

INTRODUCING A MATURITY MODEL FOR ENTERPRISE GIS

The Emergence of Enterprise GIS

The term “**Enterprise GIS**” is widely used and often misunderstood. It has been used to refer to an enterprise software license, to a centralized repository, a common mapping website, and other tangible items. While these examples can be *components* of an Enterprise GIS, they do not alone define a comprehensive GIS approach that aligns with the priorities of the larger organization.

***An Enterprise GIS provides a comprehensive suite of capabilities,
integrated into operational workflows,
that support and help attain enterprise priorities.***

Notice that this definition does not refer to platforms and technologies. *Enterprise GIS* does not necessarily need to be *Expensive GIS*. While a large organization with extensive systems may need a significant investment in GIS technology, a smaller organization may achieve an aligned approach through careful targeting of resources to key priorities.

The core characteristics of an Enterprise GIS include:

- Alignment with Enterprise Priorities
- Comprehensive, Accurate, and Timely Data
- Accessibility at all user levels
- Relevance to Operational Workflow
- Integration with Enterprise Systems & Data
- Demonstrated Return On Investment
- Sustainability

The maturity model will evaluate these characteristics in detail at each level.

Why a GIS Maturity Model?

Changes in both geographic technology and enterprise software are driving fundamental changes in the once isolated GIS world.

While an organization may recognize a strategic value in the use of GIS, it will not settle for inaccessible data and tedious workflows. GIS Organizations are evolving from a small group of GIS practitioners to a much more visible, and technical development organization.

The GIS Maturity Model proposes definitions and characteristics of the various stages travelled on the way to a true Enterprise GIS operation. It assists in benchmarking of current level of GIS in your organization, and provides a road map to the next level.

What is a maturity model?

A maturity model is a structured collection of elements that describe certain aspects of evolution in an organization. A maturity model may provide, for example:

- a place to start
- the benefit of a community’s prior experiences
- a common language and a shared vision
- a framework for prioritizing actions
- a way to define what improvement means for your organization.

A maturity model can be used as a benchmark for assessing different organizations for equivalent comparison.

--- Wikipedia¹



GIS Maturity Levels in Brief

Each level below describes typical stages in the development of an Enterprise GIS. Many organizations may have a foothold in more than one level as they evolve. This evolution is often necessary to build the understanding and support needed to sustain the highest level.

Level 1 – Enthusiasts

This is typically the introduction level of GIS to an organization. Individuals with interest obtain tools and use the technology on an ad-hoc basis to support their own deliverables. GIS technology tends to be individually licensed at the desktop level. Data is acquired for one-time use and discarded.

Level 2 – Department Based

During Level 2, specific departments or agencies within the larger organization recognize the value of building GIS capability for their internal use. The Department may support local equipment and supplies and designate resources to provide GIS services to other department users. Relevant GIS data to the department is authored and stored at the department level. As multiple departments begin to embrace GIS, multiple versions of base data proliferate. Informal user groups start to meet and share best practices.

Level 3 – Centralized

The Level 3 organization establishes a *Centralized GIS* unit to serve GIS needs across all of the other departments. The value of centralizing redundant data maintenance and equipment is often the catalyst for this change. The Central GIS begins to set standards that improve data quality and internal GIS workflows. Pooled purchasing of technology produces cost savings. Formal request mechanisms are established.

