# Iowa Geospatial Infrastructure

## A Strategic ROI Business Plan for the Iowa Geographic Information Council


# FINAL REPORT

# BUSINESS PLAN FOR
# THE IOWA GEOSPATIAL INFRASTRUCTURE

## PRESENTED TO
## THE IOWA GEOGRAPHIC INFORMATION COUNCIL

## BY
## THE GEOSPATIAL INFORMATION TECHNOLOGY ASSOCIATION (GITA)

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## EXECUTIVE SUMMARY

The goal of this project was to develop a business plan for the creation of the Iowa Geospatial Infrastructure (IGI), Iowa's contribution to the National Spatial Data Infrastructure (NSDI). The strategic plan to be used by the Iowa Geographic Information Council (IGIC) to guide this effort will be completed in-house. However, IGIC received outside assistance from the Geospatial Information Technology Association (GITA) to provide expertise and education for completing the business plan, business case, and financial analysis to support the strategic plan. This combined effort will facilitate the implementation of the National Spatial Data Infrastructure by assessing the needs of local entities that are not currently using geospatial technology, as well as those trying to maintain existing investments, and further support and promote the creation of high quality local datasets compatible with the IGI.

Successful implementation of a statewide LiDAR project has shown that creative solutions can be achieved to fund major GIS projects. IGIC desires to leverage its experience of using a revolving loan fund to meet the needs of building a statewide geospatial infrastructure. The desired general direction for creation of the IGI is to evolve a nontraditional distributed governance and funding model.

Iowa decided to implement the Return on Investment (ROI) analysis methodology for multi-agency projects that GITA developed in 2006-2007 for the Federal Geographic Data Committee (FGDC). GITA also provided its single agency financial analysis methodology developed over the past five years as a major ongoing research project.

Financial analysis for the project was conducted through a process of GITA delivering training to IGIC members in a series of meetings, webinars, training sessions, and follow-up consulting. Considerable effort was dedicated to determining scope for the project, summarized by the following business case description:

*"This project will focus on development of an Iowa spatial data infrastructure, including hardware, software, communications, training and other services, to provide delivery of the seven NSDI framework data layers. Data will be collected and maintained by counties, cities, state and Federal agencies, and others and provided as a seamless statewide data collection. The data will be publicly available through the Internet. Coordination and technical assistance will be provided by a cooperative agreement between agency partners. A public awareness campaign will be conducted to attract participation in the project and use of the data. We will do a 20 year analysis for this study."*

IGIC ultimately determined that the project would focus on nine data layers. The first seven layers are those of the NSDI Framework Layers – Geodetic Control, Ortho-imagery, Administrative Boundaries, Cadastral, Transportation, Elevation, and Hydrography. Over the course of the project, it was discovered that it would be

beneficial to the business case and the constituents to add an additional two layers – Address Points and Building Footprints. Although this project is unusual in attempting a broad and simultaneous analysis of many complex data issues, it is the conviction of IGIC that a holistic approach to the envisioned IGI project will best capture the realizable costs and benefits of such a program. It is also the conviction of IGIC that an analysis of the entire envisioned program is necessary for presentation to legislative bodies and other decision makers.

The multi-agency financial analysis incorporated spreadsheets describing costs and benefits for all 99 counties of Iowa, 11 state agencies, three utilities plus Iowa One Call, and consulting firms. Many additional organizations were interviewed during the project but not all were able to provide quantifiable benefits in the time frame of this study. The 20 year analysis shows Net Present Value of $271M and Return on Investment of 24.21%. Sensitivity analysis was performed to determine the effect of a delayed implementation of GIS over 20 counties and the effect of Imagery for the Nation contracting capabilities not being available. Neither of these analysis resulted in severe detriment to the project. However, sensitivity analysis on the effect of a county attempting to implement GIS in standalone mode, not using the resources of IGI, showed that such a project may have difficulty breaking even.

Development of costs for the IGI focuses on three major areas: the cost of establishing service agencies to provide for the GIS needs of county and state agencies, the cost of adopting GIS for the 20 counties with no program, and the cost of participation in the IGI for organizations that have already invested in GIS. Analysis of benefits was by far the most time consuming and challenging portion of this project. The GITA resource formally interviewed 90 entities and created spreadsheets with applicable cost and benefit information. The Iowa Department of Natural Resources provided additional interviews, as well as conducting and attending many meetings and outreach discussions with potential participating organizations in Iowa.

Analysis of strategic benefits shows many areas which may become quantifiable as they are studied over time. These include: data accessibility, timeliness, data quality, depth and breadth of data, and fostering equitable distribution of resources. Two areas in particular emerged as providing great strategic and tangible benefits and need for further study. Economic development benefits to the state from availability of geospatial data are enormous. In the case of counties without GIS, the strategic benefit of moving proactively to attract new business through adoption of GIS could signify the type of attitude shift that is required for low-growth areas to take charge of their future. Emergency response staff at the county and state level are just beginning to reap the rewards of GIS capabilities. The majority of these organizations do not currently have a means to track benefits during a natural disaster or other type of unique emergency. It will be necessary to work with them over time to devise methods for measuring the changes brought to their processes through use of geospatial technology.

## SECTION 1: BUSINESS NEEDS, GOALS AND FRAMEWORK

Iowa Geospatial Infrastructure (IGI) is Iowa's contribution to the National Spatial Data Infrastructure (NSDI). IGI's central focus is on the collection of standardized local, state, federal and other GIS data layers ("framework" data layers in NSDI terminology) that are freely available to the public through the Internet. IGI will follow NSDI practices for metadata and data standards, and use Iowa's data clearinghouse for data discovery. IGI includes people, technology and agreements to make this happen.

The principal IGI components will be the framework data layers. At startup, data with the best currently available resolution and accuracy will be used. For acquisition of new data, the accuracy goal will be 1"=400' (1:4800) in rural areas and 1"=100' (1:1,200) in urban areas. Best practices/standards will be developed for seamless, statewide databases. FGDC Metadata standards will be used. Public access will be provided.

Data and web application servers will be provided to house the IGI data. These will be based on service oriented architecture (SOA) principles if possible. Services to framework data providers and users will include: coordination assistance, contracting assistance, web hosting and application development assistance, training, and technical assistance. Agreements will be developed between data providers, service bureaus and funding sources.

The IGI Framework layers are made up of the seven NSDI layers with two additions:

1. Geodetic control: county GPS control monuments and NGS benchmarks
2. Ortho imagery: black and white, color and color-infrared orthorectified aerial imagery
3. Administrative boundaries: city, county and state boundaries
4. Cadastral data: public land survey section corners, section lines and parcel boundaries
5. Transportation: road centerlines, railroads, trails, airports, waterways
6. Elevation: digital elevation models and contours
7. Hydrography: rivers and streams, water bodies, watershed boundaries
8. Address points
9. Structures: 2D building footprints, bridges, towers. Includes homeland security critical infrastructure

Framework data layers will come from a variety of sources:

1. Control points – counties
2. Administration boundaries - counties
3. Ortho-imagery – counties, state, federal
4. Cadastral - counties
5. Transportation – state and counties
6. Hydrography – state and federal

7. Elevation – state and federal
8. Address points – state and counties
9. Structures – state and counties

The business case for the IGI revolves around providing the best possible data sources for statewide use. Much of the best GIS data in the state is created and maintained by county GIS programs. They have the best geodetic control networks, orthophotography, city/county boundaries, and parcel data. This data is extremely valuable to everyone. It is imperative that we create a fair system that helps maintain their investment in exchange for wider access.

To fulfill many of their required functions, state agencies and other entities need to have access to county GIS framework layers such as parcels, city boundaries, public land survey system (PLSS), high-resolution orthophotos, local streets, and geodetic control. There is currently no clearinghouse or compilation of county GIS data for all of Iowa, although there is a data repository effort led by the Iowa County Information Technology Association (ICIT).

It is the conviction of IGIC that counties will contribute to a statewide collection if there are tangible benefits to them through participation. Benefits could include assistance in acquiring aerial photos, in writing and administering orthophotography and GIS contracts, in performing QA/QC on the data, in loading images into ArcSDE, in distributing data to users, and in developing web mapping applications. These all represent significant costs for county programs that could be reduced by joint acquisitions, contract assistance, GIS data maintenance assistance and data hosting services.

The Iowa County Engineers Association Service Bureau (ICEASB) provides one model for working with county departments. ICEASB is a 28E organization. County engineers use a portion of their road use tax allocations to pay for the ICEASB. The Service Bureau provides IT and GIS support to county engineers and is fairly narrowly focused on a few applications, especially tracking road project money through the system from Federal agency to state to regional planning to counties. They have a project management database linked to ArcIMS to show where projects are linked to Iowa Dept. of Transportation (DOT) road centerline coverage. They also have some other "toolkit" type mapping applications, calculating amount of gravel needed to cover county roads, road closures, etc.

