

A Best Management Practices Primer for GIS in Palm Beach County, Florida

– Draft for Discussion Only –

A. Introduction

This “Best Management Practice” (BMP) primer is the result of a study of circumstances and performance of GIS in Palm Beach County, including detailed stakeholder interviews. In turn, a set of four comparable “successful” counties across the United States were also examined. In all cases, analysis included a customer satisfaction survey and self assessment survey based on the Baldrige Quality Awards. The primer also includes insights gleaned from both GIS specific and information systems literature review and other research.

The purpose of this primer is two fold. First is to provide a context by which the County can begin to address, formulate and prioritize its own set of best practices. The second purpose is to provide a list or set of possible practices that the County might consider.

This primer is organized into three principal parts. The first is the “Context” which is a discussion of BMP’s concepts and their relationships to other information systems and management concepts. The second is analysis of those BMP’s that are being employed and those that may be wanting in Palm Beach County. The third section, which is set out in Appendix A, details a set of broadly based best practices in the form of a catalog. This BMP Catalog has been separated out because it is intended to be dynamic and added to over time.

B. Context

1. Best Management Defined

Generally speaking, a “Best Management Practice” is a management idea which suggests that there is a technique, method, process, activity, incentive or reward that is more effective at delivering a particular outcome than any other technique, method, process, etc.¹ At first blush, the notion of a BMP is that it should be static over some time. Similarly, there is the idea that a BMP should be transferable between organizations. While there is some merit to those propositions, consistency over time and across organizations is not necessarily the hallmark of a best management practice.

To the contrary, from an internal perspective, some forms of BMP’s must necessarily be highly dynamic and adaptable to changing circumstances. Furthermore, a BMP should not put organizations into a “box” where new and innovative approaches are eschewed. It is almost axiomatic that best management organizations engage in continuous improvement and change management as ongoing, never ending exercises.

One of the key findings of the review of Palm Beach County and the other comparable counties is that the applicability of any given BMP across all organizations is not certain. Many practices, including some detailed later in this primer, do have relevance across organizations, but at a relatively high level. As a matter of implementation though, BMP’s

¹ Adapted from *Wikipedia*, 2007.

are a function of and must fit the legal, political, cultural, and technical environment of the specific organization seeking to employ it. For example, legal mandates vary across the country and often across a state. As a result, a practice that works for one organization may not work for others. Similarly GIS systems exist within organizations with their own strategies and culture. That is to say that because each organization is unique, the array of best practices may vary from organization to organization. Key to success, though, is alignment of the GIS to those strategies and the culture of the organization.

Another key finding is that the applicability of specific BMP was very dependent on the status of the evolution of a particular program.

For example, enterprise GIS in Kern County, California is nearing the end of its start-up phase. Practices appropriate Kern are focused on building the infrastructure for the enterprise GIS; especially data and technology acquisition and encouragement of users and uses of the system. This is the “build it and they will come” approach that is especially suited to start-up organizations. As Kern moves through its maturation process the practices and the foci will naturally change.

Also, take for example, Johnson County, Kansas. Johnson has a very mature enterprise GIS program. The focus there is less on infrastructure and more on embedding GIS in the business processes and systems of client agencies. Because of the maturity of the GIS program, a more entrepreneurial model has emerged. The focus is on customer services and practices that are intended to leverage the spatial dimension of business processes. In this way, GIS has become indispensable and valuable to its customers – so much so that customers are willing to pay for explicit services.

The third and final example is Mecklenburg County, North Carolina. Again, Mecklenburg County has a mature GIS program. Although GIS was developed somewhat in a decentralized fashion, it is now becoming very centralized. This centralization goes beyond the system to include consolidation of key GIS related business functions in a central organizational model. Again, the goal is spatially enabled business systems and processes. The means to get there reflect the strategy and culture of the County such that efficiency is paramount.

The purpose of these examples is to illustrate the point that BMP’s can take many forms and they may not be transferable across time and organizations. Perhaps more appropriately, therefore, a Best Management Practice can be defined as *a high performance way to achieving business goals and objectives that solve problems, create opportunities, and improve business results*. For the BMP to be effective it must allow for the easy transfer of ideas, knowledge, and standards. Best Practices must also be flexible and adaptable as business needs, fiscal circumstances, and technology change.

2. Knowledge Management

How an organization manages knowledge is a fairly good predictor of both best practice and organizational success. In a very real sense ‘Knowledge Management’ is a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance².

² See, Carla O’Dell, C. Jackson Grayson, *If Only We Knew What We Know: The Transfer of Internal Knowledge and Best Practice*, New York: Free Press, 1998

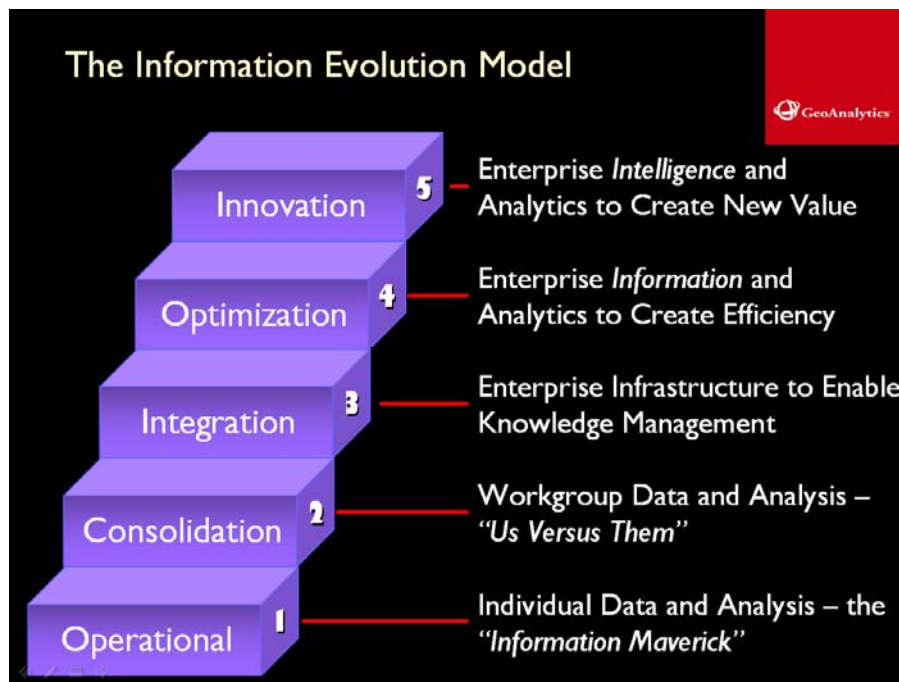
While not widely perceived as such, location is an integral part of knowledge management. Knowledge of the existence of events or business transactions and the subsequent quantification of performance or of impact is of little value without knowing “where” events occur. This is especially true in government where decisions and policies affect large numbers of citizens and communities.

For example, environmental impacts begin as localized events. Ultimately, the impacts of those environmental factors may spread and become more diffuse affecting greater areas and increasing larger numbers of people. By way of another example, social services needs are often clustered. The factors underlying those needs are usually the result of social, environmental, or demographic factors – all of which localized.

It follows, therefore that geographic information systems are integral to knowledge management systems overall. However, in most governmental organizations, the primary uses of GIS have been to automate and facilitate transactional processes. While these tactical uses of GIS are sound and beneficial, creating efficiencies and effectiveness, all too often GIS is not part of broader knowledge management – even though, these systems, business processes, data, technologies, and organizational structures can contribute mightily to strategic purposes of organizations.

At the beginning of this project, the Information Evolution Model³ was introduced as a concept of how information systems generally and GIS specifically mature over time. This model depicts how systems evolve to provide not only information, but also intelligence. The model encapsulates the basis of systems that support knowledge management.

³ *Information Revolution, Using the Information Evolution Model to Grow Your Business*, Davis, Miller, and Russell. 2006.

Figure 1: Stages of Information Systems Development toward Knowledge Management⁴

Through the course of this project, the concepts of the Information Evolution Model became more compelling. It has become clear, for example, that each of the comparable counties sought to develop the infrastructure to support a true enterprise system. That is, each county, Palm Beach included, sought to get to Level 3 Integration.

For those counties that had developed enterprise systems, the target became more than data sharing. The intent was to make GIS an indispensable part of the enterprise information systems of the county. In the case of Johnson County and Mecklenburg County, they sought to make GIS an integral part of the *business processes* of their constituent agencies. Although the approach varied, the outcome sought was the same.