Level 4 – Integrated

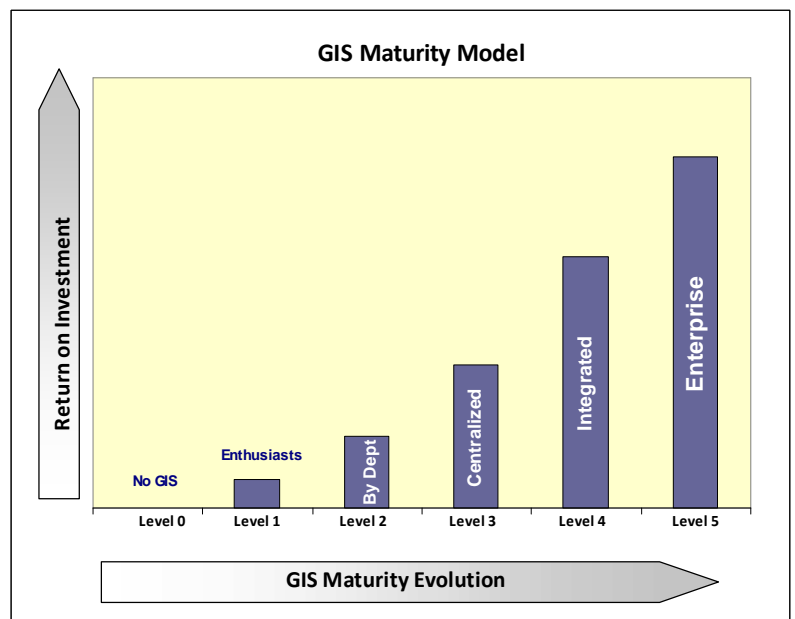
At Level 4, the GIS organization looks beyond its internal workflows to how it can enhance operational workflows.

Integration between enterprise applications and GIS functions gains greater visibility and demands more advanced data models and technology.

The GIS organization starts to develop a strategic plan for the technical development and sustainability of its operations. GIS Steering Committees are established to obtain input and direction from operational leaders.

Level 5 – Enterprise

At level 5, the GIS Strategic Plan is aligned with the overall Enterprise Strategic Plan. GIS is recognized as a tool to both improve efficiency and decision making. GIS integration is seamless with enterprise and mission-critical systems. GIS data attributes are embedded in traditional databases. GIS capability is on-demand, wherever demanded, as the focus on mobile applications and personalized tools increases. The GIS organization itself has become more technical and project oriented.



Level 1 - Enthusiasts

At the initial level of this model, an organization has no experience with GIS, or very limited experience through a small number of enthusiasts. In both cases, the enterprise has not made an investment or commitment to using the technology. GIS use is reliant on the initiative of individual practitioners.

Level 2 – Departmental GIS

At Level 2, departments centralize their GIS efforts within their own unit. It formalizes the enthusiasts as a service bureau within the departmental boundary. Multiple departments begin to establish their own units. The image to the right displays typical divisions within a public sector organization. Similar scenarios can occur with private sector entities.

The issues related to a distributed GIS model are clear. Redundant work efforts, inconsistent data, and a myopic view of priorities provide barriers to fully leveraging GIS technology.

Less obvious, is that this focus on individual departments is also a detriment to the department itself. Distributed staffs in each department spend time extracting data, cleaning the data, and producing map products.



This staff does not have the resources to get to the root cause of the cleansing activities in the first place. A better understanding of common struggles across departments would lead to solutions that benefit all of the groups.

LEVEL 2 CHARACTERISTICS

Enterprise Alignment	<ul style="list-style-type: none"> • Focus on Department’s priorities • Adhoc Collaboration, if any 	<p><i>At this level, the focus is on the priorities of the specific department. It is common to ignore or be unaware of other parts of the enterprise that can benefit from the department’s work products. Collaboration between departments is adhoc.</i></p>
Data	<ul style="list-style-type: none"> • Multiple, inconsistent copies of data • Redundant efforts to create the same data • Manual address cleansing and geocoding 	<p><i>Departments maintain GIS data that is only of interest to the department. There is little focus on reusability or sharing. Quality of data across departments is inconsistent.</i></p>
Accessibility	<ul style="list-style-type: none"> • GIS Specialists are necessary to generate even basic map products. • Services only available to the specific department. 	<p><i>Most GIS functions are accomplished through GIS Specialists using complex desktop tools. Only basic services can be provided to the department.</i></p>
Integration	<ul style="list-style-type: none"> • No Integration 	<p><i>As individual practitioners, commonly outside the IT department, GIS staff cannot develop system integrations. What integration there is tends to be throw-away procedures within the department.</i></p>
Sustainability	<ul style="list-style-type: none"> • Some limited procedures, however most knowledge is internal to a small staff. 	<p><i>For a large organization, this method of employing GIS technology is not sustainable. Knowledge exists only with a few individual specialists, procedures are not repeatable, and data quality is not reliable.</i></p>



The ROI Case for Migrating to Level 2

It is always important to evaluate the short term and long term impact of migrating to a new level. While migration may be desired, timing may be determined by the factors highlighted below.