## SECTION 2: STRUCTURE AND COSTS

### County GIS Service Bureau

IGIC has created an outline for a county GIS service bureau, modeled along the lines of the ICEASB model, similarly affiliated with the Iowa State Association of Counties (ISAC), paid for by the state but essentially run by county entities, and possibly linked with the Iowa Counties Information Technology (ICIT) data repository. Its mission would be to manage the statewide collection of county-developed framework layers, including control, ortho-imagery, boundaries, parcels, road centerlines, and address points. It would also assist counties with joint acquisition of ortho-imagery, control monument maintenance, web-hosting services, data and metadata development, and miscellaneous projects. Data maintained by the county service bureau would be available for distribution through web services to government users, private companies and the public.

It would be a good business practice for the state to invest in this type of service, rather than to continue with individual agencies making separate agreements with counties without being able to share data with other state agencies. For example, the I80 corridor project could support this kind of ongoing GIS service bureau function rather than developing a closed system within the DOT that isn't available to others.

A county GIS service bureau will collect framework GIS data layers from participating counties, process them into statewide databases and distribute them using web applications. It will assist existing and new county GIS programs with ortho-imagery acquisition, web applications, training and technical support for county GIS projects. This service bureau would be funded by the state, with services provided free to counties who participate in IGI.

Elements of the county service bureau would include:

1) an ortho-imagery service that coordinates and manages joint acquisition of high-resolution ortho-imagery, including establishment of joint RFPs and contracts with ortho-imagery providers, coordinating funding between partners, and ongoing managing and reviewing contracts. Eventually this function would serve as the Iowa contact for the Federal Imagery for the Nation program that would coordinate a three-way match between the Federal government, state and local entities.

2) a data quality and security service that provides the QA/QC for the joint ortho-imagery projects, and loads imagery and GIS data into a centralized ArcSDE/ArcGIS server that would serve as a backup for county data,

3) a web hosting service using the central ArcSDE/ArcGIS server to provide an engine

for web mapping applications for county web sites,

4) web application services that allow counties to have the option to maintain their GIS data over the Internet so they don't need extra copies of GIS desktop or server software,

5) a GIS project service that would help counties create new GIS products and applications and help with technical issues.

The state would have access to the county data server and could use the data in web applications (a statewide economic development site locator, for example). There would be one 28E agreement that sets up the county GIS service bureau. Individual counties would agree to provide their data in exchange for use of its services. The state would pay for the service bureau and would receive access to the data. The state couldn't sell or give away the counties' data without some sort of agreement or prior approval. There would be provisions for other entities to join the agreement, perhaps private entities, with some portion of derived profits returning to support service bureau operations. After a start-up period, the overall agreement could be amended or reevaluated to change the funding model.

For the first three years, it would be beneficial for a county to participate so there should be high participation. After the initial period, some of the services might have a cost to keep them going, while others might continue to be paid for by the state. There would be an opportunity to develop value-added products and services from the compiled data to help pay for operations, while not limiting access to the basic data for the partners and their applications, and the public. A key idea is that the public has access to government data through basic web services, which provides opportunity for development of value-added applications for services that go beyond basic government functions.

Job functions for approximately four county service bureau FTEs would include:

- County IGI coordinator – works with counties with no GIS program to coordinate regional partnerships for data acquisition, shared staffing and maintenance contracts.
- County ortho-imagery coordinator – works with counties to coordinate standards, RFPs, QA/QC activities and contract monitoring for joint imagery projects.
- GIS web application developer – works with counties to develop web applications common to many county departments, including general parcel web mapping, online geospatially-enabled permit applications (such as forest reserve and other tax credit applications, well and septic applications). Also maintains framework GIS data library (including metadata) and web distribution sites (links to NSDI, IGIC clearinghouse).

- GIS tech/training specialist – a GIS technical specialist that assists with county GIS framework data maintenance projects. Also provides GIS training to county staff, especially ones that can use framework data like engineering, economic development, health and conservation departments.

Costs for County GIS Service Bureau

- Salary and benefits 4 FTEs - $260,000/yr
- Framework Data Acquisition/Modernization Assistance - $250,000k/yr
- Staff Travel and Training - $25,000/yr
- Hardware, Software and Office expenses - $100,000/yr
- Control Monument Maintenance Program - $50,000/yr

***Total cost for a county GIS service bureau would be $685,000 per year.*** $250k per year is to be used to update and modernize county land records and parcel GIS data to more uniform standards across the state. This is ongoing process with priorities determined by ICIT. It could also be used for ortho-imagery acquisitions.

Costs to individual counties with GIS to participate in IGI

- Cost of staff time to provide data to IGI – minimal if automated
- County Staff – learning to use LiDAR elevation, other data layers – significant learning curve at first until county staff become proficient
- Participate in Imagery for the Nation (IFTN) – averages $5000 per year for a typical county – based on total area

***It would cost approximately $5,000- $6,000 per county per year to participate in IGI.*** This is shown on the spreadsheets as a minimal cost based on counties adopting GIS grouping into three-county units to share office and GIS coordinator resources. Counties that already have GIS would have the costs of participating in IFTN and minimal overhead in coordinating with and providing data to the IGI project.

Summary of Benefits to Counties

- Ortho-imagery Coordination – merge state and local acquisition programs; assistance with RFPs, contracting, eventually get help from IFTN
- Data Hosting and Web Applications
- Training
- Technical Assistance and Framework Data Modernization

***Counties adopting GIS would receive approximately $75,000 in benefits per county per year.*** Adopting GIS requires training for the department staff, hence the training specialist position in the service bureau. Benefits for county economic development, emergency management, conservation and engineering departments are significant with adequate GIS training and support.

**State Agency GIS Service Bureau**

The state needs an equivalent service bureau function to help maintain and distribute its share of the IGI framework layers: hydrography, elevation, transportation and building structures. In addition, many of state departments and agencies need assistance to fully take advantage of GIS technology. Many agencies have some GIS capability or at least a strong interest, including historical preservation, ICN, health, education, economic development, workforce development, agriculture, revenue, management and legislative services bureau. More could be done with GIS in these agencies, but core capabilities are there and need to be nurtured, especially in economic development, health, human services and public safety. Agencies that don't have GIS could use assistance getting started.

One possibility would be to build a state GIS service function at Iowa State University (ISU) GIS Support and Research Facility (GISSRF) to address these needs and others within state government. There are good reasons to support this location. The state service bureau would contain a complete copy of the county service GIS data server and act as its backup. It would not be wise to have both central data servers in the same city since floods or power outages could take both out of action. ISU has students to provide inexpensive labor, especially in the summer. ISU GISSRF already has good GIS relationships with DOT, Division of Homeland Security and Emergency Management (HLSEM) and DNR, and currently maintains the Iowa Geospatial Data Clearinghouse (http://maps.gis.iastate.edu/clearinghouse/) and the Iowa Geographic Map Server (http://ortho.gis.iastate.edu/). ISU GISSRF has the needed expertise in data production, training and web application development.

The state GIS service bureau should not be in an existing state agency. It needs to be responsive to all agencies, not just one. Existing GIS departments in state agencies have more than enough to do without being responsible for the rest of state government.

A state GIS service bureau will collect and distribute state framework data layers through web mapping applications. It will maintain the Iowa Geospatial Data Clearinghouse server. It will distribute state framework layers and web services to the public and provide metadata. It will assist state agencies with GIS projects, training and web applications related to the use of the IGI framework layers, especially address points for geocoding. The bureau needs to be funded by the state, with services provided free to participating state agencies.

Secure access to state databases would need to be established, especially if private information was being held. Fast data transfer to replicate data between the county GIS server would be required. Framework layers maintained by DNR (hydrography and elevation) and DOT (transportation) would have primary access points through the state service bureau server using ArcSDE direct access, WPS, WMS, WCS and WFS. These

would also be mirrored by the county GIS server. Applications could be developed on either server for specific needs, for example, the I80 corridor project.
The county and state GIS service bureaus would be interconnected and provide redundant backups of each other for emergencies. They would work closely with each other to provide assistance to participating county and state agencies, developing data and sharing expertise as needed.