3. Performance Management

Contained within the Information Evolution Model is the idea of enterprise performance management. Over the last year, in both private and public organizations, performance management has a much more prominent trend. Performance management regimes seek to not only make organizations efficient, but also to make them effective and innovative to deliver the best outcomes.

This trend has reached across sectors. For example, Bruce Gordon, the (outgoing) President of the NAACP recently said, "We are going to be very outcome-oriented, very results-oriented, as opposed to activity and effort-oriented." Transcending the last two gubernatorial administrations, state government in Florida has embraced performance management with an emphasis on strategy, performance metrics, and gauging and monitoring results.

⁴ Adapted from, *Information Revolution*.

Performance management cannot exist without some level of knowledge management. This is because performance management is built on the integration of data from many sources across the organization: operations, human resource, financial, etc.

4. Emerging Best Practices Concepts

Recent research has revealed some emerging concepts that merit discussion from a best management practices perspective. Although strategic in nature, these works can help inform and influence operational best practices. There are two broad concepts: Good to Great and innovation management.

a. Good to Great Concepts for Government

The 2001 book, *Good to Great*⁵ has been widely heralded as a profound influencer for private sector organizations. Its author, Jim Collins, recognized that business is different than government and its management needs to be different. This is, for no other reason than the fact that profit is not an appropriate measure of success in government and the social sectors. To that end, his team wrote a monograph in to the original book called *Good to Great and the Social Sectors*⁶.

The premise of this monograph is that government should not be run “like a business” because most businesses are mediocre. Rather, governments need to be run within the context of the governmental systems, but with the discipline required to be great. To that end:

“Greatness is not a function of circumstance. Greatness, it turns out, is largely a matter of conscious choice and discipline” Jim Collins.

“Good is the enemy of great”. Consider the following:

- The vast majority of companies never become great, because mostly they are good
- We don’t have great schools because we have good schools
- Few people have great lives, in large part, because it is just so easy to settle for a good life, and
- Similarly, we often don’t have great government because by and large we have good government

Collins suggests that greatness in government is determined not by measurement of inputs or processes, but rather by outcomes. That is to say what social goal is advanced; even if the goal defies quantification? Qualitative valuation, in Collins’ estimation is valid. For example, how does one measure the quality of life in a community? Certainly there are some outcomes that are quantifiable, but not all.

The key point is made by the following: “It doesn’t really matter whether you can quantify your results. What matters is that you rigorously assemble evidence – quantitative or qualitative – to track your progress”⁷. This is a proactive, not post hoc

⁵ *Good to Great*, Jim Collins, et al. 2001

⁶ *Good to Great and the Social Sectors*, Jim Collins, et al. 2005

⁷ *Good to Great and the Social Sectors*, Jim Collins, et al. 2005, page 7

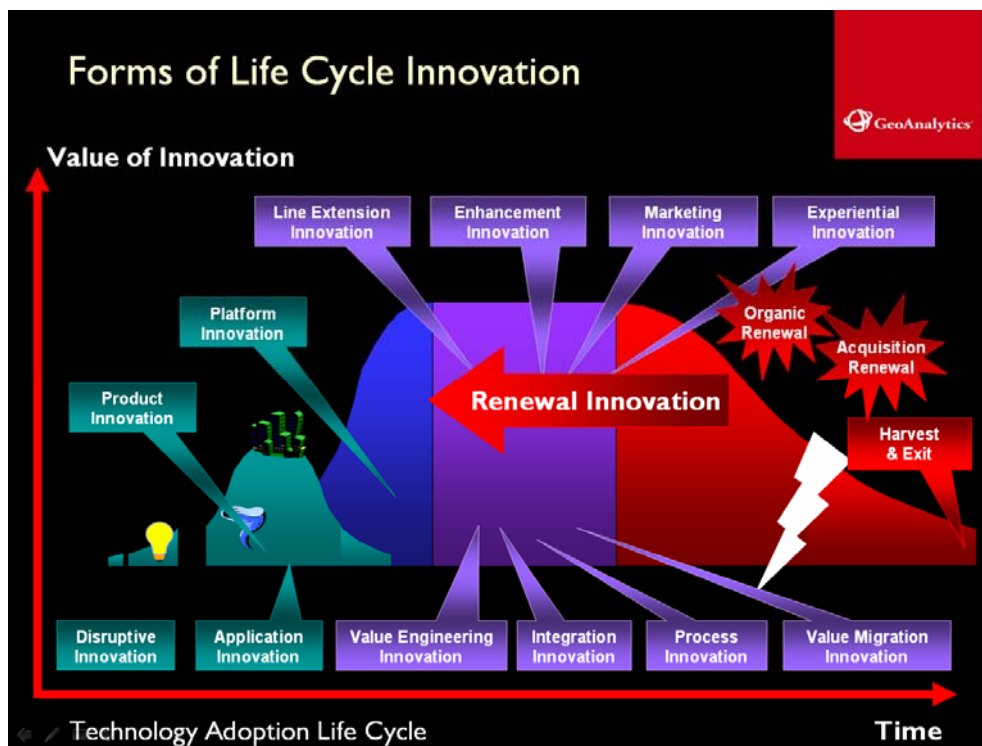
exercise. By determining what constitutes success measures up front is essential. Performance can be tracked, even in government. Tracking performance is vital to focus energy, resources, and mind-share.

b. *Dealing with Darwin* - Managing Innovation

Innovation is the life blood of most organizations. This is especially true of GIS organizations. Innovation takes many forms: technical; organizational; customer experiential; processed based; etc. There is an emerging discipline around management of innovation throughout the life cycle of the innovation.⁸

Often, innovation comes in the form of technical breakthrough - let's call that I-1. Because it is technology, that innovation will soon be replaced by other innovations - let's call that I-2. Unless I-2 completely renders I-1 technically and functionally obsolete, I-1 will continue to have value. That value may warrant some additional investment. That investment may not be in technical advancement, but rather in some form that extends the lifecycle of I-1, improves customer experience, or improves processes to reduce costs. At some time though, I-1 will need to be retired. The question is when and how will its value be maximized.

Figure 2: Innovation Management⁹



The critical point in *Dealing with Darwin* is that innovation can be managed and optimized. That means that organizations do not necessarily need to jump from one leading edge advancement to another. Rather, it may be more rational to try to sustain an investment over a longer period of time. Perhaps jumping from one to the next may

⁸ *Dealing with Darwin, How Great Companies Innovate at Every Phase of their Evolution*, Geoffrey A. Moore, 2006.

⁹ Adapted from *Dealing With Darwin*.

be rational too. The idea is that these choices must be conscious and thought out. Strategies around innovation are important.

5. Best Practices Themes

In addition to the findings of this project, several best management themes have emerged from recent research into information systems, especially spatial information system thinking. This research included interviews with GIS coordinators, geographic information officers (GIO), chief information officers (CIO), decision makers and elected officials at the local, state, and federal levels. The following details a set of propositions and related best practices themes.

Proposition:

While the value of spatial data and analysis is accepted in a majority of organizations today. A major challenge for geographic information coordinators and executive managers is integrating geographic technology and practices with the long term business planning and operations of the organization.

Themes:

- The value of geographic technology is manifest, in and out of most organizations. Services like in-car navigation systems, Google Earth imagery, and online driving directions demonstrate the power of geographic-based technology in today's world. This has reduced the need for geographic information coordinators to "prove" the value of the technology and instead moves organizations to the "why aren't we doing that?" level of acceptance.
- Spatial data, analytics, and presentation are integral to the daily lines of government business. More than a "nice to have", locational awareness is an indispensable tool in decision making, serving and supporting most government business functions.
- Linking tabular data from business systems across the enterprise with spatial data offers powerful decision making support.
- Only when spatial data and technology is critical to agency missions will policy makers realize the value of current, accurate data, information, systems, and analytics. At that time, the struggle to fund initiatives will lessen.
- The challenge today is making geographic technology and analysis integral to the everyday operations and management of the organization. In the same way that organizations no longer question telecommunication technology but only ask for budget and planning purposes what resources are needed for which projects, geographic technology must fade into the background of the organization by embedding the technology in day-to-day production applications and work processes, and cease being a "special" project-based work unit with special appeals, special resources, and special support needs.

Proposition:

Organizations must evolve from "what we think" to "what we know."¹⁰

¹⁰ Adapted from Gary Loveman, CEO Harrah's Entertainment, Inc.