BENEFITS

Benefits	Description & Assumptions
Reduced Costs / Increased Revenues	+ Establishment of owners for GIS data important to the department
Productivity & Workflow	+ Consistency throughout the department
New / Enhanced Services	+ Mapping services for non-GIS departmental users
Risk Mitigation	+ Mapping assets are more controlled and preserved within the department
Health & Safety	

INVESTMENTS

Costs	Description & Assumptions
Expenses	- Minimal investment in software licenses
External Services	-
Salaries & Benefits	- Officially designating some employee time to GIS efforts
Training & Org Change	-
Ongoing Support	- License Maintenance



Level 3 – Centralized GIS

Centralization is the typical step taken when an enterprise recognizes that GIS is useful to multiple aspects of its organization, and requires increased rigor and standardization. Centralization may be approached initially as a cost saving measure. It also allows the introduction of GIS capabilities to departments that previously did not have access to the technology.

Centralization of data access provides a standard location for GIS stakeholders to obtain current and high quality data. Consolidated licensing and infrastructure, standardized data, and streamlined workflows can all result in a lower cost to accomplish the same activities as level 2. While this does not require, centralized *ownership* of the data, it *does* require a standard approach to design, quality, and maintenance.



Successful centralization provides reliable data with easy to use toolsets. Server-based GIS applications are developed to provide a central GIS website and self service tools. It enables the organization to easily “come to GIS”.

LEVEL 3 CHARACTERISTICS

<p>Enterprise Alignment</p>	<ul style="list-style-type: none"> • Broader focus due to new support role • Standards Setting Authority • Establishment of User Group • Focus on efficiency of internal GIS Workflows • Funding limited to staff and infrastructure. • Priorities set within GIS Organization. 	<p><i>During this stage, the new central GIS organization is establishing its identity and workflows.</i></p> <p><i>As a new service bureau, it begins to learn more about other parts of the enterprise and their needs. The need for standards, data quality, and better communications become apparent. A formal cross-department user group is established to assist department based practitioners.</i></p>
<p>Data</p>	<ul style="list-style-type: none"> • Central Data Repository • Establishment of Data Ownership • Addressing and Naming Standards • Editor Procedures & Tools improve efficiency • Quality Control Standards 	<p><i>The most tangible sign of centralization is the establishment of a central repository for base GIS data. Core tasks related to GIS editing and data management benefit from eliminating duplicative efforts and multiple copies of standard data. Results include the establishment of formal data ownership for base data, data standards, and data use and security policies.</i></p>
<p>Accessibility</p>	<ul style="list-style-type: none"> • GIS Portal for data, standards, and requests • Central Geocoding Engine • Interactive Mapping Website • Focus on Self Service tools that reduce need for desktop software & training • Web-based Map Generation 	<p><i>Establishment of one-stop portals for finding GIS data, information, tools, and maps allows casual and new users to take better advantage of GIS.</i></p> <p><i>Self Service tools and websites are developed to both make GIS accessible to a broader audience, and lessen the demand on the central team for simple tasks.</i></p> <p><i>A central tool for address validation and geo-coding is a top priority application. Not only does this immediately impact productivity, it builds the framework for more advanced and integrated applications.</i></p>



