter 7
Software (con't)	Yes	Yes	High	Intranet GIS Data Browser Software Tier 3 GIS software is critical to the County's GIS implementation. Tier 3 GIS applications will be widely distributed to a majority of County departments as Intranet GIS data viewers (i.e., server-based software). ArcGIS Server (AGS) will be needed to enable Intranet GIS applications. Internet GIS Data Viewer In addition to providing County personnel with access to GIS applications, the County will improve its services to the public by implementing an Internet public GIS application that allows citizens to view a variety of County spatially enabled data. Touch Screen GIS Software Departmental GIS needs analyses identified the need for a touch screen kiosk at County buildings that will enable citizens to conduct "self-serve" mapping and queries for information.	

Staff/Organizational Structure

Component	Existing	Desired	Priority	Notes	Document Reference
GIS Personnel	Limited	Yes	High	GIS Coordination GIS Coordination is a key component for local government GIS efforts. The County needs a GIS Coordinator to ensure that there is proactive coordination and management of resources and GIS-based initiatives. This position, along with GIS support staff, is recommended to reside within ITD. GIS Steering Committee A GIS Steering Committee serves as a coordination and oversight mechanism to ensure that all relevant departments have participation and representation in the County's GIS. It is recommended that the current IT-ESC structure remain intact, but include representatives from each County department. GIS User Group In addition to a GIS Steering Committee, the County will need to establish a GIS Users Group to enable technical staff that utilize the GIS on a frequent basis to share ideas, techniques, troubleshoot problems, and develop a "culture of GIS". This Group would be composed of all Tier 1 and Tier 2 users within each County Department. Department/Division GIS staff Designated GIS personnel that manage departmental GIS data are critical. A GIS staffing structure that includes Tier 1 and Tier 2 positions within identified departments is a major component of this Implementation Plan. Each department that has recommended staffing should strongly consider staffing these GIS positions within year one or two of the Strategic Implementation Plan.	Chapter 2 Chapter 5
Training / Education	No	Yes	High	Relevant staff from each County department will need to receive and engage in GIS training. Various types of training should be offered to each type of user (based on a multi-tiered system of GIS utilization).	Chapter 2 Chapter 8

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design System Design Strategies



Chapter 7: System Design Strategies

Chapter Outline

Introduction

System Architectural Design

Recommended System Design

Hardware

Desktop Computers

Servers

Field Notebook Computers

Data Capture Devices

Output Devices

Printers

Plotters

Networks

Applications to Meet Identified Needs

GIS Software

Enterprise System Application Integration

Outline of GIS Software Recommendations

GIS Services

Introduction

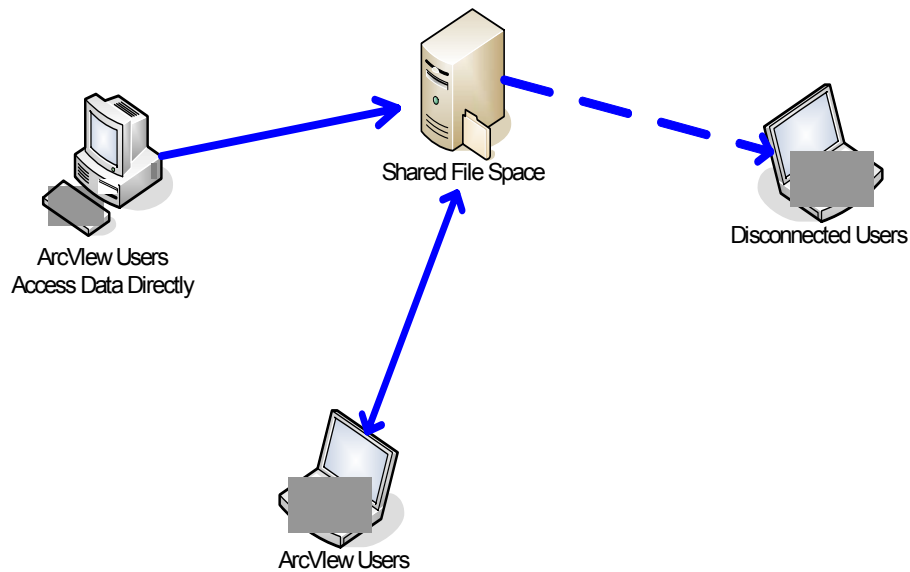
Although the County's GIS System Design begins with a GIS Governance Model, it certainly does not end there. This Chapter of the GIS Needs Analysis and Strategic Implementation Plan will focus on the many components (hardware, software, data, training, and personnel) of a system design and how they interact with each other, their place in an enterprise GIS, and how these components come together within the context of the current and future County organization model in regards to a full GIS enterprise implementation.

System Architectural Design

The County does not currently have a formal architecture defined for its Geographic Information Systems. GIS Data used by the County's departments are stored in a series of shapefiles and image files that are located on common file storage on the County Network. The County has a limited number of desktop GIS users, under which this type of data storage and retrieval approach can operate. As Geographic Information Systems manifests itself throughout the business procedures at the County, a distributed, geodatabase centric architecture must be adopted to meet the growing needs of these departments.

County GIS users access data by directly connecting to the data sources on the shared drives, or by creating copies of the data onto their machines or by a combination of both methods. GIS users that have significant networking capabilities can connect to these data sources directly and perform mapping and analysis. GIS

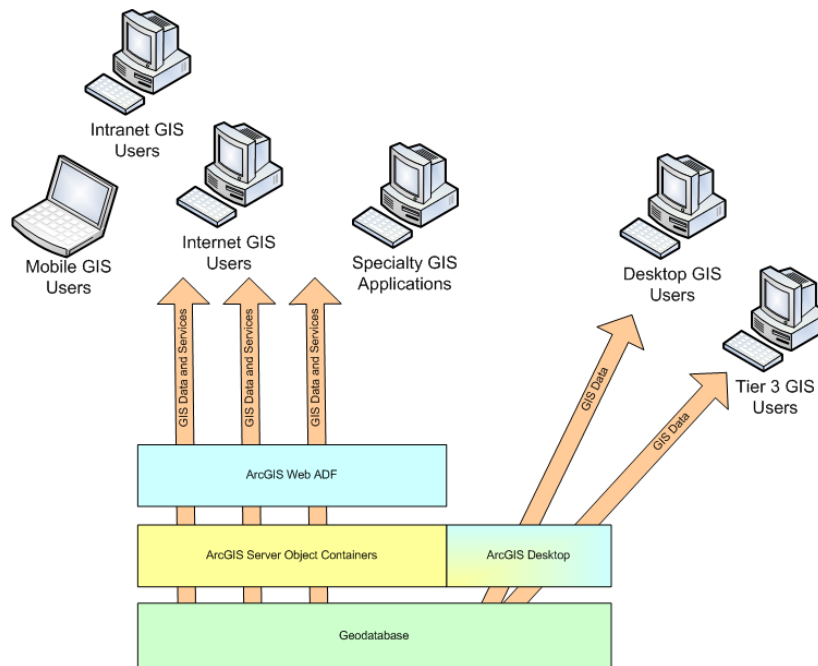
users that have limited networking capabilities must connect a machine into the network at the main government complex and place copies of current GIS data on a laptop and bring back to the field office.



Current Data Access and Retrieval Schematic

Recommended System Architecture

The County should implement a client-server based GIS architecture that is centered on the geodatabase. This approach requires investment into database and application servers and enterprise GIS software to implement. The architecture will consist of a total of three production class servers, ArcGIS Server software and network capacity upgrade to enable disconnected offices to take advantage of the enterprise GIS.



Enterprise GIS Centered on the Geodatabase and ArcGIS Server

The existence of centrally-located enterprise geodatabase(s) will be the cornerstone component in the County's GIS program. The geodatabase will be accessed directly through multiple desktop GIS applications, as well as various ESRI ArcGIS Services. ESRI desktop GIS application clients (ArcView, ArcEditor, and ArcInfo) will connect to the geodatabase(s) using the "Direct Connect" method of viewing and editing data. Additionally, ArcGIS Server (AGS) components will also connect to the geodatabase(s) using the same ESRI "Direct Connect" technology to provide access to GIS data through web services. This configuration will eliminate the need to place ArcSDE or AGS components on the server machine that warehouses all the actual geodatabase data.

The second major component of the County's GIS architecture is the ESRI AGS suite. AGS consists of two parts: Server Object Containers (SOCs) and the Server Object Manager (SOM). SOCs manage the interaction between the geodatabase(s) and the requests for maps or data from AGS client GIS applications. SOCs typically require the greatest amount of processing power and memory of all of the AGS components. When requests for maps or data are made through AGS client applications, the request is passed to SOCs which perform the interaction with the geodatabase(s) to extract the user's desired result. The SOM handles and transfers data and map requests by AGS client GIS applications and communicates with the SOCs. As use of ESRI server-based GIS products increase at the County, the SOM should eventually be migrated onto a separately dedicated server machine.

Hardware

Like many organizations, the County is continually upgrading hardware. New software packages often require new computer hardware. Individual departments are also continually budgeting replacements for older PCs.

Servers

The County will need to consider server configurations to host the County's GIS data and server-based desktop GIS applications. These servers will store and distribute spatial data to all GIS applications. For optimal performance, it is recommended that the County invest in three new physical servers (two ArcGIS servers and one DBMS server). The addition of these servers will enable the County to meet its GIS data and application serving needs well into the future. This configuration would require six (6) cores of ArcGIS Server (AGS). Each server should be configured according to the table on page 7 - 7; dual Intel Xeon 5160 processors (3 GHz dual core processors). The above configuration would support 230 simultaneous heavy users (each user sustaining 5 requests per minute to the server). Realistically, the average normal use would be 2 requests per minute from each user, estimating up to 570 concurrent users could be handled.¹

Of vital importance in determining the configuration and distribution of servers is the new ESRI pricing models for ArcGIS Server. The County does not currently have ArcSDE or ArcIMS as part of its GIS and cannot take advantage of ESRI's free upgrade package, thus requiring the County to procure ArcGIS Server Standard Enterprise Edition, at a minimum. ArcGIS Server Standard Enterprise Edition base price allows for the use of four cores total to run ArcGIS Server. At both the Standard and Advanced Enterprise levels, each additional core requires an additional payment to ESRI. Therefore, hardware configurations become very important.

All server scenarios should be discussed in greater detail via year one budgeted on-site consulting technical services. There exists the possibility of using a current ITD server for one of the above servers, if the cost of purchasing a new server is deemed to be unnecessary. However, this existing server should be fully examined to determine if it meets current configuration requirements.

The following are definitions of terms found in the hardware specifications on the next pages:

¹ *The County is currently conducting research regarding the use of virtual server technology with ArcGIS Server. Consideration will be given to technical feasibility and cost effectiveness as the best method is researched for the County through discussion with ESRI prior to any implementation. As of this document ESRI will not support the use of virtual server technology with ESRI software.*

SOC – Server Object Container - This is the primary component for the ArcGIS Server (AGS) application server. The SOC is the component of ArcGIS Server (AGS) that handles the direct interaction with the GIS data.

SOM – Server Object Manager - This component manages requests from users by assigning the requests to an available SOC process or by spawning a new SOC process if needed.

Web ADF – Web Application Development Framework. This component provides the web services that are used to access ArcGIS Server (AGS) functionality from web pages, custom application, and ArcGIS desktop software products.

Cores – Cores refer to the number of embedded processors contained internally on a single CPU. Essentially, a dual core processor is a single processor that internally contains two of the previous generation of processors working in tandem.

Socket – This is a term that is generally referring to a single physical processor regardless of the number of cores present within that processor. This is further complicated when considering the licensing for ArcGIS Server (AGS). ESRI allows for up to two cores per socket and if two cores on a single processor are exceeded, licensing cost increases beyond one socket. So, for example, a single quad core processor would actually count as two sockets for ESRI AGS pricing.

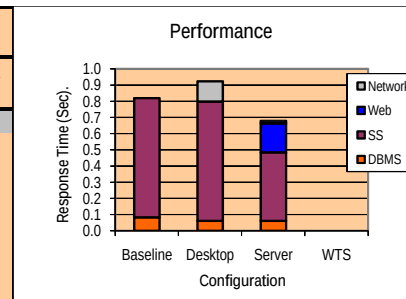
Web Application Server – A server used to host the Web ADF and SOM components of ArcGIS Server when the installation has been scaled beyond a single server.

Container Machines – When AGS is installed in a multi server configuration, this machine is dedicated entirely to the SOC component. When installed in a single server environment, this machine contains the Web ADF, SOM, and SOC components.

Database Server – This server is used to host SQL Server and the underlying databases of the SDE Geodatabases. Under our recommendation of using Direct Connect from all client applications and from AGS map services, there should be no ESRI software loaded on this server. If the ArcSDE component of AGS is placed on this server to host traditional ArcSDE service connections from clients, all processors on this server will need to be licensed under AGS socket licensing.

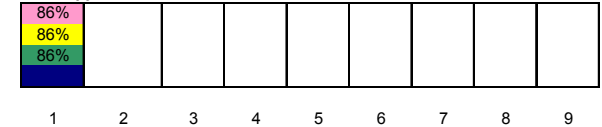
Requirements Analysis				
Types of Workflows		User Requirements		
Data Source		Peak Workflow		Network Mbps
		Users	DPM/Client	
1_ArcGIS Desktop	SDE DC/DBMS	25	10	250
2_ArcGIS Desktop WTS/Citrix	SDE DC/DBMS		10	
3_AGS9.2 Map Server	SDE DC/DBMS	230	5	1,150
4_IMS ArcMap Service	SDE DC/DBMS		6	
5_IMS Image Server	SDE DC/DBMS		6	
6_AGS9.1 Map Server	SDE DC/DBMS		6	
1_Batch Map Production Process	SDE DC/DBMS		143	
2_Batch Reconcile and Post Process	SDE DC/DBMS		11	
Total Workload		255	1,400	80.833

Web Application Server		Platform	12 GB RAM / Node	SRint2000	80,148
ADF	0.245	Intel Xeon 4 core (2 socket) 3000(4) MHz		120.0	
Average User	5 DPM	Cores = 4	Sockets = 2	2	30.0/Core
Total Required	1,150 DPM	Service Times	Capacity	Multiple Platforms	Fix
CPU Utilization	86% CPU	Seconds	Display/Min	Nodes	Capacity
Peak Users	267.2	0.180	1,336	1	1,336
Web Performance = 0.66 sec		0.68 sec	Sockets = 6		Minimal
Container Machines		Platform	12 GB RAM / Node	SRint2000	ADF+SOC
SOC	0.573	Intel Xeon 4 core (2 socket) 3000(4) MHz		120.0	
Average User	5 DPM	Cores = 8	Sockets = 4	2	30.0/Core
Total Required	1,150 DPM	Service Times	Capacity	Multiple Platforms	Fix
CPU Utilization	101% CPU	Seconds	Display/Min	Nodes	Capacity
Peak Users	228.5	0.420	571	2	1,142
		34,269 TPH		68,539 TPH	
Database Server		Platform	8 GB RAM / Node	SRint2000	
	0.082	Intel Xeon 2 core (1 socket) 3000(4) MHz		60.0	
Average User	5 DPM	Cores = 2	Sockets = 1	2	30.0/Core
Total Required	1,400 DPM	Service Times	Capacity	Multiple Platforms	Fix
CPU Utilization	70% CPU	Seconds	Display/Min	Nodes	Capacity
Peak Users	363.5	0.060	1,996	1	1,996
		363.5 / Node			
Workgroup Server		Platform	8 GB RAM	SRint2000	
Single Platform Configuration	0.754	Intel Xeon 2 core (1 socket) 3000(4) MHz		60.0	
Average User	5 DPM	Cores = 2	Sockets = 1		30.0/Core
Total Required	1,400 DPM	Service Times	Capacity	Multiple Platforms	Fix
CPU Utilization	645% CPU	Seconds	Display/Min	Nodes	Capacity
Peak Users	39.5	0.553	217	1	217
SQL Express Peak Users: 181.7		0.060	998	1	998
B	C	D	E	F	



	Baseline	Desktop	Server	WTS
Network	0.125	0.02		
Web			0.18	
SS	0.737	0.737	0.42	
DBMS	0.082	0.060	0.06	0.819
				0.483

Web Application Server



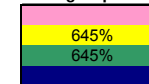
Container Machines



Database Server



Workgroup Server



Server Configuration Analysis

Desktop Computers

Recommendations are given in this chapter that specify minimum and desired configuration of PCs needed to run GIS software applications. The County needs to refer to these specifications to see if it will need to upgrade PCs to run specific GIS applications. Specifications will be looked at in two levels:

- **Level 1:** PCs to run robust GIS software such as ESRI ArcGIS Desktop 9.x (ArcInfo, ArcEditor or ArcView)
- **Level 2:** PCs to run ArcGIS Server client applications, such as an Intranet GIS Data Browsers

There is a difference between a typical PC and a GIS workstation. A typical PC for word processing is not likely appropriately configured for GIS use. A GIS workstation demands, at a minimum, a high-end processor, large amounts of RAM (memory), and large disk space.

In the short-term, it is important that all County personnel that will utilize Level 1 computers are capable of effectively supporting recommended GIS applications. In the long-term, as more County personnel begin to use Level 1 and Level 2 GIS applications, they should have access to computers that can effectively support these applications.

Level 1 PC to Run ArcEditor and ArcView

Minimum Configuration – or equivalent to current ITD recommended 5 year computer configuration

- Windows XP Professional Edition
- 2.1 GHz Pentium PC or Greater
- 1 GB of RAM or Greater
- 17" or Greater High Resolution Monitor
- 24x CD-ROM drive or greater
- 80 Gigabyte hard drive or greater
- 100 MBPS Ethernet Card
- 128MB Video RAM or greater

Recommended Configuration

- Windows XP Professional Edition
- 2.8 GHz Intel Core Two Duo Processor or Greater
- 2 GB of RAM or Greater

- 19" or Greater High Resolution Monitor
- 8x DVD-ROM Drive or Greater
- 80 Gigabyte Hard Drive or Greater
- Gigabit Ethernet Card
- 256 MB Video RAM or Greater

Level 2 PC to Run ArcGIS Server End User Applications

Minimum Configuration

- Windows XP
- 512MB of Ram or Greater
- 17" Monitor
- 1.6 GHz Processor or Greater
- 100 MB of Unused Disk Space, or Greater
- 100 MBPS Ethernet Card
- 128 MB Video Ram or Greater

Recommended Configuration

- Windows XP
- 1 GB of Ram or Greater
- 19" Monitor or Greater
- 2 GHz Processor or Greater
- 100 MB of Unused Disk Space, or Greater
- 100 MBPS Ethernet Card
- 128 MB Video RAM or Greater

Field Notebook Computers

There are two (2) hardware options for accessing GIS data in the field: hand-held computers and notebook computers. The recommended solution for field access to spatial data is the use of notebook computers. The primary advantage of hand-held computers is their small size, which allows for greater portability. The primary disadvantages of hand-held computers are their small-screen size, and limited memory capacity. Notebook computers have much more memory capacity and processing speed than hand-held computers, and also have much larger screens.

Ruggedized notebook computers are optimal for field personnel needing access to GIS data in the field. Mounts for notebook computers should be installed in any vehicle that will contain a notebook computer. Mounting computers in vehicles makes them much easier to access and reduces wear on

the machine. The mount should not be permanent, however, as notebook computers will need to be taken out of the field periodically to update data. Ruggedized notebook computers are more expensive than regular notebook computers, but the cost of ruggedized notebook computers is offset by their longevity. A ruggedized notebook computer will outlast a regular notebook by three times. Analysis should be made on the continual cycle of repurchasing damaged or worn notebooks, vs. the initial purchase of a rugged version.

The following Departments/Divisions were determined to have a need that could be met by a mobile computer:

- Agricultural Commissioner
- Assessor's Office
- Farm Advisor
- Health Agency
- Office of Emergency Services
- Planning and Building
- Probation
- Public Works
- Risk Management
- CAL FIRE-San Luis Obispo County Fire

The following is the recommended configuration for notebook computers:

Notebook Computer – Approximate Cost = \$4,500

- Ruggedized
- Weigh Less than 5 Pounds
- 1.6 GHz Processor or Greater
- 12 Inch or Greater Anti-glare Display
- CD-ROM Drive
- 1 GB RAM or Greater
- 80 GB Hard Drive Space or Greater
- 10/100/1000 MBPS Ethernet Card
- Wireless Network Adapter



Data Capture Devices – Mapping Grade GPS Receivers

The County should evaluate the current number of existing mapping-grade GPS receivers. Due to the large amount of data needed to be collected in some County departments (Public Works, General Services, etc) it is recommended that the majority of the initial data collection be outsourced (some departments/divisions may wish to maintain own data if deemed feasible). This can save time and money vs. using in-house resources to collect data. Any data that takes longer than a year for in-house staff to collect can usually be outsourced at a lower cost and the data can be used for analysis purposes sooner. However, GPS units will be utilized for in-house GPS data collection of new or modified features.

If the County decides that new GPS receivers are needed, it is recommended that the County acquire the Trimble GeoXH as its mapping grade GPS receiver. The Trimble is ideal for use by utility companies and local government organizations managing assets or mapping critical infrastructure that requires spatial accuracy and data capture.

The following Departments/Divisions were determined to have a need that could be met by a using a mapping grade GPS receiver:

- Agricultural Commissioner
- Assessor's Office
- CAL FIRE
- Health Agency
- Office of Emergency Services
- Probation
- Public Works
- Planning & Building

The following is the recommended configuration for GPS receiver:

Trimble GeoXH – Approximate Cost = \$4,295

- H-Star technology for sub-foot postprocessed GPS accuracy
- Microsoft Windows Mobile version 5.0 software, allowing maximum flexibility in software choice
- 512 MB Flash data storage
- 320 x 320 screen size
- Bluetooth, Wi-Fi compatible
- CompactFlash expansion slots
- Rugged handheld with all-day battery



Field-mounted GPS receivers will need to be configured and linked, as needed, to County computing resources, including computer systems (hand-held computers, notebook/tablet computers, workstations, and servers), networks, and enterprise-wide databases.

Output Devices

Printers

It is important that the County's GIS users have the means to print maps and documentation generated from these applications. Every GIS user should have access to a high-resolution color printer, to print 8"x11", 11"x17", or 8"x14" maps. In the short-term, each GIS user should have access to at least one networked color printer, even if it is not in their immediate work space. As output demand increases, additional color printers should be purchased for appropriate departments and users.

Plotters

It is important that Level 1 GIS Application users (ArcEditor and ArcView) have access to wide-format plotters. Many maps must be outputted onto large sheets to be properly visualized. The following are recommend specifications for wide format plotters:

Plotters – Approximate Cost = \$9,000

- 36" or Greater Paper Sheet Size
- 64 MB of Built-in RAM
- 7.5 GB Hard-drive
- 1200 dpi Addressable Resolution
- Adobe PostScript 3 Capability



HP 1055 Plotter

Additional plotters may be required in the future as Level 1 GIS utilization in the County expands and departmental needs for wide-format printing increase.

Networks

ITD will continue to administer the County's network in support of GIS and its related components. The recommended GIS Coordinator in ITD will need to continually evaluate network infrastructure and configuration to facilitate data transfer and systems integration. The County has existing capacity to serve GIS data via the intranet and internet, with some exceptions in satellite offices located in remote areas. The Agricultural Commissioner, Clerk-Recorder's Office, General Services, Library, Social Services, CAL FIRE, and Public Works all have various satellite offices. As these remote offices are brought on-line using the County's Enterprise GIS, the County should consider fiber optic lines to these locations for network efficient connectivity. Connecting through fiber will provide these departments with ample networking capability for GIS data production and maintenance procedures.

Connecting some of these remote offices with fiber will likely be cost prohibitive, therefore requiring ITD to mitigate the networking demands of production GIS work by increasing the capacity of the existing cable modem / VPN configuration or by adding additional modems and reducing the number of computers per modem. Additionally, other network capacity mitigation techniques can be utilized by ITD that will reduce the demand on the existing network configuration. Large, static datasets such as aerial photography, historical data sources and topographic data can be stored on the user machine. Because these data sets do not change frequently, accessing these data sets from the local machine will give the users a more responsive experience and reduce data transfer across the network (in the case of aerial photography, the reduction can be significant). Other mitigation techniques can be utilized by ITD such as using server based applications such as an Intranet GIS Data browser, using remote desktop capabilities or by implementing thin client application distribution software such as Citrix Metaframe. These mitigation techniques can not duplicate the

responsiveness of connecting to the network through fiber cabling, but have been proven to be effective approaches to maintain an acceptable level of responsiveness within an enterprise GIS

The GIS Coordinator will also need to administer GIS user permissions for each GIS user—users must have different levels of read or write access to GIS data, depending on their responsibilities.

Applications to Meet Identified Needs

The following table outlines the identified GIS Needs as determined by the Department Needs Analysis and what application or service is designed to meet that need (further information on both can be found in Chapter 2 within each department's Needs Analysis and in Chapter 9: *Enterprise Wide Applications*):

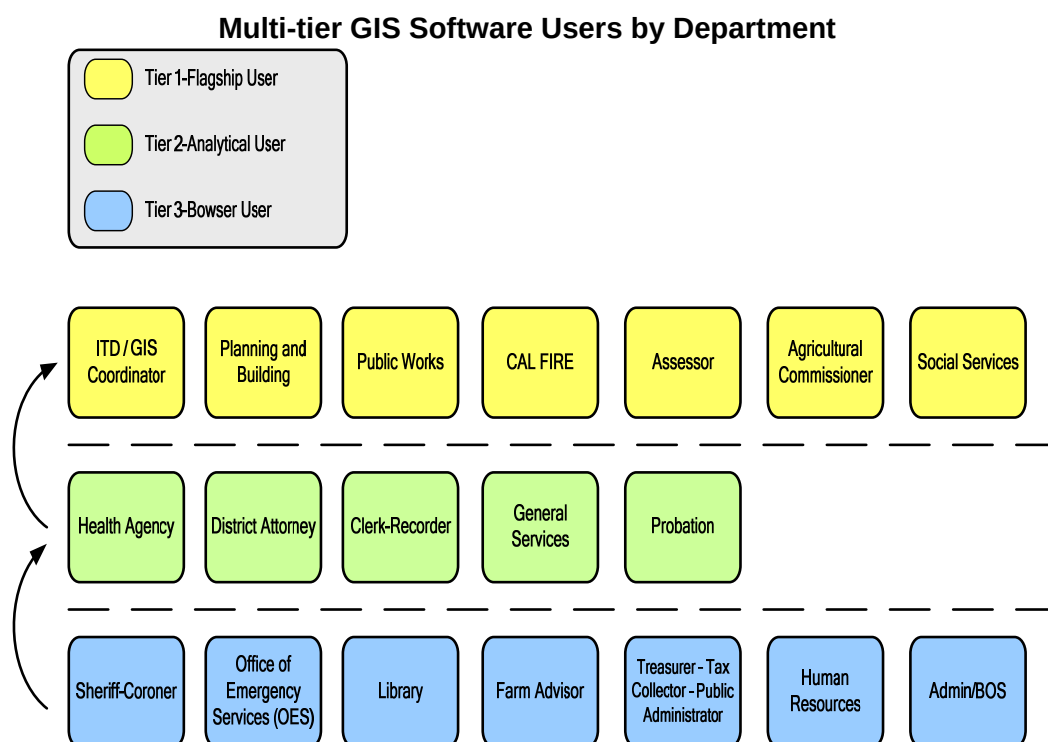
GIS Needs	GIS Application/Service to meet GIS Needs or Duties
<i>Access to Spatially Enable Documents and Drawings / Access to Digital Pre-plans and Hazardous Material Data</i> • Planning and Building • Public Works • Assessor • CAL FIRE • Sheriff	Integration between Document Management software and GIS – To Be Determined (TBD)
<i>Automatic Vehicle Location (AVL)</i> • OES • Probation • Planning & Building	Intranet Data Browser with AVL module
<i>Data Development and Management of Pertinent Data Layers</i> • Clerk-Recorder • General Services • ITD • Public Works • Risk Management • Agricultural Commissioner • Planning & Building • Assessor	ArcGIS (ArcEditor and/or ArcInfo)
<i>Department Wide Access to Geospatial Data</i> • All Depts./Divisions	Intranet GIS Data Browser
<i>Desktop GIS Application to Perform Advanced Mapping functions</i> • All Depts./Divisions	ArcGIS (ArcInfo, ArcEditor, or ArcView) in conjunction with ArcGIS Server
<i>Economic Development GIS Initiatives</i> • Planning and Building	Development of an ArcGIS Server based Web Portal

GIS Needs	GIS Application/Service to meet GIS Needs or Duties
<i>Enabling Existing Databases / Geospatial Data Creation and Integration</i> • <i>Planning and Building</i> • <i>CAL FIRE</i> • <i>Health Agency</i> • <i>Probation</i> • <i>Public Works</i> • <i>Social Services</i> • <i>Agricultural Commissioner</i> • <i>Assessor</i>	GeoManager by GTG
<i>Field Access to Geospatial Data</i> • <i>Agricultural Commissioner</i> • <i>Assessor</i> • <i>CAL FIRE</i> • <i>Farm Advisor</i> • <i>Health Agency</i> • <i>Library</i> • <i>OES</i> • <i>Planning and Building</i> • <i>Public Works</i> • <i>Risk Management</i> • <i>Sheriff</i> • <i>Probation</i>	Mobile GIS Data Browser based on ArcGIS Server platform
<i>Field Data Collection</i> • <i>Agricultural Commissioner</i> • <i>CAL FIRE</i> • <i>Farm Advisor</i> • <i>Health Agency</i> • <i>Public Works</i> • <i>Planning & Building</i> • <i>Assessor</i>	ArcPad with Field Computers (handhelds or rugged tablets)
<i>GIS Based Work Order Management</i> • <i>General Services</i> • <i>Public Works</i>	Work Order Enterprise software application integrated with SAP and GIS
<i>Formal GIS Training</i> • <i>All Depts./Divisions</i>	Specific Application Training
<i>GIS Enabled Recreation Management Software</i> • <i>General Services/Parks</i>	TBD via RFP
<i>Network Admin</i> • <i>ITD</i>	ArcGIS Server
<i>Mapping and Spatial Analysis of Department Data</i> • <i>All Depts./Divisions</i>	ArcGIS (ArcInfo, ArcEditor, or ArcView) in conjunction with ArcGIS Server Intranet GIS Data Browser

GIS Needs	GIS Application/Service to meet GIS Needs or Duties
<i>Mass Notification</i> - Agricultural Commissioner - CAL FIRE - ITD - OES - Sheriff	<i>Mass Notification System</i>
<i>Public Access to Geospatial Data</i> All Depts./Divisions	Internet GIS Data Browser Touch Screen Application
<i>Routing</i> - Assessor - Planning & Building - Probation - Social Services	Intranet GIS Data Browser with Routing Module
<i>Property Tax (PD) System</i> Assessor	TBD via RFP

GIS Software

The following diagram provides a general overview of the expected types of GIS software use within each department/division. It should be noted that the classification is based on the current utilization of GIS within each department/division. Departments/divisions are expected to move into different tiers as GIS utilization within the County increases.

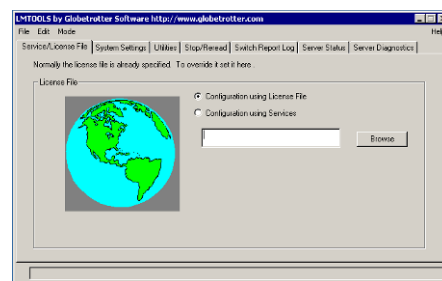


The County currently maintains the following GIS software. All licenses need to be replaced or upgraded to the most recent version. The ability to edit data in the ArcGIS Server platform requires Tier 1 and Tier 2 users to have ArcEditor or ArcInfo.

Department / Division	Software	Type	Number
Agricultural Commissioner	ArcPad 7.0.1	Single use	1
	ArcPress 2.0	Single use	1
	ArcView 9.2	Single use	5
Assessor	ArcView 9.2	Single use	4
	ArcEditor	Concurrent	1
	Global Mapper	Single use	5
	Photomapper		
	Autodesk Map 3D	Single use	5
BOS	ArcReader	Single use	5
Cal Fire	ArcView 9.2	Single use	4
	Spatial Analyst	Single use	1
	Network Analyst	Single use	1
	3D Analyst	Single use	1
Clerk Recorder	ArcView 9.2	Single use	1
General Services	ArcView 9.2	Single use	3
Health Agency	ArcEditor (EH)	Single use	1
	ArcPad	Single use	
	ArcView 9.2	Single use	2
	Spatial Analyst	Single use	
Planning and Building	3D Analyst	Single use	1
	ArcGIS Publisher	Single use	1
	ArcView 3.x	Single use	5
	ArcView 9.2	Single use	6
	Global Mapper	Single use	10
	Photomapper	Enterprise	Unlimited for 2003 aerial
	Spatial Analyst	Single use	1
	ArcReader	Single use	
Public Works	ArcEditor 9.x	Concurrent	1
	ArcGIS Publisher	Concurrent	1
	ArcGIS Publisher	Single use	1
	ArcPad 6.0.3	Single use	1
	ArcPad 7.0.1	Single use	1
	ArcPress	Single use	1
	ArcView 9.2	Concurrent	1
	ArcView 9.2	Single use	5
	Global Mapper	Single use	2

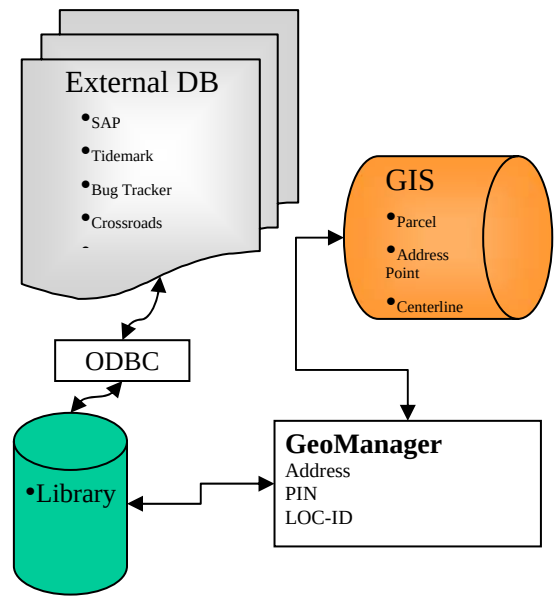
Department / Division	Software	Type	Number
Public Works (con't)	MrSid for ArcGIS	Single use	1
	Xtools	Single use	1
Social Services	MapInfo	Single use	1

It is recommended that the County implement a centralized license management protocol made available through ArcGIS 9.x, along with the installation of AGS. All ESRI ArcGIS desktop and extension licenses should then be managed through this centralized system. Monitored access to the floating ESRI licenses would be policed through the protected installation of ArcGIS desktop software. This standard will ensure that all GIS users have the same version of a specific type of software. All licenses should be under one account number and maintained by ITD and the recommended GIS Coordinator.



Enterprise System Application Integration

In addition to the ESRI software products, each department maintains various applications that could incorporate a spatial component or integrate with ESRI software. These applications are department-specific and provide users with the ability to import, integrate, and extract data spatially. Each department stores much of its information in electronic databases that have addresses as an attribute; therefore spatially enabling these databases will yield important datasets for the GIS. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried. These applications should be upgraded and configured, as necessary, to ensure that they are compatible with the new versions of ESRI software that have been recommended. Until the base map layers (Street Centerlines and/or Address Points) are updated the functionality of this application will be limited.



Outline of GIS Software Recommendations

Software	Department of Deployment	Recommended Year(s) of Purchase
ArcGIS Server Enterprise Standard	ITD	1
ArcInfo 9.x Concurrent License	ITD	1 - 2
Database GIS Integration Software (Geomanager)	Assessor, Planning and Building, CAL FIRE, Sheriff,	1
ArcGIS Server based Intranet GIS Data Browser	Enterprise	1 - 2
Upgrade County funded copies of ArcView 9.2 to Concurrent ArcEditor 9.x licenses	CAL FIRE	1
Upgrade single use ArcView 9.2 to concurrent use ArcEditor 9.x licenses (for existing and new staff)	Enterprise	1 - 2
Upgrade ArcGIS Server Enterprise Standard to Advanced	ITD	3
GIS Link to Document Management System	Planning and Building, Public Works, Assessor	3
Field Access and Mobile Data Browser	Agricultural Commissioner, CAL FIRE, Farm Advisor, Health Agency, Library, OES, Planning and Building, Public Works, Risk Management, Sheriff, Probation, Assessor, General Services	3 - 5

Software	Department of Deployment	Recommended Year(s) of Purchase
Economic Development Web Portal	Planning and Building	4
GIS Based Work Order Management System tied to SAP Enterprise Integration	General Services, Public Works	4
Public Internet Site Portals	Enterprise	4
Automated Vehicle Location (AVL) software	Office of Emergency Services, Probation, Planning and Building(for routing functions), Assessor (routing), Social Services (routing)	5
Enterprise Mass Notification System (CodeRED)	CAL FIRE, ITD, Office Emergency Services, Sheriff, Agricultural Commissioner	5
Incident Modeling and Visualization software	OES, Agricultural Commissioner	5
Property Tax (PD) System	Assessor	5
Touch Screen GIS Application (3)	Admin/BOS, Agricultural Commissioner, , Library, Planning and Building	5

GIS Services

The County will require external support to enable the successful continued implementation of the County's GIS. Expert support will ensure that the County will realize the maximum return on investment (ROI) during the implementation and deployment process. Additionally, expertise of external support will enable the gradual transfer of missing knowledge to County personnel. This will ensure that staff has the knowledge for continued utilization of the GIS as a critical decision support system.

The possible tasks and deliverables provided by third-party spatial service providers follow. Some of these tasks can be performed by the GIS Manager depending on skill sets and time constraints.

- Setup of Intranet and Internet ArcGIS Server portals
- Optimal setup of ArcGIS Server and recommended hardware
- Data and database development (assistance with creation of all required and recommended layers)
- Public Works and other major department's data collection in the field
- Setup of Extraction Routines and Clean Up of Existing ITD Databases
- Application Integration
- Development of Specialized Economic Development Web Site
- Imaging Integration
- Updating this Needs Analysis and Implementation Plan
- Other Technical Support Issues as they arise

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design GIS Training and Education



Chapter 8: GIS Training and Education

Chapter Outline

Enterprise-wide Training on the Three Tiers of GIS Usage

Training Classes

- Intro to ArcGIS I and II

- Building Geodatabases I and II

- Intro to ArcGIS Server

- ArcGIS Server Enterprise Configuration and Tuning for SQL Server

- Tier 3 Applications

GIS Training Matrix

Recommended Number of Personnel (by Department) for Training Continuing Education

Enterprise-wide Training on the Three Tiers of GIS Usage

Training will be an integral part of the County of San Luis Obispo's GIS implementation strategy. The training model should follow the same Tiers of GIS use outlined in previous chapters. To recap: a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.

Tier 1 users responsible for the creation/maintenance of GIS databases in the ArcGIS 9.x environment should take the weeklong ArcGIS class (ArcGIS I and ArcGIS II). The ArcGIS classes teach functionality for ArcInfo 9.x, ArcEditor 9.x, and ArcView 9.x. ArcGIS I and ArcGIS II classes can be provided on-site by ESRI or ESRI Authorized Instructors. In addition to the weeklong ArcGIS class, Tier 1 users that will have direct interaction with ArcGIS Server should also take the Intro to ArcGIS Server and Building Geodatabases I and II classes.

Tier 2 users should be provided, at a minimum, with the two-day ArcGIS I training class. This will include an introduction to the base functionality of the software, from data management to desktop level analysis. Realistically, Tier 2 users should also take the ArcGIS II class as well. Students can either travel to an ESRI office for this training, or hire an ESRI Authorized Instructor to teach ArcGIS I on-site (recommended – more cost efficient).

Tier 3 users will receive customized training sessions on each individual application that is developed. These applications are very intuitive and user-friendly. Half-day training sessions on each application will be sufficient. This training can be performed either on or off-site by County staff or hired consultants.

Training Classes

Introduction to ArcGIS I – for ArcView 9.x, ArcEditor 9.x, and ArcInfo 9.x (Two days) **Recommended for Tier 1 and Tier 2 users**

Overview:

This two-day course introduces participants to ArcGIS and provides the foundation for becoming a successful ArcView, ArcEditor, or ArcInfo user. Participants learn how to use ArcMap, ArcCatalog, and ArcToolbox and explore how these applications work together to provide a complete GIS software solution. The course covers fundamental GIS concepts as well as how to create, edit, and work with georeferenced spatial data. Participants learn how to manipulate tabular data, query a GIS database, and present data clearly and efficiently using maps and charts.

Audience:

This course is for those who are new to ArcGIS or to geographic information systems in general.

Goals:

- Display feature and tabular data
- Work with georeferenced spatial data
- Query features using logical expressions
- Find features using spatial relationships
- Edit spatial and attribute data
- Associate tables with joins and relates
- Produce maps, reports, and graphs

Topics covered:

- ArcGIS overview: Capabilities and applications; Interacting with the interface; Basic display
- Spatial data concepts: Representing spatial data and descriptive information
- ArcGIS data model: Geodatabases; Shapefiles; Coverages; Feature types; Attributes
- GIS software: Components; Functions; Applications
- Spatial coordinate systems and map projections: Georeferencing data; What map projections are; How ArcMap works with map projections
- Querying data: Selecting and identifying features; Creating reports and graphs
- Map displays: Creating; Symbolizing; Scaling; Adding map elements

Prerequisites and recommendations:

Participants should know how to use windowing software. This course provides the fundamental ArcGIS knowledge and experience needed to enroll in *Introduction to ArcGIS II* (for ArcView 9.x,

ArcEditor 9.x, and ArcInfo 9.x) as well as several other ESRI courses. Many of the topics covered in this course are similar to those in *Migrating from ArcView 3.x to ArcView 9.x*. Participants who complete this course should not enroll in *Migrating from ArcView 3.x to ArcView 9.x*. Participants who have worked with prior versions of ArcView and want to learn about ArcView 9.x applications should take *Migrating from ArcView 3.x to ArcView 9.x*.

Price: \$900 per student. Reduced rates may apply for onsite training.

Introduction to ArcGIS II – for ArcView 9.x, ArcEditor 9.x, and ArcInfo 9.x (Three days)

Recommended for Tier 1 and Tier 2 users

Overview:

This three-day course follows *Introduction to ArcGIS I (for ArcView 9.x, ArcEditor 9.x, and ArcInfo 9.x)* and continues to present important concepts and functionality for successfully working with ArcGIS. With further exploration of ArcMap, ArcCatalog, and ArcToolbox, participants focus on spatial analysis, automation of spatial and attribute data, editing, and advanced options for cartographic display and reports. Hands-on exercises teach ArcGIS procedures in the context of solving real-world problems. Examples and exercises use data from a variety of application areas. A portion of the class is reserved for carrying out an analysis project and applying many of the new skills and techniques learned in this course. Participants conduct queries, perform spatial analysis, and present their results in a hard-copy map and report.

Audience:

This course is designed for those with fundamental knowledge of ArcGIS and geographic information systems in general.

Goals:

- Perform spatial analysis
- Manage geographic data
- Perform geocoding
- Automate data through heads-up digitizing
- Convert data from other formats
- Edit spatial and attribute data
- Create and use metadata
- Produce high-quality maps and reports

Topics covered:

- Spatial analysis and data management: Buffers; Spatial overlays; Extracting features for analysis; Analytical methods and tools
- Geocoding and display of locations from tabular data: Address geocoding; Display of points from x, y coordinates
- Editing: Tools for creating and editing spatial data; Editing attribute data; Spatial adjustment
- Data automation: Data sources; Digitizing; Data conversion
- Project management: Database organization; File and directory naming conventions; Creating and using metadata
- Cartography: Advanced symbology and labeling

Prerequisites and recommendations:

This course is for those who have completed *Introduction to ArcGIS I* (for ArcView 9.x, ArcEditor 9.x, and ArcInfo 9.x) or *Migrating from ArcView 3.x to ArcView 9.x* (instructor-led or Web-based course). If one of the prerequisite courses is not completed, a participant should have comparable experience with ArcGIS before taking this course. The course also provides participants with the fundamental ArcGIS knowledge and experience needed to enroll in *Building Geodatabases I* (for ArcEditor 9.x and ArcInfo 9.x).

Price: \$1,350 per person. Reduced rates may apply for onsite training.

Building Geodatabases I (Three days)

Recommended for Tier 1 users

Overview:

This three-day course details the capabilities of the geodatabase and how to migrate existing data to build a geodatabase for ArcGIS 9.x. Participants learn how to create, use, edit, and manage spatial and attribute data stored in the geodatabase. Discussion topics include loading data into the geodatabase; defining appropriate topology rules; and maintaining data integrity through subtypes, attribute domains, and relationship classes. Instruction will be given on loading existing data from coverages, shapefiles, and computer-aided design (CADD) formats to create new point, line, polygon, and annotation feature classes.

Audience:

This course is for spatial data Coordinators who have a basic understanding of ArcGIS desktop applications and are ready to use the geodatabase. New and existing data Coordinators waiting to migrate to the geodatabase will benefit from this course.

Goals:

- Load data into the geodatabase from a variety of formats
- Set spatial reference and spatial domain
- Build a topology in the geodatabase
- Apply the appropriate topological rules for data
- Use the appropriate attribute rules for data with subtypes and domains
- Edit topological data
- Generate relationship classes
- Create and use rules for relationship classes and attribute data entry
- Produce and edit annotation

Topics covered:

- Introduction to the geodatabase: Data storage options; Geodatabase structures and permissions; Enterprise vs. personal geodatabase; Geodatabase tables in a database management system (DBMS)
- Building a geodatabase: Designing the geodatabase; Defining its structure; Creating a new schema; Loading data from shapefiles, CADD files, and coverage point, line, polygon, region, and annotation features
- Understanding spatial domain: Precision vs. accuracy; Geodatabase coordinate storage
- Geodatabase topology: Topology management in the geodatabase; Building a topology; Setting the properties of a topology; Setting appropriate topological rules; Fixing topological errors; Editing topological data
- Relationship classes: Creating relationship classes; Setting relationship class properties; Using relationships in ArcMap; Relationship rules; Validation; Simple vs. composite relationships
- Attribute validation rules: Subtypes and domains; Creating subtypes; Editing subtypes in ArcMap; Creating domains; Editing with domains in ArcMap; Coded value vs. range domains; Subtypes and relationship rules

Prerequisites and recommendations:

Prior knowledge of the geodatabase is not required; however, participants should complete *Introduction to ArcGIS I and II* (for ArcView 9.x, ArcEditor 9.x, and ArcInfo 9.x), or *What's New in ArcInfo 9.x* (previously offered instructor-led course or currently available Web-based course), or have equivalent knowledge. Participants should not take this course if they have completed the previously offered course, *Creating and Managing Geodatabases* (for ArcEditor 9.x and ArcInfo 9.x).

Price: \$1,350 per person, plus travel expenses

Building Geodatabases II (Two days)

Recommended for select Tier 1 users

Overview:

This new two-day course extends the content of *Building Geodatabases I (for ArcEditor 9.x and ArcInfo 9.x)* by discussing the advanced capabilities for modeling and working with linear features in the geodatabase. Discussion topics include creating, editing, and performing analyses on geometric networks; managing linear referenced data for displaying data that occurs along linear features; and migrating coverage arcs, routes, and events to the geodatabase.

Audience:

This course is for spatial data Coordinators who work with linear features and are ready to take advantage of the geometric network and linear referencing capabilities of the geodatabase.

Goals:

- Build and perform analyses on geometric networks
- Set rules for editing and analyzing on geometric networks
- Build route systems in the geodatabase
- Edit route systems
- Dynamically locate events on route systems

Topics covered:

- Geometric networks: Storing a network; Simple vs. complex network features; Logical network; Flow on a geometric network; Performing network analysis; Network weights; Restricting the area of a trace; Complex edges; Building a geometric network; Setting network rules; Validating connectivity rules
- Linear referencing: Linear referencing basics; Creating routes; Storing routes in the geodatabase; Hatching routes; Rules for editing routes; Tools for editing routes; Displaying route anomalies; Reroute events; Advanced route events options; Transforming events

Prerequisites and recommendations:

Participants should complete *Building Geodatabases I* (for ArcEditor 9.x and ArcInfo 9.x) or have equivalent knowledge.

Price: \$900 per person, plus travel expenses

Introduction to ArcGIS Server (Three days)

Recommended for select Tier 1 users

Overview:

ArcGIS Server provides a complete server-based GIS system that supports the use of centrally managed spatial data for mapping and analysis. This course introduces ArcGIS Server and teaches how to install, configure, and use the product as administrators and consumers of GIS services. Students learn how to publish maps, globes, and geoprocessing models that are optimized for performance. Students also create out-of-the-box Web applications using Coordinator and learn how to use GIS services in both Web applications and ArcGIS Explorer.

Audience:

This course is designed for those new to ArcGIS Server who want to learn about its architecture, capabilities, and client applications.

Goals:

- Understand the client and server components of the ArcGIS Server architecture.
- Configure the ArcGIS Server system.
- Administer the GIS Server and GIS services.
- Optimize the performance of GIS services.
- Build Web applications that consume GIS services.
- Utilize ArcGIS Explorer to work with GIS services.

Price: \$900 per person, plus travel expenses

ArcGIS Server Enterprise Configuration and Tuning for SQL Server (Two days)

Recommended for select Tier 1 users

Overview:

ArcGIS Server includes ArcSDE technology, a server-side software product that acts as the GIS gateway to spatial data stored in relational database management systems (RDBMS). It is an integrated part of ArcGIS and a core element of any enterprise GIS solution. This course prepares SQL Server® database administrators to implement an enterprise geodatabase by teaching how to set up an individual ArcSDE server. Students get familiar with the ArcSDE architecture and learn how to configure SQL Server to support ArcSDE, install and configure ArcSDE, and identify and troubleshoot connection types and issues. The course emphasizes the importance of managing storage settings for loading vector and raster data and teaches techniques for maintaining geodatabase performance in an editing environment. Additionally, the course explains how ArcSDE interacts with SQL Server databases and presents solid strategies for maintaining and managing an enterprise geodatabase.

Audience:

This course is designed for experienced SQL Server database administrators who need to understand how to install and configure an enterprise geodatabase.

Goals:

- Configure SQL Server to support ArcSDE.
- Install and configure ArcSDE.
- Customize storage for spatial data.
- Configure, create, and monitor connections.
- Implement data management strategies for vector and raster data.

- Optimize ArcSDE.
- Maintain performance of an enterprise geodatabase.

Prerequisites and recommendations:

Students should have experience with SQL Server database administration or application development. Although these courses are not required, students will benefit from completion of *Introduction to ArcGIS I*, *Introduction to ArcGIS II*, or *Building Geodatabases*.

Price: \$900 (Two days) plus travel expenses

Tier 3 Applications (GIS Intranet Data Browser, Mobile and/or Field applications, Routing, etc.)

Recommended for Tier 3 users as application need arises.

The cost of all Tier 3 applications includes training for selected personnel. Enterprise-wide training of Tier 3 applications can be conducted by the GIS Coordinator.

Tier 3 application training should cover the following topics/functionality:

- Brief overview of GIS
- Zoom and pan functionality
- Map extents
- Feature identification
- Map production/printing
- Reports (as needed)
- Spatial queries (as needed)
- Exporting maps

- Saving projects

In addition to the aforementioned topics/functionality, Tier 3 users should receive additional training specific to individual workflows or modules, such as work order request mapping and tracking or public notification via mapping module.

GIS Training Matrix

Class	Site	Trainer	Days	Year of Training	Participants	Cost
Introduction to ArcGIS I	On	ESRI Authorized Trainer	2	1,2	Tier One and Two GIS Users	\$900
Introduction to ArcGIS II	On	ESRI Authorized Trainer	3	1,2	Tier One and Two GIS Users	\$1,350
Building Geodatabases I	Off	ESRI	3	1,2	Tier One Users and GIS Coordinator	\$1,350
Building Geodatabases II	Off	ESRI	2	1,2	Tier One Users and GIS Coordinator	\$900
Introduction to ArcGIS Server	Off	ESRI	2	1,2	Tier One Users and GIS Coordinator and ITD Staff	\$900
ArcGIS Server Enterprise Configuration and Tuning for SQL Server	Off	ESRI	2	1,2,3	GIS Coordinator, and ITD Staff	\$900
Tier 3 Applications	On	Internal	1	1,2,3	Various	Varies

Recommended Number of Personnel (by Department) for Training

Department	<i>ArcGIS I</i>	<i>ArcGIS II</i>	<i>Building Geodatabase I and II</i>	<i>Intro to ArcGIS Server</i>	<i>ArcGIS Server Tuning and Configuration</i>
Administrative Office / Board of Supervisors	0	0	0	0	0
Agricultural Commissioner	4	4	1	1	0
Assessor's Office	5	5	5	1	0
CAL FIRE	2	2	2	1	0
Clerk Recorder's Office	1	1	0	0	0
Office of the District Attorney	1	0	0	0	0
Farm Advisor	0	0	0	0	0
General Services	2	2	0	0	0
Health Agency	2	2	0	0	0
Human Resources / Risk Management	0	0	0	0	0
Information Technology	3	3	3	3	3
Library	0	0	0	0	0
Office of Emergency Services	0	0	0	0	0
Planning and Building	4	4	4	3	0
Probation	1	1	0	0	0
Public Works	2	2	1	1	0
Sheriff - Coroner	0	0	0	0	0
Social Services	1	1	1	1	0
Treasure / Tax Collector / Public Administrator	0	0	0	0	0
Totals:	28	27	17	11	3

Continuing Education

An important part of professional GIS education is not only formal training classes, but attending GIS conferences. GIS conferences allow attendees to attend workshops and seminars (some free, some at additional cost), and to interact with other GIS professionals from around the region, state, country, and world. The County should budget approximately \$5,000 every year for conference attendance. Important conferences that should be attended by County staff (at the GIS Coordinator's discretion, within budgetary limitations) include:

ESRI International User Conference

August 4-8, 2008

San Diego, California

(<http://www.esri.com>)

Who Should Attend?

- The ESRI User Conference is open to all ESRI software users including:
 - o New Users
 - o Experienced Users
 - o User Group Members
 - o Coordinators
 - o Programmers
 - o Specialists
 - o Analysts
 - o Technicians
 - o First Responders
 - o Management Information Services and Industry Solutions Coordinators
 - o Project Coordinators
 - o Department Heads
 - o Division Chiefs
 - o Executive Directors
 - o Faculty
 - o Elected Officials
 - o Board Members
 - o Chairpersons
 - o NGO Representatives
 - o Local, Regional, National, and International Committee Members

Topics Covered

- Application Success Stories
- Lessons Learned
- Data Standards
- Data Migration
- Data Access
- Project Applications
- Software Development
- Complimentary Technology
- Mandates
- Grant Programs
- Collaborative Projects
- Initiatives

Urban and Regional Information Systems Association (URISA)

Annual Conference and Exposition

October 7-10, 2008

New Orleans, LA

(<http://www.urisa.org>)

The URISA Annual Conference offers a unique multidisciplinary approach, with sessions led by industry leaders, powerful keynote presentations, panels, roundtable discussions and networking meetings you won't find anywhere else.

This conference is vital to professionals concerned with the effective application of Management Information Services in all state and local government agencies, including:

- Community & Economic Development
- Emergency Services/Public Safety
- Environmental Management
- Land Records
- Public Works
- Tax Assessment
- Transportation Planning
- Urban Planning & Design
- Utilities

Geospatial Information and Technology Association (GITA)
Geospatial Infrastructure Solutions Conference and Exhibition
March 9 - 12, 2008 April 19-22, 2009
Seattle, Washington Tampa, Florida
(<http://www.gita.org>)

Presenting the geospatial industry's first and only industry conference completely dedicated to exploring, discussing, and addressing the growing issues, challenges, and solutions for America's and the world's infrastructure.

The Geospatial Infrastructure Solutions Conference (formerly Annual Conference) offers geospatial professionals and professionals involved with all levels of infrastructure planning, design and management the opportunity to convene in one place to identify leading geospatial solutions in the context of infrastructure management. The program features 111 technical sessions, 13 half-day seminars, a massive products and services exhibition, and so much more.

in-fra-struc-ture: all fundamental services, activities, and operations that sustain our communities and way of life

Anyone who is interested in using geospatial information technologies is invited to attend. The conference program will address topics of interest to executives and managers in government agencies; electric, gas, and water/wastewater utilities; telecommunications companies; pipeline companies; the public sector; and other organizations interested in using geospatial information to enhance their bottom line.

San Luis Obispo GIS Users Group
Quarterly meetings
Embassy Suites, 333 Madonna Road, San Luis Obispo
<http://gisug.calpoly.edu/>

The San Luis Obispo GIS Users Group meets quarterly. They generally have three presentations by members, vendors, or ESRI. Perhaps more valuable is the opportunity to network. Membership includes state and local government, education, non-profit, and private organizations. Meetings are free and open to all.

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Enterprise Wide Applications



Chapter 9: Enterprise Wide Applications

Chapter Outline

Introduction

GIS Applications Overview

- Desktop vs. Web Applications
- ArcGIS Server Architecture
- Licensing Overview
- ArcGIS Product License Information

Recommendations

- Server
- Desktop
- Intranet
- Internet
- Public Access Application
- Mobile GIS Functionality
- Mass Notification System

Introduction

This section provides details about GIS applications that will be used Countywide by personnel in various departments, by the public, or by both County personnel and the public. GIS applications are one of the key building blocks for the County's enterprise-wide GIS implementation. GIS application use is based on a multi-tiered model based on three types of users: Flagship users (Application Developers), Analytical users (GIS Data Developers), and Browser users (GIS daily users).

As a recap, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. Please refer to specific department/division sections in Chapter 2: *Departmental GIS Needs Analysis*, to determine the types of users within each department/division.

GIS technology has long been valued for improving communication and collaboration in decision-making, for effectively managing resources and assets, for enhancing the efficiency of workflows, for improving the accessibility of information, and generally offering tangible cost savings to organizations like San Luis Obispo County. In an effort to deliver geospatial information and functionality throughout an enterprise, organizations are choosing to extend their desktop GIS implementations with server based GIS solutions and Web services. In addition, focused sets of GIS logic can be embedded and deployed in custom applications and increasingly, GIS is deployed in mobile field devices.

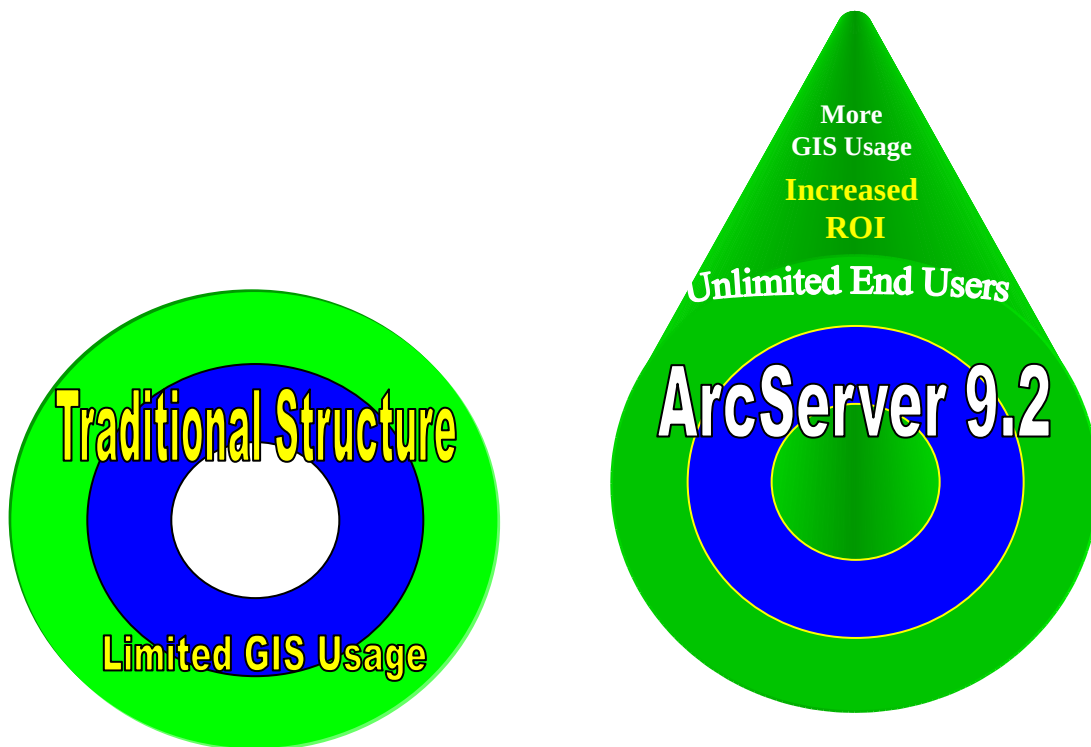
GIS Applications Overview

Desktop vs. Web Applications

Traditionally, GIS professionals have concentrated primarily on data compilation and focused application projects, investing time in creating GIS databases and authoring geographic knowledge. Desktop-based GIS applications have been used by end-users for connecting to geographic datasets via shared databases, building workflows for data compilation and quality control, authoring maps and analytical models and documentation. This was all based on licensing structure within the organization. Organizations commonly took advantage of the ESRI Single Use or Concurrent licensing structures. The Single Use license is dedicated for each computer or network access point that has use rights for software, data or documentation. The Concurrent license permitted execution of the software on any computer on the network and was controlled by a license manager application. This traditional distribution structure limits GIS application usage based on budgeted number of licenses.

ArcGIS Server Architecture

Progressively, an increased number of GIS professionals have begun to use and exploit their results in numerous GIS applications and settings. The work of authoring and serving geographic data will largely remain within the domain of GIS professionals. However, these professionals will also increasingly create server-based applications that allow common users, both internal and external to the organization, to have access to the power of GIS. The influence of GIS is still growing rapidly and will provide a powerful medium for managing, visualizing and communicating information between GIS professionals and the end-users. ArcGIS Server offers enterprise level functionality, which directly addresses Single Use and Concurrent Use license limitations by offering unlimited GIS application usage.



The implications for the County are that end users will more actively utilize GIS enterprise-wide, become more proficient users, and can perform more complex GIS tasks. By incorporating this level of end-user into an organization, the County will realize an increased return on investment (ROI) based on steady increases of internal and external GIS usage, developing in-house server based applications and eliminating cost for single use licenses; making GIS widely available through custom application development via ArcGIS Server intranet/internet capabilities.

Licensing Overview

Most Environmental Systems Research Institute's (ESRI) products are licensed under the "click-wrap" license agreement included with the product. ESRI generally requires signed licenses for server products, developer products, and web service products. A signed Master License Agreement (MLA) is required for some ESRI products. The signature page is provided by ESRI or its distributor and will incorporate the MLA Terms and Conditions.

There are many different types of license agreements which ESRI has placed on its software distribution to consumers. Listed below are the different types of license agreements and a description about each.

License Type	Description
Single Use License	A license dedicated for each computer or network access point that has use rights for software, data, or documentation. The licensee may make a second copy for his or her exclusive use on a portable computer so long as only one copy of the software, data, and documentation is in use at any one time.
Concurrent Use License	A license that permits execution of the software on any computer on the network. The number of simultaneous/concurrent users may be controlled by a License Manager to access and use the software, data, or documentation.
Server License	A license for server-side software that resides on a server computer and provides services to multiple users in a client/server distributed computer agreement.
Stand-alone Redistribution / Deployment License	A license which grants the licensee the right to redistribute a stand-alone application to end users provided the application is installed on each computer on which the application is run. This license requires payment of redistribution or deployment fees.
Server Deployment / Internet Redistribution License	A license which grants the right to redistribute an application via a network, the Internet, or Intranet to end users of the application. This license does not require a payment of additional deployment or redistribution fees.
Dual Use License	A license in which the software may be installed on a desktop computer and may be used simultaneously with either a PDA or handheld mobile device provided that the software is only used by a single individual at any one time.
Development and Testing Server License	A license which is specifically intended for a specific server/CPU which includes the right to develop, test, and deploy applications to end users. All developer licenses are single use licenses. This license is not intended for deployment of applications for production by end users. Licensees may use the Server software to test and deploy applications on the Internet provided the source and object code are not accessible to users of the application. Except for ArcGIS Server, the Server software administration tools may be copied and redistributed throughout the licensee's organization.

The two most common types of ESRI licensing are single use and concurrent use licenses. A single use license is installed on and dedicated to a particular Personal Computer (PC). A concurrent use license permits execution of the GIS software from any PC on the network and allows multiple users to gain access at the same time. In this case there is a shared pool of “floating” licenses administered by a central license manager. Currently the County utilizes a variety of both single use and concurrent use licenses.

ArcGIS Product License Information

ArcGIS is an integrated collection of GIS software products for building a complete GIS. ArcGIS enables users to deploy GIS functionality wherever it is needed—in desktops, servers, or custom applications; over the Web; or in the field. It introduces a new workflow that allows organizations to be more productive. As a complete geographic information system (GIS), ArcGIS allows agencies to author data, maps, globes, and models on the desktop; serve them to a GIS server for many others to access; and use them through web, desktop, and mobile clients. The diagram below highlights the interconnectivity between each of these realms within ArcGIS and their respective products.



Desktop GIS:

ArcGIS Desktop is the primary platform for GIS professionals to compile, author, and use geographic information and knowledge. It provides a collection of software products that create, edit, import, map, query, analyze, and publish geographic information. ArcGIS desktop products include ArcReader, ArcView, ArcEditor, ArcInfo, and ArcGIS Desktop Extensions. Although licensed separately, these products share the same core applications, user interface, and development environment. Each product provides additional GIS functionality, which is enabled as organizations move from ArcReader to ArcView to ArcEditor to ArcInfo.

ArcGIS desktop products share the same core applications (ArcMap and ArcCatalog), user interface, and development environment so users can share their work with others. Maps, data, symbology, map layers, geoprocessing models, custom tools and interfaces, reports, and metadata can be accessed interchangeably. A wide-ranging suite of optional extensions expands the functional capabilities of these products with specialized GIS tools.

ArcView:

ArcView allows users to visualize, explore, and analyze geographic data, revealing underlying patterns, relationships, and trends. Organizations can use ArcView to create maps, manage data, and perform spatial analysis. ArcView can be distributed by single use license or by concurrent use licenses.

ArcEditor:

ArcEditor provides advanced editing, data validation, and workflow management tools to maintain the integrity of an organization's data. With ArcEditor, users can author quality maps and perform sophisticated spatial analysis. Additionally, organizations can use ArcEditor to manage complex information, automate the editing workflow, and allow multiple users to update the same data simultaneously. ArcEditor can only be distributed by a concurrent use license.

ArcInfo:

ArcInfo is the complete GIS product to build a comprehensive desktop GIS. The de facto standard for GIS professionals, ArcInfo provides tools for data integration and management, visualization, spatial modeling and analysis, and high-end cartography. It supports single-user and multi-user editing and automates complex workflows. Organizations can use ArcInfo to gather, build, and manage data, analyze geographic relationships, discover new information, and produce publication-quality maps. ArcInfo and its workstation extensions can only be distributed by concurrent use licenses.

ArcGIS Desktop Extensions:

ArcGIS Desktop Extensions allow organizations to perform additional tasks such as raster geoprocessing, three-dimensional visualization, and geostatistical analysis. They can be distributed by single use license or by concurrent use licenses.

Server GIS:

Server GIS allows GIS software to be centralized in application servers—delivering GIS capabilities to large numbers of users over networks. ESRI offers a range of server GIS software products—ArcGIS

Server, ArcGIS Explorer, ArcIMS, and ArcGIS Image Server. These products allow GIS and data services to be hosted in a server-based environment. Centralized data management and application support, combined with adherence to information technology standards, make server GIS software products the key to broad use of geospatial technology with enterprise information systems.

Basically, Server GIS enables organizations to distribute their maps, models, and tools out to others in the organization in a way that fits well into business workflows. Staff in other departments and out in the field can query accurate, up-to-date data without a significant amount of training. This increases users' productivity as well as the enterprise as a whole. Server GIS complements ArcGIS Desktop by allowing GIS analysts to cost-effectively author maps, globes, and geoprocessing tasks on a desktop and publish them via a server using integrated tools. GIS functions can then be delivered as services throughout the enterprise. Server GIS allows GIS desktop applications and capabilities to be available to large numbers of users over IT networks without incurring costs associated with purchasing single use or concurrent licensing. Enterprise GIS users connect to central GIS servers using traditional desktop GIS as well as Web browsers, mobile computing devices, and digital appliances. ESRI Server GIS is IT-compliant and interoperates well with other enterprise software, such as customer resource management (CRM) or enterprise resource planning (ERP) systems. It offers support for interoperability standards in both the GIS domain (Open Geospatial Consortium) as well as the broader IT domain World Wide Web Consortium (W3C). The W3C develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential. W3C is a forum for information, commerce, communication, and collective understanding.

ArcGIS Server:

ArcGIS Server is ESRI's primary server GIS product. It is a complete and integrated server-based GIS. It comes with out-of-the-box, end user applications and services for spatial data management, visualization, and spatial analysis. ArcGIS Server can be distributed by single use license, server license, server deployment license, developer license, and developer and testing server license. Listed below are two tables which outline each of the available ArcGIS Server editions and levels.

ArcGIS Server Editions	
Basic	This edition of ArcGIS Server is essentially ArcSDE bundled together with database replication functionality.
Standard	This edition of ArcGIS Server includes all of the functionalities associated with the Basic edition, standard map publishing (similar to ArcIMS), Globe Server for 3D map rendering (such as ArcGIS Explorer), and standard geoprocessing.
Advanced	This edition of ArcGIS Server includes GIS feature editing through a web browser, support for connected or disconnected mobile clients through the mobile Application Development Framework (ADF), and advanced geoprocessing.

ArcGIS Server Levels	
Workgroup	This level of ArcGIS Server includes a version of ArcSDE that works only with SQL Server Express 2005 and is limited to ten users, 4 GB of data storage, and one socket.
Enterprise	This level of ArcGIS Server allows for unlimited users and SDE database size, but requires the use of a Database Management Service (DBMS), such as SQL Server or Oracle.

ArcGIS Image Server:

ArcGIS Image Server is a management, processing, and distribution platform for geospatial imagery that integrates with ArcGIS Server. It provides fast and open access to geospatial imagery, allowing organizations to leverage their investments in raster data. When used in conjunction with ArcGIS Server, clients use a direct connection to ArcGIS Image Server for fast access and an advanced level of functionality. ArcGIS Image Server can be distributed by single use license, server license, server deployment license, developer license, and developer and testing server license.

ArcIMS:

ArcIMS is widely used for GIS Web publishing to deliver maps, data, and metadata to many users on the Web. For example, ArcIMS provides browser-based access to many GIS catalog portals that enable users to publish and share geographic knowledge with other users. ArcIMS can be distributed by single use license, server license, server deployment

license, developer license, and developer and testing server license. The product will not continue to be sold individually in the near future. Instead, this product will be merged into ArcGIS Server.

Mobile GIS:

Mobile GIS enables field-based personnel to capture, store, update, manipulate, analyze, and display geographic information. ArcGIS technology can be deployed on a range of mobile systems from lightweight devices to PDA's, laptops, and Tablet PCs.

ArcPad:

ArcPad is software for mobile GIS and field mapping applications. ArcPad provides mapping, GIS, and GPS integration to field users via handheld and mobile devices. Data collection with ArcPad is fast and easy and improves field-based data validation and availability. ArcPad is distributed by single use license and dual use license. It is not licensed for navigational use.

Hosted / Web GIS:

Hosted GIS offers a cost-effective way to include mapping and location services in Web-enabled applications. ArcGIS Web services give a diverse user community access to geospatial content. They offer a cost-effective way to include mapping and location services in Web-enabled applications. ArcWeb Services provide access to both GIS content and GIS capabilities on demand when needed and eliminate the overhead of purchasing and maintaining large data sets. An ArcWeb Services subscription provides organizations with instant access to imagery and aerial photos, real-time weather and traffic incidents, demographic data, and much more. Organizations can use ArcWeb Services in ArcGIS, or to build unique Web-based applications.