The state GIS service bureau has several functions related to new GIS programs in state government:

- assist state agencies with small GIS programs or no GIS programs
- coordinate with, educate and provide training to GIS programs in state agencies
- assist in GIS data development project for state agencies
- provide GIS application development services to state agencies

The state GIS service bureau works with existing state GIS programs to collect and distribute IGI framework layers

- provide spatial data framework support to DNR, DOT and others
- provide central ArcSDE/ArcGIS server linked to county central ArcSDE/ArcGIS server
- collect state framework layers from DNR (elevation and hydro) and DOT (transportation)
- maintain the Iowa Geospatial Data Clearinghouse server

Job functions for approximately four state agency service bureau FTEs would include:

- GIS database/clearinghouse administrator – coordinates data collection from state agency of framework and non-framework data layers and maps; coordinates the IGI hardware/software maintenance; coordinates infrastructure connections and data exchanges with county GIS service bureau
- Web application developer – provides technical assistance to state agencies to build applications on top of IGI; builds WxS components of IGI
- GIS tech/training specialist – helps train state agency staff to use framework layers and services; assists in data development projects
- Community of Practice coordinator - administrative program manager for applications build on top of IGI

Communities of Practice (COP) are envisioned as groups of like-minded professionals working together across jurisdictional lines. One example would be a group of emergency management people that use GIS from federal, state and local agencies, private and university staff as well. These communities will attract funding and develop cross-cutting applications. Communities of Practice in Iowa include: Economic Development, Education, Health and Humans Services, Environment, Public Safety, Emergency Management, and Government Efficiency. As these communities come together for further GIS development in the state, a COP coordinator is needed to work

with these groups to develop business plans, funding sources, RFPs and contracts to build vertical applications that take advantage of the IGI horizontal infrastructure.

State GIS Service Bureau Costs

- Salary and benefits 4 FTEs - $260,000/yr
- Staff Travel and Training - $25,000/yr
- Hardware, Software and Office expenses - $100,000/yr
- IFTN Orthos and LiDAR Data - $600,000/yr for ongoing data acquisition projects

***Total costs for state GIS service bureau and data acquisition projects would be $985,000/year recurring costs.***

Other IGI costs would be incurred for data conversion projects. These include a project to convert USGS National Hydrography Dataset to high-resolution, LiDAR-based lines, at $100,000/yr for 5 years, and a project to create address point and structures framework layers and merge county boundary and parcels into statewide coverages with metadata, at $300,000/yr for 5 years.

***Total $2M for one-time projects***

**Federal Participation in IGI**

The financial analysis for the IGI project assumes federal funding for Imagery for the Nation (IFTN) about three years in the future, starting in 2011. Based on cost projections from the National State Geographic Information Council (NSGIC), the cost for 1' color leaf-off ortho-imagery for the state of Iowa would be about $5.6 million (about $100 per square mile) on a 3 year cycle. Under current plans, the federal government would pay for half ($2.8 million), while the state and local entities paying the other half. For an average sized county (16 townships), it would cost $60,000 for IFTN 1' color ortho-imagery, with $30k federal, $15k state and $15k in local funding, every 3 years. In IGI business case spreadsheet, the federal cost does not appear. State and local shares are present and calculated in the state service bureau and individual county spreadsheets.

## SECTION 3: BUSINESS CASE METHODOLOGY AND PROJECT COMPONENTS

The goal of this project was to develop a business plan for the creation of the Iowa Geospatial Infrastructure (IGI), Iowa's contribution to the National Spatial Data Infrastructure. The strategic plan to be used by the Iowa Geographic Information Council (IGIC) to guide this effort will be completed in-house. IGIC received outside assistance from GITA to provide expertise and education for completing the business plan, business case, and financial analysis to support the strategic plan. This combined effort will facilitate the implementation of the National Spatial Data Infrastructure by assessing the needs of local entities that are not currently using geospatial technology, as well as those trying to maintain existing investments, and further support and promote the creation of high quality local datasets compatible with the IGI.

Successful implementation of a statewide LiDAR project has shown that creative solutions can be achieved to fund major GIS projects. IGIC desires to leverage its experience of using a revolving loan fund to meet the needs of building a statewide geospatial infrastructure. The project can also be used to address a variety of relevant issues, including economic development, emergency management, and environmental quality. The desired general direction for creation of the IGI is to evolve a nontraditional distributed governance and funding model.

Iowa decided to implement the ROI analysis methodology for multi-agency projects that GITA developed in 2006-2007 for the Federal Geographic Data Committee (FGDC). GITA also provided the single agency financial analysis methodology developed over the past five years as a major ongoing research project. The single agency methodology provides considerable time savings through the financial calculations of its templates.

IGI has discovered a number of issues concerning data availability and access due to holdings in various organizations and their varying policies regarding data sharing, common standards, and metadata. Additional challenges are presented by cities and counties that have not yet been able to create a GIS.

### Detailed Approach to the Project

#### 1. Kick-off Meeting

The first step of the project was a kick-off meeting conducted by Mary Ann Stewart, GITA project lead, with the IGIC Steering Committee. This meeting set the stage for project facilitation focused on participation and consensus-building. This introductory phase of the project took place over two days, with varying participation required from members of IGIC. Goals for this task were:

- develop/clarify IGI vision, purpose, definition
- prioritize goals for the project
- define scope of the project, roles, responsibilities, expectations
- determine stakeholders, including those not yet using geospatial technology
- formalize specifications of the IGI

There was identification of a pressing need for clear definitions of the structure of the IGI in order to have a complete understanding of projected changes in the workflow of participating organizations and thus correctly estimate costs and benefits. Among the diverse services to be provided are coordinated imagery acquisition, financing for data development, data maintenance services, data and web application hosting, and bulk printing and training services. Findings were used to establish a baseline for the statewide coverage of all framework data layers.

An Iowa Grant Steering Committee meeting was held July 18, 2008, with the following agenda:

1) Discuss vision and purpose of the project
2) Clarify and finalize scope
3) Discuss roles, responsibilities, expectations
4) Discuss potential participating agencies, level of participation; do participants differ from stakeholders
5) Discuss approaches to accomplishing needs assessment
6) Formalize specifications of the IGI; discuss implications of changes it will make to agency workflows
7) Discuss timeline
8) Discuss content of webinar and first training/information gathering meeting
9) Discuss various levels of interest in financial analysis training, interview training and implications for additional gathering of agency data for analysis
10) Discuss first set of interview subjects
11) Discuss outreach to decision makers; who are the ultimate recipients of the financial analysis and how to best educate them throughout the six months of this project

The IGIC Board Meeting was held on July 19 and included Mary Ann Stewart's presentation on the project as well as a general discussion and question and answer session.

Preliminary interviews were conducted by Mary Ann Stewart and Jim Giglierano on July 19 and 20 with State DOT departments (Right of Way, Traffic and Safety, Soils, LRS, GIMS, Maintenance), the University of Iowa Department of Urban and Regional Planning, and the Office of the State Archeologist.

## 2. Webinar

A one-hour webinar was conducted August 13 to prepare participants for the first training session. The webinar included a short overview of the project and of the ROI/financial analysis process, with the concept that this was a promotional piece for the potential project participants as well as a source of information for those planning to attend training to learn financial analysis principles and perform financial analysis for their agencies.

Webinar Attendee List:

Milo Robinson, Lisa Swanson, Jim Giglierano, Dawn Jones, Mike Mahaffie, Michelle Fields, Carl Wilburn, Adam, Brenda, Jason Siebrecht, Dave Croll, Paula Lemke, Mary Ann Stewart, Lawrence Hartpence, Brad Cutler, Aaron Greiner, Jessy Willadsen, Melanie Riley, Chris Solberg, Karen Fouts, Anne Packard, Kenny Miller, Mike Kallas, Nate Pollock, Micah Cutler, Steve Cooper, Herb Kuehne, Patrick Wilke-Brown, Paul Bushore, Nikki, Gregg Hadish, Chad Olson, Karen Rawson, Rick Havel, Sharon Aupperle, Ray, sksebree, John DeGroote, Roger R. Patocka, Ben McConville

The webinar was followed by a same day conference call for participants in training. Discussion included expectations of the upcoming training session and the metrics participants should attempt to collect prior to the session. There was dialogue concerning the first set of interview subjects. A discussion of the data resources of participating organizations led to the topic of needs assessment.

Two documents concerning data for financial analysis were distributed in conjunction with the conference call. These were "Preparation for Business Case Workshops" and "Data Collection in Preparation for ROI Training."

Following the webinar, IGIC developed a matrix to summarize organizational data resources. There was a discussion of prioritizing interview candidates with the IGIC Steering Committee, and arrangements were made for interviews to be conducted during the week of the first training session.

## 3. Training and Information Gathering Session (Including On-Site Interviews)

On August 27 and 28, 2007, a two-day training session in ROI analysis and business case development was held at the Johnston Public Library in Johnson, Iowa. The training was based on GITA seminar materials, including the workbook developed recently for FGDC, "Building a Business Case for Shared Geospatial Data and Services: A Practitioner's Guide to Financial and Strategic Analysis for a Multi-Participant Program," and the GITA publication "Building a Business Case for Geospatial Information Technology: A Practitioner's Guide to Financial and Strategic Analysis."