Themes:

- Organizations need to base decisions on information that is reliable and consistently prepared and analyzed.
- Data must be transformed into useful knowledge and understanding to support decisions. Decision makers need situational and locational awareness “to know.”
- Using predictive analytics, ideas and alternatives may be tested and evaluated in virtual environments rather than real ones. These kinds of analytics minimize risk, increase understanding, and enhance performance. Driving exceptional outcomes is the essence of spatial intelligence.

Proposition:

Data is government’s key strategic asset – nevertheless while enormous amounts data get created, very little of it is currently used effectively. That is to suggest that data is either not accessible or it is not used to create information or intelligence.

Themes:

- Agencies need two kinds of business/spatial intelligence:
 - External – Knowledge and understanding how events and alternatives affect customers and services (Government to government, Government to citizens, Government to business);
 - Internal - Knowledge and understanding to optimize and create new value with internal operations (budgeting, performance metrics, earned value).
- Organizations are evolving from using geographic technology for routine and repetitive transactional work processes, to leveraging geographic information and analysis to develop business intelligence, provide decision-support, and pervading all aspects of management and operations.
- Organizations that embrace intelligence frameworks over simply managing data stores will be well positioned to more fully exploit data investments to be efficient, effective, and responsive to dynamic events and circumstances. If spatially enabled, those intelligence frameworks will be contextual and visually powerful.

Proposition:

The role of the GIO must change from primarily managing systems to providing useful intelligence about the organization and its customers.

Themes:

- GIO’s must understand and embrace the integrative, analytical, and persuasive power of place (spatial data);
- GIO’s must understand and embrace the synergy of business intelligence and spatial intelligence and how visual information can help with decision support and effective communications.
- GIO’s can provide the greatest value to their clients and citizens by making information technology strategic, not just tactical resources.
- To be strategic, GIO’s should lead the business intelligence and analysis functions for their organization.

- Integrating tabular data with spatial data offers more value than mere aggregation of data. With the application of spatially enabled business intelligence, leaders can move from just having data to using information to garnering knowledge to create understanding to application of intelligence for decision making.

C. Palm Beach County Best Practice Assessment

Palm Beach County is a leader in GIS.

This leadership cuts across County government. EGIS is innovative. The use of GIS as an embedded, transparent part of business processes is unique and powerful. The engagement of stakeholders in EGIS vests those agencies in EGIS as a driver for their own success. While the interests of stakeholder agencies and EGIS are not always perfectly aligned, the level of collaboration and, indeed, comity is special. The success of GIS in Palm Beach County is the result of a team effort – from the PMT to the GISPAC to CWGC to users.

When judged against the comparable counties and others, it is clear that Palm Beach employs many innovative and traditional best management practices. These BMP's address all system components and all topical areas identified in the Baldrige quality survey. Palm Beach has built its Enterprise GIS (EGIS) on the foundation of a strong organizational model and technical innovation. The approach to GIS in the County embraces the human dimension of systems development, management, governance, and operations.

The technical infrastructure for EGIS mirrors that of a level 3 organization in the Information Evolution Model. There is consistent, enterprise data accessible to users, systems, and services. The EGIS technical infrastructure is as sophisticated and effective as any to our knowledge. It is innovative in that it leverages the best aspects of multiple technologies. Moreover, it employs a services oriented architecture to deliver both data and application services in an innovative way. In addition, business systems across the County seamlessly access and use these services.

As with any organization though, there are many opportunities to improve. As noted above, Best Management Practices, by their very nature, must be dynamic and adaptable to circumstances as they change over time. In addition, there are opportunities to further develop existing practices to optimize outcomes.

Figure 4 and Figure 3, on pages 15 and 16 respectfully, provide score cards on the status of best practices in Palm Beach County. Figure 3 illustrates this from an internal perspective. Figure 4 assesses best practices status relative to the comparable counties that were part of this study.

The following delineates BMP strengths and areas in need of improvement in Palm Beach County. As with the Best Management Practices Catalog, this review is organized around the systems components: business process; data; technology and applications; and organization. It should be noted that the focus of this review is on EGIS and Countywide GIS Coordination (CWGC).

1. Business Process

Business processes are those activities undertaken by CWGC in support of EGIS, its constituent agencies and other customers.

a. Strengths:

- **Separation of Coordination from Service Bureau Functions.** The effort to keep distinct identifies for these two activities is important. While related, these functions are, in fact, distinct. The managerial and operational approach to these activities can cause conflict.
- **Service Orientation.** CWGC provides services to agencies that in turn provide business services to citizens and other stakeholders. This not only focuses CWGC, but also empowers agencies to meet their mandates and missions.
- **Involvement from Stakeholders.** Although nominally an organizational consideration, stakeholder involvement and leadership on the PMT and GISPAC provides accountability and direction to CWGC activities.
- **Systems Administration.** Management of EGIS from a systems administration perspective is consistent with best information systems practices. In addition, both customer satisfaction and interviews revealed an overall satisfaction with the system availability.
- **Risk Mitigation on Initiatives.** The approach taken for system, data, and application development is focused and incremental. This approach mitigates risk and results in positive outputs.
- **Providing Relevant Data and Applications.** Both comparatively and from the customer satisfaction perspective data and applications provided in EGIS meets most business needs in the County.

b. Areas for Improvement

- **Business Planning.** Strategic plans may have a useful life cycle of up to five years. However to be most effective, strategic plans should be refreshed with business planning on an annual or budget cycle basis. The purpose of these plans is to: align with changing organizational strategies; adaptation to changing or evolving fiscal or issues circumstances; to identify priorities and refocus efforts to those priorities. Current and organizationally aligned planning helps assure successful execution of key initiatives.
- **Execution of Key Initiatives.** In interviews and PMT priority listing, there has been some frustration with the advancement of a key strategic initiative, namely Enterprise Addressing. Although constrained by staff and financial resources, this is a necessary effort and momentum is required to achieve this key initiative.
- **Performance Management.** Although EGIS and CWGC have been successful, there have been few predetermined key performance indicators. Programmatically and as a workgroup, the establishment of performance measures will focus activities and provide both reporting and accountability structures.
- **Customer Satisfaction.** Although a customer satisfaction survey was undertaken as part of this project, ongoing efforts to gauge customer satisfaction will provide insight as to priorities for improvement.
- **Evolution.** Palm Beach County is uniquely poised to become a leader in taking the next steps up the information evolution model. That is to suggest not only just spatial intelligence, but to position EGIS to be a source for decision support for the County at the operational, departmental, and enterprise levels.

2. Data

a. Strengths

- **Data Management.** The number and richness of data sets that are managed and supported in EGIS is an impressive accomplishment. In addition to the volume and variety of data available, the data management protocols are generally first rate. This includes decentralized data custodianship with centralized data access.
- **Data Publication and Access.** Data resident in EGIS are managed in ways that make them accessible for a variety of users and uses, including data and application services. Data management has been fit to the business of governmental agencies in Palm Beach County.
- **Data Standards.** Formal adoption of data standards is also representative of BMP. Although there are only a limited set of standards, they add to the reliability, consistency, and utility of spatial data sets.

b. Areas for Improvement

- **Documentation.** Additional data documentation is needed in several areas to document the existing environment, communicate what else is available in other departments, and to outline operational processes and procedures.
- **Data Catalog.** The development of a data catalog is increasingly necessary to manage the 150-160 (and growing) layers of information within EGIS. Data catalogs are also indispensable for regular and occasional users.
- **Metadata.** Enhancements in metadata management are needed. This includes improving the frequency of updates, triggers for making specific layers available via the intranet versus the internet, and the feedback loop for corrections, enhancements and additional layers are the early scope of this effort.