Recommendations

The following section provides base recommendations on enterprise GIS solutions that will be used on some level by all County departments, if not directly, then in a supporting role. Server and desktop product recommendations are made based on the assessment and analysis of the County's current GIS and IT configuration. Specific number of licenses and in which department these licenses should be deployed will be discussed in Chapter 16: *Five Year Phased Implementation Plan*.

- Server Product Recommendations - ESRI's ArcGIS Server
- Desktop Product Recommendations – ESRI's ArcGIS Desktop (ArcGIS – ArcInfo, ArcEditor, and ArcView)

- Intranet GIS Solution Recommendations – Enhance or Replace Photomapper with an ArcGIS Server Enabled Intranet GIS Data Browser
- Internet GIS Solution Recommendation – Replace SLO Prospector with an ArcGIS Server Technology Based Application - Developed In-house
- Public Access Application Recommendation – Kiosk in Key County Government Building Locations
- Mobile GIS Functionality – Mobile GIS Browser and AVL
- Mass Notification System – Third Party Telephone Calling System

Server Product Recommendations – ESRI ArcGIS Server

The structure of ESRI server products changed with the release of ArcGIS 9.2. The ArcGIS Server product split into three products which are referred to as editions (Advanced, Standard, and Basic), each offering two levels of usage (Enterprise and Workgroup). Moreover, as part of the changes that took place for ArcGIS Server 9.2, ArcSDE became an integrated part of ArcGIS Server and is no longer available as a stand-alone product.

Below is a chart which highlights the level and edition of ArcGIS Server recommended for the County. GTG highly recommends that the County move to an ArcGIS Server environment. Specific physical server hardware recommendations can be found in Chapter 7: *System Design Strategies*.

Server Product Recommendations		
Solution: ArcGIS Server 9.2	Level: Enterprise	Edition: Standard
	• Unlimited users and SDE database size. • Requires the use of a DBMS such as SQL Server or Oracle.	• All functionality of ArcGIS Server Basic • Standard map publishing • Globe Server for 3D map rendering • Standard Geoprocessing

****In Year 3 of the Implementation Plan it is recommended that the County upgrade to ArcGIS Server Advanced Edition to support mobile/field use.**

ArcGIS Server is licensed by sockets (or two cores) which are meant to reference a physical processor socket located inside the server. ESRI allows up to two cores per socket for licensing costs. If a processor has more than two cores, the ESRI server pricing will count the single processor as more than one socket. For example, if an organization has a single quad core socket, it will count as two sockets according to ESRI. At the Enterprise licensing level, sockets can be distributed across multiple physical servers, as needed, in order to employ the desired server implementation.

Historically, users have accessed the SDE geodatabase through ArcSDE services running on a physical server. In this manner, ArcSDE acted as middleware and in turn accessed the Database Management System (DBMS) hosting the data on behalf of the client. When end users connected to an ArcSDE service, the server spawned a process dedicated to that user in order to handle his or her request to the underlying DBMS. ESRI currently recommends using Direct Connect to access SDE. Direct Connect places a small amount of additional processing on the client machines by essentially moving the same dedicated processing done by the ArcSDE physical server to the end user. In other words, when using Direct Connect to access SDE, the end user is accessing the underlying DBMS directly and there is no longer a need for a server dedicated to ArcSDE. With all users using Direct Connect, ArcSDE is simply used to manage the SDE geodatabase schema. Thus, a single instance of ArcSDE can be used to manage multiple geodatabases on multiple servers and, since the workload is reduced, it can easily coexist with another ArcGIS Server component to reduce socket costs.

Desktop Product Recommendations – ESRI ArcGIS Desktop

Based on the information provided, the County is currently maintaining a variety of ESRI licenses; and a variety of ESRI extensions.

The County's GIS users are composed of thirty six (36) data editors and approximately two thousand five hundred four (2504) data viewers across over 20 departments and divisions. Realistically all of these County staff members will not be viewing GIS data at one time. There is expected to be anywhere from 200 to 500 daily users (at any one given time) of the County's Enterprise GIS.

The following table illustrates the existing GIS functionality (Tier GIS users) required by each of the departments and their anticipated software requirements.

Recommended ESRI Software by Department/Division				
	Tier 3	Tier 2	Tier 1	
Department	Intranet GIS Data Browser	ArcView or ArcEditor	ArcEditor	ArcInfo
Administrative Office / Board of Supervisors	13	0	0	0
Agricultural Commissioner	46	3	1	0
Assessor's Office	95	0	5	0
CAL FIRE	246	1	2	1
Clerk Recorder's Office	21	1	0	0
Office of the District Attorney	94	1	0	0
Farm Advisor	7	0	0	0
General Services	168	2	0	0
Health Agency	356	2	0	0
Human Resources / Risk Management	27	0	0	0
Information Technology	84	0	2	1

Recommended ESRI Software by Department/Division				
	Tier 3	Tier 2	Tier 1	
Department	Intranet GIS Data Browser	ArcView or ArcEditor	ArcEditor	ArcInfo
Library	UNL	0	0	0
Office of Emergency Services	9	0	0	0
Planning and Building	101	3	3	1
Probation	169	1	0	0
Public Works	190	2	1	0
Sheriff - Coroner	400	0	0	0
Social Services	448	1	1	0
Treasure / Tax Collector / Public Administrator	30	0	0	0
Totals	2504	17	15	3

Users that are only viewing data or are performing simple analyses should be provided with applications that do not utilize ArcGIS Desktop licenses. Only users that edit data or that perform complex data analyses need to use ArcGIS Desktop applications.

ArcGIS Desktop is a scalable system of software designed to meet all Tier 1 and Tier 2 needs. Three different levels of ArcGIS are available: 1) ArcInfo, 2) ArcEditor, and 3) ArcView. Although licensed separately, ArcGIS is a scalable set of software with the same underlying executables and user interface. ArcInfo, ArcEditor, and ArcView can all be customized using VB, C, and many other popular programming languages within the ArcObjects object and ArcGIS Server models.

Final Recommendations for ESRI Products

Outlined below is the phased recommended approach for the County with regard to ESRI products and licensing. Following these four steps in sequential order will increase benefits and maximize efficiency within the County.

Step 1: Consolidate existing ArcGIS Desktop licenses. Single use licenses should only be maintained for users that need disconnected capabilities, such as users that will be working in the field. All other desktop GIS software use should utilize ESRI concurrent licensing structure as outlined earlier, thus saving the County software licensing costs.

Step 2: Implement ArcGIS Server Standard Enterprise Edition.

Step 3: Transfer all users to an ArcGIS Server based enterprise GIS. This will involve transitioning existing applications to utilize ArcGIS Server, possibly involving development effort to modify existing applications, upgrade software provided by third party vendors, acquire new software from third party vendors, or develop new custom software.

Step 4 (Year Three of the Strategic Implementation Plan): When the County is ready to start developing and deploying ArcGIS Server Mobile ADF applications for field use, the County will need to update the existing (obtained during Step 2) ArcGIS Server Standard Enterprise licensing to ArcGIS Server Advanced Enterprise. The Mobile ADF is only included with the Advanced Enterprise licensing level of ArcGIS Server and contains licensing for up to 50 deployments to mobile devices. Applications developed on the Mobile ADF can be used on PDA devices, smart phones using the Windows Mobile OS, or on laptops and tablet PCs using Windows XP.

Intranet GIS Solution Recommendation – Enhance or Replace Photomapper with an ArcGIS Server Enabled Intranet GIS Data Browser

The majority of potential GIS users need easy-to-use, intuitive interfaces that perform well-defined tasks. Thus, the third tier of GIS software was born: customizable/open GIS. GIS software companies have moved GIS functionality to common, widely used programming languages such as C++ and Microsoft Visual Basic. The result is that application developers can create very user-friendly interfaces that have the look and feel of other personal computer applications. Only the GIS functionality needed for a specific program is used. Thus the overhead of non-used functionality is not slowing down the applications. Custom applications can be created via in-house development or third-party applications and distributed throughout the County.

The open programming interface opens the GIS door for any application developer in any industry. No longer is GIS development the domain of an elite few GIS gurus. Now any programmer adept at a standard programming language can embed GIS functionality in applications to be used by anyone throughout the County.

forward in enterprise-wide GIS technology as it offers just enough spatial analysis, geographical viewing and map production, as well as external database links. The browser should include:

- Advance Search Criteria
- Automated Mailing Labels
- Customized Departmental Query Control
- On-Line Help and Tutorial
- Advanced Graphic Design
- Enhanced Text Placement
- Link to External Databases
- Simple drawing tools
- Easy-to-Use Interface

Each department is presented with pertinent GIS data and custom defined queries for easy end-user interaction and module development allows for the configuration or addition of module departments or functions to the browser based interface.

Upon consolidation, centralization and standardization of GIS data, the Intranet GIS data browser should be modified to provide department-specific data and functionality. Additional functionality should include the ability to view all base map data, department-specific queries, and standardized mapping templates. Additional departmental/divisional requirements are provided in specific department/division sections in Chapter 2: *Departmental GIS Needs Analysis*.

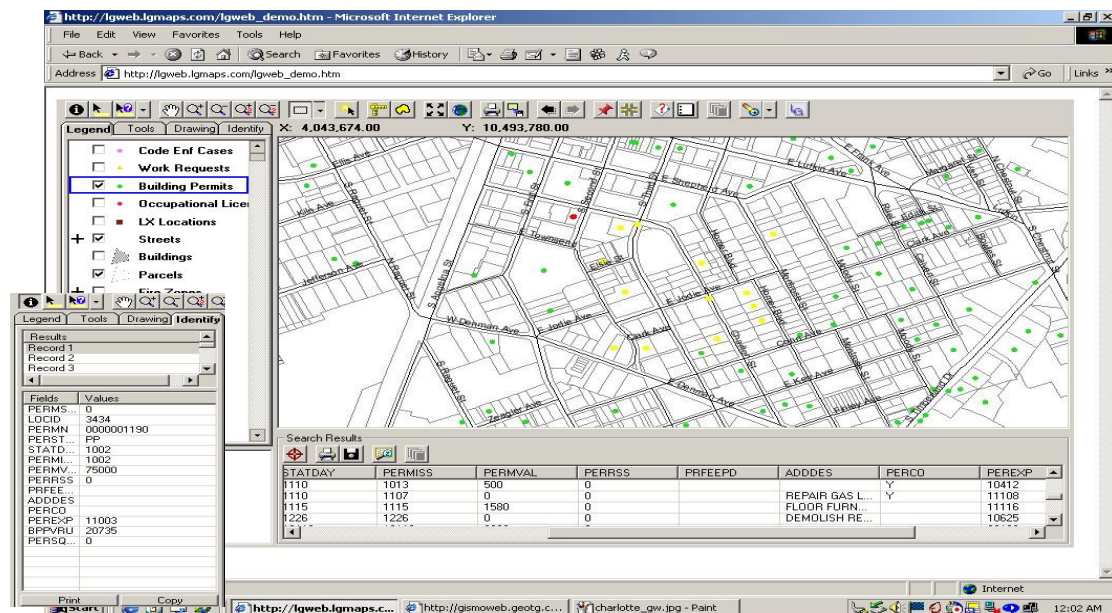
Currently the County has deployed over 100 licenses of AirPhoto USA's Photomapper; Photomapper provides aerial photography viewing software that utilizes a proprietary file format that allows for rapid display of large proprietary imagery files by swapping resolution specific layers as the viewer zooms in or out of the imagery. GIS layers and related attribute tables can be added to Photomapper providing the user with limited GIS capabilities.

It is recommended that the County work with a third party software developer to build an ArcGIS Server based platform to leverage the investment in current databases with an enterprise GIS. In doing so, all County users will have access to the County's GIS data. The eventual ArcGIS Server platform utilized for the Intranet GIS Data Browser can also be leveraged to implement other Intranet GIS applications in the future as well as publicly-accessed Internet GIS data browser applications.

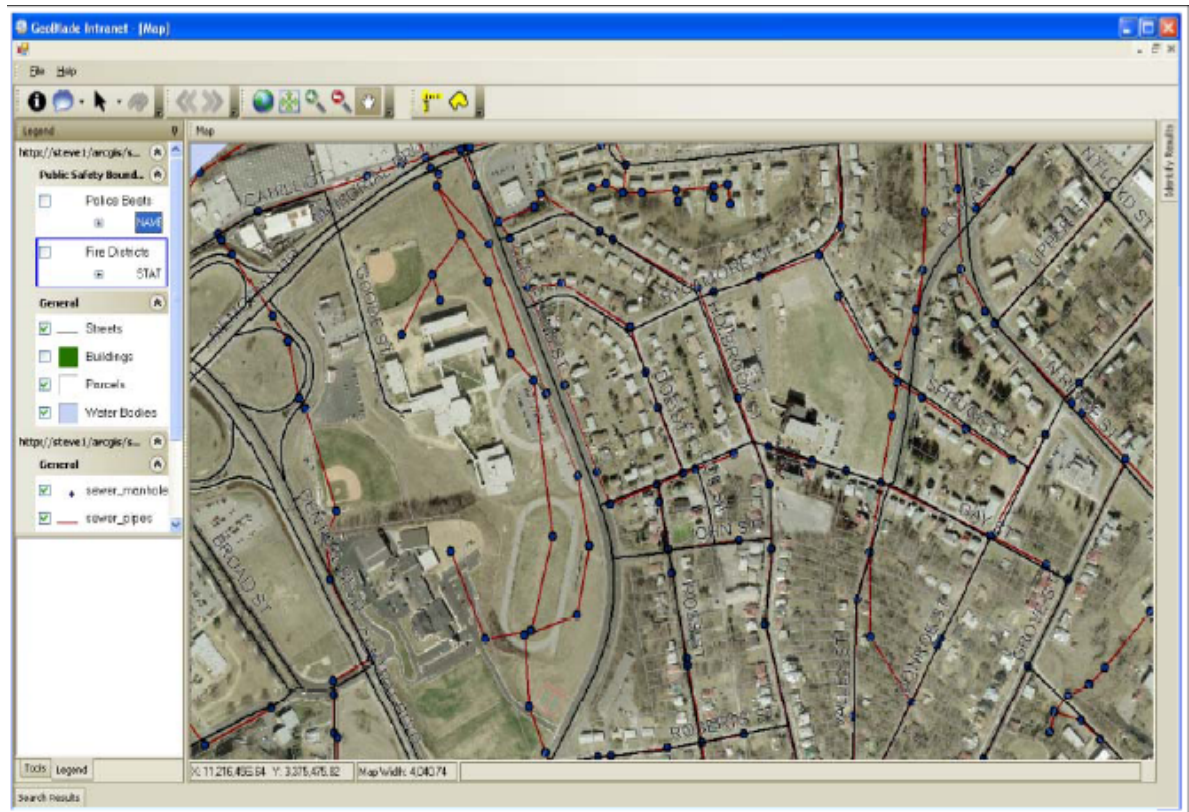
An Intranet GIS Data Browser solution presents targeted tool sets for local governments and utilities while leveraging all of the data residing in existing data sets. Users can:

- Geographically query land base data. For instance, show me all work orders in my service area or show me all certificates of occupancy in the downtown area. Users can now geographically query their existing data.

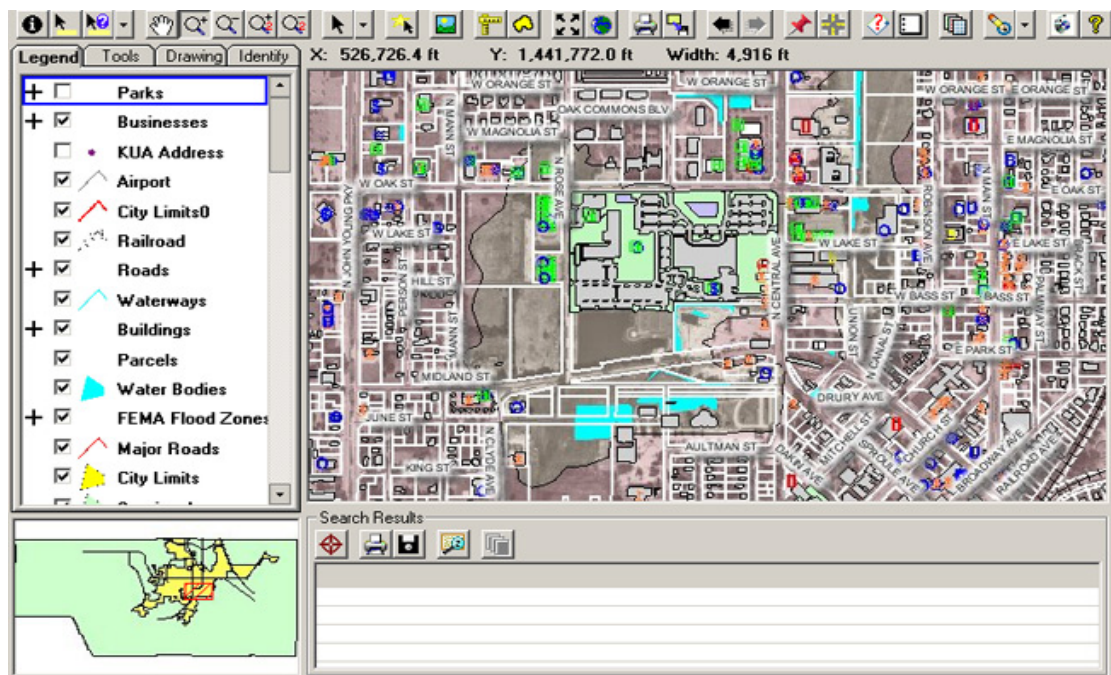
- Provide accurate data to the public – Assist front counter staff in fielding public concerns and questions by supplying relevant and updated information accurately, and efficiently.
- Utilize map-tips – users can now hover over a GIS record and have tabular data displayed. As the cursor is moved over the map, any combination of data is automatically shown to the user.
- Find addresses easily – The tool should provide a smart intersection finder and advanced address finding capabilities.
- Produce advanced reports – An infinite amount of pre-defined reports can be made available to the end users. Gone are the days of having to try to create a cumbersome report via a report writer. A well written Intranet tool will make this a task accomplishable in seconds. This includes mailing labels, letters to customers, or any report needed.
- Quickly measure distance and area – In local government the size of a lot, the distance from a house to a utility, or the dimensions of a building footprint, etc. are often needed. This has traditionally been a cumbersome task. The Intranet tool should allow the user to do this in a few seconds and see results in acres, square feet, and square miles automatically.
- Notify citizens – with a reverse dialing extension (TeleWorks, CodeRed) users can quickly select a geographic area and have their citizens phoned automatically. This is used for emergency and non-emergency events.
- Print quality maps – Maps of any size and scale can be printed by the user.



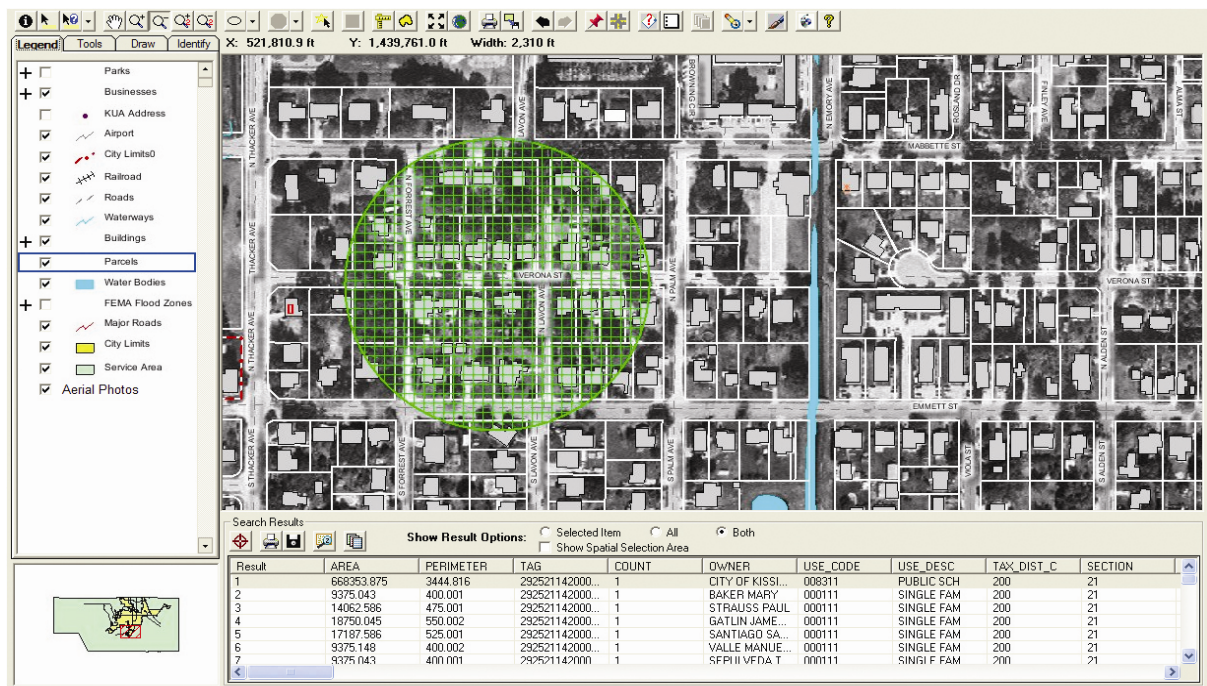
Department specific and GIS Data available via an easy-to-use browser interface



Query and analyze data



Simple, yet powerful



Quick Buffer Search

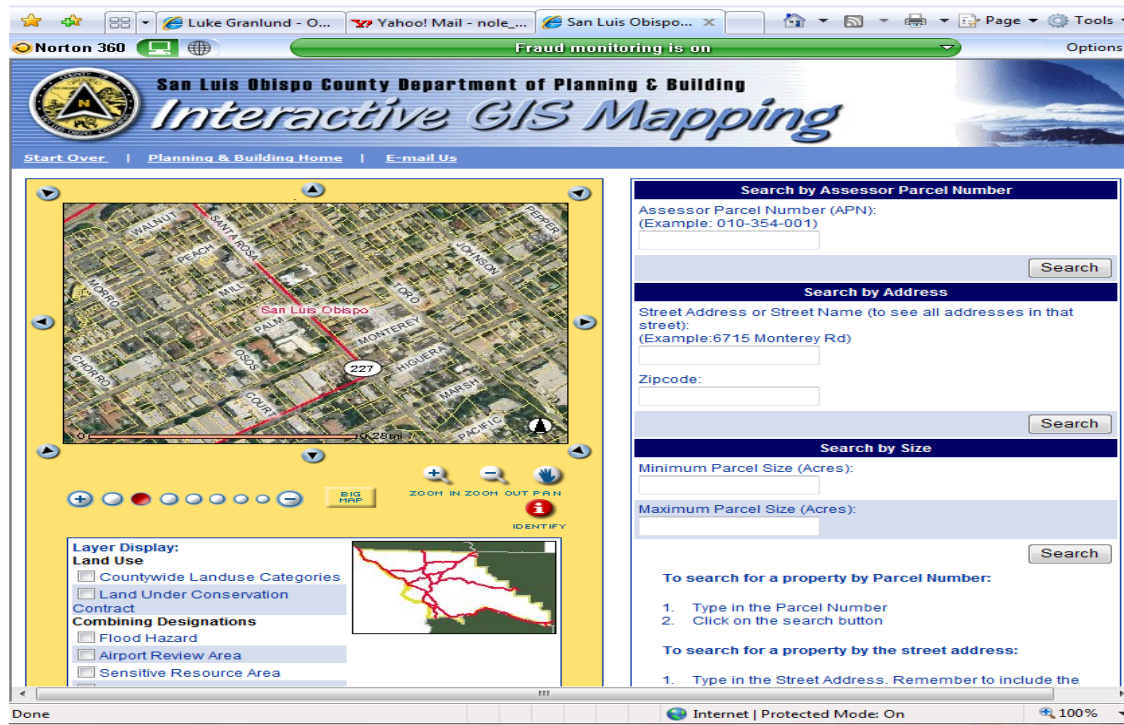
Internet GIS Solution Recommendation - Replace SLO Prospector with an ArcGIS Server Technology Based Application – Developed In-house

The Internet is the fastest and easiest communication touch point between the County and its citizens. A growing number of households have some level of Internet access. The Internet is also available to the public at most libraries and schools. By utilizing an internet based GIS application, the public can save time, money, and even an automobile trip to County offices. The Internet represents a store front and customer service link that is always open. GIS data and information is well suited for dissemination via the Internet. Internet browser applications can be configured and customized to serve a variety of user levels. The Internet browser should include:

- Basic Search Criteria
- Map Export or Print Capability
- On-Line Help and Tutorial
- Pre-defined / Non-editable set of Data Layers Including Attributes and Symbology
- Easy-to-Use Interface

The County expressed an interest in continuing to provide its citizens with access to online maps and geo-spatial information via a web-based solution. Currently the County has contracted with GIS Planning to deploy a solution called “SLO Prospector”. Current queries include Search by Assessor Parcel Number,

Search by Address, and Search by Size. Users can pinpoint information about variety of layers including, Landuse, Combining Designations, Coastal Designations, Planning/District Boundaries, Base Map, Emergency Preparedness, and Environmental.



County's SLO Prospector Internet Mapping Application

It is recommended that once the County upgrades its GIS platform, this enterprise Internet GIS Browser application also be upgraded to be based on the latest ESRI ArcGIS Server technology. The Internet browser application should continue to include an intuitive interface, and should incorporate the use of a graphic outline. The interface should be re-developed to match the most current County website in color scheme, layout, logo etc.

Map Navigation Query Tools via Intranet Data Browser

The Intranet and Internet browsers should have a variety of navigation and query tools.



Sample Navigation and Query Toolbar

Navigation tools should include:

- Pan
- Zoom in
- Zoom out
- Zoom to active layer
- Zoom previous
- Zoom to full extent
- Zoom to address
- Zoom to neighborhood

The simple query tools should include the following functions:

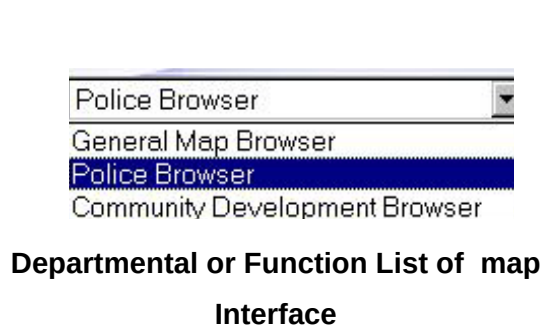
- Identify
- Ad-hoc query builder
- Find Address
- Identify Latitude and Longitude points
- Spatial selection by box or polygon
- Buffer selection by layer
- Find Assessor Parcel Number (APN)

Multiple Interfaces or Services by Department or Function

The browsers should have a selection box for every major department or work-related function in the organization. Once a department is selected then the interface, layers available, search mechanisms, and available reporting change to focus on the needs of that department. These associated layers and stored queries should be definable by staff and not require the use of outside consultants to edit or update.

Data Search Methods and Stored Queries

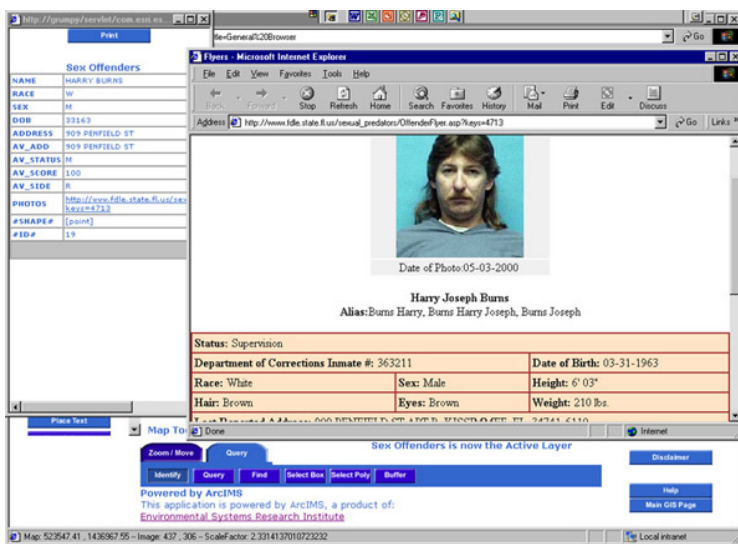
Various methods of finding information should be available. Each departmental interface will have a definable list of data search methods. These methods will be editable and storable by an administrative user and then shared out to the end user community. The following graphic depicts some more popular ways of searching for data in local government.



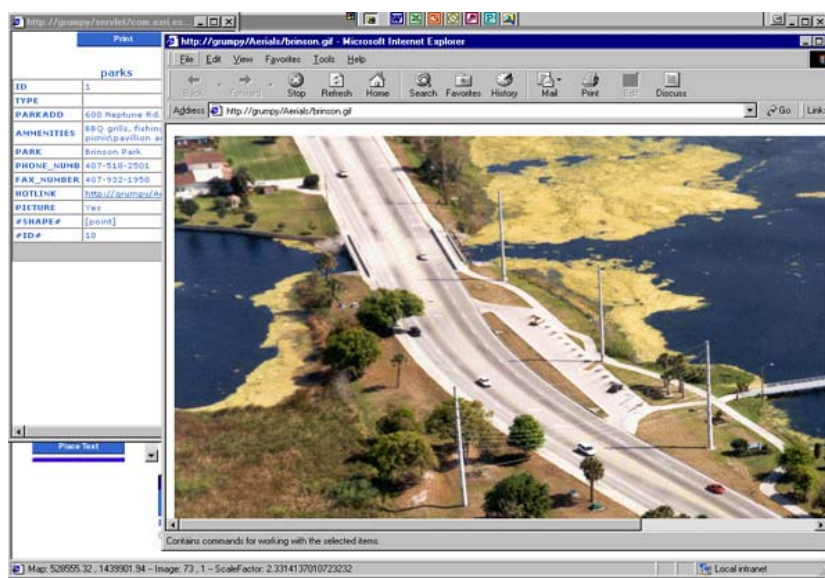
Data Display and Hyper-linking

The browser solutions should support hyper linking to web supportable file formats. Following are excellent examples of hyper-linking opportunities from the application datasets:

- Parcel deeds and plats
- Sexual Offenders link to the State
- Imagery of County Facilities
- Pictures of individual structures
- Maps to County Facilities



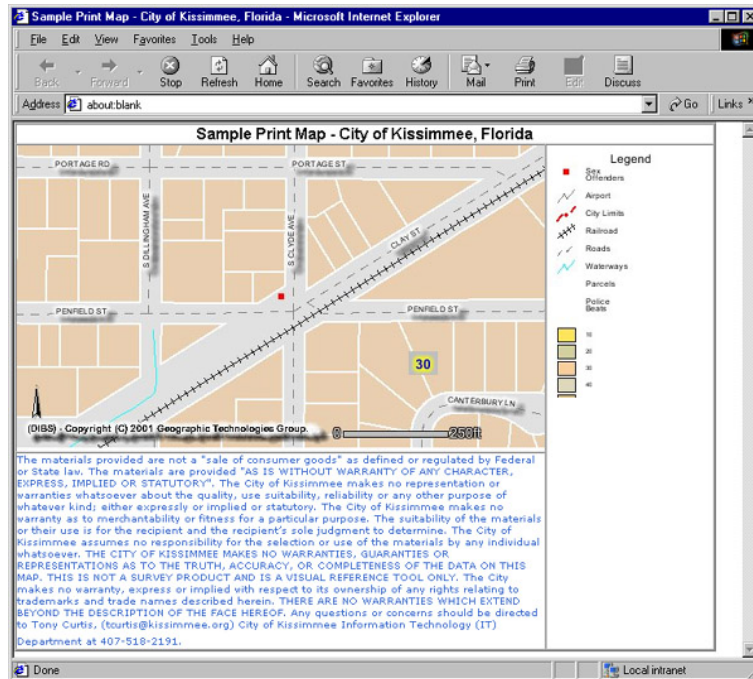
Sample of Sexual Offender link



Sample of Aerial Photo

Printing and Reporting

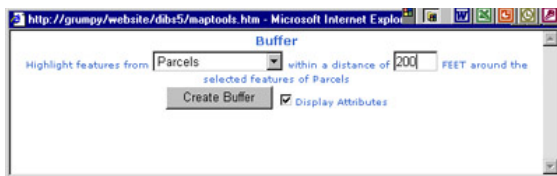
The browser solutions should provide the ability to generate quality prints to a local printer. The print should include the map, legend, title and scale bar for quick reference.



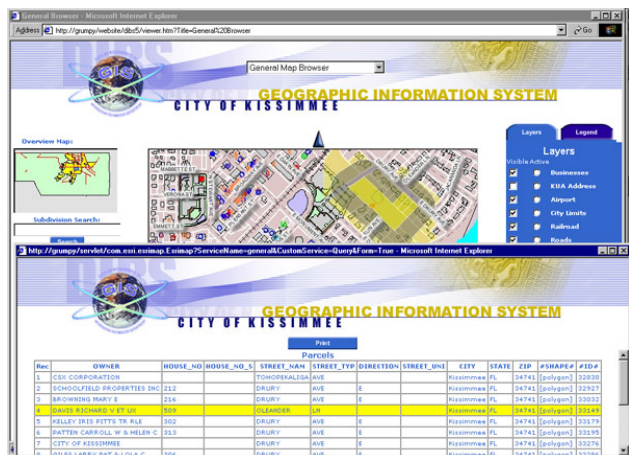
Sample of Print Page

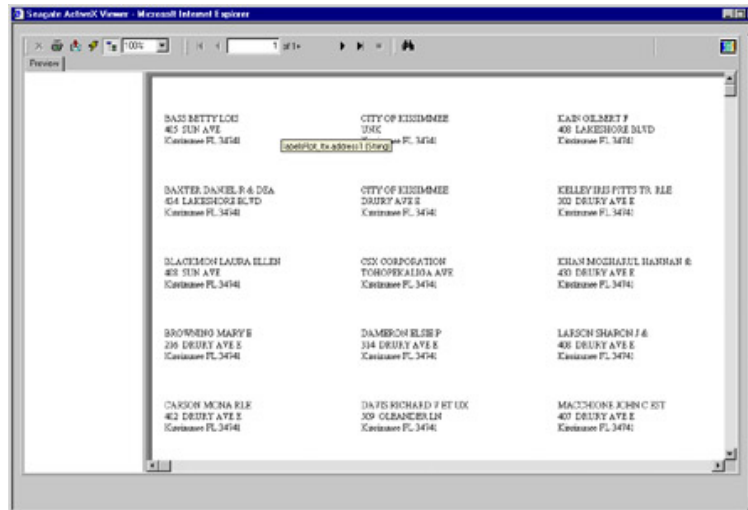
Buffering for Notification or Mailing Label Generation

The browser solutions should provide a method for staff to generate mailing labels for notification purposes. This should be accomplished by the server automatically producing a standard list using Crystal Reports or a similar reporting application.



A buffer interface (above) should provide the user with a simple method to produce buffers and select features based on that buffer. The resulting buffer and selected set should be displayed for the user (right). Generation of mailing labels should be supported by the application (below).





Sample Buffering and Mailing Label Generation

Public Access Application Recommendation – Kiosks in Key County Government Building Locations

Several Departments indicated a need to provide a more user friendly and immediate way for the public to inquire about County data. At present, many citizens must physically go to County offices in order to obtain this information. Often citizens have to wait for an available staff person to provide assistance. A public access kiosk would allow citizens to look up this information immediately in a user friendly manner. Replacing current County public kiosks that do not have GIS software would be the most logical first step in establishing a County Public Kiosk GIS application (those in the main foyer area on the first (1st) floor of the New and Old County Government buildings). A next step would be to provide additional kiosks at public libraries or other available locations throughout the County

The Internet has become a powerful means for disseminating geographic information to the public. However, a need for public physical access to geographic information at an organization's buildings is even more essential. A touch screen kiosk provides an ideal solution because it will allow users to find information for themselves, thus relieving the workload of County staff members.

To be effective, a public access application must be easy to use. For many users, this means an application that does not require use of a mouse or keyboard. Touch screen monitors have enabled applications that do not require a mouse and keyboard to become a reality. Buttons and slider bars must be large so that they are easily selected by touching the screen. A touch screen kiosk application should be implemented at various locations around the County Buildings complex with an eye to expanding their placement to various locations throughout the County. Please refer to the Departmental Needs Analysis in Chapter 2 for a listing of all departments that indicated a need for a public kiosk.



Kiosk Application with Key GIS Functions

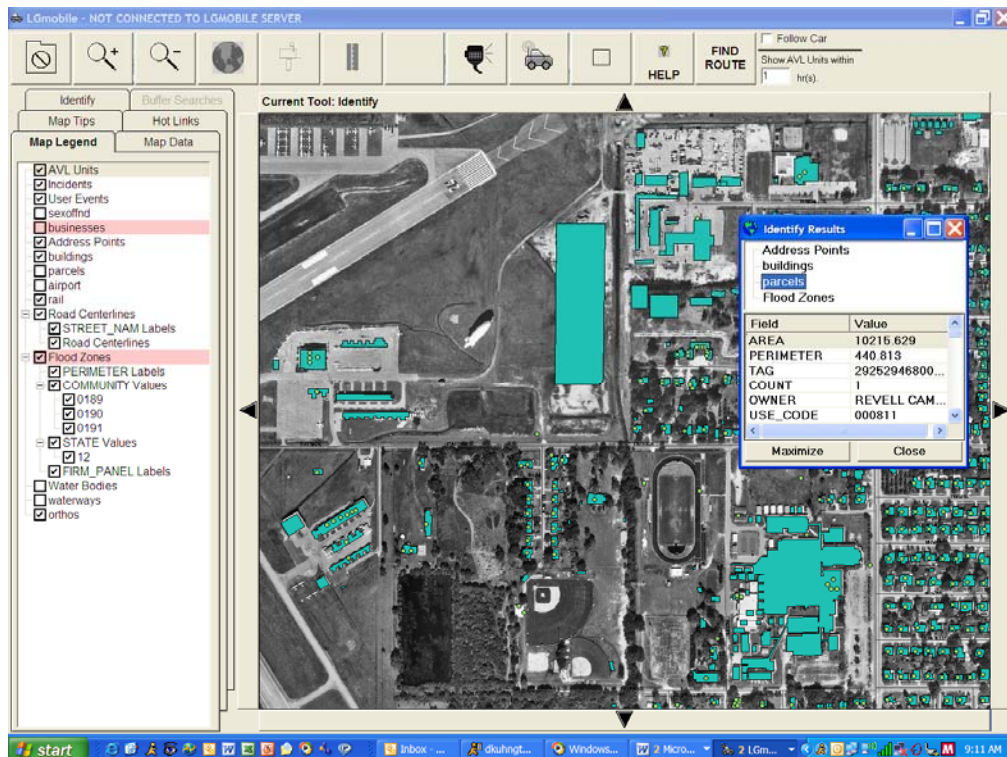
The public access application should target the following goals:

- Configurable for at least 10 preset queries
- Extremely user friendly — no keyboard, no mouse
- Designed with the latest GIS technology
- Must have an administration package for complete control of layers, colors, and data
- Network ready for automatic update of configuration and setup files
- Easy to customize data setup and query configuration
- Supports imagery and ortho-photography
- Easy and quick setup

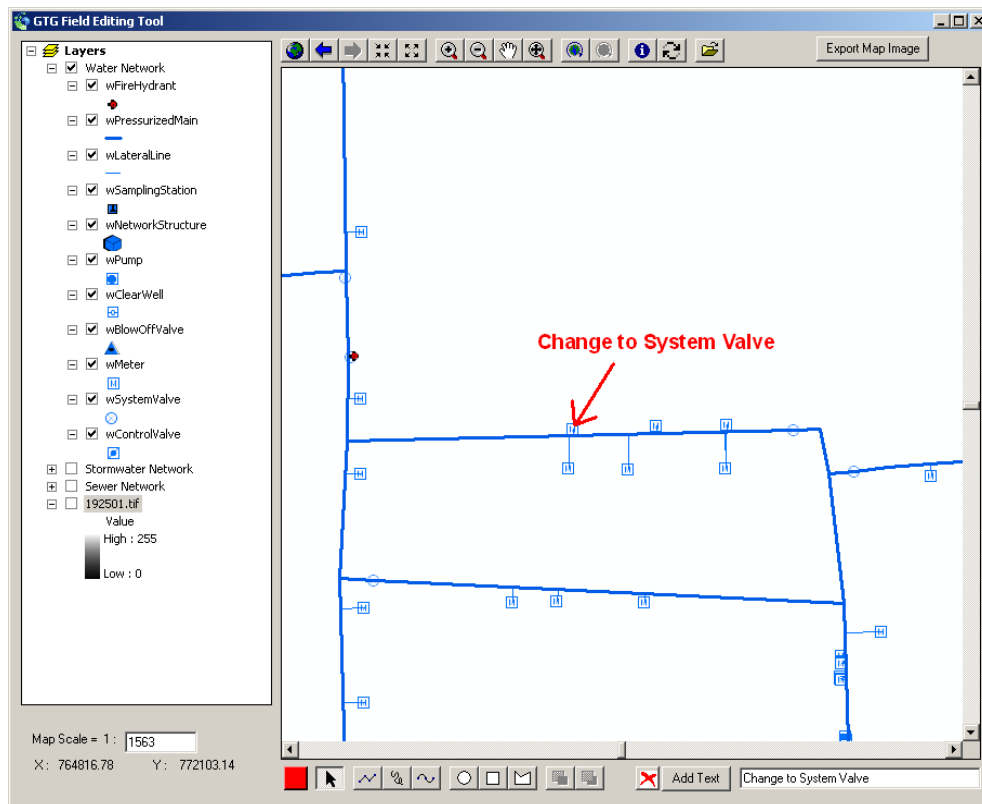
Mobile GIS Functionality Recommendation – Mobile GIS Browser and AVL

Mobile GIS Browser

A variety of County departments have expressed a strong desire for mobile GIS access. There are two types of mobile access to GIS data. The first is “real time” access and the alternative is intermittent synchronization. The latter does not require a full-time wireless connection between the mobile computing device and the database. The screenshots below illustrates the typical functionality of a mobile GIS browser that should be implemented for the County:



Mobile GIS data browser

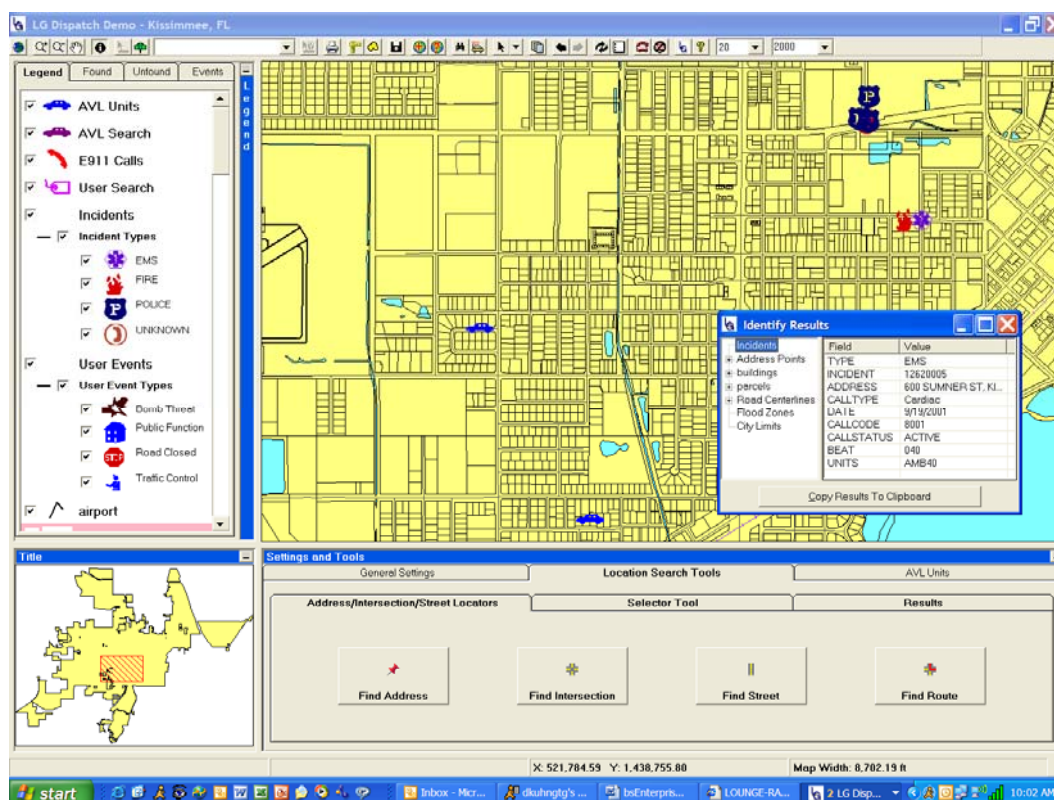


Field Editing Tool (annotation of current GIS data layers)

Please refer to specific department sections to determine the types of mobile browsers recommended for each department.

Automatic Vehicle Location (AVL)

Automatic Vehicle Location (AVL) provides up-to-date location information for emergency vehicles, delivery trucks, freight trucks, service vehicles etc. An AVL system consists of a GPS receiver in a vehicle, a communications link between the vehicle and the dispatcher, and pc-based tracking software for dispatch. The communication system is usually a cellular network similar to the one used for cellular phones. As an alternative communications link, a satellite communication network (not to be confused with the GPS satellite system) is available for areas where ground-based wireless communications is weak. The communication satellite receives position information from the AVL vehicle's satellite transmitter (uplinks) and forwards it (downlinks) to a tracking dispatch application. A typical GIS-based dispatch application displays vehicle locations as icons against specific local streets and intersections. The following screenshots illustrate how AVL is displayed in a GIS browser application:



AVL tracking overlay on GIS dispatch data browser

Several hardware/software investments will need to be made in order to outfit vehicles with GPS receivers and communications devices; an AVL mapping application will also need to be implemented.

The complete cost of implementing AVL can vary considerably depending on the type and quantity of equipment that is procured. In general, outfitting one vehicle for AVL will cost approximately \$2,000-\$5,000, depending on the type and quality of hardware that is procured.

In addition to hardware costs for vehicles, communications equipment and services need to be factored into the cost. In general, communications infrastructure will cost anywhere from a few hundred dollars to thousands of dollars. Subscription to different types of communication services can also cost anywhere from less than one hundred dollars to several hundred dollars per month. Lastly, a GIS-based mapping application is required; these applications also vary in price. Several approximate costs are provided below to provide a general idea of associated costs.

In-Vehicle Laptop *Approximate Cost*

- Fixed Mobile Terminal: \$5,000
- Ruggedized Notebook PC: \$3,500
- Standard Notebook PC: \$1,250
- Display Terminal Only: \$500

In-Vehicle Modem *Approximate Cost*

- Public digital network \$200
- Public analog network \$1,000
- Wi-Fi Mesh Network \$300
- Private 800 MHz networks \$3,250
- Private VHF or UHF 19.2K \$2,500

Communications Connection/month *Approximate Cost*

- Public digital network \$50
- Public analog network \$50
- Wi-Fi Mesh Network \$100

Mapping/Dispatch Software *Approximate Cost*

- Basic mapping/tracking \$3,000
- Robust dispatch/mapping tracking \$5,500
- High-end software \$10,000 and up

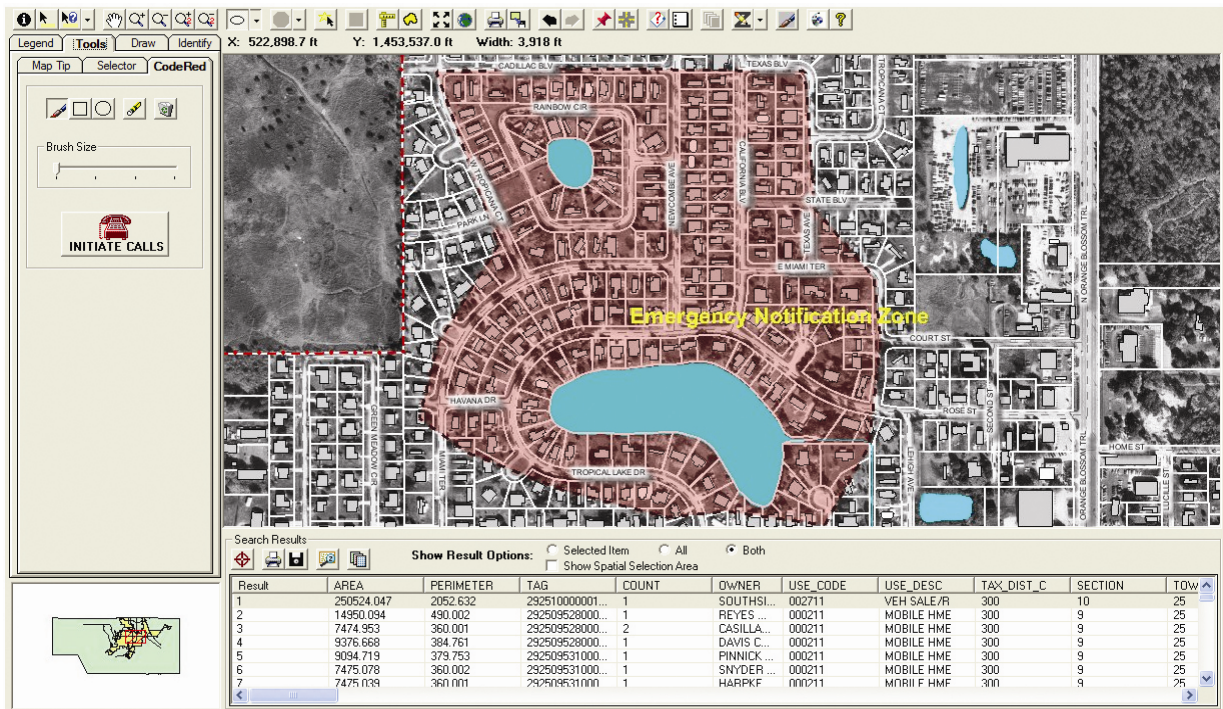
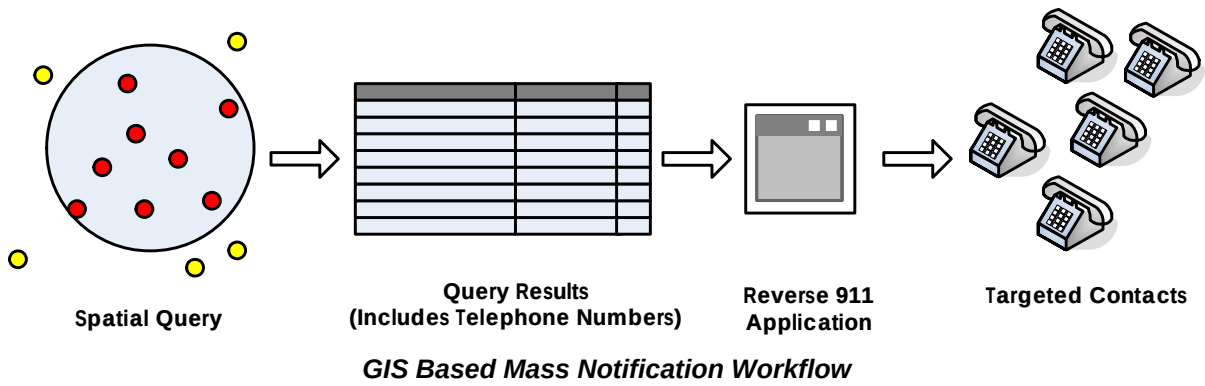
Mass Notification System – Third Party Telephone Calling System

Several County departments also identified a Mass Notification System as a critical need. It is recommended that the County implement a GIS-based Mass Notification System solution across the enterprise, where multiple departments should have the opportunity to participate in this recommended Countywide application.

The uses of a GIS-based Mass Notification System application include:

- Emergency Evacuations
- Missing Person Alerts
- HAZMAT Emergency
- Crime Prevention Safety Tips
- Public Service Announcements
- Citizen Surveys
- Business Crime Alerts
- Investigation Assistance
- Prison Escape Alerts
- Sexual Offender and Predator Notices
- Parolee and Juvenile Check-ups
- Search and Rescue Operations
- Neighborhood Watch Meeting Notices

GIS-based Mass Notification System applications include functionality to select target audiences for distribution of messages based on spatial queries, tabular queries, user-defined areas, buffers, and existing data layers. A key need identified by multiple departments, including Planning and Building, Public Works, Sheriff's Office, CAL FIRE, and the Agricultural Commissioner/Office of Emergency Services (OES), is notification of incidents/events to affected citizens. Using a GIS-based Mass Notification System application, County personnel could use spatial analyses to determine appropriate contact information for selected groups of citizens occupying the vicinity of an incident or event. The GIS Coordinator in ITD should implement a Mass Notification System application that can be easily and effectively integrated with the County's GIS program.



Integration of notification software

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Database Design and Development



Chapter 10: Database Design and Development

Chapter Outline

Introduction

Logical Database Design

- Why Conduct a Logical Database Design?

- Logical Database Design Methodology

- Logical Database Design Products

Physical Database Design

Data Migration

Database Setup and Administration

Data Replication and Distribution

Introduction

It is recommended that the County of San Luis Obispo conduct a full database design. The following components of the Database Design process are recommended for the County:

1. Logical Database Design
2. Physical Database Design
3. Data Migration
4. Database Setup and Administration

As the County moves forward with its GIS implementation, geospatial data management and maintenance needs will grow, and the need to distribute data to various departments (as well as the public) will increase. There are several alternatives that the County may wish to pursue in terms of geospatial data management in the context of a database. Given the diverse and stratified workflows for data management inherent within each County department, the possibility of maintaining a decentralized environment, wherein geospatial data is managed as flat files (i.e., Shapefile and CADD) as well as in a database, is feasible. However, such an environment presents some limitations in terms of the ability to leverage the relational and distributed capabilities of an enterprise database.

This chapter provides detailed information about logical and physical database design, as well as data migration and database setup and administration. This information is provided with the expectation that the County will initialize migration to a geodatabase environment during the first year of this GIS implementation. It is expected that a majority of the County's geospatial data will reside in an enterprise SDE geodatabase within the first year of this GIS implementation.

Logical Database Design

Why conduct a logical database design?

The logical database design process can be time consuming and produces no end-user applications. Therefore, the logical design process often receives limited attention, if any. However, there may be risks associated with not conducting a logical database design. By not going through the logical design process, the County could foster the likelihood of having a poorly constructed database that does not meet present or future requirements. Poor database design can result in duplicate, missing, or unnecessary data; inappropriate representation of data; or lack of proper data management techniques.

One of the key aspects of a successful GIS implementation is good database design. What makes a good database design is asking the right questions:

- How can GIS technology be implemented to streamline existing functions, or change the way a particular goal is achieved?
- What data will benefit the County most?
- What data can be stored?
- Who is, or should be, responsible for maintaining the database?

How the County answers these questions will improve its understanding of GIS technology, as well as provide new insight into the organization and its functions. A good database design results in a well-constructed, functional, and operationally efficient database that:

- Satisfies objectives and supports organizational requirements
- Contains all necessary data without redundancy
- Organizes data for different users with various access levels
- Accommodates different views of data
- Identifies and distinguishes applications that maintain data from those that use it
- Appropriately represents, codes, and organizes geographic features
- Enforces rules for how geographic features interact

Benefits of the database design process include:

- Increased flexibility of data retrieval and analysis
- Distributed costs of data capture, storage, and use
- Versatile data that supports many different uses
- Maintained data that supports many different users
- Extendibility that readily and easily accommodates future functionality
- Reduced data duplication and data archiving

The key task in building a logical data model is to precisely define the set of objects of interest and to identify the relationships between these objects. Once an initial logical data model is developed, it should be validated against the County GIS users' requirements for entering, updating, and accessing data, and by testing it against the organization's practices and procedures (also known as "business rules").

During logical data modeling, it is critical to involve representatives from the various County departments that will be utilizing the enterprise GIS data. A logical data model built for a subset of users is guaranteed to have deficiencies for unidentified users. Building a logical data model is an interactive process, an art form that is acquired through experience. There is no single "correct" model, but there are often good models and bad models. It can be difficult to determine when a model is correct and complete, but the County would have an indication of a good data model when it can answer "yes" to these questions:

- ➡ Does the logical data model represent all data without duplication?
- ➡ Does the logical data model support the County's business rules?
- ➡ Does the logical data model accommodate different views of data for distinct groups of users?

Logical Database Design Methodology

The Logical Database Design should consist of four (4) parts:

1. Kickoff Meeting
2. Existing data acquisition and review
3. Interviews
4. Logical Database Design

Kickoff Meeting

Kickoff meeting attendees should include all County personnel that currently or will in the *future*:

- Create spatial data
- Provide input on the creation, updating or use of spatial data
- Use spatial data on a regular basis.

The kickoff meeting should introduce the goals and objectives of this project, outline how the project will be conducted, and inform attendees of what will be required of each of them.

Existing Data Acquisition and Review

Before the Logical Database Design process can move forward, the County will need to ensure that it has a copy of all existing County data layers and source data from each department that will be included in the database design.

Interviews

All pertinent staff members from each County department should be interviewed. Interviews can be conducted separately for each department, or in logical groupings. The goal of each interview is to discuss in detail each data layer for which attendees are the Subject Matter Expert. Issues that should be discussed include:

- Deletion of existing attribute fields
- Addition of new attribute fields
- Allowable values for important attribute fields
- Relationship of layer to other layers
- Associated tables and cardinality (number of elements in the table)
- Description or alias of each field (when not obvious)
- Subtypes
- Default values
- Whether null values are allowed or not
- Indexes

Logical Database Design

Several important metadata aspects (if not documented or available from pre-existing data acquisition) should be documented, including (but not limited to):

- Feature Class Name
- Feature Class Type (point, line, polygon or raster)
- Feature Dataset
- Description
- Purpose
- Data source
- Primary and secondary data custodians
- Acquisition scale and accuracy
- Spatial information (projection, coordinate system, datum, units, etc.)
- Status of the data (complete, incomplete, etc.)
- Data update frequency
- Constraints on accessing and using the data
- Point of contact for each layer

Logical Database Design Products

The logical database design process should result in two products:

- Printed Documents
- Flow Chart Drawings

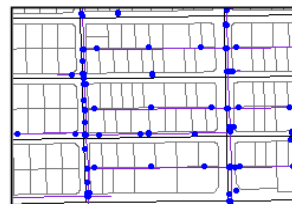
Printed documents

A printed and bound database design document should be developed. The database design document should individually document each data layer that will be included in the process. Important metadata about each layer should be documented at the top of each sheet, as well as a snapshot of what the layer looks like visually. Every attribute field should be listed, to include:

- Field Name
- Description (of the field)
- Data Type (string, date, integer, etc,)
- Allows Nulls (whether null values are allowed or not)
- Default Value (if appropriate)
- Domain (reference to domain that dictates allowed values for this field)
- Length (number of characters allowed)
- Precision (number of allowable significant digits)
- Scale (number of allowable decimal places)
- Index (whether a field is indexed)

Potable Water Valves

Feature Class Name: PotableWaterValves
Feature Dataset: PotableWaterDistributionSystem
Feature Class Type: Point
Data Source: 2002 GPS Data Collection
Primary Custodian: Michelle Wang – GIS Technician – EIS/GIS
Accuracy: +/- 1 meter
Projection: NC State Plane, NAD83, feet
Status: Complete as of April 23, 2003
Data Update Frequency: As changes are made in the field
Constraints: Data may NOT be released to the public
Point of Contact: Katherine O'Brien – EIS/GIS (919) 123-4567, KO'Brien@fac.unc.edu
Description: Point layer of water valve locations.
Purpose: Inventory of all campus potable water valves



Attributes:								
Field Name	Data Type	Allows Nulls	Default Value	Domain	Precision	Scale	Length	Description
BypassValve	Small Integer	Yes	0	Boolean	0	0	2	Indicates if the valve has a bypass valve for maintenance
ClockwiseToClose	Small Integer	Yes	1	Boolean	0	0	2	Does the valve close in a clockwise direction?
CurrentlyOpen	Small Integer	Yes	1	Boolean	0	0	2	Is the valve currently open?
Motorized	Small Integer	Yes	0	Boolean	0	0	2	Is the valve motorized?
NormallyOpen	Small Integer	Yes	1	Boolean	0	0	2	Is the valve designed to be open under normal network circumstances?
PercentOpen	Integer	Yes	100		0	None	None	Current percent open
PressureSetting	String	Yes			None	None	20	Current pressure setting
RegulationType	String	Yes		WHSysValveRegulationType	None	None	20	Type of pressure regulation performed (if applicable)
TurnsToClose	Integer	Yes			0	None	None	Number of full turns required to close the valve
Diameter	Integer	Yes	10	MainDistributionDiameter	0	None	None	Diameter of the valve
Elevation	Double	Yes			0	0	None	Elevation of the valve
WaterType	String	Yes	Potable	WaterType	None	None	20	Type of water flowing through the system
AdministrativeArea	String	Yes	N	AdministrativeArea	None	None	200	The administrative area that contains the object
FacilityID	String	Yes			None	None	20	A unique facility number for the object
InstallDate	Date	Yes			0	0	8	Date object was installed in the ground
LocationDescription	String	Yes			None	None	200	Text description of the location
OperationalArea	String	Yes	D1	OperatingArea	None	None	200	Engineering or operational district for the feature
Rotation	Double	Yes			0	0	None	Rotation angle for map symbology
LifeCycleStatus	String	Yes	Active	LifeCycleStatus	None	None	20	Stage of the facility lifecycle
SubType	Integer	Yes	1		0	None	None	Type of feature
WorkOrderID	String	Yes			None	None	20	
AncillaryRole	Integer	Yes			0	None	None	
Enabled	Small Integer	Yes	1	Enabled	0	0	2	Work Order that installed the object

Example Printed Logical Database Design Sheet

Flow Chart Drawings

Data model flow charts for the organization of each data layer within the geodatabase should be developed. Developed products should include individual printed drawings, digital drawings in MS Visio format, as well as digital images of each drawing. Data should be logically organized into the following categories:

- Geodatabase
- Feature Datasets
- Feature Classes

All data should be organized into one geodatabase. Feature Datasets should be established to logically group Feature Classes of similar type or business process. The data model flow charts should document all Feature Datasets, and the Feature Classes within each Feature Dataset. Feature Classes should be displayed according to type: point, line, or polygon. Additionally, the organization of other types of data that will be stored within the geodatabase, including (but not limited to) rasters (such as aerial photography), and CADD data, should be documented.

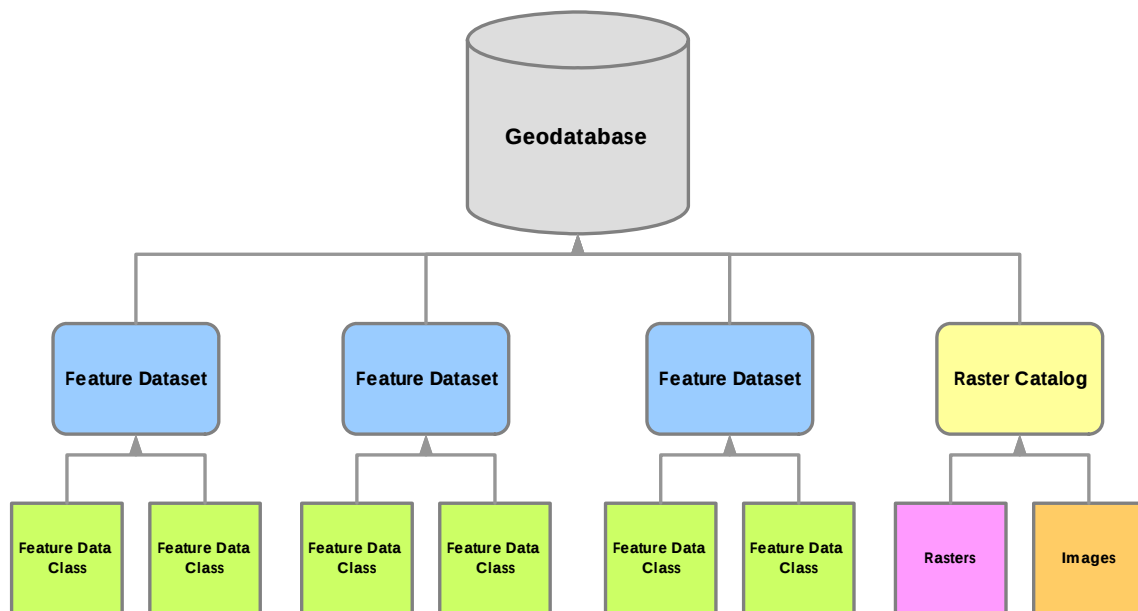
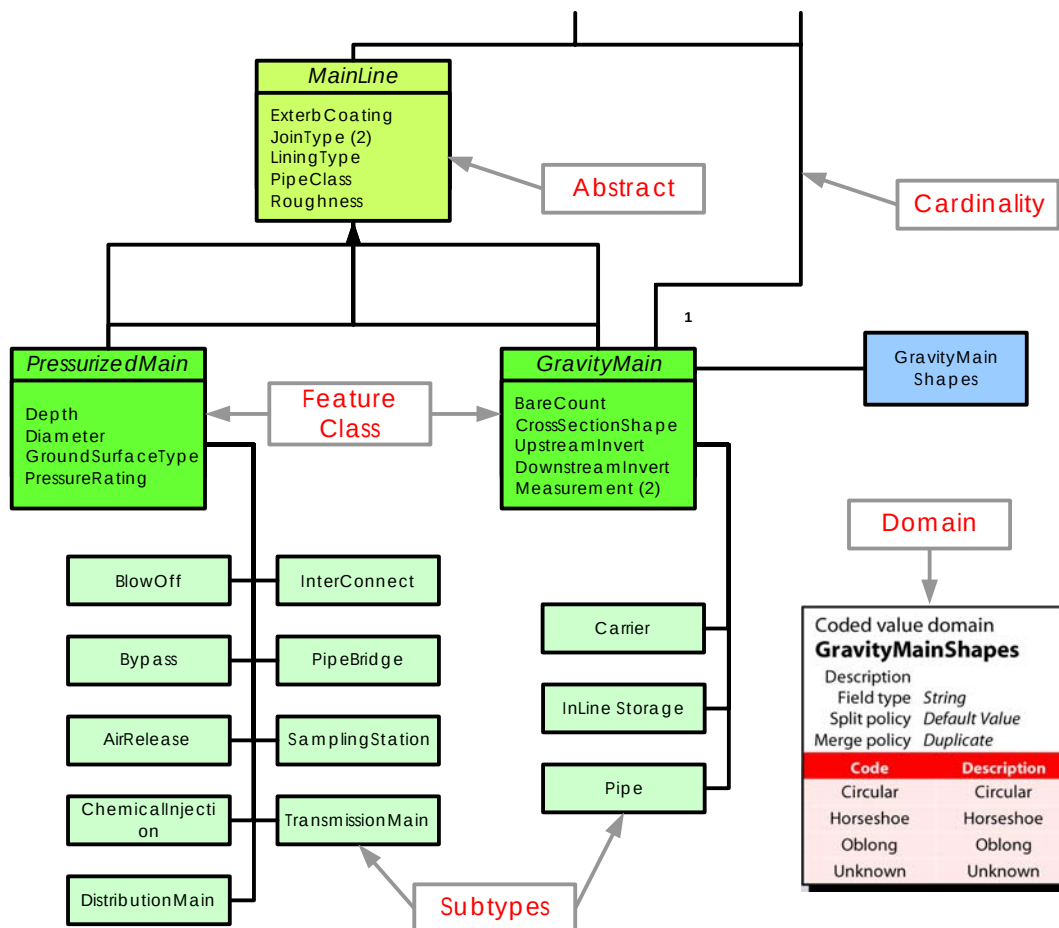


Diagram of Overall Logical Database Design

Each Feature Class in the Data Model Flow Chart should further display all attribute fields. Other information that should be documented, when necessary, includes:

- Abstract Classes – a device for documented common attribute fields used by more than one subsequent Feature Class, to avoid redundancy.
- Subtypes - variations of similar features
- Domains - allowable values for an attribute field
- Cardinality – relationships between feature classes, or between feature classes and objects (tables)



**Example Section of a Logical Database Design
Data Model Flow Chart**

Physical Database Design

A physical data model must be created after the logical data model is complete. The Physical Database Design consists of implementing the logical data model schema within the geodatabase. This entails physically creating all of the features designed in the Logical Data Model.

This is the final step before the migration of existing data to the geodatabase. Therefore, a decision must be made with regard to which data layers should be represented in the geodatabase once the initial geodatabase is created. The County currently has a considerable number of spatial data layers, almost all representing ESRI shapefile format. Some of these data layers will be relatively easy to migrate, while most will require significant effort, including conversion and consolidation. The County should consider the following criteria when it has identified layers to implement in the Physical Database Design during initial implementation:

- The County may wish to restrict access to some data layers until an agreed-upon level of completeness or accuracy is achieved

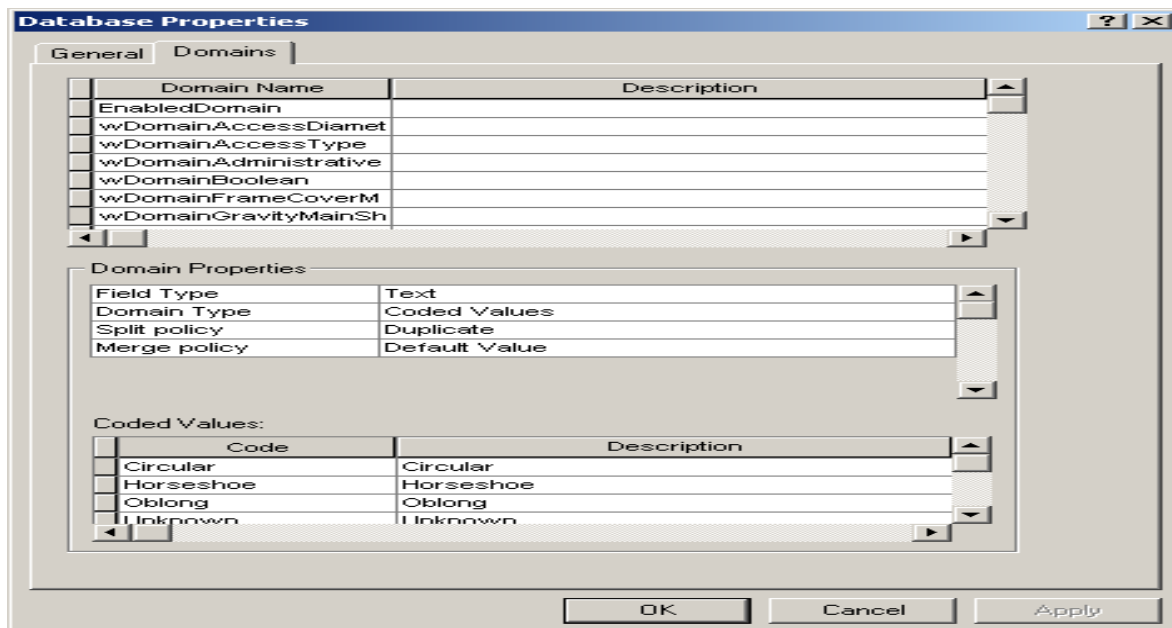
- Data layers may require a customized data model provided by a software vendor
- Users may be more comfortable with the existing format of data layers, or users may not have received training on utilizing data stored in a geodatabase

It is recommended that the County assess all of the aforementioned points of consideration during the Logical Database Design prior to moving forward with the Physical Database Design for those layers that are deemed appropriate, based on the assessment. Once the County decides which data layers should be migrated to or created in the geodatabase, these features can be physically created within or migrated to the geodatabase. A data layer does not need to have been created for that layer's physical design to move forward. Empty Feature Classes can be created, which can be populated with actual data at a later point. The table below shows many of the types of features that must be created within the Physical Database Design process. The geodatabase itself stores pre-defined information on domains.