Copies of the latter publication, containing substantial case study and template material not included in the FGDC multi-participant version of the workbook, were provided.

GITA training methodology has been developed from experience gained over five years of delivering seminars on the topic of ROI and business case development. In work with the Washington State DOT, a model was developed for delivering training while gathering information for the business case at hand. IGIC project participants were asked to bring pre-identified metrics from their organizations as well as their laptop computers. They began to create a business case from the bottom up, with each organization populating GITA templates with individual costs and benefits

All needs assessment information was submitted prior to this session, whether brought to the session by participants or sent in on behalf of organizations that would not be attending. At the conclusion of the training session, the entire group reviewed the collected data and created a single consistent documentation of all organizations' needs.

Participants included:

Matt Boeck, Story County
Joe Artz, Office of the State Archeologist
Chris Ensminger, Iowa DNR
Kevin Kane, Iowa State University
Herb Kuehne, Sioux City Police Department
Dave Croll, City of Johnston, Iowa
Carl Wilburn, Carroll County
Micah Cutler, Hardin and Franklin Counties
Brad Cutler, MIDAS Council of Governments
Gregg Hadish, USDA-NRCS
Michelle Fields, Iowa DOT
Sonja Sebree, Kirkham and Michael
Anne Packard, Fox Engineering
Patrick Wilke-Brown, Iowa DNR
Jim Giglierano, Iowa DNR
Adam Martin-Schwarze, Hamilton County
Paula Lemke, Cerro Gordo County
Ray Weiser, Scott County

This training was structured around the steps of developing a financial analysis for a business case.

Step 1: Define the Investment
Step 2: Calculate Costs
Step 3: Calculate Tangible Benefits
Step 4: Schedule Cash Flows
Step 5: Perform Financial Analysis

Step 6: Prepare Strategic Analysis

The first morning of training focused on a discussion of the concept and scope of the IGI project. The need for clear project identification and communication throughout the body of stakeholders and interested parties was addressed. A list of organizations served by the project was begun, with organizations attending training as a starting point.

There was extensive discussion regarding the vision and purpose of this project. Is it to get buy-in from local agencies wanting to develop their GIS capabilities? Is it to achieve a statewide coverage of certain data layers in a standard format? Consensus was yes to both questions.

The fundamental structure for determining the scope of the IGI financial analysis was working through the steps to create a Business Case Document. The group worked to develop consensus on the following Project Description:

*"This project will focus on development of an Iowa spatial data infrastructure, including hardware, software, communications, training and other services, to provide delivery of the seven NSDI framework data layers. Data will be collected and maintained by counties, cities, state and Federal agencies, and others and provided as a seamless statewide data collection. The data will be publicly available through the Internet. Coordination and technical assistance will be provided by a cooperative agreement between agency partners. A public awareness campaign will be conducted to attract participation in the project and use of the data. We will do a 20 year analysis for this study."*

The remainder of training focused on developing an understanding of the principles of financial analysis, with accompanying development of each agency's business case at each step. The group learned about common values used for rate of inflation, opportunity cost of capital and future years' cost of labor for each agency's spreadsheet.

After a discussion of the principles of financial analysis, the costs portion of the analysis spreadsheets were developed. Participants had been asked to bring charts showing pay bands for appropriate job categories at their agencies and these were used to populate the Labor Rate tabs of their spreadsheets. Considerable discussion centered on typical costs for a county GIS program, with illustrations provided by county participants. The result of this discussion was a generic county costs spreadsheet, which has been enhanced and modified throughout the project.

The second day of training focused on discussion and quantification of benefits, including productivity benefits and other benefits. This topic addressed common benefits for an agency, specific examples from participants, with an extensive question and answer session regarding the process of interviewing department staff using GIS in

order to determine the benefits they are receiving. Once costs and benefits for each agency had been estimated, participants worked with the spreadsheets to schedule the flow of cash over the 20 year time frame of the project. The financial analysis portion of training was followed by a discussion of strategic benefits and their importance in tying to the mission of a project.

This project presents a somewhat unusual challenge in categorizing benefits, as it was necessary to collect projected benefits to counties adopting GIS for the first time through participation in the IGI as well as to quantify benefits to counties, state agencies, and other entities with GIS from participation in the data acquisition and sharing capabilities provided by the IGI. Once all potential benefits have been quantified, they will need to be sorted into appropriate categories (primarily with or without GIS) for use in the financial analysis.

Training concluded with a discussion of the use of a financial analysis in creation of a business case. There was review of the meaning of common terms such as Net Present Value and Return on Investment, with examination of how they are developed during the process of creating a spreadsheet. The creation of alternate scenarios for analysis and the performance of sensitivity analysis were addressed. Finally there was a presentation on the consolidation of the business case for presentation to decision makers.

The training session wrapped up with a discussion of next steps and participants were sent back to their agencies to interview GIS users and complete their spreadsheets.

Following the two-day training session, Mary Ann Stewart conducted on-site interviews on August 29 and 30. The goal of each interview was to collect all metrics and information needed for a financial and strategic analysis of the organization. Interviews were held with DOT on August 29 and with Lawrence Hartpence of Jasper County GIS and Mark Castensen of Warren County GIS on August 30.

As some participants were interested in hands-on training in conducting interviews, Jim Giglierano and Kevin Kane accompanied Mary Ann on the DOT interviews and Brad Cutler attended the Jasper and Warren County interviews. Increasing internal capabilities to determine costs and benefits in an organization through structured interviews has greatly improved the results of this project by increasing the number of organizations interviewed. This also has enabled participants to contribute to the matching funds requirement through use of their time for additional interviews. Mary Ann provided follow-up guidance and advice for combining results of interviews conducted subsequently by IGIC participants.

## 4. Follow-up Metrics Collection

Following the training session, GITA developed an online forum to aid in sharing of spreadsheets by training participants and to serve as an area for discussion of the IGI financial analysis. Logon was restricted to Iowa participants as they desired a private space for work while the project was in its formative stages.

GITA worked with the IGI steering committee to determine total costs based on needs assessment and prioritized goals. Additional metrics were incorporated into the master templates, based on subsequent interviews or by training session participants who collected additional data.

IGIC elected to cancel the second training session and reallocate this time to additional interviews. These were conducted over a wide range of time, October 2007 through June 2008, and included diverse government agencies and private companies. Mary Ann conducted 90 formal interviews, mostly by telephone with email follow-up. Jim Giglierano conducted meetings, attended meetings, and traveled to conduct interviews at individual agencies. Other IGIC members contributed to the metric collection process in similar fashion.

A deadline of November 16, 2007, was established for submission of additions to templates completed during the training sessions or through participant interviews of additional agencies. During the fall, IGIC conducted a discussion about the inclusion of address points and building footprints as the 8th and 9th data layers of the framework and ultimately decided to add these layers to the analysis.

IGIC decided as the year 2007 drew to a close to extend the time frame for interviews and to have Mary Ann conduct additional interviews by phone. This phase of the effort began in January 2008 and continued into June 2008. Additional work was also done on refinement of the structure of the nine data layers and additional spreadsheets were completed.

## 5. Development of Financial Analysis

Mary Ann assembled the template information provided by IGIC participants and by its own interview and analysis process. The financial analysis was delivered in the multi-agency format developed for the FGDC multi-agency project, with an analysis for each organization and a composite analysis for the project as a whole. Alternate scenarios were evaluated for: one county adopting GIS with and without participation in IGI, the project without the benefits of Imagery for the Nation, and for slower adoption of GIS ramping up over 20 years rather than 10 years.

The financial analysis methodology used has been developed by GITA over the past five years to serve the analysis of geospatial projects. Single agency spreadsheets were developed for a 2004-2006 project funded by the American Water Works Association Research Foundation (AWWARF), GeoConnections of Canada, GITA and FGDC. FGDC then funded a project in 2006-2007 for development of the multi-agency analysis spreadsheets and methodology.

## 6. Development of Strategic Analysis

Many strategic benefits were revealed in the course of determining metrics for costs and benefits. These were compiled for each participating organization and an analysis was performed for the IGI as a whole.

Some strategic benefits took the form of new initiatives or directions for the project. An early example was the discovery of the strategic and tangible benefits of adding address ranges and building footprints to the seven layers of the framework. IGIC was notified in February 2008 it would receive a category 5 CAP grant to work on getting structures (building footprints) and transportation into the IGI and NSDI. All of the funding will go to Iowa State GIS staff to develop a web tool to convert LiDAR data into building footprints and an automated script to extract DOT transportation data into IGI. Matt Boeck's ROI spreadsheet begun during ROI training was used in the proposal to justify the project, providing dramatic feedback on the benefits of using financial analysis methodology to make the business case.