LEVEL 3 CHARACTERISTICS

Integration	<ul style="list-style-type: none"> • Interfaces developed to feed addressing and geocoding to established systems • Closer coordination between GIS Editing roles and related business processes and owners. • Construction of professional technical infrastructure for data and applications 	<p><i>As the central GIS organization assumes responsibility for base GIS data, opportunities to streamline editing processes and improve data quality will rely on closer coordination with the business owners of the data. This is the first catalyst for better integration with enterprise processes and systems.</i></p>
Sustainability	<ul style="list-style-type: none"> • Dedicated Central Team • Skill sets: Cartographers, Editors, Analysts • Early stages of streamlining GIS workflows • Early stages of developing technical development skills 	<p><i>Many organizations form Central GIS units by transferring existing distributed GIS staff from departments. A with any change, there will be considerable growing pains. At this point it is important to appoint a GIS Leader that has both technical credibility and an enterprise outlook.</i></p> <p><i>The trend today, especially with the evolution of GIS technology, is to establish this new group within the Information Technology department.</i></p>

The ROI Case for Migrating to Level 3

BENEFITS

Benefits	Description & Assumptions
Reduced Costs / Increased Revenues	<ul style="list-style-type: none"> + Desktop software licensing reductions + Server rationalization
Productivity & Workflow	<ul style="list-style-type: none"> + Elimination of redundant data management + Data Maintenance tools used to increased productivity of GIS tasks
New / Enhanced Services	<ul style="list-style-type: none"> + Self Service Tools + Address Standardization
Risk Mitigation	<ul style="list-style-type: none"> + Decisions made based on current and high quality data + Higher quality data through standard maintenance systems
Health & Safety	<ul style="list-style-type: none"> + Faster access to current data

INVESTMENTS

Costs	Description & Assumptions
Expenses	<ul style="list-style-type: none"> - Investment in server-level hardware and software - Investment in more sophisticated data base platforms
External Services	<ul style="list-style-type: none"> - Development of data maintenance applications - Outsourcing where advanced skill sets do not exist internally
Salaries & Benefits	<ul style="list-style-type: none"> - Role changes, new job requirements - Department Transfers
Training & Org Change	<ul style="list-style-type: none"> - Training for the newly formed team - Marketing the new team's role to the enterprise
Ongoing Support	<ul style="list-style-type: none"> - Infrastructure maintenance - Employment benefits

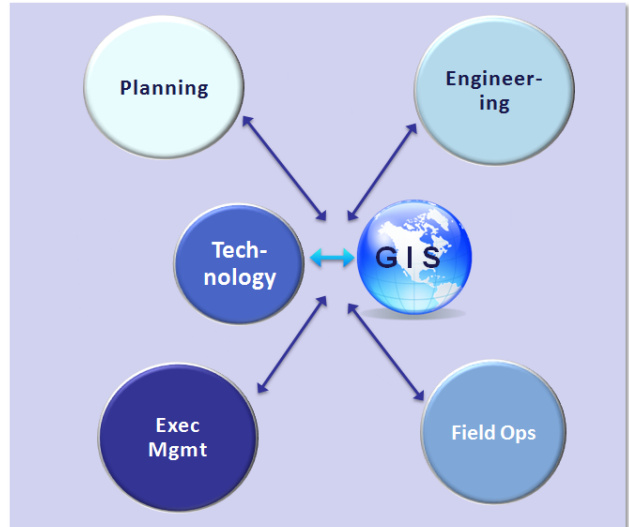


Level 4 – Integrated GIS

Level 3 focused on putting the GIS “house in order”. Level 4 begins to look outward to the needs of the enterprise. Applications start to receive more attention as data management becomes routine.

Integration between GIS capabilities and enterprise applications is piloted with loosely coupled toolsets. New applications are developed that retrieve data from multiple sources and renders them together spatially. Mission-Critical enterprise systems are targeted for direct integration with GIS data and capabilities.

GIS now comes to the Enterprise.