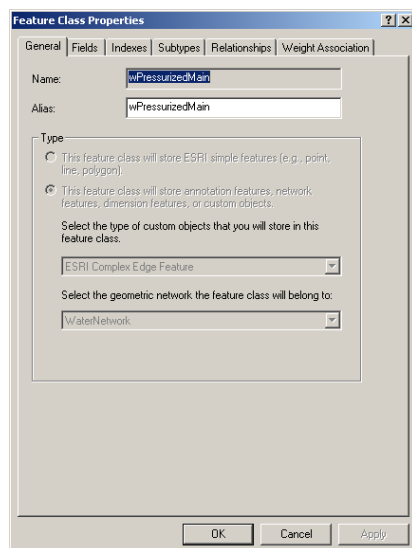
	Geodatabase
	Feature Dataset
	Polygon Feature Class
	Line Feature Class (Edge when part of a Geometric Network)
	Point Feature Class (Junction when part of a Geometric Network)
	Annotation Feature Class
	Geometric Network
	Relationship
	Table
	Topology

Features that will be created during the Physical Database Design

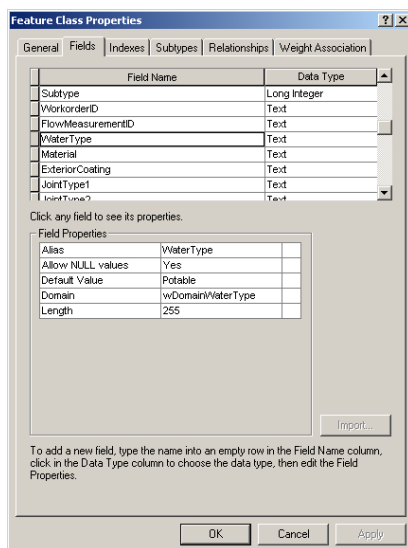
Domains should be created within the geodatabase according to the Logical Database Design specifications. According to the agreed upon Logical Database Design, Feature Datasets should be created. The screen shot below displays domains created for a geodatabase, domain properties, and values (in this case, coded values).



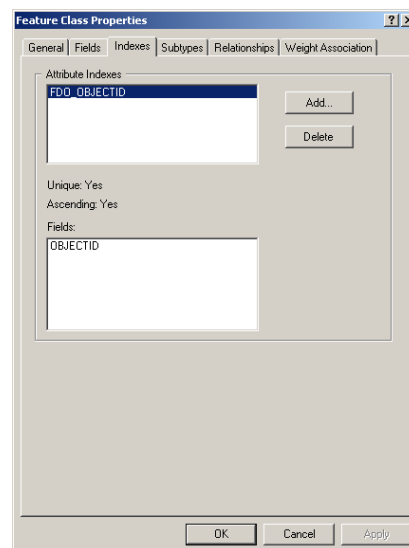
Feature Datasets should be created according to the agreed upon Logical Database Design. Within Feature Datasets, Feature Classes should be created. Feature Classes should be created according to the agreed upon Logical Database Design. Important information about each Feature Class that must be created includes: Name and Alias; Fields – to include Field Name, Data Type, Alias, Allow Null Values, Default Value, Domain, Precision, Scale, and Length; Indexes; Subtypes; and Relationships.



Feature Class General Properties



Creating Feature Class Fields and Field Properties



Creating Feature Class Indexes

Feature Class Properties

General Fields Indexes Subtypes Relationships Weight Association

Subtype Field: Subtype

Default Subtype: BlowOff

Subtypes:

Code	Description
2	Bypass
3	AirRelease
4	ChemicalInjection
5	DistributionMain
6	Interconnect
7	PipeBridge

Default Values and Domains:

Field Name	Default Value	Domain
Enabled	1	EnabledDomain
AdministrativeArea		wDomainAdministrativ
FacilityID		
InstallDate		
OperationalArea		wDomainOperatingAre
LifecycleStatus	Active	wDomainLifecycleStat

Use Defaults Domains...

OK Cancel Apply

Creating Feature Class Subtypes

Feature Class Properties

General Fields Indexes Subtypes Relationships Weight Association

This feature class participates in the following relationships:

Relationship	Label	Related To	Role
wPressMain_H...	wSpatialRecord	wSpatialOpera...	Origin

Properties...

OK Cancel Apply

Feature Class Relationships

Data Migration

Once the Physical Database Design process is complete, existing County GIS data can be migrated from its existing shapefile format to the SDE geodatabase(s). It is highly recommended that this process occur simultaneously with the database design process. Some data manipulation will be part of the migration process. Attribute fields from the existing data are matched with its respective counterpart in a Feature Class in the Physical Database Design. Only fields of similar data type can be migrated (e.g. text to text, date to date, etc.). Once data layers are in a state conducive for migration, the ESRI ArcGIS Desktop 9.x ArcCatalog software application should be used to physically migrate the data from its existing shapefile format to the SDE geodatabase(s).

Simple Data Loader

For each target field, select the source field that should be loaded into it.

Target Field	Matching Source Field
AncillaryRole [short int]	AncillaryRole [short int]
Enabled [short int]	Enabled [short int]
AdministrativeArea [string]	AdministrativeArea [string]
FacilityID [string]	FacilityID [string]
InstallDate [DATE]	InstallDate [DATE]
LocationDescription [string]	LocationDescription [string]
OperationalArea [string]	OperationalArea [string]
Rotation [double]	Rotation [double]
LifecycleStatus [string]	LifecycleStatus [string]
Subtype [int]	LifecycleStatus [string]

None> AncillaryRole [short int] Enabled [short int] AdministrativeArea [string] FacilityID [string] LocationDescription [string] OperationalArea [string] Rotation [double] Subtype [int]

OK Cancel Apply

Data Migration – Simple Data Loader in ArcCatalog

Concurrent with the migration of data, all necessary metadata for each data layer should be documented. Metadata information gathered during the data acquisition and interview process should be combined with any pertinent metadata information made available during the database design process.

Editing "LightPoles"

Identification | Data Quality | Data Organization | Spatial Reference | Entity Attribute | Distribution | Metadata Reference

General | Contact | Citation | Time Period | Status | Spatial Domain | Keywords | Browse Graphic | Security | Cross Reference

Description

Abstract: UNC Campus Light Poles

Purpose: The location and type of all UNC campus light poles

Language: english

Supplemental Information:

Access Constraints: No access constraints

Use Constraints: No use constraints

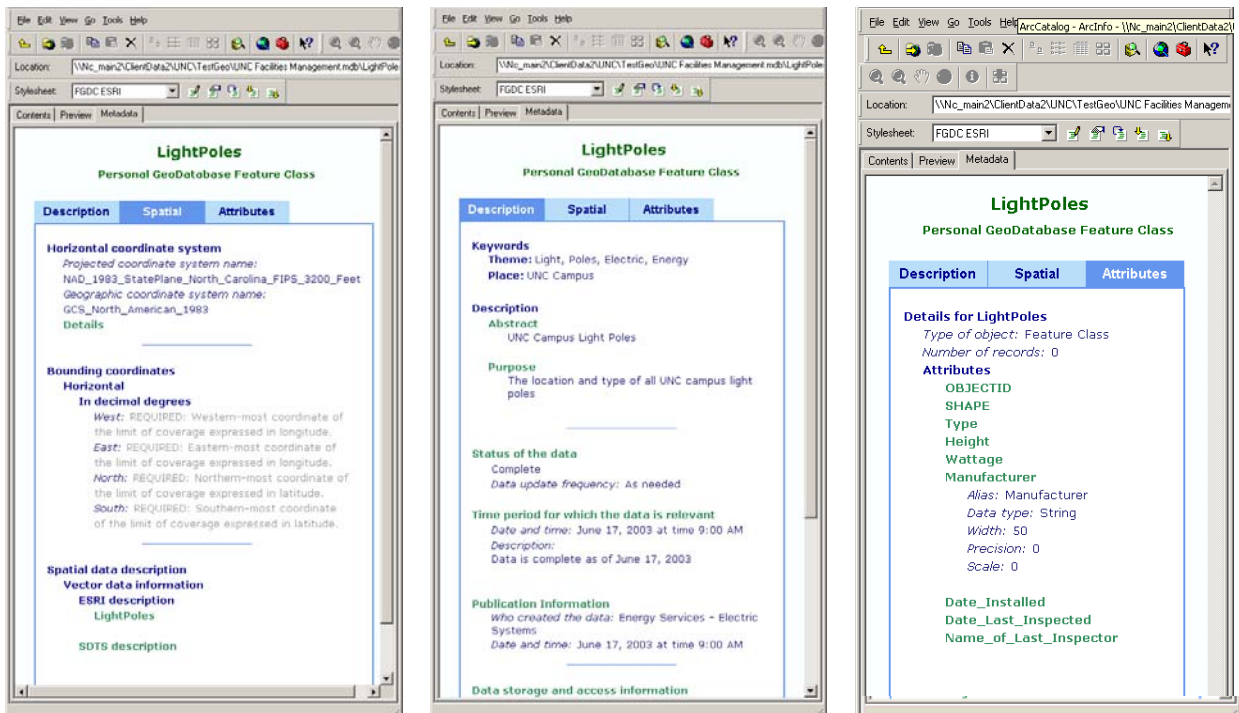
Data Set Credit:

Native Data Set Environment: Microsoft Windows 2000 Version 5.0 (Build 2195) Service Pack 2; ESRI ArcCatalog 8.3.0.800

Native Data Set Format: Personal GeoDatabase Feature Class

Save Cancel Help

Metadata Editor in ArcCatalog



Descriptive, Spatial, and Attribute Metadata Information of a Feature Class Displayed in ArcCatalog

Database Setup and Administration

Once the Physical Database Design is completed, versions and permissions must be established within the SDE-enabled geodatabase.

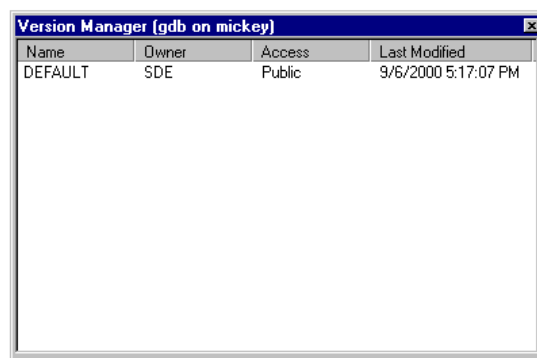
Versions

With ESRI ArcGIS Desktop 9.x, multiple users can access geographic data in a SDE geodatabase format through versioning. Versioning allows users to simultaneously create multiple and persistent representations of the database without any data reproduction. Users can edit the same features or rows without explicitly applying locks to prohibit other users from modifying the same data.

The County can use versioning to manage alternative engineering designs, solve complex "what if" scenarios without impacting the master corporate database, and create point-in-time representations of the database.

Primarily, versioning simplifies the editing process. Multiple users can directly modify geodatabases without having to extract data or lock features and rows before editing. If, by chance, the same features are modified by a separate user at the same time, a conflict resolution dialog box guides the user through the process of determining the feature's correct representation and attributes.

The ESRI ArcGIS Desktop 9.x ArcCatalog software application allows an administrator user to create new versions, rename existing versions, delete versions, and modify version properties. These administrative tasks are accomplished using the Version Manager dialog box within ArcGIS Desktop 9.x, as shown below.



Version Management in SDE

Initially, the database consists of one version named "DEFAULT", owned by the SDE Administrator user. The new versions that are created are always based on an existing version, typically the "DEFAULT". When the new version is created, it is identical to the version from which it was derived.

Over time, the versions will diverge as changes are made to the parent (or “master”) version and the new version. A version consists of several properties: an alphanumeric name, an owner, an optional description, the creation date, the last modified date, the parent version, and the version's permission settings.

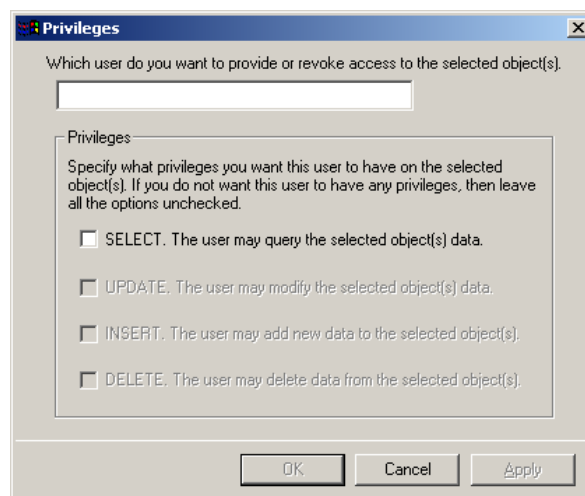
Available permission settings

Various permissions for access to data layers and datasets within the geodatabase must be created.

A version's permission can only be changed by its owner. The available permission settings are:

- Private - the owner may view the version and modify available feature classes.
- Protected - user may view the version, but only the owner may modify available feature classes.
- Public - user may view the version and modify available feature classes.

Only the version's owner can rename, delete, or alter the version. A parent version can't be deleted until all dependent child versions are deleted.



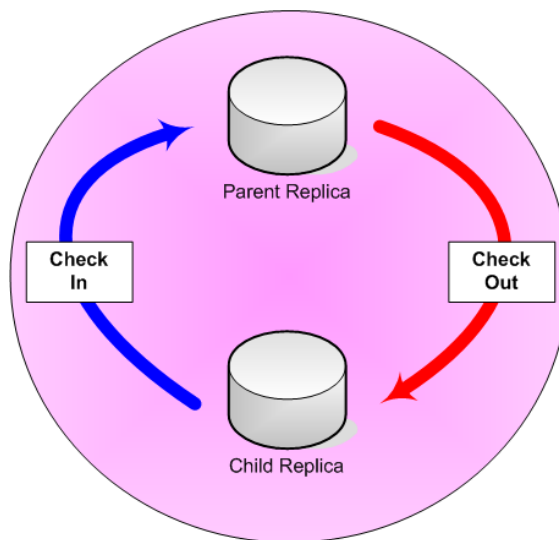
Defining Privileges in SDE

Data Replication and Distribution

Full implementation of the geodatabase will provide the County with numerous benefits to users who are connected to the network and have networking capabilities to support working with GIS data. Users who are disconnected or do not have significant networking capabilities can also benefit through data replication. Through check-in and check-out replication, users that do not have significant network connectivity will have a mechanism to edit and manage their spatial data within the enterprise geodatabase.

Check out/Check in Replication

Check out/Check in Replication is a method of data distribution that allows users to create a copy of geospatial data, perform edits on the data and post the changes back to the original geodatabase. This type of replication is similar to the “Disconnected Editing” functions that have been part of ArcGIS version 9.1. With Check out/Check in Replication, the user will make a connection to the database and create a new “child replica” version of the desired data and export it to another ArcSDE database, a file based geodatabase or a personal geodatabase. The user may then disconnect from the network and perform edits to the data as needed. When the edits are complete, the child replica database can be connected to the original “parent replica” and the edits can be posted and reconciled into the original. If additional edits are needed, another child replica needs to be made after the original changes have been posted back to the original geodatabase.



Check out/Check in Replication

Check out/Check in Replication will serve as an effective method to allow for individual subject matter experts (SME) to maintain ownership over data when their networking capacity is limited. The process is initiated by connecting to the enterprise geodatabase using a laptop at the main government complex. When connected, the user will “Check out” (create a child replica) data to be edited. This data will be stored on the laptop and can be brought back to the sight to be edited. When the edits are completed, the child replica is “Checked in” to the parent database. When checking the data in, the user will be prompted with options to resolve conflicts and to accept the new edits into the original database. The SME will at that point, use their knowledge of the system and data to make decisions to how the data will be reconciled. When completed with the check in process, the data will become visible to the remainder of the enterprise GIS users.

One Way Data Replication

The County should also take advantage of the “One Way Replication” functions within ArcGIS 9.2. Using this replication, read-only copies of the enterprise geodatabase can be made available for applications and users to view and analyze without impacting the editing capabilities of the data

stewards. When applications such as intranet browsers, ArcReader and ArcGIS connect to a spatial database, locks are placed on the data files to prevent data loss and prevent changes when analytical work is being performed. These locks prohibit any data editing to be performed upon spatial data that is being viewed. ArcGIS 9.2 contains tools that allow for creation of a second database that can be used as a “Read-only” database that can be used by GIS viewers. The replication process will create copies of the original data layers and place them in another geodatabase. This process can be scheduled so that the most current data is viewed in the “Read-only” database without interrupting the editing of existing GIS data layers.

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Master Data List

Chapter 11: Master Data List



Chapter Outline

Introduction

Legend

Master Data List

Introduction

The following Master Data List (MDL) is a compilation of data gathered during the Need Analysis' questionnaire documentation, interview phase, and document review process. The MDL represents GIS layers that are, or should be available to the Countywide enterprise GIS. Various departments are identified as being responsible for maintaining GIS layers throughout the enterprise GIS. As the recommended GIS Coordinator in ITD assumes the lead role in the coordination and supervision of County data development and maintenance, more base data layer control can be shifted to the enterprise GIS and the GIS Coordinator. Careful consideration should be given to current shared roles and responsibilities of maintaining current data layers, and coordination of future GIS data custodial duties should be managed through the recommended GIS Coordinator.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Feature Type	The layer type is an indicator of the type of geometry that is stored in the GIS data layer. There are five possible types: point , line , polygon , raster and annotation . Point layer types contain geometries that are described by a single coordinate point. Line layer types contain geometries that are described as a series of linked coordinate points. Polygon layer types contain geometries that are described by a series of linked coordinate points that terminate at the starting coordinate. Raster layers consist of georeferenced images, digital elevation models or cell-based abstractions of vector features. Annotation layers contain text and numeric information that are affixed to a spatial location.
Creation Methodology	This column describes how the layer was, or is anticipated being created.
Department Currently Maintaining Data Set	This field outlines the department or organization that currently maintains or develops the data layer.

Department Responsible for Data Coordination (Recommended)		This field outlines the department or organization that is anticipated to maintain or develop the data layer after full implementation of the Countywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status		Layer state of existence.
	Existing	These layers currently exist with the County's GIS.
	Partially Existing	These layers currently exist in an incomplete or outdate state.
	Recommended	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will complement other GIS data sets that are already existing and in use by the County. Cost associated for recommended layers are based on general estimates – actual cost may vary (see Chapter 16: <i>Five Year Phased Implementation Plan</i>)
Priority		The priority is a recommended level of precedence for a spatial data layer. The priority is determined by the layer's criticality to government functions, departmental usage, public interaction and use with emergency services and public safety. This field will help in determining which year of the Phased Implementation Plan a layer should be developed (if recommended, or partially existing). If the layer is labeled as "existing", prioritization can assist the department responsible for data coordination in managing available resources.
	High	Layers that are given a "High" level have a high impact on the enterprise GIS and are integrated into the business of the County. These layers may contribute to revenue collection, public safety and basic mapping layers
	Medium	Layers that are given a "Medium" level are layers that are frequently used data layers, may be dynamic in nature and are supportive of a specific department's business functions
	Low	Layers that are given a "Low" level are data layers that are infrequently used, are static in nature, are historical layers or have a very specific scope within a department's business functions

Master Data List – (Sorted Alphabetically)

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Active Participants	Point	Geocode based on Social Services Database		Social Services	Recommended	Low
ADA Sidewalk ramps	Line	GPS field surveys	Public Works	Public Works	Existing	Low
Address Points (Countywide)	Point	Some address points have been created by CAL FIRE. This layer needs to be comprehensive and completed based on enterprise data found in a variety of sources (Tidemark, CAL FIRE data, Assessor) Details on the creation of this data layer can be found in Chapter 13: Base Map Data	CAL FIRE /Planning & Building/ Assessor	GIS Coordinator in ITD	Partially Existing	High
Adopt-a-Road	Point	Generate based on existing from-to information		Public Works	Recommended	Low
Aerial Photography (1997, 2003, and 2007) (Countywide)	Raster	Provided by private firms contracted by Planning & Building	Planning & Building	GIS Coordinator in ITD	Existing	High
Aesthetics Theme (Sensitive Resource Area)	Polygon	Digitized from various reference sources	Planning & Building	Planning & Building	Existing	Medium
Agricultural Facilities	Point	Generate either from high-resolution aerial photography or GPS field surveys	Agricultural Commissioner	Agricultural Commissioner	Partially Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Agricultural Well and Pesticide Storage Areas	Point	Agriculture Commissioner is currently creating a point layer for Agricultural Wells only - no GPS only from farm operator information. Wells located near crop field borders.	Agriculture Commissioner	Agriculture Commissioner	Partially Existing	Medium
Air Pollution Control District Pollution Sources	Point	Created from existing data: a non-GIS APCD database with spatial information		APCD	Existing	Medium
Air Quality	Point	Provided by the local Air Pollution Control District (APCD)	APCD	APCD	Existing	Medium
Air Temperatures	Point	Digitize locations of recording stations		Farm Advisor, in conjunction with the Agricultural Commissioner	Recommended	Low
Airport Noise Zones	Polygon	Digitized from reference sources	Planning & Building	General Services	Existing	Medium
Airport Runways	Line	CAD file from General Services converted to GIS shape file	Planning & Building	General Services	Partially Existing	Low
Airport Safety Zone	Polygon	CAD file from General Services converted to GIS shape file	Planning & Building	General Services	Partially Existing	Medium
Ambulance Service Zones	Polygon	Utilize existing data	CAL FIRE	Public Health's Emergency Medical Services Agency	Existing	Medium
Ambulance Stations	Point	Geocode address, or generate from aerial photography	CAL FIRE	Public Health's Emergency Medical Services Agency	Partially Existing	Medium
Ammonia Utilization Facilities	Point / Polygon	Geocode address, or generate from aerial photography	Ag Commissioner has a points and polygon layer of Vegetable Coolers (Part of Agricultural Facilities) CAL FIRE	Agricultural Commissioner, Health Agency and CAL FIRE	Partially Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Archeology Report Locations	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium
Archeology Sites	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium
Armories	Point	Geocode address, or generate from aerial photography		Office of Emergency Services (OES)	Recommended	High
Assessment Neighborhoods	Polygon	Utilize existing data	Assessor	Assessor	Existing	Medium
Assessment Regions	Polygon	Utilize existing data	Assessor	Assessor	Existing	Medium
Assessor Map Books	Point	Utilize existing data	Assessor	Assessor	Existing	Medium
Aviation Facilities • Fixed Wing • Helo • Hospital • Private	Point	Utilize existing data	Agricultural Commissioner - point file	General Services	Partially Existing	High
Bikeways	Line	Utilize existing data and generate either from high-resolution aerial photography or GPS field surveys	Planning & Building	Public Works	Partially Existing	Low
BioAssessment Program	Polygon	Developed by LSA Consultants	Planning & Building	Planning & Building	Existing	Medium
Biology Reports	Polygon	Linked to Parcel APN	Digitized from parcel data and reference sources	Planning & Building	Existing	Medium
Board of Supervisors (BOS) Districts	Polygon	Statistical Analysis using Census Block Data	Planning & Building	GIS Coordinator in ITD	Existing	High
Bridges	Point	Generate either from high-resolution aerial photography or GPS field surveys	Public Works for County bridges	Public Works	Existing	High

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Buffered Toxic Air Contaminant (TAC) Sources	Polygon	Created from existing data: a non-GIS APCD database with spatial information		APCD	Existing	Medium
Building Inspection Zones	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium
Building Inspection Zones by Day	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium
Business Licenses	Point	Extract, cleanse, and automatically map from SAP		GIS Coordinator in ITD	Recommended	High
Cable TV Lines	Line	Generate either from high-resolution aerial photography or GPS field surveys		Office of Emergency Services	Recommended	Low
CAL FIRE Battalions	Polygon	Utilize existing data	CAL FIRE	CAL FIRE	Existing	Medium
California Water Project	Line	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	Medium
Campgrounds (Public and Private)	Point	Generate either from high-resolution aerial photography or GPS field surveys		General Services	Recommended	Low
Capital Project Locations	Point	Generate either from high-resolution aerial photography or GPS field surveys		Public Works	Recommended	Low
Carrizo Plains National Monument Boundary	Polygon	Download from BLM	Planning & Building	Planning & Building	Existing	Low
Cell Tower Locations (Current & Proposed)	Point	Acquire coordinates from Client Application	Planning & Building	Planning & Building	Existing	Medium
Cemetery Districts	Polygon	Derive from TRA layer and maps and legal description filed with the Assessor and the BOE	Local Agency Formation Commission (LAFCO)	Assessor	Partially Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Census Block Groups (2000)	Polygon	Download from Census Bureau	Planning & Building	GIS Coordinator in ITD	Existing	Medium
Census Blocks (1990 & 2000)	Polygon	Download from Census Bureau	Planning & Building	GIS Coordinator in ITD	Existing	Medium
Census Designated Places	Polygon	Download from Census Bureau	Planning & Building	GIS Coordinator in ITD	Existing	Medium
Census Roads (2006)	Line	Download from Census Bureau	Planning & Building	GIS Coordinator in ITD	Existing	Medium
Census Tracts (1990 & 2000)	Polygon	Download from Census Bureau	Planning & Building	GIS Coordinator in ITD	Existing	Medium
Central Business District (CBD) Boundaries	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium
Chemical Pharmaceutical Manufacturers	Point	Utilize existing data	Agricultural Commissioner - 1996 information	Office of Emergency Services (OES) and Health Agency	Existing	Medium
City Limits	Polygon	Digitized from parcel data and reference sources	Planning & Building	Assessor	Existing	High
City Points (with population)	Point	Derived from City Limits polygon (centroid)	Planning & Building	GIS Coordinator in ITD	Existing	Medium
Coastal Dams Proposed in the General Plan	Polygon	Digitized from reference sources	Planning & Building	Planning & Building	Existing	Medium
Coastal Incident Response Plan	Point	Digitize based on existing hard copy documentation and knowledge	CAL FIRE	CAL FIRE	Existing	High
Coastal/Beach Access	Point	Digitized from reference sources	Planning & Building	General Services	Partially Existing	Low
Communications Facilities/Sites	Point	CAL FIRE file that identifies were repeater and radio towers are located.	CAL FIRE	GIS Coordinator in ITD (Communications Group)	Existing	High
Community Access Gates	Point	Derived from CAL FIRE existing data	CAL FIRE	GIS Coordinator in ITD	Partially Existing	High
Community Advisory Councils (CACs) Boundaries	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Community Separators	Polygon	Digitized from reference sources	Planning & Building	Planning & Building	Existing	Low
Community Septic Systems	Line	Utilize existing data		Health Agency	Recommended	High
Community Services Districts (CSDs)	Polygon	Derived from TRA code associated with parcel data	Planning & Building or LAFCO***	Assessor	Partially Existing	Medium
Conservation/Scenic/Open Space Easements	Polygon	Extracted from parcel data and reference sources	Planning & Building	Planning & Building	Existing	Medium
Contour Lines	Line	Derived from Interferometric synthetic aperture radar (IFSAR) DEMs	Planning & Building	GIS Coordinator in ITD	Existing	Medium
County Boundary	Polygon	Digitized from USGS 7.5 min maps	Planning & Building	Assessor	Existing	High
County Building Emergency Planning Data	Point	Digitize using existing hard copy paper maps referencing base data such as parcels, roads, building footprints, and high-resolution aerial photography		Human Resources / Risk Management	Recommended	Medium
County Maintained Roads	Lines	Digitized from aerial photography	Public Works	Public Works	Existing	High
County Service Areas (CSAs)	Polygon	Derive from TRA layer and maps and legal description filed with the Assessor and the BOE	LAFCO or Planning	Assessor	Partially Existing	Medium
County-Maintained Easements	Polygon	Digitize based on existing hard paper records		General Services	Recommended	Medium
County-Owned/Leased Facilities	Polygon	Geocode and link to existing database		General Services, in conjunction with GIS Coordinator in ITD	Recommended	Medium
Countywide Road Data	Line	Licensed data - Provided by NAVTEQ	Public Works	Public Works	Existing	High

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Crime Data	Point	Extract, cleanse, and automatically map from LP01		Sheriff's Office, in conjunction with GIS Coordinator in ITD	Recommended	High
Critical Facilities	Point	Geocode based on inventoried facilities data		Health Agency	Recommended	High
Critical Habitat (Endangered Species)	Polygon	Provided by USFWS and NOAA	Planning & Building	Planning & Building	Existing	Medium
Critical Habitats	Polygon	Provided by US Fish and Wildlife Services (USFWS)	Planning & Building	Planning & Building and Public Works	Existing	Medium
Crops	Polygon	Utilize existing data	Agricultural Commissioner	Agricultural Commissioner	Existing	High
Culverts (Countywide)	Line	Generated from GPS field survey	Public Works	Public Works	Existing	Medium
Dairy Locations	Point	Utilize existing data	Agricultural Commissioner	Agricultural Commissioner, in conjunction with Office of Emergency Services (OES)	Existing	Medium
Dam Failure Inundation Areas	Polygon	Digitized from various sources	Planning & Building	Office of Emergency Services (OES)	Existing	High
Dams and Levees	Point / Line	Utilize existing data	Agriculture Commissioner	Public Works	Partially Existing	High
Daycare Facilities	Polygon	Geocode based on inventoried facilities data	Agriculture Commissioner -Public Health	Health Agency	Existing	Low
Development Services Projects (Land Development Review)	Polygon	Generate from digital CAD drawings, attached legal descriptions, and/or maps of proposed projects		Public Works	Recommended	Low
Diablo Canyon Power Plant Compass Radius Point	Point	Radius from Diablo Canyon NPP	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	High
Diablo Canyon Power Plant Agricultural Hold Areas for Santa Barbara County	Polygon	Hold Areas for Food Safety in reference to Ingestion Pathway Zone	Agriculture Commissioner	OES	Existing	Medium
Diablo Canyon Power Plant Agricultural Hold Areas for SLO	Polygon	Hold Areas for Food Safety in reference to Ingestion Pathway Zone	Agriculture Commissioner	OES	Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Diablo Canyon Power Plant Carless Collection Points	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	Medium
Diablo Canyon Power Plant Decontamination Centers	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	High
Diablo Canyon Power Plant Early Warning Sirens	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services	Existing	High
Diablo Canyon Power Plant Emergency Planning Zones	Line / Polygon	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	High
Diablo Canyon Power Plant Low Population Zone	Point	Digitize existing data	OES	OES	Existing	High
Diablo Canyon Power Plant Predetermined Sample Locations • Field Monitoring Teams (FMT) • Pressurized Ion Chambers (PIC) • Thermoluminescent Dosimeters (TLD) • Air Samplers	Point	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	High
Diablo Canyon Power Plant Protective Action Zones (PAZ)	Polygon	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	High
Diablo Canyon Power Plant Reception and Decontamination Care Centers	Point	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	Low
Digital Elevation Models (DEMs) (2004 – 5 meter)	Raster	Acquired from Intermap Technologies (IFSAR) DEMs	Planning & Building	GIS Coordinator in ITD	Existing	High
DOQQ Grid Tiles	Line	Downloaded from USGS website	Planning & Building	GIS Coordinator in ITD	Existing	Low
Earth Quake Fault Zones (Alquist-Priolo)	Polygon	Digitized from State Mines & Geology maps	Planning & Building	GIS Coordinator in ITD	Partially Existing	High
Election Results and Voter Turnout	Point	Generate from GEMS elections management system		Clerk-Recorder	Recommended	Low
Electrical Switch and Substations	Point	Geocode address, or generate from aerial photography	PG&E	Office of Emergency Services (OES)	Partially Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Emergency Facility Response Time Zones	Polygon	Utilize existing data	CAL FIRE	CAL FIRE	Existing	Medium
Emergency Incident Data	Point	Utilize existing data		CAL FIRE	Recommended	Low
Emergency Medical Services Heli-spots	Point	Utilize existing data	EMSA (Public Health)	EMSA (Public Health)	Partially Existing	High
Emergency Operation Centers (County, Local, State, and Federal)	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	High
Emergency Shelters (Evacuation and Cooling Centers)	Point	Digitize using existing hard copy paper maps	Office of Emergency Services (OES)	Office of Emergency Services (OES)	Existing	Low
Environmental/Biological Reports	Point	Digitized from reference sources	Planning & Building	Planning & Building	Existing	High
Equestrian Centers	Point	Generate either from high-resolution aerial photography or GPS field surveys		General Services	Recommended	Low
Evacuation Routes	Line	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Partially Existing	High
Evacuation Shelters	Point	Generate either from high-resolution aerial photography or GPS field surveys		Office of Emergency Services (OES)	Recommended	Medium
Explosive Storage	Point	Generate either from high-resolution aerial photography or GPS field surveys		Sheriff and Office of Emergency Services (OES)	Recommended	High
Facility Requirements	Point	Utilize other existing data		General Services, in conjunction with GIS Coordinator in ITD	Recommended	Low
Fault Lines (2000)	Line	Acquired from County Geology Mapping Project	Planning & Building	Planning & Building	Existing	High
FEMA Flood Zones (2004)	Polygon	Download from FEMA	Planning & Building	Public Works	Existing	High

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Fiber Optic Lines (County ITD Lines Only)	Line	Generate with GPS or digitize hard copy plans		GIS Coordinator in ITD	Partially Existing	Low
Fire Hazard Severity Zones	Polygon	Utilize existing data	CAL FIRE	CAL FIRE	Existing	High
Fire History (Wildland)	Polygon	Utilize existing data	CAL FIRE	CAL FIRE	Existing	High
FIRE Mutual Aid Zones and Disaster Branch/Division Boundaries	Polygon	Utilize existing data	CAL FIRE	CAL FIRE, in conjunction with Office of Emergency Services (OES)	Existing	High
Fire Service Facilities (fire stations, ambulance stations, air attack base, conservation camps)	Point	Utilize existing data	CAL FIRE	CAL FIRE	Existing	High
Fire Station Response Areas	Polygon	Utilize existing data	CAL FIRE	CAL FIRE	Existing	High
Flood Control basins and associated drainage structures	Point	Generate either from high-resolution aerial photography or GPS field surveys	Public Works	Public Works	Existing	High
Food Banks	Point	Geocode based on Social Services Database		Social Services	Recommended	Medium
Food Distribution Points	Point	Utilize existing data	Agricultural Commissioner - 1996 information	Office of Emergency Services (OES)	Existing	High
Food Facility/Restaurants	Point	Utilize existing data from inspections		Health Agency	Recommended	Medium
Foster Homes	Point	Geocode based on Social Services Database		Social Services	Recommended	Low
Freeway Interchanges	Point	Utilize existing data		GIS Coordinator in ITD	Recommended	Medium
GAP Vegetation Data	Point / Polygon	Provided by US Fish and Wildlife Services (USFWS)	Planning & Building	Planning & Building / Public Works	Existing	Medium
Gasoline Dispensing Facilities (Large and Typical)	Point	Utilize existing data	APCD, or Agricultural Commissioner	APCD, or Agricultural Commissioner and Health Agency	Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
General Plan Highway Corridor Design Standard Areas	Polygon	Digitized from reference sources	Planning & Building	Planning & Building	Existing	Medium
General Plan Circulation Element (Street Classes)	Line	Created using Census 2006 Road data and reference sources	Planning & Building	Planning & Building	Existing	Medium
General Plan Combining Designations (24 Layers)	Polygon / Point	Digitized from reference sources	Planning & Building	Planning & Building	Existing	Medium
General Plan Jurisdictional Boundaries (Planning Areas)	Polygon	Digitized from reference sources	Planning & Building	Planning & Building	Existing	Medium
General Plan Land Use Categories (Zoning)	Polygon	Digitized from reference sources	Planning & Building	Planning & Building	Existing	High
Golf Courses	Point	Utilize existing data		General Services	Recommended	Low
Grape Varieties	Point	Build from combination of other existing data, or generate based on GPS coordinates		Farm Advisor, in conjunction with the Agricultural Commissioner	Recommended	Low
Greenways/Greenbelts	Point	Digitize based on existing hard paper records		General Services, in conjunction with GIS Coordinator in ITD	Recommended	Low
Grid and Quint System for Pest Detection Trapping	Polygon	Provided by the California Department of Food and Agriculture	Agricultural Commissioner	Agriculture Commissioner	Existing	Low
Groundwater Basins	Polygon	Provided by State of California	Planning & Building	Public Works, in conjunction with GIS Coordinator in ITD	Existing	Medium
Groundwater Protection	Polygon	Utilize existing data	Agricultural Commissioner / Public Works	Agricultural Commissioner / Public Works	Existing	Medium
Habitat Conservation Plan Data	Polygon	Provided by private consultants	Planning & Building	Planning & Building	Partially Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Hazardous Materials Facilities	Point	Utilize existing data	Agriculture Commissioner (but data is from the 90s)	Health Agency	Partially Existing	High
Hazardous Materials Pipelines	Point	Utilize existing data	Agriculture Commissioners (but unable to re-project to CA State Plane Projection)	CAL FIRE/OES	Partially Existing	High
Hazardous Materials within County-Owned Facilities	Point	Geocode and link to existing database		General Services, in conjunction with GIS Coordinator in ITD	Recommended	High
High Traffic Roads	Line	Utilize existing data	Public Works	GIS Coordinator in ITD / APCD	Existing	Medium
Historic Designations	Point	Digitized from various sources	Planning & Building	Planning & Building	Existing	Medium
Hospitals (including Acute Care Hospitals)	Point	Utilize existing data	Agricultural Commissioner	Health Agency/Office of Emergency Services (OES), with assistance from other departments	Existing	High
Hotels/Motels/Inns	Point	Geocode address, or generate from aerial photography		GIS Coordinator in ITD	Recommended	Low
Jails/Prisons	Point	Utilize existing data	Agricultural Commissioner	Sheriff	Existing	Low
Juvenile Crime Data	Point	Extract, cleanse, and automatically map from LP01 (must be kept separately due to confidential nature)		Probation, in conjunction with the GIS Coordinator in ITD	Recommended	Medium
Laboratories	Point	Geocode address, or generate from aerial photography		GIS Coordinator in ITD	Recommended	Low
Land Use - Appraisal	Polygon	Using parcel data and existing land use codes		Assessor	Recommended	Medium
Land Use Ordinances	Polygon	Digitized from reference sources	Planning & Building	Planning and Building Department	Partially Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Landmarks	Point	Utilize existing data		GIS Coordinator in ITD	Recommended	Low
Large Animal Sites	Point	Geocode address, or generate from aerial photography		GIS Coordinator in ITD	Recommended	Low
Law Enforcement Facilities	Point	Utilize existing data	Agricultural Commissioner	Sheriff	Existing	High
Library Card Holders / Patrons	Point	Geocode based on existing Library database		GIS Coordinator in ITD	Recommended	Low
Major Highways	Line	Utilize existing data (Tiger road data from 2006)	Planning & Building	Public Works, in conjunction with GIS Coordinator in ITD	Existing	High
Medical Clinics	Point	Geocode address		GIS Coordinator in ITD	Recommended	Low
Military Facilities	Point	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	High
Mines (SLO County)	Point	Utilize existing data	Planning & Building	Planning & Building	Existing	High
Mines (EPA)	Point	Provided by Environmental Protection Agency (EPA)	Provided by Environmental Protection Agency (EPA)	Planning & Building	Existing	High
Mosquito Abatement	Point	Generate based on West Nile database	Health Agency	Health Agency	Partially Existing	Low
Named (Common) Places	Point	Utilize existing data		GIS Coordinator in ITD	Recommended	Low
Natural Diversity Database	Polygon	Provided by CA Department of Fish and Game (DFG)	Planning & Building	Planning & Building / Public Works	Existing	Medium
Natural Gas Pipelines	Line	Utilize existing data		Office of Emergency Services (OES) & CAL FIRE	Recommended	High
Noise Contours	Polygon	Spatial analysis	Planning & Building	Planning & Building	Existing	Low
Non-Conforming Subdivisions	Polygon	Digitized from reference sources	Planning & Building	Planning & Building	Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Normal Background Radiation	Point	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	Medium
Nursing & Convalescent Homes, and Senior Living Facilities	Point	Utilize existing data	Agricultural Commissioner	Public Health	Partially Existing	Low
Ocean (Central Coast)	Polygon	Digitized from aerial photography	Planning & Building	GIS Coordinator in ITD	Partially Existing	Low
Offenders on Probation	Point	Extract, cleanse, and automatically map from LP01		Probation, in conjunction with the GIS Coordinator in ITD	Recommended	Low
Oil Pipeline Right of Ways	Polygon	Generate based on existing paper maps		Assessor	Recommended	Medium
Organic Grower	Point	Utilize existing data	Agricultural Commissioner	Agricultural Commissioner	Existing	Low
Parcel Layer (Countywide) (Needs to be purchased or recreated at a higher accuracy)	Polygon	Licensed Parcel Data: generated and maintained via Planning & Building contract with private vendor	Planning & Building Outsourced	Assessor's Office	Partially Existing	High
Park and Ride Lots	Point	Utilize existing data	Planning & Building	GIS Coordinator in ITD	Partially Existing	Low
Parks	Polygon	Provided by private consultants or other jurisdictions	General Services	General Services, in conjunction with GIS Coordinator in ITD	Partially Existing	Low
Pismo Clarkia Habitat Analysis Data	Polygon	Created via analysis	Planning & Building	Planning & Building	Existing	Low
Planning Special Study Areas	Polygon	Digitized	Planning & Building	Planning & Building	Existing	Low
Points of Interest (POI)	Point	Built from combination of other existing data like airports, schools, public facilities, etc. Intended to replace existing "Landmarks" data layer		GIS Coordinator in ITD	Recommended	Medium
Polling Locations	Point	Geocode records to a Countywide Address Point GIS data layer	Clerk-Recorder	Clerk-Recorder	Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Population Centers (URL/VRL Points)	Point	Utilize existing data	Planning & Building	Planning & Building	Existing	Low
Ports/Harbors	Point	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	High
Power Generating Facilities	Point	Geocode address, or generate from aerial photography		Office of Emergency Services (OES)	Recommended	Medium
Power Transmission Lines (Primary)	Line	Utilize existing data (but needs to be updated from aerial photography)	Planning & Building	GIS Coordinator in ITD	Partially Existing	Medium
Precinct District Boundaries	Polygon	Generate based on Major and Minor District Boundary Maps and TRA code attributes within Parcels	Clerk-Recorder	Clerk-Recorder	Existing	High
Precipitation Gauges	Point	Utilize existing data	Public Works	Public Works	Existing	Medium
Pre-Plan Data (Buildings)	Polygon	Digitize building footprints with hyperlinks to scanned versions of building schematics. CAL FIRE Visio Diagrams		CAL FIRE / Sheriff's Office, in conjunction with GIS Coordinator in ITD	Recommended	High
Public Land Survey Grid	Polygon	Developed by Department of Pesticide Regulation	Agriculture Commissioner Exclusive to Pesticide Regulation Program	Agriculture Commissioner	Existing	Low
Public Lands	Polygon	Digitized from parcel data and reference sources	Planning & Building	Assessor	Existing	Medium
Radiological Materials	Point	Geocode address, or generate from aerial photography		Health Agency and Office of Emergency Services (OES)	Recommended	High
Railroad Centerlines	Line	Digitized	Planning & Building	Assessor	Existing	High
Railroad Crossings	Point / Polygon	Digitized	Planning & Building	Planning & Building	Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Railroad Right of Ways	Polygon	Prepare using utility roll railroad maps and parcel layer		Assessor	Recommended	High
Refineries	Polygon	Utilize existing data	Air Pollution Control District	San Luis Obispo County Air Pollution Control District (APCD)	Existing	Medium
Registered Voters	Point	Geocode DIMS-NeT voter registration records to a Countywide Street Centerline GIS data layer		Clerk-Recorder	Recommended	Low
Regulated Bed & Breakfast Locations	Polygon	Digitized from parcel data and reference sources	Planning & Building	Planning & Building & Health Agency	Existing	Low
Re-Offenders	Point	Extract, cleanse, and automatically map from LP01		Probation, in conjunction with the GIS Coordinator in ITD	Recommended	Medium
Road Encroachment Permits	Point	Generate based on address information and/or hand-drawn graphics within hard paper application forms		Public Works	Recommended	Medium
Road Intersections	Point	Generate either from high-resolution aerial photography or GPS field surveys	Public Works	Public Works / GIS Coordinator in ITD	Existing	High
Road Islands	Polygon	Use NAVTEQ data as a baseline to generate either from high-resolution aerial photography or GPS field surveys		Public Works	Recommended	Medium
Road Pavement Condition	Line	Generate from GPS field surveys, then linked to MicroPAVER system		Public Works	Recommended	Low
Road Phased Improvements	Line	Delivery from private consulting firm		Public Works	Recommended	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Road Restrictions	Point / Line	Generate either from high-resolution aerial photography or GPS field surveys		Public Works	Recommended	Low
Road Right-of-Ways	Polygon	Variety of sources	Planning, Public Works and CAL FIRE	GIS Coordinator in ITD	Partially Existing	High
Road Segments (By Mile Markers)	Line	Generate based on existing from-to information		Public Works	Recommended	Low
Road Signs	Point	Generate from GPS field surveys		Public Works	Recommended	Medium
Roadside Guardrails	Line	Generate GPS field surveys	Public Works	Public Works	Existing	Low
SAP Fixed Asset Inventory (General Services Data)	Point	Generate based on building information inside SAP		General Services	Recommended	High
SAP Fixed Asset Inventory (Public Works Data)	Point	Generate based on Latitude/ Longitude information inside SAP		Public Works	Recommended	High
School Districts	Polygon	Based on TRA legal descriptions and maps filed with the Assessor and BOE	Planning & Building / LAFCO	Assessor	Partially Existing	High
Schools (Private & Public)	Point / Polygon	Utilize existing data	Agricultural Commissioner (This layer is also a requirement for the Public Health Department.)	CAL FIRE / Agricultural Commissioner Public Health, in conjunction with Office of Emergency Services (OES)	Partially Existing	High
Section 8 Housing	Point	Geocode based on Social Services Database		Social Services	Recommended	Medium
Sensitive Biological Data	Polygon	Provided by various private consultants	Planning & Building	Planning & Building	Existing	Medium
Septic Systems (Individual)	Point	Geocoded from inventoried facilities data and GPS	Planning & Building	Health Agency	Partially Existing	High
Serpentine Rock (2002)	Polygon	Acquired from County Geology Mapping Project	Planning & Building	Planning & Building	Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Sewer Treatment Facilities	Polygon	Utilize existing data	Agriculture Commissioner	Public Health and Public Works	Partially Existing	Medium
Sex Offender Registry	Point	Utilize existing data		Sheriff's Office, in conjunction with GIS Coordinator in ITD	Partially Existing	High
Shallow Water Road Crossings	Point	Digitize, or generate from aerial photography		Public Works	Recommended	Medium
Sheriff District/Zones	Polygon	Digitize based on Sheriff's drawing on paper maps		Sheriff's Office, in conjunction with GIS Coordinator in ITD	Recommended	High
Shorelines (past & present)	Line	Utilize existing data	Planning & Building	GIS Coordinator in ITD	Partially Existing	Low
Sidewalks	Line	Generate either from high-resolution aerial photography or GPS field surveys	Public Works	Public Works	Existing	Medium
Social Service Shelters	Point	Geocode based on Social Services Database		Social Services	Recommended	Medium
Social Services Regions	Polygon	Digitize based on hard copy maps		Social Services	Recommended	Low
Soils	Polygon	Provided by National Resource Conservation Services (NRCS)	Planning & Building	Planning & Building	Existing	Medium
Solid Waste Facilities	Point	Geocoded from inventoried facilities data	Health Agency	Health Agency	Existing	Medium
Special Districts	Polygon	Derive from TRA layer and maps and legal description filed with the Assessor and the BOE	LAFCO or Planning	Local Agency Formation Commission (LAFCO) in conjunction with BOE and Assessor	Partially Existing	Low
Special Needs Population	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES) and Health Agency	Existing	Medium
Spheres of Influence (SOIs)	Polygon	Utilize existing data	Local Agency Formation Commission (LAFCO)	Local Agency Formation Commission (LAFCO)	Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Staging Areas for Large Equipment	Polygon	Geocode address, or generate from aerial photography		Office of Emergency Services (OES)	Recommended	High
State Assessed Properties	Polygon	Generate based on parcel information and BOE Utility Roll data		Assessor	Recommended	Low
State Responsibility Areas (CAL FIRE Public Resources Code)	Polygon	Provided by the State of California	CAL FIRE	CAL FIRE	Existing	Low
Stormwater Facilities	Point / Line	Digitized either from high-resolution aerial photography or GPS field surveys	Public Works	Public Works	Partially Existing	High
Stream Gauges	Point	Utilize existing data	Public Works	Public Works	Existing	Medium
Streams	Line	National Hydrographic Dataset	Planning & Building	Planning & Building	Existing	Medium
Street Centerlines (Countywide)	Line	Utilize from a variety of existing sources	Multiple versions exist at the County. CAL FIRE has the most complete and accurate layer.	Public Works, in conjunction with GIS Coordinator in ITD	Partially Existing – CAL FIRE has the best version of this layer currently.	High
Subdivision (Proposed) Boundaries	Polygon	Utilize parcel data		GIS Coordinator in ITD	Recommended	Low
Survey Control Points	Point	Utilize existing data	Public Works	Public Works Department	Partially Existing	Medium
Swimming Pool Facilities	Point	Geocoded from inventoried facilities data	Health Agency	Health Agency	Existing	Low
Tax Rate Areas (TRA)	Polygon	Generated based on parcel layer and existing paper TRA maps		Board of Equalization in conjunction with Assessor	Recommended	High
Telephone Exchange Boundaries	Polygon	Provided by private consultants	Agriculture Commissioner	Office of Emergency Services (OES)	Partially Existing	Low
Telephone Exchange Facilities	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Telephone Line (Including Undersea)	Line	Digitize, or generate from aerial photography		Office of Emergency Services (OES)	Recommended	Low
Tort Claims Against County	Point	Digitize using location-based information from claim forms		Human Resources / Risk Management	Recommended	Low
Township-Range & Section Boundaries	Polygon	Digitized from USGS 7.5 min maps	Planning & Building	Assessor	Partially Existing	Medium
Traffic Analysis Zones	Polygon	Delivery from private consulting firm		Public Works	Recommended	Medium
Traffic Collisions (County)	Point	Extract data from existing Crossroads Database		Public Works	Recommended	Medium
Traffic Control Points (TCPs)	Point	Utilize existing data	Agriculture Commissioner	Sheriff and Office of Emergency Services (OES)	Existing	Medium
Traffic Counts	Point	Delivery from private consulting firm and Public Works		Public Works	Recommended	Medium
Traffic Model Planning Areas	Polygon	Delivery from private consulting firm		Public Works	Recommended	Medium
Traffic Regulation Codes	Point / Line	Generate based on from-to milepost information		Public Works	Recommended	Low
Traffic Signals and street lighting	Point	Digitized either from high-resolution aerial photography or GPS field surveys		Public Works	Recommended	Medium
Traffic Speed Zones	Polygon	Generate based on GPS field surveys		Public Works in conjunction with GIS Coordinator in ITD	Recommended	Low
Trails	Line	Utilize existing data		General Services, in conjunction with GIS Coordinator in ITD	Partially Existing	Low
Transfer Development Credit (TDC) Program Data	Polygon	Digitized	Planning & Building	Planning & Building	Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Transient Occupancy Tax (TOT)	Point	Extract, cleanse, and automatically map from SAP		GIS Coordinator in ITD	Recommended	High
Transit Routes	Line	Existing sources	SLOCOG	GIS Coordinator in ITD	Partially Existing	Low
Transportation Hubs	Point	Utilize existing data		GIS Coordinator in ITD	Recommended	Medium
Transportation Traffic Permits	Point	Digitized either from high-resolution aerial photography or GPS field surveys		Public Works	Recommended	Low
Tree Coverage Area (within County Parks)	Polygon	Digitize based on high-resolution aerial photography		General Services, in conjunction with GIS Coordinator in ITD	Recommended	Low
Tsunami Evacuation Line (50' elevation line)	Polygon	Derived from IFSAR DEMs	Planning & Building	Office of Emergency Services (OES)	Existing	High
Tsunami Inundation Planning Points	Point	Utilize existing data	Agricultural Commissioner	Office of Emergency Services (OES)	Existing	High
Underground Storage Tanks (USTs)	Point	Provided by Regional Water Quality Control Board	Planning & Building	GIS Coordinator in ITD (Be sure to include Health Agency)	Existing	High
Urban Services Line (USLs)	Polygon	Digitized	Planning & Building	Planning & Building	Existing	Medium
Urban/Village Reserve Line (URLs & VRLs)	Polygon	Digitized	Planning & Building	Planning & Building	Existing	Medium
USGS 7.5 Minute Quad Grid	Line	Provided by United States Geological Survey (USGS)	Planning & Building	GIS Coordinator in ITD	Existing	Low
Vegetation Mapping for North Coast	Polygon	Provided by private consultants	Planning & Building	Planning & Building	Existing	Low

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Vegetation Mapping for SLO Planning Area	Polygon	Provided by private consultants	Planning & Building	Planning & Building	Existing	Low
View shed Protection Data/Visual Analysis Data	Polygon	Generated from IFSAR DEMs Analysis	Planning & Building	Planning & Building	Existing	Medium
Water distribution lines, including Nacimiento pipeline, Chorro Valley pipeline, State water project Line	Line	GPS field surveys and vendor provided data	Public Works	Public Works	Partially Existing	Low
Water Features	Polygon	National Hydrographic Dataset	Planning & Building	Planning & Building	Existing	High
Water Planning Areas	Polygon	Utilize existing data	Public Works	Public Works	Existing	High
Water Providers	Point	Utilize existing data	Planning & Building	Health Agency	Partially Existing	High
Water Pumping Stations	Point	Utilize existing data	Public Works	Public Works and Public Health	Existing	High
Water Sources	Polygon	Utilize existing data	Public Works	Public Works and Health Agency	Partially Existing	High
Water Supplies (Open & Covered, Public & Private)	Point	Utilize existing data	Agriculture Commissioner	Public Works and Health Agency	Partially Existing	High
Water Treatment Facilities	Point	Utilize existing data	Agriculture Commissioner / Public Works	Public Works and Public Health	Existing	High
Water Wells	Point	Geocoded from inventoried facilities data	Health Agency	Public Works and Health Agency	Partially Existing	High
Water Wells (Private)	Point	Generate based on GPS coordinates	Health Agency	Health Agency	Partially Existing	Medium
Watershed Subbasins	Polygon	National Hydrographic Dataset	Public Works	Public Works	Existing	Medium
Watersheds	Polygon	Provided by Regional Water Quality Board	Planning and Building	Public Works, in conjunction with GIS Coordinator in ITD	Existing	Medium
Weather Stations & Meteorological Towers	Point	Utilize existing data	Agriculture Commissioner	Office of Emergency Services (OES)	Existing	Low
Williamson Act – Current Contracts	Polygon	Derived from Parcel database	Planning & Building	Planning & Building	Existing	Medium

<i>Data Layer</i>	<i>Feature Type</i>	<i>Creation Methodology</i>	<i>Department Currently Maintaining Data Set</i>	<i>Recommended Department Responsible for Coordination of Data Set</i>	<i>Layer Status</i>	<i>Priority</i>
Williamson Act – Farmland Management Monitoring Program (FMMP)	Polygon	Provided by Department of Conservation	Planning & Building	Planning & Building	Existing	Medium
Williamson Act – Preserve Parcels	Polygon	Digitized based on Department of Conservation information	Planning & Building	Planning & Building	Existing	Medium
Williamson Act Boundaries	Polygon	Download from Department of Conservation	Planning & Building	Planning & Building	Existing	Medium
Wineries	Polygon	Various sources including Ag Commissioner crops and Assessor's crop layers	Agricultural Commissioner	Agricultural Commissioner	Existing	Medium
Zip Codes	Polygon	Download from external source		GIS Coordinator in ITD	Recommended	Low

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Data Standards and Transfer Mechanisms

Chapter 12: Data Standards and Transfer Mechanisms



Chapter Outline

Introduction

Data Format

Coordinate Systems

- Datums

- Coordinate Conversion

- Recommended Coordinate System

Transfer Media and Backup

- Transfer Media

- Sharing Data via the Internet

Data Creation and Maintenance

- Roles

- Standard Operating Procedures

 - Data Maintenance Procedure for Existing Data

 - New Data Resource Procedure

 - Criteria for Acceptance or Rejection of New Data

 - Procedure

Data Indexing Strategies

- Metadata

- Why Metadata

- ArcCatalog

 - Data Access in ArcCatalog

 - Creating and Accessing Geodatabases

 - Data Organization in ArcCatalog

 - How Metadata Is Stored

 - Metadata for Folders and Geodatabases

 - About Importing and Exporting Metadata

FGDC Metadata Workbook

The Standard

Additional Information

Examples

Metadata Recommendations

Introduction

The “*Seven Keys to a Successful GIS Implementation*” states that there is a compelling need to establish good relationships with other organizations to facilitate sharing of data. No successful municipal GIS can be an island unto itself. Forging partnerships and deciding to share data with other organizations is only the first step. The next step involves the technical issues of data sharing.

Once the County of San Luis Obispo has identified data that can be shared, it needs to determine the mediums, media, and formats that will be used to share that data. As the County proceeds with its GIS

implementation, it will find that many organizations are willing to share data. However, getting viable, quality data may prove to be a challenge.

There are three discrete issues that must be addressed whenever sharing digital GIS data with other organizations:

- Data Format
- Coordinate System and Datums
 - o Coordinate Conversion
 - o Recommended Coordinate System
- Transfer Media and Backup

Data Format

GIS data can be maintained in a number of formats. The format depends on the type of software used to create the data and the output format an organization uses to distribute its information. The ESRI ArcGIS suite of software recommended for use by the County offers considerable flexibility. There are only a few data formats that this suite of applications cannot read (or import).

Some formats are easier to use than others. The following is a list of common data formats, their derivation, their ease of use, and whether they can contain tabular (attribute) data as well as geographic data.

Data Formats Table:

Data Format	Derivation	Ease of Use	Tabular	Notes
ArcGIS Enterprise Geodatabase	ArcGIS: ArcInfo, ArcEditor	High	Yes	Format of choice. ArcGIS data model. Can be exported as geodatabase, coverage, export file, shapefile, or others. Consists of feature datasets, feature classes, tables, etc. Stored in commercial RDBMS, and accessed with ArcSDE as an SDE data layer. Allows multi-user editing and limitless storage capacity
ArcGIS Personal Geodatabase	ArcGIS: ArcInfo, ArcEditor, ArcView	High	Yes	ArcGIS data model. Can be exported as geodatabase, coverage, export file, shapefile, or others. Consists of feature datasets, feature classes, tables, etc. Stored in MS Access database. Limited storage capacity

Data Format	Derivation	Ease of Use	Tabular	Notes
ArcGIS File Geodatabase	ArcGIS: ArcInfo, ArcEditor, ArcView	High	Yes	A file geodatabase is an ArcGIS geodatabase in the native computer file system without a DMBS. File geodatabases allow users to easily exchange geodatabases, store more than one terabyte of data per table, support the compression of vector data into a read-only format. The data can still be used for GIS analysis applications, but compressing can dramatically reduce the storage size.
ArcInfo Coverage	ArcInfo	High	Yes	Previous format of choice for polygonal data, such as tax parcels. Native ArcInfo Workstation file format. Is comprised of many files, tabular and geographic. All files must be copied if this type of file format is to be used. Utilizes topology. Not supported by ArcGIS 8.3 and 9.x Desktop
ArcInfo Export File (.e00)	ArcInfo	High	Yes	Format of choice for distribution of coverages. Contains all of the data in an ArcInfo coverage in one file. This file format has to be imported but makes transport of data very efficient
ArcView Shapefile	ArcView	High	Yes	Format of choice. Native ArcView file format. Easily converted to an ArcInfo Coverage or Geodatabase
DXF	CADD Products	Medium	Yes	Hard to transfer tabular data. Usually obtained from engineering firms and surveyors
DWG	AutoCAD	Medium	Yes	Native AutoCAD format. ArcInfo and ArcView can read these files without conversion
DGN	Intergraph	Low	Yes	Must be converted to a different format for use with ArcInfo or ArcView
DLG	USGS	Low	Yes	Digital Line Graph data used by the USGS. Often DLG files have been converted already into a more usable format
SDTS	USGS	Low	Yes	Spatial Data Transfer Standard. Developed by the National Mapping Division of the USGS. Primarily used as a cross-platform distribution format. Point and Raster formats
Tiger Files	Census Bureau	Low	Yes	Contains valuable demographic data. Should be acquired. But the native tiger file format is cumbersome and difficult to translate. Try to find a state agency that has done the conversion already

Data Format	Derivation	Ease of Use	Tabular	Notes
DEM Digital Elevation Model	Various Sources	Low	Very Little	Used for the generation of elevation contours. Cumbersome to use but often necessary. Requires ArcGIS Spatial Analyst to utilize raster data
TIFF, Sun Raster, JFIF, BMP, BIL, GIF, JPEG, MrSID	Various Sources	Low	No	Various image formats that can be displayed directly in ArcGIS and AutoCAD. Useful for display, aerial imagery and photographs

Whenever possible, data should be obtained in ArcGIS geodatabase feature class, ArcView Shapefile, or AutoCAD (with object data) format. These formats are typically the easiest to transfer and use. GIS datasets are usually large and will require data transfer by DVD, compact disc, or via the Internet. Data can be supplied on CD as an ArcView Shapefile or ArcGIS geodatabase (file or personal), but most CDs can only hold up to 700 Megabytes (MB). Any amount of GIS data larger than 700 MB will have to be either transferred via DVD, which can hold at least 6 ½ times as much information as a CD (approximately 4.6 Gigabytes and up), or through the Internet. It should be noted that surveyors and engineers frequently utilize a computer aided drafting and design (CADD) product like Autodesk's AutoCAD or Bentley's Microstation. The optimal means of transferring data from or to a CADD system is to utilize the Digital Exchange Format, or DXF.

Coordinate Systems

GIS layer spatial information is stored in a coordinate system, defined by the projection of the map. The coordinate system of the digital map is important. If digital data are obtained and the coordinate system is unknown, then the user may or may not be able to convert the data to the correct units. It is best to inquire about the coordinate system before receiving data. ESRI ArcGIS software includes tools to convert between coordinate systems. Because coordinate conversion can be cumbersome and time consuming, requesting or providing all map projection information with exchange files is crucial. This information should be provided as a standard in all metadata files that accompany County data, or are requested from outside sources (see Metadata section below).

The existing standard utilized by the County is NAD 83, California V Zone, US Feet (this is the same as the recommended coordinate system presented below; see "Recommended Coordinate for the County of San Luis Obispo" below).

Datums

Another consideration along with the coordinate system is datum. There are two horizontal datums used almost exclusively in North America. These are the North American Datum of 1927 (NAD27) and the North American Datum of 1983 (NAD83). It is recommended that cadastral maps in California

be based upon state plane coordinates adjusted to the 1983 horizontal datum. Other projections and coordinate systems may be used to satisfy special requirements.

The North American Datum of 1927 uses the Clarke spheroid of 1866 to represent the shape of the Earth. The origin of this datum is a point on the Earth referred to as Meades Ranch in Kansas. Many NAD27 control points were calculated from observations taken in the 1800s. These calculations were done manually and in sections over many years. As a result of this process, errors varied from each station. Many technological advances in surveying and geodesy since the establishment of NAD27 - electronic theodolites, GPS satellites, Very Long Baseline Interferometry, and Doppler systems - revealed weaknesses in the existing network of control points. Differences have become particularly noticeable when linking existing control with newly established surveys. The establishment of a new datum allowed for a single datum to cover consistently North America and surrounding areas.

The North American Datum of 1983 is based on both Earth and satellite observations, using the GRS80 spheroid. The origin for this datum is the Earth's center of mass. This affects the surface location of all latitude-longitude values enough to cause locations of previous control points in North America to shift, sometimes as much as 500 feet. A ten (10)-year multi-national effort tied together a network of control points for the United States, Canada, Mexico, Greenland, Central America, and the Caribbean.

NAD27 and NAD83 should not be used in conjunction with one another. If any NAD27 derived data exists then it must be converted to NAD83. Tools within GIS software make this a relatively easy process.

Coordinate Conversion

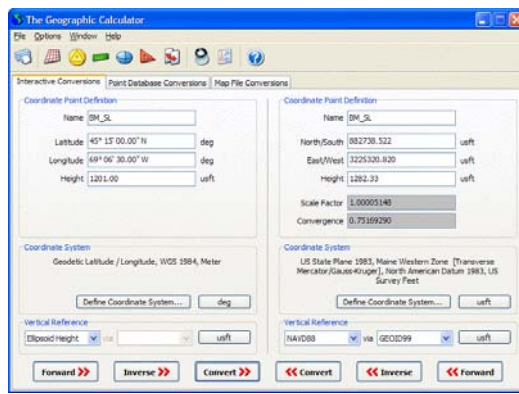
A GIS layer's spatial information is stored in a coordinate system, defined by the projection of the map. The coordinate system of the digital map is extremely important. If digital data are obtained without a specified coordinate system, it may not be readily possible to determine the projection. Various map projection and coordinate conversion tools are available in the ESRI product suite, as well as other commercial and governmental applications (Blue Marble, Corpscon, etc.). Most of the routine coordinate conversions can be performed in standard ESRI ArcGIS desktop software, yet the following software is also available for other custom and batch coordinate processing as well as for conversion of other data formats that may be useful.

FME Desktop Suite
<http://www.safe.com>



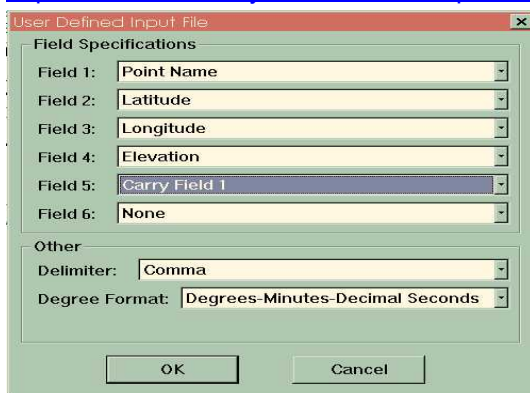
FME Desktop Suite supports many popular data formats including MapInfo TAB, DGN, DXF, DWG, SDTS, SHP, and TIGER. FME Suite contains a gallery of over 2,000 supported coordinate systems, based upon a wide variety of projections, ellipsoids and datums. Users can also define and include their own custom coordinate systems. Coordinate conversion is now included with the Desktop Suite.

Blue Marble Geographics
<http://www.blumarblegeo.com/>



The Geographic Calculator converts individual coordinates, point databases, and map files from virtually any coordinate system, datum, and map projection to any other. Users can transform between coordinate systems, calculate the distance and azimuth between coordinates, and calculate coordinates at a known distance and azimuth from known coordinates. The Geographic Calculator also computes grid convergence, point scale factor, datum shifts, and grid shifts. The Geographic Calculator is professionally documented and supported.

U.S. Army Engineer Topographic Engineering Center CORPSCON
<http://crunch.tec.army.mil/software/corpscon/corpscon.html>



Corpscon is a MS-Windows-based program which allows the user to convert coordinates between Geographic, State Plane and Universal Transverse Mercator (UTM) systems on the North American Datum of 1927 (NAD 27), the North American Datum of 1983 (NAD 83) and High Accuracy Reference Networks (HARNs). Corpscon uses the National Geodetic Survey (NGS) program Nadcon to convert between NAD 27, NAD 83 and HARNs.

Recommended Coordinate System for the County of San Luis Obispo

It is recommended that the County utilize the California State Plane Coordinate System, Zone V, based in the North American Datum of 1983 with adjustments to the High Precision Geodetic Network (NAD83/HPGN). This should be the standard for which all existing and future GIS data is viewed through various end-user applications, including the suggested Countywide GIS software standard, ESRI's ArcGIS software suite,

Parameter	Value
Zone	California V
Coordinate System	State Plane
Datum	NAVD 88
Projection	Lambert Conformal Conic
Units	U.S. Feet
Scale	0.09999411764705882
Central Meridian	-118.0
Origin (Latitude)	33.5
False Easting (m)	656166.6666666667
False Northing (m)	1640416.6666666667

Transfer Media and Backup

Transfer Media

One of the greatest challenges in sharing data is the transfer of data from one computer system to another. One computer may have data that is in a specific format and coordinate system, yet there may be no common way to transfer the data to other computers. There are several ways to provide access to data between computers, but few standards exist. Floppy disks were the traditional method of data transfer for years. However, the sheer size of data has significantly reduced the usefulness of diskettes. Given that, an average GIS data file can require up to thirty diskettes or more worth of disk storage, determining other alternatives for data transfer is necessary.

The table below lists some standard transfer media and their characteristics:

Transfer Media	Platform	Storage Capacity	Notes
 External Hard Drives	Unix and PC	Up to 160GB+	Compact and portable using USB 2.0 or Firewire for data transfer
 Compact Disk (CD) Media	Unix and PC	720 MB	Excellent media for transferring and archiving large files.
 DVD-R/RW	Unix and PC	4.7 GB-9.4 GB	Comparable to the CD, but has much larger storage capacity. Included on most new PCs.
 Thumb Drives	PC	1 GB-4 GB+	Excellent for quick file swap using USB connection.
ZIP Drives	PC	1 GB	Good for data transfer with other PCs that have zip drives (not recommended – being replaced by higher capacity thumb drives)
Ditto or Jaz	PC	100 MB - 2 GB	Good for PCs but no standards exist. Data sharing between machines is difficult (not recommended – being replaced by higher capacity thumb drives)

It is recommended that the County utilize compact discs (CD-ROM) and DVD-R discs as the transfer media of choice. Re-Writeable CDs and DVDs should be utilized for data sharing and distribution, depending on which type of media can be utilized by those receiving the data. Using these two types of media will allow for flexibility when sharing data with or receiving data from other entities. Re-Writeable CDs can be used for data sharing between all types of computers, as almost all computers today come standard with a CD-ROM drive. Therefore, any data written with the Re-Writeable CD-ROM drive can be used on any PC with a CD-ROM drive. Likewise, DVDs have routinely replaced CD-ROM drives on newer PCs of the past few years. Another important factor is that DVD drives can access CD-ROM media, whereas CD drives cannot read DVDs. DVDs offer greater storage capacity and the ability to transfer large data sets that would have normally needed to be divided into multiple CDs.

A majority of internal data sharing at the County will be done through the County's high-speed network. Data sharing through the network eliminates the need for sharing via disk or drive. However, GIS personnel should have thumb drives available to them for timely copy and carry situations.

Sharing Data via the Internet

An excellent way of sharing data is via the Internet. Sharing data through the Internet precludes the need to use disks and drives for transfer data. However, there are some limiting factors to this type of data transfer, primarily data transfer speed. A single GIS file could take hours and possibly days depending on file size, to transfer via a modem. Additionally, modem connections to the Internet can often be lost during file transfer, requiring the restart of the entire file transfer process. However, modem (dial up) connectivity in commercial and government organizations is rapidly declining. Private citizens that may still use dial-up should access GIS data via the Internet at the County's GIS website using a browser application.

Most organizations have high-speed (broadband) connections to the Internet at the desktop level. Files that would typically take hours to transfer with a modem take only a few minutes to transfer using a high-speed (broadband) connection and file transfer protocol (FTP) software. **It is recommended that the County develop a FTP site to include a public access section for transferring files with data sharing partners and vendors.**

Data Creation and Maintenance

Roles

This section describes the roles and responsibilities of the individuals involved in GIS data sharing: requestors, the recommended GIS Coordinator in ITD, subject matter experts (SMEs), and department supervisors (with respect to modifying existing or adding new resources to the GIS).

Requestor:

A Requestor is a person who wants to modify or add a data resource to the GIS. If the data meets minimum requirements, or if the GIS Coordinator authorizes the submittal, the requestor must complete the appropriate Request Form.