Another emerging theme from the area of strategic benefits is the strong demand for a state service agency to provide geocoding capabilities to all agencies in the state. This appears currently as a strategic benefit, as many agencies are simply not able to do massive geocoding they desire due to technology and time constraints. It is anticipated that this need will transform into a tangible benefit once there is structure in place to have a state geospatial service agency perform the desired geocoding. This is a good illustration of the potential for transforming strategic benefits into tangible benefits as projects evolve to meet new capabilities.

## 7. Development of Business Case

The business case incorporates the findings of the financial and strategic analysis and presents them in a compelling fashion for review by stakeholders and decision makers. The business case shows alternate scenarios (technical direction and degree of implementation) through use of sensitivity analysis. Mary Ann and Jim Giglierano worked together to create the most effective possible business case for the IGI.

## 8. Delivery of Final Documents

The original delivery requirement of March 15, 2008 was extended to June 30, 2008. IGIC decided not to opt for the proposed two-day workshop to review the business plan and develop strategies for communicating with stakeholders. The time allocated for this was reallocated to additional interviewing, analysis and business case development efforts.

## SECTION 4: FINANCIAL ANALYSIS

Financial analysis of the IGI shows strong benefits to diverse statewide agencies and private entities as well as to the individual 99 counties of Iowa. Breakeven point is reached very quickly, within two years. Sensitivity analysis shows that a project of this magnitude is not very sensitive to changes in timeline or variations in contractual mechanisms. However, individual counties adopting GIS are quite sensitive to the economy of using IGI capabilities vs. attempting startup in a standalone mode.

The financial analysis for the IGI project shows an overall net present value of $271 million and an annualized return on investment of 24.21%. Breakeven is anticipated in 2010.

The multi-agency analysis was performed for a 20 year project beginning in 2008, with the assumption of a 2.3% rate of inflation and 5% opportunity cost of capital. State agencies are assumed to receive 3% annual cost of living adjustments, with other entities receiving cost of living adjustments as appropriate to their business processes. The study represents the 99 counties of Iowa, of which seven are considered top growth counties, 66 are considered small counties with GIS, and 20 are considered counties adopting GIS during the life cycle of the project. An additional six counties with individual analysis parameters are included. The study also represents 11 statewide agencies, as well as utility companies, the statewide One Call system, and consulting firms.

The mass of tangible benefits discovered is large and exerts dominant influence on the financial profile of this project. Tangible benefits can be grouped by productivity benefits and other benefits. They can also be grouped by state agency, county, and other entity. The following tables summarize these benefits, which can be found in greater detail in the individual agency spreadsheets.

### *State Agency Productivity Benefits*

| Agency | Job Category | Benefit Description |
|---|---|---|
| *State Historic Preservation Office* | Advanced Clerk | Walk-in, call-in time eliminated by having data on web server = 125 hours/year |
| *Department of Education* | Statistical Research | Time saved maintaining school district boundaries = 20 hours/year |

| | | |
|---|---|---|
| | Analyst | |
| | GIS Technician | Time saved geocoding for special projects = 250 hours/year for |
| *Human Services* | Statistical Research Analyst | Time saved manually adjusting geocoding for six special projects each year = 1100 hours/year |
| *Public Health* | GIS Coordinator | Time saved maintaining landbase = 347 hours/year |
| | GIS Coordinator | Time saved dealing with time lag inaccuracies from county data = 40 hours/year |
| *DOT* | Surveyor | Labor avoidance researching control points = 80 hours/year |
| | Transportation Engineer | Labor avoidance incorporating found points into DOT system = 90 hours/year |
| | Transportation Engineer | Labor avoidance acquiring, creating and manipulating cadastral data = 725 hours/year |
| | Right of Way Agent | Labor avoidance researching ownership = 438 hours/year |
| | Environmental Specialist | Labor avoidance acquiring, creating and manipulating cadastral data = 228 hours/year |
| | Environmental Specialist | Labor avoidance acquiring, creating and manipulating hydrology = 510 hours/year |
| | Environmental Specialist – Regulated | Labor avoidance researching ownership = 76 hours/year |
| | Environmental Engineer | Labor avoidance analyzing hydrology = 4 hours/year |
| | Program Planner 2 | Labor avoidance updating city limits in GIS = 1040 hours/year |
| | Program Planner 2 | Labor avoidance maintaining & analyzing LRS & GIMS = 2912 hours/year |
| *FSA* | Program Technician | Time saved researching ownership changes = 6000 hours/year in |

| | | |
|---|---|---|
| | Farm Resources | multiple county offices |
| *DNR* | Geo III | Animal Feeding Operations - identify locations of new = 50 hours/year |
| | Geo III | Animal Feeding Operations - Manure Management Plan assessment = 150 hours/year |
| | Geo III | One Stop Environmental Permitted Facilities - geocoding = 233 hours/year |
| | Geo III | Geological Survey - source water reports, LUST reviews and well forecasts - better locations improves efficiency = 50 hours/year |
| | Geo III | Geological Survey - source water Phase 2 reviews - field review - better locations improves efficiency = 20 hours/year |
| | Geo III | Geological Survey – geology/ hydrogeology public inquiries - better locations/imagery = 50 hours/year |
| | Geo III | Geological Survey - coal mine inquiries - better locations = 12.5 hours/year |
| | Geo III | Geological Survey - GIS program - AFO database QA/QC - better locations improve efficiency = 32 hours/year |
| | Forester 2 | State Forest Program - field operations - better maps to direct field crews to work area = 48 hours/year |
| | Forester 2 | District Forester Program - map making for field operations - find land owner information while on the phone = 50 hours/year |
| | Forester 2 | State Forest Program - acquisition of new tracts adjacent to SF units - |

| | | |
|---|---|---|
| | | eliminate parcel lookup = 160 hrs/year |
| | Natural Resources Biologist | Wildlife Program - private lands biologists contact private land owners for possible CRP signup - better location and ownership improves efficiency = 125 hours/year |
| | Natural Resources Biologist | Wildlife Program - wildlife management areas, new acquisitions = 40 hours/year |
| | Environmental Specialist | Watershed Improvement - Reduced time separating segments for 305(b) sampling = 40 hours/year |
| | Environmental Specialist | Watershed Improvement - Reporting to EPA - time savings = 20 hours/year |
| | Environmental Specialist | Watershed Improvement - WQIP - watershed planning and inventory = 40 hours/year |
| | Environmental Specialist | Watershed Improvement - TMDL reporting = 40 hours/year |
| | Environmental Specialist | Contaminated Sites - environmental site assessment - need to find location and ownership = 33 hours/year |
| | Environmental Specialist | Water Quality NPDS - point discharge permit locations, how far from streams, where does it drain = 180 hours/year |
| | Environmental Specialist | Parks and Preserves - Environmental Reviews - better location information improves review = 75 hours/year |
| | Environmental Specialist Sr. | Watershed Improvement - WQIP - improvements to watershed modeling for sediment delivery = 200 hours/year |

| | | |
|---|---|---|
| | Environmental Specialist Sr. | Waste management program - Land Application Project - Used to determine land application of sewage sludge/solids. All use aerial photography, soils in some way to identify location for permit or addition to already permitted area = 25 hrs/year |
| | Environmental Specialist Sr. | Iowa Waste Exchange - Geocoding 8000 to 10000 addresses = 466 hours/year |
| | Environmental Engineer | Floodplain Management - floodplain determinations for buildings = 260 hours/year |
| | Environmental Engineer | AFO and Landfill permitting - time savings and accuracy improvement = 60 hours/year |
| | Environmental Engineer | Floodplain Management - floodplain determinations for buildings = 600 hours/year |
| | Executive Officer 2 | One Stop Environmental Facilities - geocoding QA/QC - increased efficiency in reporting to EPA = 50 hours/year |
| | Right of Way Agent | Realty Section - Flow easement determination currently use 7.5' topo maps for determination of floodplain. Reduced time with better elevation data or 2' contours = 15 hours/year |
| | Right of Way Agent | Realty Section - Access easements, conservation easements etc. use assessor sites for info, taxes, addresses, etc. ROW agents typically use the plat books for everything. Having cadastral data with attributes in one area would help. = 60 hours/year |
| | Statistical | Watershed Improvement - |

| | | |
|---|---|---|
| | Research Analyst | biological sampling - find locations faster with better hydrography data = 40 hrs/year |
| | Statistical Research Analyst | Watershed Improvement - fill kills - find locations = 12.5 hours/year |
| | Administrative Assistant | Records Management - open records requests - make searchable by area or address = 300 hours/year |
| | Natural Resource Tech. | State Forests - Field Crew - better maps for locating work zones = 240 hours/year |
| *Homeland Security* | GIS Coordinator | Time saved obtaining data = 208 hrs/year |
| | Planners | Time saved obtaining data = 416 hours/year |
| | Planners | Time saved mapping emergency response information = 320 hours/year |
| | Field Assessors | Time saved in the field and in looking for information = 96 hours/year |

***State Agency Other Benefits***

| **Agency** | **Benefit Description** |
|---|---|
| *Public Health* | Cost avoidance to buy TeleAtlas files = $6000/year |
| *Department of Revenue* | Cost avoidance buying tax rate shape files = $20000/year |
| *State Historic Preservation Office* | Cost avoidance having their own web server = $10000/year |
| *Iowa Department of Agriculture CREP* | Cost avoidance of preliminary surveys by use of Lidar = $67500/year |
| *Homeland Security* | Cost avoidance purchase of satellite imagery for individual incidents = $2496/year |
| *Office of the State Archeologist* | Savings due to reduced searches = $13500/year |
| | Savings due to reduced review by SHPO = |

| | |
|---|---|
| | $5625/year |

Productivity benefits were also modeled for typical medium/large counties and typical small counties as shown in the following table.