3. Technology and Applications

a. Strengths

- **Technology Adoption.** GIS in Palm Beach County has evolved through a history of innovation in technical architectures and approaches. Most of that innovation has been “leading”, not “bleeding” edge – which is a very important balance to achieve. One exception to that was the original Operational Data Store project where the County was the first organization to implement a production version of new technology. Even though that was arguably a bleeding edge project, careful attention was paid to risk management.
- **Technical Approaches.** More than just adopting technology, EGIS has leveraged the best of emerging and traditional technical approaches. This optimizes the output to serve business objectives. For example, services oriented architectures coexist with more traditional data warehousing approaches.
- **Leverage.** CWGC has adroitly leveraged the considerable IT infrastructure of the County to meet the needs of its customers and stakeholders.
- **Adaptability.** EGIS has been nimble to adapt to changing needs of its users and stakeholders. As the technical landscape of the County has changed (e.g., ePZB) GIS has been an integral part of the evolution.

b. Areas for Improvement

- **Innovation Category Lifecycle.** Innovation around particular technologies and applications has a useful lifecycle (see *Dealing with Darwin*, above). Some innovations can be extended, some must be drawn down. Decisions about various technologies will need to be made. For example, “Should GeoNav be enhanced and extended or should it be replaced?” Those are the kinds of questions that must be asked and answered.
- **Technology Evaluation.** Technology Evaluation is becoming more critical to keep up with the myriad and constantly evolving technologies employed to support and take advantage of the EGIS infrastructure. These include, web, server, network, database and application hardware and software. This process should be inclusive and evaluate criteria such as funding, deploying and maintaining the infrastructure, and ancillary uses of the system.
- **Technical Sustainability.** At some level, EGIS is the victim of its own success. EGIS is mission critical to many agencies across the County. That places extraordinary demands on EGIS and forces a level of complexity and the need for high availability. Continuous evaluation of EGIS and the forces upon it is essential to sustainability.

4. Organization

a. Strengths

The organizational dimension of EGIS and CWGC is exceptional in its structure and longevity. At all levels, it is very significant that leadership comes not just from CWGC but also the stakeholder agencies and, in the case of the Forum, from the broader community.

- **Governance.** The governance model for EGIS and CWGC has been a key driver for the successes and sustainability of Countywide GIS. The governance model in the County is inclusive of stakeholders and of stakeholder leadership. Leadership of both the GISPAC and of the PMT is diverse. While maintaining a vital governance model may be challenging, the fact that these institutions have lasted so long is a testament to their relevance.
- **Operational Model.** CWGC has a mature operational model that is clear and understood by those in the governance role and on the user side. Now that this entity is physically located with several constituent agencies, it should be even more effective.
- **User Involvement.** The County GIS Forum is an exceptionally robust and vibrant group as compared to other similar organizations around the country. The South Florida GIS Expo is one of the largest and most vibrant “sub-state” conferences held in the U.S. This user involvement is so exceptional as to be without a peer.

b. Areas for Improvement

- **Executive Engagement and Leadership.** While EGIS enjoys support from the County Administration and the Board of Commissioners, they are not stakeholders in the sense that they rely on EGIS as they would other aspects of the IT infrastructure. In part this could be because EGIS has not evolved to the point that it could be considered a decision support tool. As described above, GIS

coupled with other business systems and cast into an intelligence framework has the potential to be a very powerful tool, not only for executive management, Commissioners, but also operational managers. Engagement of this class of stakeholders could have tremendous benefit not only for the GIS program but other participants and stakeholders over time.

- **Operational Structure.** There are two dimensions of structure.
 - a. Closely aligned with the Executive Engagement and Leadership is the notion of the structure of CWGC and EGIS with the County's organizational chart. A question that should be investigated is whether it is time for CWGC and EGIS to be its own separate agency. Two of the comparable counties, both of which could be characterized as "successful" Johnson County, Kansas and Mecklenburg County, North Carolina have made their enterprise GIS programs separate agencies. While the reasons for this separateness vary in each of these cases, both recognized that the strategic and tactical roles for enterprise GIS are different than other "applications" within a technology agency. In both cases, similar to Palm Beach County, GIS is very much cross-cutting and highly integrated into the work flows and processes of constituent agencies. Moreover, GIS has the potential, if leveraged appropriately, to be a truly strategic resource, not simply a transactional system. Whether the Johnson and Mecklenburg represent a best practices trend cannot be said with certainty without further investigation. However, this organizational structure offers benefits to enterprise GIS programs, including: visibility with decision makers; credibility; flexibility; and focused accountability to stakeholders;
 - b. The second dimension relates to the organizational structure of CWGC, EGIS operations, and the Service Bureau. Some consideration should be given to whether the roles represented in those structures might be better served in some other configuration. It has been suggested, for example, that the management and execution of Service Bureau functions may have been a "drag" on the progress of EGIS. The role and function of the Service Bureau while important and beneficial to the County, is project oriented and thus more tactical. Because leadership of CWGC handles both Service Bureau and Coordination functions, there is less time for the more strategic advancement of EGIS. This question is, obviously, related to the "separateness" and reporting structure.
- **Succession Planning.** One of the major drivers for this project was the idea that GIS in Palm Beach County needs to be sustainable. In many respects, EGIS is highly sustainable insofar as it is an integral part of the business of many agencies across the County. Regardless of structure or reporting lines, it would behoove the County to develop a succession plan that would cover personnel management, cross training, and crisis management. Because EGIS is mission critical to so many processes in the County, it is essential that the system does not become dependent on specific individuals. At the same time, it is important to best leverage those individuals' talents as they pass through the cycles of their careers.
- **Marketing.** Over the years, Countywide GIS sought to "fly under the radar". That is to say, CWGC did not undertake any concerted effort to market EGIS to decision makers, potential customers, or the public. That has been a useful strategy to allow the program and systems to mature without excess demands on CWGC or the system as a whole. However, in both the comparable counties studied as part of

this project and others across the country, some level marketing is the hallmark of a successful program. Raising the visibility and building the “brand” of EGIS will be important to advance the program moving forward. Although the kinds and extent of the marketing efforts vary, the benefit of marketing will be to communicate to decision makers, stakeholders, users, and the public at large of the value of EGIS. Even soft marketing efforts can help build political support for funding, new initiatives and the like.

- **Human Resources.** It has been often and aptly said, that people, not data or technology, are what drive system success. There are two human resource considerations. One is that positions and pay grades are aligned so that agencies across the County can recruit, promote, and retain qualified staff. This may include upgrading the existing GIS Ladder will help to remediate this issue. The second issue relates to having adequate staffing for project and other specific efforts. Consideration should be given to staff augmentation and other forms of contract staff, in addition to permanent staff.
- **Training.** Training models and resources are essential to successful GIS across the County. Training programs are a vehicle for “growing” GIS expertise in-house and a necessity for maintaining skills and expertise in dynamic technology field. Training has the additional benefit of enhancing the employee experience and providing growth paths to address sustainability.