Recommended GIS Coordinator in ITD:

The GIS Coordinator is responsible for tracking all resource submittals and providing some initial quality assurance (QA) of the data. The GIS Coordinator is in charge of layers that are used by all departments. The GIS Lead or Subject Matter Expert (SME) is a person who accepts or is assigned the responsibility of maintaining GIS data in his or her own department. This person should have sufficient technical expertise to be assigned with this responsibility. Regardless of who makes a request, the GIS Coordinator has the authority to refuse requests from a Requestor; the GIS Coordinator also acts as the point of contact for requestors and SMEs for particular submittals. This pivotal position provides guidance in converting file formats, data cleanup, and

compatibility of proposed resources with existing GIS resources. If a resource is accepted, the GIS Coordinator will install the resource and make changes to any relevant documentation.

Subject Matter Experts (SME):

Subject Matter Experts are responsible for particular data. An SME may also act as the department's GIS liaison. If proposed data is similar to, or has a potential impact on existing data, the SME for the existing data needs to review the submittal. The SME will make or oversee the changes to the data when updates are required. The SME should provide guidance to the GIS Coordinator as to whether or not the proposed resource conflicts with, enhances, or will result in changes to an existing data. The SME is further responsible for updates to the data metadata file. County departments with recommended Tier 1 – Flagship and/or Tier 2 – Analytical GIS Users should designate those staff as SMEs. For most other County departments, SMEs should be considered semi-advanced Tier 3 - Browser GIS Users.

Supervisor:

The Supervisor for each SME is responsible for ensuring that the SME is qualified and has enough time as well as resources (i.e., training, computer system, or other resources) to perform the duties required.

Standard Operating Procedures

Outlined below are two (2) recommended data creation and maintenance Standard Operating Procedures (SOPs) for the County:

1. Maintaining or updating existing data resources, and;
2. Adding new data resources to the GIS.

Data Maintenance Procedure for Existing Data

Three types of spatial data layers will be utilized by the County:

- Layers used and maintained by only one department/division
- Layers maintained by one department/division, but used by many
- Layers updated by the GIS Coordinator

The following guidelines do not apply to layers that are used and maintained by only one department.

Any GIS user may request changes or updates to an existing data layer. The request is made to their SME using the Data Maintenance Request form (see Example A below). The SME will review the request and approve it, if deemed appropriate, and forward the request to the GIS Coordinator. The GIS Coordinator will review the request to ensure that the layer is in compliance, and if it is, the request will be facilitated by the SME and GIS Coordinator.

The SME is responsible for completing all of the corrections and/or updates, including updates to the metadata file. Corrections should be made to copies of the data resource files as required. The GIS Coordinator may assist the SME in this effort by providing technical support, staff resources, CADD to GIS conversion, and other tasks as required; however, it is ultimately the SME's responsibility to ensure that the new data is correct.

Once a request is approved and new files are finalized, the SME will return the completed request form to the GIS Coordinator along with the updated data. Data files may be on separate media (CD, DVD), or corresponding network location(s) may be indicated on the request form. The intended final disposition of the original data files should also be indicated on the form.

The GIS Coordinator will be responsible for validating new data. This responsibility includes:

- A final check to ensure that the new spatial data has not been corrupted or changed, except where intended
- Verifying that topology and attribute structure of the new data matches that of the old
- Verifying that attribute record data are intact
- Verifying that all links and joins used by the GIS system are still functional within the new data
- Verifying that the new data and metadata are in agreement
- Verifying that the new dataset conforms to County data standards (as referenced above: format, coordinate system, and media/medium)

Any discrepancies found must be resolved with the SME prior to the implementation of the updated data within the GIS.

Once the GIS Coordinator and the SME have approved the updated data, the GIS Coordinator will move the old data resource files (including the old metadata file) to an archive directory for temporary storage, and copy the updated files to the network GIS server(s). The GIS Coordinator will be responsible for updating any other relevant GIS documents, such as File Lists, Layer Lists, and Metadata Indices.

New Data Resource Procedure

This Standard Operating Procedure (SOP) relates to the addition of new data resources to the GIS, and does not address changes to existing GIS data. To update or amend any existing GIS data, contact the GIS Coordinator. **Example A** of this section contains a submittal form that provides some guidelines on data requirements.

Criteria for Acceptance or Rejection of New Data

The County is interested in seeing its GIS become more broadly available for decision support and information dissemination. This requires that new data resources be added to the system so that a wider group of users will productively use the GIS. To achieve this objective, the proposed data acquisition and acceptance process has not been made overly rigid. The GIS Coordinator is authorized to accept or reject a submittal based on some basic criteria, with additional discretionary flexibility.

The GIS Coordinator may accept new resources only if all of the following criteria are met:

- Resource is ready “as-is” and requires no updates or modifications (with the exception of CADD and ArcInfo files, which may be converted to SDE geodatabase feature classes)
- It conforms to County GIS Data Standards (as referenced above: format, coordinate system, and media/medium)
- The proper SME is already assigned and has signed off on the submittal
- Future update and maintenance requirements are minimal, or the requestor accepts responsibility for the needed updates and/or maintenance

The GIS Coordinator may reject new resources if:

- No one needs access to the data
- Significant maintenance of the data will be required and no one inside the organization can assume responsibility for this task

Procedure

The procedure for submitting new data for inclusion in the GIS is outlined below. The requestor is encouraged to consult with the GIS Coordinator if one or more requirements are not met. The GIS Coordinator may grant an exception, allowing the process to continue. This exception does not imply that the data has been accepted; the data must still go through the normal review process.

After the requestor determines that the data is eligible for consideration, the submittal form entitled “Request to Add New GIS Data Resource” must be completed (see **Example B** below). The requestor should have the request reviewed and approved by his or her supervisor. If the requestor is not the designated SME, the SME’s agreement needs to be obtained and authorized by his or her designated Supervisor.

The aforementioned process needs to be complete before the request package is submitted to the GIS Coordinator. The GIS Coordinator should receive the following three items:

- A completed “Request to Add New GIS Data Resource” document with authorizing signatures; AND
- A copy of the proposed data resource on transfer media, or a copy transferred electronically via email or ftp; AND
- A hard-copy printout of the electronic file (if practical)

The GIS Coordinator will perform an initial review. If the submittal is not complete, it will be sent back to the requestor with the deficiencies identified. Otherwise, the SMEs for affected data must be consulted to determine if the proposed data duplicates or overlaps existing resources.

If all SMEs and the GIS Coordinator approve the submittal, the GIS Coordinator will place the new data on the GIS server and update any affected documentation.

Example A: GIS Data Maintenance Request Form

Request to Update Existing GIS Data Resource

SUMMARY INFORMATION

Submitted by: _____ Date: _____

Department: _____ Phone: _____

County Name of Dataset: _____

Description: _____

Update to Data Type:
(Check all that apply)

☐ Vector

☐ Raster

☐ Tabular

☐ Documents

☐ Other _____

Subject Matter Expert (SME): _____

Describe the corrections, updates, or additions to the data resource you are requesting:

List (or attach) any additional documents that are related to this update:

The SME shown above has examined this request to update an existing GIS data resource, and has determined that the updates or corrections are needed. The SME has acquired copies of the data resource files, made the appropriate changes or additions, and has duly modified the associated metadata files. These corrected files are provided to the GIS Coordinator with authorization to replace the existing data resource files on the network GIS server with the updated data resource files attached or referenced in this form.

(SME Signature)

Date

SME Use:

Provide the network location of the updated data resource files related to this update request:

Final disposition of existing data resource files ☐ Archive ☐ Delete

The GIS Coordinator for the County GIS has received all required files and approvals from the SME regarding this data resource maintenance request, and implemented the updated files on the network GIS server. All other affected GIS files have been updated to reflect the changes in this data resource.

(GIS Coordinator Signature)

Date

Example B: New Data Resource Form

Request to Add GIS Data Resource

1.SUMMARY INFORMATION (all information in Section 1 is required)

Submitted by: _____ Date: _____

Department: _____ Phone: _____

Title of Dataset: _____

Description: _____

Type: ☐ Vector ☐ Raster
☐ Tabular ☐ Document
☐ Other _____
(Complete checklist for the appropriate type)

Frequency of Update:

☐ Never ☐ Annually ☐ Quarterly ☐ Monthly ☐ Weekly ☐ Daily

Subject Matter Expert (SME): _____

The SME shown above agrees to be responsible for updating, creating and maintaining this layer at the frequency shown above. The SME's supervisor, by signing below, acknowledges that SME is authorized to perform this function as collateral duty (unless otherwise designated).

(SME Signature)

(SME Supervisor's Signature)

Who are the potential users of this layer (list by name, department, and/or position)?

Why do you think this resource should be added to the GIS?

Does this data replace (yes/no) or duplicate (yes/no) any data set currently in the GIS? If answer to either is "yes," explain here:

2. SPATIAL DATA ATTRIBUTES (all information in Section 2 is required)

These questions should be answered for spatial data only (i.e., CADD, GIS, and orthorectified photos).

How are the data georeferenced?

☐ Projected (X,Y) ☐ Geographic (Lat/Long) ☐ N/A

If Projected:

What projection system was used?

State Plane

☐

FIPS Zone:

Other (Specify)

☐

What datum was used?

NAD83

☐

NAD27

☐

Other (Specify)

☐

What units are distances in?

US Feet

☐

Int'l Feet

☐

Meters

☐

Other (Specify)

☐

If Geographic,

What datum was used?

NAD83

☐

NAD27

☐

Other (Specify)

☐

What units are distances in?

Decimal Degrees

☐

Deg. Min Sec. ☐

Other (Specify) ☐ _____

Does the data have a vertical component? ☐ Yes ☐ No

If Yes:

What datum was used?

NGVD29 ☐

NAVD88 ☐

ELLIPSOID ☐ Spheroid Used: _____

Other (Specify) ☐ _____

What units are the elevations in?

US Feet ☐

Int'l Feet ☐

Meters ☐

Other (Specify) ☐ _____

3. DATA FORMAT

Answer as many of the following questions as possible for all data types. Questions with an asterisk (*) must be answered.

What software was used to generate this data set (include version or release number)?

Vector Data

GIS

ESRI Personal Geodatabase ☐

Autodesk .DWG Release 14 – 2000 – 2005 ☐

ESRI Geodatabase ☐

ESRI Shapefile ☐

ArcInfo Coverage	☐
Other	☐ specify _____

Include attribute specifications for GIS spatial data

Raster Data Type

Scanned Photos	☐	Choose one:	Projected ☐	Un-projected ☐
Scanned Documents	☐	Choose one:	Projected ☐	Un-projected ☐
Satellite Imagery	☐			
Data Surface (single)	☐			
Data Surface (stack)	☐			
Other	☐ specify _____			

Format

TIF/TFW	☐
GeoTIF (TIF 6)	☐
BIL, BIP, BIF (raw)	☐
GIF, JPG, BMP	☐
MR. SID	☐
ArcInfo GRID	☐
Other	☐ specify _____

Is the data compressed? ☐ NO ☐ YES (Algorithm used: _____)

How many bands? ☐ 1 (binary or gray) ☐ 3 (color) ☐ >3 (satellite or stack)

If >3, specify the bands and their content: _____

Radiometric Resolution: ☐ 6-bit ☐ 8-bit ☐ Other _____

Tabular Data Spreadsheets

Excel	☐
Lotus 1-2-3	☐
QuattroPro	☐
Other	☐ _____

DatabasesAS400 ☐Access (MDB) ☐Paradox ☐Oracle ☐SQL Server ☐Other ☐ _____**Text**Delimited ☐ Specify Delimiter:Fixed Length ☐ (Attach file specification)**Document Data****Format**Word Pro ☐Ami Pro ☐Word ☐WordPerfect ☐PDL ☐HTML ☐Other ☐ _____**4. DATA QUALITY**

Answer as many of the following questions as possible for all data types. Questions with an asterisk (*) must be answered.

Why were these data collected (i.e., for what purpose)?

*How were these data collected?

*When were these data collected?

Have these data been updated since their original creation? If so, how often and what was the nature of the update?

When was the last update and what percentage of the data were affected (estimate if unknown and indicate it is approximate)?

(GIS Coordinator Signature)_____ Date_____

Data Indexing Strategies

Metadata

Simply put, Metadata is "data about data." Metadata gives detailed information about all aspects of geospatial data.

Metadata can give background information about:

- Source
- History
- Content
- Quality
- Condition
- Availability
- Processing
- Technical Details

Why Metadata?

The major uses of metadata are:

- Help organize and maintain an organization's internal investment in spatial data,
- Provide information about an organization's data holdings to data catalogues, clearinghouses, and brokerages
- To provide information to process and interpret data received through a transfer from an external source.

Although metadata is usually developed and obtained in a digital format, metadata can be posted as part of a paper map, primarily as part of the map legend. In this form, metadata is readily apparent and easily transferred between map producers and map users. This data is usually fairly simple and short, maybe just a few sentences, conveying the generalities about the data. For example: "This flood plain map was created with data obtained from USGS, was created in 1998, is in California State Plane, Zone V projection, and the datum is NAD83."

Digital data requires more effort and detail in development and maintenance on the part of data producers. However, this data is valuable in two ways:

- The primary creator of the data benefits because metadata maintains the value of the data set, enabling its continued use over time

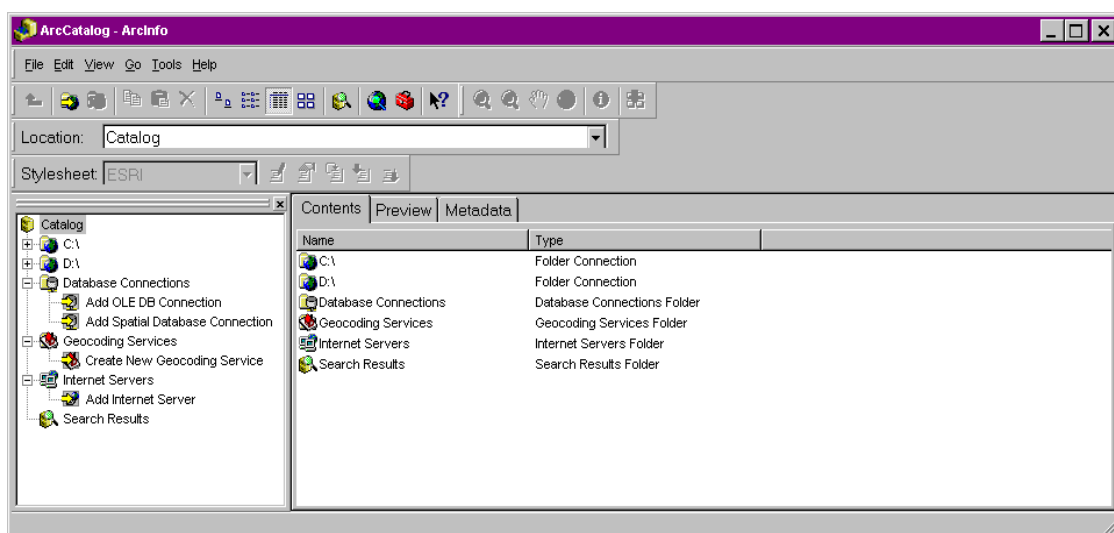
- Metadata helps other users to find and use geo-spatial data, especially if the data are stored in a GIS clearinghouse or general repository

Various metadata standards have been developed over the years. One standard in wide use and acceptance is the Federal Geographic Data Committee (FDGC) “Content Standards for Digital Geospatial Metadata” in use by all Federal data producing agencies. The comprehensive metadata example provided below (see **Example C**) complies with Federal guidelines. However, there are minimum content standards that greatly simplify this standard, and alternatives are also presented.

ArcCatalog

It is strongly recommended that the GIS Coordinator implement a data indexing system to logically organize and share data. For immediate expanded use of GIS throughout the organization, metadata, storage location, and maintenance processes should be documented so all potential users of the GIS data will have a better understanding of the dataset they are using.

Integrating metadata into a GIS in a way that is readily accessible to users of all experience levels has proven to be a major challenge. Additionally, many government and private agencies have found the metadata system to be a bit cumbersome; consequently, these entities have not proactively updated or created this base information which is so crucial for end-users. With ESRI’s latest release of ArcGIS Desktop 9.x desktop of applications, GIS data indexing has greatly improved and as a result has allowed GIS users charged with managing data to update and edit metadata easily. ArcGIS 9.x ArcCatalog software provides an intuitive and effective approach to previewing data, metadata, and managing data locations.



ArcCatalog Interface

Through the use of ArcCatalog, users can easily view directory structure, preview actual geodatabases and their diverse content, coverages, shapefiles, CADD files, and orthophotography files, as well as numerous other file types. Previously created Metadata is automatically linked to these files, and is referenced with a click of the Metadata tab in the ArcCatalog preview pane. Metadata that has not been previously created can either be imported or created in one of many formats chosen by the user. These types are explained in detail below.

Data Access in ArcCatalog

ArcGIS 9.x ArcCatalog is where users can assemble connections to data sources. When a connection is selected, the user accesses the data to which the file is linked. The Connection might access a folder on a local disk, a database on the network, or an ArcGIS Server Internet server. Together, the connections create a catalog of geographic data sources. Once the desirable data has been found, the preview and metadata tabs can be clicked to show a view of the data, as well as the metadata describing the file.

Creating and Accessing Geodatabases

To manage a spatial database (often referred to as a “geodatabase”), users can create a file or personal geodatabase, which stores data in a Microsoft Access format. For an enterprise geodatabase, ESRI SDE data warehousing technology lets many people in an organization update data stored in a centrally located Relational Database Management System (RDBMS).

Data Organization in ArcCatalog

ArcCatalog manages and maps geographic data in a similar style as Windows Explorer. All standard Windows shortcuts and drag/drop techniques for copying, moving, renaming, or deleting items work in ArcCatalog. These features make it easy to organize not only data sources on a disk (such as coverages and shapefiles), but data stored in databases as well. The user can copy or move database connections and coordinate systems from folders in the Catalog to any other folder in any location; for example, SDE geodatabase connections and custom coordinate systems can be placed in a shared folder on the network where everyone in the organization can access them.

Note:

When a user copies, renames, or deletes data sources with ArcCatalog, auxiliary files and other data sources that are linked to the datasets are also copied, renamed, or deleted. For example, metadata, projection, and index files all accompany a file-based data source. A file-based raster's auxiliary files will accompany the raster. When copying a feature class from one personal geodatabase to another, any feature classes and tables that are linked to it through relationship classes will also be copied to the destination geodatabase.

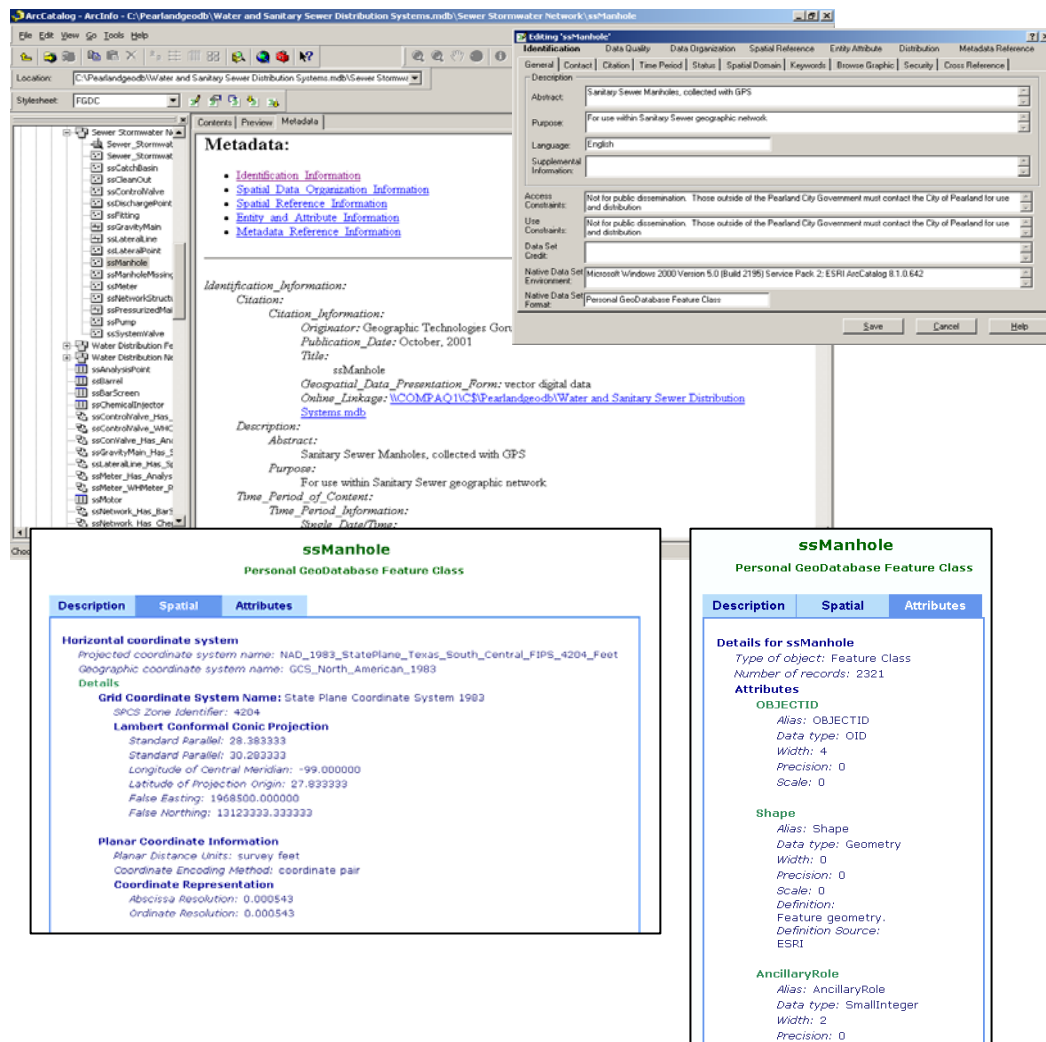
How metadata is stored

Metadata created with ArcCatalog is stored as XML, either in a file alongside the item, or within its geodatabase. XML is a structured markup language similar to hypertext markup language (HTML). HTML defines both the data and how it is presented. XML, on the other hand, lets the user define data using tags that add context and meaning.

XML is an emerging industry standard that is being used to transfer data across the Internet. For example, it is often used in e-commerce transactions. Many different applications can be used to view or edit metadata XML files.

Metadata for Folders and Geodatabases

Another new option of ArcCatalog is that the user can document the contents of a folder or geodatabase. This metadata is created in the same way as shapefile, coverage, or geodatabase layer metadata. The benefit of this type of documentation is to track important information such as date of creation, description of file contents and their purpose, and the status of completion. This type of information is helpful to other users when they are browsing for data.



ArcCatalog's Metadata Documentation Functionality

About Importing and Exporting Metadata

Metadata that exists in earlier ESRI formats can be easily imported into ArcCatalog. The formats that are easily importable are:

- Text
- XML
- SGML - Standard Generalized Markup Language (SGML) format defined by the FGDC's metadata parser utility

ArcCatalog uses the FGDC's metadata parser utility itself to import and export metadata in its supported formats. The XML format can be used to import metadata that was created with ArcCatalog. The importers provided with ArcCatalog will overwrite all of an item's existing metadata.

Note:

If “**Enable automatic update of metadata**” is unchecked, ArcCatalog will not overwrite any existing values.

FGDC Metadata Workbook

The FGDC Metadata Workbook, Version 2.0 is in electronic form (Adobe PDF - book marked enabled). The workbook is free of charge and is easily down loadable (size 130 pages, 1Mb). The workbook complies with the latest version of the FGDC Content Standard for Digital Geo-spatial Metadata (CSDGM), FGDC-STD-001-1998 and contends both textual and color graphical information about the FGDC CSDGM including background information, how to read and use the Standard, a color graphical and textual representation of the content information of the Standard, a description of Profiles and User Defined Metadata Extensions, and some metadata examples. The workbook is free to download and can be distributed among organizations. To access this workbook, visit the following link:

http://www.fgdc.gov/metadata/documents/workbook_0501_bmk.pdf

The Standard

What do internal and external organizations need to know about the County’s datasets? The standard provides a common set of terminology and definitions for the documentation of geo-spatial data, including data elements for the following topics:

Metadata Topic	Description / Examples
Identification Information	• Basic information about the data set • Examples include title, geographic area covered, currentness, and rules for acquiring or using the data
Data Quality Information	• An assessment of the quality of the data set • Examples include positional and attribute accuracy, completeness, consistency, sources of information, and methods used to produce the data. Recommendations on information to be reported and tasks to be performed are in the Spatial Data Transfer Standard (Federal Information Processing Standard 173 - 1992)
Spatial Data Organization Information	• The mechanism used to represent spatial information in the data set • Examples include the method used to represent spatial positions directly (such as raster or vector) and indirectly (such as street addresses or County codes) and the number of spatial objects in the data set

Metadata Topic	Description / Examples
Spatial Reference	• Description of the reference frame for, and means of encoding, coordinates in the data set • Examples include the name of and parameters for map projections or grid coordinate systems, horizontal and vertical datums, and the coordinate system resolution
Entity and Attribute Information	• Information about the content of the data set, including the entity types and their attributes and the domains from which attribute values may be assigned • Examples include the names and definitions of features, attributes, and attribute values
Distribution Information	• Information about obtaining the data set • Examples include a contact for the distributor, available formats, information about how to obtain data sets online or on physical media (such as cartridge tape or CD-ROM), and fees for the data • Security and confidentiality of the data
Metadata Reference Information	• Information on the currentness of the metadata information and the responsible party

The standard has sections that specify contact information for organizations or individuals that develop or distribute the data set, temporal information for time periods covered by the data set, and citation information for the data set and information sources from which the data were derived. The standard does not specify how this information is organized in a computer system or in a data transfer, nor the means by which this information is transmitted or communicated to the user. At this point in time, these formats are optional.

Additional Information

The standard and other metadata materials, along with the implementation guidelines for the clearinghouse, are available from the FGDC at the above address or from the FGDC server connected to the Internet via:

- Anonymous FTP Metadata - www.fgdc.gov under the subdirectory /pub/metadata
- Clearinghouse - www.fgdc.gov under the subdirectory /pub/clearinghouse
- The README files in the subdirectories give detailed information about the available files.

Examples

Example A: FGDC- Compliant Metadata

Identification_Information:

Citation:

Citation_Information:

Originator:

U.S. Department of Commerce

Bureau of the Census

Geography Division

Publication_Date: 2001

Title: TIGER/Line Files, Redistricting Census 2000

Edition: Redistricting Census 2000

Series_Information:

Series_Name: TIGER/Line Files

Issue_Identification: Version (MMYY) represents the month and year file created

Publication_Information:

Publication_Place: Washington, DC

Publisher:

U.S. Department of Commerce

Bureau of the Census

Geography Division

Description:

Abstract:

TIGER, TIGER/Line, and Census TIGER are registered trademarks of the Bureau of the Census. The Redistricting Census 2000 TIGER/Line files are an extract of selected geographic and cartographic information from the Census TIGER database. The geographic coverage for a single TIGER/Line file is a county or statistical equivalent entity, with the coverage area based on January 1, 2000 legal boundaries. A complete set of Redistricting Census 2000 TIGER/Line files includes all counties and statistically equivalent entities in the United States and Puerto Rico. The Redistricting Census 2000 TIGER/Line files will not include files for the Island Areas. The Census TIGER data base represents a seamless national file with no overlaps or gaps between parts. However, each county-based TIGER/Line file is designed to stand alone as an independent data set or the files can be combined to cover the whole Nation. The Redistricting Census 2000 TIGER/Line files consist of line segments representing physical features and governmental and statistical boundaries. The Redistricting Census 2000 TIGER/Line files do NOT contain the ZIP Code Tabulation Areas (ZCTAs) and the address ranges are of approximately the same vintage as those appearing in the 1999 TIGER/Line files. That is, the Census Bureau is producing the Redistricting Census 2000 TIGER/Line files in advance of the computer processing that will ensure that the address ranges in the TIGER/Line files agree with the final Master Address File (MAF) used for tabulating Census 2000.

Purpose:

In order for others to use the information in the Census TIGER data base in a geographic information system (GIS) or for other geographic applications, the Census Bureau releases to the public extracts of the data base in the form of TIGER/Line files. Various versions of the TIGER/Line files have been released;

previous versions include the 1990 Census TIGER/Line files, the 1992 TIGER/Line files, the 1994 TIGER/Line files, the 1995 TIGER/Line files, the 1997 TIGER/Line files, the 1998 TIGER/Line files, and the 1999 TIGER/Line files. The Redistricting Census 2000 TIGER/Line files were originally produced to support the Census 2000 Redistricting Data Program.

Supplemental_Information:

To find out more about TIGER/Line files and other Census TIGER data base derived data sets visit <http://www.census.gov/geo/www/tiger>.

Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: 2000

Currentness_Reference: 2000

Status:

Progress: Complete

Maintenance_and_Update_Frequency:

TIGER/Line files are extracted from the Census TIGER data base when needed for geographic programs required to support the census and survey programs of the Census Bureau. No changes or updates will be made to the Redistricting Census 2000 TIGER/Line files.

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: +131.000000

East_Bounding_Coordinate: -64.000000

North_Bounding_Coordinate: +72.000000

South_Bounding_Coordinate: -15.000000

Keywords:

Theme:

Theme_Keyword_Thesaurus: None

Theme_Keyword: Line Feature

Theme_Keyword: TIGER/Line

Theme_Keyword: Topology

Theme_Keyword: TIGER/Line Identification Number (TLID)

Theme_Keyword: Street Segment

Theme_Keyword: Coordinate

Theme_Keyword: Boundary

Place:

Place_Keyword_Thesaurus:

FIPS Publication 6-4

FIPS Publication 55

Place_Keyword: United States

Place_Keyword: Puerto Rico

Place_Keyword: County

Access_Constraints: None

Use_Constraints:

None. Acknowledgment of the U.S. Bureau of the Census would be appreciated for products derived from these files. TIGER, TIGER/Line, and Census TIGER are registered trademarks of the Bureau of the Census.

Native_Data_Set_Environment:

TIGER/Line files are created and processed in a VMS environment. The environment consists of two Alpha Server 8400s clustered together running OpenVMS version 6.2-1H3 used for production operations.

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

Accurate against Federal information Processing Standards (FIPS), FIPS Publication 6-4, and FIPS-55 at the 100% level for the codes and base names. The remaining attribute information has been examined but has not been fully tested for accuracy.

Logical_Consistency_Report:

The feature network of lines (as represented by Record Types 1 and 2) is complete for census purposes. Spatial objects in TIGER/Line belong to the "Geometry and Topology" (GT) class of objects in the "Spatial Data Transfer Standard" (SDTS) FIPS Publication 173 and are topologically valid. Node/geometry and topology (GT)-polygon/chain relationships are collected or generated to satisfy topological edit requirements. These requirements include:

- * Complete chains must begin and end at nodes.
- * Complete chains must connect to each other at nodes.
- * Complete chains do not extend through nodes.

Completeness_Report:

Data completeness of the TIGER/Line files reflects the contents of the Census TIGER data base at the time the TIGER/Line files (Redistricting Census 2000 version) were created.

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report:

The information present in these files is provided for the purposes of statistical analysis and census operations only. Coordinates in the TIGER/Line files have six implied decimal places, but the positional accuracy of these coordinates is not as great as the six decimal places suggest. The positional accuracy varies with the source materials used, but generally the information is no better than the established national map Accuracy standards for 1:100,000-scale maps from the U.S. Geological Survey (USGS); thus it is NOT suitable for high-precision measurement applications such as engineering problems, property transfers, or other uses that might require highly accurate measurements of the earth's surface. The USGS 1:100,000-scale maps

met national map accuracy standards and use coordinates defined by the North American Datum, 1983.

Lineage:

Source_Information:

Source_Citation:

Citation_Information:

Originator:

U.S. Department of Commerce
Bureau of the Census
Geography Division

Publication_Date: Unpublished material

Title: Census TIGER data base

Edition: Redistricting Census 2000

Type_of_Source_Media: On line

Source_Time_Period_of_Content:

Time_Period_Information: Single_Date/Time: Calendar_Date: 2000 Source_Currentness_Reference: Date the file was made available to create TIGER/Line File extracts: Source_Citation_Abbreviation: TIGER Source_Contribution: Selected geographic and cartographic information (line segments) from the Census TIGER data base. Process_Step: Process_Description: In order for others to use the information in the Census TIGER data base in a GIS or for other geographic applications, the Census Bureau releases periodic extracts of selected information from the Census TIGER data base, organized as topologically consistent networks. Software (TIGER DB routines) written by the Geography Division allows for efficient access to Census TIGER system data. TIGER/Line files are extracted from the Census TIGER data base by county or statistical equivalent area. Source_Used_Citation_Abbreviation: Census TIGER data base Process_Date: 2000 Spatial_Data_Organization_Information: Indirect_Spatial_Reference: Federal Information Processing Standards (FIPS) and feature names and addresses. Spatial_Reference_Information: Horizontal_Coordinate_System_Definition: Geographic: Latitude_Resolution: 0.000458 Longitude_Resolution: 0.000458 Geographic_Coordinate_Units: Decimal degrees 3) Locations of KGLs Distribution_Information: Distributor: Contact_Information: Contact_Organization_Primary: Contact_Organization: U.S. Department of Commerce Bureau of the Census Geography Division Products and Services Staff Contact_Address: Address_Type: Physical address Address: 8903 Presidential Parkway, WP I City: Upper Marlboro State_or_Province: Maryland Postal_Code: 20772 Contact_Voice_Telephone: (301) 457-1128 Contact_Address: Address_Type: Mailing address Address: Bureau of the Census City: Washington

State_or_Province: District of Columbia
 Postal_Code: 20233-7400
 Contact_Voice_Telephone: (301) 457-1128
 Contact_Facsimile_Telephone:
 (301) 457-4710
 Contact_Electronic_Mail_Address: tiger@census.gov
 Resource_Description: Redistricting Census 2000 TIGER/Line Files
 Distribution_Liability:
 No warranty, expressed or implied is made and no liability is
 assumed by the U.S. Government in general or the U.S. Census Bureau in specific as
 to the positional or attribute accuracy of the data. The act of distribution shall
 not constitute any such warranty and no responsibility is assumed by the U.S.
 Government in the use of these files.

Standard_Order_Process:
 Digital_Form:
 Digital_Transfer_Information:
 Format_Name: TGRLN (compressed)
 Format_Version_Number: Redistricting Census 2000
 Format_Version_Date: 2000
 File-Decompression_Technique: PK-ZIP, version 1.93A or higher
 Digital_Transfer_Option:
 Online_Option:
 Computer_Contact_Information:
 Network_Address:
 Network_Resource_Name: www.census.gov/geo/www/tiger

Fees:
 The online copy of the TIGER/Line files may be accessed without charge. See
<http://www.census.gov/geo/www/tiger> for information on availability on CD-ROM/DVD
 and associated costs for these products.

Ordering_Instructions:
 To obtain more information about ordering TIGER/Line files visit
<http://www.census.gov/geo/www/tiger>.

Metadata_Reference_Information:
 Metadata_Date: 2000
 Metadata_Contact:
 Contact_Information:
 Contact_Organization_Primary:
 Contact_Organization:
 U.S. Department of Commerce
 Bureau of the Census
 Geography Division
 Products and Services Staff
 Contact_Address:
 Address_Type: Physical Address
 Address: 8903 Presidential Parkway, WP I
 City: Upper Marlboro
 State_or_Province: Maryland
 Postal_Code: 20772
 Contact_Voice_Telephone: (301) 457-1128
 Contact_Electronic_Mail_Address: tiger@census.gov
 Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
 Metadata_Standard_Version: 19940608

Example B: FGDC- Compliant Metadata Table

Type	Example
Name	q3flood
Metadata date	1998
Feature	Polygon
Originator	Federal Emergency Management Agency
Description	The Q3 Flood Data are derived from the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA). The file is georeferenced to the earth's surface using the Universal Transverse Mercator (UTM) projection and a zonal coordinate system (units in meters). Specifications for the horizontal control of Q3 Flood Data files are consistent with those required for mapping at a scale of 1:24000.
Purpose	Purpose: The FIRM is the basis for floodplain management, mitigation, and insurance activities for the National Flood Insurance Program (NFIP). Insurance applications include enforcement of the mandatory purchase requirement of the Flood Disaster Protection Act, which "requires the purchase of flood insurance by property owners who are being assisted by Federal programs or by Federally supervised, regulated, or insured agencies or institutions in the acquisition or improvement of land facilities located or to be located in identified areas having special flood hazards" (Section 2 (b) (4) of the 1973 Flood Disaster Protection Act). In addition to the identification of Special Flood Hazard Areas (SFHAs), the risk zones shown on the FIRMs are the basis for the establishment of premium rates for flood insurance coverage offered through the NFIP. Q3 Flood Data files convey certain key features from the existing hard copy FIRM. Edge-matching errors, overlaps and deficiencies in coverage, and similar problems are not corrected during digitizing or post-processing. The Q3 Flood Data files are intended to provide users with automated flood risk data that may be used to locate SFHAs. More detailed information may be obtained from the paper FIRM.
Time Period of Content	Calendar Date: 1998
Status	Progress: Complete Maintenance and Update Frequency: Irregular
Point of Contact	Contact Organization: Federal Emergency Management Agency, Mitigation Directorate Contact Address Address: 500 C Street, S.W. City: Washington State or Province: District of Columbia Postal Code: 20472 Contact Voice Telephone: 1-800-358-9616
Attribute Definitions	Fips: County code. Long: Longitude Lat: Latitude State: State code etc.
Process Steps	Q3 Flood Data were produced by either scanning and vectorizing or manually digitizing a hardcopy version of the graphic materials. The scanning and vectorization process captured the digital data as raster data that were vectorized and attributed on an interactive editing station. The manual digitizing process used a digitizing table to capture the digital data; attribution was performed either as the data were digitized or on an interactive edit station after the digitizing was completed. The determination of the production methodology was based on various criteria, including availability of production systems. Four

Type	Example
Process Steps (con't)	to nine control points per FIRM panel were used for registration during manual digitizing. A projective transformation was performed on the coordinates used in the data collection and editing systems to register the digital data to the Universal Transverse Mercator (UTM) grid coordinates. An ARCINFO coverage of the Q3 Flood Data was generated and used to create the Q3-DLG file. The Q3 Flood Data were checked for position and attribute accuracy by comparing plots of the digital data to the source graphic and by symbolized display on an interactive computer system. Selected attributes that could not be visually verified were individually queried. In addition, an ARCINFO Arc Macro Language (AML) software program was applied to the dataset to test the attributes against a master set of valid attributes for the specific data category and a complete set of valid attribute combinations. Source graphics were revised to reflect updates affected by Letters of Map Change (Letter of Map Revision [LOMR], Letter of Map Amendment [LOMA]). These revisions were included in the Q3 Flood Data if they were map able at the publication scale of the source graphic.

Metadata Recommendations

It is recommended that the County establish a written metadata standard that incorporates each parameter of this chapter, as previously described. Additionally, it may prove valuable for the County to collaborate with the other inter-governmental agencies within the County on modifying metadata standards in the future to ensure that metadata is homogenous both locally and regionally.

There are a number of third party software applications that make standardization and production of metadata a much simpler task. ESRI ArcGIS 9.x software applications also include metadata tools (as detailed above) that are recommended. Regardless of the metadata standard or production method selected, it should be:

- standardized adopted for Countywide use
- documented for distribution
- readily accessible with any GIS layer
- a “living” document that can be modified
- distributed along with data
- required for new data additions/submissions

The County of San Luis Obispo, California



Phase II: GIS Conceptual System Design Base Map Data: Creation and Implementation Strategies

Chapter 13: Base Map Data: Creation and Implementation Strategies



Chapter Outline

Introduction

Base Map Data

Implementation of Standards for All Geospatial Data

Critical Base Layers

Parcels

- Introduction

- History and Current Status

- Recommendations

Address Points

- Introduction

- History and Current Status

- Recommendations

Street Centerlines

- Introduction

- History and Current Status

- Recommendations

Orthophotography

- Introduction

- History and Current Status

- Recommendations

Digital Elevation Model (DEM)

- Introduction

- History and Current Status

- Recommendations

Conclusion

Introduction

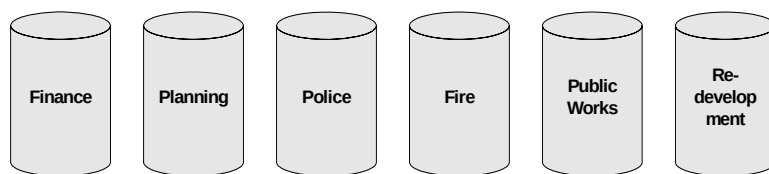
Much of the data covered in this chapter has been previously discussed in the Needs Analysis chapters of the Assessor's Office, Planning and Building Department, CAL FIRE and the Office of Emergency Services (OES). This chapter will serve as a summary of the core or foundational layers that comprise an enterprise GIS.

Critical to the future success of County's enterprise-wide GIS program will be how it harmonizes best within the organization. As stated in previous chapters, the County's GIS program began approximately 10 years ago when interested county departments began an effort to convert hard-copy mapping information into a digital format. The County's Planning and Building Department took the lead by converting all of the planning data (zoning, hazards, etc.) into a GIS file format.

As the County GIS effort matured, several key data sets were acquired, including digital aerial photography, digital elevation model (terrain model), GPS road centerlines (from NAVTEQ), countywide soils and geology, etc., eventually amounting to several hundred GIS data sets. The purchase of key GIS data has been coordinated by the Planning and Building Department's Geographic Technology and Design section. Purchase of commonly used data and costs for data maintenance (i.e., quarterly GIS parcel update, digital aerial photography, GPS road centerlines, GIS inter-active web site) has been subject to inclusion within the Planning and Building budget submittal.

The County's department-based location of the GIS management role is not unique. The initial beginnings of GIS technology within local government often transpired in one specific department out of basic need – typically either the Planning or Public Works functional groups.

Traditionally, as counties have grown, islands, Silos or “stovepipes” of technology had been unintentionally implemented. For instance, a department would have a need for a software product to assist with a given task. They would acquire a product that fulfills that need but would not incorporate other



Data “Stovepipes” or Silos

departments/divisions functions. This caused counties to have islands of software applications and databases that did not communicate with each other. Inefficient results often occurred, such as redundant databases and business processes being served by

multiple applications. Many counties have a host of databases containing the same data. Each of the databases often utilizes a key land feature to track data, such as parcel number or address. Therefore, any given local government typically has multiple databases with the same repeated data. To compound these inefficiencies, the data entered into these disparate systems is often entered differently.

These same issues are faced by almost every local government in the United States. This is due to the natural progression of public agency computing, as outlined above. Local governments are now realizing that they must tear down these data and computing “stovepipes” and move towards systems that share data and communicate with each other. Specifically, the County is analyzing enterprise needs for GIS technology. During dialogue with County staff, limitations as a result of the existing decentralized and fragmented GIS management structure was frequently referenced. As a direct side effect of the County's current disjointed configuration, duplication of work and inefficiencies often thrive.

A good example involves both the CAL FIRE and Department of Public Works paralleled work on creating a Countywide street centerline GIS data layer. Each has their own valid intentions, and both have executed their plans to relative precision. But because a more centralized enterprise-wide GIS governance model does

not exist, neither communicate on a routine basis about GIS initiatives. This translates into unnecessary duplication of challenging work.

Due to this inefficient Countywide GIS management environment, a critical recommendation of this report centers on the recommended GIS Division in the Information Technology Department (ITD) to assist and coordinate the County's enterprise-wide GIS implementation. This recommended GIS Division in ITD, in conjunction with other core departments, will coordinate the creation, maintenance, and management of key GIS base layers that all departments will utilize.

Base Map Data

Base map data are geospatial data that represent key geographic features within a specific area; these features are the foundation upon which other geospatial data can be overlain. A base map can be defined differently, depending on organizational needs. For some organizations, a base map may be simply land ownership boundaries, while for other organizations it may be a multi-layered compilation of geospatial data including various layers such as roads, rivers, lakes, wetlands, topographic contours, land use, land cover, and land ownership boundaries, and other geographic, demographic, and political boundary information.

The County's base map is comprised of five (5) critical map layers:

1. Parcels
2. Address Points
3. Street Centerlines
4. Orthophotography
5. Digital Elevation Model (DEM)

These five (5) data layers can be used to create a variety of maps for both organizational and public use. In addition, these layers can be used in GIS applications to effectively manage and coordinate several County functions, including land use management and planning, transportation routing, emergency management services, utility maintenance, and a variety of other applications that rely on these layers for reference and spatial analysis.

The successful deployment of comprehensive base map datasets requires careful planning and consideration of both proposed and anticipated uses. Technological developments and advanced applications that can affect these considerations include: controlled digital image and planimetric feature overlays (hydrology, water utility features, pavement outlines, building footprints, etc.) and emergency vehicle location and routing through real-time GPS tracking (AVL). Subsequent attempts to accommodate unanticipated data and/or application needs, which are dependent upon or associated with the quality and accuracy of the original base map, can be extraordinarily time-consuming and cost-prohibitive.

Implementation of Standards for All Geospatial Data

Prior to a specific discussion about each critical base layer it should be noted that a critical issue in the County's GIS efforts is the implementation of geospatial data standards. In addition to the standards that may be established by regional governing bodies, it is suggested that the recommended GIS Division in ITD develop standards for the maintenance of the County's base layers. Using a common standard will enable the County to operate more efficiently by providing a common structure for the layers and its derivative products, as well as by enabling streamlined data distribution internally and externally.

The recommended GIS Division in ITD, will need to develop geospatial data standards, including layer and directory naming conventions, directory structures, metadata, and index conventions. It should be noted that these standards do not apply solely to base layers and their derivative products, but rather that these standards will apply and support all enterprise geospatial data.

Layer Naming Convention:

LD_<SCALE>_<LAYER NAME>_<VERSION>_<REVISION>

Example: LD_24000_FIRESTATIONS_2_1

Directory Naming Convention:

☐<DEPARTMENT>

☐ <THEME A>

☐ <THEME B>

☐ <SUBTHEME A>

☐ <SUBTHEME B>

Example:

☐FIRE

☐FIRE_STATIONS

☐RESPONSE_AREAS

☐COUNTY_AREAS

☐WILDLAND_AREAS

Layer and Directory Naming Conventions

Critical Base Layers

The focus of the remaining portions of this chapter will be on the five (5) aforementioned critical base layers including their history and current status, as well as recommendations for future use with regards to the County's GIS initiative.

Parcels

Introduction

For local governments, the acquisition and integration of an accurate and up-to-date parcel base map is arguably the most critical centerpiece of their GIS efforts. The parcel/ownership ("cadastral") base data layer represents the chief source of County government revenue, planning analysis, and ultimately development.

Several immediate and long-lasting benefits normally derived from base map integration include:

- A comprehensive inventory and accounting of all taxable land
- Comparisons of deeded and calculated (actual) acreage
- Inventory and determination of County-owned lands and conveyances
- Verification of tax rolls and incorporation of County annexations, providing checks-and-balances of appraisal entity records
- Provides a strong foundation for control and analysis of future growth, land development, and population forecasting
- Fosters closer cooperation with other local governmental entities

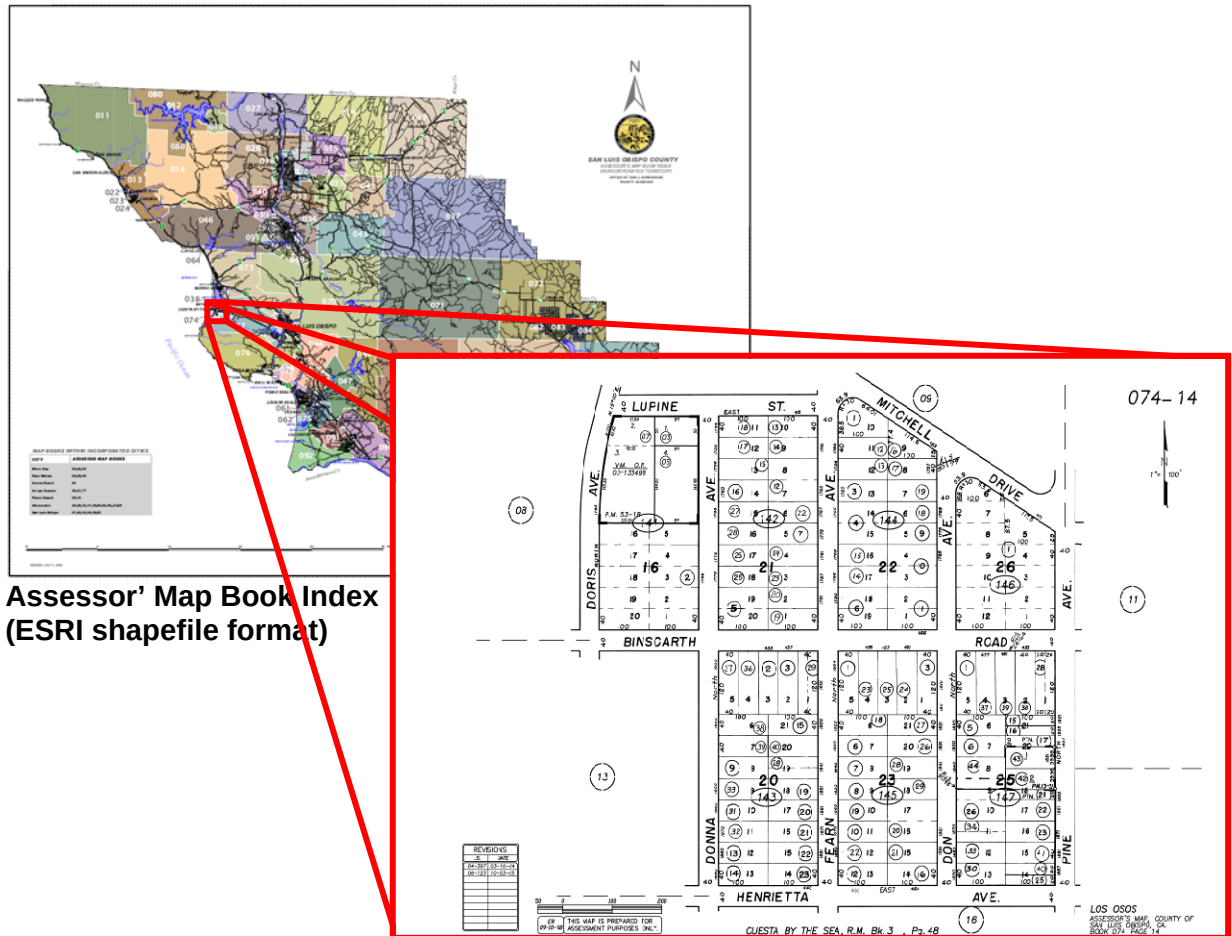
Among the more tangible and practical benefits emerging from the base map layer:

- Improved public safety response and emergency evacuation
- County mailing lists & affected property owner notifications (i.e., zoning changes, public works notification)
- Readily available property ownership information
- Property valuations and County service expansion/prioritization
- Nuisance abatement & building code enforcement
- Creation of improved County Map Books and Atlases

History & Current Status

Currently, the County Assessor manages a set of approximately 5,000 countywide parcel maps (referred to as the "Assessor Maps") some of which were developed using a Computer-Aided Design and Drafting (CADD) drawing program. Below is an illustration of the "Assessor Map"

system, which includes a map book index grid in ESRI GIS format, and individual sub-tile maps in CADD format:



**Assessor's Map Book Index
(ESRI shapefile format)**

**Sub-tile Maps
(AutoCAD Map format)**

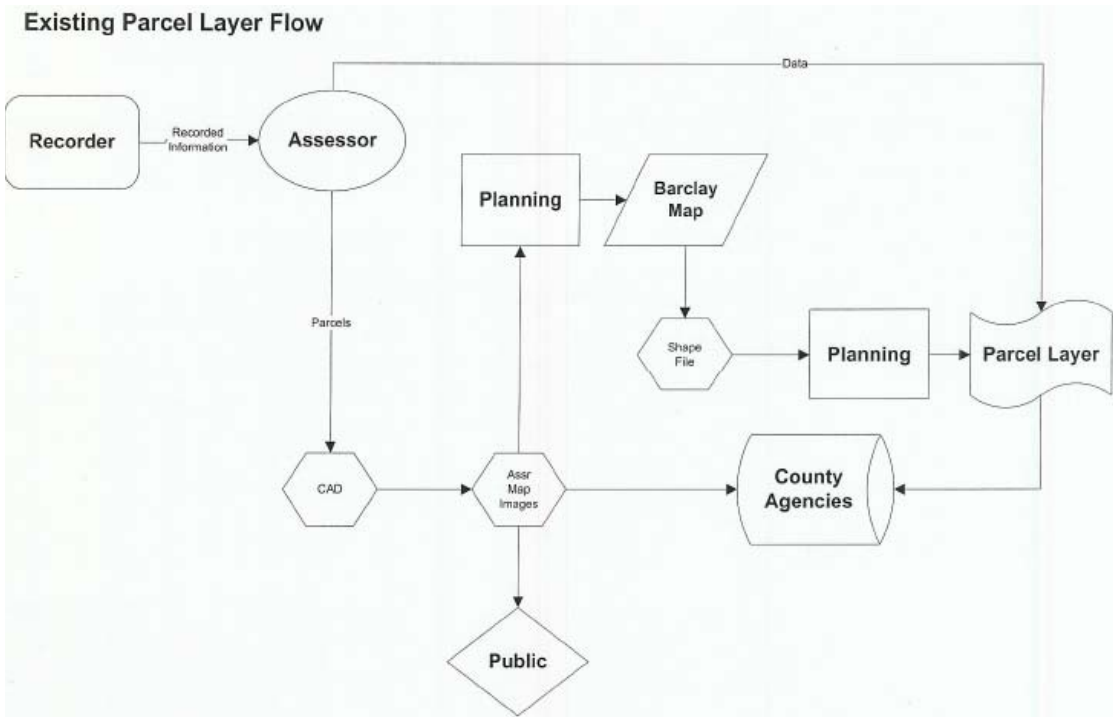
Assessor Maps Index Grid System

Cadastral Mapping staff within the Assessor's Office currently assigns unique identification codes for each parcel called Assessor's Parcel Numbers (APNs), in conjunction with the parcel line drawings done using AutoCAD Map and Raster Design CADD software. This information represents a unique identification code for each parcel, which is commonly the most critical attribute attached to each parcel record. Assessor's Parcel Numbers (APN) are assigned using the next available number in sequence. The old APN's are portioned and balanced into the new APN's on an instruction sheet for later input into the mainframe Property Data System. After Cadastral Mapping section staff has finished their CADD and/or TIFF image map work, which includes the assignment of new Assessor's Parcel Numbers, it often takes months for those new numbers to get into the Assessor's database system. (This is where the "bottleneck" occurs. At

this point in the process, map changes out-pace the transfer of ownership changes in the assessor's database.) This causes some difficulty tracking recent map changes.

The Department also maintains a history of over 28,000 property maps, dating back to as far as 1896. All are in a different state of decay and associated care. This repository of historic maps offer valuable resources to County citizens, and play a critical role in the historical background of the County. Serious considerations should be given to research restoration and/or climate-controlled storage services for some of these highly historic maps.

The diagram below illustrates the current process taken to manage the parcel GIS data layer. Once recorded documents pertinent to property ownership occurs, like tract and parcel maps, records of survey and various deeds, copies of those official documents are delivered to the County Assessor's Office from the Clerk-Recorder. Tract and Parcel Map documents are also provided to the Assessor in CADD format by outside Surveyors and Engineers. The Assessor then takes those documents and CADD maps and updates both their legacy Property Data System information and legacy CADD drawings to reflect those parcel ownership changes. From there, the Assessor delivers digital image files from the hybrid TIFF/CADD drawings to the Planning and Building Department, where GIS staff within that workgroup forward those changes on to the outside vendor, Barclay Publishing, L.L.C. Barclay then completes a comprehensive data conversion of those raster image files to a digital parcel GIS data layer in the format of ESRI shapefiles. That deliverable from Barclay then goes back to the Planning and Building Department for QA/QC verification. The Assessor performs a property ownership extract as a data table from the Property Data System and joins it to the parcel shapefile. Once the shapefile has gone through the necessary review process, and the data joined together, it then gets posted to the centralized GIS data server for all County departments to consume.



Current Workflow of Parcel GIS Data Layer Creation

An extremely important aspect to this workflow process that must be stressed is that the County currently contracts out the parcel GIS data layer's full data management responsibilities to an outside vendor, Barclay Publishing, L.L.C.. Initially, the County paid \$50,000 to convert the CADD maps and TIFF images to a GIS environment. Currently, the County pays Barclay \$25,000 per year for the quarterly maintenance (\$6250 per quarter) of this vital GIS base map layer. The current contract is set to expire in December 2008. While this arrangement has been somewhat productive, the County is not allowed to take ownership of the GIS shapefile datasets based on their contract with the company. County Assessor staff had also voiced concern over the time delay between when property ownership changes get recorded (e.g. final plat) and visualizing those changes in GIS. That process typically takes six (6) months to be realized, which is much too long for a moderately growing County. Ideally, GIS users would have an updated parcel layer once every month, at a bare minimum. The accuracy of the parcel information is also a concern, since there are numerous errors that occur in the Barclay data including erroneous APNs, inaccurate parcels, and errors in the overall geographic positioning.

Tax assessment data is acquired from other work groups within the Assessor's Office. Most other GIS data layer attributes are brought over from the Assessor's Property Data System. The outside vendor, Barclay Publishing L.L.C. maintains the parcel GIS data layer in the ESRI environment; the parcel layer has numerous attributes associated with it. Particularly important attributes include the APN unique field.

FIELD NAME	FIELD DESCRIPTION
APN	9 Digit Assessor Parcel Number
Assessee	Assessed Owner Name
C_O	In Care Of
Address_1	Mailing Address Street
Address_2	Mailing Address Street
Address_3	Mailing Address Street
City	Mailing Address City
State	Mailing Address State
Zip	Mailing Address Zip
Plus_4	Mailing Address Zip Extension
Situs	Primary Property Address Number
Direction	Primary Property Address Direction (NSEW)
Street	Primary Property Address Street Name
Apt_Space	Primary Property Address Apartment Number
Type	Primary Property Address Type (St. Rd. Ln. etc)
Community	Primary Property Address Community
Legal	Legal Description
Prim_luc	Primary Land Use Code
Luc_1	Secondary Land Use Code 1
Luc_2	Secondary Land Use Code 2
Luc_3	Secondary Land Use Code 3
TRA	Tax Rate Area
Land	Land Value
Imps	Improvement Value
Pers	Personal Property Value
Fix	Fixtures Value
HOX	Homeowners Exemption

Example of the AIR system attributes attached to the Parcel GIS data layer

At present, several County departments utilize the GIS parcel base map layer. This data is made available by the GIS group within the Planning and Building Department as shapefiles, after delivery from Barclay.

Recommendations

There are three (3) primary recommendations for the management and maintenance of a County tax parcel GIS data layer:

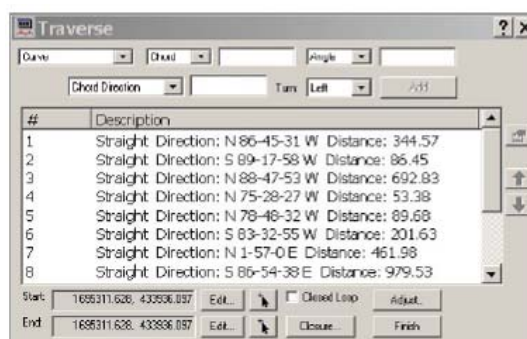
- Make Better Use of ESRI ArcGIS Desktop Software
- Take Control of Parcel GIS Data Layer Maintenance
- Integration of Geospatial Data to a Centralized Data Store (e.g. Geodatabases)

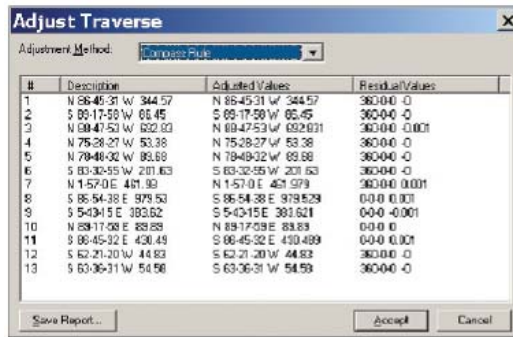
1. Make Better Use of ESRI ArcGIS Desktop Software and Staff

The Assessor already has multiple seats of ESRI ArcGIS 9.x desktop software, which are currently used for activities outside the parcel GIS data layer creation and maintenance tasks. Duties such as GIS analysis, creating and maintaining the aforementioned map book index grid GIS data layer, neighborhood code layer, and general map production tasks are all already done within ArcGIS 9.x software. However, the bulk of typical County Assessor GIS work resides around the management and upkeep of a real-time, accurate parcel GIS data layer.

Parcel GIS data layer maintenance procedures must be done in-house by a fully-staffed Cadastral Mapping section within the Assessor's Office, and ESRI ArcGIS 9.x should be at the forefront of those activities. Currently, Assessor staff use Computer-Aided Drafting and Design (CADD) software to create and maintain parcel information in a digital format. One major flaw with that system is that the Assessor's CADD drawing files are not drawn within the context of any geographic projection. As such, the digital parcel CADD information developed by the Assessor cannot be easily exchanged with any ESRI GIS format. This causes significant hindrances towards the County maintaining their own parcel GIS data layer, thus requiring the contract with an outside vendor.

With the release of ESRI ArcGIS Desktop 8.3 in 2003, an advanced implementation of topology was built into ArcInfo and ArcEditor levels of software, along with the ability to define, store, and update coordinate geometry (COGO) attributes (e.g. bearing/angle, distance). Additionally, much of the functionality traditionally performed at the command line, through ArcTools or by custom applications, is now available through the standard ArcGIS user interface. Advanced functionality, such as feature-linked annotation, can dramatically speed up basic parcel maintenance tasks even more by automating the placement of new annotation, updating annotation when features are split, and deleting annotation when associated features are deleted.





Users can create and adjust features based on Coordinate Geometry (COGO) bearing/angle and distance using the Traverse commands located on the Advanced Editing toolbar in ArcMap 9.x

It is strongly recommended that the County Assessor move away from their legacy CADD system for parcel maintenance, and move towards an ESRI-based only workflow process for maintaining a parcel GIS data layer. With the addition of new supervisory GIS staff, there is no logical reason to prevent this change. The four (4) existing Cadastral Mapping specialists within the department have been trained in and received GIS Certification, so ArcGIS Desktop 9.x training courses and costs should be minimal.

2. Take Control of Parcel GIS Data Layer Maintenance

The County Planning & Building Department currently contracts out the creation and maintenance of the GIS parcel map layer to an outside vendor. Barclay Publishing, L.L.C. provides data conversion services from the Assessor's native CADD and TIFF image format to ESRI GIS shapefiles for the County. The positional accuracy of Barclay's GIS parcel base map layer and parcel identification errors has caused some confusion for County Agencies and the public at large.

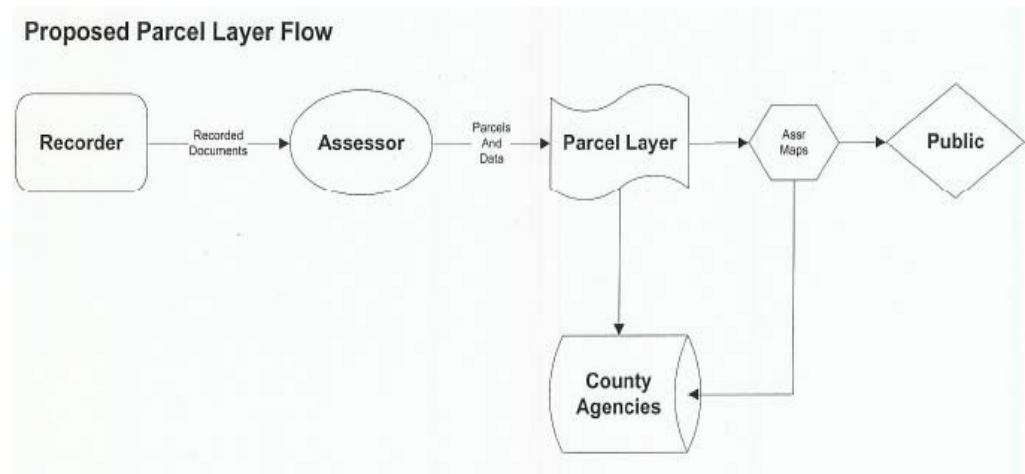
A newly hired GIS supervisory position who will oversee all Cadastral Mapping Systems Specialists opens the door of new possibilities for the Assessor. With the inclusion of an experienced and knowledgeable ESRI ArcGIS specialist, the department can now initiate the steps necessary to create and maintain their own parcel GIS data layer. With the proper staff and GIS software systems in place, it is important that the Assessor's Cadastral Mapping section takes control of the parcel GIS data layer management function.

Not only would the County save a substantial amount of money in contract fees by Barclay, but the department would now be equipped to update and publish a countywide GIS parcel base map layer at a much higher frequency rate than what is currently being

realized. A process that once took six (6) months to complete and distribute could now be done monthly, if not weekly. Numerous other County departments, governmental agencies, and the general public would all be better supported, thus improving the Assessor's customer service in alignment with the Office's Mission Statement..

Once the Assessor collects all the land-related recorded documents from the Clerk-Recorder and the CADD files provided by outside Surveyors and Engineers, the Cadastral Mapping section staff would take those digital documents and update the parcel GIS data layer using COGO functionality built in to ESRI ArcGIS Desktop 9.x software. Once complete, the revised parcel GIS data layer could then be posted to the centralized SDE geodatabase(s), as well as an Assessor FTP site for outside parties. Initially it would be recommended that the Assessor GIS staff consult with the recommended GIS Division in ITD as an advisory role to this revamped update process to make sure all the available ESRI tools are being used properly. Later, once the Assessor GIS staff hones the new parcel data layer update process, the consultation with the GIS Division in ITD could slowly be relinquished.

The graphic below illustrates the revised parcel GIS data layer update process:



Proposed Workflow of Parcel GIS Data Layer Creation

Future Management and Maintenance Options

Two main options are available to the County for taking control of the management and maintenance function of the parcel data layer. The County can opt to have this done by total outsourcing of the task or can do this with a combination of in-house work and outsourcing to a consultant. The combination method is suggested for the County (the estimated costs of these options will be discussed in Chapter 16: *Five Year Phased Implementation Plan*).

The County should be divided into four sections and a two-year mapping project should be undertaken. Major roadways should be utilized to divide the County into logical quadrants. The correction of two of these quadrants should be outsourced and funded over a two-year period and the other two quadrants should be completed in-house. This will allow the project to move along quickly without burdening the County with the full outsourcing expense. The County should require that the combination of COGO and best fit methodology be utilized in the conversion process (see below). Key growth and populated areas should be converted with COGO and surrounding areas should be moved with best fit methods.

- 1) *Purchase the ESRI GIS shapefile from Barclay (estimated at \$100,000), and rebuild it to improve accuracy.*

If the County elects this option it will be necessary for staff to work on improving the quality of the data set. As noted above, one of the critical elements required of the parcel base map layer is improving the positional accuracy and the parcel identification errors of the dataset. The following methods are utilized for parcel correction:

Best-Fit Mapping

During this conversion process, ground evidence is used to register the features on the cadastral maps to a more accurate land base. Using features visible on digital orthophotography, property lines are adjusted or “best-fit” to be consistent with fences, hedgerows and hydrological features that typically represent property boundaries. Buildings and roadways are also considered during the adjustment so that property lines do not overstrike buildings and roadways fall within the designated rights-of-way.

COGO Mapping

To achieve an even more accurate product, coordinate geometry (COGO) commands are used to digitally construct parcels from their boundary descriptions. During this process, survey information on the original property source documents (deeds and plats) is used to create the parcel boundaries. Once a parcel has been constructed, mapping technicians locate the parcel relative to other parcels and land base features.

Without the availability of extensive control data, one possibility for improving the data set would be to rectify the existing Township/Range/Section and Rancho Boundary grid, using aerial photography and available control points, to act as a framework for adjusting parcels. Parcels would then be rectified to the sectional grid so that all positional inaccuracies are contained within each 1 square mile section. As maps are updated and new surveys and subdivisions are recorded, errors within the section would eventually be resolved by using the latest subdivision map survey information. While this effort would not guarantee 100% accuracy of the parcel data set it would improve the accuracy of the data set to an acceptable scale.

- 2) *Recreate a Parcel GIS data layer using the partially existing data that the County owns, or has access to.*

The County owns (in georeferenced shape and CAD files) about 45% of the total number of parcels (which covers about 25% of the geographic area of the county). Even though these parcels have not been updated for about 5 years, this would substantially reduce the amount of time necessary to create a new parcel layer.

Another related option may be to purchase a portion of the parcel layer from Barclay at a reduced cost and combine this with the parcels we already own to create a new parcel layer.

Another consideration in deciding which parcel GIS data layer option the County is the factor of time. Option #1 would offer a significant reduction in time necessary for project completion versus Option #2. Developing the parcel GIS data layer in-house could take close to 3 ½ years to complete.

3. Integration of Geospatial Data into a Centralized Data Store

All County departments will benefit from access to a single, up-to-date, and accurate digital parcel layer. In addition, other geospatial data products derived from parcel data need to be consolidated and centrally distributed to eliminate duplicate and disparate versions of the same data (this includes geospatial data maintained for department-specific projects such as Planning and Building, and Public Works). In order to seamlessly distribute tax parcel data to appropriate users, the tax parcel layer, or a copy of the tax parcel layer, should be maintained in an ESRI ArcGIS enterprise SDE

geodatabase. Currently the parcel GIS data layer is stored and distributed as ESRI shapefiles. The distribution of this layer to other County departments, especially via an Intranet GIS Data browser, will require that the layer and its corresponding attributes be maintained in a central data store that can be easily read and accessed by a variety of GIS client applications and users.

An enterprise SDE geodatabase format is the most efficient and effective spatial data format used in ESRI and ESRI-based applications. This format stores all spatial and attribute data in one centralized location, within a commercial Relational Database Management System (RDBMS). The County has existing SQL Servers which could be utilized for initially establishing an SDE geodatabase. Accordingly, it has been recommended elsewhere that the County migrate to an ESRI ArcGIS Server (AGS) environment, which includes SDE data warehousing functionality and tools.

A direct benefit to storing a countywide parcel GIS data layer in an ESRI SDE geodatabase would be its built-in versioning capabilities. SDE's versioning allows multiple editors in ArcGIS 9.x Desktop software (e.g. ArcMap) to edit the same GIS data layer (in SDE, "feature classes"), at the same time. The commands of reconcile and post provide the avenue by which versioning communicates, and a conflict detection process occurs once similar edits are posted to the "SDE.DEFAULT" (also known as the "master") version of the SDE data layer. Under the current system, only one Cadastral Mapping Specialist can work on any single Assessor's Map at a time. With parcel ownership records continually changing, any one Assessor's Map could have numerous unrelated pending map amendments by one of the four (4) Assessor Cadastral Mapping staff members. As a result, the coordination between Assessor Cadastral Mapping staff is spotty at best because there exists no tracking system for pending map amendments to the Assessor's Maps. SDE geodatabase functionality could alleviate all these critical issues with its multi-editor versioning functionality.