***County Productivity Benefits***

| **County Type** | **Job Category** | **Benefit Description** |
|---|---|---|
| *Top Growth* | Auditor's Office Staff - voting | Time saved not answering phone calls regarding voting location = 80 hrs/yr |
| | Assessor's Office Admin. Asst. | Site analysis structures = 10 hrs/yr |
| | Assessor's Office - Appraisers | Site analysis structures = 10 hrs/yr |
| | County Assessor | Site analysis structures = 5 hrs/yr |
| | Emergency Mgment – Support Staff | Utilize Surrounding County Data = 40 hrs/yr |
| | P&Z Planner | Utilize Surrounding County Data = 10 hrs/yr |
| | | Site planning savings for structures = 40 hrs/yr |
| | Sheriff | Emergency preparedness savings for structures = 10 hrs/yr |
| | Sheriff Deputy | Assist in response = 20 hrs/yr |
| | | Emergency preparedness savings for structures = 20 hrs/yr |
| | Dispatch | Assist in response = 40 hrs/yr |
| | | Assist in response for structures = 10 hrs/yr |
| | Conservation | Use LiDAR data = 5 hrs/yr |
| *Small Counties with GIS* | GIS Coordinator | Reduction in time negotiating for aerial photography = 40 hrs every 5 years |
| | | Reduction in time to provide elevation data to public = 5 hrs/yr |
| | Emergency Planner | Time saved by application automating mapping of emergency |

| | | |
|---|---|---|
| | | response information (Paoli) = 320 hrs/yr |
| | Public Health Staff | Savings in staff field time due to use of imagery (50% of Johnson Co.) = 209 hrs/yr |
| | Dispatch Staff | Time saved for dispatcher using GIS (Jones Co.) = 520 hrs/yr |
| | Conservation Director | Time saved on standard operations and special projects (Jones Co.) = 408 hrs/yr |
| | Economic Development Staff | Time saved creating information packets = 360 hrs/yr |
| *Counties Adopting GIS* | GIS Technician/ Cadastral Maintenance | Reduction in time answering internal queries = 20 hrs/yr |
| | | Reduction in time answering external queries with IMS server deployed (Jasper County) = 5 hrs/yr |
| | | Reduction in time searching for data from surrounding counties (Jasper County) = 5 hrs/yr |
| | | Reduction in time providing elevation data to the public = 5 hrs/yr |
| | Clerk II - Auditor | Reduction in time spent on parcel maintenance, real estate management = 520 hrs/yr |
| | | Time saved answering phone calls regarding voting districts = 80 hrs/yr |
| | Clerk II -- Assessor | Reduction in time spent on parcel maintenance, real estate management = 520 hrs/yr |
| | | Reduction in time spent answering walkin and phone questions from the public (assume IMS server deployed--Jasper county) = 650 hrs/yr |
| | | Reduction in time from manually developing CSR points = 3997 hrs/one |

| | | |
|---|---|---|
| | | time only |
| | | Time saved from all documents linked back to GIS (Winneshiek County) = 750 hrs/yr |
| | Public Health Inspector | Time savings from using aerial survey data = 40 hrs/yr |
| | Planning Director | Reduced time seeking/reconciling data = 416 hrs/yr |
| | Sheriff | Faster tracking, court support, license checks (Woodbury County) = 80 hrs/yr |
| | County Engineer | Time saved searching for data = 80 hrs/yr |

***Counties Other Benefits***

| **County Type** | **Benefit Description** |
|---|---|
| *Top Growth* | Avoidance of aerial survey contract (Story County) = $100,000 on a 3 yr cycle |
| | Avoidance of survey crew time through use of LIDAR for preliminary design (Jones County) = $50,000/yr |
| | Avoidance of managing aerial survey contracts at 29% of contract = $29,000 on a 3 yr cycle |
| | Saving to public from LIDAR use for critical natural resource delineation (Linn Co P&Z) = $40,000/yr |
| | Avoidable road maintenance costs using LIDAR for analysis (Emmet Co. Engineer) = $92,200/yr |
| *Small Counties with GIS* | Cost avoidance using LIDAR for preliminary surveys for roads and culverts = $50,000/yr |
| | Cost avoidance of having a county web server = $10,000/yr |
| | Cost avoidance in not having to re-fly aerials = $57724 every 5 yrs. |
| | Avoidable road maintenance costs using LIDAR for analysis (Emmet Co. Engineer) = $92,200 |
| *Counties Adopting GIS* | Avoidance of survey crew time through use of LIDAR for preliminary design 20 crew days/year at $150/hour |

| | |
|---|---|
| | = $24,000/yr |
| | Fuel saved by Officer who reviews hunting licenses not having to check out sites (Woodbury County) = $400/yr |

Other entities include utilities (electric, gas, telecommunications), the statewide One Call System, and consulting firms.

***Other Entities Productivity Benefits***

| **Agency** | **Job Category** | **Benefit Description** |
|---|---|---|
| *Iowa One Call* | GIS Manager | Labor avoidance from having IGI data = 1040 hours/year |
| | GIS Technician | Labor avoidance correcting bad address matching = 450 hours/year |
| *Bear Creek Archeology* | GIS Technician | Labor avoidance completing Structure Forms = 1200 hours/year |
| *Paetec* | GIS Technician | Labor avoidance on underground facilities and One Call mapping = 250 hours/year |

***Other Entities Other Benefits***

| **Agency** | **Benefit** |
|---|---|
| Iowa One Call | Cost avoidance of dig-ins (hits) = $90,000/year |
| | Cost avoidance of translation from paper maps = $100,000 for total project |
| | Cost avoidance paying counties for annual updates = $5000/year |
| Iowa Telecom | Cost avoidance outsourced landbase maintenance = $8844/year |
| Consulting firms | Cost avoidance collection of redundant data = 75 firms * $37500 = $2,812,000/yr |

The financial analysis for the IGI project shows an overall net present value of $271 million and an annualized return on investment of 24.21%. Breakeven is anticipated in 2010.

Because it is anticipated that a central service agency (IGIC Central Project) is funding the bulk of this investment, its internal net present value is negative. The participating state agencies, counties, and private entities will reap the benefits of the shared data for little or no contribution of staff time and thus show extraordinarily high ROI.

The table below summarizes the project value for each participant or participant group.

| Participant | NPV | ROI | Breakeven |
|---|---|---|---|
| IGIC Central Project | *-$29,748,530* | *-5.00%* | *Does Not Break Even* |
| DNR | *$1,247,254* | *6.62%* | *2014* |
| Iowa State DOT | *$3,448,744* | *1772.29%* | *2009* |
| Iowa Department of Public Health | *$351,150* | *560.28%* | *2009* |
| Iowa Homeland Security & Emergency Management | *$630,783* | *5054.35%* | *2008* |
| FSA Office Iowa State | *$2,426,932* | *3030.63%* | *2008* |
| Office of the State Archaeologist | *$378,013* | *17.41%* | *2013* |
| Various State Agencies: Human Services, Historic Preservation, Public Health, Dept of Education, Dept of Revenue | *$2,557,250* | *731.11%* | *2008* |
| Utilities: Iowa Telecom, MidAmerican Energy, Paetec | *$300,572* | *317.91%* | *2010* |
| Iowa One Call | *$1,826,597* | *349.29%* | *2010* |

| | | | |
|---|---|---|---|
| Consulting Firms | *$34,369,925* | *36352.98%* | *2009* |
| Franklin and Hardin Counties | *$541,570* | *16.77%* | *2012* |
| Story County, Iowa | *$878,211* | *23.04%* | *2011* |
| Scott County, Iowa | *$1,203,829* | *56.74%* | *2008* |
| Carroll County, Iowa | *$198,727* | *11.03%* | *2011* |
| Woodbury County - Sioux City | *$1,468,926* | *74.18%* | *2009* |
| 7 top growth counties | *$25,051,494* | *83.54%* | *2010* |
| Small Counties with GIS | *$218,563,418* | *188.13%* | *2009* |
| Twenty Counties Adopting GIS with IGIC | *$11,809,834* | *3.26%* | *2018* |

The tables below summarize cash flows by year.