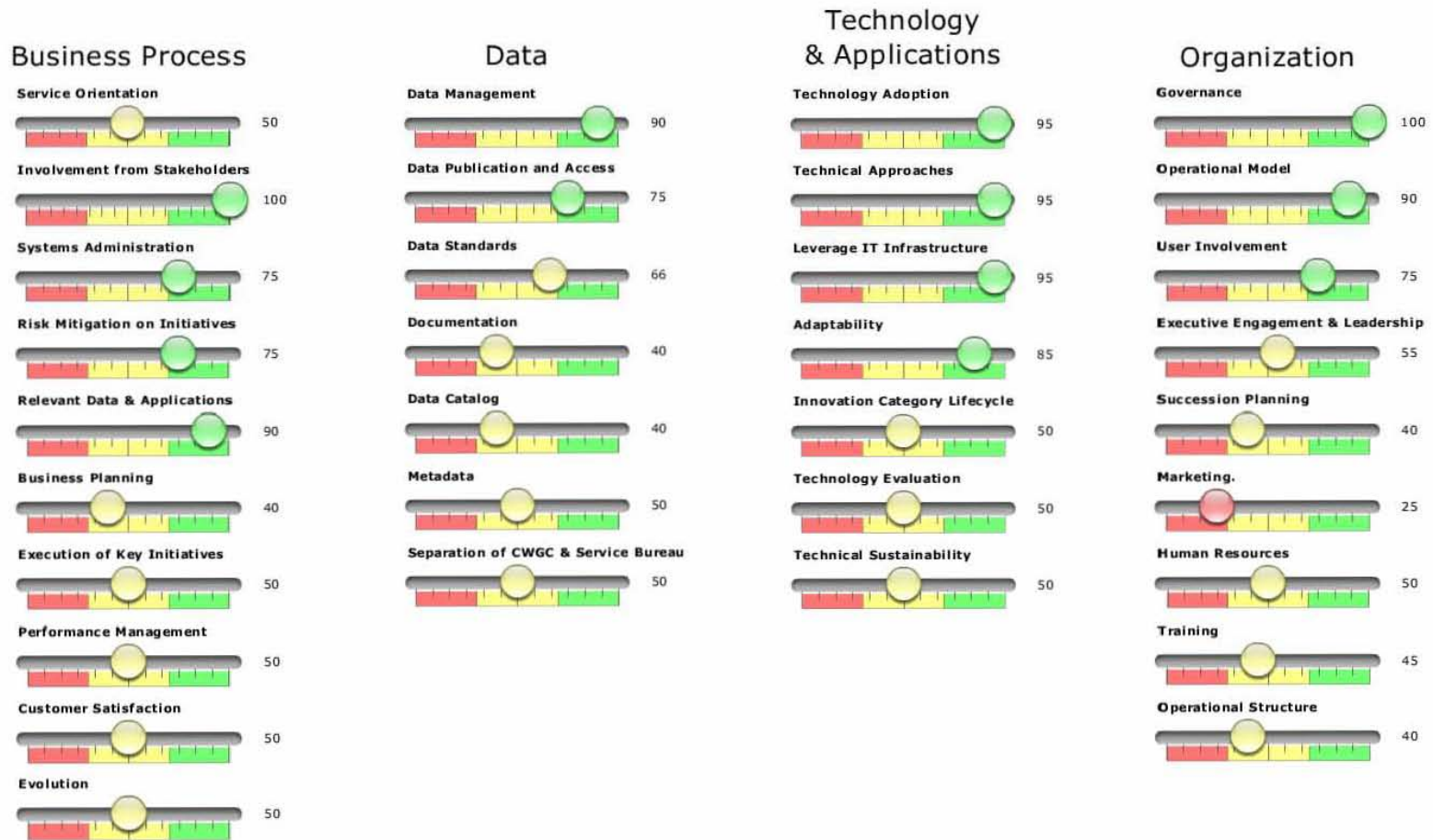
Figure 3

Status of Best Practices in Palm Beach County



Figure 4

Status of Best Practices in Palm Beach County Relative to Comparative Counties



Appendix A: Best Management Practices Catalog

The Palm Beach Countywide Geographic Information System (CWGIS) program 'Best Practice Primer' is intended to be a practical guide to policies, procedures, and approaches that will improve CWGIS performance, as well as performance and knowledge management. This document also provides background information that underlies the recommended practices. The following Catalog can be used as a template for implementing best practices and procedures for specific areas such as: Communication, Data, New Technologies and Personnel.

These Best Practices will help PBC achieve business goals and objectives, create opportunities, and improve business results. Best Practices should be flexible, adaptable, and responsive to changing business needs, fiscal circumstances, and technology change.

The 'Primer' will use the following conventions and definitions with regard to GIS best practices within Palm Beach County.

- a. **Definition:** the problem or issue
- b. **Goal:** the desired outcome of adhering to the best practice
- c. **Best Practice:** the set of policies or guidelines that is recommended
- d. **Limitation:** (when appropriate) exception to the best practice

1. Coordination

a. Business Outcome Orientation

1) Definition:

Coordination of an enterprise system is a form of a business process, but is unique in that it supports other business processes. However, Coordination is not, in and of itself a business outcome.

2) Goal:

The coordination process is intended to accomplish one or both of two things. First is to facilitate the business processes and outcomes of those agencies and business units that participate in the enterprise. Second is to advance the interest of the enterprise overall through the broad concept of performance management or by providing data publication or brokerage services.

3) Best Practice:

a) Stakeholder Driven

To reflect the business needs of participants in the enterprise, the coordination process should be driven from a stakeholder perspective. This may take many structural forms, from democratically structured "board of directors" to advisory councils. Minimally, the interests of participants in the enterprise must be formally heard and acknowledged. To that end, the adage, "*Those with a stake in the outcome must have a voice in the process*" is applicable.

b) Business Planning

Business planning for the coordination entity should occur no less often than budget cycles, preferably on an annual basis. Budget estimations and requests for the coordination entity should be driven by the business plan. The business plan should be modeled after some accepted planning methodology that addresses: A Mission Statement of the coordination body that is reflective of the missions of stakeholders and the organization overall; A Vision Statement that identifies the coordination group's sense of what it proposes to be and to do; A set of Strategies or a game plan to accomplish the Vision; A set of actionable steps or Tactics required to carry out the vision; Resources required; Timelines for strategies and tactics; and a set Success Criteria (more details in the following best practice), performance or outcome measures, to gauge success.

c) Accountability

To be meaningful, success of the coordination effort should be measured in either quantitative (performance metrics) or non-quantitative terms (qualitative outcomes). The criteria for success should be determined prior to the period of performance. Success criteria should be developed with stakeholders. Success criteria should reflect the strategic goals and objectives of the enterprise and of stakeholders. Success Criteria should be continuously monitored so that corrective actions may be taken to tactics, resources, and, if necessary, strategies. Status of the Success Criteria should be published and accessible to all stakeholders. If possible, rewards or, at least, acknowledgement, for exceeding performance should be offered.

4) Limitation:

There are few limitations to these practices. However, consideration should be given to not letting these planning processes eclipse outcomes.

b. Communication

1) Definition:

Because CWGIS supports many core operations of County agencies and those of several other units of government, it is important that communication is timely and persistent among users, maintainers, developers and system administrators within the CWGIS community. This set of best practices is proposed for events that require communication to the CWGIS Community. What are described here are appropriate communicative responses to common events. The events identified concern data, applications, hardware, software, and personnel. The proposed responses include communication methods that are tailored to the appropriate audience and urgency of the message. Information in this section is summarized as a table in Appendix A.

2) Goal:

The goal of communication is to provide sufficient information to all CWGIS users, maintainers, developers and system administrators about events that may impact data, systems, applications, operations, and staff. Note: *Italics* is used to identify and emphasize communication infrastructure components that may be lacking in current practice. There may be substantial support or evidence of partial or even whole forms of some or all of these components but it still remains necessary to

further establish these infrastructure elements with regard to CWGIS communication methods and practice.

3) **Best Practice:**

a) **Events**

Events include scheduled events (e.g., GIS Expo, GIS Forum, Training, etc.)

Email *CWGIS All* - The event moderator/sponsor adds to the *regular e-mail Digest* prior to the event. *GISPMT* and *User Group* (CWGIS Forum) announcement - the event moderator/sponsor makes an announcement at the next meeting. *CWGIS Website* - the CWGIS Coordinator posts current events on the front page in a timely manner.

b) **New Data Layer**

Email *CWGIS Datanews* - The data custodian adds to *regular e-mail Digest* prior to the event. *GISPMT* and *User Group* (CWGIS Forum) announcement- the custodian makes an announcement at various meetings during stages of development including initial planning. *CWGIS Website* - the CWGIS Coordinator posts the event on the front page in a timely manner.

c) **Change Data Layer**

Email *CWGIS Datanews* - If routine or transactional, the data custodian adds to regular e-mail Digest prior to the event. *GISPMT* and *User Group* (CWGIS Forum) announcement- the custodian makes an announcement at the next meeting. *CWGIS Website* - the CWGIS Coordinator posts the event on the front page in a timely manner.

Note: if the changes could affect existing production applications it is essential that the change be communicated well in advance of the change. Identification of any impact must be communicated as soon as there is knowledge of a potential production system conflict or impact.

d) **Delete Data Layer**

Email *CWGIS Datanews* - The data custodian adds to *regular e-mail Digest* prior to the event. *GISPMT* and *User Group* (CWGIS Forum) announcement- the custodian makes an announcement at various meetings both before and after the event. *CWGIS Website* - the CWGIS Coordinator posts the event on the front page both prior to the event and after the event.

e) **Data Errors**

Email Custodian - the discoverer emails custodian upon discovery along with an explanation including the geographic location. Email *CWGIS Datanews* - the custodian e-mails upon notification includes geographic location and anticipated time of repair. *GISPMT* and *User Group* (CWGIS Forum) announcement - the custodian provides a report, at each meeting, on the type, magnitude and disposition status of data errors discovered. If there is uncertainty or a dispute regarding errors the *GISPMT* may arbitrate the proposed resolution.

- f) **Data Development Needs**
GISPMT and *User Group* (CWGIS Forum) announcement – the requestor makes an announcement at meeting. *CWGIS Website* –the CWGIS Coordinator maintains and posts a link to Data Development needs and status report.
- g) **Enterprise GIS (EGIS) Structure Change**
Email *CWGIS Datanews* – the DBA adds to *regular e-mail Digest* prior to the change. GISPMT and *User Group* (CWGIS Forum) announcement – the DBA makes an announcement at the next meeting. *CWGIS Website* – the CWGIS Coordinator posts the event on the front page both prior to the change and after the change.
- h) **Planned Production Server Outage**
Email *CWGIS All* – The administrator adds to the regular e-mail Digest prior to the event and sends out an e-mail reminder 24 hours prior to the event. GISPMT and *User Group* (CWGIS Forum) announcement – the meeting moderator announces the outage schedule at the next meeting. *CWGIS Website* – the CWGIS Coordinator posts the event on the front page prior to the event.