Address Points

Introduction

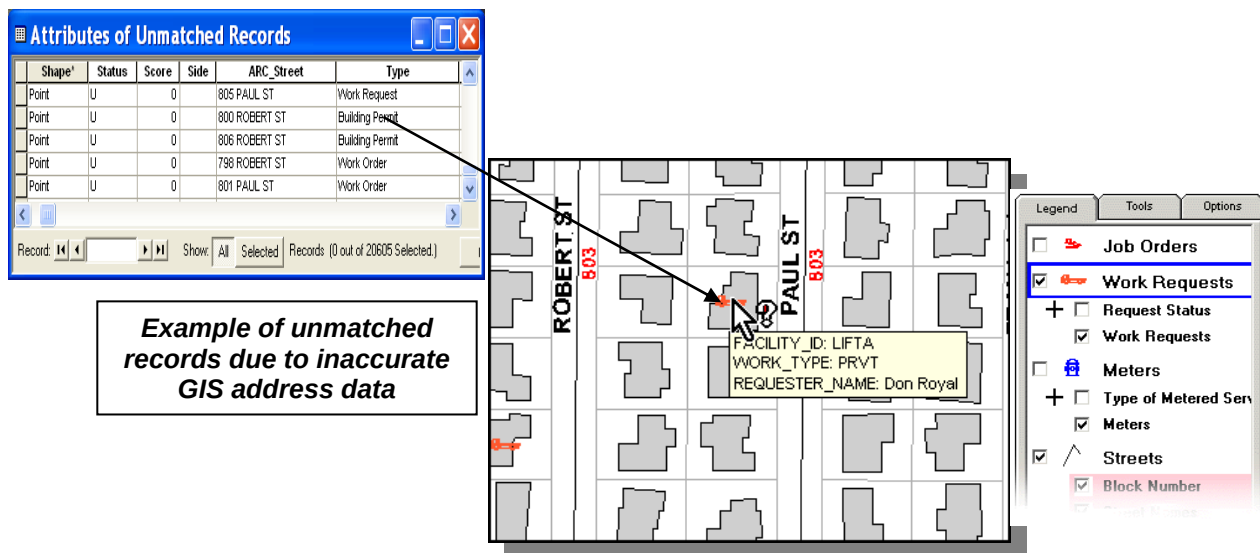
Why do we need address points that are so accurate? Why are we so concerned with cleaning up the existing address databases? There are several major reasons, the list could be endless:

- Critical use of address points during an emergency public safety response
- Accurate mapping of permit records from Tidemark
- Assigning new addresses
- Supplying a list of addresses for the decennial census

The County is faced with the challenge of accurately mapping the location of address records throughout the County, which include:

- Current Planning Projects
- Long Range Planning Projects
- Code Enforcement Cases
- Building Permits
- Certificates of Occupancy
- General Permitting
- Conditions of Approval

If an accurate address point layer does not exist, unfavorable results will occur when attempting to map any County records using an address or assessor parcel number (APN). Lack of an accurate address point layer will often result in unmatched records. The County will then need to invest additional time and resources trying to determine the location of the information manually.



Having an accurate street centerline layer is vital, but relying solely on street centerline data to map addresses has some limitations. The geocoding (address matching) process uses a mathematical algorithm to place addresses at an offset, along the street centerlines based on the attributed address range. This results in address points that may or may not be placed next to the correct structure. If, however, an accurate address point layer is used to match addresses, a much more accurate placement will be realized.



Addresses Matched to Street Centerlines (less accurate)



Addresses Matched to Address Point Layer (very accurate)

For years, cities and counties all over the country have been using table database structures to update and maintain addresses. Organizations often had many disparate address datasets feeding multiple computer applications. Often entry of this data was not regulated. Therefore, addresses were being entered free-form without any standards. Instead of entering clean, valid, and uniform addresses – an addressing nightmare was created. One government agency had entered the address for the local mall in their enterprise IT application 94 different ways. This old world method is cumbersome, allows for error in data entry, retards data analysis and data standards are difficult to enforce. The new method for maintaining good address records is for an address point GIS layer to serve as the Countywide authoritative address repository.

The County must place the creation of a Countywide address GIS point data layer as one of the highest needs. The following steps need to be in-place for success at the enterprise-level:

- 1) Complete and verify address points GIS data layer – a full audit and field inspection should take place to insure 100% accuracy. In order to avoid unnecessary duplication of work, the existing data maintained by the Cities that have address point GIS data layers and the CAL FIRE layer should be utilized as a starting point and then the missing areas should be created. This initial step will require a large number of staff hours spent, but the payoff of having a comprehensive (unincorporated and incorporated areas) Countywide address GIS point data layer will amount to significant cost savings down the road, once other IT systems are compared.
- 2) Place the address layer in the central GIS repository – data should no longer be maintained in separate “stovepipes” of data storage per department or agency (as described earlier), but should be moved to the central GIS repository and maintained as a geodatabase. By keeping the address point data layer in the central geodatabase repository, all County departments will have immediate access to the latest set of Countywide addresses.
- 3) Identify gatekeepers that have the authority to update the layer (County only) – only a select few employees should have the ability to add, change, or delete records from the address point data layer. An initial recommendation is that specific staff should be given the training and capability to edit the address point data layer. This staff should be comprised of a representative from the Addressing Section in Planning and Building, a Tier 1 Flagship GIS user in Planning and Building, a Tier 1 Flagship GIS user in the Assessor’s Office, and the GIS Coordinator in the GIS Division of ITD. The GIS Coordinator should review each entry to insure that GIS and enterprise address database rules and compliance are met.

- 4) Provide an address update GIS application – this application should allow for the update of the critical GIS layers. This application is described later in this section.
- 5) Integrate the process with core applications such as Tidemark and the Assessor's Property Data System – optimally the address point GIS application will have integration points with information from these enterprise applications.

History and Current Status

Much like the street centerlines, the County does not possess an up-to-date address point GIS data layer. Address points take street centerlines a step further because they graphically depict a one-to-one relationship with every actual unit within each building structure that is out in the real world. Street centerlines use mathematical algorithms to estimate the distance an address *might* fall along a street centerline segment. Instead, an address point GIS data layer uses no estimates – its location is the exact spot for a physical building or subunit of a building.

Address point information is extremely important to emergency service agencies like CAL FIRE, as well as other County departments. It encompasses an absolute must when locating emergency incidents and preplanning for emergencies like what OES coordinates. Another benefit to generating a countywide address point GIS data layer is its relationship to the street centerlines. County GIS staff could utilize address points to better manage and update the vital address range information within the street centerlines. Incorrect, missing, or duplicate address ranges in the street centerline data has the potential for seriously delaying emergency response.

During the CAL FIRE street centerline validation project, it was discovered early on that the County did not have a single database that precisely and geographically depicted each address throughout the County. CAL FIRE personnel also found that the current tax parcel data layer does not meet requirements for accurately adding address ranges to their new street centerline GIS data layer. Perhaps most glaring is the fact that the tax parcel GIS data does not include numerous known addresses.

As for the actual address system, CAL FIRE, Planning and Building, and Assessor staff all voiced serious concerns over the incorrectness of the addresses already in the real world. As stated previously, CAL FIRE personnel has begun the process of generating a Countywide address point layer by driving areas with a standard GPS unit, and creating a point file for some rural residential dwelling units. Vast amounts of missing information that would be helpful to numerous County agencies were found due to this initial GPS work. Many inaccuracies were identified during the GPS data collection process as well. Such gross errors as odd and even address on

the same side of the street, and 5 digit addresses next to 4 digit addresses existed. These serious issues can make finding an emergency incident in a dispatch center and out in the field extremely difficult, especially during limited visibility during nighttime. The somewhat good news is that CAL FIRE has been recording these issues and has submitted letters to the Planning and Building Department. CAL FIRE has documented over one hundred and fifty (150) of these types of addressing problems, and to date most have not been corrected. Some cities within the County are maintaining address GIS point data layers. This is arguably the most important base layer for a county or municipal GIS.

Automation of GIS data layer creation and maintenance requires an accurate and complete address point layer. This layer should become the official and authoritative address repository for the entire County. As such, other applications should use this repository to populate their address fields. Each of these other applications (SAP, Tidemark, Property Data System, AIR, DIMS-NeT and GEMS in Clerk-Recorder, VOS in Human Resources/Risk Management, LP01, Environmental Health's Envision, etc.) would then have a pick list of valid addresses. Users would only then be able to assign valid addresses to a record.²

Recommendations

It is recommended that the County pursue a comprehensive field verification project, much like the street centerlines, intended for the creation of a countywide address point GIS data layer. The project should include multiple steps, all contusive towards the ultimate goal – an address point layer that directly relates to the live, real world.

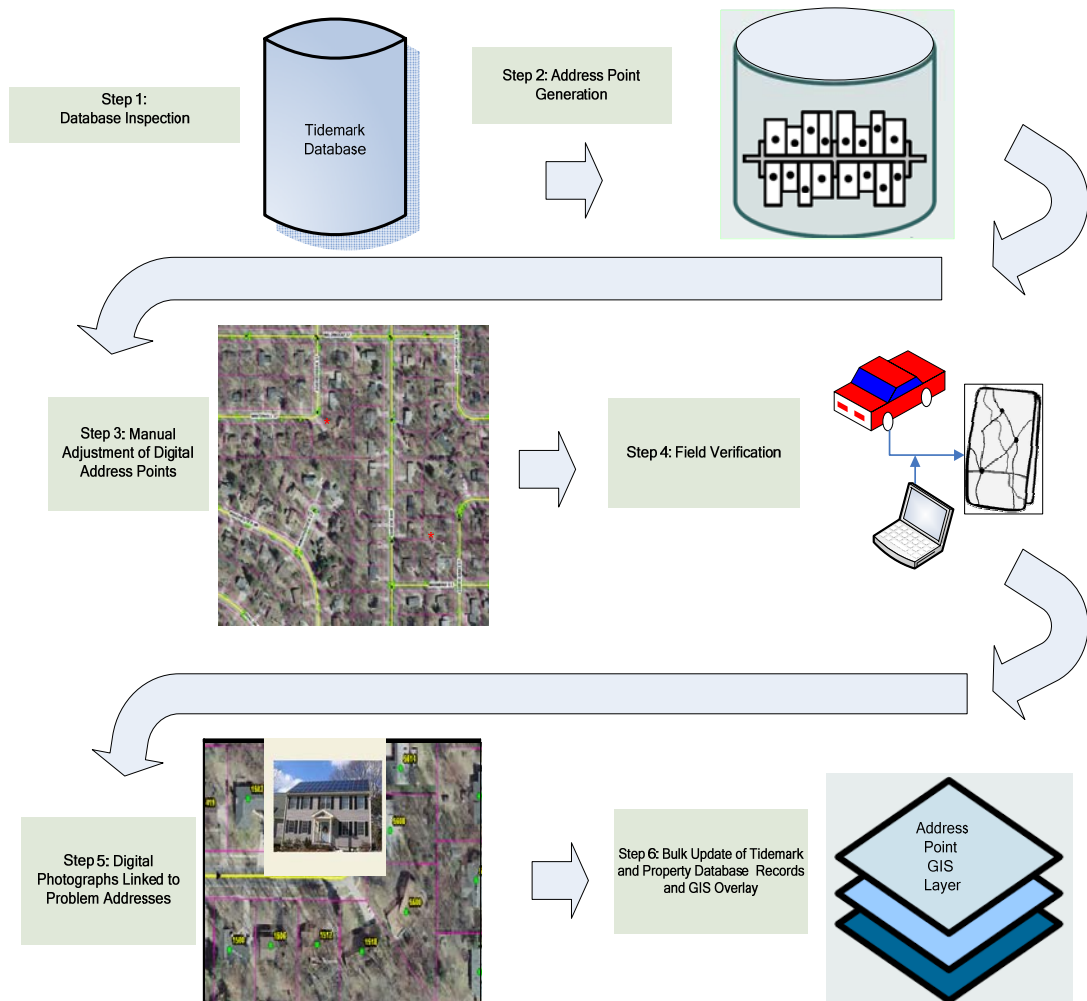
Once the County has gone through many of the appropriate steps to create the current address point layer, the following information is included as documentation on the optimal process for 100% validation of the layer. Address information stored within Planning & Building's Tidemark and the Assessor's Property Data System should be used as a source for address point creation and validation. Once address points are validated and finalized, a GIS based application should be used by identified gatekeepers to update all new addresses and create or modify all address points. Optimally, the GIS based addressing application will integrate with the existing enterprise-

² Currently, work is underway by the Planning and Building Department to embark on a two year address point layer project based on the LUCA Census Address Update project. This project was first brought to Planning and Building's attention in November 2007. Planning and Building attended three different Census sponsored workshops during November and December of 2007. In January 2008 Planning and Building picked a reporting option and decided upon a strategy. The strategy decided upon was to create geo-coded address points from an address master list that was cobbled together from different sources. The geo-code address point layer will subsequently be geographically corrected using aerial photography and field verification. Planning and Building will follow GTG's methodology as outlined in this chapter and the Planning and Building Needs Analysis (found on page 2-478).

wide applications. Through the use of an integrated GIS-based addressing management application linked to enterprise application data, users can simultaneously maintain accurate address points and address records within these applications. Additionally, the address points should serve to feed the master address tables in other IT applications.

The following is the recommended methodology for the creation of a digital address point GIS data layer using existing data, a cleaned combined Address Database (from both Tidemark and the Property Data System, and implementation of a GIS based address management tool. The following methodology will not only insure 100% completion of address points, but will insure that data within the address database applications integrates with the address GIS points.

San Luis Obispo County Addressing Project



1. Database Inspection
2. Address Point Generation
3. Manual Adjustment of Digital Address Points
4. Field Verification
5. Digital Photographs Linked to Problem Addresses
6. Bulk Update of Tidemark and Property Database Records and GIS Overlay

Step 1: Database Inspection

Inspection of the both address databases is critical to the success of accurate address point creation. A custom extract application must be used to perform the extraction of the data to a more manageable format. It is important to acquire all the necessary GIS layers in order to accomplish the project tasks. These data layers might include existing address points, street centerlines, parcels, and aerial photography.

Inspection of the address databases land/address database is used to identify errors with the data that may prevent addresses from being matched correctly. Some of the problems that may be encountered include the following:

- Data has been entered into the database incorrectly
- Apartment numbers in the street post qualifier or street pre qualifier fields
- Street post qualifier information in the apartment number field (i.e. SCHOO in post qualifier and L in apartment – appears to be apartment L)
- Address Ranges (i.e. 3500-3590 State Rd 84)
- Addresses with multiple units (3490 101St Street Bldg 5 Unit 1-6)

Performing a database inspection facilitates the accurate assessment of the current database state and identifies ways to most efficiently map the addresses.

Street Number	Prefix	Street Name	Street Type	Post Qualifier	Apartment
8420		STATE RD 7		U-611	
8420		STATE RD 7		U-609	
8420		STATE RD 7		U-601	U-612
3504		OLD COUNTRY	MNR	U-325	328
3505		OLD COUNTRY	MNR	U-317	324
2985		PALM TRACE LANDINGS	DR	U310	
3506		OLD COUNTRY	MNR	U-308	316
3507		OLD COUNTRY	MNR	U-301	308
3508		OLD COUNTRY	MNR	U-213	220
204		EVERGREEN	PL	U204	
3508		OLD COUNTRY	MNR	U-125	132
3509		OLD COUNTRY	MNR	U-113	124
8480		STATE RD 7		U-101	103
3510		OLD COUNTRY	MNR	U-101	112
2945	SW	45	ST	TRAI	PUBLI
654		STIRLING	RD	SCHOO	L

Example of a Sample Address Database Structure

✓ Step 2: Address Point Generation

Once the addresses that need to be generated on the map are determined, the cumulative physical address field in the database will be address matched (also known as geocoded) against the attributed GIS address point and street centerline files, once they are completed and fully-verified. The database will be processed through the ESRI ArcGIS Geocoding Service in ArcCatalog. CAL FIRE has completed some GPS field work that includes address point GIS data, which is another excellent source for this initial data generation step.

An alias table may also be created to store detailed address information about common (vanity) location names, such as “New Government Center”. The result of the initial geocoding process will not be a complete point file, but it will eliminate some of the work necessary for the finalization of the point layer. Addresses that do not have a matching address point location will be addressed matched to another GIS data layer such as a building or the street centerline file. Due to the mechanisms used to determine the addresses of rural structures, the geocoding process against the street centerlines should use a single range option. This option will geocode the points to the center of the street and will have a higher level of initial accuracy than a geocode based on other systems such as a dual range system.

Address Match Database against Street Centerline File

Table

Centerlines

Attributes of AddressPoints					
Physical Number	Prefix	Street Name	Street Type	Suffix	Physical Address
102	(Null)	Jefferson	St	SE	102 Jefferson St SE
213	(Null)	Williamson	Rd	SE	213 Williamson Rd SE
126	(Null)	Gilmer	Ave	SW	126 Gilmer Ave SW
331	(Null)	Patton	Ave	NW	331 Patton Ave NW
315	(Null)	Rutherford	Ave	NW	315 Rutherford Ave NW
325	(Null)	Hackley	Ave	NW	325 Hackley Ave NW

Record: 0 | Show: All | Selected | Records: (0 out of 6 Selected) | Options

An aerial photograph of a city street grid. The streets are represented by dark, thin lines on a lighter, textured background of buildings and vegetation. The grid is dense and covers a significant portion of the visible area.

In the GIS, the new address point Geodatabase feature class created by the geocoding process will include two additional fields: 1) “Status” and 2) “Score”. “Status” indicates whether individual records were matched or unmatched, with values of “M” or “U”, respectively. “Score” indicates the percentage of confidence in the match. One hundred (100) % indicates an exact match, 70% a less than perfect match, etc. The Geocoding Service in ArcGIS allows users to control what score will constitute a match. In addition, all unmatched addresses can be interactively matched.

Geocoded address points can be offset at a designated distance; otherwise, each will be placed on top of the street centerline. “Status” and “Score” fields will remain visible to County staff responsible for maintaining the master address point layer, but should not be visible to end users.

The final product of this step will be one GIS point layer made up of both the CAL FIRE GPS address points, as well as the geocoded results of the Tidemark geocoding process. A field should be included inside this GIS dataset that would differentiate between the CAL FIRE GPS and geocoded Tidemark records. The next step will be to take these two sources and rectify their locations using GIS software.

Step 3: Manual Adjustment of Digital Address Points

Once that file is generated, County GIS staff throughout multiple departments (as described in the street centerline discussion) should manually adjust the records utilizing ESRI ArcGIS 9.x software. Because the geocoding to street centerline process is not considered the most accurate method for producing address points, virtually every feature will have to be manually moved. That includes the moving of points more to the center of structures, as opposed to along street centerlines.

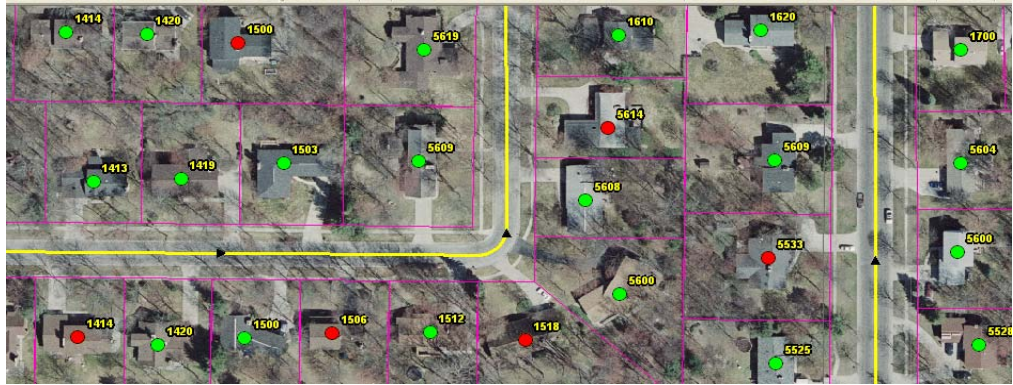
A manual review and inspection of this digital point address data must be performed followed by the adjustment of the dataset (or data records) to their actual location on the earth's surface. Using the aerial photography each digital point should be placed in the middle of each structure.

The following procedures are applied during this step:

1. Coding of matched digital address points – Address verification field indicating the status of each address point should be added to the digital address point layer. The following methodology should be followed:

Field of the Digital Address Point Layer:

Code	Status	Description
1	OK	The point or street has been verified and moved to the appropriate location
2	Field Verify	The point or street cannot be placed on a structure with 100% certainty and needs to be field verified



1's are green; 2's are red

2. Obvious problems in regards to data entry errors should be corrected and the placement of all address information in the appropriate fields within the address point layer should be completed. As a time-savings strategy, staff should also identify errors that will take longer to fix (i.e. one that will require public notification).
3. Detailed documentation of any and all changes made to the data should be maintained so that a full record of any changes that have been made will be recorded and referenced if necessary.

From this coding system, County field validation staff will be able to better focus their hectic efforts on a core group of problem addresses that are inaccurately placed. The third phase within the data adjustment task, an Address Inventory Plan, is also designed based on the coding system for multi-tenant properties like apartment complexes, mobile home parks, and commercial strip centers. Distinguishable attributes such as Unit ID and Building ID should be created so that a consistent system can be put in place before field verification should occur.

Step 4: Field Verification

The fourth step should focus on the complete data verification of the address point GIS data layer. Many of the addresses will need to be field verified after they have been address matched and manually inspected. The corresponding structures or the address for these points may not be decipherable from a heads up digitizing method using the aerial photography. Apartment complexes and commercial buildings will need to be visited in order to determine the appropriate location for these address points.

In the process of verifying each site address, field crews should employ a defined process to identify and record attributes for those records that may need additional review. Additionally, GIS software employs several alternative electronic data comparison routines to verify the accuracy of each address record to existing data sets, such as the Assessor's parcels and recommended Countywide street centerline file. This process provides the means to ensure each address is correctly field verified.

The following methodology should be used during the field verification process:

Verification Field of the Digital Address Point Layer

A verification field should be added to the address point layer with the following attributes:

Code	Status	Description
6	Field Verified	The point has been field verified and moved to the appropriate location
3	Problem	The address has not been placed with 100% certainty due to various problems encountered during the field verification.

Verification of Secondary Address Units

Secondary address units are utilized when a building has more than one place where an individual could live or work. Approximately twenty-five percent of residential housing units are in structures with more than one unit. This housing is typically referred to as "multi-family." Multi-family housing, commercial structures and mobile homes represent the majority of secondary address units. The location and addressing for secondary address units is a critical component of the effective delivery of government services, from emergency services and routing to the collection and allocation of personal property taxes.

Often for multi-family structures, field crews can obtain a site map from the apartment complex administration office. This map is a reliable source to verify the address and location of each living unit in the complex.

The focus in the field verification process should be to ensure that the digital address points for each structure is placed in a highly accurate and cost-effective manner.



✓ Step 5: Digital Photographs Linked to Problem Addresses

Some of the problems that may be encountered during field verification include the following:

- *Does Not Exist* – somewhat positive that this address no longer exists.
- *Could Not Find* – the point did not correspond to a nearby structure. This may include meter boxes or utility locations.
- *No Posted Number* – a building was present but there was no posted number.
- *Grouped Mailboxes* –there were mailboxes grouped and the address could not be matched to a specific structure.
- *Wrong Address* – the address street number or apartment number appears to be wrong because it does not fit with other addresses in the vicinity. Or the street name is wrong.
- *New Development* – the address could not be accurately placed because it is located in a new development that does not appear on the orthophotography, or the structure or building was under construction at the time of field verification and no address information was posted, or the parcel has an address but no structure has been constructed.
- *Empty Lot* – appears to be an empty lot or vacant parcel.

During the field verification process, a defined process should be deployed to identify all problem addresses. A digital photo should be captured for each structure that could not be visually verified, where no address number is posted on the house, or grouped mailboxes exist. The digital photo will be linked via GIS and can be opened within any GIS software application when clicking on the address point.



Problem Address Digital Photo Capture

✓ Step 6: Bulk Update of Tidemark and Property Database Records and GIS Overlay

Step 6 will require detailed knowledge of address databases data structures and data interaction. This step will bulk update the address databases address/land records utilizing the new address point GIS databases. The unique record ID for each record should be maintained through the address point finalization process. Each one of the valid records should have a corresponding valid address point. The addresses associated with the address point should be the official address. This official address can then be utilized to insure that the record contains a clean address. This can be completed by using a SQL script to update each record based on its X, Y location.

The following describes all the typical fields that should be updated when this update script is applied:

- Street Number
- Street Prefix
- Street Name
- Street Type
- Street Suffix
- Unit

In addition, the record should allow for the addition and population of an X, Y (latitude, longitude) field. This field would get updated for all records that have a corresponding GIS address point.

Not all of the records will be able to be associated with a valid address point. Some of these records may contain addresses that no longer exist or are invalid for other reasons. These records should be researched to determine if an accurate address can be determined and corrected. At this point, the County would have a 100% complete address point layer and each address database record would have an accurate X, Y coordinate.

Reports and Statistics

Additionally the creation of reports and statistics showcasing the results of all the steps leading up to that point in time will be generated. The first compiled report and related statistics should contain every untouched parcel centroids used to first create the address point GIS data layer. This report should include all aspects of the Address Verification process, including:



Reports and Statistics

- 1** Statistics for untouched parcel centroid addresses
- 2** Total number of manually adjusted features
- 3** Total number of field verified features
- 4** Exception Report

Address Reporting and Statistics Variables

Addition of New Address Records into Tidemark and Property Database

Throughout the address adjustment and verification phases many new addresses not existing in the address databases will be found throughout the County.

Using various methods new digital points for these addresses should be created. Some of the methods that will be used to accomplish this include the following:

- Use of existing GIS address point layer (if available)
- Use of existing GIS parcel layer (if available)
- New addresses found during the field verification process

These new points should be included in the final address database integration process. New address/land records should be created for these addresses making them address records that will be available to the appropriate database modules.

Mass GIS Overlay Possibilities

Once all address records have been updated and loaded into Tidemark and Property Database, attribute values for many of the fields in these database can be updated based on the new and improved address point spatial location information. For example, the zip-code or Tax Rate Area (TRA) layer, if up-to-date in the GIS, will be used as an overlay, allowing all Tidemark address records to be updated with the correct zip code or TRA based on spatial location.

Map overlay capabilities provide the user with a window into GIS and parcel management data records. This will allow for the bulk update and overlay of GIS layers to maintain spatial attributes in Tidemark.

Examples of GIS layers that could be overlain with address points to extract information which could be used to populate Tidemark fields:

- Parcel
- Slope characteristics
- Standards
- Fire Hazard Zones
- California Natural Diversity Database
- Zip Codes
- Elected Officials District
- Zoning
- Land use
- Inspection District
- In/Out of City or County
- Subdivision
- Fire District
- Jurisdiction
- Combining designations

This list of GIS layers to be included in the overlay will be dependent on whether or not these layers currently exist. If not, these layers should be developed.

Maintenance Procedures

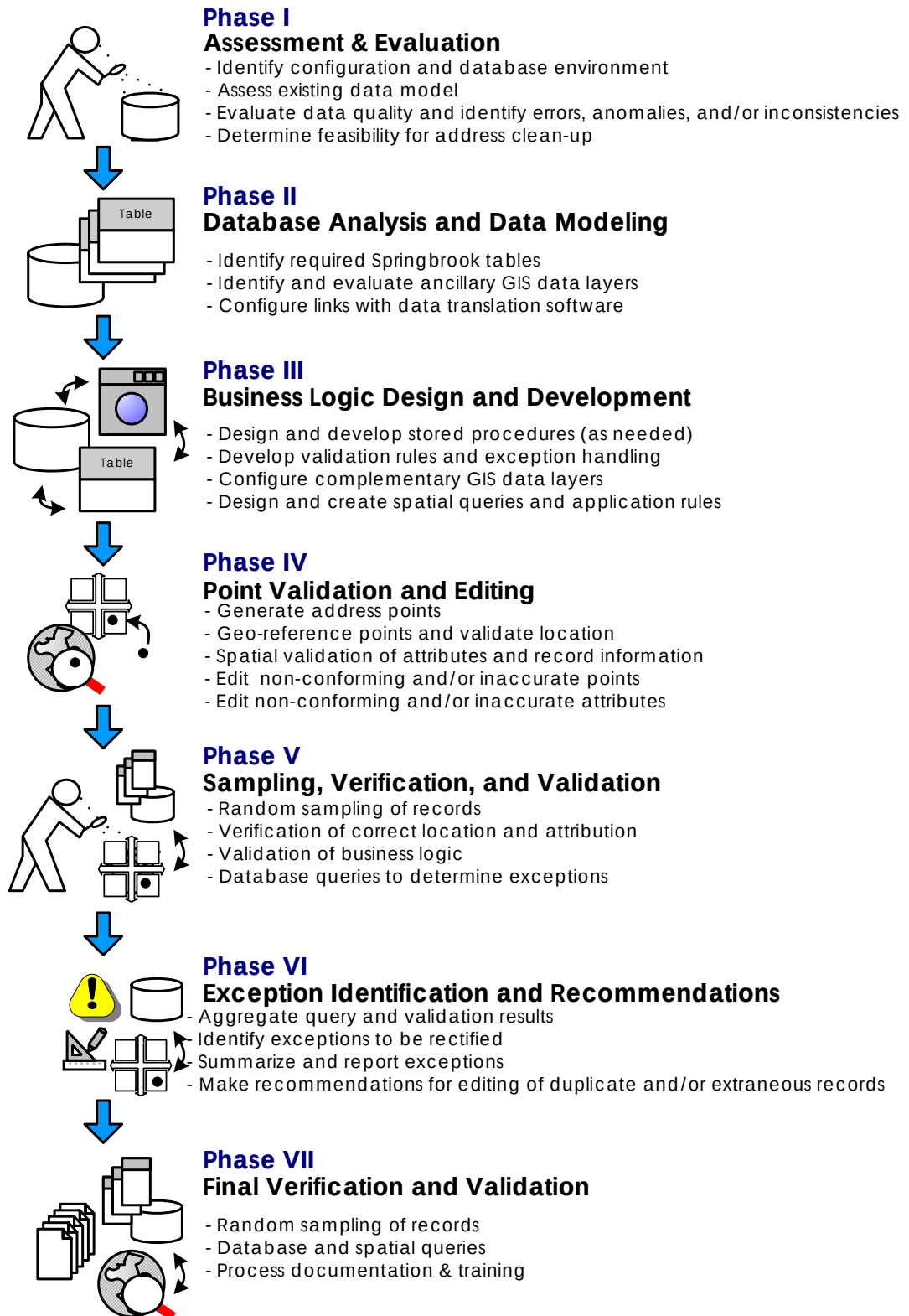
The Addressing System maintenance procedures should be well documented and understood throughout the enterprise. Numerous departments and software systems will rely on the County's master address database/GIS point layer, so accurately updating and maintaining that data is imperative. The Assessor, Planning and Building, and the recommended GIS Coordinator must coordinate with one another on who does what to the master address GIS point layer. In the unincorporated areas of the county current Planning division staff, within the Planning and Building Department, presently assigns new addresses to plats, and correct necessary addresses. In the incorporated cities the Assessor is notified of new addresses and street names for entry into the Property Database System. For the guaranteed future use of the address point GIS data layer as the "master address database", GIS staff in Planning and Building, the Assessor's Office and the GIS Coordinator must work together to maintain a seamless and efficient address maintenance process.

Johnson County, Kansas GIS group, AIMS, has written a resourceful guide on addressing guidelines for their entire county:

<http://aims.jocogov.org/otherResources/AddressingStandard.aspx>

It is strongly recommended that the County adopt a similar document that fully describes the standards for each aspect of addressing throughout the County. The initial step should be to order a summit of all the addressing staff representing any agency that assigns addressees within the County. A committee should be formed and tasked with the duty of drafting the aforementioned Countywide addressing guideline document. Once a draft is written, it will be the responsibility of the entire summit group to come to a consensus on the final draft.

The figure below outlines a sample addressing point creation methodology:



Address Point Creation Methodology

Street Centerlines

Introduction

An accurate street centerline GIS data layer has many critical uses. Among them is the mission critical use to public safety departments like CAL FIRE, OES, the Sheriff's Department, and many others. Crucial to the ultimate success of a government organization's emergency 911 dispatch center and response times is an up-to-date, reliable, and highly accurate street centerline GIS data layer, complete with actual and meticulous address range attributes. Emergency response personnel must have the tools available to them to properly dispatch and located a call for service, and then arrive at the scene in an efficient and timely manner. As of this writing, only one (1) San Luis Obispo County department has taken the initiative to fully develop a true countywide, address-based street centerline GIS data layer – CAL FIRE-San Luis Obispo County Fire.

History and Current Status

No one (1) County governmental agency has taken complete control of the street centerline GIS data layer management. Currently, street centerline files are being maintained by multiple County departments, including CAL FIRE and Public Works. Public Works maintains a GIS dataset that represents the street centerlines broken out by mile marker, in reference to their asset management system. In relationship to the parcel layer, the Assessor's Office also maintains road edges.

Most importantly, CAL FIRE has put the effort and time into completing and verifying the accuracy of a singular, address range-based countywide street centerline GIS data layer. At this time, the CAL FIRE GIS dataset has to be considered the most reliable and accurate due to the fact that it is based on the standard address-range by intersection system for street centerline GIS data.

CAL FIRE began a project in 2005 to update the GIS street centerline data layer in response to needs from their Computer Aided Dispatch (CAD) system. The goal was (and still is) to have the most current and accurate countywide street centerline GIS data layer available that would enable CAL FIRE to identify the pinpoint location of all emergency incidents within the County, and to efficiently and effectively route and dispatch the closest available resources. The main initial push for this validation project was the fact that CAL FIRE was periodically receiving E911 phone calls on street centerlines that they either did not possess, or were improperly identified in the existing street centerline GIS data layer. These missing or incorrectly named street centerlines have the potential for severely delaying emergency response times, thus fostering an environment that could be threatening to human life for County citizens.

To correct this location-based identification problem, CAL FIRE conducted a survey of other County departments to measure what GIS datasets existed. Early in the process, it was recognized that there was no single County department who was ultimately responsible for a comprehensive street centerline file. The results of that survey were as follows:

- The Planning and Building Department had procured NAVTEQ national GIS data that was somewhat accurate in urban areas, but missed a considerable number of streets in more rural, desolate areas. Emergency response personnel may already be delayed in arriving to residents in these unincorporated areas of the County due to their remote nature. By not having a reliable and accurate street centerline GIS data layer, it only compounds the situation.
- Public Works had clean GIS data, but only for County-maintained streets that they have jurisdiction and responsibility for maintenance. There are literally hundreds (100's) of miles of streets in the unincorporated areas of the County that are either State or privately (non-County maintained) owned.

With all these issues in the fold, CAL FIRE had no alternative choice but to take the charge in field verifying the most current and accurate GIS dataset available. As stated earlier, CAL FIRE had repeatedly received E911 phone calls into the dispatch center that were either mapped to the wrong location, or could not be found. These two (2) errors in an E911 dispatch system could easily open the County up for litigation due to delayed response times to emergency events.

Due to budgetary and personnel constraints, the street centerline GIS data layer field verification project has been extremely time consuming. Because of these limiting factors, CAL FIRE is only approximately three-quarters the way done, and are still missing important attribute data that would be helpful for creating maps and preplanning.

Recommendations

Along with the parcel layer, the street centerline layer comprises one of the most important datasets for the County. The layer is used and relied upon by law enforcement and emergency services for life-critical dispatching to emergency incidents. With the citizen's well-being in mind, it is simply one of the most critical recommendations that the County works together to build and continually update a current, reliable, and highly accurate street centerline GIS data layer.

There are four (4) primary and two (2) optional recommendations for the development and maintenance of the County's street centerline layer

- Establish a Plan for Creating and Updating a Street Centerline GIS Data Layer
- Integration of Geospatial Data to a Centralized Data Store

- Population of Attributes to Support Routing and Address Geocoding
- Requiring CADD Digital File Submittal
- Requiring GIS Shapefile Delivery of New Plats (*optional*)
- Development of an Address Range Updating Tool (*optional*)

Establish a Plan for Creating and Updating a Street Centerline GIS Data Layer

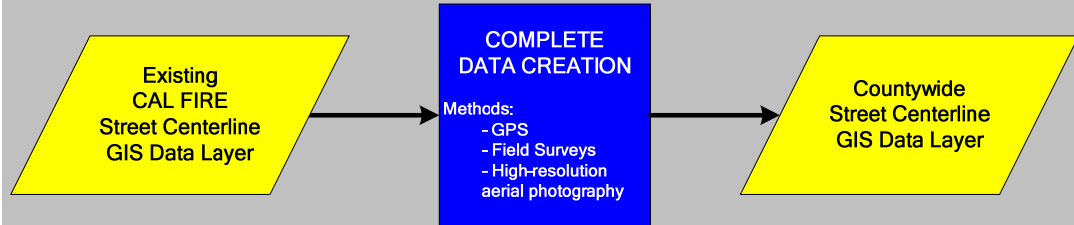
No county government can properly and adequately dispatch to emergencies without a comprehensive and up-to-date street centerline GIS data layer. Without clean and accurate street centerline data, governments may open themselves up for possible litigation due to negligence. The County's public safety agencies dispatch centers currently receives E911 phone calls that are either directed to the wrong geographic location, or cannot be located due to inaccurate street centerline GIS data.

Also worth noting are the streets that exist within incorporated city limits. Since Public Works and Planning & Building only maintain county layers, a policy should be developed to include the assimilation of data from cities. One method already mentioned in Chapter 5: *Organizational Structure and Staffing*, on page 5- 26, would be to enter into a formal Inter-local Agreement to fund and share common GIS data layers.

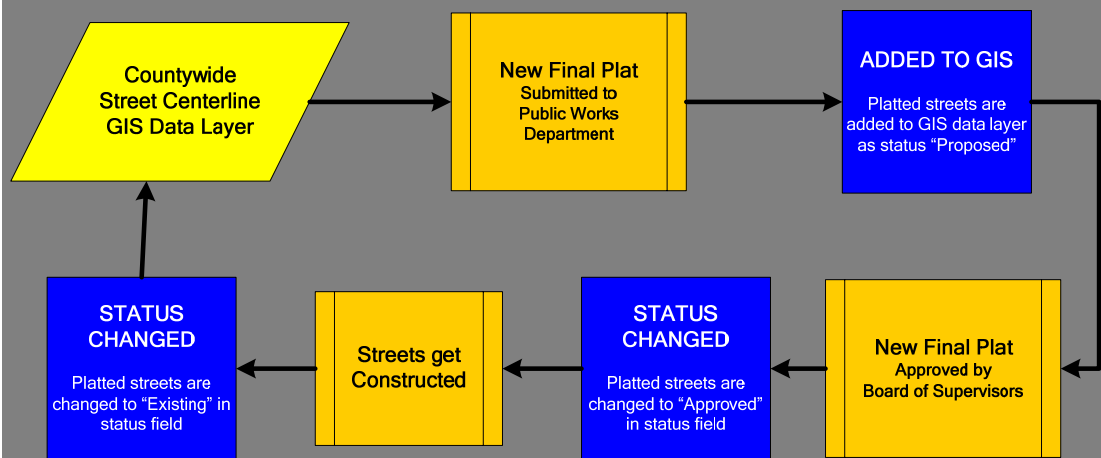
This data development initiative must be one of the top priorities for the County as a whole. It is of the intention of this section that a plan be developed for the completion and continual update of a current and highly accurate street centerline GIS data layer. Just like the parcel and address point layers, the creation and maintenance of street centerlines should be addressed via constant communication and a well documented plan.

CAL FIRE has laid an excellent foundation for a very solid countywide street centerline GIS data layer with their massive street field verification project. The following graphic depicts the proposed workflow process for the County to arrive at a current and accurate street centerline GIS data layer:

CREATION STAGE



MAINTENANCE STAGE



Street Centerline Workflow Process by Stage

Creation Stage

The first stage represents the completion of the work started by CAL FIRE. While CAL FIRE has executed a good portion of the creation work, there is still approximately twenty-five (25) percent of the County that remains. CAL FIRE, with cooperation from the Planning and Building and Public Works departments, should continue to work on field verifying every street centerline in the County. During interviews, it was stated that there were budgetary considerations for this project, so the strategic use of temporary intern help from Cal Poly should be considered. With the cooperation of multiple large-scale County departments, establishing this vital intern position should be a first priority.

Maintenance Stage

Once a fully verified countywide street centerline GIS data layer transpires from the first stage, the maintenance phase will progress. While creating the initial GIS data is vitally important, even more emphasis must be placed on establishing a formal and effective maintenance procedure for the street centerlines. As proposed in the above graphic, when a new final plat is submitted to the Public Works Department, GIS staff there should be responsible for adding the proposed platted streets as new features onto the GIS data layer, while also giving the value of “proposed” in a “Status” field. After the new final plat gets approved by the Board of Supervisors, Public Works GIS staff should change the status of those platted features to “approved”.

Another issue during the maintenance stage is that streets shown on subdivision maps are quite often offered for dedication to the public and rejected by the local authority (Board of Supervisor’s for the county and City Council in incorporated areas). The Assessor must show all roads whether they are accepted or not. Also streets are sometimes created or accepted through recorded documents. Currently the Assessor is the only agency who analyzes ALL documents recorded documents as to their effect and have both the resources and expertise to react to them, so this needs to be considered before committing to a new process.

Construction of Platted Streets

The next and final step in the maintenance procedure for the countywide street centerline GIS data layer is the actual construction of the platted streets. Once the Engineering group within the Public Works Department completes the final inspection of the constructed streets, GIS staff inside Public Works should alter the values in the “Status” field of those GIS features to “existing”, or other secondary status designation (i.e. offered for dedication, accepted, rejected, maintenance agreement, private road, etc). The whole process repeats itself again once another final plat (or group of plats) is submitted to the Public Works Department.

Because they can directly benefit from a clean and reliable street centerline GIS data layer, it is imperative that the following County departments be involved in the creation and maintenance of the countywide street centerline GIS data layer:

- GIS Division in ITD (advisory role)
- Planning and Building Department
- Public Works Department
- Assessor

- CAL FIRE
- Sheriff's Department
- Agricultural Commissioner/Office of Emergency Services (OES)

The reason for the inclusion of the Agricultural Commissioner/Office of Emergency Services (OES) is for funding opportunities. The Agricultural Commissioner acts as the GIS liaison for the OES, and OES has access to State and Federal funds for GIS data development. Because a reliable and accurate street centerline file would directly benefit the OES Emergency Operations Center (EOC), it would behoove them to be involved in the entire process.

Important to note in the discussion of a countywide street centerline GIS data layer is that the Public Works Department currently maintains a GIS dataset, but just for County-maintained streets within the unincorporated areas County. Their GIS data layer is based on mile posting of the physical length of the roadway, which directly relates to the SAP asset management system. The Public Works Department should participate in the above creation and maintenance procedures. The ultimate goal would be to combine the address based street centerline layer with a milepost based layer, creating referenced attributes to both methods.

Public Works GIS staff should take that completed work and break those GIS line segments based on the mile marker GIS point layer. From that point forward, Public Works GIS staff should update and maintain that mile marker-based street centerline data in direct correlation to the "master" address range-based layer. This once daunting task should be made easier by the fact that Public Works GIS staff is recommended to be involved in the last construction step of the "master" street centerline GIS data layer maintenance procedure, as illustrated in the above graphic.

Integration of Geospatial Data to a Centralized Data Store

As with the parcel layer, all County departments will benefit from access to a single, up-to-date, and accurate street centerline GIS data layer. In order to facilitate this access, it will be necessary to integrate the street centerline data into a centralized data warehouse, or "store". The layer should be integrated into a centralized data store using the same method as for the parcel layer. As illustrated below high-resolution orthophotography will enhance the accuracy of the countywide street centerline GIS data layer when used as a georeferenced overlay during the heads-up digitization process.



Example of Street Centerlines Overlaying Aerial Photography

Additionally, a comprehensive set of standards, specifications, and procedures for maintenance of the street centerline layer will support the development of an accurate and up-to-date base map layer. The Yolo County (CA) GIS Cooperative has developed such standards that may be useful guides for the County. The first document provides a comprehensive set of layer development standards. The second document entitled “GIS Cooperative Street Centerline Maintenance Procedures” provides guidelines for the long-term maintenance of the street centerline layer.

http://www.sacog.org/gis/counties/yolo/downloads/yolo_cl_specifications.pdf

http://www.sacog.org/gis/counties/yolo/downloads/yolo_cl_maint_process.pdf

These two documents should provide the County with industry standard GIS data maintenance and management processes for, but not limited to, the County’s street centerline layer. Additionally, a unique field (key) by which all County street segments can be tracked should be developed when the Street Centerline layer is consolidated into a central data store. This key should be utilized to track any internal changes made to the street centerline GIS layer by varying departments such as Public Works and Planning and Building, as well as the GIS Coordinator.

Population of Attributes to Support Routing and Address Geocoding

An example of a street centerline data model includes the following attributes (fields):

Field Name	Type	Description
Shape	ESRI_SHAPE (Binary)	The shape field contains geometry information.
Unique_ID	Long Integer	System ID for records of this table. Each numeric value is unique. See the discussion below.
PrefixType	String	Prefix street type (e.g. Avenida, etc.)
PrefixDir	String	Prefix street direction (e.g. S in 'S Main St')
StreetName	String	Primary name of the street segment.
StreetType	String	Type of street (e.g. st, ave, blvd, etc.)
SuffixDir	String	Street direction as suffix (e.g. West in 'Embarcadero West').
FullStreet	String	Fully specified name of the street segment (e.g. 'S Main St').
LF_Actual	Long Integer	Beginning actual left address for the segment
LT_Actual	Long Integer	Ending actual left address for the segment
RF_Actual	Long Integer	Beginning actual right address for the segment
RT_Actual	Long Integer	Ending actual right address for the segment
LF_Exhaust	Long Integer	Beginning exhaustive left address for the segment
LT_Exhaust	Long Integer	Ending exhaustive left address for the segment
RF_Exhaust	Long Integer	Beginning exhaustive right address for the segment
RT_Exhaust	Long Integer	Ending exhaustive right address for the segment
CityLeft	String	City on the left of the segment
CityRight	String	City on the right of the segment
ZipLeft	String	Zip code on the left of the segment
ZipRight	String	Zip code on the right of the segment
CountyLeft	String	County on the left of the segment
CountyRight	String	County on the right of the segment
TravelDirection	String	Indicates allowable travel direction. FR for 'from node' to 'to node', TO for 'to node' to 'from node', and BH for both directions.
Status	String	Status of the segment (e.g. existing or planned). A segment entered in the database before the roadway is built would have the status of planned.
Length_Cal	Long	Calculated length of the segment.
LengthSource	String	Length collection method (e.g., GIS, field, other database, etc.)
NameValidation	String	Indicates whether, or not the street name used should be validated. When a street name is not found in the master street name table, users may be allowed to type in the name while entering a new record by indicating that the name must be validated later on.
IsBoundary	Short Integer	Indicates whether or not the segment runs along jurisdiction boundary.
Source	String	Indicates which agency/department has entered the data. This helps in identifying the responsible party for the data.
Method	String	Indicates how the data was collected. This information will help in understanding the quality of data.
CFCC	String	Functional classification of street segment based on census feature class codes (CFCC).
DateEntered	String	Date when the segment was first created in the database.
DateUpdate	String	Date in yyyyymmdd format of most recent segment spatial change
Ac_Date	String	Date in yyyyymmdd format of most recent segment attribution change
Qc_Exhaust	String	Flag indicating entity responsible for exhaustive range
Exh_Except	String	Exhaustive range exception codes (see section on address range standards).

This set of attributes is adequate for use of the street centerline layer for geocoding and routing. Unfortunately, the County does not currently possess much of this information. Therefore, it is suggested that the recommended GIS Division in ITD serve an advisory role and verify that these attributes are populated and updated as the street centerline data layer progresses (specifically "TravelDirection" and "PrefixDir" fields intended for routing). In doing so, the County will have ownership of a highly-valuable street centerline layer that can be used for accurate routing, emergency/incident response, work orders, and AVL.

Important pavement condition information must be included from the Public Works Department, and the "Status" field must be continually updated and verified by all involved participants for emergency response purposes.

Requiring CADD Digital File Submittal

Street Centerline creation and maintenance requires an establishment of a digital file submittal standard throughout the County's reviewing departments/divisions. Requiring that developer and engineering firms deliver Computer-Aided Design and Drafting (CADD) digital versions of new

plats and streets would exponentially streamline the development process, and most importantly, reduce the turnover time for new street segments to be shown in GIS.

The Assessor already receives digital CAD maps from local Surveyors and Engineers. Approximately 95% of all recorded subdivision maps are received as CAD files. The Assessor receives them just prior to recording when the tentative maps come into the office for bond review.

The Assessor also has well established digital submittal standards in place:

Requirements for Maps Submitted in Digital Format - SLO-ADM 15A (11/09/07)

PLEASE NOTE: All maps submitted digitally must accompany a full size paper copy. Submittal of a digital map for condominium projects must include the condominium plan layers and a paper copy.

1. Media:

The Assessor's Office will accept map files on:

- CD-ROM
- DVD
- Via e-mail when mailed to: asmap@co.slo.ca.us

2. File Format:

The Assessor's Office will accept the following file types:

- AutoCAD 2008 (or previous release) Drawing (*.dwg) files.
- AutoCAD compatible data interchange files (*.dxf) files.

* File name should be Tract/Parcel Map/Adjustment number specific.

3. File Compression:

If compressed files are submitted, we will accept only those compressed files that are self-extracting or have used PKZIP or WINZIP as the compression software. If PKZIP is used, a copy of PKUNZIP must accompany the compressed files on the diskette. The Assessor's Office recommends the compression of all e-mailed files.

4. Digital Map File Content:

Files should contain 2-dimensional (zero elevation) seamless vector point & line data drawn at real-world scale and orientation. Poly lines, polygons, block objects or shape files for each Lot/Parcel/Unit should also be included on a separate layer. Digital Map Files should include the following information:

- Subdivision boundary lines (intersecting at nodes)
 - Lot/Parcel boundary lines (intersecting at nodes)
 - Condominium unit boundary lines (intersecting at nodes)
 - A set of all closed polygons for all lots or parcels on a separate layer
 - Road centerlines (intersecting at nodes)
 - Right of ways
 - Easements & Building restriction zones
 - Offers of dedication
 - Monuments (found and set)
 - Underlying subdivision information
 - Subdivision Tract, Parcel Map or Adjusted Line number
 - Company/agency name, phone number and e-mail address
5. The Assessor's Office reserves the right to reject the submittal of any digital map not meeting the above requirements. If your digital map is accepted, a reduced fee of \$75 per Assessor's Parcel created as a result of your subdivision will apply. If your digital map is rejected, you must pay the regular fee of \$120 per Assessor's Parcel created as a result of your subdivision. The Assessor's Office also reserves the right to amend these requirements at any time deemed appropriate or as dictated by technological change.

In regard to street development, and in the long term, further work must be done to implement the Federal Geospatial Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering, Construction, and Facilities Management (FGDC-STD-007.4-2002); this standard is generally known as Part 4 of the FGDC's Geospatial Positioning Accuracy Standards.

Part 4 provides accuracy standards for engineering drawings, maps, and surveys used to support planning, design, construction, operation, maintenance, and management of facilities, installations, structures, transportation systems, and related projects. It is intended to support geospatial mapping data used in various engineering documents, such as architectural, engineering, and construction (A/E/C) drawings, site plans, regional master planning maps and related GIS, CADD, and Automated Mapping/Facility Management (AM/FM) products. These products are typically created from terrestrial, satellite, acoustic, or aerial mapping techniques that output planimetric, topographic, hydrographic, or feature attribute data. Most developers utilize CADD technology and will be able to adhere to a well written policy with little extra burden and cost

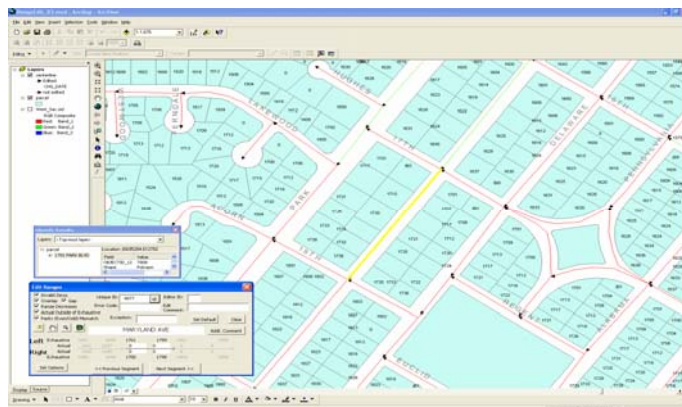
 Requiring GIS Shapefile delivery of new plats (optional: short-term)

Requiring that developer and engineering firms deliver ESRI shapefiles of new plats and streets could streamline the development process and increase the spatial accuracy of the layer. However, this process would require concrete standards by which all firms would be required to adhere. Additionally, a quality assurance (QA) process would have to be put in place prior to the shapefile data being added to the centralized base map layer.

However, this process would dramatically streamline the regional map update process, which requires the County's GIS staff to send hard copies of the new plats to numerous external organizations.

 Development of an address range updating tool (optional: long-term)

A future development process that would streamline the layer maintenance process would be the development or acquisition of a tool that allows for the updating of address ranges in the ESRI ArcGIS environment. Updates to this proposed countywide GIS data layer would be frequently performed on by various County GIS staff; it is expected as the organization grows other GIS personnel within Planning and Building and Public Works may assist with the effort of updating and rectifying the street centerline layer. Required training or access to the production ready data and using ArcInfo (flagship) applications should not be required of all users, especially if their data development responsibilities are narrowly focused (e.g. street centerlines only). For these types of data custodians an application developed for a specific task reduces the risk of data corruption and data entry error. The application functions like a GIS data browser with limited data layer access based on administrative rights.



Example of a Street Centerline Layer Editing Tool

Orthophotography

Introduction

Digital orthophotography (aerial photographs/images) can be useful as a backdrop to a GIS, with overlays of parcel, street centerline, or other thematic data. Digital orthophotography is a valuable asset to an organization such as the County. Current, high-resolution aerial imagery offers two (2) benefits:

1. *Raises GIS to a new level.* When users can actually see their house, their car, the sidewalk they walk on every morning, it heightens the realness of GIS.
2. *Quality Assurance/Quality Control (QA/QC) Measure.* By comparing vector (point, line, and polygon) GIS data to sub-meter accurate high-resolution orthophotography, positional accuracies can become exposed. Through the use of a manual adjustment process, vector GIS data like the other base map data layers discussed herein can become much more accurate.

History and Current Status

Digital orthophotography is inherently disk-consuming and process-intensive. These files can be difficult to manipulate and have the potential to considerably slow down IT networks. As the County GIS effort matured, several key data sets were acquired, including digital aerial photography. The purchase of key GIS data has been coordinated by the Planning and Building Department's Geographic Technology and Design section. Purchase of commonly used data and costs for data maintenance (i.e., quarterly GIS parcel update, digital aerial photography, GPS road centerlines, GIS inter-active web site) has been subject to inclusion within the Planning and Building budget submittal.

AirPhoto USA has been the selected vendor for the County's past two (2) countywide aerial photography flights in 2003 and 2007. The data delivery medium for these two (2) projects has been color orthophotography.

Recommendations

- Continue to Regularly Acquire High-resolution Orthophotography
- Upgrade to Annual Updates in High-growth Areas
- Use Raster Data to Generate Accurate Vector Data
- Perform Change Detection Analysis
- Use Compressed Format to Store Data
- Acquire More Ground Control Points to Ensure and Improve Geo-positional Accuracy
- Use Orthophotography Combined with Oblique Photography (optional)

 Continue to Acquire High-resolution Orthophotography

It is recommended that the County continue to acquire high-resolution orthophotography of the entire County through a Request for Proposals (RFP) process once every two (2) years. Although the data storage requirements are large for such data, it is suggested that the County continually acquire new aerial photography raster data. The acquisition of high-resolution imagery will provide a more accurate and detailed set of base data from which other layers can be rectified.

 Upgrade to Annual Updates in High-growth Areas

A discussion could be made for annual aerial photography updates of high-growth areas throughout the County. A full-fledge benefit versus cost analysis should be derived from a cooperative between the recommended GIS Division in ITD, other County departments like Planning and Building, Public Works, Agricultural Commissioner, amongst others, and City governments. The first initial goal of this group should be the identification of specific high-growth areas, possibly based off the Public Land Survey System (PLSS) mile by mile township-range-section grid as a guide (or other grid based layer). A prioritization ranking system should be added as attributes to the “grid” GIS data layer, where the value of 1 equals the highest growth rate areas, and 10 being the lowest to no growth rate areas. Once the total number of high-growth sections has been established, a bid should go out for estimates on flying those areas. From there, the same steering group from above should make the decision on whether or not to complete the project.



Example of color orthophotography

Use Raster Data to Generate Accurate Vector Data

In addition to the raster image data itself, it is also recommended that the County utilize this form of spatial data to derive and generate new vector GIS data layers (points, lines, and polygons), including planimetrics. Most aerial photography vendors can provide digital vector GIS data layer creation services in conjunction with the digital orthophotography raster data. As stated earlier in this section, a GIS user can author extremely accurate vector GIS data based on ground feature interpretation methods applied to high-resolution aerial photography. Below is a list of typical planimetric vector GIS data layers that can be generated based on orthophotography:

- Alley
- Bridge
- Building
- Cemetery
- Lake
- Road Striping
- Culvert
- Culvert Inlet
- Dam
- Drainage
- Driveway
- Electrical Pole
- Fire Hydrant
- Golf Course
- Gravel Parking
- Gravel Road
- Heliport
- Slab
- Manholes
- Mobile Home
- Paved Parking
- Paved Road
- Playground
- Pool
- Railroad
- Railroad Signal
- Recreation Area
- Recreation Court
- Recreation Path
- Sidewalk
- Water valves
- Stream
- Street Light
- Traffic Light
- Trail
- Trees
- Wall
- Construction Areas

Perform Change Detection Analysis

The County should explore the possibility of performing change detection analysis using chronologically sequential digital orthophotographs. Change detection analysis can be used to assess and evaluate physical changes with regard to physical geography and land use. Typically, change detection is done with multi-spectral imagery (e.g. infrared) for vegetation cover and land use change. However, new techniques using ArcGIS extension (add-ons), like feature analyst, enable planimetric data changes to be inferred from natural color and black and white orthoimagery.



Past



Present

Example of change detection using sequential orthophotography

✓ Use Compressed Format to Store Data

The County should make it an enterprise standard to utilize existing digital orthophotography in a compressed format (e.g. "MrSID"). Traditional digital orthophotography formats, such as TIFF, are inherently large and take up significant disk space. Compressed orthophotography aids the end user in the quick retrieval of information. In addition, the use of the digitally re-sampled orthophotography enables quicker printing and plotting. The display of compressed orthophotography can be configured to be scale-dependent. Using this configuration, end users view a map that displays the appropriate, higher-resolution imagery at a certain scale threshold. By maintaining orthophotography in a compressed format, the County will be able to distribute its digital orthophotography to remote client application sites like web-based Intranet and Internet GIS browsers more efficiently.

✓ Use Orthophotography Combined with Oblique Photography (optional)

The Assessor and other departments have a need for oblique photography as well. This would allow for viewing of all sides of a structure. This would benefit the Assessor by cutting down the number of field trips to inspect properties. The Sheriff and CAL FIRE would also benefit during emergency response, by knowing in advance what type of structure is being responded to and how to access it. A key software vendor that produces oblique photography is Pictometry:

Pictometry produces digital, oblique aerial imaging. Pictometry is utilized for homeland security, public safety agencies, and first responders. Additionally, governments are using Pictometry data to improve operational efficiencies, reduce expenses, and better manage community growth. Oviedo is utilizing Pictometry data to quickly view and analyze ground features from an easy viewing tool. Pictometry data should be integrated in any City GIS viewing tools.

Digital Elevation Model

Introduction

The Digital Elevation Model (Terrain Model) can be useful for ortho-rectifying aerial photography, slope analysis, creating contour lines, line-of-sight, cut & fill estimations and view shed analysis. The DEMs can be used with overlays of imagery, parcel data, street centerline, or other thematic data when terrain is a consideration. The Digital Elevation Model is a valuable asset to an organization such as the County. High resolution terrain models offers three (3) benefits:

1. *Raises GIS to a new level.* When users can actually see data in 3D it heightens the realness of GIS layers.
2. *Quality Assurance/Quality Control (QA/QC) Measure.* The high-resolution Digital Elevation Model provides highly accurate vertical and horizontal information for landmark features and is capable of generating accurate, detailed geographic data for producing numerous highly defined derivative products. The DEM is used to generate slope maps and elevation contour lines and to perform landslide risk analysis as well as view shed analysis, line-of-site and cut and fill estimates.
3. *Fire Preparedness.* Provides valuable terrain data for planning fire defense strategies. CAL FIRE uses FARSITE software to produce the following layers: slope, elevation and aspect. The DEM data determine the accuracy of the outputs of the computer model. Accurate predictions are important to fire control and firefighter safety. This program is also utilized for vegetation management projects such as prescribed burns. Increased accuracy of county fire predictions reduce the chance of fire escape.

History and Current Status

The Digital Elevation Model is inherently disk-consuming and process-intensive. These files require specialized GIS software to manipulate. As the County GIS effort matured, several key data sets were acquired, including the digital elevation model. The purchase of key GIS data has been coordinated by the Planning and Building Department's Geographic Technology and Design section. Purchase of commonly used data and costs for data maintenance (i.e., quarterly GIS parcel update, digital aerial photography, GPS road centerlines, GIS inter-active web site) has been subject to inclusion within the Planning and Building budget submittal.

Recommendations

1. Continue to use the high-resolution DEMs for 3D analysis
2. Consider purchasing updates in high-growth areas
3. Use DEM for ortho-rectifying imagery
4. Generate new flood plain/flood hazard data

Conclusion

As stressed in the opening sections of this chapter, base map data represents the most critical GIS data development investment a government entity can achieve. In return, a local government receives numerous benefits from properly investing their time, money, and energy into continually providing precise base map GIS data. An example would be that emergency response and public safety personnel must have a current, reliable, and highly accurate street centerline and address point GIS data layers so that they can provide adequate services to County citizens.

During discussions with various emergency response staff, one of the biggest current issues facing them was the fact that no one (1) true “master” street centerline GIS data layer existed with validated address range attribute information. Repeated events have either been incorrectly placed, or could not be found at all. Not only that, but no address point GIS data layer exists either, which vastly improves a dispatch workgroup’s positional accuracy for incident response times in areas with multi-unit structures.

Ideally, the County would have the resources both in personnel and budget to properly develop each base map GIS data layer at the same time. In that sense, the County would have parcels, orthophotography, street centerlines, and address points all at their disposal around the same timeframe. Realistically, that grand proposition is simply out of the question due to personnel and budgetary restrictions. **Accordingly, an overall recommendation for the County is to develop the aforementioned data layers in a strategic systematic order, based on available resources and established priorities as outlined in the above sections.** In Chapter 16: *Five Year Phased Implementation Plan*, cost options (High, Medium, and Low) will be laid out for the data layer development of these key layers. Costs, resources and management priorities should all be used in moving forward with these data layers.

Using available and recommended staffing resources, along with the current developmental state of these base layers, each base layer should be developed sequentially. Each base layer plays an important role in not only other base layers, but the entire enterprise. Listed below are some suggestions for determining the order of base map creation and maintenance:

- ✍ The County has already begun a semi-frequent system for delivering countywide aerial orthophotography, so the process for continually updating that base map layer is generally accomplished.
- ✍ Because this chapter recommends that the address points be generated partly based on the newly-revised street centerlines, straight-forward logic would indicate that the County first completes the development of the street centerlines, followed by the address points. (The strategy for developing

both the street centerlines and address point GIS data layers comes from their innate spatial composition).

- ✍ Although the Assessor's Office will play an important role in the creation and maintenance of address points and street centerlines, there initial efforts should be focused on the parcel base map layer processes and procedures outlined in the chapter.

As stated in previous sections, a well documented plan to address creation and maintenance of these base layers must be established. Establishing a structured plan and task order should be coordinated by the recommended GIS Coordinator in ITD. **Prioritization is the key.** Chapter 17: *Plan of Action*, will address the recommended tasks and there priority and structure in a five year phased timetable.

The County of San Luis Obispo, California



Phase III: GIS Strategic Implementation Plan The County's Return on Investment (ROI)

Chapter 14: The County's Return on Investment



Chapter Outline

Introduction

ROI Overview

- Financial Benefits
- Saved Time
- Increased Productivity
- Improved Efficiency
- More Accurate Data
- Better Decisions
- Saved Lives
- Automated Workflows
- Improved Information Processing
- Easier Compliance
- Better Protection for the Community
- Improved Communications, Coordination, and Collaboration
- Improved Ability to Provide Data to Regulators, Developers, and Others
- Respond More Quickly to Citizens Requests
- Improved Citizen Access to Government
- More Effective Management of Assets and Resources

Cost – Benefit Analysis

- Cost
- Benefits

Enterprise Issues and Program Cost Reductions / ROI

Departmental Level Issues and ROI / Program Cost Reductions

Departmental Specific Issues, ROI and Case Studies Provided by San Luis Obispo

County Departments

GIS Implementations: Cost – Benefit Case Studies

Introduction

Information from a GIS reveals patterns and relationships in geographic data not usually seen in tables and lists. GIS provides insight to a place, helps you focus actions, and helps you choose the best options. The benefits of a GIS are countless. Although everyone in an organization has different daily concerns, they all share the same ultimate goal: **results**.

Elected officials want to know how GIS delivers a return on the taxpayers' investment and makes the community a better and safer place to live.

County department managers focus on the governance of GIS and how best to invest resources to benefit all stakeholders. Clear lines of responsibility and accountability as well as the ability to measure results are chief concerns.

Information technology (IT) directors and GIS managers concentrate on the challenges of bringing the technology to users: designing GIS architecture, managing bandwidth demands, budgeting for software and server acquisition, and training personnel. For IT directors or GIS coordinators, the goal is to provide useful technology that immediately yields a high ROI at the lowest possible cost.

One of the primary benefits of a GIS implementation is increased efficiency and productivity in existing operations. GIS technology can transform existing business practices and reduce resources required to perform daily tasks. An investment in GIS based technology is often accompanied by questions about the benefits of the investment. Do the proposed benefits outweigh the costs? Any technology investment requires support from organizational leaders who often believe that the benefits will exceed the cost of implementation. One of the most commonly raised questions is "Can we afford not to do this?" This is often driven by the intangible as well as the tangible benefits of the technology. It is therefore important to illustrate that there are multiple types of benefits of implementing GIS technology.

Return on Investment (ROI) Overview

Following are examples of the benefits and the return on investment of a GIS:

Financial Benefits

GIS helps agencies control spending through direct cost controls and cost avoidance. Direct reductions in program cost arise from improved decision-making and increased productivity. Cost avoidance becomes apparent over time, as costs are reduced or eliminated due to GIS applications that save staff time.



Saved Time

Having the information when you need and want it saves time, staff resources and ultimately money. General information can be made available to the public through a Web site or touch screen kiosks located in County buildings. Both reduce demands on the County's staff and free them to do what they do best.



Increased Productivity

The County's personnel won't waste time searching for lost data or trying correct inaccurate data. Accurate digital and electronic GIS mapping can be easily accessed by all departments. Access is essential, as management constantly weighs new approaches to increase productivity. And because information can be accessed so quickly and accurately, productivity will improve in all departments.



Improved Efficiency

Efficiency can be improved vastly using GIS in the County by reducing or eliminating redundant or outdated steps in work processes.

More Accurate Data

GIS creates maps from data pulled from databases. Existing paper maps can be digitized and translated into the GIS as well. Maps can then be created on any location, at any scale, showing selected information symbolized effectively to highlight specific characteristics. Working with precise GIS data will enable the County to generate accurate reports and produce quality maps instantly.



Better Decisions

A GIS is not just an automated decision-making tool to query, analyze, and map data. GIS can, for example, be used to help choose the location of a development that minimizes environmental impact, is in a low risk area, and is close to a population center.

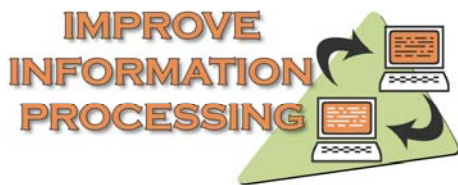
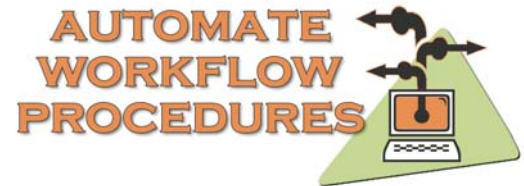
Saved Lives

When emergencies are reported, GIS can help responders reach the scene more quickly than ever before, and the time saved in locating a citizen in distress can be the difference between life and death.



Automated Workflows

GIS offers the County the opportunity to automate a variety of tasks that expedite work flows and enhance the County's ability to react during a crisis. GIS can be used to automate routine analysis, map production, data creation and maintenance, reporting, and statistical analysis.



Improved Information Processing

Enterprise-wide GIS improves operational effectiveness by improving access to accurate and reliable data. By processing information quickly and accurately, you can improve efficiency.

Easier Compliance

Digital GIS-based inventories of water, sewer and storm water infrastructure are becoming increasingly important in local governments. A total GIS, supports asset management, inventory control and depreciation that requires accurate and timely data on age, size and construction materials. GIS helps organizations anticipate and set priorities for the repair and replacement of infrastructure.



Better Protection for the Community

Intelligent emergency response, emergency planning and homeland security require timely access to data that help the County monitor conditions, recognize threats, predict consequences, and respond effectively and efficiently to man-made or natural disasters. GIS can pinpoint precise locations affected by adverse conditions and allow information to immediately flow to County agencies responsible for public safety.



Improved Communication, Coordination, and Collaboration

Good communication is the key to running an effective organization. GIS helps County leader's present complicated statistical information clearly and graphically. Maps are inherently easy to understand and help assimilate vast amounts of data and illustrate complex ideas without overwhelming the audience.

Improved Ability to Provide Data to Regulators, Developers, and Others

A total GIS solution will help ensure that the County will have accurate, reliable and repeatable digital information for complex political and regulatory requirements. GIS allows regulators and developers to consider all pertinent data involved in a project, which results in better decisions and better results.



Respond More Quickly to Citizen Requests

Responding to citizen information requests and explaining complex data are among the most time-consuming responsibilities of government agencies. Maps are instantly understandable and help even the most complicated information seem self-explanatory. With GIS, the County will have an enormous opportunity to use maps as a communication tool. GIS allows for questions to be answered simply, quickly, and effectively.

Improved Citizen Access to Government

GIS on the Internet allows citizens to get geographical information themselves, at their convenience, without involving County staff members. Web access to GIS information gives citizens an interactive link to the government, and enhances the government's ability to serve citizens, improve education, and compete globally.



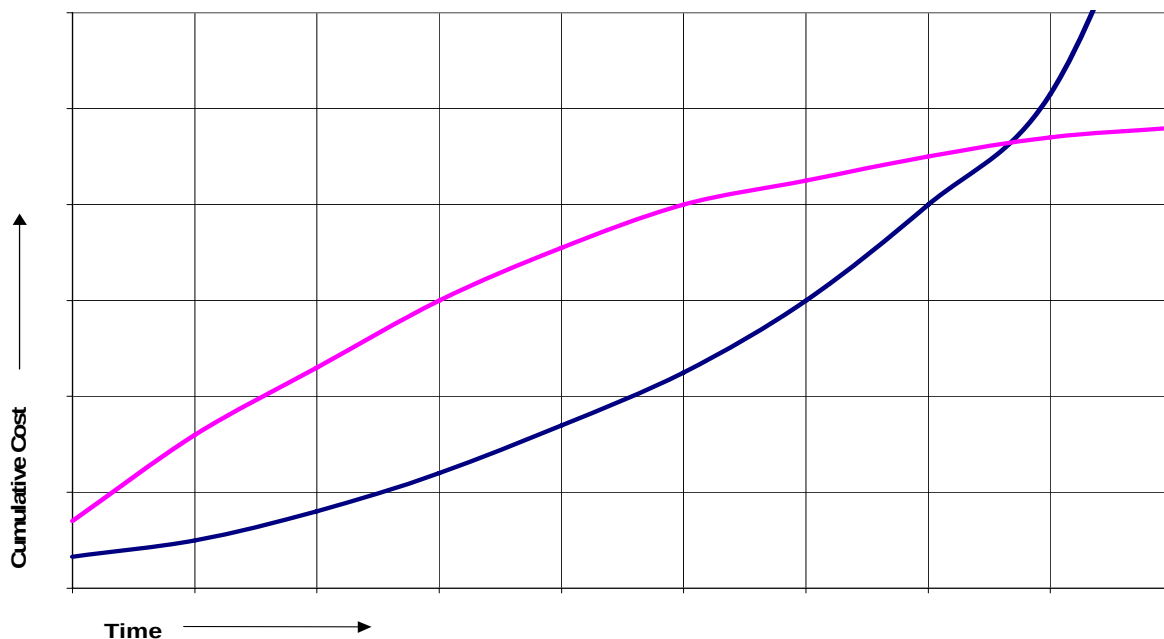


More Effective Management of Assets and Resources

Effective resource and asset management requires GIS systems to operate with peak user efficiency and under proper management. Effective management starts with analyzing, tracking, managing, allocating and conserving assets. Enterprise resource planning technology makes production and delivery quick and efficient.