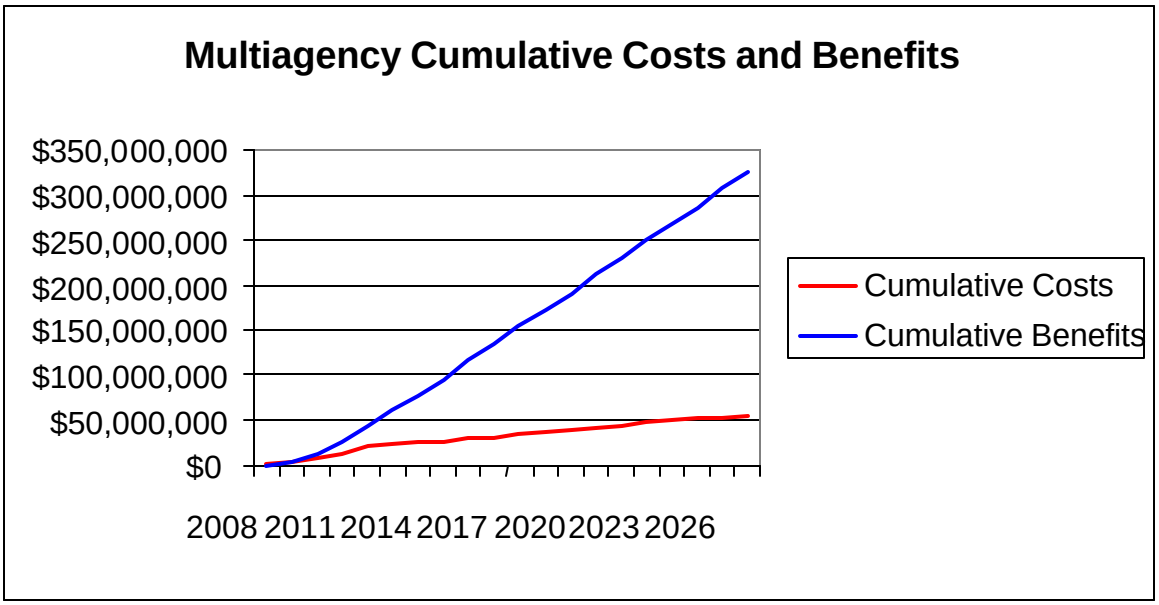
| | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|
| **Cash Flows for All Participants** | | | | | |
| Costs (Future Value) | ($2,330,625) | ($2,391,245) | ($4,460,255) | ($5,539,724) | ($6,599,100) |
| Benefits (Future Value) | $326,334 | $4,029,121 | $8,123,411 | $16,847,647 | $18,661,531 |
| *Present Value Multiplier:* | *100.0%* | *97.4%* | *94.9%* | *92.5%* | *90.1%* |
| **Current Values** | | | | | |
| *Annual Project Costs* | *($2,330,625)* | *($2,329,756)* | *($4,233,820)* | *($5,123,269)* | *($5,946,071)* |
| *Cumulative Costs* | *($2,330,625)* | *($4,660,381)* | *($8,894,200)* | *($14,017,469)* | *($19,963,540)* |
| *Annual Project Benefits* | *$326,334* | *$3,925,515* | *$7,711,007* | *$15,581,105* | *$16,814,835* |
| *Cumulative Benefits* | *$326,334* | *$4,251,849* | *$11,962,856* | *$27,543,962* | *$44,358,797* |
| **Cumulative Net Benefits** | **($2,004,291)** | **($408,531)** | **$3,068,656** | **$13,526,492** | **$24,395,257** |

| | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| **Cash Flows for All Participants** | | | | | |
| Costs (Future Value) | ($4,168,415) | ($2,586,717) | ($2,193,633) | ($3,780,296) | ($2,391,803) |
| Benefits (Future Value) | $18,849,169 | $19,968,200 | $21,298,239 | $26,003,361 | $23,868,515 |
| *Present Value Multiplier:* | *87.8%* | *85.5%* | *83.3%* | *81.2%* | *79.1%* |
| **Current Values** | | | | | |
| *Annual Project Costs* | *($3,659,339)* | *($2,212,417)* | *($1,827,966)* | *($3,069,139)* | *($1,891,918)* |
| *Cumulative Costs* | *($23,622,879)* | *($25,835,295)* | *($27,663,262)* | *($30,732,401)* | *($32,624,319)* |
| *Annual Project Benefits* | *$16,547,176* | *$17,078,783* | *$17,747,944* | *$21,111,552* | *$18,880,019* |
| *Cumulative Benefits* | *$60,905,973* | *$77,984,755* | *$95,732,699* | *$116,844,251* | *$135,724,270* |
| **Cumulative Net Benefits** | **$37,283,094** | **$52,149,460** | **$68,069,437** | **$86,111,851** | **$103,099,951** |

| | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| **Cash Flows for All Participants** | | | | | |
| Costs (Future Value) | ($2,546,615) | ($4,259,567) | ($2,840,175) | ($2,917,752) | ($4,401,752) |
| Benefits (Future Value) | $24,385,501 | $24,563,486 | $25,575,821 | $30,173,587 | $26,598,965 |
| *Present Value Multiplier:* | *77.1%* | *75.1%* | *73.2%* | *71.3%* | *69.4%* |
| **Current Values** | | | | | |
| *Annual Project Costs* | *($1,962,577)* | *($3,198,270)* | *($2,077,692)* | *($2,079,557)* | *($3,056,569)* |
| *Cumulative Costs* | *($34,586,896)* | *($37,785,166)* | *($39,862,858)* | *($41,942,415)* | *($44,998,984)* |
| *Annual Project Benefits* | *$18,792,953* | *$18,443,345* | *$18,709,647* | *$21,505,488* | *$18,470,277* |
| *Cumulative Benefits* | *$154,517,223* | *$172,960,568* | *$191,670,216* | *$213,175,703* | *$231,645,981* |
| **Cumulative Net Benefits** | **$119,930,327** | **$135,175,402** | **$151,807,358** | **$171,233,289** | **$186,646,997** |

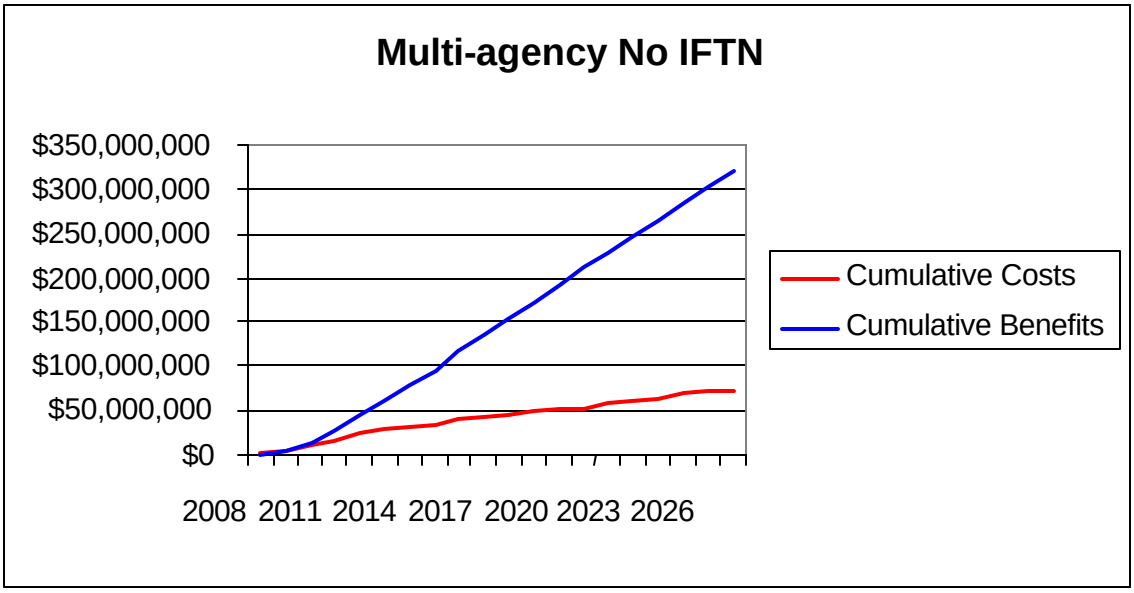
| | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| **Cash Flows for All Participants** | | | | | |
| Costs (Future Value) | ($3,079,632) | ($3,019,851) | ($4,609,071) | ($3,149,954) | ($3,247,567) |
| Benefits (Future Value) | $27,648,233 | $28,276,918 | $28,418,270 | $33,753,364 | $30,722,346 |
| *Present Value Multiplier:* | *67.7%* | *65.9%* | *64.2%* | *62.6%* | *61.0%* |
| **Current Values** | | | | | |
| *Annual Project Costs* | *($2,083,502)* | *($1,990,522)* | *($2,959,928)* | *($1,970,871)* | *($1,979,696)* |
| *Cumulative Costs* | *($47,082,486)* | *($49,073,008)* | *($52,032,935)* | *($54,003,807)* | *($55,983,503)* |
| *Annual Project Benefits* | *$18,705,202* | *$18,638,606* | *$18,250,103* | *$21,118,890* | *$18,728,144* |
| *Cumulative Benefits* | *$250,351,183* | *$268,989,788* | *$287,239,891* | *$308,358,782* | *$327,086,925* |
| **Cumulative Net Benefits** | **$203,268,697** | **$219,916,781** | **$235,206,956** | **$254,354,975** | **$271,103,423** |