UNIX Broadcast Message – the administrator makes an announcement 15 minutes prior to the event. UNIX Login Message – the administrator adds the outage schedule to the login message.
- i) **Unplanned Server Outages**
Email *CWGIS Datanews* – the administrator adds to *regular e-mail Digest* a diagnosis, duration and description of the event. GISPMT and *User Group* (CWGIS Forum) announcement – the administrator or DBA reports on outage occurrence at the next meeting. *CWGIS Website* –the CWGIS Coordinator maintains and posts a link to a cumulative Outage status report.
- j) **Staff Changes**
Email *CWGIS All* – the supervisor adds to the *regular e-mail Digest*. GISPMT and *User Group* (CWGIS Forum) announcement – the agency representative makes an announcement at the next meeting.
- k) **New Applications**
Email *CWGIS All* – the sponsor adds to the *regular e-mail Digest* prior to the release. GISPMT and *User Group* (CWGIS Forum) announcement – the sponsor makes an announcement at meetings during various stages of development including initial planning, testing and final release. *CWGIS Website* – the CWGIS Coordinator posts the application release status in a timely manner.
- l) **Application Changes**
Email *CWGIS All* – the sponsor adds to the regular e-mail Digest prior to the change release. GISPMT and *User Group* (CWGIS Forum) announcement – the sponsor makes an announcement at meetings during various stages of development including initial planning, testing and final release. *CWGIS*

Website – the CWGIS Coordinator posts the application change release status in a timely manner.

Note: changes that could affect existing production application functionality need to be communicated well in advance of the change.

m) **Network (IP) Changes**

Email *CWGIS All* – the administrator adds to the regular e-mail Digest and just prior to event.

n) **Server Replacement/Upgrades**

Email *CWGIS Datanews* – the administrator adds to *regular e-mail Digest*. GISPMT and *User Group* (CWGIS Forum) announcement – the administrator or DBA makes an announcement at the next meeting. *CWGIS Website* –the CWGIS Coordinator posts the event in a timely manner.

o) **Server Retirement**

Email *CWGIS Datanews* – the administrator adds to *regular e-mail Digest*. GISPMT and *User Group* (CWGIS Forum) announcement – the administrator or DBA makes an announcement at meetings both before and after the event. *CWGIS Website* –the CWGIS Coordinator posts the event on the front page both before and after the event.

p) **Software Upgrades/Reconfiguration**

Email *CWGIS Datanews* – the administrator adds to *regular e-mail Digest* just prior to the event. GISPMT and *User Group* (CWGIS Forum) announcement – the administrator or DBA makes an announcement at meetings both before and after the event. *CWGIS Website* –the CWGIS Coordinator posts the event on the front page both before and after the event.

4) **Limitation:**

Regular communications should be undertaken on an appropriately scheduled basis so as not to become intrusive. Communication scheduling should be linked to the type and urgency of the event. For example, immediate announcements for system problems, weekly announcements for data availability, and monthly announcements of upcoming planned events.

2. Data

The ultimate utility of CWGIS is dependent on the perceived and actual reliability of what is provided in the system. This includes quality, accuracy and consistency of the data available for use by users of the system. Palm Beach County has been committed to data standards that when properly implemented and monitored will ensure that the data is acceptable for a wide range of applications supporting results that can be published and shared easily and meaningfully throughout the county. The following is a set of Best Practices for managing the integrity of data within Palm Beach County.

a. Data standards

1) Definition:

Data standards provide a definition or format that has been approved by an internal review committee, a recognized standards organization or is accepted as a de facto standard by an industry. Data Standards could also be referred to as protocols, specifications, application protocols, and technical standards. Clearly established Data Standards facilitate the development, sharing and use of spatial data.

2) Goal:

Data has to meet minimum standards for quality, accuracy and consistency prior to being accepted into the EGIS repository.

3) Best Practices:

- All production data will be verified for projection, precision and topology prior to insertion into EGIS.
- Data already existing in EGIS goes through a certification process to determine if it meets current data standards. If not, appropriate remediation will be implemented with notification provided as detailed in Section 2, Best Practices for Communication of Events.
- Consistent measurements to determine the quality of data are implemented to continuously monitor and analyze data improvements over time.

4) Limitation:

Non-production data that may be classified as 'best available' does not necessarily conform to current standards.

b. Data Quality Assurance

1) Definition:

Quality assurance concerns the enforcement of standards for data posted in EGIS production.

2) Goal:

All production data on EGIS must meet minimum standards.

3) Best Practices:

a) Data Collection

Data collection and maintenance tasks will include strict data integrity checks at the point of data entry. Data quality will be protected from routine typo's, inaccurate values, and inconsistent entry practices through the use of pull down selection menus of valid values, notification of invalid or duplicate entry, confirmation to commit prompts, and other automated data entry aids.

b) Data Publication

Data submitted to EGIS will be tested for data standards compliance prior to insertion. Any data failing to meet standards require that the custodian be

notified by email, with clear and concise descriptions of the reason for rejection along with possible solutions for alleviating the problems cited.

4) **Limitation:**

Data presented to EGIS as uncertified non-production data need not comply with data standards.

c. Data Access

1) **Definition:**

Manage user access to EGIS data, allowing for the possibility that not all users need the same access for all data.

2) **Goal:**

Provide appropriate user definition and access to GIS data.

3) **Best Practice:**

- Provide separately maintained access for production and non-production data.
- Each data custodian should manage access to their un-certified non-production data.
- Shared EGIS data should be cataloged and indexed to meet minimum metadata requirements.

4) **Limitation:**

Data for access by a single individual need not adhere to best practice standards.

d. Data Refresh/Currency

1) **Definition:**

Data currency standards concern the timeliness of the delivery and review of all data provided to EGIS.

2) **Goal:**

Data currency standards ensure data provided to EGIS are the most up-to-date data and that historical data is clearly identified, or are removed or archived.

3) **Best Practice:**

- The data custodian assumes the following responsibilities with regard to posting data:
- Data that can become obsolete or inaccurate over time must be updated at an interval that is appropriate, agreed to by the custodian and documented as part of the metadata.
- If new data sources are not available for updating a data set, the custodian may take one of the two following actions:

- i. Following the appropriate notification procedures as described in Section 2, Best Practices for Communication Events, the data custodian changes the data set filename to indicate the appropriate year of the data set (e.g., census blocks=> blocks90). In addition, the data custodian makes clear notations in the data set's metadata regarding the historical nature of the data set and the lack of foreseeable updates.
 - ii. Using the appropriate notifications as detailed in Section 2, Best Practices for Communication of Events, the data custodian removes the data set from EGIS and evaluates it for either archival or deletion.
- Data custodians updating data should follow notification procedures detailed in Section 2, Best Practices for Communication of Events.
 - When an update occurs in one data set that is the source for derivative data sets (e.g., any summarized data that is obtained from a more detailed source), a process must be implemented and documented that coordinates the update of all dependent data sets.
- 4) **Limitation:**
Data that do not become invalid over time (e.g., locations of historical events) are exempted from this requirement, provided that an appropriate explanation about the lack of updates is clearly noted in the metadata.

e. Data Publication

- 1) **Definition:**
Publishing the most current data prevents confusion among CWGIS users and the public.
- 2) **Goal:**
Data published to high traffic/visibility venues should be the most current available.
- 3) **Best Practices:**
 - Data published on the web should be refreshed on a regular schedule agreed upon by CWGIS, GISPMT and the data custodian
 - All data produced on the web should have dates associated with the data so users know what currency limitations may apply.
 - Prior to publishing data, the publisher should notify the custodian/owner of the data that the data would be accessible from a web application.
- 4) **Limitation:**
NONE

f. Data Redundancy

1) Definition:

Data redundancy standards concern instances where there appears to be multiple occurrences of the same information in separate data sets on EGIS.

2) Goal:

Data redundancy standards ensure that duplication of information in different data sets occurs only when data sets have clearly divergent and defined differences in purpose.