Cost - Benefit Analysis

Implementing a GIS requires a substantial initial investment for staff, hardware, software, data, applications, interfaces, and communications. Typically, the benefits of a GIS start to outweigh the costs within a three to five year period. The total benefits of a GIS are only fully realized over time. Over a ten-year period the cost-benefit ratio is 1: 2.5. Thus, for every dollar spent on GIS implementation, the benefit to the organization over time is two and a half dollars.



	Benefit
	Cost

Costs

There are many components associated with the implementation of GIS technology. The following is a list of major cost accounting issues to address during the implementation phase.

It is important during the initial implementation of GIS technology that all Capital and Operating costs are identified and anticipated. These costs may include:

- Personnel costs
- Overhead costs
- Maintenance fees
- Supplies

Personnel Costs are incurred when an organization utilizes an independent coordinator and staff to design, develop, implement, and operate the GIS. This cost accompanied by consulting costs should be considered during the implementation-planning phase. Consultant costs for the development of the implementation plan, pilot studies, training, and software prototyping should be considered. Training and user support is often overlooked during this phase

Database costs will be incurred during the initial database construction phase. This can be substantial and often jeopardize the project. Costs can include aerial photography, GPS survey, data conversion and data adjustment. Database development can often involve labor efforts both internal and external to the organization.

Most Hardware costs are addressed in the five-year phased implementation plan. Components that should be addressed include:

- Computers
- Servers
- Data storage devices
- Terminals
- Printers
- Plotters
- Scanners

Software costs should be divided into four types:

- Operating Systems
- GIS software
- Application software
- Device software

Benefits

The potential benefits of geographic information systems technology can be categorized. Quantifiable or tangible benefits include improved efficiency in existing practices. Cost controls may

be achieved through the reduction or elimination of redundant activities. A geo-spatial GIS based application for zoning variance notification will eliminate all manual operations for the identification of residents living within 200' of a zoning variance applicant. This is an example of how GIS technology will reduce a thirty-minute manual procedure to an approximate 15-second activity. Automation of geographic data capture, handling, archiving, and manipulation also represents examples of improvement in existing practices.

Another quantifiable benefit is improved productivity in existing practices. The continued implementation of GIS-based software will facilitate the improved production of accurate maps and map products. GIS is currently used in a few County departments, but should be moved to the entire enterprise. Thematic mapping as well as three-dimensional mapping can be produced quickly and efficiently. Expanding and adding capabilities in the form of spatial analysis and analytical computation also offers improvement in existing procedures.

Some direct benefits include:

- Productivity gains
- Efficiency gains
- A possible reduction in workload
- A possible reduction in labor costs
- Improved accuracy which means better and more well informed decisions

Some benefits challenge quantification in the traditional monetary sense. Non quantifiable or intangible benefits are diverse and vary in type and significance. Intangible benefits may include:

- Improved data access
- Public access to information that would otherwise be impossible
- A possible perception of reduced liability - having a good management system in place for the tracking and monitoring of assets will go a long way in off-setting liability issues
- A sense of achievement and increased staff morale

Some of the benefits of GIS cannot be anticipated. However, they can be measured after the fact. Hazard mitigation is an example of how GIS can be used to save lives. Utilizing GIS for emergency preparedness, response, and recovery is a good example of how GIS can be utilized in response to events that could not have been predicted. A gas line explosion or a contamination event will prompt organizations to recognize the unforeseen benefits of geographic information systems.

Enterprise Issues and Program Cost Reductions / ROI

The following table (alphabetized in no particular order) details some of the general cost reductions and benefits that will be realized by an enterprise GIS implementation. General Issues are specific to the County as identified in the Needs Analysis (see Chapter 2 for further explanation of Issue):

General Issue	Benefits	Department(s)	Program Cost Reductions / Return on Investment
Automated Vehicle Location (AVL)	Will allow for tracking the location of all the vehicles of the fleet in order to improve response time and monitor the location of vehicles in case of an emergency and non-emergency situations	OES, Probation, Public Works	The ability to identify the locations of resources enables dispatchers and supervisors to optimally deploy resources saving time and money in response to both emergency and non-emergency calls.
Centralized GIS Environment and Shared ESRI Licensing Structure	Provides access to GIS data layers maintained by all departments on one platform.	ALL	Will streamline the process of accessing data throughout the County. Will remove duplication of efforts, thereby saving both time and money. More efficient data production will result from identifying key departments maintain key data layers. Using the most efficient method to create and maintain data on one set of servers instead of multiple sets. Using the most up-to-date licensing structure will eliminate duplicate software licenses. Using shared, or “concurrent” licenses, can save thousands of dollars per year.
Completed Metadata and GIS Data Update Notification	Helps organize and maintain investment in spatial data, provides information about data holdings, and provides information to external sources about data.	ALL	Accurate “data about data” saves valuable time in determining the source of the most recent data layers.
Convert Tax Parcels to a GIS Based Parcel Layer	Will increase the positional accuracies of data and provide a timelier update of data.	Assessor	This critical base map data layer is one of the foundations of an enterprise GIS. All departments will benefit.

General Issue	Benefits	Department(s)	Program Cost Reductions / Return on Investment
Countywide Staffing Issues	Staffing Tier 1 and Tier 2 GIS users will provide much needed GIS specific personnel to manage departmental data and processes. Staff is required to perform necessary daily GIS duties. Without them the enterprise GIS would suffer	ALL	GIS personnel in each department will provide coordination, system support, application design, database support, user support, and production of data (collection).
Data Development and Management of Pertinent Data Layers	Developing data layers that currently do not exist (or partially exist) will provide data to key departments in need. Countywide development of important base map layers (parcels, street centerlines, and address points) will provide much needed accuracy for public safety needs.	ALL	Up-to-date GIS layers provide all departments with much needed levels of accuracy currently not in place. Correcting and maintaining base map layers will enhance multi-departmental efforts in a variety of fields (public safety, revenue generation, etc).
Departmental access to spatially integrated databases	Will provide access to special permits, variances, building permits, utility billing, and other data stored in tabular databases via GIS	ALL	Will reduce time required to access data in these RMS. Tabular data can be visualized in a spatial context. Will allow department to generate mailing labels and other types of addresses-based information in a matter of seconds.
Departmental Access to Spatially Enable Documents and Drawings	Documents and scanned image files can be linked to all pertinent GIS data layers. This provides staff and the public immediate access to appropriate data.	Planning and Building, Public Works, Assessor	Will reduce the cost and time associated with paper documents and drawings.
Desktop GIS Applications to Perform Advanced Mapping Functions	GIS applications provide the necessary tools to edit and analyze spatial data.	ALL	GIS editing task can be completed in a timely fashion using enterprise software. Eliminating the duplication of efforts across multiple departmental lines.

General Issue	Benefits	Department(s)	Program Cost Reductions / Return on Investment
Economic Development GIS Initiatives	GIS data can be provided to local businesses and developers	Planning and Building	Increased business development in the County
Enterprise Access to Digital Pre-plans and Hazardous Material Data	Replaces paper maps currently in use. GIS can add additional information and analysis capabilities.	CAL FIRE, OES, Sheriff	Valuable time will be saved and information will be readily available to emergency personnel in the field. Information can save lives.
Field Access to GIS Data	Will provide access to data such as streets, addresses, building plans, response plans via a mobile interface. This application will also allow field crews to access digital maps showing infrastructure location	Agricultural Commissioner, Assessor, CAL FIRE, Farm Advisor, Health Agency, Library, OES, Planning and Building, Public Works, Risk Management, Sheriff, Probation	Will reduce time required to locate assets in the field. Particularly important in instances where potential safety hazards may not be readily visible or instances in which infrastructure repairs are critical
Field Access to Work Order Management and Processing integrated with County databases (SAP)	Real-time (wireless) processing of work orders and order creation for repairs, replacement, and maintenance identified in the field	General Services, Public Works	Will save operations and field personnel time by identifying, documenting, and processing work orders in the field. Additionally, new orders can be sent out to resources in close proximity to existing work saving travel time and expense. Asset and operations data accuracy will increase because data entry and processing is taking place at the time the error is found and corrected.
Field Data Collection	Replaces the pen-to-paper method of manually collecting data. More timely and accurate data will ensue.	Agricultural Commissioner, CAL FIRE, Farm Advisor, Health Agency, Public Works	Accurate collection of data will save time and resources.

General Issue	Benefits	Department(s)	Program Cost Reductions / Return on Investment
Formal GIS Training	An educated staff is an empowered staff. Training	ALL	Fully trained personnel will be empowered to work more efficiently.
GIS for ISO Rating	GIS can improve ISO rating by providing tools to create necessary resources and documentation.	CAL FIRE	Reduction in ISO rating will save residents and business thousands of dollars annually.
Department wide Access to Geospatial Data and Mapping and Spatial Analysis of Department Data	Through the distribution of Departmental GIS data across the agency, all personnel will have full understanding of virtually every department-related data and information at the tips of their fingers.	ALL	All County departments and staff will benefit from viewing GIS data. Along with the integration of department specific data (SAP, Tidemark, etc), staff will have up to the minute information needed to make decisions.
Mass Notification System	Enable public notification from a mapping interface during emergency or scheduled events that impact Citizens	CAL FIRE, ITD, OES, Sheriff, Agricultural Commissioner	This technology can save lives by providing pertinent information to citizens on a mass scale. Additionally, this system can be used to notify specific areas of scheduled maintenance events that may inconvenience them and provide an alternate route. This system can also be used to notify specific groups of upcoming events or warnings based on queries from mapped data
Optimal Response Area Analysis	Analysis of calls for service can result in redeployment of beats, stations, and response zones to increase coverage and reduce response times	Sheriff, CAL FIRE, OES	Will allow public safety resources to respond more quickly to calls for service and may result in saved lives and less crime. Management staff will be able to better calculate and analyze the department's abilities to respond to any particular emergency incident utilizing an Intranet GIS Data Browser's spatial analysis functionality

General Issue	Benefits	Department(s)	Program Cost Reductions / Return on Investment
Public Access to Information	Will provide access via public kiosk or Internet mapping to multiple data layers such as tax parcels, permits, crime incidents, fire response areas, and zoning	ALL	Providing public access to data will save the County significant staff hours per week in responding to public requests for information. The time savings generated by these applications will grow as citizens become aware of and familiar with the technology. This will also enable the public with the ability to research questions normally asked of County staff. This can be promoted by staff to encourage the public to search for information to satisfy their requests and needs. Allowing the public to freely access information at a kiosk will free up staff to perform other duties.
Public Forum Neighborhood and Vicinity Mapping	Enables staff members to quickly and efficiently create current neighborhood and vicinity maps.	Planning & Building	Will save staff time in the preparation of routine maps used for citizen meetings and zoning notifications.
Routing	Will identify the most efficient route to complete field operations	Probation, Social Services, Public Works	Will reduce time, resources, and equipment wear by designing optimal routes for visitation of probationers, meter reading, street cleaning, garbage pickup or any common utility or infrastructure repair routine. The end result is real cost saving in repairs, overtime, and utilization.
Spatial Analysis for Recreation Programs	Will allow Park Rangers to analyze usage and location to identify patterns and optimize offerings	General Services	Saving will be realized in program development and facility utilization by offering popular programs in locations that will maximize attendance and involvement. Revenue will increase as programs are offered in locations in close proximity to primary users maximizing registration

Departmental Level Issues and ROI / Program Cost Reduction

GTG has identified the following possible program cost reductions based on departmental interviews during the Needs Analysis phase of this project. These program cost reductions are generalized for the entire enterprise, based on a specific department's implementation of a particular GIS component, but an enterprise usage of that component. Hourly and dollar savings are based on enterprise usage and are a combination of multiple departments and multiple staff members using GIS technology on various levels. For example, not one department can be attributed with the implementation of a GIS Based Internet Data Browser, but, the entire county will realize an extreme and true ROI. Furthermore, program cost reductions are not exclusively based on a one-to-one salary to staff relationship. Not only should salary be considered in a dollar savings equation, but additional software/hardware cost saved, saved equipment usage, saved consulting fees, saved levied fines, saved time, saved citizen expense, etc. All of these factors equate to the possible program cost reductions for each department implementation of identified GIS components.

Department	Return on Investment	Possible Program Cost Reductions
Administrative Office/Board of Supervisors	• Improve Emergency Response Planning and Communication • Respond better to Citizen Requests • Eliminate reliance on the Planning and Building Department for producing maps and performing analysis • Eliminate the manual look-up process by integrating SAP with GIS	Increased efficiency and 1000s of hours saved due to easy-to-use geo-spatial tools. \$25,000 – \$50,000 cost reduction
Agriculture Commissioner	• Eliminate paper mapping, printing costs, and duplication of effort by making GIS available in the field • Save lives using GIS for Emergency Notification • Save lives by using GIS to enhance Hazard Mitigation – Preparedness, Response and Recovery • Improve Communication at Public Forums • Comply with State and Federal mandates	Estimated 870 enterprise hours saved, and \$52,200 in enterprise wide reductions.

Department	Return on Investment	Possible Program Cost Reductions
Assessor's Office	• Eliminate duplication of effort by integrating legacy Systems (SAP – Hummingbird – Kofax – Property Data System) • Eliminate annual Consulting (\$25,000) costs by managing all Tax parcel management tasks • Automate traditional manual mapping tasks • Improve accuracy and save lives by creating building footprint layer • Save time and money by enabling field crews with data, and routing tools • Improve Public Access and reduce calls to the County by deploying internet solutions • Assure proper allocation of revenue by improving the accuracy of the Tax Rate Area (TRA) • Better customer service by improving data accuracy.	Estimated 1000 enterprise hours saved , and \$250,000 in enterprise wide cost reductions. (Cost of current consulting, labor, automation, time, revenue, etc)
CAL FIRE	• Save Lives by supplying accurate, up-to-date digital centerlines, parcels, address points and photography • Improve the ISO rating • Save lives using the Emergency Notification tool • Save time, money, and automate the manual process by integrating pre-plans and hazardous materials data • Improve Public access to critical data • Save money and time by using GIS for Optimum facility location, drive time analysis, and creating of response zones, and fire districts	\$100,000 based on improved ISO rating in reallocation of resources to citizens Hours saved, over 500 and \$45,000 in program cost reductions.
Clerk Recorder's Office	• Reduce Redundancy by integrating existing systems – DIMS-Net • Improve efficiency by managing and maintaining critical data layers, including Precinct Boundaries, Polling Locations, Registered Voters, • Improve Public Access to Election Information	1000 hours saved for citizens and over 400 staff hours saved and \$42,000 in program cost reductions enterprise wide.

Department	Return on Investment	Possible Program Cost Reductions
Office of the District Attorney	- Save time and Money and reduce research time by making all County data available - Improve Accuracy by producing court case exhibits in-house using accurate, and up-to-date information	Over 300 hours saved and \$18,000 in program cost reductions implementing GIS tools.
Farm Advisor	- Reduce the need for outside consultants and improve communication by deploying GIS software that produces quality mapping products - Eliminate redundant processes, and improve accuracy by using industry standard GIS - Eliminate duplication of effort and redundancy by automate field access to GIS	Save \$25,000 in consulting fees. Save over 200 hours and \$18,000 (travel costs, improved work process, eliminate duplication)
General Services	- Save time, and money, and improve service, planning, and communication by integrating existing software (RecTrac and MainTrac) with GIS - Improve Public Access to data - Automate traditionally manual tasks including property owner searches, creating of mailing labels. - Improve Communication and Management by creating digital data layers - Improve efficiency and management by integrating GIS with SAP and viewing data geographically - Save time and money, and reduce redundancy by enabling field crews with data	Save \$50,000 - \$100,000 via department use and application of GIS components.
Health Department	- Save time and money, and reduce redundancy by enabling field crews with data - Improve Public Access to Data - Improve accuracy and management by creating digital layers of water well locates, and hazardous materials	Time will be saved since staff will be able to make better informed decisions.

Department	Return on Investment	Possible Program Cost Reductions
Human Resources/Risk Management	- Improve efficiency and management by integrating GIS with SAP and viewing data geographically - Improve Communication by producing high quality maps - Save time and money, and reduce redundancy by enabling field crews that inspect County facilities with data	Time saved in research.
Information Technology	- Enterprise coordination will eliminate redundancy, save time, and money and allow Fire, Public Works, Planning and Building, and other departments to be custodian of specific data layers, and share data layers with the enterprise. - Money will be saved through licensing centralization and optimization	Savings of 30 – 50 hours per week in replicated work; \$600 - \$1,000 per week in staff costs \$50,000 annually in maintenance fees and \$100,000 in direct licensing fees overall
Library	- Mapping and analysis of patron location to optimize branch locations and mobile services, and outreach programs (mailings) - Easy access to County data improves services to citizens and saves staff time	Saves both staff and citizens time. There is more time to focus on other tasks. Creates better efficiency.
Office of Emergency Services	- Ability to notify residents in a targeted area post disaster. - Quickly determine losses and value. - Quick reporting to federal agencies. - Use GIS to determine tsunami inundation lines for optimal creation of evacuation plan.	Saves time since more residents are notified in a shorter period of time. Creates better efficiency. \$100,000+ program cost reductions department and enterprise wide.
Planning and Building	- Allow Customers to access pertinent data themselves though public kiosks - Permitting, zoning, and inspection application projects can be tracked via the internet. - More and better data will save time and money	Estimated 6000 enterprise hours saved, and \$400,000 in enterprise wide program cost reductions by deploying GIS components.
Probation	- Reduce crime by mapping the locations of parolees - View the location of offenders wearing GPS bracelets - Offense types mapped and cross referenced with recurring crime. - Map all offender locations for optimized site visits	Estimated 780 hours saved, and \$60,000 in program cost reductions department wide.

Department	Return on Investment	Possible Program Cost Reductions
Public Works	• Improve efficiency by cross referencing all work orders and various construction projects to insure optimal work flow. • Reduce redundancy by quickly viewing work requests and identify repetitive problem areas. • Map infrastructure to comply with State and Federal mandates and avoid damage to underground facilities • Mapping and analysis of traffic accidents for roadway safety improvements • Tracking of work permits within the public right of way • Centralized retrieval and viewing of record drawings and survey data referenced to roadway milepost location. • Mapping and analysis of roadway pavement conditions for improved public safety.	Estimated 780 hours saved and \$300,000 in both enterprise and department wide program cost reductions.
Sheriff-Coroner	• Save time and money and save live by quickly viewing patterns in crimes, emergency calls and viewing critical data such as hazardous materials and critical facilities.	Estimated 400 hours saved and \$24,000 in program cost reductions via use of GIS technology and components.
Social Services	• Welfare to Work Initiatives, viewing open jobs, daycares, transit, para-transit and training centers. 40% reduction in time and 10% to 20% reduction in welfare rolls will Save Money and Assist Citizens. • Improve public safety, policing, and patrolling by mapping the incidents of crime and vandalism • Optimize site visits will Increase Productivity and Save Money in fuel and staff time.	Estimated 1000+ hours saved and \$100,000 program cost reductions via 40% reduction in the time it takes to gather information.
Treasurer/Tax Collector/Public Administrator	• Identify Noncompliance with Business Licensing laws, lost license fees, sales tax and uncollected penalties will increase revenue. • Quickly identify transient occupancy tax (TOT) areas, and cross reference these with rental properties and violators will Increase Revue and Make for better decisions.	Revenue increased by an estimated more than \$100,000 to \$250,000

Departmental Specific Issues, ROI and Case Studies Provided by San Luis Obispo County Departments:

Each department was asked to identify possible ROI's during and after the Needs Analysis phase of this project. Below are department specific identified issues. This list is only a start, and as knowledge and awareness of the benefits and in program cost reductions GIS offers to each department increases, more examples will follow. **These initial identified program cost reductions total more than double the projected cost for year one of the Implementation Plan** (see Chapter 16: *Five Year Phased Implementation Plan*).

Department	Issue(s)	Return on Investment
Agricultural Commissioner	• Improve Public Communication	The Department has frequent interaction with the public and is often describing information that is tied to geography. Having the ability to view this data live at public forums would improve communication with the public greatly. Provide better customer service by field inspections with GIS components. Site visits minimize the trips and travel time to the office for the customer.
	• Save Time and Money	<u>Pest Detection Program</u> ▪ Automated Viewer/Browser capability for each route (15) total will assist seasonal trappers in training on how to find locations/addresses more efficiently. The Pest Detection trapper will then have more time to carefully inspect the trap at designated locations. ▪ The estimated time savings = 22.5 hours per week. ▪ Potential reduction in program cost = \$1327.5 per year. ▪ The number of weeks that is anticipated for training = 4 weeks.
	• Save Money and Time	<u>Light Brown Apple Moth Project – October 2007</u> This explanation of cost effectiveness is based on a 81 square mile delimitation method that factors in crop information, core square miles and first buffer from the insect find. Explanation of Cost Estimates without GIS ▪ Total cost in salaries = \$611.76 ▪ Inspector and Technician time is required to prepare field study work by paper method. ▪ Technician I salary = \$31.46/hour (8 hours) ▪ Inspector II salary = \$45.01/hour (8 hours) Explanation of Cost Estimates with GIS ▪ Total reduction in program cost = \$449.55 ▪ Total hourly cost = \$162.21 ▪ Total cost reduction = 73% ▪ 1 hour @ Technician salary = \$31.96

Agricultural Commissioner (con't)	Save Money and Time (con't)	1 hour @ Inspector salary = \$45.01 2 hours @ Mapping Graphics salary @ \$42.87 = \$85.06 - Total hourly cost = \$162.21 ***The savings in economics for the agricultural industry - Faster response reduces the likelihood of pest spread. - Faster, effective response reduces the quarantine impact to the County and State of California.
	Improved Efficiency	- Automation of Field Inspections for our Pesticide Use Enforcement, Pest Exclusion and Land Use Planning would show a cost reduction in time and salary. Also, the chance of human error would be less. - Currently staff estimates that 53.5 hours per month are spent on manual counting and recording mandated monthly reports. A 45% time and cost reduction would be realized by the use of PC Tablets that have geodatabase links for electronic transfer of data to the monthly reports. A cost reduction of \$23,922.24 is estimated. - Better analysis tools quickly display relationships of crops to water areas, schools and sensitive site locations. Aid in public safety and public communication.
	Saved Money	Incorporating a PC Tablet with information such as accurate streets, parcel addresses, routing information and host plant information will cause a decrease in vehicle mileage costs and time by shuffling through paper in binders for needed information. Annual travel costs reductions of \$45,000.
	Case Studies:	
	- The use of a data browser has greatly enhanced the capabilities for the Pesticide Use Enforcement, Pest Detection Viewing aerial photography, and data layers such as crop, soils, land use category designations, grids and parcel information with Agricultural Commissioner's customers has truly become a more efficient process and has provided a great deal of customer information in regards to the surroundings of their sites. - Currently, the Pesticide Program Inspectors use a data viewer which has cut the search for field locations down to approximately 5 minutes. The cost reduction in issuing 1234 Pesticide Permits with 4,563 field locations is estimated at \$9643.71 annually. Geographic Information System technology has provided the ability to quickly represent field borders for our county's agricultural crops. This information can be used by programs within the department, other departments, and agencies for better analysis and emergency response. - A similar cost reduction of \$6737.16 is estimated for the Land Use Program. Researching soils information, parcel information and locations of project sites has reduced the number of trips to project sites. - Map creation from hard copy maps could take as long as 8-10 hour/per week. This portion of project time has been cut down to approximately 2 hours per project.	
	Total Program Cost Reductions (based on examples given): \$87,080	

Department	Issue(s)	Return on Investment
Assessor's Office	Save Time and Improve Existing Systems	Staff will be able to view GIS data along with data from existing systems (Permitting certificates of occupancy, inspections, and nuisance abatement cases). Gives much added value to existing IT investment. Staff time will be reducing in searching for pertinent information. Data searches that have a geographic component will be reduced from hours to seconds. Annual savings in time 30 hours per week. 1,560 hours a year. \$93,600 in burdened salary time.
	Save Money and Provide Better Data	Elimination of external parcel contract \$25,000 . Additionally. Current parcel map data is inaccurate. Inaccuracies will be reduced from +/- 100 feet to +/- 1 foot. Efficiencies in mapping will save 15 hours a week of staff time. 780 hours a year - \$46,800 in burdened staff time.
	Case Studies	
	<i>Real Estate Analysis:</i> Beyond optimizing revenue from clean GIS parcel data, the appraisers will additionally require less field time in which to value agricultural properties. This affords them the time to do a thorough assessment of those properties and to be more complete in their other duties. It is estimated that accurate GIS parcel data will reduce four Ag appraisers time in the field by 20% each. Utilizing a loaded rate for an Appraiser II classification, \$45.90 per hour. At 2080 working hours in a year this equals an annual cost reduction of \$76,378. <i>Correcting Tax Rate Areas (TRA) Overlays:</i> There are many Assessors' Parcels that have incorrect TRA's assigned. The result of an incorrect TRA is that tax revenue is allocated to the wrong districts. In order to correct all of the errors in the county, each hard copy Assessor's Map would have to be verified against the Property Data System and the hard copy TRA Maps. This would equate to thousands of hours. Using GIS would allow this task to be accomplished in a day or two. It is estimated an average of 0.5 hours per Assessor Map page for the review and there are currently 5148 Assessor Map pages. This review would be done by a Cadastral Mapping Systems Specialist III at a loaded rate of \$50.17. The cost reduction that could be realized from this exercise is \$129,138. <i>Public Access to Accurate Data:</i> The Assessor's Office counter assists the public with many general questions and questions that could easily be self-serviced with the use of a public kiosk and accurate and complete GIS data. It is anticipate upwards of 40 hours saved each week at the counter, which would not only provide greater access to Assessor data for the public, but would also allow Assessment Tech II's more time to complete their assigned tasks.	

Assessor's Office (con't)	40 hours a week, correlates to 2080 hours per year time savings. At a loaded rate of \$30.89, the Assessor's office would see an annual cost reduction of \$64,251. <i>Optimal Routing for Field Staff:</i> Appraisers are often appraising various locations within the County, including rural unincorporated areas. They may be required to cover various locations throughout the County in the same work day. GIS should be used to generate a route manifest in order to optimize the appraiser's time in the field. It is estimated a savings of one hour per week for each Appraiser by using this functionality of GIS. The Assessor's office currently has 28 appraisers with field duties. At a loaded rate for Appraisers II of \$45.90 and 1456 hours (28 appraisers multiplied by 52 work weeks) saved each year, a cost reduction of \$66,830 is generated. <i>Better Customer Service:</i> In addition to contacts at the public counter, the Assessor's office receives a high volume of phone calls from the public each month. On average there are 1500 customer calls in a month that can be reduced by 10 – 30 minutes each. It is estimated that approximately half of these calls could be answered more efficiently in about half the time using GIS. Half of the 1500 calls per month (750) at an average of 12 minutes saved per call correspond to 1800 hours saved each year. The loaded rate for the Assessment Tech II's that are fielding these calls is \$30.89 per hour. The cost reductions that could be realized is \$55,602 annually. Total Program Cost Reductions (based on examples given):\$416,379

Department	Issue(s)	Return on Investment
CAL FIRE- SAN LUIS OBISPO COUNTY FIRE	Save Time, Money and Lives	The integration of fire pre-plans and hazardous materials data will potentially save lives. Additionally, finding pertinent information now may take from 5-10 minutes. Using GIS it would take 5 seconds. Annual time savings of over 250 hours. \$15,000 in staff costs and potential of saving lives.
	Save Time and Money	Optimal facility location can reduce response time and potentially save money.
	- Save Lives - Save Time - Make Better Quality and More Effective Decisions	CAL FIRE-SAN LUIS OBISPO COUNTY FIRE primarily relies on accurate and up-to-date GIS road centerline and addressing data for incident dispatching with their Computer Aided Dispatching (CAD) application. Inaccurate or incomplete road centerline and addressing data has serious negative ramifications for adequately preplanning for emergencies, timely and efficient dispatching and response of resources and incident mitigation. Implementing an Enterprise GIS and prioritizing critical base map layers (as discussed in Chapter 13: <i>Base Map Data: Implementation Strategies</i>) would provide data that would allow CAL FIRE to better serve the community via proper and effective response to citizens during an emergency.
	- Increase Productivity - Effective Management of Assets and Resources	CAL FIRE's utilization of ESRI ARCPAD with GPS would allow for more efficiency in conducting annual Defensible Space Inspections. This application would allow CAL FIRE to prioritize areas and develop inspection routes that would allow fire personnel to be more efficient, leading to more home visits. Tracking compliance and implementing follow-up inspections for residents that don't comply with the defensible space requirements would also improve.
	Make Better Quality and More Effective Decisions	GIS is utilized by Fire Prevention staff to analyze wildland fire location distribution and arson investigations. Strategies are developed for reducing risks (such as building signs warning people not to mow after 10:00 and enforcing spark arrestor regulations). CAL FIRE has also utilized fire location information for investigating and developing strategies for arson caused fires. Reducing the number of wildland fires is a large cost savings to the County. Wildland fires are extremely costly to fight, especially when aircraft is utilized.

CAL FIRE- SAN LUIS OBISPO COUNTY FIRE (con't)	Case Studies: <i>Creating Fire Pre Plans:</i> CAL FIRE-SAN LUIS OBISPO COUNTY FIRE utilizes GIS to produce wildland fire pre-attack and evacuation plans. GIS allows personnel to create plans that meet our needs and can be updated on a regular basis. If we did not have this capability we would have to hire a private contractor to produce this product. This would limit our ability to continuously update components of our plan without a significant cost. Fire personnel visit businesses and prepare written preplans that describe the building layout, where utilities are located, locations of water supplies and other hazards. These preplans are compiled in binders and carried on emergency equipment. Since these plans are kept in binders they are hard to find and not easy for fire personnel to utilize in route or during incidents. If these documents were available electronically for use with our Mobile Mapping (In process of being implemented) fire personnel would be able to quickly identify water supplies, utilities and hazards. Being able to quickly identify these items results in more efficient and quicker incident mitigation, which would amount to a reduced damage to citizens. Also, this information would improve firefighter safety and possibly reduce injury. <i>Calculating Response Times:</i> CAL FIRE-SAN LUIS OBISPO COUNTY FIRE currently utilizes ESRI's Network Analysis extension to calculate equipment response times. The San Luis Obispo County Land Use Ordinance Subdivision Design Standards utilize a 15 minute response time as an analysis criteria. The network analysis extension allows us to calculate 15 minute response times around all of our 21 fire stations in a matter of minutes. To have fire equipment physically drive approximately 12,600 miles of roads and record manually on maps were they would be able to respond in 15 minutes would take hundreds of hours. This would also result in unneeded wear and tear on expensive fire equipment. <i>Addressing Errors:</i> CAL FIRE has identified over 200 specific addressing errors such as odd or even numbers mismatched or numbers out of sequence. These errors have the potential of confusing emergency responders and could significantly delay response times. CAL FIRE has estimated another 100 to 200 addresses errors. CAL FIRE has sent these addressing errors to Planning and Building asking that these problems be corrected. Planning and Building estimates that would cost approximately \$200 per point to correct (using the current manual process). The use of GIS to assign addresses using street centerlines, with pre-determined address block ranges will eliminate the manual process of correcting addresses. Approximate saving of \$80,000.
	Total Program Cost Reductions (based on examples given): \$95,000

Department	Issue(s)	Return on Investment
Clerk - Recorder	Save Time	Staff have to gather information from disparate systems (DIMS-Net, Exigent, others). Having this information available via a common interface will save staff time. An estimated 200 hours a year will be saved. \$12,000 in staff time.
	Save Time, Money, and Improve Citizen Access to Government	The county would save \$20,000 in consulting fees by managing the drawing and maintenance of voting districts and precincts. Additionally, GIS will allow staff to quickly find an address and whether it is in a city or in the county and assign the appropriate polling place and ballot. Two hundred hours (\$12,000) of staff time will be saved throughout the life of the project. Additionally, citizens' ability to register to vote with little confusion will be enabled. Optimization of precincts will allow the number of voters to be equalized by precinct reducing the amount of wait time at the polling place (1000's of hours of voter time saved).
	Total Program Cost Reductions (based on examples given): \$44,000	

Department	Issue(s)	Return on Investment
Office of the District Attorney	Save Time and Money	Investigators have to do a tremendous of research. Data is gathered from various sources. Having GIS as a portal will reduce research time by 200 hours a year (\$12,000).
	Save Time, Money, and Improve Citizen Access to Government	Staff has to produce case exhibits with accurate information. Using GIS will save in excess of 100 hours a year (\$6,000) and will assist in proving cases.
	Total Program Cost Reductions (based on examples given): \$18,000	

Department	Issue(s)	Return on Investment
Farm Advisor	Save Money	Outside consultants are utilized for the production of mapping products. \$25,000 a year will be saved by doing this in-house.
	Save Time and Money	Having information in the field with editing tools would allow staff to streamline efforts and reduce redundant data entry. 200 hours a year - \$18,000 in staff and travel costs.
	Total Program Cost Reductions (based on examples given): \$43,000	

Department	Issue(s)	Return on Investment
Information Technology Department (ITD)	Enterprise Coordination will Eliminate Redundancy, Save Time, and Save Money	Fire, Public Works, Planning and Building, and other departments maintain the same datasets (centerlines, addresses, and others). Results of Streamlining will include: - Complete and accurate data in one reliable place (multiple places now) *Savings in time of 30 - 50 hours a week in replicated work *Elimination of \$600 - \$1,000 a week in staff costs - Completion of these critical data sets will allow other departments to save hundreds of hours monthly due to quick access of accurate data and potentially saving lives (public safety)
	Save Money Through Licensing Centralization and Optimization	Over \$50,000 annually in maintenance fees. Over \$100,000 in direct licensing fees saved over life of the project. 2007 IT Assessment – GIS is named as an enterprise need and recommendation.
	Total Program Cost Reductions (based on examples given): \$200,000	

Department	Issue(s)	Return on Investment
Planning and Building	Save Time and Money	Public Kiosk. Customers accessing pertinent data themselves. Staff time savings of 40 hours a week – 2080 hours a year - \$124,800.
	Effective Management of Assets and Resources	Williamson Act State Reimbursement. As of 2005 the County of San Luis Obispo had 771,569 acres under the Land Conservation Act and received \$1,099,327 in subventions from the State of California that year. The County is reimbursed between eight and five dollars per acre of land for Prime Farm Land and one dollar per acre of Non-Prime Farm Land. The early recording of these data used paper maps drawn by hand. Using GIS and up-to-date soils data, the County could spatially analyze where Prime Farm land exists and where those lands intersect with lands under the Land Conservation Act Program. This analysis could potentially increase the County's subventions between four to seven dollars per acre. Realistically, this could be a 4% increase in subvention dollars provided to the County, equaling around \$276,000*. *This dollar amount was generated by considering the total number of acres currently reported as Non-prime land and multiplying those acres by the maximum amount of subventions allotted. \$270,000 is about 10 percent of that total.
	Improve Citizen Access To Government	Potentially save the public vehicle trips to the Planning and Building department by making GIS data available over the internet. If the public can locate what they are looking for over the internet then they may be able to avoid a trip to the Planning and Building department saving them fuel and time costs as well as freeing up county staff time.
	Better Customer Service	Internet Access. Permitting, zoning, and inspections applications project tracking via the Internet. Save citizens and staff time and frustration. Save 5-15 hours per project – 3,900 hours a year - \$234,000 in staff time – citizen time saved. *Based on an average of \$60 per hour of staff and citizen time saved. Based on estimate of 260-780 projects potentially tracked via Internet GIS application that required additional non-standard follow-up time for both staff and citizens.
	Effective Management of Assets and Resources	Generate ordinance related map data layers so front counter staff can avoid looking information up in printed materials. It is estimated that front counter staff spend roughly 20 minutes to look up data in various planning documents for each customer at the counter. This time could be cut in half if the data were available in a GIS linked to bookmarked digital documents. Printing costs would also be saved.

Department	Issue(s)	Return on Investment
Planning and Building (con't)	Make Better Quality and More Effective Decisions	Perform land use analysis identifying land use types that are more expensive to develop and service. Various development types depending on their locations would cost the county different amounts to provide services. GIS has the capability to identify the location and type of development that is the most efficient. GIS can provide decision makers an expanded set of tools to make the most intelligent decisions possible.
	Better Customer Service	Staff Desktop Access to GIS Data. Average citizen request for information and data will drop from one-hour on average to ten minutes. Possible cost reductions of \$3,000 a month in staff time - \$36,000 annually.
	Improve Information Processing	Perform land use analysis to target future infrastructure investment. One of the highest costs to the County is physical infrastructure construction and maintenance. GIS can help locate any future infrastructure investments wisely
	Make Better Quality and More Effective Decisions	Associate development permits to real-world coordinates. Currently the County maintains an Assessor Parcel database and this is used for developing many other datasets. In this case, it is used to associate permit information by parcel number. The problem is, the parcel data is only an inventory of current parcel numbers, not all parcel numbers, and parcel numbers change. If each permit had a latitude and longitude point associated with it, the County would have up-to-date geographic permit activity information. The County would benefit from this resource by utilizing this inventory to analyze permit active across the county and would provide the ability for staff to geographically track permits by type, date or location.
	Improve Data Accuracy	Address geographic data for all structures. These points can be used for many applications, from emergency response to updating the Census Count. Many State and Federal grant programs allocate funds based on the population count determined by the Census. Updating this count for the County of San Luis Obispo would ensure that the maximize dollar amount is allocated to this county. CAL FIRE has identified over 300 out-of-sequence or odd/even addressing errors in the unincorporated area. The estimated cost to the Planning Department to fix addressing errors is \$200 each. Assigning address points via a GIS application will eliminate errors and save the department money.
	Save Time and Money	General Plan Updates. Using GIS technology to implement changes to zoning boundaries and combining designations requires less time and fewer staff than using conventional (hand-drawn) maps. Historically for substantial general plan amendments (area plan updates) it would take up to 30 days to change and publish planning zoning maps and documents using conventional mapping techniques. Using GIS technology, staff time required to implement general plan changes has been reduced to one week. As a result GIS technology has saved the department material costs and increased productivity without increasing staffing levels.

Department	Issue(s)	Return on Investment
Planning and Building (con't)	- Save Time - Increased Productivity	Request for Geographic Information. GIS technology can return statistical information and associated map products remarkably faster than compared to conventional (hand drawn) maps. Consider the time it takes to calculate areas on hard copy maps using geometry or a planimeter. Prior to GIS it took weeks to gather maps and calculate areas of zoning or property sizes. Not only was the process of area calculations time consuming but were also more prone to human error. Using GIS calculations are provided instantaneously and results can be summarized in hours instead of weeks.
	Improve Efficiency	Mapping Efficiencies. GIS has provided a wealth of information to staff in an extremely efficient and improved manner. Geographically positioned GIS layers allow for comparison and integration of information that could not be performed using conventional hard-copy maps. Consider the methodology used for analyzing landslide and liquefaction risk potential. Combining geology, soil types and slope layers onto a 3D digital terrain model to evaluate potentially hazardous areas using GIS technology has supplied us with a new generation of information never before available for consideration. Better, more accurate hazard mapping made possible using GIS has the potential to save lives and property.
	Case Study:	
	- Efficient routing information for building inspectors It is estimate that the field viewing of code enforcement cases costs the department \$198/hour, and each case averages to 40 minutes per site visit, or \$132.00. - Using an <i>Internet GIS Data Browser</i> integrated into LP01, Investigators view all the cases they will be viewing that day. With the additional functionality of routing, they then determine the most efficient way to drive to these locations. - Using a <i>Mobile Data Brower</i>, the individual addresses or locations are sorted into a Route. - Using a GPS antenna and synchronizing it with the laptop in the car, the Investigator is then audibly guided from stop to stop without having to refer to a map, and can view other associated GIS layers. It is estimated that an averaging a time savings of 10 minutes per case, which translates to a cost reduction of \$33. Planning and Building is averaging 950 site visits per year which means a cost reduction of approximately \$31,350/year.	
	Total Program Cost Reductions (based on examples given): \$426,150	

Department	Issue(s)	Return on Investment
Probation	Improve Community Protection	Map locations of parolees. Offense types mapped and cross referenced with recurring crime. View clients with GPS bracelets.
	Optimize Field Visits and Client Tracking	Map all client locations for optimizing site visits. 15 hours a week in time savings – 780 hours a year - \$60,000 in staff time and travel costs
	Total Program Cost Reductions (based on examples given): \$60,000	

Department	Issue(s)	Return on Investment
Public Works	Save Time and Money	Optimizing field crews' daily manifest will save thousands of dollars per year in staff and fuel costs and hundreds of staff hours – 780 staff hours a year - \$60,000 in staff time and travel costs.
	Comply with State and Federal Mandates	Must map infrastructure to comply with mandates. Stormwater, ADA compliance, sidewalks, ramps. Potential savings of non-levied fines. Increased creation and maintenance of public utility system GIS data layers inside the Public Works Department will ensure that the County complies with all storm water system mapping requirements as laid out by the National Pollutant Discharge Elimination System (NPDES) Phase II federal mandates established by the Environmental Protection Agency (EPA). Not only will in-house GIS data management functions avoid hefty federal fines, but it may also free up the Department from contracting out the work to outside consulting firms at an approximate remaining cost of \$100,000.
	Save Money and Improve Customer Service	Quickly view work request and identify repetitive problem areas. Proactive repairs for problem areas produce overall dollar savings and yields better customer service.

Department	Issue(s)	Return on Investment
Public Works (con't)	Save Money	Cross reference all work orders with each other and various construction projects (CIP) to insure optimal work flow. No digging up a newly paved road or sidewalk due to another project. Potential of \$250,000 in cost reductions over the life of the project.
	Case Study:	
	- Public Works is responsible for creating maps and diagrams of hazardous traffic patterns and vehicle collisions histories by location. - Each static hand drawn map takes three days to create by hand with cut out paper and hand drawn arrows or diagrams put over photos of the roads. - GIS will give Public Works staff the tools to reduce this three day process down to three hours. - It is estimated that 18 total hours and \$1125 are currently used to generate reports (18 hours @ \$62.50/hr - \$1125) - Same process using GIS tools, 3 total hours and \$187.50. - Total savings of \$937.50 per report, with an average of about 15 reports per year - \$14,062.50 - Increased benefit of ability to generate more reports, which will result in a safer community and less cost paid out in potential lawsuits.	
	Total Program Cost Reductions (based on examples given): \$424,062.50	



Case Study Summary

Challenge

The third largest county in California, Kern needed superior-quality, low-cost elevation datasets to support numerous government agencies and their key mapping projects, including flood studies for the “Southern Beltway” which will connect three major highways.

Solution

Kern County selected our NextMap® USA – California 3D elevation datasets and geometries, including digital surface models (DSMs), digital terrain models (DTMs) and orthorectified radar images (ORIs) – for their high-stakes mapping projects.

Results

Using Intermap’s superior and cost-effective datasets, the county expects to **realize up to \$3 million in taxpayer savings** and a tenfold return on investment.

Customer Profile

Kern County is one of California’s largest and most lucrative regions. With valley, mountain, and desert areas, the county covers a territory larger than the state of Massachusetts, more than 8,200 square miles. Known as the California Golden Empire, the county remains California’s top oil-producing county, with nearly 90 percent of the state’s oil wells. Kern County accounts for one-tenth of overall U.S. oil production and three of the largest U.S. oil fields. It also has a large agricultural base and a wealth of minerals, including gold.



The Challenge

The County needed digital mapping elevation datasets to support projects for numerous governmental agencies, including: Kern Council of Governments, an association of 12 city and county governments primarily created to address regional transportation issues; City of Bakersfield; Kern County Water Agency; Kern County Roads, Waste Management, and Fire departments, along with other small cities in the area. “For years, we used poor-quality elevation data for mapping projects. When you have such a large area, precision is key,” said Jeff Orton, geographic information systems (GIS) coordinator. “We needed more accurate, available data for our entire county at a lower cost.” Of particular note, the county required elevation datasets to conduct flood studies for a major transportation project, the “Southern Beltway.” The beltway is a planned highway that will connect from Highway 58 to State Route 99 and Interstate 5, two major highways in the state’s Central Valley, bypassing congestion in central Bakersfield.

The Solution

Numerous representatives from various governmental agencies worked together to consider several mapping options for shared use. “After meeting with the Intermap Technologies’ sales consultant, we realized we could get everything we needed at a reduced cost,” said Orton. Ultimately, Kern County selected the digital elevation models created by Intermap’s proprietary Interferometric Synthetic Aperture Radar (IFSAR) technology to meet their needs. Now, various county departments and agencies use NEXTMap® USA – California 3D elevation datasets and geometries, including digital surface models (DSMs), digital terrain models (DTMs), and orthorectified radar images (ORIs) for their high-stakes mapping projects. According to Orton, “Kern County now has 10 times more data than ever before at a much higher resolution.”

Implementing the Solution

After the purchase, Intermap’s sales consultant worked with the twelve government agencies for more than a year to introduce them to the data and demonstrate different ways to use it. The agencies now use Intermap’s datasets for a variety of applications, such as road planning, watershed analysis, and orthorectification. “We expected to receive consistent, accurate data that would allow us to address multiple, county wide or regional projects,” said Orton. “When we received it, we were impressed with its clarity and accuracy that, in many cases, was better than we anticipated. It has definitely improved our capabilities.”

Members of the beltway project committee contacted Orton because the new highway would cross a large floodplain and they needed to develop flood area studies and review barriers to flooding the new transportation link. He specifically credits Intermap’s DTM data as having positive impacts on the beltway’s preliminary planning work. “Overall, we’ve experienced a very smooth implementation process. One thing we didn’t expect was for the high-

quality images to have anomalies, such as noticeable variances where reflectivity issues from radar caused unanticipated results in the images.”

Intermap quickly addressed the anomalies to Kern County’s satisfaction. “We worked with the company’s extremely responsive technical team to address the situation. They conducted the necessary investigative research and re-worked the data quickly.”

Orton noted the county agencies have changed their focus from not having the data they need and being forced to cancel projects to now having the data and addressing how they will manage the time, resources, and skills to handle various projects. “We can accomplish things we’ve never been able to accomplish before purchasing Intermap’s datasets,” he said. “Basically, it’s as if we were using crayons for years and one day Intermap gave us a complete, professional art set to create detailed oil paintings.”

The Results

Kern County has seen firsthand how Intermap enables government agencies and commercial enterprises worldwide to quickly and affordably meet a wide range of geospatial needs.

“During our decision-making process, we estimated the purchase and use of Intermap’s data would save Kern County four or five times what the data actually cost,” Orton said. He also noted that the data is expected to “save the public up to \$3 million over the next ten years due to the impact of flood studies on insurance rates.

“Once we complete the flood studies,” Orton added, “we anticipate a tenfold direct tax-payer return on investment if we aggregate all county expenditures and public savings over a decade. We know the returns will continue many times over because we’re constantly finding new ways to use the data that will positively impact our region.”

Case study taken from Intermap’s website, <http://www.intermap.com/>.

Department	Issue(s)	Return on Investment
Sheriff	Save Lives	Quickly view patterns in crimes, emergency calls, and view critical data such as hazardous materials and critical facilities.
	Save Time	Crime statistics and crime reporting. Average report and analysis one week down to 2 hours – annual time savings 400 hours - \$24,000 in staff hours.
	Total Program Cost Reductions (based on examples given): \$24,000	

Department	Issue(s)	Return on Investment
Social Services	Save Money and Assist Citizens	Welfare to Work Initiatives - Place clients by viewing open jobs, daycares, transit, para-transit, and training centers. 40% reduction in time in gathering this information (thousands of staff hours a year). Reduce welfare rolls from 10% to 20%. Hundreds of thousands of dollars saved in welfare benefits.
	Increase Productivity and Save Money	Optimization of site visits with save time and money. \$60,000 annually in staff time and travel costs.
	Total Program Cost Reductions (based on examples given): \$60,000	

Department	Issue(s)	Return on Investment
<i>Treasurer / Tax Collector / Public Administrator</i>	Increase Revenue	Increase revenue by identifying noncompliance with business licensing laws, lost license fees, sales tax, and uncollected penalties. Increase revenue by \$100,000
	Increase Revenue and Make Better Decisions	Quickly identify transient occupancy tax (TOT) areas. Cross reference these with rental properties and violators
	Total Program Cost Reductions (based on examples given): \$100,000	

GIS Implementations: Cost – Benefit Case Studies

The following are examples of how other government organizations are utilizing GIS to save time, lives, and money:

Organization	Discipline	Problem	Solution Using GIS	Return on Investment
<i>Newport News Waterworks, Virginia</i>	Water Department	State permits require right-of-way view, profile, and vicinity maps. Hand drawing these maps was very time-consuming.	The State automated map production using ArcView GIS.	Production time for each map was reduced from between two to four hours to just 15 minutes using ArcView GIS.
<i>City of Washington, Illinois</i>	Planning Department	Need to reduce the cost of plat map production by streamlining the process.	The City used the County GIS to prepare annexation plats for forced annexations.	Eliminated the need for outsourcing annexation plat creation and saved an estimated \$1,000 per plat.
<i>City of Bartlett, Tennessee</i>	Planning and Finance Departments	A review of the City budget revealed that the City sticker fee of \$25 per vehicle was not keeping pace with the estimated number of households in the City.	The City found that the County Trustees Office had vehicles listed as located in unincorporated Shelby County. City staff performed a simple address match against these addresses and identified a gap between the County and City record caused when a revised annexation was not communicated.	Geocoding 16,000 additional records by ZIP Code yielded 2,100 households that were not paying the required City sticker fee. The inclusion of these households will generate \$52,500 annually in revenue.
<i>Pierce County, Washington</i>	Sheriff's Department and County GIS Division	Pierce County wanted to supply citizens with information on sex offenders residing in the County.	The Pierce County Sheriff's Crime Unit developed an online sex offender registry.	Pierce County offers a greater level of citizen service in a cost-effective manner. The registered sex offender Web site receives 5,000 visitors per month. Since each visitor represents an estimated five minutes of staff time, without the Web site, the County would need an additional 12 employees to handle these requests.
<i>State of Indiana</i>	State Department of Health	Screening of all children on Medicaid for lead poisoning is federally mandated. However, such large-scale screening is prohibitively expensive, so State health officials wanted a more efficient and targeted method of screening.	Officials' geocoded State health records and developed an application that provides regression analysis and predictive modeling so that high-incidence areas can be identified.	This analysis revealed that the majority of cases of elevated blood lead in children were concentrated in just a few counties. By redirecting screening efforts to these areas, the State saved nearly \$2 million and secured a grant from the Center for Disease Control for \$239,980 that will fund the State's lead poisoning prevention program.
<i>City and County of Honolulu, Hawaii</i>	Honolulu Wastewater Information Management System (WIMS)	Maps of sewer infrastructure facilities were needed to support facility maintenance and management programs. Updated and comprehensive maps were also needed for facilities master planning that would support capital improvement program funding, planning, scheduling, and tracking.	Created digital model of sewer infrastructure facilities for the island that supports data maintenance procedures, capacity modeling programs, and production of work order maps.	Avoided more than \$6 million in federal fines while providing more accurate assessments of facility capacity requirements, creating more effective preventive maintenance programs, and developing more accurate budgeting for projects.

Organization	Discipline	Problem	Solution Using GIS	Return on Investment
<i>City of St. Paul, Minnesota</i>	Information Systems, GIS Division	City was participating in the Local Update of Census Addresses (LUCA) program to ensure a more accurate census count.	City staff, using GIS, identified 1,099 housing units that the Census Bureau had missed.	The 2,900 people residing in the identified housing will give the City an additional estimated \$5 million in federal funding over a 10-year period.
<i>City of St. Paul, Minnesota</i>	Public Works and Information Systems	Right-of-way permit system needed.	GIS-based right-of-way permit system sets fees for permits to dig up or obstruct street rights-of-way in Saint Paul. These fees are based on street characteristics stored in the GIS.	The Public Works Department now uses GIS to set fees that yield revenue of \$800,000 annually.
<i>City of Vallejo, California</i>	Economic Development	The City needed to attract companies to increase revenues and employment.	Developed a GIS-based Internet site that supplies information on available commercial and retail buildings and land, demographics, and traffic counts to companies looking for relocation sites.	Retail vacancy rate was reduced 45.3 percent between 1998 and 2000 after the economic development Web site was introduced
<i>City of Lincoln, Nebraska</i>	Police Department	Formulate an effective response to numerous complaints relating to drinking parties held near the University of Nebraska.	Mapped party complaints to target areas with high-risk drinking parties and started media campaign to create perception of risk of arrest. Established special enforcement projects.	Complaints reduced 27 percent within one-mile radius of the campus.
<i>City of Lincoln, Nebraska</i>	Police Department	Need to identify high crime areas and reduce burglaries in those areas.	Identified problem neighborhoods and trends. Monitored program results. Initiated community outreach programs to targeted neighborhoods.	Crime reduced in target neighborhoods 67 percent in seven weeks.
<i>City of Lincoln, Nebraska</i>	Police Department	Solve child sexual assault case.	Identified patterns of indecent exposure incidents in the area and georeferenced reports of matching descriptions to sexual offender list.	Suspect was arrested one week after the incident.
<i>County of Bernalillo, New Mexico</i>	County Assessor	Unrealized revenue caused by undervalued properties.	Overlaid digital orthophotography to GIS parcel base and verified the use status of properties with the tax rolls. Uncovered \$1.4 billion dollars worth of un surveyed or undervalued properties.	Increased tax revenue by \$6 million per annum.
<i>Winnebago County, Wisconsin</i>	County Assessor	Limited precision of County maps led to delays in permit issuance and misidentification of properties located in the floodplain.	Cooperative data project created a much more accurate basemap while reducing redundant data capture.	Accurate maps sped up permitting, will produce savings of \$300–\$500 per year , and increased property values by more than \$1 million for approximately 1,100 property owners whose homes were erroneously designated as in a flood zone.
<i>Citrus County, Florida</i>	County Assessor	Properties not assessed because building permit information is inaccurate or missing.	Used image analysis to identify changes in property improvements.	\$200 million in unrecorded property improvements and building additions detected, causing adjustments to 5 percent of the tax base .
<i>Lucas County, Ohio</i>	County Assessor	County unable to defend assessed values using standard appraisal models.	Used ArcView GIS with the ArcView Spatial Analyst extension to create continuous sales price surfaces for factoring location into valuation model.	A 60 percent increase in the success of valuations defense.

Organization	Discipline	Problem	Solution Using GIS	Return on Investment
<i>Elsinore Valley Water District, California</i>	Public Works Department GIS Division	Need to determine which parcels in the district are subject to annual standby assessments.	A standby charge on unimproved parcels is used to fund the maintenance and replace the District's current facilities.	Improved parcels were identified and assessed, generating \$5,000 in revenue.
<i>City of Los Angeles, California</i>	Emergency Management	Need to ensure quicker response times during emergencies.	Developed GIS Internet-based solution for quick access to data.	Response times decreased by 25 percent and operations were more efficient during year 2000 drills.
<i>Western Australia, Australia</i>	Fire and Emergency Services Authority	Choosing the best of three possible sites for a fire station.	Loss and response time modeling showed all sites were equal.	Saved more than \$300,000 on the cost of the land by choosing the least expensive parcel.
<i>City of Newton, Massachusetts</i>	Information Technology Department	Production of labels for abutter notifications was time-consuming.	GIS used to generate mailing labels for abutter notifications required by zoning board of appeals, traffic council, conservation commission, and other city agencies.	Savings of approximately 500 hours of staff time annually across four departments.
<i>City of Newton, Massachusetts</i>	Inspections Department	Need to streamline permit assistance procedures.	Developed automated front counter system using GIS.	System saves approximately 250 hours of staff time annually.
<i>City of Newton, Massachusetts</i>	Public Works	Customers connected to the sewer system were not being billed because the properties were not in the sewer billing system.	Mapped those properties not entered in the City sewer system and rectified customer billing for properties connected to the sewer system.	More accurate billing system's database generates an additional \$8,000 in revenue annually.
<i>Clark County, Washington</i>	Weed Management Department	Difficulty in identifying the owners of properties needing weed abatement.	The weed control officers now use laptop computers with access to a custom GIS application that uses GPS to locate each parcel with noxious weeds and identify the property owner.	Weed control officers now identify more than 100 outbreaks of noxious weeds per day compared to eight to 10 before using the GIS.
<i>County of Orange, Florida</i>	County Auditor/GIS Division	Comptroller's Office requested an audit of the County's cable TV customers.	The GIS Division did a complete audit of the auditor's database by geocoding and comparing jurisdictional boundaries.	Traditional random or partial audits performed by Comptroller's Office typically resulted in \$2,000 per year in revenues. The GIS audit netted \$63,000 in franchise fees and identified customers that had been assigned to wrong county and/or whose locations were erroneously reported in incorporated or unincorporated areas. Subsequently, a cellular telephone audit netted \$650,000 , and a resort tax audit of condominiums collected \$700,000.
<i>City of Richmond, Virginia</i>	Community Development Department/Division of Land Use Administration	The City needed to automate map and data maintenance. Traditional methods required separate maps with varying scales for property, zoning, and land use. These maps were manually updated.	GIS was used to simultaneously update both maps and data.	Map and database maintenance was coordinated resulting in an optimized work process . Individual map production went from 5 to 7 hours to 30 minutes with an overall productivity increase of 90 percent.

Organization	Discipline	Problem	Solution Using GIS	Return on Investment
<i>District of North Vancouver, Canada</i>	GIS Department	The District needed to automate routine data maintenance and entry tasks.	The GIS Department decided to design, develop, and implement two new components that would allow them to work more efficiently.	The system has resulted in a 75 percent reduction in staff hours .
<i>District of North Vancouver, Canada</i>	GIS Department	District mandate required improved citizen services.	The District established a Web portal, GeoWeb that provides access to spatial data. Using ArcIMS, the District has created four applications that supply information to citizens—Property Information Explorer, Parks Online, Air Photos, and North Vancouver Public Art.	Maps are the Department's most popular product. The automated mapping system produces more than 75 percent of the District's cartographic products. GeoWeb, which averages more than 100 visitors each day, improves GIS staff productivity by allowing staff members to work on other projects and administer the system instead of filling counter requests.
<i>Grason County, Texas</i>	Planning Department/ 911 Emergency Center	The County wanted to develop other uses for the GIS database.	The County automated production of emergency center map books using the street and structure information from databases maintained by the Planning Department.	By applying the GIS database to ongoing processes, the County was able to save approximately \$4,000 by producing the map book in-house rather than outsourcing it.
<i>City of Rivera Beach, Florida</i>	Community Development Department	City staff wanted to increase productivity and efficiency.	The staff developed a centralized GIS resource center that assists employees in performing routine project research.	The resource center has made staff research more efficient and saves approximately 520 staff hours per year . Now staff members have time to perform additional tasks.
<i>Summit County, Colorado</i>	GIS Department	The County was charged with identifying new methods for increasing staff efficiency and productivity.	GIS was chosen as the technology that would enable County staff members to do more with less.	A cost-benefit analysis estimates that the County realized cost savings of \$2,146,000 during the 10-year period between 1991 and 2001.
<i>National Interagency Fire Center Boise, Idaho</i>	• Bureau of Indian Affairs • Bureau of Land Management • National Park Service • U.S. Forest Service • National Oceanic and Atmospheric Administration	During the 2000 fire season, wildfires devastated the western United States, burning nearly the 7.26 million acres by mid-November. These agencies needed to track all activity by all agencies in order to deploy resources efficiently.	Within a two-week period, the Geospatial Multi-Agency Coordination Group (GeoMAC) developed an Internet-based GIS application that uses ArcIMS and SDE. The application lets public safety personnel receive real-time incident information and deploy resources.	GeoMAC integrates real-time infrared satellite imagery, displays of current incident-specific information, fuel types, current acreage, aircraft hazards, and other critical analysis information. This is the first system that includes information on all fires nationwide and lets users manage response on an up-to-the-minute basis .
<i>City of Ontario, California</i>	Fire Department	The department needed a more accurate and efficient method for inventorying fire hydrants and fire plugs.	Used GIS and GPS to quickly gather spatial and attribute data on hydrants and plugs.	Combining GPS and GIS increased the accuracy of data collection and eliminated data input. The data collection process developed by staff in District 6 required 35 hours and cost \$615. It resulted in data input cost avoidance of \$4,575, staff time reduction of four months, and improved the accuracy of the inventory by correcting the locations of 212 of the 942 hydrants.

Organization	Discipline	Problem	Solution Using GIS	Return on Investment
Fort Collins, Colorado	Emergency Operations Center GIS Department	A 500-year-magnitude storm hit the City of Fort Collins in July 1997. The situation required immediate response to aid flood victims both during and after the flood.	Because GIS was part of normal City operations, Fort Collins was prepared to respond quickly and be proactive during the emergency.	GIS and emergency operations staff established an intelligence center so that city, state, and federal government workers could get to work immediately. Staff produced about 1,000 maps with detailed information that helped speed damage assessment and gain national disaster area status so relief funds were available within 10 days .
Marin County, California	Fire Department Fire and Advanced Life Support	Some citizens were concerned that certain houses were being saved in preference to others during the Marin area fires. Community conflict resolution was needed.	At a town hall meeting, fire personnel displayed the fire model depicting homes, aerial images, and models of the hillside that showed the slope, aspect, and fuel types in the area as part of a demonstration of how the fire spread.	By learning more about fire operations, the community was reassured that the tactics deployed saved as many homes as possible.

The County of San Luis Obispo, California



Phase III: GIS Strategic Implementation Plan GIS Vision, Goals, and Objectives

Chapter 15: GIS Vision, Goals, and Objectives



Chapter Outline

Introduction

GIS Vision

GIS Goals and Objectives

- Enterprise-Wide Goals and Objectives

- Vision, Mission, and Goals Summary Table

- Departmental/Division Goals and Objectives

Using the Need Analysis and Implementation Process to Accomplish Further GIS Goals

Introduction

The County of San Luis Obispo has identified and utilized technology as a means for improving its business processes, infrastructure, services, information and decision-making. The County has recognized the value and importance of an enterprise GIS, thereby taking the necessary action to ensure that its implementation of GIS is efficient, effective, and viable.

As the acquisition, management, and dissemination of information continue to become increasingly valuable functions within local governments, so too has GIS proven to be increasingly valuable. The County of San Luis Obispo is no exception to this observation, as it too has benefited from its preliminary implementation of GIS. GIS and related output (e.g. maps and analysis) has already contributed to improve the County's business processes, information exchange, and decision-making.

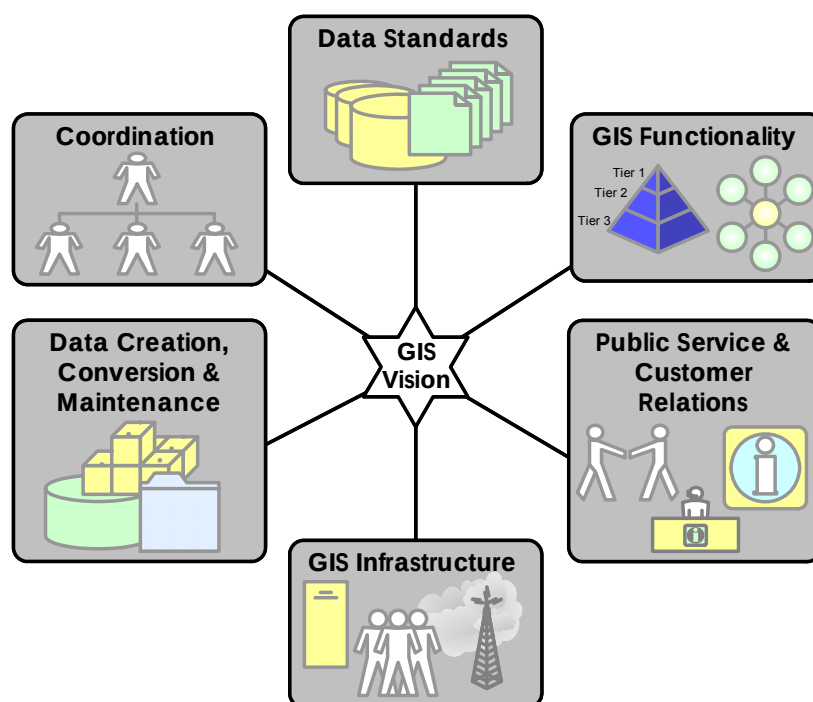
Positive, yet pragmatic, vision, mission, and goals will prove to be critical as the County proceeds with its GIS implementation. The benefits of GIS, especially an optimal return on investment (ROI) and improved efficiency and effectiveness, can only be realized if GIS is adopted and integrated on a County-wide basis.

GIS Vision

A Countywide vision statement was created based on interviews with staff throughout the County. Based on this feedback the proposed GIS vision statement of the County is:

“The County of San Luis Obispo enterprise Geographic Information System (GIS) will support and enhance the County's mission by collaboratively providing and maintaining accurate and current geographic information for the benefit of the entire community”.

The County will accomplish this vision by focusing on the six functional areas outlined below:



Implementation of the County's GIS Vision

1. Coordination

- Establish Enterprise-Wide GIS
- Leadership & Management Support
- Necessary Skills in Spatial Data Handling
- Wide Variety of Public Service Needs
- Strategic and Tactical Support for Projects and Programs

2. Data Standards

- Accurate, Reliable and Consistent Digital GIS Data
 - Metadata Standards/Procedures
- Documentation, Archiving, and Indexing of Geo-Spatial Data Standards

3. GIS Functionality

- Effective Use of GIS
- Three-Tiers of GIS Functionality
 - Power/Flagship Users (e.g. GIS Coordinator and GIS Application Developers)
 - Analytical Users (e.g. GIS Technicians and GIS Data Developers)
 - Browser Users (e.g. Department level GIS Users)
- Internal (County) and External (Public) Access
 - Data Network

- o Intranet
- o Internet

4. Data Creation and Maintenance

- Spatial Data Handling to Acquire, Process, Store, and Distribute Geospatial Data
- Capitalize off existing GIS/CAD data from Cities and other External Agencies
- Scalable, Centralized Data Storage with Enterprise-Wide Accessibility
- Documentation and Archiving of Geospatial Data Processing Methodologies and Workflows

5. GIS Infrastructure

- Materials
 - o Technology
 - o Hardware
 - o Software
 - o People
 - o Networks
- Knowledge
 - o Training
 - o Documentation
 - o GIS Users Group
- Process
 - o Methodologies
 - o Procedures
 - o Protocols

6. Public Service and Customer Relations

- Improve Efficiency, Increase Productivity and Enhance Public Service
- Expand and Improve Public Access to GIS

GIS Goals and Objectives

The County of San Luis Obispo's Enterprise-wide GIS program will provide the technology to support and assist County staff to acquire, convert, integrate, maintain, document, analyze, coordinate, and distribute geographic information for a variety of County needs. The County's GIS overall goal, in a greater context, is to utilize GIS and GIS-based technologies to improve analysis and provide vital, accurate information to decision makers, aimed at improving internal and public services and products.

Enterprise-Wide Goals and Objectives

After extensive interviews with County department staff, GTG has categorized six primary goals for the County's enterprise-wide implementation of GIS:



Goal #1 - Build and Maintain Reliable GIS Data: Focus on building and maintaining accurate, consistent, and reliable geographic data.



Goal #2 - Make GIS Data Accessible: The enterprise-wide GIS initiative should make data accessibility simple and easy for County departments and citizens.



Goal #3 - Integrate GIS Functionality and Efficiencies with Existing Business Practices and Data Systems: The integration and interoperability of GIS with existing County business processes and systems is critical.



Goal #4 - Train, Educate and Inform County Staff: The County GIS initiative should improve the GIS knowledge base within County departments.



Goal #5 - Implement an Optimum GIS Governance Model: The County GIS plan should have a clear and understandable strategy for the management and effective utilization of GIS.



Goal #6 - Build and Maintain Enterprise TIM Infrastructure: Implement infrastructure for an enterprise GIS initiative that will sustain growth and change.

The following table summarizes the Enterprise-wide GIS Vision, Goals and Objectives for the County:

Vision					
<i>"The County of San Luis Obispo enterprise Geographic Information System (GIS) will support and enhance the County's mission by collaboratively providing and maintaining accurate and current geographic information for the benefit of the entire community."</i>					
Goals					
Goal #1 Build and Maintain Reliable GIS Data Focus on building and maintaining accurate, consistent, and reliable geographic data.	Goal #2 Make GIS Data Accessible Make data accessibility simple and easy for County departments and citizens.	Goal #3 Integrate GIS Functionality and Efficiencies with Existing Business Practices and Data Systems Ensure that existing IT investments are leveraged and that the technology is integrated and interoperable with existing and future County business processes and systems	Goal #4 Train, Educate and Inform County Staff Continue to improve the GIS knowledge base within County departments.	Goal #5 Implement an Optimum GIS Governance Model Institute a clear and understandable strategy for the management and effective utilization of GIS.	Goal #6 Build and Maintain Enterprise IT Infrastructure Implement infrastructure for an enterprise GIS initiative that will sustain growth and change.
Objectives					
<i>Objective:</i> Establish a centrally managed geographic database. <i>Objective:</i> Establish and implement a system design for enterprise GIS architecture. <i>Objective:</i> Establish standards and procedures for the development and maintenance of data. <i>Objective:</i> Establish standardized methods and procedures for application development.	<i>Objective:</i> Establish effective organization-wide access to geospatial data. <i>Objective:</i> Guide the implementation of web based applications that facilitate access by citizens and departments. <i>Objective:</i> Improve public access to online County services. <i>Objective:</i> Use GIS as a tool to provide timely and accurate data to the community.	<i>Objective:</i> Integrate GIS with existing business systems. • SAP • Tidemark • Legacy Mainframe • Doc Mgmt Sys • AS400 • LP01 • Envision • MS Access • AIR • PD System <i>Objective:</i> Use state of the art technologies in order to ensure more seamless technology integration. <i>Objective:</i> Integrate GIS as fully as possible and apply it in a simple but effective way.	<i>Objective:</i> Implement a total governance model for sharing ideas, discussions, and information about GIS and related topics like GPS, AVL, and Mobile Solutions. <i>Objective:</i> Provide GIS training and educational opportunities to all County staff to empower them to fully utilize GIS knowledge. <i>Objective:</i> Establish a GIS user group network within the organization to help facilitate growth. <i>Objective:</i> Demonstrate to end users the methodology for gleaned information from GIS. <i>Objective:</i> Ease transition from established business processes to new ones. <i>Objective:</i> Address staff concerns and challenges of using GIS, by training departmental staff to use and understand the value of GIS	<i>Objective:</i> Establish a governance structure for review and coordination for all GIS initiatives. <i>Objective:</i> Establish a GIS Division in ITD, along with a GIS Coordinator to lead and maintain the GIS initiative. <i>Objective:</i> Develop an on-going GIS program to ensure efficient use of enterprise GIS resources. <i>Objective:</i> Develop inter-governmental agreement to facilitate data sharing and cooperation among County and other external organizations. <i>Objective:</i> Maintain adequate staffing levels to meet GIS demands.	<i>Objective:</i> Implement the most optimum network and hardware for the GIS initiative. <i>Objective:</i> Implement networking infrastructure that creates an efficient technological teamwork environment for the GIS initiative. <i>Objective:</i> Insure network connectivity and system architecture can handle all remote department needs. <i>Objective:</i> Develop data storage and distribution strategies that make effective use of current resources. <i>Objective:</i> Centralize software licensing and training.