LEVEL 4 CHARACTERISTICS

<p>Enterprise Alignment</p>	<ul style="list-style-type: none"> • GIS Strategic Plan in place • Cross-Department GIS Steering Committee • GIS is used as the Enterprise Dashboard for “Current State” • Considered a “Best Practice” by the Enterprise • Establishment of GIO role 	<p><i>The GIS organization begins to look beyond improving traditional GIS activities, to understand the operational needs of the wider enterprise. It begins to identify ways it can assist in resolving issues. It prioritizes projects that benefit multiple departments in the enterprise.</i></p> <p><i>As the GIS organization becomes more strategic to the enterprise, the Geographic Information Office role becomes more formal, and more involved at the executive level.</i></p>
<p>Data</p>	<ul style="list-style-type: none"> • Advanced Data Modeling • Central source for addresses/locations in enterprise systems. • GIS Element integration with traditional databases • Data maintenance imbedded in the business workflow 	<p><i>Originally, GIS data is established as a separate repository to itself. It may be the result of enhanced extracts from traditional databases. In stage 4, maintenance is more tightly integrated with the business source of the information. Some data extracts are abandoned in favor of direct integration. GIS databases are now the enterprise source for addressing and location-based data.</i></p>
<p>Accessibility</p>	<ul style="list-style-type: none"> • Self-service Mapping & Reporting Tools • Customizable Web Mapping • Central Portal for access to all resources 	<p><i>In this stage, the enterprise begins to find GIS functionality in non-GIS systems and workflows. Rather than a flow that first approves a project and then maps it, the two activities are simultaneous and indistinguishable. End users begin to demand basic GIS functionality in their systems and workflows.</i></p>
<p>Integration</p>	<ul style="list-style-type: none"> • Addressing, geocoding, and mapping web services (SOA) suite • Integration with Mission Critical enterprise applications and reporting • Applied towards high cost/value enterprise workflows 	<p><i>As the GIS organization better understands operational workflows, it is exposed to the supporting mission critical information systems. Greater collaboration with the traditional technology group evolves to identify both data and functionality integration points.</i></p>



LEVEL 4 CHARACTERISTICS

Sustainability

- GIS integrates or aligns with the IT Department
- Self Service Applications free up GIS Team for more complex tasks
- Professional IT Management practices for GIS Infrastructure
- Need for advanced GIS technical skills

As functionality becomes simpler for end users, the necessary architecture becomes more complex. Automation of mechanical GIS tasks within end user workflows allows the central GIS organization to build its technical capability. GIS development is much more closely aligned with the Information Technology department.

The ROI Case for Migrating to Level 4

BENEFITS

Benefits	Description & Assumptions
Reduced Costs / Increased Revenues	<ul style="list-style-type: none"> + Near elimination of desktop licenses + Reduction in cost for data editing as it migrates to operational owners
Productivity & Workflow	<ul style="list-style-type: none"> + Streamlined workflows + Elimination of separate steps between GIS editing and operational editing
New / Enhanced Services	<ul style="list-style-type: none"> + New external services + Real-time operational tracking
Risk Mitigation	<ul style="list-style-type: none"> + Decision support toolsets + Single source for addresses & locations
Health & Safety	<ul style="list-style-type: none"> + Emergency management toolsets + Trend spotting & tracking

INVESTMENTS

Costs	Description & Assumptions
Expenses	<ul style="list-style-type: none"> - Continued investment in hardware and software platforms - Acquisition of supplemental data
External Services	<ul style="list-style-type: none"> - Systems Integration consulting fees - Database expertise consulting fees
Salaries & Benefits	<ul style="list-style-type: none"> - Recruiting of advanced skills
Training & Org Change	<ul style="list-style-type: none"> - Training in new skill sets - Establishment of GIO position
Ongoing Support	<ul style="list-style-type: none"> - Need for more 24-7 support with integration in mission critical systems