3) Best Practice:

- i. The data custodian will assume the following responsibilities in regards to redundant data.
- ii. In cooperation with CWGIS and before creating a new data set, an informal evaluation of currently available data should be completed. If another data set exists with similar information, the data custodian of the newly created data will contact the existing data set's custodian to determine whether the currently posted data set can be modified/updated/merged with the new data set to meet the identified needs.
- iii. If data sets covering similar information must co-exist, the data custodians of those data sets must:
 1. Coordinate where possible any data updates for portions of the data set which are similar between the data sets to avoid duplication of effort.
 2. Clearly define in the metadata, with references to the similar data sets available, which data set is appropriate for which conditions and uses.

4) Limitations:

None

g. Data Replication

1) Definition:

Data copied/replicated from EGIS to a secondary storage location for purposes of security, safety of other business need.

2) Goal:

To maintain data currency and keep data sets maintained and synchronized on multiple servers.

3) Best practice:

- iv. Replicated copies of data will not be modified on the secondary site.
- v. New and/or modified data on the secondary server will be refreshed from EGIS on an agreed to schedule.

- vi. Since data custodian can not control and may be unaware of the replicated data, the responsibility for keeping the data on the secondary server current with the source data falls upon the administrator of the secondary site.
- vii. If data changes format, (i.e. from coverage to shape file or some other format), the data should be QC'ed to ensure against corruption.
- viii. The EGIS database administrator will be notified when a data set is replicated on any secondary server site. Notification will include a contact name, and full documentation of the replication process frequency and timing.

h. Data Creation and Work Procedures

1) Definition:

Documented work procedures that are predictable and recurring allows for a more complete understanding of how and why processes are in place and who or what work group is responsible for creating and maintaining EGIS data. It also aids staff training and assures consistent practices and workflow.

2) Goal:

All recurring work procedures are to be well documented.

3) Best Practice:

- ix. Annual work processes, both for individuals and for groups, will be evaluated for recurring, predictable procedures. When these procedures are identified, procedural documentation will be prepared and kept in a place that is readily accessible for all work group employees. Procedural documentation will be step-by-step description of the tasks necessary to perform a given work procedure, written in as much detail as is useful for ongoing maintenance of EGIS.
- x. This documentation will be maintained current, cataloged and accessible.

4) Limitation:

It is not necessary, though it may be advisable, to document procedures for a non-recurring process.

i. Data Model Migration

1) Definition:

Successful migration of spatial or tabular data from one data model/format to another requires a well formulated plan. The purpose of a data conversion/migration plan is to lessen the potential negative effects and increase the potential positive effects that data conversion/migration could have on existing projects and processes.

2) Goal:

Any conversion/migration of production data requires a formal migration plan.

3) Best Practice:

- xi. When data migration/conversion are proposed that will affect data stored by a work group of any size (as opposed to data stored and/or used by a single individual), a data migration/conversion plan will be created through a collaborative process with all potentially affected parties. The data conversion plan will evaluate the current data format and structure, the proposed data format and structure, a step-wise description of the proposed process of migrating the data from one to the other, and any impacts on applications and operations that the conversion will have, along with proposed remedies for the identified impacts. See also Section 2, best Practices for Communication of Events.
- xii. Data migration/conversion plans are documents that evaluate the current data format and structure, the proposed data format and structure, the proposed migration process and any impacts on applications and operations that the conversion will have, along with proposed remedies for the identified impacts.
- xiii. Thoroughly document the data migration/conversion process.

4) Limitation:

It is not necessary, though it may be advisable, to document conversions of data sets that are only to be used for a onetime project and/or one person.

j. Data Custodian/Steward

1) Definition:

In cooperation with CWGIS, data custodians are responsible for managing their data, including making sure that processes required to post data to EGIS are correctly followed and that data sets are well documented to ensure proper interpretation and to safeguard against misuse or accidental loss. Data custodians can be both the owner and steward of the data. The owner custodian is the person who is responsible for creating the data set and knows the most about its content; whereas the steward is responsible for making sure the data is available and documented.

The primary identification for PBC EGIS data custodians is by agency, and within that agency by person.

2) Goal:

The goal of data custodian is to have a clear point of contact and responsibility for each data layer within EGIS.

3) Best Practice:

- xiv. The person creating the non-spatial (i.e. business data) components of a spatial layer should be listed in the metadata as a content contact.
- xv. Shared data must have a PBC agency assigned to act as a data custodian.
- xvi. An agency serving as a custodian for a data layer must name one current staff member to act as primary contact for that layer. An optional secondary contact is advised.

- xvii. If the primary contact did not create the data layer, he/she will be knowledgeable enough to answer general questions, and find more information (where appropriate) if needed.
- xviii. Persons needing more information about a data layer beyond what is documented should contact the contact person(s) assigned to that data layer.

4) **Limitation:**
NONE

k. Metadata Content

1) Definition:

Metadata or "data about data" describe the content, quality, condition, and other characteristics of data. Metadata are a valuable resource of information about the data so both users and maintainers have a clear understanding of the: who, what, when, why and where issues relative to data maintenance, collection and use. Content Standard for Digital Geospatial Metadata (CSDGM) can be found online at <http://fgdc.er.usgs.gov/metadata/constan.html>. The Federal Geographic Data Committee approved the Content Standard for Digital Geospatial Metadata (FGDC-STD-001-1998) in June 1998.

The CSDGM consists of seven sections:

- | | |
|--|---|
| 1. Identification Information | Basic information about the data set |
| 2. Data Quality information | A general assessment of the quality of the data set |
| 3. Spatial data organization information | The mechanism used to represent spatial information in the data set. |
| 4. Spatial reference information | The description of the reference frame for, and the means to encode, coordinates in the data set. |
| 5. Entity and attribute information | Details about the information content of the data set, including the entity types, their attributes, and the domains from which attribute values may be assigned. |
| 6. Distribution information | Information about the distributor of and options for obtaining the data set. |
| 7. Metadata reference information | Information on the metadata itself |

Each section consists of a hierarchy of data elements and compound elements which detail the information contained in that section. Section 1 and 7 are required to meet the minimum FGDC requirements.

2) Goal:

Current, descriptive metadata adhering to content standards will be maintained for all EGIS data sets.

3) Best Practice:

- xix. Data that resides on EGIS must have FGDC compliant metadata attached. The following elements of information about the data are required:
 - xx. Identification information:
 - xxi. Citation: Originator (Agency and Contact person), Publication date, Geospatial Data Presentation Form
 - xxii. Description: Abstract, Purpose, Access Constraints, Native Data Set format
 - xxiii. Time Period: Currency Reference and Date
 - xxiv. Status: Progress, Update Frequency
 - xxv. Spatial Domain: Bounding Coordinates (N, S, E, W)
 - xxvi. Keywords: Theme
 - xxvii. Point of Contact: Agency and Contact person (name, organization, phone number, email address)
 - xxviii. Spatial Reference: Horizontal Coordinate System Information
 - xxix. Entity and Attribute: for each entity type, label, Definition (optional). For each attribute, label and definition.
 - xxx. Metadata Reference: Metadata Date, Metadata Standard Name, Metadata Contact Person (name, organization, phone number, email address)
 - xxxi. The following pieces of information are recommended:
 - xxxii. Data Quality Information: Attribute Accuracy Report, Completeness Report, Positional Accuracy (Vertical if relevant), Source Information
 - xxxiii. Process Step: Process Definition
 - xxxiv. Distribution Information: Distributor Contact Person (name, organization, phone number, email address), Distribution Liability
 - xxxv. The following pieces of information may be included if available and as time permits:
 - xxxvi. Spatial Data Organization Information, other sub-sections of the FGDC standard that are not explicitly mentioned above.
 - xxxvii. Shared data that is not certified as production quality should at a minimum include purpose, custodian/owner, limitations and date.

4) Limitation:

None

I. Metadata Development and Maintenance Tools**1) Definition:**

FGDC makes no specification as to metadata development tools or software. Metadata support is increasingly being imbedded into native geographic information software and technology. In addition, a variety of independent

software packages are available. CWGIS makes use of an ArcGIS based metadata creation and maintenance tool.

2) Goal:

Metadata development and maintenance should leverage imbedded metadata functionality in ArcGIS and other software but not lessen the quality or content of the metadata because of software limitations.

3) Best Practice:

- i. Select a metadata tool that is flexible, supports manual edits or corrections to automatically generated content, and supports different versions of metadata, e.g., production and publication metadata.
- ii. Where possible, populate and maintain FGDC-compliant metadata using available functionality imbedded in current GIS software.
- iii. Manually correct or modify metadata files as needed to make the content more accurate and useable for the specific end user audience.

4) Limitation:

None.

m. Metadata Format and Availability

1) Definition:

FGDC makes no specification on metadata format or layout. However, a number of tools have been developed and are widely available. CWGIS makes use of an ArcGIS based metadata creation and maintenance tool.