Departmental/Division Goals and Objectives

The previous section described the overall goals for the County in regard to GIS implementation. However, taken by themselves, these goals are not specific enough to ensure that the needs of the individual departments are fully met. The next several pages review the goals and objectives identified by staff of many County departments during on-site interviews and subsequent feedback on the Needs Analysis (found throughout Chapter 2). These goals will be utilized to prioritize projects through the five year implementation of GIS at the County (see Chapter 16: *Five Year Phased Implementation Plan*). Therefore, it is imperative that staff review, understand, and agree with the goals for their department and the set forth prioritization of these goals. Some of these goals are common across departments but each department will be responsible for carrying out their respective objectives to make the enterprise GIS successful.

Priority

Each goal has been given a priority based on departmental feedback. The priority ranking is threefold: low, medium, or high.

Priority	Definition
Low	A low priority is one that will make a department more efficient and effective but is not as critical to the department and can wait for implementation later in the project
Medium	A medium priority is important but one in which an immediate adverse effect on the department is not occurring due to its absence
High	A high priority is one that is critical for the department to function effectively and efficiently

Level of Effort

Additionally, each goal has been given a level of effort to accomplish the task. The level of effort ranking is threefold: low, medium, or high.

Level of Effort	Definition
Low	A low level of effort indicates that the project can be put into place without significant data constraints, without significantly altering County workflows, and has few technological hurdles
Medium	A medium level of effort indicates that the project has a moderate non-existing data component, requires the alteration of some County workflows, and/or has a few technological hurdles
High	A high level of effort indicates that the project requires a large non-existing data component, requires the alteration of multiple existing County workflows, and/or is technologically difficult to implement

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES Administrative Office / Board of Supervisors		
GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Support Implementation and Use of GIS within all County's Departments	High	Medium
2. Provide Office-Wide Access to Geospatial Data	Low	Low
3. Implement Public Access Tools via the Internet	High	Low
4. Implement Public Access Tools in Strategic County Locations	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES Department of Agricultural / Weights and Measures (Agricultural Commissioner)		
GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	Medium
2. Completed Metadata and GIS Data Update Notification	Medium	High
3. Desktop GIS Application to Perform Advanced Mapping Functions	High	Medium
4. Data Development and Management of Pertinent Data Layers	Medium	Medium
5. Geospatial Data Creation and Integration	High	High
6. Mapping and Spatial Analysis of Department Data	High	Low
7. Department-Wide Access to Geospatial Data	High	Low
8. Public Forum Neighborhood and Vicinity Mapping	Low	Medium
9. Pre-disaster Mitigation Planning	High	Medium
10. Incident Modeling and Visualization	Medium	High
11. Field Access to Geospatial Data	High	High
12. Field Data Collection	High	High
13. Public Access to Geospatial Data	High	Low
14. Mass Notification System	Medium	Low
15. Formal GIS Training for Agricultural Commissioner's Staff	High	Low

County of San Luis Obispo:
DEPARTMENTAL GOALS AND OBJECTIVES

Assessor's Office

GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
2. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	Medium
3. Convert Tax Parcels to a GIS Based Parcel Layer	High	High
4. Preparation and publishing of mandated Assessor maps using GIS.	High	High
5. Mapping and Spatial Analysis in Support of Assessor's Office Operations	High	Low
6. Creation of Building Footprint data from AIR Database	Medium	High
7. Field Access to Geospatial Data with Routing	Low	High
8. Office Vehicle Routing Analysis	Low	High
9. Historical Imagery Scanning	Medium	High
10. Historical Archiving of GIS Records Using New Database Technologies	Low	High
11. Selection of Property Tax (PD) System	High	High
12. Public and Office-wide Access to Geospatial Data	High	Low
13. Formal GIS Training for Assessor's Office staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
CAL FIRE – San Luis Obispo County Fire		
GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Finalize Critical Data Layers	High	Medium
2. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
3. Geospatial Data Creation and Integration	High	High
4. Improve Connectivity to the County Network	High	High
5. Mapping and Spatial Analysis of Fire Incidents and EMS Incidents	High	Low
6. Department-Wide Access to Geospatial Data	High	Low
7. GIS for ISO Rating	High	Low
8. Field Access to Geospatial Data	Medium	Medium
9. Field Data Collection	High	Medium
10. Mass Notification System	Low	Low
11. Enterprise Access to Digital Pre-plans and Hazardous Material Data	High	High
12. Public Access to Geospatial Data	Medium	Low
13. Completed Metadata and GIS Data Update Notification	Medium	Low
14. Formal Training for Fire Department Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Clerk – Recorder’s Office		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Designated Tier 2 User within the Department	Medium	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	Medium	Low
3. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	Low
4. Data Development and Management of Pertinent Data Layers	Low	High
5. Mapping and Spatial Analysis of Department Data	High	Low
6. Department-Wide Access to Geospatial Data	High	Low
7. Public Access to Geospatial Data	Low	Low
8. Completed Metadata and GIS Data Update Notification	Medium	Low
9. Formal GIS Training for Clerk-Recorder’s Office Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Office of the District Attorney		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Centralized GIS Environment	High	Medium
2. Mapping and Spatial Analysis of Office Data	Medium	Low
3. Department-Wide Access to Geospatial Data	High	Low
4. Formal GIS Training for District Attorney Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Farm Advisor		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Mapping and Spatial Analysis of GIS Data	High	Low
2. Department-Wide Access to Geospatial Data	Low	Low
3. Field Access to Geospatial Data	Medium	High
4. Field Data Collection	High	High
5. Formal GIS Training for Farm Advisor Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
General Services		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Designated Tier 2 Analytical Users within the Department	High	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
3. Mapping and Spatial Analysis of Departmental Data	High	Low
4. Data Development and Management of Pertinent Data Layers	High	High
5. Department-Wide Access to Geospatial Data	High	Low
6. GIS Enabled Recreation Management Software	Low	High
7. GIS Based Work Order Management	Medium	High
8. Automated Project and Vicinity Mapping	Low	High
9. Public Access to Geospatial Data	High	Low
10. Formal GIS Training for General Services Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Health Agency		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Designated Tier 2 Analytical User within the Department for Full Utilization of GIS	High	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
3. Geospatial Data Creation and Integration	High	High
4. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	Medium	Medium
5. Mapping and Spatial Analysis of Department Data	High	Low
6. Department-Wide Access to Geospatial Data	High	Low
7. Field Access to Geospatial Data	Medium	High
8. Field Data Collection	High	High
9. Public Access to Geospatial Data	High	Low
10. Formal GIS Training for Health Agency Staff	High	Low
11. More Robust Network Connection	High	High

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Human Resources / Risk Management		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Data Development and Management of Pertinent Data Layers	Low	High
2. Mapping and Spatial Analysis of Department Data	Low	Low
3. Department-Wide Access to Geospatial Data	High	Low
4. Field Access to Geospatial Data	Low	High
5. Formal GIS Training for Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Human Resources		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Countywide GIS Staffing Issues	High	Medium
2. Support of Recommended GIS Positions within Specific Departments	High	Low
3. Assistance with GIS Job Descriptions within Specific Departments	High	Medium

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Information Technology (ITD)		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Enterprise GIS Coordination	High	High
2. GIS User Support	High	High
3. GIS Software Support	Medium	Medium
4. Desktop GIS Application to Perform Advanced Mapping Functions	High	Medium
5. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	High
6. Data Development and Management of Pertinent Data Layers	High	High
7. Geospatial Data Creation and Integration	High	High
8. Countywide Training	High	Low
9. Mapping and Spatial Analysis of Department Data	Medium	Low
10. Department-Wide Access to Geospatial Data	Low	Low
11. Public Access to Geospatial Data	High	High
12. Mass Notification System	Medium	Low
13. Completed Metadata and GIS Data Update Notification	High	High
14. Network Administration	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Library		
GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Department-Wide Access to Geospatial Data	Medium	Low
2. Public Access to Geospatial Data	High	Low
3. Field Access to Geospatial Data	Medium	High
4. Formal GIS Training for Library Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Office of Emergency Services (OES)		
GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Data Development and Management of Pertinent Data Layer	High	High
2. Mapping and Spatial Analysis of Department Data	High	Low
3. Pre-disaster Mitigation Planning	High	Medium
4. Department-Wide Access to Geospatial Data	High	Low
5. Field Access to Geospatial Data	High	High
6. Automated Vehicle Location (AVL)	Medium	High
7. Public Access to Geospatial Data	High	Low
8. Incident Modeling and Visualization	Medium	High
9. Mass Notification System	Medium	Low
10. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	Medium
11. Completed Metadata and GIS Data Update Notification	High	Low
12. Formal GIS Training for OES Staff	High	Low

County of San Luis Obispo:
DEPARTMENTAL GOALS AND OBJECTIVES

Planning and Building

GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. County Enterprise GIS Coordination with the Inclusion of the Geographic Technology and Design Section	High	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
3. Enabling Existing Databases	High	High
4. Mapping and Spatial Analysis of Department Data	High	Low
5. Improve Access to Planning and Building Data	Medium	Low
6. Automated Vicinity Mapping	Medium	Low
7. Access to Spatially Enabled Documents and Drawings	Medium	High
8. Public Forum Neighborhood and Vicinity Mapping	Low	Low
9. Cartographic Products for Grant Proposals	Low	Low
10. Geospatially Enabling the County General Plan	Medium	Medium
11. Economic Development GIS Initiatives	Low	High
12. Field Access to Geospatial Data	Medium	High
13. Department Vehicle Routing Analysis	Low	High
14. Public Access to Geospatial Data	High	Low
15. Completed Metadata and GIS Data Update Notification	High	High
16. Formal GIS Training for Planning and Building Staff	High	Low

County of San Luis Obispo:
DEPARTMENTAL GOALS AND OBJECTIVES

Probation

GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Designated Tier 2 Analytical User within the Department for Full Utilization of GIS	Medium	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	Medium	Medium
3. Geospatial Data Creation and Integration	High	High
4. Mapping and Spatial Analysis of Department Data	High	Low
5. Department-Wide Access to Geospatial Data	High	Low
6. Field Access to Geospatial Data	Low	High
7. Automated Vehicle Location (AVL)	Low	High
8. Optimal Routing of Staff for Daily Offender Visits	Low	High
9. Formal GIS Training for Probation Department Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES

Public Works

GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Designated Tier 1 and 2 GIS Users within the Department	High	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
3. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	Medium
4. Data Development and Management of Pertinent Data Layers	High	High
5. Geospatial Data Creation and Integration	High	High
6. Mapping and Spatial Analysis of Department Data	High	Low
7. Utility Geodatabase Geometric Networks for Water and Wastewater Systems	Medium	High
8. Department-Wide Access to Geospatial Data	High	Low
9. Field Access to Geospatial Data	Medium	High
10. Field Data Collection	High	High
11. Automated Vehicle Location (AVL)	Low	High
12. Department Vehicle Routing Analysis	Low	High
13. GIS Based Work Order Management	Low	High
14. Public Access to Geospatial Data	High	Low
15. Access to Spatially Enabled Documents and Drawings	Medium	High
16. Participation in the ESRI SAP Users Group (ESUG)	Medium	Low
17. Completed Metadata and GIS Data Update Notification	High	Low
18. Formal GIS Training for Public Works Staff	High	Low
19. GIS Access to SAP Financials, Assets, and Work Orders	High	High

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Sheriff - Coroner		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Mapping and Spatial Analysis of Criminal Activity, Incidents, and Accidents (Pin Mapping and Advanced Crime Analysis)	High	Low
2. Department-Wide Access to Geospatial Data	High	Low
3. Field Access to Geospatial Data	High	High
4. Mass Notification System	High	Low
5. Enterprise Access to Digital Pre-plans and Hazardous Material Data	High	High
6. Formal Training for Sheriff Department Staff	High	Low

County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Social Services		
GOALS AND OBJECTIVES:	Priority	Level of Effort
1. Designated Tier 2 Analytical User within the Department for Full Utilization of GIS	Medium	High
2. Desktop GIS Application to Perform Advanced Mapping Functions	High	Low
3. Centralized GIS Environment and Shared ESRI Licensing Structure for the County	High	Medium
4. Geospatial Data Creation and Integration	High	High
5. Mapping and Spatial Analysis of Department Data	High	Low
6. Department - Wide Access to Geospatial Data	High	Low
7. Optimal Routing of Staff Providing In-Home Visits	Low	High
8. Public Access to Geospatial Data	High	Low
9. Formal GIS Training for Department of Social Services Staff	High	Low

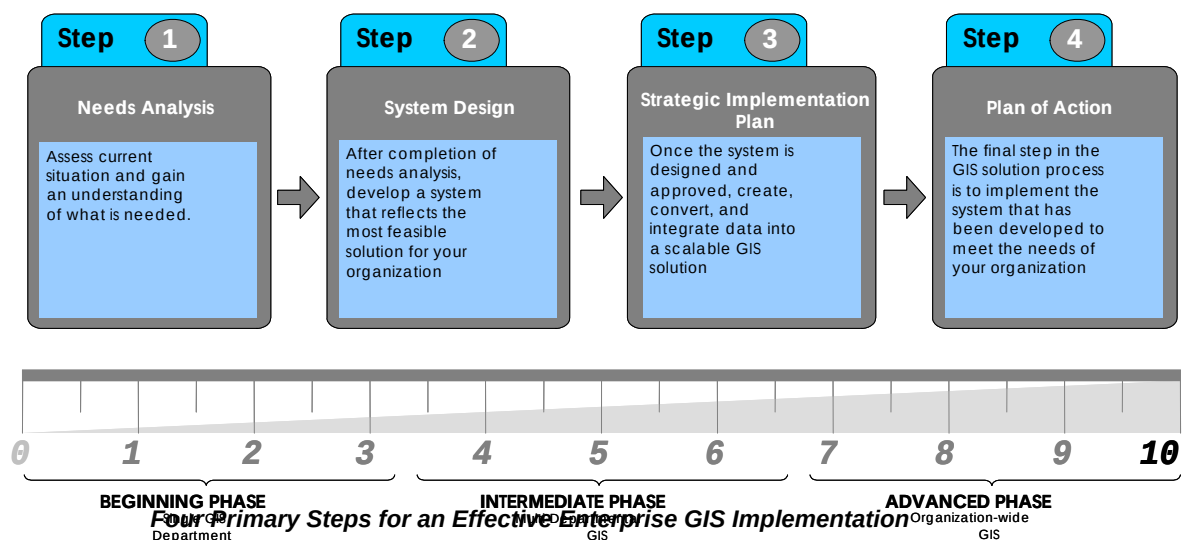
County of San Luis Obispo: DEPARTMENTAL GOALS AND OBJECTIVES		
Treasurer / Tax Collector / Public Administrator		
GOALS AND OBJECTIVES:	<i>Priority</i>	<i>Level of Effort</i>
1. Mapping and Spatial Analysis of Office Data	Medium	Low
2. Department-Wide Access to Geospatial Data	High	Low
3. Public Access to Geospatial Data	Medium	Low
4. Formal GIS Training for Staff	High	Low

Using the Needs Analysis and Implementation Process to Accomplish Further GIS Goals

The execution of a comprehensive and effective GIS Needs Analysis and Implementation Plan provides the County with an excellent apparatus to assist with further meeting its additional short-term and long-term goals. As each goal is accomplished the County can use the same process to achieve the next goal.

There are four (4) primary steps that comprise an effective enterprise GIS implementation. These steps mimic the GIS Needs Analysis and Strategic Implementation Plan process:

1. Needs Analysis
2. System Design
3. Strategic Implementation Plan
4. Plan of Action

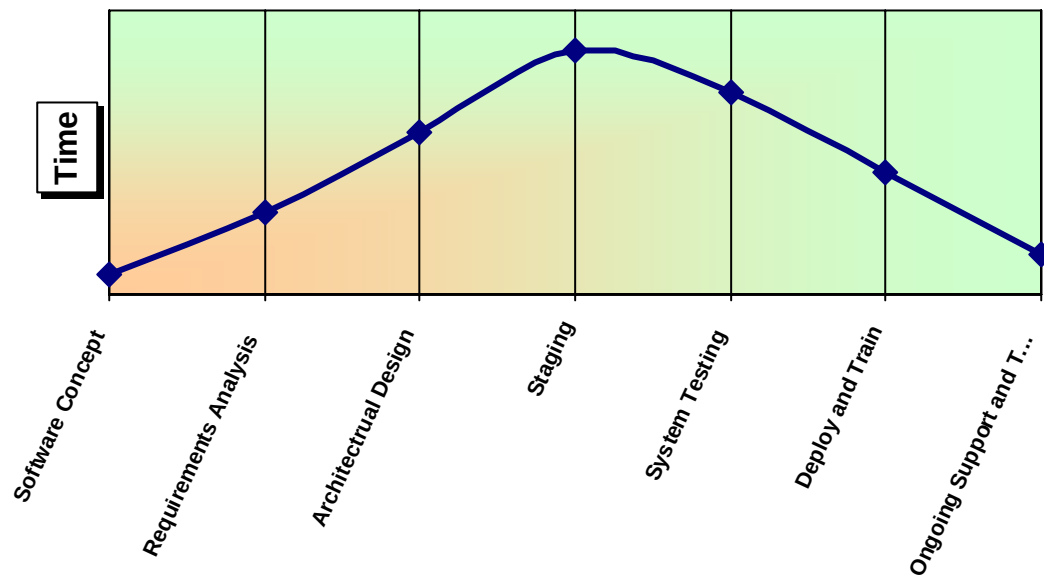


Building on its current GIS implementation, the County is poised to improve its existing GIS by developing goals based on these steps, thereby establishing a foundation for a successful GIS implementation. It is an exciting time for the County, as it follows the recommendations in this GIS Needs Analysis and Strategic Implementation Plan, the County's GIS will eventually become a model of a true enterprise-wide GIS implementation in local/county government.

These steps can be included in a systems development context, such as a system design life cycle (SDLC). SDLC is a systematic approach to problem solving and is made up of several phases, each comprised of multiple steps. A typical SDLC includes:

1. A **software concept phase** that identifies and defines a need for the new system (e.g. Needs Analysis)

2. A **requirements analysis phase** that analyzes the information needs of the end users (e.g. Needs Analysis)
3. The **architectural design phase** and tasks creates a blueprint for the design with the necessary specifications for the hardware, software, people and data resources (e.g. System Design)
4. A **staging phase** involving tasks for configuration, coding, and debugging of the system applications and integration of legacy data for final system testing (e.g. Development and Integration)
5. A **system testing phase** to evaluate the system's actual functionality in relation to expected or intended functionality with additional data development (e.g. Development and Integration)
6. A **deployment and training phase** in which the tested application is rolled out to the end users (e.g. System Implementation)
7. An **ongoing support and maintenance phase** including additional training, help desk hand-off, and system support (e.g. System Implementation)



***The GIS Implementation Curve:
System Design Life Cycle (SDLC) Process***

The County of San Luis Obispo, California



Phase III: GIS Strategic Implementation Plan Five Year Phased Implementation Plan

Chapter 16: Five Year Phased Implementation Plan



Chapter Outline

Introduction

Five Year Implementation Plan Cost

Personnel Cost Implications

Further Cost Considerations

Public Works Data Creation Initiative

Recurring Cost

Funding Mechanisms

Five Year Recommendations

Year One Recommendations

Year Two Recommendations

Year Three Recommendations

Year Four Recommendations

Year Five Recommendations

Five Year Strategic Investment

Optional Three Year Implementation

Cost Summary

Introduction

This chapter defines the necessary costs associated with the tasks and procedures for executing the County's GIS Strategic Implementation Plan. It should be noted that much of the information included in this chapter is condensed and based on the previous chapters in this document:

- Chapter 2: *Departmental GIS Needs Analysis* contains each department's GIS needs and identified an application or method to meet that need.
- Chapter 5: *Organizational Structure and Staffing (Countywide Governance)*, discusses staffing issues as they relate to current and additional recommended staffing.
- Chapter 6: *Gap Analysis*, analysis identified gaps between the current County's GIS efforts and a true enterprise GIS effort.
- Chapter 7: *System Design Strategies*, gives an overview of necessary and recommended hardware and software options as they relate to an enterprise GIS.
- Chapter 8: *GIS Training and Education*, recommends training options and personnel to attend training.
- Chapter 9: *Enterprise Wide Applications*, details Countywide applications to serve the enterprise GIS.
- Chapter 11: *Master Data List*, lists and prioritized data layers that are either existing or recommended to be created.

- Chapter 13: *Base Map Data: Creation and Implementation Strategies*, further breaks down critical data layers that are imperative to the success of the enterprise GIS.
- Chapter 14: *The County's Return on Investment (ROI)*, specifies measureable GIS events and activities that can lead to cost, time, and/or efficiency savings.

It is recommended that these chapters be read and understood in order to have the necessary context for the tasks and procedures outlined in this chapter. The next chapter, Chapter 17: *Plan of Action*, will detail the Five Year costs as prioritized tasks and procedures for each identified department.

Five Year Phased Implementation Plan Costs

Outlined in this chapter are estimated costs that are associated with a five-year phased implementation plan. This five-year phased implementation plan, if implemented, will provide the County with a thorough and sophisticated enterprise-wide GIS, on par with enterprise-wide GIS implementations found in mid-sized counties across the United States. It is expected that the recommended expanded GIS Steering Committee (to include all GIS using departments) will serve as the primary mechanism for determining the priority and sequence for GIS-related tasks and procedures outlined in this chapter. The tasks in this plan represent the recommended level of achievement for a Five Year phased approach.

Cost can be broken down into seven core enterprise activities:

- **Data Layer Development**
 - o Basemap layers(critical importance, to be a priority in Year One)
 - Parcels
 - Street Centerlines
 - Address Points
 - Digital Orthophotography
 - o Associated layers identified in Chapter 11: *Master Data List* (spread throughout the five years of the implementation plan)
- **Hardware** (staggered throughout five years)
 - o Servers
 - o Mobile computers/rugged laptops
 - o Handheld Computers
 - o GPS Units
 - o Kiosks
 - o AVL related hardware
- **Software** (staggered throughout five years)
 - o ESRI-ArcGIS related (ArcGIS Server, GIS data editing and data viewing, and extensions)

- o GIS Intranet Data Browser, based on ArcGIS Server
- o Mobile GIS Data Browser, based on ArcGIS Server
- o GIS Data Integration
- o Automated Vehicle Location (AVL) Software
- o Routing Capabilities
- o GIS Integrated Work Order Management application
- o Crime Incident Analysis Application
- o GIS Link to Document Management System
- o Enterprise Mass Notification System
- o GIS Enable Recreation Management Software
- o Internet Web Portal
- o Economic Development Web Portal
- o Public Kiosk
- **Maintenance**
 - o Yearly Software Maintenance
- **Training and Education** (staggered throughout five years)
 - o Software Related
 - o Set-up and Installation of all Applications
- **Personnel** (staggered throughout five years)
 - o Recommended GIS Staffing to Supplement Current GIS Personnel
- **GIS Consulting** (staggered throughout five years)
 - o Onsite Services to Assist with Implementation
 - o Yearly Updates to the Plan

Personnel Cost Implications (for recommended additional staff)

Perhaps the most critical component to any successful local government GIS implementation is its people. Without trained, educated, and experienced GIS staff positioned in high-impact departments, the remaining components to an enterprise-wide GIS like data development, geodatabase design and maintenance, and hardware/software simply disintegrate. Throughout the Needs Analysis and Conceptual System Design portions of this document, recommendations for additional staffing for GIS personnel were cited in multiple County departments. The need for these positions has been identified in departments that do not have either full-time specific dedicated staff, or rely on part-time/split duty staff to perform functional GIS duties within that department. This supplementary staffing is in addition to the existing Tier 1 and Tier 2 users performing GIS duties throughout the organization.

In each year of the Implementation Plan it is recommended that the County staff additional GIS specific positions to create and maintain the various infrastructure data layers in their respective departments, and to

coordinate and administer the County's enterprise GIS. These positions are critical to the success of the GIS implementation. For each identified position, dollar figures are *estimated* and based on information received from the County. Actual figures for hiring purposes may yield different results depending on employee credentials, years of experience and other factors. These identified positions (as found in each department's Needs Analysis - titles are for reference purposes only to reflect continuity throughout this document) are as follows:

- o **GIS Coordinator:**
 - Total fiscal impact of \$150,000 per year, including benefits
 - **Recommended for staffing in Year One**

- o **GIS Data Base Analyst:**
 - Total fiscal impact of \$120,000 per year
 - Model Recommendation (viewed as needed, but optional)
 - **ITD – Year Two**

- o **GIS Analyst:**
 - Total fiscal impact:
 - Step I - \$89,000 per year
 - Supervisor responsibilities - \$106,000
 - **Recommended for staffing, Public Works - Year One**
 - Model Recommendation (viewed as needed, but optional) :
 - Social Services - **Year Three**
 - **ITD - Year Four**

- o **GIS Technician:**
 - Total fiscal impact of \$77,000 per position
 - Model Recommendation (viewed as needed, but optional):
 - Public Works - **Year Two**
 - General Services – **Year Three**
 - Social Services – **Year Four**
 - Public Works, Clerk-Recorder, General Services, District Attorney, Probation - **Year Five**

Staffing these positions can be addressed in **one of three (3) ways** (additional information can be found in Chapter 5: *Organizational Structure and Staffing (Countywide Governance Model)*):

1. *Create new positions and hire qualified personnel*

Most departments will be able to utilize existing staff to meet their GIS needs. However, as highlighted above, GTG recommends hiring two (2) new positions within the scope of the Five Year Implementation Plan (GIS Coordinator, and GIS Analyst in Public Works). If additional funds become available, it would be strongly recommended to also create the additional positions that are outlined as “Model Recommendations” above.

2. *Realign existing personnel’s roles and responsibilities into a more specific GIS position*

Another possible model for the creation of the recommended additional positions is to realign existing staff to perform the recommended GIS duties on a full-time basis. These positions could be department staff not functioning in a current GIS role (based on knowledge, skills, and abilities). GTG recommends that the “Model Recommendation” positions be filled by a combination of this option and/or option three below. Considerations for this option:

- o Move part-time/split duty staff to full-time
- o Previous job duties would need to be assigned to other, existing staff
- o Minimum to little fiscal impact

3. *Assign GIS duties to existing staff, along with current workload*

In theory, some of these positions could be staffed by existing staff. The best scenario for this option would be to use part-time GIS staff to perform the necessary task until resources could be made available for full-time staff. Considerations for this option:

- o Workload would be dramatically impacted
- o No fiscal impact

Further Cost Considerations

Public Works Data Creation Initiative

Continued data collection of Public Works data is not reflected in the Five Year Implementation cost. A Public Works data creation initiative could either be done in-house, outsourced, or through a combination of both methods. This task should be initiated and coordinated by the Year One recommended GIS Analyst in Public Works and the actual data collection effort be augmented by the Year Two and Three GIS Technicians for Public Works. It is imperative that an internal Public Works data collection initiative move forward as soon as feasible. It is recommended that this effort begin early in Year Two.

Public Works should seek a way to fund the data collection initiative. Enterprise funds and/or a Capital Improvements Project (CIP) are funding alternatives. It is recommended that the collection of data not occur over multiple years. Based on lessons learned by other counties, data collection projects that are handled by in-house staff over a long period of time lose momentum and fail before completion. The optimal solution is for internal staff to collect data sets that are manageable given limited time and resources. Data layers that should be captured by in-house staff are ones that can be completed in a reasonable time period (less than a year).

Major data sets should be outsourced to an Engineering/Consulting firm that can complete the assigned project within a year. A fully out-sourced collection of these systems could feasibly cost from \$500,000 to \$1,500,000 based on amount of data collected and level of accuracy. Of critical importance, is the implementation of a work order management system (recommended in Year Two) that will allow the County to track and update system changes as they occur in the field.

Recurring Costs

After the fifth year of implementation, the County should expect to budget **approximately \$50,000 - \$75,000** a year for the maintenance of software licenses. Hardware should be replaced in accordance with the County's replacement policy. Personnel costs should also be budgeted in subsequent years, at a minimum \$239,000 for just the GIS Coordinator up to \$1,230,000 for full staffing of additional recommended positions.

Funding Mechanisms

There are multiple funding mechanisms the County can explore as alternative funding sources for these identified GIS initiatives, in whole or part. Funding options can be broken down into two major types; fee-based and grant-based. Fee-based funds are the most stable source of funding and enable program managers to establish budgets and plan for normal operations and initiatives. Grant-based funds can fund large or special projects, usually on a one-time basis.

Fee Options

The County has many opportunities to apply small fees to transactions that require GIS support. In this way the fees charged would be ear-marked for systems required to maintain and enhance the service level. Building and Development Permit Fees are good examples of County services that utilize GIS products as part of the business workflow. The fee structure does not have to be exorbitant to be an effective funding source. For example, a \$15 recording fee or \$10 building permit fee can supply significant level of funds over time.

Land development fees should be explored for funding. A developer can typically pay tens of thousands of dollars in fees to permit and plat a development project. A subdivision or platting fee could be an effective funding source. For example, the Assessor's Office currently charges a fee to create new Assessor's parcels. If an additional \$20 fixed fee were charged at this time and earmarked for GIS data development, an estimated \$25,000 per year could be realized based on 1250 new parcels per year (the number of new subdivision parcels created in the 2006-07 fiscal year). This is win-win for the County and for the land developers as both would realize benefits from the use of more accurate and reliable GIS data.

Grant Options

Numerous federal programs could provide funds for specific GIS projects, such as:

- Street Centerlines Creation, Development, and Maintenance
- Address Point Creation and Maintenance
- Parcel Layer Development as a Component of both Address Points and Street Centerlines
- More Frequently Obtained Aerial Orthophotography
- Software Purchases that relate to GIS Development (ArcGIS, Intranet GIS Data Browser)
- Public Safety Software Applications
- Development of Data Layers that Direct Benefit Public Safety Personnel

The following lists some federal agencies and organizations that offer grant-based funds.

U. S. Department of Homeland Security:

Homeland Security Grant Program - Enhances the ability of State, local and tribal governments to prepare, prevent, and respond to terrorist attacks and other disasters. The Homeland Security Grant Program (HSGP) is comprised of five separate grant programs:

- Urban Areas Security Initiative (UASI)
- State Homeland Security Program (SHSP)
- Law Enforcement Terrorism Prevention Program (LETPP)
- Metropolitan Medical Response System (MMRS)
- Citizen Corps Program (CCP)

Together, these grants fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and

administration costs. HSGP programs support objectives outlined in the National Preparedness Guidelines and related national preparedness doctrine, such as the National Incident Management System, National Response Plan, and the National Infrastructure Protection Plan.

Funding from this source includes a commitment to risk-based funding and assists with regional planning and security coordination. The County should pursue funding from the Homeland Security Grant Program as well as other California transportation related and health related grant sources to advance its GIS program.

Federal Geographic Data Committee offers three funding options:

- 1) Cooperative agreements for projects that will establish clearinghouses to find and access geospatial data, develop standards related to geographic data, implement educational programs to increase awareness and understanding of the National Spatial Data Infrastructure, and build or strengthen relationships among organizations to support digital geographic data coordination.
- 2) Framework demonstration projects that support efforts to implement and test the data, technology, and organizational aspects of the framework.
- 3) Consortia propose projects in which their members work together to produce, maintain, and disseminate framework data needed for national, regional, state, and local analyses.

The National Spatial Data Infrastructure (NSDI) Benefits program funds cooperative projects that assess the impact of inter-organizational cooperation and data sharing to address important issues or solve problems over a particular geographic area. Projects may focus on environmental, economic, social, or cultural problems.

Technology Opportunity Program (TOP)

National Telecommunications and Information Administration (NTIA) provides matching grants for projects that improve the quality of, and the public's access to, education, health care, public safety, and other community-based services. Grants are used to purchase equipment for connection to networks, including computers, video conferencing systems, network routers, and telephones; to buy software for organizing and processing all kinds of information, including computer graphics and databases; to train staff, users, and others in the use of equipment and software; to

purchase communications services, such as Internet access; to evaluate the projects; and to disseminate the project's findings.

Environmental Protection Agency

EPA's State, Local and Tribal Projects section includes programs that provide support for open space preservation, parks creation; Brownfield clean up, water quality improvement, environmental protection, and pollution prevention. The Agency also offers funding opportunities related to specific geographic regions, as well as environmental management, financing, and technology.

Five Year Recommendations

Each year of the Strategic Implementation Plan is outlined below. Based on experience and identified issues currently facing the County, GTG has established a cost for each GIS related task. These associated costs reflect a mix of high, medium, and/or low cost options. Chapter 17: *Plan of Action* will identify these cost options and afford County staff an opportunity to reflect on alternatives (this chapter will also include a prioritization of tasks, phased timetable and more).

YEAR ONE RECOMMENDATIONS:

Enterprise-Wide Deployment, Data Maintenance and Creation, and Enterprise Database Design and Development Phase

Year One will be focused on continued groundbreaking data development efforts, as well as the development and acquisition of enterprise-wide GIS applications. A priority for Year One is the creation and/or continued maintenance of three critical base layers – Parcels, Street Centerlines, and Address Points. The County will also begin to develop the foundation for a geodatabase by commencing on a logical and physical database design, which will be used for an enterprise geodatabase (as one County employee put it, a “single, inclusive and authoritative source for information”). The primary objective for Year One is to gain several “quick successes” in terms of application implementation, data development and integration, data maintenance procedures, and training. Year One will be pivotal in terms of providing GIS access across the enterprise through an ArcGIS Server based GIS Intranet Data Browser. It is important to note that these recommendations are predicated on a GIS Coordinator being staffed during the first year of this project.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 1 - Data Layer Development				
Critical Data Layer Creation/Maintenance <i>Parcel Layer</i>	\$184,000	Assessor	Data from Barclay, then Selected Consultant	Purchase Barclay data in Year 1; develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment, \$352,000.
Critical Data Layer Creation/Maintenance <i>Street Centerlines</i>	\$25,000	GIS Coordinator for Enterprise	Selected Consultant	Outsource development, over 3 yr period. 3 year investment, \$75,000.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Critical Data Layer Creation/Maintenance <i>Address Points</i>	\$25,000	Planning & Building, in coordination with GIS Coordinator	Selected Consultant	Combination of in-house (75%) and outsourced (25%) – if needed. Work underway for the LUCA Census Address Update project. Completed by the end of Year 2.
Critical Data Layer Creation/Maintenance <i>Digital Ortho-photography</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Replace in Year 4
Data Layer Creation Prioritization from <i>Master Data List</i>	\$75,000	Enterprise	Selected Consultant / In house	Combination of in-house (75%) and outsourced (25%) development of recommended layers. Higher amount in Year to create bulk of important high prioritized layers. Spread evenly over Year 2 through 5. Public Works layers should be considered in separate initiative, beginning in Year Two. 5 year investment, \$225,000.
Data Subtotal:	\$309,000			
Core Activity 2 - Hardware				
Enterprise GIS Servers	\$18,000	Enterprise	Existing ITD hardware	2 ArcGIS Servers and DBMS server
GPS units with Software, X 2	\$8,600	Enterprise	Selected Hardware Vendor	Data collection and maintenance - supplement to current inventory
Hardware Subtotal:	\$26,600			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 3 - Software				
ArcGIS Server Standard Edition Enterprise Level	\$30,000	GIS Division in ITD	ESRI	Standard -6 core configuration, used with 3 server config and no MDB. List price only, price will come directly from ESRI.
Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	\$55,000	Enterprise	ESRI	10 single use to 10 concurrent upgrades. List price only, price will come directly from ESRI.
ArcInfo Concurrent License	\$14,000	GIS Coordinator in ITD	ESRI	New License
ArcGIS Server GIS Intranet Data Browser	\$12,500	Enterprise: Estimated 230 simultaneous Tier 3 – Browser GIS Users	Selected Consultant	Configurations will be deployed across multiple departments. Implement over 2 year timeframe
GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	\$6,500	Enterprise	Selected Consultant	Database mining application, set-up and training for 3 databases (see Training and Education section)
Software Subtotal:	\$118,000			
Core Activity 4 - Maintenance				
Maintenance on Existing Software	\$0	Enterprise	Various	This schedule assumes that existing software is being maintained and budgeted at this time. Full documentation on maintenance begins in Year Two of this plan.
Maintenance Subtotal:	\$0			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 5 - Training and Education				
Introduction to ArcGIS I – onsite in SLO	\$5,000	Selected Tier 1 and Tier 2 users	ESRI Certified Trainer	Up to 10 users, onsite in SLO. Remaining users in Year 2. Expenses not included.
Introduction to ArcGIS II – onsite in SLO	\$7,500	Initial Arc Editor users	ESRI Certified Trainer	Up to 10 users, onsite in SLO. Remaining users in Year 2. Expenses not included.
Building Geodatabases I	\$2,700	GIS Coordinator, and one Tier 1 user	ESRI	Cost does not include travel and per diem.
Building Geodatabases II	\$1,800	GIS Coordinator, and one Tier 1 user	ESRI	Cost does not include travel and per diem.
Introduction to ArcGIS Server	\$900	GIS Coordinator	ESRI	Cost does not include travel and per diem.
ArcGIS Server Enterprise and Tuning for SQL Server	\$900	GIS Coordinator	ESRI	Cost does not include travel and per diem.
Creating and Maintaining Metadata Using ArcEditor 9.x	\$78	GIS Coordinator	ESRI (web-based)	ESRI web-based training course
Data Production and Editing Techniques	\$1,470	GIS Coordinator	ESRI (web-based)	ESRI web-based training course
Geoprocessing with ArcGIS Desktop	\$104	GIS Coordinator	ESRI (web-based)	ESRI web-based training course

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
ArcGIS Server Intranet Data Browser Solution Setup	\$3,600	Enterprise	Selected Consultant	This should include on-site training. A department specific setup should be created for each department. Training should be provided to each department over a two year period. Administrative training will be conducted separately. Travel and per diem will be billed separate.
ArcGIS Server Intranet Data Browser Solution Training	\$6,000	Enterprise	Selected Consultant	5 days of department specific training
Training and Set-up for GIS Data Creation and Integration Application	\$2,400	Enterprise	Selected Consultant	1 database, 2 days of training (possibly SAP). Travel and per diem will be billed separate.
Training and Education Subtotal:	\$32,452			
Core Activity 6 - Personnel				
Year One Staffing	\$239,000	ITD, Public Works	General Budget	GIS Coordinator, and 1 GIS Analyst in PW, includes burden rate.
Personnel Subtotal:	\$239,000			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 7 - GIS Consulting				
On-site Consulting Technical Services	\$10,000	Enterprise	Selected Consultant	Setup of ArcGIS Server and miscellaneous technical needs. Used on as needed basis.
Physical and Logical Database Design	\$25,000	Enterprise	Selected Consultant	On-site interviews and setup for logical and physical database design for critical base map GIS layers.
Consulting Subtotal:	\$35,000			
Year One Total without Staffing:	\$521,052	Year One Total with Staffing Cost Included:		\$760,052

YEAR TWO RECOMMENDATIONS:

Continued Enterprise-Wide Deployment, and Database Development Phase

Year Two will be focused on continuing development/acquisition of GIS data and integration of recently developed (and acquired) geo-spatial data. By Year Two, most, if not all, relevant County personnel will have access to critical base map layers and other pre-existing County data through an ArcGIS Server based GIS Intranet Data Browser application. The County will have the opportunity to develop a geodatabase by leveraging the database design from Year One; however, it should be noted that the County's GIS data management and maintenance may also evolve to encompass other data management structures that are complementary to a geodatabase. Year Two will also include additional training and education for both technical and non-technical staff.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 1 - Data Layer Development				
Critical Data Layer Creation/Maintenance <i>Parcel Layer</i>	\$84,000	Assessor	Data from Barclay, then Selected Consultant	Purchase Barclay data in Year 1, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.
Critical Data Layer Creation/Maintenance <i>Street Centerlines</i>	\$25,000	GIS Coordinator for Enterprise	Selected Consultant	Outsource development, over 3 yr period. 3 year investment, \$75,000.
Critical Data Layer Creation/Maintenance <i>Address Points</i>	\$25,000	Planning & Building, in coordination with GIS Coordinator	Selected Consultant	Combination of in-house (75%) and outsourced (25%) – if needed. Work underway for the LUCA Census Address Update project. Completed by the end of Year 2.
Critical Data Layer Creation/Maintenance <i>Digital Ortho-photography</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Replace in Year 4

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Data Layer Creation Prioritization from <i>Master Data List</i>	\$37,500	Enterprise	Selected Consultant / In house	Combination of in-house (75%) and outsourced (25%) development of recommended layers. Spread evenly over Year 2 through 5. Creation of Public Works layers should be considered in separate initiative, and started early in Year Two. 5 year investment, \$225,000
Data Subtotal:	\$171,500			
Core Activity 2 - Hardware				
Enterprise GIS Servers	\$0	Enterprise	Existing ITD hardware	3 Servers purchased in Year 1
Hardware Subtotal:	\$0			
Core Activity 3 - Software				
ArcGIS Server Standard Edition Enterprise Level	\$0	GIS Division in ITD	ESRI	Upgrade to Advanced in Year 3.
Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	\$55,000	Enterprise	ESRI	Add additional 10 concurrent users. List price only, price will come directly from ESRI. Year 1 and 2 combined net result is 20 concurrent licenses to be used by enterprise Tier 1 and 2 users.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Upgrade ArcPad 6 to 7	\$400	Public Works	ESRI	Enables data collections in the field on GPS hand held devices
ArcInfo Concurrent License	\$14,000	Enterprise	ESRI	1 concurrent license to be used mainly in ITD. List price only, price will come directly from ESRI.
ArcGIS Server GIS Intranet Data Browser	\$12,500	Enterprise	Selected Software Vendor	Implement enterprise wide over 2 year timeframe. At end of Year 2 all Tier 3 users should have access to GIS data.
Software Subtotal:	\$81,900			
Core Activity 4 - Maintenance				
ESRI Software Licenses	\$19,800	Enterprise	Various	Maintenance based on 20% of purchase fee. Official price will need to come from ESRI.
ArcGIS Server Intranet GIS Data Browser	\$2,500	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	\$1,300	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
Maintenance Subtotal:	\$23,600			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 5 - Training and Education				
Introduction to ArcGIS I – onsite in SLO	\$5,000	Selected Tier 1 and Tier 2 users	ESRI Certified Trainer	Up to 10 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.
Introduction to ArcGIS II – onsite in SLO	\$7,500	Various	ESRI Certified Trainer	Up to 10 students.
Building Geodatabases I	\$2,700	Various	ESRI	2 additional Tier 1 users. Does not include travel expenses.
Building Geodatabases II	\$1,800	Various	ESRI	2 additional Tier 1 users. Does not include travel expenses.
Introduction to ArcGIS Server	\$900	Various	ESRI	1 additional Tier 1 user. Does not include travel expenses.
ArcGIS Server Intranet GIS Data Browser Solution, Training	\$0	Enterprise	GIS Coordinator	GIS Coordinator to configure and train. Enterprise training over 3 years.
Training and Set-up for GIS Data Creation and Integration Application	\$2,400	Enterprise	Selected Consultant	1 database, 2 days of training. Does not include travel expenses.
Training and Education Subtotal:	\$20,300			
Core Activity 6 - Personnel				
Year Two Staffing	\$239,000	ITD	General Budget	Utilize existing System Administrators to accomplish DBA duties. Carry over cost from recommended Year 1 positions.
Personnel Subtotal:	\$239,000			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 7 - GIS Consulting				
On-site Consulting Technical Services	\$10,000	Enterprise	Selected Consultant	Miscellaneous technical needs. On an as needed basis.
Update to the Plan	\$0	Enterprise	In-house review	No formal review of Plan.
Consulting Subtotal:	\$10,000			
Year Two Total without Staffing:	\$307,300	Year Two Total with Staffing Cost Included:		\$546,300

YEAR THREE RECOMMENDATIONS:

Data Access and Sharing Phase

Year Three will revolve around continued data sharing throughout the organization and maintenance of the County's existing investment. At this point in the implementation, departments should be utilizing the GIS for sophisticated analysis; in addition, mobile access to GIS will be established in a pilot program of 10 mobile units, either in one department or shared with various departments. These mobile units will be viewing the same data as in-office users, via an interface to the GIS Intranet Data Browser application.

By Year Three the GIS Intranet Data Browser application should become another resource that employees rely on, much like a word processor or spreadsheet program. The County's critical data layers (parcels, street centerlines, and address points) should be virtually completed by the end of the year. The County will have marked success in its GIS implementation and it will be primed to move forward with increasingly sophisticated technology, resources, and knowledge. :

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 1 - Data Layer Development				
Critical Data Layer Creation/Maintenance <i>Parcel Layer</i>	\$84,000	Assessor	Data from Barclay, then Selected Consultant	Purchase Barclay data in Year 1; develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.
Critical Data Layer Creation/Maintenance <i>Street Centerlines</i>	\$25,000	GIS Coordinator for Enterprise	Selected Consultant	Outsource development, over 3 yr period. 3 year investment, \$75,000.
Critical Data Layer Creation/Maintenance <i>Address Points</i>	\$0	Planning & Building, in coordination with GIS Coordinator	Selected Consultant	Completed in Year 2.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Critical Data Layer Creation/Maintenance <i>Digital Ortho-photography</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Replace in Year 4
Data Layer Creation Prioritization from <i>Master Data List</i>	\$37,500	Enterprise	Selected Consultant / In house	Combination of in-house (75%) and outsourced (25%) development of recommended layers. Spread evenly over Year 2 through 5. Creation of Public Works layers should be considered in separate initiative, and should be well under way by Year 3. 5 year investment, \$225,000
Data Subtotal:	\$146,500			
Core Activity 2 - Hardware				
Field Tablets/Laptops	\$12,500	Enterprise	Selected Hardware Vendor	10 non-rugged laptops, shared between various departments in pilot program
Hardware Subtotal:	\$12,500			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 3 - Software				
Upgrade to ArcGIS Server Advanced Enterprise Level	\$30,000	Enterprise	ESRI	To use with MDB. List price only, price will come directly from ESRI. More than likely price will be much less based on other ESRI upgrades.
Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	\$55,000	Enterprise	ESRI	Add additional 10 concurrent users. List price only, price will come directly from ESRI. Year 1, 2 and 3 combined net result is 30 concurrent licenses to be used by enterprise Tier 1 and 2 users.
ArcGIS Server GIS Intranet Data Browser	\$0	Enterprise	Selected Software Vendor	Implemented in Year 2.
ArcGIS Server Mobile GIS Data Browser	\$8,000	Enterprise	Selected Consultant	10 users in pilot program. Uses ArcGIS Server Advanced.
GIS Link to Document Management System	\$0	Enterprise	In-house development	Viewing of scanned documents via GIS interface.
Software Subtotal:	\$93,000			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 4 - Maintenance				
ESRI Software Licenses	\$33,680	Enterprise	Various	Year 3 maintenance, based on 20% of purchase fee. Official price will need to come from ESRI.
ArcGIS Server Intranet GIS Data Browser	\$2,500	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	\$1,300	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
Maintenance Subtotal:	\$37,480			
Core Activity 5 - Training and Education				
ArcGIS Server Intranet GIS Data Browser Solution, Training	\$0	Enterprise	GIS Coordinator	GIS Coordinator to configure and train. Enterprise training over 3 years.
Training and Set-up for GIS Data Creation and Integration Application	\$2,400	Enterprise	Selected Consultant	1 database, 2 days of training. Does not include travel expenses.
ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	\$3,600	Enterprise	In-house	Year 2 users and administrators, will train subsequent users in Years 3-5.
GIS Link to Document Management System, Set-up and Training	\$0	Enterprise	In-house	Developed and trained in-house
Training and Education Subtotal:	\$6,000			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 6 - Personnel				
Year Three Staffing	\$239,000	ITD	General Budget	Reassign existing staff to perform Year 3 job responsibilities. Plus carry over cost.
Personnel Subtotal:	\$239,000			
Core Activity 7 - GIS Consulting				
On-site Consulting Technical Services	\$10,000	Enterprise	Selected Consultant	Miscellaneous technical needs. On an as needed basis.
Update to the Plan	\$0	Enterprise	In-house review	No formal review of Plan.
Consulting Subtotal:	\$10,000			
Year Three Total without Staffing:	\$305,480	Year Three Total with Staffing Cost Included:		\$544,480

YEAR FOUR RECOMMENDATIONS:

Application Development, Expanded Data Access, and Public Access Phase

This phase focuses on the implementation of advanced applications that facilitate data acquisition, sharing, and updating between the County departments and external entities. By the completion of this implementation phase the enterprise GIS should be considered a comprehensive source for spatial data and information for the County of San Luis Obispo. Now that the majority of GIS data has been developed and deployed Year Four will focus on the development of major GIS-centric applications centered on the GIS Intranet Data Browser, leveraging the County's investment to this point. In addition to the intranet, Internet users (e.g. Citizens) will have access to more accurate and timely data. An Internet GIS website will be developed so that Citizens can take advantage of the City's investment in GIS.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 1 - Data Layer Development				
Critical Data Layer Creation/Maintenance <i>Parcel Layer</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Completed in Years 1 – 3 at a total cost of \$352,000
Critical Data Layer Creation/Maintenance <i>Street Centerline</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Completed in Years 1 – 3 at a total cost of \$75,000
Critical Data Layer Creation/Maintenance <i>Address Points</i>	\$0	Planning & Building, in coordination with GIS Coordinator	Selected Consultant	Completed in Year 2 at a total cost of \$25,000.
Critical Data Layer Creation/Maintenance <i>Digital Ortho-photography</i>	\$100,000	GIS Coordinator for Enterprise	Selected Consultant	Replace 2007 layer
Data Layer Creation Prioritization from <i>Master Data List</i>	\$37,500	Enterprise	Selected Consultant / In house	Combination of in-house (75%) and outsourced (25%) development of recommended layers. Spread evenly over Year 2 through 5. Public Works layers should be nearing end of completion. 5 year investment, \$225,000
Data Subtotal:	\$137,500			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 2 - Hardware				
Field Tablets/Laptops	\$12,500	Enterprise	Selected Hardware Vendor	Additional 10 non-rugged laptops, shared between various departments in pilot program.
Hardware Subtotal:	\$12,500			
Core Activity 3 - Software				
ArcGIS Server Mobile GIS Data Browser	\$8,000	Enterprise	Selected Consultant	10 users in pilot program. Uses ArcGIS Server Advanced.
Crime Incident Analysis Application	\$25,000	Sheriff	Selected Software Vendor	Crime PIN mapping and analysis
Public Internet Site Portal	\$10,000	Enterprise	Selected Software Vendor	1 targeted site, GIS Coordinator to set-up remainder
Work Order Management System Application	\$50,000	Public Works, General Services	Selected Software Vendor	Will allow for field editing and tracking of all open work orders via Integration to SAP and GIS. Should come after development of Public Works data layers.
Software Subtotal:	\$93,000			
Core Activity 4 - Maintenance				
ESRI Software Licenses	\$50,680	Enterprise	Various	Year 4 maintenance, based on 20% of purchase fee. Official price will need to come from ESRI.
ArcGIS Server Intranet GIS Data Browser	\$2,000	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	\$1,300	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
ArcGIS Server Mobile GIS Data Browser	\$1,600	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
Maintenance Subtotal:	\$55,580			
Core Activity 5 - Training and Education				
Training and Set-up for GIS Data Creation and Integration Application	\$2,400	Enterprise	Selected Consultant	1 database, 2 days of training. Does not include travel expenses.
ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	\$0	Enterprise	In-house	In-house training from Year 2/3 users and administrators.
Crime Incident Analysis Application, Setup and Training	\$3,600	Sheriff	Selected Software Vendor	Three days of set-up and training. Travel and per diem will be billed separate.
Public Internet Site Portal Development Set-up and Training	\$3,600	Enterprise	Selected Software Vendor	Three days of set-up and training for administrator of site. Travel and per diem will be billed separate.
Work Order Management System Application Set-up and Training	\$3,600	Enterprise	Selected Consultant	On site, 3 days. Does not include travel expenses.
Training and Education Subtotal:	\$13,200			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 6 - Personnel				
Year Four Staffing	\$239,000	ITD	General Budget	Reassign existing staff to perform Year 4 job responsibilities. Plus carry over cost.
Personnel Subtotal:	\$239,000			
Core Activity 7 - GIS Consulting				
On-site Consulting Technical Services	\$10,000	Enterprise	Selected Consultant	Miscellaneous technical needs. On an as needed basis.
Update to the Plan	\$0	Enterprise	In-house review	No formal review of Plan.
Consulting Subtotal:	\$10,000			
Year Four Total without Staffing:	\$321,780	Year Four Total with Staffing Cost Included:		\$560,780

YEAR FIVE RECOMMENDATIONS:

Continued Application Development, Expanded Public Data Access, and Maintenance Phase

At this point in the Plan, departments should be utilizing the GIS for data collection, analysis, and decision support. This phase expands these efforts and provides additional tools to the mobile workforce, a custom Property Tax Data System to the Assessor's Office and an Enterprise Mass Notification System. These advanced applications will be that much more effective due to critical and base map layers being completed by Year Five. In addition to the Internet application developed in Year Four, Citizens will now have access to data at key County locations via public kiosks. Beyond Year Five the County should update the plan to reflect changing priorities and technologies that are present at that time.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 1 - Data Layer Development				
Critical Data Layer Creation/Maintenance <i>Parcel Layer</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Completed in Years 1 – 3 at a total cost of \$352,000
Critical Data Layer Creation/Maintenance <i>Street Centerline</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Completed in Years 1 – 3 at a total cost of \$75,000
Critical Data Layer Creation/Maintenance <i>Address Points</i>	\$0	Planning & Building, in coordination with GIS Coordinator	Selected Consultant	Completed in Year 2 at a total cost of \$25,000.
Critical Data Layer Creation/Maintenance <i>Digital Ortho-photography</i>	\$0	GIS Coordinator for Enterprise	Selected Consultant	Replaced in Year 4, should be replaced every two years, at minimum.
Data Layer Creation Prioritization from <i>Master Data List</i>	\$37,500	Enterprise	Selected Consultant / In house	Combination of in-house (75%) and outsourced (25%) development of recommended layers. Spread evenly over Year 2 through 5. Both MDL layers and Public Works layers should be completed and in maintenance phase by the end of Year 5. 5 year investment, \$225,000
Data Subtotal:	\$37,500			

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Core Activity 2 - Hardware				
Field Tablets/Laptops	\$12,500	Enterprise	Selected Hardware Vendor	Additional 10 non-rugged laptops, shared between various departments in pilot program.
Touch Screen Hardware	\$6,000	Multiple County Buildings	Selected Hardware Vendor	Used for public access to data via kiosk
Hardware Subtotal:	\$18,500			
Core Activity 3 - Software				
ESRI Tracking Analyst	\$2,500	Enterprise	ESRI	1 concurrent license for enterprise use. List price only, price will come directly from ESRI.
ESRI Network Analyst	\$2,500	Enterprise	ESRI	1 concurrent license for enterprise use. List price only, price will come directly from ESRI.
MapLogic's Layout Manager ArcGIS Extension	\$2,100	Enterprise	MapLogic	1 concurrent license for enterprise use. List price only, price will come directly from MapLogic.
ArcGIS Server GIS Mobile Data Browser	\$8,000	Enterprise	Selected Consultant	10 additional users, upgrade to Enterprise version in Year 6
Automated Vehicle Location (AVL) Software	\$12,500	Enterprise	Selected Consultant	Enterprise license used with Intranet GIS Data Browser. Vehicle hardware not include in Plan, budgeted by department.
Routing Module to AVL Software	\$4,000	Probation, Public Works, Social Services	Selected Software Vendor	Routing Module incorporated into Mobile GIS Data Browser Application

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Touch Screen GIS Application	\$8,000	Enterprise	Selected Software Vendor	3 Public Kiosks. Used for public access to data.
GIS Enabled Recreation Management Software	\$10,000	General Services	Selected Software Vendor	GIS component to full recreation management software application, full application should be budgeted in General Services budget.
Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser	\$50,000	Assessor	Selected Software Vendor	GIS component to full property tax data system software application, full application should be budgeted in Assessor's budget..
Mass Notification System Software	\$30,000	Enterprise	Selected Software Vendor	Used for emergency call outs (reverse 911).
Software Subtotal:	\$129,600			
Core Activity 4 - Maintenance				
ESRI Software Licenses	\$50,680	Enterprise	Various	Year 5 maintenance, based on 20% of purchase fee. Official price will need to come from ESRI.
ArcGIS Server Intranet GIS Data Browser	\$2,000	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	\$1,300	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.
ArcGIS Server Mobile GIS Data Browser	\$1,600	Enterprise	Selected Consultant	Maintenance based on 20% of purchase fee.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Public Internet Site Portal	\$2,000	Enterprise	Selected Software Vendor	Maintenance based on 20% of purchase fee.
Work Order Management System Application	\$10,000	Enterprise	Selected Software Vendor	Maintenance based on 20% of purchase fee.
Crime Incident Analysis Application	\$5,000	Sheriff	Selected Software Vendor	Maintenance based on 20% of purchase fee.
Maintenance Subtotal:	\$72,580			
Core Activity 5 - Training and Education				
ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	\$0	Enterprise	In-house	In-house training from Year 2/3/4 users and administrators.
AVL Software Setup and Training	\$1,200	Enterprise	Selected Software Vendor	One day of user and administration setup and training. Travel and per diem will be billed separate.
Routing Module Software Setup and Training	\$1,200	Enterprise	Selected Software Vendor	One day of end user training. Travel and per diem will be billed separate.
Touch Screen GIS Application Setup and Training	\$3,600	Enterprise	Selected Software Vendor	Three days of setup and training for the administrator. Travel and per diem will be billed separate.
GIS Enabled Recreation Management Software	\$1,200	General Services	Selected Software Vendor	One day of setup and training for the administrator. Travel and per diem will be billed separate.
Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser	\$2,400	Assessor	Selected Software Vendor	Two day of setup and training for the administrator. Travel and per diem will be billed separate.

Task Description	GIS Project Cost	Department(s) of Deployment	Purchased From	Notes
Mass Notification System Software	\$1,200	Enterprise	Selected Software Vendor	One day of setup and training for the administrator. Travel and per diem will be billed separate.
Training and Education Subtotal:	\$10,800			
Core Activity 6 - Personnel				
Year Five Staffing	\$239,000	ITD	General Budget	Reassign existing staff to perform Year 5 job responsibilities. Plus carry over cost.
Personnel Subtotal:	\$239,000			
Core Activity 7 - GIS Consulting				
On-site Consulting Technical Services	\$10,000	Enterprise	Selected Consultant	Miscellaneous technical needs. On an as needed basis.
Update to the Plan	\$9,000	Enterprise	Selected Consultant	Previous years completed in-house, year 5 will be needed to reflect changing priorities and technologies.
Consulting Subtotal:	\$19,000			
Year Five Total without Staffing:	\$287,980	Year Five Total with Staffing Cost Included:		\$526,980

Five Year Strategic Investment:

Core Activity	Year One	Year Two	Year Three	Year Four	Year Five	Total
Data	\$309,000	\$171,500	\$146,500	\$137,500	\$37,500	\$802,000
Hardware	\$26,600	\$0	\$12,500	\$12,500	\$18,500	\$70,100
Software	\$118,000	\$81,900	\$93,000	\$93,000	\$129,600	\$515,500
Maintenance	\$0	\$23,600	\$37,480	\$55,580	\$72,580	\$189,240
Training and Education	\$32,452	\$20,300	\$6,000	\$13,200	\$10,800	\$82,752
Personnel	\$239,000	\$239,000	\$239,000	\$239,000	\$239,000	\$1,195,000
Consulting	\$35,000	\$10,000	\$10,000	\$10,000	\$19,000	\$84,000
Totals:	\$760,052	\$546,300	\$544,480	\$560,780	\$526,980	\$2,938,592
Totals Without Staffing Included	\$521,052	\$307,300	\$305,480	\$321,780	\$287,980	\$1,743,592

Optional Three Year Implementation

The original intent of this Strategic Implementation Plan was to fund the GIS enterprise initiative in three years. The above Five Year Implementation Plan was developed based on difficult budgetary issues currently facing the County, and the need to keep cost at a reasonable yearly plane. The core cost categories were not changed, nor were their levels reduced, they were only extended out an additional two years. If the County chooses to return to a three year implementation plan (in all or in part), or when additional funds are made available, those applications that were shifted would merely need to be realigned back into years two and/or three.

For comparison purposes, below is a table summarizing the original costs based on a three year implementation:

Core Activity	Year One	Year Two	Year Three	Total
Data	\$309,000	\$209,000	\$284,000	\$802,000
Hardware	\$26,600	\$12,500	\$18,500	\$57,600
Software	\$118,000	\$194,900	\$104,600	\$417,500
Maintenance	\$0	\$23,600	\$60,080	\$83,680
Training and Education	\$32,452	\$31,100	\$12,000	\$75,552
Personnel	\$239,000	\$239,000	\$239,000	717,000
Consulting	\$35,000	\$10,000	\$19,000	\$64,000
Totals:	\$760,052	\$720,100	\$737,180	\$2,217,332
Totals Without Staffing Included	\$521,052	\$481,100	\$498,180	\$1,500,332

Cost Summary

- Three year implementation yearly average (including staffing) - **\$739,110**
- Five year implementation yearly average (including staffing) - **\$587,718**
- Tasks funded in five year plan, not included in three year plan
 - o Hardware
 - One year of additional field tablets/laptops - \$12,500
 - o Software
 - Additional year of Mobile Application - \$8,000
 - GIS link to Recreation Management Application - \$10,000
 - Tax Property Data System - \$50,000
 - Mass Notification Application - \$30,000
 - o Maintenance
 - Year 3 Maintenance difference – (\$22,600)
 - Year 4 Maintenance - \$55,580
 - Year 5 Maintenance - \$72,580
 - o Training and Education
 - Data Integration Application - \$2,400
 - Recreation Management - \$1,200
 - Tax Property Data System - \$2,400
 - Mass Notification Application - \$1,200
 - o Personnel
 - Two years of extended cost - \$478,000
 - o Consulting
 - Two additional years of on-site consulting - \$20,000

The County of San Luis Obispo, California



Phase IV: Plan of Action Plan of Action

Chapter 17: Plan of Action



Chapter Outline

Introduction

Five Year Implementation Tasks

Five Year Implementation Timetable

Typical Task Dependencies

Introduction

The previous chapter, Chapter 16: *Five Year Phase Implementation Plan*, identified seven core enterprise activities, along with the **recommended** tasks and their estimated costs associated with each activity. The successful realization of each of these core activities will play an integral part in the associated implementation of an enterprise GIS within the County. The associated costs assigned to each task reflect a mix of high, medium, and/or low cost options. This chapter will identify these cost options along with a prioritization of each task as it relates to the enterprise GIS effort.

Although preliminarily defined in Chapter 16, this chapter will further identify each task's dependency and the county department(s) responsible for the deployment of each task. In most cases the GIS Coordinator will manage enterprise tasks, but identified departments will share responsibilities with the GIS Coordinator.

Five Year Implementation Tasks

The tables on the following pages identify each of the seven core activities in each of the five years of the Five Year Implementation Plan, as found in Chapter 16: *Five-Year Phased Implementation Plan*. The data contained in these tables formed the foundation for the recommended level of expenditures for each of the tasks in Chapter 16. Also contained within each of the core activities, and subsequent tasks is a timetable for implementation of each of the tasks. Following this section will be an additional phased timetable specific to chronological order and action dependency.