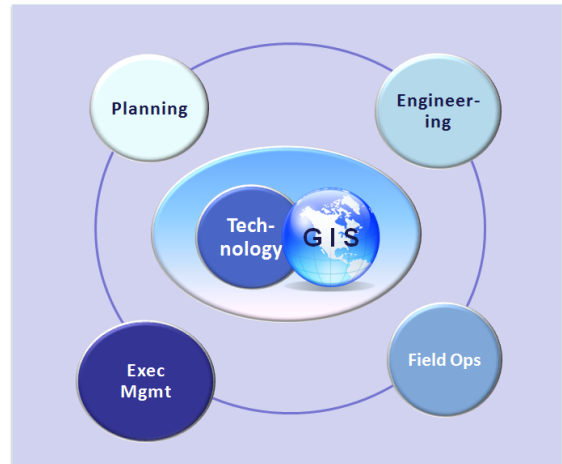


Level 5 – Enterprise GIS

GIS is recognized as a mission critical technology at level 5, as basic as the financial or work-order system. GIS is considered a seamless system feature rather than as a separate entity.

GIS technical development is more tightly aligned within the Information Technology department. GIS architecture is more fully integrated with the overall technology architecture of the organization.

Specialists in spatial analysis are found throughout enterprise departments. GIS applications are used throughout the enterprise for planning and decision support by management and operational staff.



LEVEL 5 CHARACTERISTICS

<p>Enterprise Alignment</p>	<ul style="list-style-type: none"> • GIS is part of the Enterprise Strategic Plan • Considered a mission critical technology by the Enterprise • GIO position recognized as cabinet level technology advisor • Use of GIS for decision analysis and locational awareness 	<p><i>At this level, GIS is considered a critical toolset for executive planning and decision making. Spatial analysis is integrated with other management dashboards. GIS is recognized within the overall strategic plan of the organization.</i></p> <p><i>As a critical technology, the development functions of GIS become absorbed by the IT department, as the data maintenance has already been absorbed into the workflows of departments that source the data.</i></p>
<p>Data</p>	<ul style="list-style-type: none"> • Real-time, “Live”, GIS data maintenance that eliminates versioning and cycle delays • Rationalized, or blended, GIS and Enterprise databases • Virtual databases with live external and internal data. 	<p><i>The line between GIS and traditional databases is blurred in Level 5. The concept of “Map it Where it Lives” enforces integration over redundant data extracts.</i></p> <p><i>Integrated workflows allow the real-time editing of GIS features without specialized GIS training. Data is available to the enterprise immediately, without a lengthy data management cycle.</i></p>
<p>Accessibility</p>	<ul style="list-style-type: none"> • Ubiquitous access, GIS features are available to all levels of users and skill sets • Mobility – GIS functionality is available to operations in the field • User-based customization and personalization 	<p><i>GIS becomes a natural component of relevant workflows and systems, to the extent that GIS Users may not even know the term “GIS”.</i></p> <p><i>Applications are primarily server-based and targeted at non-technical professionals. GIS finds its way to field-based operations both for tracking and as workflow aids.</i></p>
<p>Integration</p>	<ul style="list-style-type: none"> • Seamless integration with mission critical applications • Integration of IT and GIS infrastructures and standards • Investment in emerging technologies for further integration 	<p><i>GIS features are directly integrated with enterprise applications through a variety of strategies that may include database integration, web services, open source tools and integration packages. GIS becomes a prominent toolset in the Service Oriented Architecture. Technical platforms and infrastructures are blended.</i></p>



LEVEL 5 CHARACTERISTICS

Sustainability

- Blending of GIS and IT Infrastructure and Staff
- Data Editing is imbedded in operational workflows.
- Most enterprise GIS functions are server based and maintained centrally.

Maintenance of core GIS data is now a seamless component of operational workflows. Editing applications enforce quality and timeliness. The cost of maintaining this base data is now a normal operational cost.

GIS technology skills have grown throughout the IT organization and are less dependent on a small group of specialists.