2) Goal:

Metadata should be made readily available in a layout that is both transferable and easily read and interpreted.

3) Best Practice:

- iv. Both FGDC-Standard and easily read metadata formats need to be available
- v. For data on EGIS, all formats for metadata should be made available on a designated CWGIS Website.
- vi. EGIS data that is distributed outside the county should have FGDC-standard metadata attached. In addition, a more readable metadata version is recommended.
- vii. Develop and maintain both production and publication metadata.

4) Limitation:

NONE

n. Metadata Storage

1) Definition:

ArcGIS 9.x metadata are commonly stored as XML and viewable in multiple formats. Metadata for SDE layers are stored in the database, while coverage and shapefile metadata are stored as separate files associated by name along with the data.

Metadata	ArcReader	ArcView	ArcEditor	ArcInfo
General				
Automatically or Manually Generate Metadata for Data Files		X	X	X
Import/Export Metadata		X	X	X
View Metadata Using a Variety of Styles				
FGDC		X	X	X
FGDC Classic		X	X	X
FGDC ESRI		X	X	X
FGDC FAQ		X	X	X
FGDC Geography Network		X	X	X
ISO		X	X	X
ISO Geography Network		X	X	X
Raw XML		X	X	X

2) Goal:

Metadata should be maintained, stored and closely associated with its parent dataset.

3) Best Practice:

Metadata files will be stored as a set of files/data closely associated with the parent file structure. Metadata replication will be managed, see Section 3, Best Practice for Data Replication.

4) Limitations:

None.

3. New Technologies Hardware/Software/Applications

a. Hardware Upgrades

1) Definition:

Upgrades to hardware used by EGIS include replacement of individual components or entire systems. Upgrades may be driven by the need for increased performance, greater capacity, or as a result of component failure.

2) Goal:

Hardware upgrades will ensure that they meet documented business needs with regard to performance, capacity, reliability and supportability.

3) Best Practice:

- viii. The cost of hardware upgrades should be clearly justified based on analysis of factors leading to, some or all, improvements in performance, capacity, reliability, utility and supportability.
- ix. Hardware upgrades should be accomplished with the least disruption to users.
- x. Standard practices will be employed when upgrades occur (e.g., component testing, infrastructure compatibility assurance testing, failover planning including recovery execution testing, etc.).
- xi. Increased system monitoring will be put in place after implementation to verify planned improvements.
- xii. System component documentation will be updated to include new specifications, network diagrams and changes in responsibilities, as indicated.
- xiii. Staff will be notified as per Section __, Best Practice for the Communication of Events.
- xiv. Major hardware upgrades (e.g., server upgrades) require a written plan detailing timing, notification, data transfer, impact on users and applications, testing, troubleshooting and proposed implementation methodologies.

4) Limitation:

Recommended Best Practices are focused on environments that affect multiple users and applications. These practices can be equally effective for single-user desktop installations.

b. Software Upgrades

1) Definition:

Upgrades to software include operating system replacement; vendor supported GIS products; and internally developed GIS applications.

2) Goal:

Software upgrades should be justified based on documented business needs.

3) Best Practices:

- i. The cost of software upgrades will be justified based on analysis of factors leading to, some or all, improvements in functionality, performance, capacity, reliability, utility and supportability.
- ii. Software upgrades should be accomplished with the least disruption to users.
- iii. Standard practices will be employed when upgrades occur (e.g., unit testing, infrastructure compatibility assurance testing, failover planning including recovery execution testing, etc.).

- iv. Increased system monitoring will be provided after implementation to verify planned improvements are attained.
- v. Documentation will be updated to include changed specifications.
- vi. Staff will be notified as per Section __, Best Practice for the Communication of Events.
- vii. User training will be provided in regards to the upgrade
- viii. Major software upgrades (e.g., software replacement, database, and developed applications) require a written plan detailing timing, notification, data transfer, impact on users and applications, testing, troubleshooting and implementation methodologies.

4) Limitation:

Recommended Best Practices are focused on environments that affect multiple users and applications. These practices can be equally effective for single-user desktop installations.

c. License Management

1) Definition:

Software licenses are an organizational asset requiring the same evaluation, monitoring and management as other agency assets. Licenses should be regularly inventoried, allocated, or eliminated to assure the organization's "right to use", as well as to obtain the best product at the best price. As software vendors move to subscription-based licensing models, monitoring and managing licenses becomes both easier and more critical.

2) Goal:

Software licenses are deployed efficiently and in a fiscally responsible manner for maximum effect in the organization. License management aids infrastructure planning and improves vendor negotiations. License management assures that the organization is an authorized user and that staff have access to the applications they need.

3) Best Practices:

- i. Software licenses should be inventoried and monitored to support effective deployment, budgeting and infrastructure planning, and compliance and auditing reporting.
- ii. Monitor software purchases and costs.
- iii. Monitor license usage to identify the need for additional purchases.
- iv. Monitor license usage to identify and reallocate or eliminate unused licenses.
- v. Provide alerts to restrict access or purchase additional licenses.
- vi. Remove applications from computers upon license expiration.
- vii. Reduce the number of required licenses by standardizing platforms, products and applications.
- viii. Budgeting for maintenance and support as well as product acquisition

- ix. Evaluate changes in software packing and products to reassess license needs and update procedures.

4) Limitation:

Recommended Best Practices are focused on environments that affect multiple users and applications. These practices can be equally effective for single-user desktop installations.

d. Test Environments

1) Definition:

A test environment provides a means for evaluating the reliability, functionality, and compatibility of hardware, operating system, developed applications and data, and vendor software.

2) Goal:

A separate test environment helps ensure the integrity of the production environment.

3) Best Practice:

- i. Any production environment should have a corresponding test environment
- ii. The test environment should mirror the production environment in all aspects of the operating system and vendor software versions, user permissions, and directory structure
- iii. Software upgrades (see above) should be fully tested in a test environment before implementing in production.
- iv. To maximize available resources, the test environment may serve for other functions such as development activities, storage for large non-production data, failsafe for production, etc.
- v. The test environment should be used to test the impact of software changes on servers (or desktops) and pre-existing applications, database, networking software etc. Every attempt should be made to identify conflicts between software components outside of the production environment.

4) Limitation:

None

4. Application Quality Assurance

1) Definition:

Application quality can be measured based on a number of criteria. These include user satisfaction, error rates, performance, availability of desired functions, user requirements, the rate of failure or faults, etc. Quality assurance is a process by which applications are assured of meeting minimum specifications for some set of criteria.

2) Goal:

Application quality must be measured against a suitable benchmark specification.

- 3) **Best practice:**
 - i. Applications and application modifications will be fully tested including the install process prior to deployment into production.
 - ii. Where possible applications and application modifications will be subject to usability testing prior to deployment in production.
 - iii. Consideration of documentation, install procedures, support, network communication, system support personnel, and permissions should be part of the assurance plan.
 - iv. Applications should be tested in all target environments.
- 4) **Limitation:**

None

5. Human Resources for GIS Professionals

a. Individual Development

- 1) **Definition:**

Acquiring or enhancing skills for the individual GIS professional.
- 2) **Goal:**

To maintain a highly motivated, skilled and productive workforce of GIS professionals within CWGIS and the Palm Beach County government GIS community. Individual development should be driven by organizational needs as well as individual learning objectives.
- 3) **Best Practice:**
 - Individual development plans should be developed cooperatively between employees and their supervisors on no more than a biennial basis
 - Individual development plans should reflect organizational priorities, business plans, and planned initiatives.
 - Preliminary schedules for training should be produced when major changes to the production environment are planned.
 - Training for new hardware, software, or applications should be available in advance of implementation in the production environment. Individuals should take on the responsibility for maintaining skill currency through taking advantage of available training opportunities.
 - Professional development objectives are tied to industry skill standards see <http://www.urisa.org/certification/2certific.htm> for further discussion on this topic.
 - Training programs are developed with input from county organizations with GIS professionals on staff.
 - Professional development addresses both occupational skill requirements and academic or foundational knowledge, skills, and behaviors that underlie them.

- Professional development supports forms of work organization that emphasize broadening worker skills.
- Professional development is based upon an assessment of the target population's knowledge, skills, and abilities.
- Evaluations should be conducted at least semi-annually to ensure that professional development remains on track.

4) **Limitation:**

Individual development plans should be flexible to adapt to changing fiscal conditions.