Year One Core Activity 1 – Data Layer Development

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 1 - Data Layer Development																	
Task #1.1	Critical Data Layer Creation/Maintenance <i>Parcel Layer</i>	LOW	\$100,000		Purchase Barclay data in Year 1, develop 100% in-house. Would take 6 yrs to develop using COGO method, 3 yrs using COGO + best fit. 3 year investment \$100,000.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$184,000	✓	Purchase Barclay data in Year 1, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$268,000		Purchase Barclay data in Year 1, develop 100% outsourced. COGO and best-fit method, developed over 3 yr period (40% of total COGO). 3 year investment \$604,000.	X	X	X	X	X	X	X	X	X	X	X	X
		VERY HIGH	\$520,000		Purchase Barclay data in Year 1, develop 100% outsourced. COGO, developed over 3 yr period. 3 year investment \$1,360,000	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.2	Critical Data Layer Creation/Maintenance <i>Street Centerlines</i>	LOW	\$0		Continue to complete in-house via multiple County Departments	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$25,000	✓	Outsource development , over 3 yr period	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$37,500		Outsource development , over 2 yr period	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.3	Critical Data Layer Creation/Maintenance <i>Address Points</i>	LOW	\$25,000	✓	Combination of in-house (75%) and outsourced (25%) – if needed. Work underway for the LUCA Census Address Update project. Completed by the end of Year 2.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$83,000		Outsource development , over 3 yr period (\$1/point, estimated 250k points)	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$125,000		Outsource development , over 2 yr period (\$1/point, estimated 250k points)	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.4	Critical Data Layer Creation/Maintenance <i>Digital Ortho-photography</i>	LOW	\$0	✓	Use existing, replace in Year 4												
		MEDIUM	\$0		See Year 3												
		HIGH	\$0		See Year 2												
Task #1.5	Data Layer Creation Prioritization from Master <i>Data List</i>	LOW	\$75,000	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.		X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$100,000		Combination of in-house (50%) and outsourced (50%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.		X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$150,000		Combination of in-house (25%) and outsourced (75%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.		X	X	X	X	X	X	X	X	X	X	X

Year One Core Activity 2 – Hardware

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 2 - Hardware																	
Task #2.1	Enterprise GIS Servers	LOW	\$0		Use 3 existing servers	X											
		MEDIUM	\$12,000		2 new servers in Year 1, 1 new server in Year 2	X											
		HIGH	\$18,000	✓	3 New Servers	X											
Task #2.2	GPS Units with Software	LOW	\$0		0 units, use existing, outsource data collection												
		MEDIUM	\$8,600	✓	1 unit and software, will be needed if MEDIUM option is selected for data collection of critical data layers			X									
		HIGH	\$25,800		3 units and software, will be needed if LOW option is selected for data collection of critical data layers			X									

Year One Core Activity 3 – Software

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 3 - Software																	
Task #3.1	ArcGIS Server Enterprise Level	LOW	\$20,000		Standard -4 core configuration, 2 server config and no MDB. List price only, price will come directly from ESRI.	X											
		MEDIUM	\$30,000	✓	Standard -6 core configuration, used with 3 server config and no MDB. List price only, price will come directly from ESRI. Upgrade to Advanced in Year 3	X											
		HIGH	\$60,000		Advanced -6 core configuration, required for MDB applications. List price only, price will come directly from ESRI.	X											
Task #3.2	Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	LOW	\$27,500		5 single use to 5 concurrent users. List price only, price will come directly from ESRI. \$5500 each upgrade.	X											
		MEDIUM	\$55,000	✓	10 single use to 10 concurrent users, add addition users in Year 2. List price only, price will come directly from ESRI. \$5500 each upgrade.	X											
		HIGH	\$82,500		15 single use to 15 concurrent upgrades. List price only, price will come directly from ESRI. \$5500 each upgrade.	X											
Task #3.3	ArcInfo Concurrent License	LOW	\$0		Not needed if GIS Coordinator not staffed												
		MEDIUM	\$14,000	✓	GIS Coordinator. List price only, price will come directly from ESRI.	X											
		HIGH	\$0		NA												
Task #3.4	ArcGIS Server GIS Intranet Data Browser	LOW	\$7,500		Implement enterprise wide over 3 year timeframe		X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$12,500	✓	Implement enterprise wide over 2 year timeframe		X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$25,000		Unlimited enterprise license. All Tier 3 users will have access to GIS data.		X	X	X	X	X	X	X	X	X	X	X
Task #3.5	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	LOW	\$0		In-house via ITD and GIS Coordinator												
		MEDIUM	\$6,500		Purchase database mining application, set-up and training for 1 database (see Training and Education section)			X	X								
		HIGH	\$6,500	✓	Purchase database mining application, set-up and training for 3 databases (see Training and Education section)			X	X								

Year One

Core Activity 4 – Maintenance

***No maintenance budgeted in first year, assumed budgeted from previous years.**

Month of Implementation																
Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 4 - Maintenance																
	Maintenance on existing software (previously budgeted)	LOW	\$0													
		MEDIUM	\$0													
		HIGH	\$0													

Year One

Core Activity 5 – Training and Education

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 5 - Training and Education																	
Task #5.1	Introduction to ArcGIS I - onsite in SLO	LOW	\$0		No training												
		MEDIUM	\$5,000	✔	Up to 10 users, onsite in SLO. Remaining users in Year 2. Expenses not included.	X	X										
		HIGH	\$10,000		Up to 20 users, onsite in SLO. Expenses not included.	X	X										
Task #5.2	Introduction to ArcGIS II - onsite in SLO	LOW	\$0		No Training												
		MEDIUM	\$7,500	✔	Up to 10 users, onsite in SLO. Remaining users in Year 2. Expenses not included.	X	X										
		HIGH	\$15,000		Up to 20 users, onsite in SLO. Expenses not included.	X	X										
Task #5.3	Building Geodatabases I	LOW	\$0		No Training												
		MEDIUM	\$2,700	✔	GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.	X	X										
		HIGH	\$6,750		5 additional users, does not include travel expenses	X	X										
Task #5.4	Building Geodatabases II	LOW	\$0		No Training												
		MEDIUM	\$1,800	✔	GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.		X	X									
		HIGH	\$3,500		5 additional users, does not include travel expenses		X	X									
Task #5.5	Introduction to ArcGIS Server	LOW	\$0		No Training												
		MEDIUM	\$900	✔	GIS Coordinator. Does not include travel expenses.	X											
		HIGH	\$1,800		GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.	X											

Year One

Core Activity 5 – Training and Education (con't)

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 5 - Training and Education																
Task #5.6	ArcGIS Server Enterprise Configuration and Tuning for SQL Server	LOW	\$0		No Training											
		MEDIUM	\$900	✓	GIS Coordinator. Does not include travel expenses.	X										
		HIGH	\$1,800		GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.	X										
Task #5.7	Creating and Maintaining Metadata Using ArcEditor 9.x (web course)	LOW	\$0		No Training											
		MEDIUM	\$78	✓	GIS Coordinator. Does not include travel expenses.		X	X								
		HIGH	\$156		GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.		X	X								
Task #5.8	Data Production and Editing Techniques	LOW	\$0		No Training											
		MEDIUM	\$1,470	✓	GIS Coordinator. Does not include travel expenses.		X	X								
		HIGH	\$2,940		GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.		X	X								
Task #5.9	Geoprocessing with ArcGIS Desktop (web course)	LOW	\$0		No Training											
		MEDIUM	\$104	✓	GIS Coordinator. Does not include travel expenses.		X	X								
		HIGH	\$208		GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.		X	X								
Task #5.10	ArcGIS Server Intranet GIS Data Browser Solution Set-up	LOW	\$0													
		MEDIUM	\$3,600	✓	3 days of Enterprise set-up of application.		X									
		HIGH	\$25,000		Enterprise set-up in Year 1		X									

Year One

Core Activity 5 – Training and Education (con't)

Month of Implementation																	
Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	
Core Activity 5 - Training and Education																	
Task #5.11	ArcGIS Server Intranet GIS Data Browser Solution, Detailed Department by Department Training	LOW	\$2,400		2 days of training, then training by GIS Coordinator												
		MEDIUM	\$6,000	✔	5 days of department specific training			X									
		HIGH	\$12,200		10 days of department specific training			X									
Task #5.12	Training and Set-up for GIS Data Creation and Integration Application	LOW	\$0														
		MEDIUM	\$2,400	✔	1 database, 2 days of training			X	X								
		HIGH	\$3,600		3 databases, 3 days of training			X	X								

Year One

Core Activity 6 – Personnel

					Month of Implementation												
Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 6 - Personnel																	
Task #6.1	Year One Staffing Cost	LOW	\$0		No additional staffing												
		MEDIUM	\$150,000		Hire GIS Coordinator ONLY, includes burden rate	X											
		HIGH	\$239,000	✔	Hire GIS Coordinator, and 1 GIS Analyst in PW, includes burden rate	X											

Year One Core Activity 7 – Consulting

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 7 - Consulting																	
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✔	On as an as needed basis	X											
		MEDIUM	\$36,000		On an as needed basis, quarterly	X			X			X			X		
		HIGH	\$72,000		On site one week each month, needed if no GIS Coordinator is hired	X	X	X	X	X	X	X	X	X	X	X	X
Task #7.2	Physical and Logical Database Design	LOW	\$0		Designed internally	X											
		MEDIUM	\$25,000	✔	Only base layers	X											
		HIGH	\$50,000		Full design base layers and key layers identified from the Master Data List.	X											

Year Two

Core Activity 1 – Data Layer Development

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 1 - Data Layer																	
Task #1.1	Critical Data Layer Creation/Maintenance Parcel Layer	LOW	\$0		Purchased Barclay data in Year 1, develop 100% in-house. Would take 6 yrs to develop using COGO method, 3 yrs using COGO + best fit. 3 year investment \$100,000.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$84,000	✓	Purchase Barclay data, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$168,000		Purchase Barclay data, develop 100% outsourced. COGO and best-fit method, developed over 3 yr period (40% of total COGO). 3 year investment \$604,000.	X	X	X	X	X	X	X	X	X	X	X	X
		VERY HIGH	\$420,000		Purchase Barclay data, develop 100% outsourced. COGO, developed over 3 yr period. 3 year investment \$1,360,000	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.2	Critical Data Layer Creation/Maintenance Street Centerlines	LOW	\$0		Continue to complete in-house via multiple County Departments	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$25,000	✓	Outsource development , over 3 yr period	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$37,500		Outsource development , over 2 yr period	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.3	Critical Data Layer Creation/Maintenance Address Points	LOW	\$25,000	✓	Combination of in-house (75%) and outsourced (25%) – if needed. Work underway for the LUCA Census Address Update project. Completed by the end of Year 2.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$83,000		Outsource development , over 3 yr period (\$1/point, estimated 250k points)	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$125,000		Outsource development , over 2 yr period (\$1/point, estimated 250k points)	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.4	Critical Data Layer Creation/Maintenance Digital Ortho-photography	LOW	\$0	✓	Use existing, replace in Year 4												
		MEDIUM	\$0		See Year 3												
		HIGH	\$100,000		Replace 2007 layer			X									
Task #1.5	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$50,000		Combination of in-house (50%) and outsourced (50%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$75,000		Combination of in-house (25%) and outsourced (75%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X

Year Two

Core Activity 2 – Hardware

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 2 - Hardware																	
Task #2.1	Enterprise GIS Servers	LOW	\$0		Use 3 existing servers												
		MEDIUM	\$6,000		2 new servers in Year 1, 1 new server in Year 2	X											
		HIGH	\$0	✓	3 new servers in Year 1												

Year Two

Core Activity 3 – Software

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 3 - Software																	
Task #3.1	ArcGIS Server Enterprise Level	LOW	\$0		Obtain trial version of Advance Enterprise to evaluate MDB for Year 3	X											
		MEDIUM	\$0	✓	Upgrade to Advanced Enterprise in Year 3 to use with MDB. List price only, price will come directly from ESRI. More than likely price will be much less.	X											
		HIGH	\$0														
Task #3.2	Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	LOW	\$27,500		5 single use to 5 concurrent users. List price only, price will come directly from ESRI. \$5500 each upgrade.												
		MEDIUM	\$55,000	✓	10 single use to 10 concurrent users, add addition users in Year 2. List price only, price will come directly from ESRI. \$5500 each upgrade.	X											
		HIGH	\$82,500		15 single use to 15 concurrent upgrades. List price only, price will come directly from ESRI. \$5500 each upgrade.												
Task #3.3	ArcPad Upgrade / Purchase	LOW	\$0														
		MEDIUM	\$400	✓	1 license to be used in Public Works. List price only, price will come directly from ESRI.	X											
		HIGH	\$800		2 licenses, PW and ITD (for enterprise use). List price only, price will come directly from ESRI.	X											
Task #3.4	ArcInfo	LOW	\$0														
		MEDIUM	\$14,000	✓	1 concurrent license to be used mainly in ITD. List price only, price will come directly from ESRI.	X											
		HIGH	\$21,000		2 licenses to be used mainly in ITD and PW. List price only, price will come directly from ESRI.	X											
Task #3.5	ArcGIS Server GIS Intranet Data Browser	LOW	\$7,500		Implement enterprise wide over 3 year timeframe	X											
		MEDIUM	\$12,500	✓	Implement enterprise wide over 2 year timeframe. At end of Year 2 all Tier 3 users should have access to GIS data.	X	X										
		HIGH	\$0		Year 1												

Year Two

Core Activity 4 – Maintenance

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 4 - Maintenance																	
Task #4.1	ESRI Licenses	LOW	\$9,500		20% of low optioned ESRI licenses from Year 1	X											
		MEDIUM	\$19,800	✓	20% of recommended ESRI licenses from Year 1	X											
		HIGH	\$28,500		20% of high optioned ESRI licenses from Year 1	X											
Task #4.2	ArcGIS Server GIS Intranet Data Browser	LOW	\$1,500		20% of low license from Year 1	X											
		MEDIUM	\$2,500	✓	20% of recommended license from Year 1	X											
		HIGH	\$5,000		20% of high license from Year 1	X											
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	LOW	\$0		20% of low license from Year 1	X											
		MEDIUM	\$1,300	✓	20% of recommended license from Year 1	X											
		HIGH	\$1,300		20% of high license from Year 1	X											

Year Two

Core Activity 5 – Training and Education

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 5 - Training and Education																	
Task #5.1	Introduction to ArcGIS I - onsite in SLO	LOW	\$0		No Training												
		MEDIUM	\$5,000	✔	Up to 10 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.	X											
		HIGH	\$10,000		Up to 20 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.	X											
Task #5.2	Introduction to ArcGIS II - onsite in SLO	LOW	\$0		No Training												
		MEDIUM	\$7,500	✔	Up to 10 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.	X											
		HIGH	\$15,000		Up to 20 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.	X	X										
Task #5.3	Building Geodatabases I	LOW	\$0		No Training												
		MEDIUM	\$2,700	✔	2 additional Tier 1 users. Does not include travel expenses.		X										
		HIGH	\$6,750		5 additional users, does not include travel expenses		X										
Task #5.4	Building Geodatabases II	LOW	\$0		No Training												
		MEDIUM	\$1,800	✔	2 additional Tier 1 users. Does not include travel expenses.		X										
		HIGH	\$3,500		5 additional users, does not include travel expenses		X										
Task #5.5	Introduction to ArcGIS Server	LOW	\$0		No Training												
		MEDIUM	\$900	✔	1 additional Tier 1 user. Does not include travel expenses.	X											
		HIGH	\$1,800		2 additional Tier 1 users. Does not include travel expenses.	X											
Task #5.6	ArcGIS Server Intranet GIS Data Browser Solution, Training	LOW	\$0	✔	GIS Coordinator to configure and train. Enterprise training over 3 years.		X	X									
		MEDIUM	\$1,200		2 additional days of training. GIS Coordinator to configure in Year 1. Enterprise training over 3 years. Does not include travel expenses.		X	X									
		HIGH	\$0		Enterprise set-up in Year 1												
Task #5.7	Training and Set-up for GIS Data Creation and Integration Application	LOW	\$0														
		MEDIUM	\$2,400	✔	1 database, 2 days of training. Does not include travel expenses.		X	X									
		HIGH	\$3,600		3 databases, 3 days of training. Does not include travel expenses.		X	X									

Year Two Core Activity 6 – Personnel

Month of Implementation																
Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 6 - Personnel																
Task #6.1	Year Two Staffing Cost	LOW	\$239,000	✓	Utilize existing System Administrators to accomplish DBA duties. Plus carry over cost from recommended Year 1 positions.											
		MEDIUM	\$359,000		Hire ITD DBA, with burden rate. Plus carry over cost from recommended Year 1 positions.	X										
		HIGH	\$436,000		Employ full staffing of Year 2 recommended positions, includes burden rate. Plus carry over cost from recommended Year 1 positions.	X										

Year Two Core Activity 7 – Consulting

Month of Implementation																
Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 7 - Consulting																
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✔	On as an as needed basis	X										
		MEDIUM	\$36,000		On as an as needed basis, quarterly	X			X			X			X	
		HIGH	\$72,000		On site one week each month, needed if no GIS Coordinator is hired	X	X	X	X	X	X	X	X	X	X	X
Task #7.2	Update to the Plan	LOW	\$0	✔	No update to plan, in-house review. Formal review in Year 3 and 5	X										
		MEDIUM	\$9,000		To reflect changing priorities and technologies	X										
		HIGH	\$0													

Year Three

Core Activity 1 – Data Layer Development

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 1 - Data Layer Development																
Task #1.1	Critical Data Layer Creation/Maintenance Parcel Layer	LOW	\$0		Purchased Barclay data in Year 1, develop 100% in-house. Would take 6 yrs to develop using COGO method, 3 yrs using COGO + best fit. 3 year investment \$100,000.	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$84,000	✓	Purchase Barclay data, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$168,000		Purchase Barclay data, develop 100% outsourced. COGO and best-fit method, developed over 3 yr period (40% of total COGO). 3 year investment \$604,000.	X	X	X	X	X	X	X	X	X	X	X
		VERY HIGH	\$420,000		Purchase Barclay data, develop 100% outsourced. COGO, developed over 3 yr period. 3 year investment \$1,360,000	X	X	X	X	X	X	X	X	X	X	X
Task #1.2	Critical Data Layer Creation/Maintenance Street Centerlines	LOW	\$0		Continue to complete in-house via multiple County Departments	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$25,000	✓	Outsource development , over 3 yr period	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$0		Outsource development , over 2 yr period	X	X	X	X	X	X	X	X	X	X	X
Task #1.3	Critical Data Layer Creation/Maintenance Address Points	LOW	\$0	✓	Maintain in-house.	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$83,000		Outsource development , over 3 yr period (\$1/point, estimated 250k points)	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$0		Outsource development , over 2 yr period (\$1/point, estimated 250k points)	X	X	X	X	X	X	X	X	X	X	X
Task #1.4	Critical Data Layer Creation/Maintenance Digital Ortho-photography	LOW	\$0	✓	Use existing, replace in Year 4											
		MEDIUM	\$100,000		Replace 2007 layer			X								
		HIGH	\$0													
Task #1.5	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$50,000		Combination of in-house (50%) and outsourced (50%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$75,000		Combination of in-house (25%) and outsourced (75%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X

Year Three

Core Activity 2 – Hardware

Month of Implementation																
Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 2 - Hardware																
Task #2.1	Field Tablets/Laptops	LOW	\$12,500	✔	10 non-rugged laptops, shared between various departments in pilot program	X										
		MEDIUM	\$50,000		10 rugged tablets, shared between various departments in pilot program	X										
		HIGH	\$75,000		15 rugged tablets, 10 - Ag Comm / 5 -OES. Seen as high priority in one department. Implement remaining in Year 4 and beyond	X	X									

Year Three

Core Activity 3 – Software

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 3 - Software																
Task #3.1	ArcGIS Server Enterprise Level	LOW	\$0		Obtain trail version of Advance Enterprise to evaluate MDB for Year 3	X										
		MEDIUM	\$30,000	✓	Upgrade to Advanced Enterprise to use with MDB. List price only, price will come directly from ESRI. More than likely price will be much less.	X										
		HIGH	\$0													
Task #3.2	Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	LOW	\$27,500		5 single use to 5 concurrent users. List price only, price will come directly from ESRI. \$5500 each upgrade.											
		MEDIUM	\$55,000	✓	10 single use to 10 concurrent users, add addition users in Year 2. List price only, price will come directly from ESRI. \$5500 each upgrade.	X										
		HIGH	\$82,500		15 single use to 15 concurrent upgrades. List price only, price will come directly from ESRI. \$5500 each upgrade.											
Task #3.3	ArcGIS Server GIS Intranet Data Browser	LOW	\$10,000		Implement enterprise wide over 3 year timeframe. At end of Year 3 all Tier 3 users should have access to GIS data.	X										
		MEDIUM	\$0	✓	Implemented in Year 2											
		HIGH	\$0		Implemented in Year 1											
Task #3.4	ArcGIS Server GIS Mobile Data Browser	LOW	\$8,000													
		MEDIUM	\$8,000	✓	10 users in pilot program. Uses ArcGIS Server Advanced.		X	X	X							
		HIGH	\$12,000		15 users in high priority department. Uses ArcGIS Server Advanced.		X	X	X							
Task #3.5	GIS Link to Document Management System	LOW	\$0	✓	Develop application in-house								X	X		
		MEDIUM	\$25,000		Custom application with GIS interface								X	X		
		HIGH	\$0													

Year Three

Core Activity 4 – Maintenance

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 4 - Maintenance																	
Task #4.1	ESRI Licenses	LOW	\$15,000		20% of low optioned ESRI licenses from previous years	X											
		MEDIUM	\$33,680	✓	20% of recommended ESRI licenses from previous years	X											
		HIGH	\$49,360		20% of high optioned ESRI licenses from previous years	X											
Task #4.2	ArcGIS Server GIS Intranet Data Browser	LOW	\$1,500		20% of low license	X											
		MEDIUM	\$2,500	✓	20% of recommended license	X											
		HIGH	\$5,000		20% of high license	X											
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	LOW	\$0														
		MEDIUM	\$1,300	✓	Year 3 maintenance - 20% of license	X											
		HIGH	\$1,300			X											

Year Three

Core Activity 5 – Training and Education

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 5 - Training and Education																	
Task #5.1	ArcGIS Server Intranet GIS Data Browser Solution, Training	LOW	\$0	✔	GIS Coordinator to configure and train. Enterprise training over 3 years.												
		MEDIUM	\$1,200		2 additional days of training. GIS Coordinator to configure in Year 1. Enterprise training over 3 years. Does not include travel expenses.	X											
		HIGH	\$0		Enterprise set-up in Year 1												
Task #5.2	Training and Set-up for GIS Data Creation and Integration Application	LOW	\$0														
		MEDIUM	\$2,400	✔	1 database, 2 days of training. Does not include travel expenses.		X	X									
		HIGH	\$3,600		3 databases, 3 days of training. Does not include travel expenses.		X	X									
Task #5.3	ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	LOW	\$0		In house training												
		MEDIUM	\$3,600	✔	Training of 10 Year 3 pilot program users		X	X	X								
		HIGH	\$5,200		Enterprise		X	X	X								
Task #5.4	GIS Link to Document Management System, Set-up and Training	LOW	\$0	✔	Developed and trained in-house								X	X			
		MEDIUM	\$2,400		On site, 2 days. Does not include travel expenses.								X	X			
		HIGH	\$0														

Year Three Core Activity 6 – Personnel

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 6 - Personnel																	
Task #6.1	Year Three Staffing Cost	LOW	\$239,000	✓	Reassign existing staff to perform Year 3 job responsibilities. Plus carry over cost.	X											
		MEDIUM	\$448,000		Hire one GIS Analyst in department of need, includes burden rate. Plus carry over cost.	X											
		HIGH	\$602,000		Employ full staffing of Year 3 recommended positions, includes burden rate. Plus carry over cost.	X											

Year Three Core Activity 7 – Consulting

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 7 - Consulting																	
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X											
		MEDIUM	\$36,000		On as an as needed basis, quarterly	X			X			X			X		
		HIGH	\$72,000		On site one week each month, needed if no GIS Coordinator is hired	X	X	X	X	X	X	X	X	X	X	X	X
Task #7.2	Update to the Plan	LOW	\$0	✓	No update to plan, in-house review	X											
		MEDIUM	\$9,000		To reflect changing priorities and technologies	X											
		HIGH	\$0														

Year Four

Core Activity 1 – Data Layer Development

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 1 - Data Layer																	
	Critical Data Layer Creation/Maintenance - Parcel Layer	MEDIUM	\$0	✓	If based on recommendation, completed in Years 1 - 3 at a cost of \$352,000												
	Critical Data Layer Creation/Maintenance - Street Centerlines	MEDIUM	\$0	✓	If based on recommendation, completed in Years 1 - 3 at a cost of \$75,000												
	Critical Data Layer Creation/Maintenance - Address Points	MEDIUM	\$0	✓	If based on recommendation, completed in Years 1 - 2 at a cost of \$25,000												
Task #1.1	Critical Data Layer Creation/Maintenance - Digital Ortho-photography	LOW	\$100,000	✓	Replace 2007 layer												
Task #1.2	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$50,000		Combination of in-house (50%) and outsourced (50%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	
		HIGH	\$75,000		Combination of in-house (25%) and outsourced (75%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	

Year Four Core Activity 2 – Hardware

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 2 - Hardware																	
Task #2.1	Field Tablets/Laptops	LOW	\$12,500	✔	Additional 10 non-rugged laptops, shared between various departments in pilot program	X											
		MEDIUM	\$50,000		Additional 10 rugged tablets, shared between various departments in pilot program	X											
		HIGH	\$255,000		51 tablets, Health-PW-Library - Roll out remainder of enterprise in Year 5 and beyond (approx cost \$350,000)	X	X										

Year Four Core Activity 3 – Software

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 3 - Software																	
Task #2.1	ArcGIS Server GIS Mobile Data Browser	LOW	\$8,000														
		MEDIUM	\$8,000	✔	10 additional users, upgrade to Enterprise version in Year 5		X	X									
		HIGH	\$18,000		Upgrade to Enterprise version		X	X									
Task #2.2	Crime Incident Analysis Application	LOW	\$0		No application												
		MEDIUM	\$25,000	✔	Pin mapping with crime analysis					X	X						
		HIGH	\$50,000		Pin mapping and advanced crime analysis					X	X	X					
Task #2.3	Public Internet Site Portal	LOW	\$10,000	✔	1 targeted site, GIS Coordinator to set-up remainder	X											
		MEDIUM	\$25,000		3 targeted portals	X	X										
		HIGH	\$50,000		6 targeted portals	X	X	X									
Task #2.4	Work Order Management System Application	LOW	\$0		No application, paper driven process												
		MEDIUM	\$50,000	✔	GIS based application tied to Intranet Data Browser									X	X	X	
		HIGH	\$250,000		Full Work Order Management System, with GIS integration									X	X	X	

Year Four

Core Activity 4 – Maintenance

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 4 - Maintenance																	
Task #4.1	ESRI Licenses	LOW	\$39,180		20% of low optioned ESRI licenses from previous years	X											
		MEDIUM	\$50,680	✓	20% of recommended ESRI licenses from previous years	X											
		HIGH	\$50,180		20% of high optioned ESRI licenses from previous years	X											
Task #4.2	ArcGIS Server GIS Intranet Data Browser	LOW	\$1,500		20% of low license	X											
		MEDIUM	\$2,000	✓	20% of recommended license	X											
		HIGH	\$5,000		20% of high license	X											
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	LOW	\$0		20% of low license	X											
		MEDIUM	\$1,300	✓	20% of recommended license	X											
		HIGH	\$1,300		20% of high license	X											
Task #4.4	ArcGIS Server GIS Mobile Data Browser	LOW	\$1,600		20% of low license												
		MEDIUM	\$1,600	✓	20% of recommended license	X											
		HIGH	\$2,400		20% of high license	X											

Year Four

Core Activity 5 – Training and Education

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation												
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	
Core Activity 5 - Training and Education																	
Task #5.1	Training and Set-up for GIS Data Creation and Integration Application	LOW	\$0														
		MEDIUM	\$2,400	✓	1 database, 2 days of training. Does not include travel expenses.		X	X									
		HIGH	\$3,600		3 databases, 3 days of training. Does not include travel expenses.		X	X									
Task #5.2	ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	LOW	\$0	✓	In house training		X	X									
		MEDIUM	\$3,600		Training of 10 Year 4 pilot program users												
		HIGH	\$5,200		Enterprise												
Task #5.3	Crime Incident Analysis Application Set-up and Training	LOW	\$0		No application, so no training												
		MEDIUM	\$3,600	✓	On site, 3 days. Does not include travel expenses.					X	X						
		HIGH	\$7,200		Pin mapping, plus addition training, as required by Advanced Crime Analysis application. Estimated additional 3 days of training.					X	X	X					
Task #5.4	Public Internet Site Portal Development Set-up and Training	LOW	\$1,400		1 targeted site, GIS Coordinator to develop remainder	X											
		MEDIUM	\$3,600	✓	3 targeted portals. Does not include travel expenses.	X	X										
		HIGH	\$7,200		Enterprise portals	X	X	X									
Task #5.5	Work Order Management System Application Set-up and Training	LOW	\$0		No application, so no training												
		MEDIUM	\$3,600	✓	On site, 3 days. Does not include travel expenses.									X	X	X	
		HIGH	\$0											X	X	X	

Year Four Core Activity 6 – Personnel

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 6 - Personnel																	
Task #6.1	Year Four Staffing Cost	LOW	\$239,000	✔	Reassign existing staff to perform Year 4 job responsibilities. Plus carry over cost.												
		MEDIUM	\$537,000		Hire one GIS Analyst in department of need, includes burden rate. Plus carry over cost.	X											
		HIGH	\$845,000		Employ full staffing of Year 4 recommended positions, includes burden rate. Plus carry over cost.	X											

Year Four Core Activity 7 – Consulting

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 7 - Consulting																	
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X											
		MEDIUM	\$36,000		On as an as needed basis, quarterly	X			X			X			X		
		HIGH	\$72,000		On site one week each month, needed if no GIS Coordinator is hired	X	X	X	X	X	X	X	X	X	X	X	X
Task #7.2	Update to the Plan	LOW	\$0	✓	No update to plan, in-house review	X											
		MEDIUM	\$9,000		To reflect changing priorities and technologies	X											
		HIGH	\$0														

Year Five

Core Activity 1 – Data Layer Development

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 1 - Data Layer Development																	
	Critical Data Layer Creation/Maintenance - Parcel Layer	MEDIUM	\$0	✓	If based on recommendation, completed in Years 1 - 3 at a cost of \$352,000												
	Critical Data Layer Creation/Maintenance - Street Centerlines	MEDIUM	\$0	✓	If based on recommendation, completed in Years 1 - 3 at a cost of \$75,000												
	Critical Data Layer Creation/Maintenance - Address Points	MEDIUM	\$0	✓	If based on recommendation, completed in Years 1 - 2 at a cost of \$25,000												
	Critical Data Layer Creation/Maintenance - Digital Ortho-photography	MEDIUM	\$0	✓	Purchased in Year 3												
Task #1.1	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X
		MEDIUM	\$50,000		Combination of in-house (50%) and outsourced (50%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X
		HIGH	\$75,000		Combination of in-house (25%) and outsourced (75%) development of Recommended layers, over a 5 year period. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X	X

Year Five Core Activity 2 – Hardware

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 2 - Hardware																	
Task #2.1	Touch Screen Hardware	LOW	\$2,000		1 Public Kiosk												
		MEDIUM	\$6,000	✓	3 Public Kiosk		X	X									
		HIGH	\$12,000		6 Public Kiosk		X	X	X								
Task #2.2	Field Tablets/Laptops	LOW	\$12,500	✓	Additional 10 non-rugged laptops, shared between various departments in pilot program	X											
		MEDIUM	\$50,000		Additional 10 rugged tablets, shared between various departments in pilot program	X											
		HIGH	\$365,000		73 tablets, Assessor-Probation-Social Services - Roll out remainder of enterprise in Year 4 (approx cost \$350,000)	X	X										

Year Five

Core Activity 3 – Software

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 3 - Software																	
Task #3.1	ESRI Tracking Analyst	LOW	\$0		No purchase												
		MEDIUM	\$2,500	✓	1 concurrent license for enterprise use. List price only, price will come directly from ESRI.	X											
		HIGH	\$0														
Task #3.2	ESRI Network Analyst	LOW	\$0		No purchase												
		MEDIUM	\$2,500	✓	1 concurrent license for enterprise use. List price only, price will come directly from ESRI.	X											
		HIGH	\$0														
Task #3.3	MapLogic's Layout Manager ArcGIS Extension	LOW	\$0		No purchase												
		MEDIUM	\$2,100	✓	1 concurrent license for enterprise use. List price only, price will come directly from MapLogic.	X											
		HIGH	\$0														
Task #3.4	ArcGIS Server GIS Mobile Data Browser	LOW	\$8,000														
		MEDIUM	\$8,000	✓	10 additional users, upgrade to Enterprise version in Year 6		X	X									
		HIGH	\$18,000		Upgrade to Enterprise version		X	X									
Task #3.5	Automated Vehicle location (AVL) Software	LOW	\$0		No Implementation												
		MEDIUM	\$12,500	✓	Enterprise license used with Intranet GIS Data Browser. Vehicle hardware not include in Plan, budgeted by department.				X	X							
		HIGH	\$0														

Year Five
Core Activity 3 – Software (con't)

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 3 - Software																	
Task #3.6	Routing Module to AVL Software	LOW	\$0		No Implementation												
		MEDIUM	\$4,000	✓	Enterprise license used with Intranet GIS Data Browser and AVL. Vehicle hardware not include in Plan, budgeted by department.					X	X						
		HIGH	\$0														
Task #3.7	Touch Screen Software Applications	LOW	\$5,000		1 Public Kiosk												
		MEDIUM	\$8,000	✓	3 Public Kiosk		X	X									
		HIGH	\$11,000		6 Public Kiosk		X	X	X								
Task #3.8	GIS Enabled Recreation Management Software	LOW	\$0														
		MEDIUM	\$10,000	✓	GIS Component to Recreation Management Software Application							X					
		HIGH	\$60,000		Complete Recreation Management Software Application							X	X	X			
Task #3.9	Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser	LOW	\$0														
		MEDIUM	\$50,000	✓	GIS Integration to PD system					X	X						
		HIGH	\$100,000		Full PD System with GIS Integration					X	X	X					
Task #3.10	Enterprise Mass Notification System	LOW	\$0														
		MEDIUM	\$30,000	✓	Based on minutes of use							X					
		HIGH	\$0														

Year Five

Core Activity 4 – Maintenance

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 4 - Maintenance																	
Task #4.1	ESRI Licenses	LOW	\$39,180		20% of low optioned ESRI licenses from previous years	X											
		MEDIUM	\$50,680	✔	20% of recommended ESRI licenses from previous years	X											
		HIGH	\$50,180		20% of high optioned ESRI licenses from previous years	X											
Task #4.2	ArcGIS Server GIS Intranet Data Browser	LOW	\$1,500		20% of low license	X											
		MEDIUM	\$2,000	✔	20% of recommended license	X											
		HIGH	\$5,000		20% of high license from	X											
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	LOW	\$0														
		MEDIUM	\$1,300	✔	20% of license	X											
		HIGH	\$1,300		20% of license	X											
Task #4.4	ArcGIS Server GIS Mobile Data Browser	LOW	\$1,600		20% of license												
		MEDIUM	\$1,600	✔	20% of license	X											
		HIGH	\$2,400		20% of license	X											
Task #4.5	Public Internet Site Portal	LOW	\$2,000	✔	20% of license	X											
		MEDIUM	\$5,000		20% of license	X	X										
		HIGH	\$10,000		20% of license	X	X	X									
Task #4.6	Work Order Management System Application	LOW	\$0														
		MEDIUM	\$10,000	✔	20% of license	X											
		HIGH	\$50,000			X											
Task #4.7	Crime Incident Analysis Application	LOW	\$0														
		MEDIUM	\$5,000	✔	20% of license	X											
		HIGH	\$10,000			X											

Year Five

Core Activity 5 – Training and Education

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 5 - Training and Education																	
Task #5.1	ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	LOW	\$0	✓	In-house Training		X	X									
		MEDIUM	\$3,600		Training of 10 Year 5 pilot program users												
		HIGH	\$5,200		Enterprise												
Task #5.2	Automated Vehicle location (AVL) Software	LOW	\$0														
		MEDIUM	\$1,200	✓	Enterprise wide. Does not include travel expenses.				X	X							
		HIGH	\$0														
Task #5.3	Routing Module Set-up and Training	LOW	\$0														
		MEDIUM	\$1,200	✓	Enterprise, 1 day training. Does not include travel expenses.						X	X					
		HIGH	\$0														
Task #5.4	Touch Screen Software Application Set-up and Training	LOW	\$0														
		MEDIUM	\$3,600	✓	Set-up for 3 kiosks. Does not include travel expenses.		X	X									
		HIGH	\$7,200		Set-up for 6 kiosks. Does not include travel expenses.		X	X	X								
Task #5.5	GIS Enabled Recreation Management Software	LOW	\$0														
		MEDIUM	\$1,200	✓	1 day training. Does not include travel expenses.							X					
		HIGH	\$2,400		2 day training. Does not include travel expenses.							X	X	X			
Task #5.6	Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser	LOW	\$0														
		MEDIUM	\$2,400	✓	2 day training. Does not include travel expenses.					X	X						
		HIGH	\$3,600		3 day training. Does not include travel expenses.					X	X	X					
Task #5.7	Enterprise Mass Notification System	LOW	\$0														
		MEDIUM	\$1,200	✓	1 day training. Does not include travel expenses.							X					
		HIGH	\$2,400		2 day training. Does not include travel expenses.												

Year Five Core Activity 6 – Personnel

Month of Implementation																
Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 6 - Personnel																
Task #6.1	Year Five Staffing Cost	LOW	\$239,000	✔	Reassign existing staff to perform Year 5 job responsibilities. Plus carry over cost.	X										
		MEDIUM	\$614,000		Hire One GIS Technician in department of need, includes burden rate. Plus carry over cost.											
		HIGH	\$1,230,000		Employ full staffing of Year 5 recommended positions, includes burden rate. Plus carry over cost.											

Year Five Core Activity 7 – Consulting

Task Description		Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Core Activity 7 - Consulting																	
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X											
		MEDIUM	\$36,000		On as an as needed basis, quarterly	X			X			X			X		
		HIGH	\$72,000		On site one week each month, needed if no GIS Coordinator is hired	X	X	X	X	X	X	X	X	X	X	X	X
Task #7.2	Update to the Plan	LOW	\$0		No update to plan, in-house review	X											
		MEDIUM	\$9,000	✓	To reflect changing priorities and technologies	X											
		HIGH	\$0														

Five Year Implementation Timetable

Another key component to a successful implementation is identifying a timetable, or a schedule for phased implementation. Adhering to a timetable will ensure that each year of the implementation plan, and the recommended tasks within each year, is successful and no issues are left outstanding. This responsibility primarily will fall on the shoulders of the GIS Coordinator who will be responsible for assisting the County in meeting its short and long-term goals and directing the overall GIS efforts of the organization. Having a phased timetable will be the mechanism used to ensure both the success of the GIS Coordinator and the implementation plan.

The tables on the following pages prioritize the recommended tasks in each of the five years of the Five Year Implementation Plan, as found in Chapter 16: *Five-Year Phased Implementation Plan*. Each task is color coded to correspond to the appropriate Core Activity:

Core Activity 1 - Data Layer Development
Core Activity 2 - Hardware
Core Activity 3 - Software
Core Activity 4 - Maintenance
Core Activity 5 - Training and Education
Core Activity 6 - Personnel
Core Activity 7 - Consulting

Individual tasks are listed in chronological order of suggested commencement or commencement/completion. Some tasks can be grouped together (i.e. purchase of software from the same vendor), other subsequent tasks rely on the completion of previous tasks to be completed properly, and a variety of tasks will be multi-year projects spread over the entire implementation plan (i.e. data layer creation).

Five Year Implementation Timetable Year One

Task ID	Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #6.1	Year One Staffing Cost	HIGH	\$239,000	✓	GIS Coordinator, and 1 GIS Analyst in PW, includes burden rate	X											
Task #3.3	ArcInfo Concurrent License	MEDIUM	\$14,000	✓	GIS Coordinator. List price only, price will come directly from ESRI.	X											
Task #3.2	Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	MEDIUM	\$55,000	✓	10 single use to 10 concurrent users, add addition users in Year 2. List price only, price will come directly from ESRI. \$5500 each upgrade.	X											
Task #2.1	Enterprise GIS Servers	HIGH	\$18,000	✓	3 New Servers	X											
Task #3.1	ArcGIS Server Enterprise Level	MEDIUM	\$30,000	✓	Standard -6 core configuration, used with 3 server config and no MDB. List price only, price will come directly from ESRI. Upgrade to Advanced in Year 3	X											
Task #7.2	Physical and Logical Database Design	MEDIUM	\$25,000	✓	Only base layers	X											
Task #1.1	Critical Data Layer Creation/Maintenance Parcel Layer	MEDIUM	\$184,000	✓	Purchase Barclay data in Year 1, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.2	Critical Data Layer Creation/Maintenance Street Centerlines	MEDIUM	\$25,000	✓	Outsource development , over 3 yr period	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.3	Critical Data Layer Creation/Maintenance Address Points	LOW	\$25,000	✓	Combination of in-house (75%) and outsourced (25%) – if needed. Work underway for the LUCA Census Address Update project. Completed by the end of Year 2.	X	X	X	X	X	X	X	X	X	X	X	X
Task #5.1	Introduction to ArcGIS I - onsite in SLO	MEDIUM	\$5,000	✓	Up to 10 users, onsite in SLO . Remaining users in Year 2. Expenses not included.	X	X										
Task #5.2	Introduction to ArcGIS II - onsite in SLO	MEDIUM	\$7,500	✓	Up to 10 users, onsite in SLO . Remaining users in Year 2. Expenses not included.	X	X										
Task #5.3	Building Geodatabases I	MEDIUM	\$2,700	✓	GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.	X	X										
Task #5.5	Introduction to ArcGIS Server	MEDIUM	\$900	✓	GIS Coordinator. Does not include travel expenses.	X											
Task #5.6	ArcGIS Server Enterprise Configuration and Tuning for SQL Server	MEDIUM	\$900	✓	GIS Coordinator. Does not include travel expenses.	X											

Five Year Implementation Timetable Year One (con't)

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #3.4	ArcGIS Server GIS Intranet Data Browser	MEDIUM	\$12,500	✓	Implement enterprise wide over 2 year timeframe		X									
Task #5.10	ArcGIS Server Intranet GIS Data Browser Solution Set-up	MEDIUM	\$3,600	✓	3 days of Enterprise set-up of application.		X									
Task #1.5	Data Layer Creation Prioritization from Master Data List	LOW	\$75,000	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in		X	X	X	X	X	X	X	X	X	X
Task #5.4	Building Geodatabases II	MEDIUM	\$1,800	✓	GIS Coordinator, plus one additional Tier 1 user. Does not include travel expenses.		X	X								
Task #5.7	Creating and Maintaining Metadata Using ArcEditor 9.x (web course)	MEDIUM	\$78	✓	GIS Coordinator. Does not include travel expenses.		X	X								
Task #5.8	Data Production and Editing Techniques	MEDIUM	\$1,470	✓	GIS Coordinator. Does not include travel expenses.		X	X								
Task #5.9	Geoprocessing with ArcGIS Desktop (web course)	MEDIUM	\$104	✓	GIS Coordinator. Does not include travel expenses.		X	X								
Task #5.11	ArcGIS Server Intranet GIS Data Browser Solution, Detailed Department by Department Training	MEDIUM	\$6,000	✓	5 days of department specific training			X								
Task #5.12	Training and Set-up for GIS Data Creation and Integration Application	MEDIUM	\$2,400	✓	1 database, 2 days of training			X	X							
Task #3.5	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	HIGH	\$6,500	✓	Purchase database mining application, set-up and training for 3 databases (see Training and Education section)			X	X							
Task #2.2	GPS Units with Software	MEDIUM	\$8,600	✓	1 unit and software, will be needed if MEDIUM option is selected for data collection of critical data layers			X								
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X										

Five Year Implementation Timetable Year Two

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #4.1	ESRI Licenses	MEDIUM	\$3,040	✓	20% of recommended ESRI licenses from Year 1	X										
Task #4.2	ArcGIS Server GIS Intranet Data Browser	MEDIUM	\$180	✓	20% of recommended license from Year 1	X										
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	MEDIUM	\$1,300	✓	20% of recommended license from Year 1	X										
Task #3.4	ArcInfo	MEDIUM	\$14,000	✓	1 concurrent license to be used mainly in ITD. List price only, price will come directly from ESRI.	X										
Task #3.2	Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	MEDIUM	\$55,000	✓	10 single use to 10 concurrent users, add addition users in Year 2. List price only, price will come directly from ESRI. \$5500 each upgrade.	X										
Task #3.5	ArcGIS Server GIS Intranet Data Browser	MEDIUM	\$12,500	✓	Implement enterprise wide over 2 year timeframe. At end of Year 2 all Tier 3 users should have access to GIS data.	X	X									
Task #1.1	Critical Data Layer Creation/Maintenance Parcel Layer	MEDIUM	\$84,000	✓	Purchase Barclay data, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.	X	X	X	X	X	X	X	X	X	X	X
Task #1.2	Critical Data Layer Creation/Maintenance Street Centerlines	MEDIUM	\$25,000	✓	Outsource development, over 3 yr period	X	X	X	X	X	X	X	X	X	X	X
Task #1.3	Critical Data Layer Creation/Maintenance Address Points	LOW	\$25,000	✓	Combination of in-house (75%) and outsourced (25%) – if needed. Work underway for the LUCA Census Address Update project. Completed by the end of Year 2.	X	X	X	X	X	X	X	X	X	X	X
Task #1.5	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in	X	X	X	X	X	X	X	X	X	X	X
Task #3.3	ArcPad Upgrade / Purchase	MEDIUM	\$400	✓	1 license to be used in Public Works. List price only, price will come directly from ESRI.	X										
Task #5.1	Introduction to ArcGIS I - onsite in SLO	MEDIUM	\$5,000	✓	Up to 10 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.	X										
Task #5.2	Introduction to ArcGIS II - onsite in SLO	MEDIUM	\$7,500	✓	Up to 10 users, onsite in SLO. Remaining users not trained in Year 1. Expenses not included.	X										
Task #5.5	Introduction to ArcGIS Server	MEDIUM	\$900	✓	1 additional Tier 1 user. Does not include travel expenses.	X										
Task #5.3	Building Geodatabases I	MEDIUM	\$2,700	✓	2 additional Tier 1 users. Does not include travel expenses.		X									
Task #5.4	Building Geodatabases II	MEDIUM	\$1,800	✓	2 additional Tier 1 users. Does not include travel expenses.		X									
Task #5.6	ArcGIS Server Intranet GIS Data Browser Solution, Training	LOW	\$0	✓	GIS Coordinator to configure and train. Enterprise training over 3 years.		X	X								
Task #5.7	Training and Set-up for GIS Data Creation and Integration Application	MEDIUM	\$2,400	✓	1 database, 2 days of training. Does not include travel expenses.		X	X								
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X										

Five Year Implementation Timetable Year Three

Task #	Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
						Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #4.1	ESRI Licenses	MEDIUM	\$7,208	✓	20% of recommended ESRI licenses from previous years	X											
Task #4.2	ArcGIS Server GIS Intranet Data Browser	MEDIUM	\$5,000	✓	20% of recommended license	X											
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	MEDIUM	\$1,300	✓	Year 3 maintenance - 20% of license	X											
Task #3.1	ArcGIS Server Enterprise Level	MEDIUM	\$30,000	✓	Upgrade to Advanced Enterprise to use with MDB. List price only, price will come directly from ESRI. More than likely price will be much less.	X											
Task #3.2	Upgrade copies of ArcView 9.x to Concurrent ArcEditor 9.2 Licenses	MEDIUM	\$55,000	✓	10 single use to 10 concurrent users, add addition users in Year 2. List price only, price will come directly from ESRI. \$5500 each upgrade.	X											
Task #1.1	Critical Data Layer Creation/Maintenance Parcel Layer	MEDIUM	\$84,000	✓	Purchase Barclay data, develop 50% in-house and 50% outsourced. COGO and best-fit method, developed over 3 yr period. 3 year investment \$352,000.	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.2	Critical Data Layer Creation/Maintenance Street Centerlines	MEDIUM	\$25,000	✓	Outsource development , over 3 yr period	X	X	X	X	X	X	X	X	X	X	X	X
Task #1.5	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in	X	X	X	X	X	X	X	X	X	X	X	X
Task #2.1	Field Tablets/Laptops	LOW	\$12,500	✓	10 non-rugged laptops, shared between various departments in pilot program	X											
Task #3.4	ArcGIS Server GIS Mobile Data Browser	MEDIUM	\$8,000	✓	10 users in pilot program. Uses ArcGIS Server Advanced.		X	X	X								
Task #5.3	ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	MEDIUM	\$3,600	✓	Training of 10 Year 3 pilot program users		X	X	X								
Task #5.1	ArcGIS Server Intranet GIS Data Browser Solution, Training	LOW	\$0	✓	GIS Coordinator to configure and train. Enterprise training over 3 years.		X	X									
Task #5.2	Training and Set-up for GIS Data Creation and Integration Application	MEDIUM	\$2,400	✓	1 database, 2 days of training. Does not include travel expenses.		X	X									
Task #3.5	GIS Link to Document Management System	LOW	\$0	✓	Develop application in-house								X	X			
Task #5.4	GIS Link to Document Management System, Set-up and Training	LOW	\$0	✓	Developed and trained in-house								X	X			
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X											

Five Year Implementation Timetable

Year Four

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #4.1	ESRI Licenses	MEDIUM	\$22,442	✓	20% of recommended ESRI licenses from previous years	X										
Task #4.2	ArcGIS Server GIS Intranet Data Browser	MEDIUM	\$2,000	✓	20% of recommended license	X										
Task #4.3	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	MEDIUM	\$1,300	✓	20% of recommended license	X										
Task #4.4	ArcGIS Server GIS Mobile Data Browser	MEDIUM	\$1,600	✓	20% of recommended license	X										
Task #1.2	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X
Task #1.1	Critical Data Layer Creation/Maintenance - Digital Ortho-photography	LOW	\$100,000	✓	Replace 2007 layer	X	X									
Task #2.1	Field Tablets/Laptops	LOW	\$12,500	✓	Additional 10 non-rugged laptops, shared between various departments in pilot program	X										
Task #2.3	Public Internet Site Portal	LOW	\$10,000	✓	1 targeted site, GIS Coordinator to set-up remainder	X										
Task #5.4	Public Internet Site Portal Development Set-up and Training	MEDIUM	\$3,600	✓	3 targeted portals. Does not include travel expenses.	X	X									

Five Year Implementation Timetable Year Four (con't)

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #5.1	Training and Set-up for GIS Data Creation and Integration Application	MEDIUM	\$2,400	✓	1 database, 2 days of training. Does not include travel expenses.		X	X								
Task #2.1	ArcGIS Server GIS Mobile Data Browser	MEDIUM	\$8,000	✓	10 additional users, upgrade to Enterprise version in Year 5		X	X								
Task #5.2	ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	LOW	\$0	✓	In house training		X	X								
Task #2.2	Crime Incident Analysis Application	MEDIUM	\$25,000	✓	Pin mapping with crime analysis				X	X						
Task #5.3	Crime Incident Analysis Application Set-up and Training	MEDIUM	\$3,600	✓	On site, 3 days. Does not include travel expenses.				X	X						
Task #2.4	Work Order Management System Application	MEDIUM	\$50,000	✓	GIS based application tied to Intranet Data Browser								X	X	X	
Task #5.5	Work Order Management System Application Set-up and Training	MEDIUM	\$3,600	✓	On site, 3 days. Does not include travel expenses.								X	X	X	
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X										

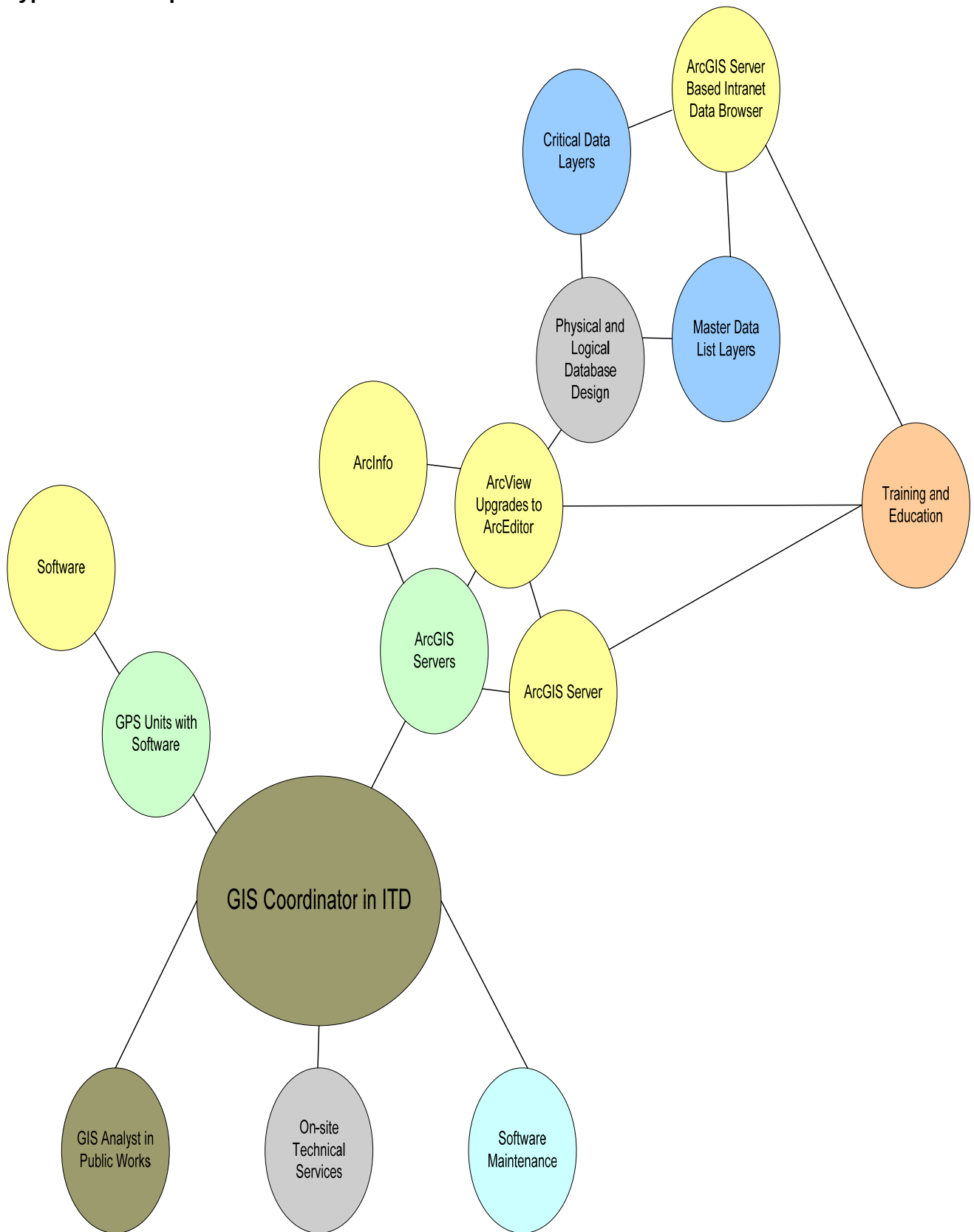
Five Year Implementation Timetable Year Five

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #4.2	ArcGIS Server GIS Intranet Data Browser	MEDIUM	\$10,000	✓	20% of recommended license	X										
Task #4.4	ArcGIS Server GIS Mobile Data Browser	MEDIUM	\$4,488	✓	20% of license	X										
Task #4.6	Work Order Management System Application	MEDIUM	\$10,000	✓	20% of license	X										
Task #4.7	Crime Incident Analysis Application	MEDIUM	\$400	✓	20% of license	X										
Task #1.1	Data Layer Creation Prioritization from Master Data List	LOW	\$37,500	✓	Combination of in-house (75%) and outsourced (25%) development of Recommended layers. Amount after year 1, spread evenly over 4 years. Public Works layers should be considered in separate initiative.	X	X	X	X	X	X	X	X	X	X	X
Task #2.2	Field Tablets/Laptops	LOW	\$12,500	✓	Additional 10 non-rugged laptops, shared between various departments in pilot program	X										
Task #3.1	ESRI Tracking Analyst	MEDIUM	\$2,500	✓	1 concurrent license for enterprise use. List price only, price will come directly from ESRI.	X										
Task #3.2	ESRI Network Analyst	MEDIUM	\$2,500	✓	1 concurrent license for enterprise use. List price only, price will come directly from ESRI.	X										
Task #3.3	MapLogic's Layout Manager ArcGIS Extension	MEDIUM	\$2,100	✓	1 concurrent license for enterprise use. List price only, price will come directly from MapLogic.	X										
Task #2.1	Touch Screen Hardware	MEDIUM	\$6,000	✓	3 Public Kiosk		X	X								
Task #3.4	ArcGIS Server GIS Mobile Data Browser	MEDIUM	\$8,000	✓	10 additional users, upgrade to Enterprise version in Year 6		X	X								
Task #5.1	ArcGIS Server Mobile GIS Data Browser Solution, Set-up and Training	LOW	\$0	✓	In-house Training		X	X								

Five Year Implementation Timetable Year Five (con't)

Task Description	Cost Level Option	Total	GTG Recommendation	Notes	Month of Implementation											
					Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Task #3.7	Touch Screen Software Applications	MEDIUM	\$8,000	✓	3 Public Kiosk		X	X								
Task #5.4	Touch Screen Software Application Set-up and Training	MEDIUM	\$3,600	✓	Set-up for 3 kiosks. Does not include travel expenses.		X	X								
Task #3.5	Automated Vehicle location (AVL) Software	MEDIUM	\$12,500	✓	Enterprise license used with Intranet GIS Data Browser. Vehicle hardware not include in Plan, budgeted by department.				X	X						
Task #5.2	Automated Vehicle location (AVL) Software	MEDIUM	\$1,200	✓	Enterprise wide. Does not include travel expenses.				X	X						
Task #3.6	Routing Module to AVL Software	MEDIUM	\$4,000	✓	Enterprise license used with Intranet GIS Data Browser and AVL. Vehicle hardware not include in Plan, budgeted by department.				X	X						
Task #5.3	Routing Module Set-up and Training	MEDIUM	\$1,200	✓	Enterprise, 1 day training. Does not include travel expenses.					X	X					
Task #3.9	Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser	MEDIUM	\$50,000	✓	GIS Integration to PD system				X	X						
Task #5.6	Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser	MEDIUM	\$2,400	✓	2 day training. Does not include travel expenses.				X	X						
Task #3.8	GIS Enabled Recreation Management Software	MEDIUM	\$10,000	✓	GIS Component to Recreation Management Software Application						X					
Task #5.5	GIS Enabled Recreation Management Software	MEDIUM	\$1,200	✓	1 day training. Does not include travel expenses.						X					
Task #5.7	Enterprise Mass Notification System	MEDIUM	\$1,200	✓	1 day training. Does not include travel expenses.						X					
Task #7.1	On-site Consulting Technical Services	LOW	\$10,000	✓	On as an as needed basis	X										
Task #7.2	Update to the Plan	MEDIUM	\$9,000	✓	To reflect changing priorities and technologies	X										

Typical Task Dependencies



The County of San Luis Obispo, California



Phase IV: Plan of Action Executive Summary

Chapter 18: Executive Summary



Chapter Outline

Introduction

Summary of Recommendations

Existing Departmental Structure and Functions

Existing Hardware and Software

Recommended GIS Applications to Meet Identified Needs

Existing GIS Data Layer Inventory and Future Recommendations

Multi-Tier GIS Application Use

Summary of Five Year Implementation Cost

Introduction

Geographic Technologies Group, Inc. (GTG) was retained by the County of San Luis Obispo to perform a countywide Geographic Information System (GIS) Needs Analysis, Conceptual System Design, and a Strategic Implementation Plan with an associated Plan of Action. GTG is recommending a five-year phased implementation of GIS. A “Five-Year Phased GIS Implementation Plan” was developed through information gathering, questionnaires, and interviews conducted with the departments of the County.

The goal of the Needs Analysis, System Design and Implementation Plan is to assess, evaluate, and make recommendations for many strategic, tactical, technical, and logistical issues facing the County. After extensive on-site interviews and presentations, meetings, document submission and review, and telephone conversations, a summary of the key recommendations and conclusions made by GTG for the County is provided in this chapter.

Summary of Recommendations

Some of the critical elements needed for a successful GIS in the County are:

- Enterprise Coordination of GIS Efforts Countywide to Improve Effectiveness, Reduce Duplicate Efforts, and Realize Optimal Return On Investment – Establish an Independent GIS Coordinator
- Implement a “Hybrid” Organizational Structure - GIS Governance Model
- Establish Base Levels of GIS Staffing for Each County Department
- Coordination with External Entities:
 - Cities
 - State of California
 - Universities
 - Regional Boards

- Private Sector
- Leverage Current GIS Investments by Upgrading or Purchasing the Latest ESRI (Environmental Systems Research Institute) Technology Offerings:
 - ArcGIS Server
 - ArcGIS Desktop
- Develop a Centralized GIS Environment with a Shared ESRI Licensing Structure
- Create New GIS Data Layers and Update Existing GIS Data Layers:
 - Prioritization of Master Data List Layers
 - Critical Base Map Layers (Parcels, Street Centerlines, Address Points, Digital Orthophotography, Digital Elevation Models)
- Convert Existing GIS Data to a Standard Countywide Format
- Consolidate, Centralize, and Manage GIS Data Layers for use by All Departments
- Develop a Logical and Physical Database Design
- Develop Standards for the Creation of Metadata
- Create User-friendly Tools to Access GIS Efficiently and Effectively
- Implement Countywide Viewing and Data Sharing Application via an ArcGIS Server Based GIS Intranet Data Browser
- Enable Existing Databases by Using an ArcGIS Server Based GIS Intranet Data Browser (GIS front end):

• SAP - Countywide • Tidemark - Countywide • Property Data System - Assessor	• LP01 – Legacy Public Safety Databases • Envision – Health Agency • Various Document Management Solutions; Tidemark, Open Text, Exigent - Countywide
- Make GIS accessible to all County employees and the public
- Make GIS Training Available to all GIS Using Departments

This Needs Analysis, System Design and Implementation Plan document should be relied on to direct the implementation of GIS technology over a five year period. However, this document should be looked upon as a living document that will evolve to incorporate the invariable changes that occur in local government. Additionally, new and emerging technologies will need to be considered as the phases of implementation progress. It is therefore imperative to regularly update the Implementation Plan. It is recommended that the County update the plan on an annual basis, either in-house or via an outside consultant.

Outside of County department's uses and advantages, the technology presented in this Needs Analysis, System Design and Implementation Plan will give County leaders, Board of Supervisor members, and citizens' access to GIS data that will allow for:

- Viewing the potential impact of annexation, re-zoning, and other property issues
- Viewing residences within specific districts
- Conducting on-the-fly analysis such as progress on development projects and CIP projects
- Viewing predictive modeling such as infill analysis, population trends, and neighborhood wellness
- Improving economic development efforts

Existing Departmental Structure and Functions

The County has identified and utilized technology as a means for improving its business processes, infrastructure, services, information and decision-making. The County has recognized the value and importance of an enterprise GIS, thereby taking the necessary action to ensure that its implementation of GIS is efficient, effective, and viable. The County has been utilizing GIS in a variety of capacities for several years in various stages, primarily functioning out of two or three major departments. It is recommended that the County move to a more integrated, scalable, enterprise-wide implementation.

The County should utilize a hybrid GIS organizational structure. A recommended GIS Coordinator in the Information Technology Department (ITD) will serve as the primary coordinating GIS resource for the County. The GIS Coordinator will bring together many of the County's GIS enterprise implementation efforts, with support and assistance from the GIS Steering Committee, the ITD Chief Information Officer and other department/division heads. Chapter 5: *Organizational Structure and Staffing*, addresses the feasibility of moving the current GIS Coordinator within the organization to be autonomous of any one department or division within the County.

Key GIS staff for data creation, collection, and analysis are distributed throughout certain County departments; though these staff members are not directly responsible for the County's enterprise GIS, they play a key role in the County's implementation of GIS and its complementary technologies. With training and experience these users can handle the majority of GIS task for their particular department, giving more flexibility to the GIS Coordinator to handle larger enterprise issues. For the present and near future, the GIS Coordinator should assist smaller departments until demand outpaces his or her ability to adequately meet their needs.

Other key personnel issues identified are:

- Staff a GIS Analyst in Public Works to create and maintain the various infrastructure data layers
- Train key staff in each department to serve as their department's GIS liaison
- Assign additional GIS roles and responsibilities to current staff (if funding is available, these positions could be new hires)

- In Year Two of the Implementation Plan, restructure the duties of an existing System Administrator in ITD to be responsible for GIS server maintenance and database administration to ease the workload on the GIS Coordinator so that there can be a more concentrated on ESRI ArcGIS Server technology
- Schedule and adhere to monthly (or quarterly) technical meetings of the GIS Users Group and GIS Steering Committee
- Based on the implementation plan, develop rules/protocols to decide administrative issues such as:
 - Data development priorities
 - Application development priorities
 - Data standards and documentation
 - Maintenance responsibilities
 - Public data access
 - Cost recovery options
- Conduct annual reviews of GIS activities and user satisfaction survey (modify implementation based on review and survey results)
- Develop educational programs for citizens of the community which can be used to demonstrate the utility of the GIS
- Distribute a County GIS newsletter (hardcopy and/or Intranet) as a means of sharing successes and educating the organization about the uses of GIS
- Develop training and educational mechanisms to involve all levels of employees

Existing Hardware and Software

As the acquisition, management, and dissemination of information continue to become increasingly valuable functions within local governments, so too has GIS proven to be increasingly valuable. The County is no exception to this observation, as it has benefited from its preliminary implementation of GIS. GIS and GIS-based technologies have contributed to improve the County's business processes, infrastructure, services, information, and decision-making.

The County has already invested in software and associated databases. Utilizing GIS as a window into these databases will improve County operations and allow a much more significant return on investments from these existing products.

Key hardware and software issues identified are:

- Invest in three new servers to store and distribute spatial GIS data
- Upgrade desktop hardware in accordance with County existing policies and procedures (ITD recommended 5 year computer configuration)

- Embark on a field laptop/tablet pilot program in Year Three of the Implementation Plan for viewing of GIS data away from an office environment that will provide field staff with access to both static and dynamic data layers
- Explore networking options for remote satellite offices located throughout the county
- Continue to utilize Environmental Systems Research Institute (ESRI) products and applications where applicable to the enterprise GIS effort
- Implement data maintenance applications within appropriate departments
- Acquire and utilize an easy-to-use enterprise ArcGIS Server based GIS Intranet Data Browser that will enable all necessary staff to utilize GIS to answer daily questions.

Recommended GIS Applications to Meet Identified Needs

The following table outlines the identified GIS Needs as determined by the Department Needs Analysis and what application or service is designed to meet that need (further information on both can be found in Chapter 2 within each department's Needs Analysis and in Chapter 9: *Enterprise Wide Applications*):

GIS Need	GIS Application/Service to Meet GIS Needs	Department in Need
<i>Access to Spatially Enable Documents and Drawings / Access to Digital Pre-plans and Hazardous Material Data</i>	Integration between Document Management software and GIS – To Be Determined (TBD)	• Planning and Building • Public Works • Assessor • CAL FIRE • Sheriff
<i>Automatic Vehicle Location (AVL)</i>	Intranet Data Browser with AVL module	• OES • Probation • Planning & Building
<i>Data Development and Management of Pertinent Data Layers</i>	ArcGIS (ArcEditor and/or ArcInfo)	• Clerk-Recorder • General Services • ITD • Public Works • Risk Management • Agricultural Commissioner • Planning & Building • Assessor
<i>Department Wide Access to Geospatial Data</i>	Intranet GIS Data Browser	• All Depts./Divisions
<i>Department Specific Access to Geospatial Data</i>	Crime Incident Analysis Application	• Sheriff
<i>Desktop GIS Application to Perform Advanced Mapping functions</i>	ArcGIS (ArcInfo, ArcEditor, or ArcView) in conjunction with ArcGIS Server	• All Depts./Divisions

GIS Need	GIS Application/Service to Meet GIS Needs	Department in Need
<i>Economic Development GIS Initiatives</i>	Development of an ArcGIS Server based Web Portal	• <i>Planning and Building</i>
<i>Enabling Existing Databases / Geospatial Data Creation and Integration</i>	GIS Data Creation and Integration Application (used with ArcGIS Server GIS Intranet Data Browser)	• <i>Planning and Building</i> • <i>CAL FIRE</i> • <i>Health Agency</i> • <i>Probation</i> • <i>Public Works</i> • <i>Social Services</i> • <i>Agricultural Commissioner</i> • <i>Assessor</i>
<i>Field Access to Geospatial Data</i>	Mobile GIS Data Browser based on ArcGIS Server platform	• <i>Agricultural Commissioner</i> • <i>Assessor</i> • <i>CAL FIRE</i> • <i>Farm Advisor</i> • <i>Health Agency</i> • <i>Library</i> • <i>OES</i> • <i>Planning and Building</i> • <i>Public Works</i> • <i>Risk Management</i> • <i>Sheriff</i> • <i>Probation</i>
<i>Field Data Collection</i>	Field Computers (handhelds or rugged tablets) enabled with a data collection application	• <i>Agricultural Commissioner</i> • <i>CAL FIRE</i> • <i>Farm Advisor</i> • <i>Health Agency</i> • <i>Public Works</i> • <i>Planning & Building</i> • <i>Assessor</i>
<i>GIS Based Work Order Management</i>	Work Order Enterprise software application integrated with SAP and GIS	• <i>General Services</i> • <i>Public Works</i>
<i>Formal GIS Training</i>	Specific Application Training	• <i>All Depts./Divisions</i>
<i>GIS Enabled Recreation Management Software</i>	TBD via RFP	• <i>General Services/Parks</i>
<i>Network Admin</i>	ArcGIS Server	• <i>ITD</i>
<i>Mapping and Spatial Analysis of Department Data</i>	ArcGIS (ArcInfo, ArcEditor, or ArcView) in conjunction with ArcGIS Server Intranet GIS Data Browser	• <i>All Depts./Divisions</i>

GIS Need	GIS Application/Service to Meet GIS Needs	Department in Need
<i>Mass Notification</i>	<i>Mass Notification System Software, via RFP</i>	• <i>Agricultural Commissioner</i> • <i>CAL FIRE</i> • <i>ITD</i> • <i>OES</i> • <i>Sheriff</i>
<i>Public Access to Geospatial Data</i>	Internet GIS Data Browser Touch Screen Application	• All Depts./Divisions
<i>Routing</i>	Intranet GIS Data Browser with Routing Module	• <i>Assessor</i> • <i>Planning & Building</i> • <i>Probation</i> • <i>Social Services</i>
<i>Property Tax (PD) System</i>	Custom Development of Property Tax Data System Integrated with GIS Internet Data Browser via RFP	• <i>Assessor</i>



Existing GIS Data Layer Inventory and Future Recommendations

The recommended GIS Coordinator in ITD will manage and maintain all of the County's GIS databases. These databases contain most of the spatial data that is currently in use by the County. These data elements, both recommended and existing should be used as the baseline GIS data when developing an enterprise Geodatabase. See Chapter 11: *Master Data List* for a complete list of existing and recommended layers.

Other key data layer issues:

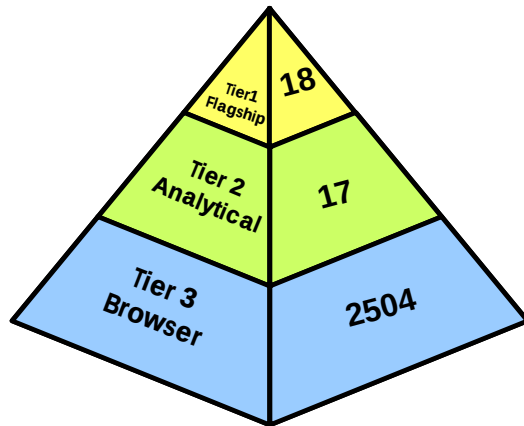
- Maintain a dynamically updated repository for all GIS data (currently stored as shapefiles; eventually stored in SQL Server and accessed via ArcGIS Server) that is accessible to all users with appropriate security
- Work in conjunction with cities within the County and other external agencies to continue data development and data sharing efforts
- Create, consolidate, and convert needed data layers; this process is critical and should be a focus in the first year of this initiative
- Share data with the public through Internet based GIS applications.



Multi-Tier GIS Application Use

The County's GIS users are composed of thirty six (36) data editors and approximately two thousand five hundred four (2504) data viewers across over 20 departments and divisions. Realistically all of these County staff members will not be viewing GIS data at one time. There is expected to be anywhere from 200 to 500 daily users (at any one given time) of the County's Enterprise GIS. The estimated total number of potential GIS users is based on the departmental interviews, organizational charts, and estimated total number of personal computers within the County.

The following chart describes the current and recommended GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



Tiers of GIS Users	
Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Below is a chart which outlines the number of departmental GIS users and broken down by type of capability.

Recommended ESRI Software by Department/Division				
	Tier 3	Tier 2	Tier 1	
Department	Intranet GIS Data Browser	ArcView or ArcEditor	ArcEditor	ArcInfo
Administrative Office / Board of Supervisors	13	0	0	0
Agricultural Commissioner	46	3	1	0
Assessor's Office	95	0	5	0
CAL FIRE	246	1	2	1
Clerk Recorder's Office	21	1	0	0
Office of the District Attorney	94	1	0	0
Farm Advisor	7	0	0	0
General Services	168	2	0	0
Health Agency	356	2	0	0
Human Resources / Risk Management	27	0	0	0
Information Technology	84	0	2	1
Library	UNL	0	0	0
Office of Emergency Services	9	0	0	0
Planning and Building	101	3	3	1
Probation	169	1	0	0
Public Works	190	2	1	0
Sheriff - Coroner	400	0	0	0
Social Services	448	1	1	0
Treasure / Tax Collector / Public Administrator	30	0	0	0
Totals	2504	17	15	3

Summary of Five Year Implementation Costs

The following cost estimate includes costs associated with a five-year phased implementation, which is based on baseline budgetary projections. This five-year phased implementation plan, if implemented, will provide the County with a thorough and sophisticated enterprise-wide GIS, on par with enterprise-wide GIS implementations found in mid-sized counties and cities across the United States. For a detailed breakdown of these costs, please review the schedules found in Chapter 16: *Five-Year Phased Implementation Plan*.

Year One – Enterprise-Wide Deployment, Data Maintenance and Creation, and Enterprise Database Design and Development Phase

Year One will be focused on continued groundbreaking data development efforts, as well as the development and acquisition of enterprise-wide GIS applications. The Year One implementation tasks lay the foundation for an enterprise GIS. At the **end of Year One** the County will have accomplished the following goals:

- Partially created critical GIS data layers (parcels, street centerlines, address points) - work spread out over three years
- Created recommended (from Master Data Layer list) GIS layers to serve a variety of County departments – spread out over five years
- Upgraded essential hardware and software to support County-wide GIS usage
- Implemented field data collection via hand-held GIS/GPS units and recommended software for shared use by departmental field staff
- Upgraded to a standardized GIS platform across County departments, based primarily on ESRI software tools (ArcGIS Server based technology)
- Implemented an enterprise Intranet GIS data browser for data access throughout the County
- Implemented Enterprise data automation tools that geographically enable existing IT investments
- Completed monthly/quarterly meetings to continue prioritization of GIS data design and development objectives (both at the user level and steering committee level)
- Completed a logical and physical database design
- Provided training to key staff throughout the County
- Staffed GIS Coordinator in ITD to maintain and manage the Enterprise GIS and GIS, and a GIS Analyst in Public Works to manage department GIS initiative

Year One Resources: \$760,052

Year Two - Continued Enterprise-Wide Deployment, and Database Development Phase

Year Two will be focused on continuing development/acquisition of GIS data and integration of recently developed (and acquired) geo-spatial data. The GIS will expand across the enterprise during the second year of implementation. The Intranet will provide accessibility to all levels of users as desktop browsers are deployed to all departments and divisions. At the **end of Year Two** the County will have accomplished the following goals:

- Continued creation of critical GIS data layers (parcels, street centerlines) - work spread out over three years (in-house address point effort completed in Year Two)
- Continued creation of Master Data List layers – spread out over five years
- Completed implementation of an enterprise Intranet GIS data browser for data access throughout the County
- Upgraded essential desktop applications
- Configured an additional database via Data Creation Integration application
- Provided additional training to key staff throughout the County

Year Two Resources: \$546,300

Year Three – Data Access and Sharing Phase

The third year of the project will revolve around continued data sharing throughout the organization and maintenance of the County's existing investment. At this point in the implementation, departments should be utilizing the GIS for sophisticated analysis. In addition, mobile access to GIS will be established in a pilot program of 10 mobile units, either in one department or shared with various departments. These mobile units will be viewing the same data as in-office users, via an interface to the GIS Intranet Data Browser application. At the **end of Year Three**, the County will have accomplished the following goals:

- Completed creation of critical GIS data layers (parcels, street centerlines) – Year Four begins maintenance stage
- Continued creation of Master Data List layers – spread out over five years
- Upgraded to ArcGIS Server Enterprise Advanced
- Upgraded essential desktop applications
- Implemented a GIS link to the existing imaging system – via in-house development
- Configured an additional database via Data Creation Integration application
- Implemented a mobile data browser tool for data access in the field – pilot program
- Centralized all data into an enterprise-wide data store
- Enabled GIS for use by all County departments

Year Three Resources: \$544,480

Year Four - Application Development, Expanded Data Access, and Public Access Phase

This phase focuses on the implementation of advanced applications that facilitate data acquisition, sharing, and updating between the County departments and external entities. By the completion of this implementation phase the enterprise GIS should be considered a comprehensive source for spatial data and information for the County of San Luis Obispo. At the **end of Year Four**, the County will have accomplished the following goals:

- Replaced digital orthophotography taken in 2007
- Continued creation of Master Data List layers – spread out over five years
- Continued implementation of pilot mobile data browser tool for data access in the field – additional users/departments
- Implemented a GIS centric Crime Incident Analysis application tool at the Sheriff's Department
- Enhanced its Internet GIS portal presence with more complex functionality web portal
- Implemented GIS based Work Order Management application in General Services and Public Works – with integration into SAP
- Configured an additional database via Data Creation Integration application

Year Four Resources: \$560,780

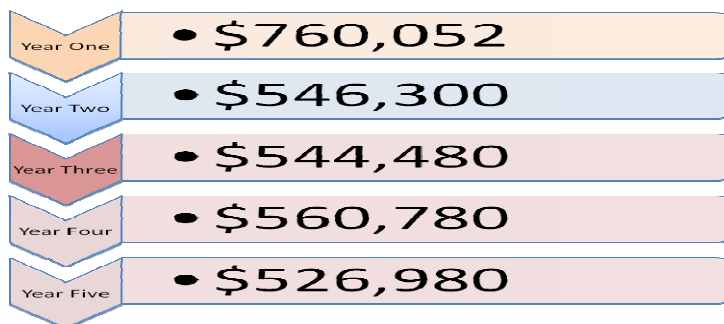
Year Five - Continued Application Development, Expanded Public Data Access, and Maintenance Phase

At this point in the Plan, departments should be utilizing the GIS for data collection, analysis, and decision support. This phase expands these efforts and provides additional tools to the mobile workforce, a custom Property Tax Data System to the Assessor's Office and an Enterprise Mass Notification System. At the **end of Year Five**, the County will have accomplished the following goals:

- Completed creation of Master Data List layers – begin ongoing maintenance stage in Year Six
- Implement a GIS touch screen application for public data access at County buildings
- Continued implementation of pilot mobile data browser tool for data access in the field – additional users/departments
- Implemented advanced ESRI desktop extensions
- Configured Intranet GIS Data Browser with mobile and automated vehicle location (AVL) tools, including routing functionality
- Implemented Enterprise level Mass Notification System that allows ALL departments to send GIS-Centric notifications to County citizens
- Configured Intranet GIS Data Browser with link to Recreation Management application
- Issued RFP and selected vendor for custom development of a Property Tax Data System integrated with Intranet GIS Data Browser
- Established a solid foundation for additional development and refinement of the County GIS

Year Five Resources: \$526,980

Total Five Year Investment:



\$2,938,592