The ROI Case for Migrating to Level 5

BENEFITS

INVESTMENTS

Benefits	Description & Assumptions
Reduced Costs / Increased Revenues	<ul style="list-style-type: none"> + Reduction in dedicated GIS Editor roles + Streamlining of technology costs with central IT
Productivity & Workflow	<ul style="list-style-type: none"> + Real-time locational awareness + Just-in-time field dispatching + Cross-Department Collaboration
New / Enhanced Services	<ul style="list-style-type: none"> + Customer / Constituent access to location based data + SOA GIS services for "plug and play" in enterprise systems
Risk Mitigation	<ul style="list-style-type: none"> + Improved management and maintenance of physical infrastructure and utility networks + Emergency Preparedness
Health & Safety	<ul style="list-style-type: none"> + Incident Management + Disease Tracking and Prevention

Costs	Description & Assumptions
Expenses	<ul style="list-style-type: none"> - Server based licensing and infrastructure
External Services	<ul style="list-style-type: none"> - Advanced technology consulting and outsourcing
Salaries & Benefits	<ul style="list-style-type: none"> - Advanced GIS technology roles
Training & Org Change	<ul style="list-style-type: none"> - Continuing technical and GIS training - Increasing complexity of skill sets
Ongoing Support	<ul style="list-style-type: none"> - System and data maintenance



Taking the First Step

Most organizations will identify themselves as a combination of a couple of levels. The purpose of this analysis is to provide a vision for the evolution of GIS within an enterprise. The primary step for any organization is to identify enterprise priorities and implement a Strategic GIS Plan that will support the achievement of those goals.



About the Author

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This white paper is available for download from Even Keel Strategies, Inc. at the following URL:

http://portal.evenkeelstrategies.com/MakingHeadway/Blog%20Attachments/2008/EKS2008_GISMaturity.pdf



GIS Maturity Model – Characteristics Summary

		1 - Enthusiasts	2 - DEPARTMENTAL	3 - CENTRAL	4 – INTEGRATION	5 – Enterprise
ALIGNMENT <i>Exec Support, Priorities, Governance</i>	Alignment	None	Aligned only with individual Department	Broader enterprise focus due to new support role	<ul style="list-style-type: none"> GIS Strategic Plan defined Establishment of GIO role 	<ul style="list-style-type: none"> GIS strategies are aligned with Enterprise Strategic Initiatives and included in the Enterprise Strategic Plan GIO position recognized as cabinet level technology advisor
	Governance	None	None	<ul style="list-style-type: none"> Establishment of User Group Standards Setting Authority 	Cross-Department GIS Steering Committee	GIS has a seat in the Enterprise Technology Steering Committee
	Budgeting	None	Departmental expense. No support from other departments.	<ul style="list-style-type: none"> Funding limited to staff and infrastructure. Special projects compete for funds 	<ul style="list-style-type: none"> Operational budget for infrastructure and software is enhanced with funds for enterprise projects. Other projects are funded by “client” department. 	Operational budget includes funding for enterprise GIS initiatives as a cost of doing business.
	Enterprise Projects	None	Adhoc collaboration, if any	Focus on new GIS Workflows to manage & fulfill requests from multiple departments	GIS is used as the Enterprise Dashboard for “Current State” of operations. GIS Projects focused on Enterprise productivity	<ul style="list-style-type: none"> GIS used to support enterprise performance measures GIS Projects focused on Enterprise mission
	Exec Support	None	Department management only	Priorities are set within GIS Organization.	Executive recognition of GIS Analysis as a best practice.	Executive recognition of GIS as a strategic technology. It is used by executives for decision analysis.
	DATA Management <i>Modeling, Editing, QA</i>	Data Quality	<i>Extracts are quickly out of date</i>	Multiple, inconsistent copies of data Manual address cleansing & geocoding	<ul style="list-style-type: none"> Data accuracy built into editing Defined Data Ownership Quality Control Procedures 	Geocoding of data in its source database, rather than use of data extracts.
Data Modeling		None	None – master file approach	<ul style="list-style-type: none"> Advanced Address Model and Standardization Central database becomes source of Address Validation <i>Intentional</i> modeling of base datasets 	<ul style="list-style-type: none"> Advanced Data Modeling Central source for addresses/locations in enterprise systems. GIS Element integration into traditional databases 	Rationalization of enterprise and GIS databases. Redundancy is reduced in direct integration of GIS into enterprise databases and vice versa.
Data Management		<i>Informal if any. Data stored locally</i>	Redundant efforts across departments. No standards or version management.	<ul style="list-style-type: none"> Central Data Repository Editor Procedures & Tools improve efficiency 	Data maintenance starts to be imbedded in the business workflow and pushed out to operational data owners.	Real-time GIS data maintenance on live production data. Data maintenance integrated with source systems edited by end-user owners of the data.

		1 - Enthusiasts	2 - DEPARTMENTAL	3 - CENTRAL	4 – INTEGRATION	5 – Enterprise
Accessibility <i>Ease of Use, Self Service, Portals</i>	Ease of Use	N/A	Poor. GIS Specialists are necessary to generate even basic map products.	<ul style="list-style-type: none"> GIS One-Stop Portal Focus on Self Service tools that reduce need for desktop software & training Web-based Map Generation 	<ul style="list-style-type: none"> Central Portal for access to all resources Self-service Mapping & Reporting Tools Customizable Web Mapping 	<ul style="list-style-type: none"> On-Demand mapping against traditional databases. Ubiquitous access, GIS features are available to all levels of users and skill sets.
	Services	None	Services and Map Making are for the department only.	<ul style="list-style-type: none"> Central Geocoding Engine Interactive Mapping Website Address Validation Tools Geocoding Tools 	<ul style="list-style-type: none"> GPS Tracking Dispatching and Routing Pilots of seamless integration of GIS in enterprise applications. 	<ul style="list-style-type: none"> Mobility – GIS functionality is available to operations in the field. Virtual GIS blends internal and external GIS data End User customization and personalization
Integration <i>Workflow, Systems, Architecture</i>	Enterprise Workflow	None	Used for departmental analysis but not operations.	Closer coordination between GIS Editing roles and related business processes and owners.	Begins to improve enterprise operational workflows with GIS tools. Applied towards high cost/value enterprise workflows.	Most relevant operations use GIS as part of their workflow.
	Tech Architecture	Usually desktop only	Desktops and possibly department servers.	<ul style="list-style-type: none"> GIS Data Server Architecture GIS Application Development Architecture 	<ul style="list-style-type: none"> IT Staff used for infrastructure support More complex infrastructure 	<ul style="list-style-type: none"> GIS Infrastructure integrated with IT Infrastructure GIS Standards integrated with IT Standards
	Systems Integration	None	None	Interfaces developed to feed addressing and geocoding to established systems	<ul style="list-style-type: none"> Direct Integration with Mission Critical enterprise applications Web Services for Core GIS functions 	<ul style="list-style-type: none"> All key Enterprise Applications have seamless GIS functions. Explores emerging technologies such as SOA, GEO-Xml, and Open Source.
Sustainability <i>Internal Workflows, Skill Sets, Roles, Funding</i>	GIS Workflows	None	Procedures and standards are not formalized.	Focus on GIS workflow improvement and automation. Emphasis on consistency and quality by design rather than by inspection.	<ul style="list-style-type: none"> Self Service Applications free up GIS Team for more complex tasks. Cartography becomes a minor focus, delegated to end users. 	<ul style="list-style-type: none"> Data Editing is imbedded in operational workflows. Most applications are server based and enterprise accessible.
	Skill Set Focus	Self-taught	Geocoding, Cartography, some analysis	<ul style="list-style-type: none"> Core skills in Cartography, Editing, and Analysis. Developing technical skills for geodatabase mgmt and website development. 	<ul style="list-style-type: none"> Need for advanced GIS technical skills. Alignment with enterprise IT Management for technical support. 	Systems Integration, Database management, web services, architecture, and emerging technologies
	Roles	No official role	Part-time practitioners with primarily desktop cartography skill sets.	<ul style="list-style-type: none"> Backups for primary roles. Data Editors, Map Makers, Interactive Map Developers 	<ul style="list-style-type: none"> Application Developers, DBAs, Architects, Project Managers GIO position reports to CIO 	Blending of GIS and IT technical staff. Specialization of analytical staff.