The following chart shows cumulative costs vs. benefits over the 20 year life span of the project.

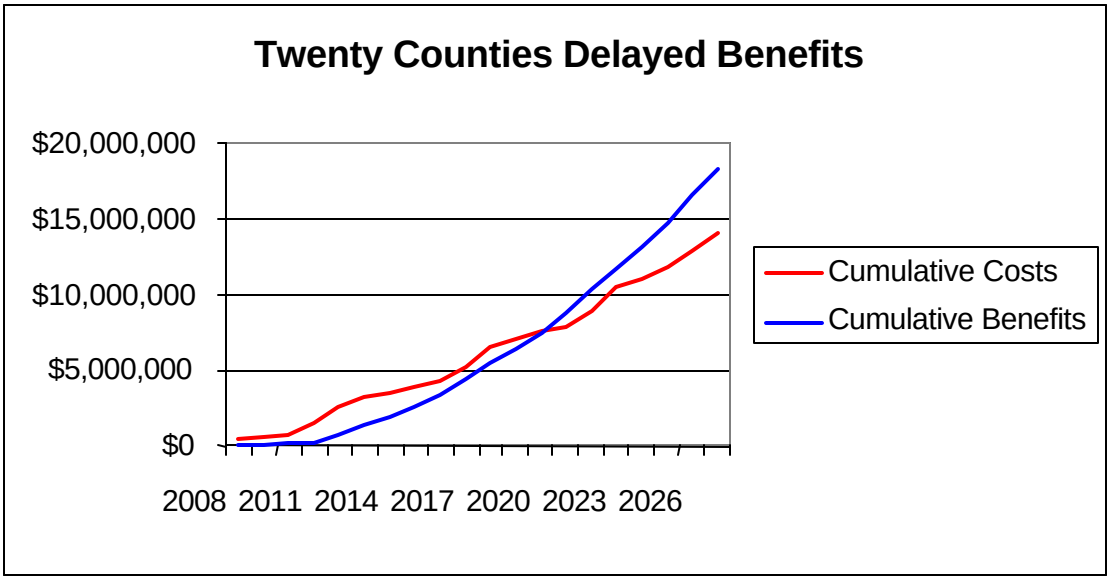


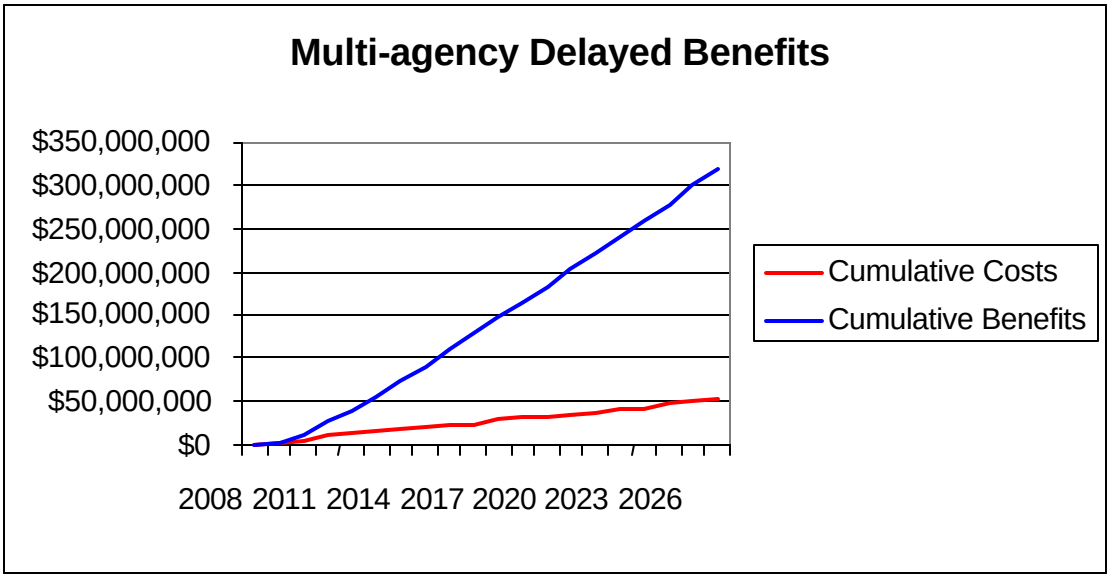

## SENSITIVITY ANALYSIS

If Imagery for the Nation (IFTN) federal funding and contract mechanisms are not available, the benefit to the multi-agency project is somewhat reduced, as the state would need to take charge of contracting for aerial surveys for the counties. Financial analysis shows NPV of $248M and annualized ROI of 17.04% in this case. NPV is approximately $23M less than it would be with IFTN.

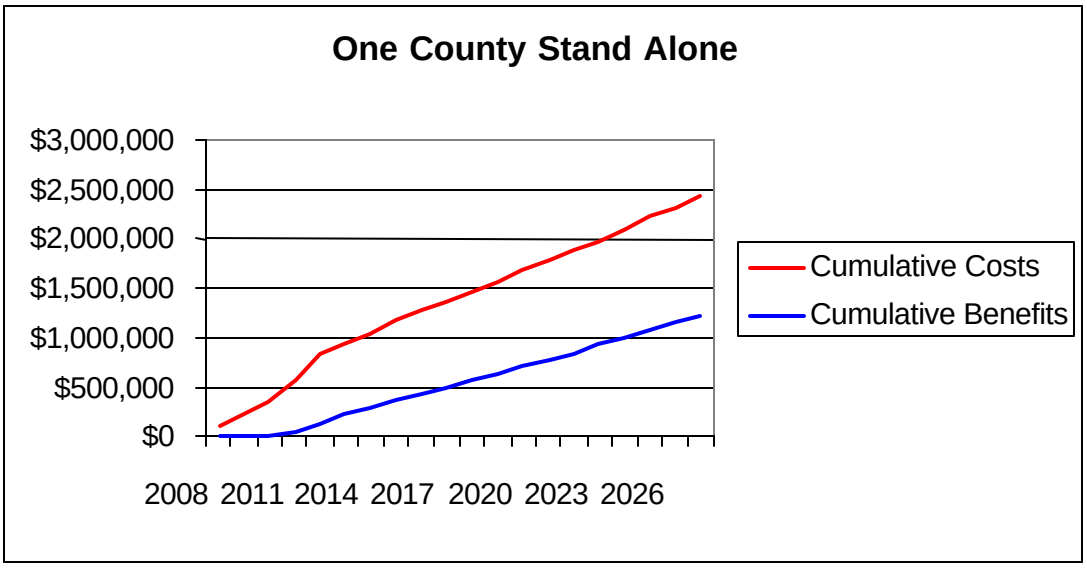


If it takes longer than expected to get all 20 counties without GIS up to speed and to get the statewide data sharing project at full capacity, benefits may ramp up slowly over the 20 years of the project's lifetime rather than over 10 years as modeled for the base case. The effect of this slow development on the 20 counties would take NPV from $11,809,834 down to $4,280,148 and would reduce ROI from 3.29% down to 1.52%. However, the effect on the overall project would be minimal, as reduced costs throughout the 20 years would offset the slight reduced benefits to the agencies. NPV for the overall project would be reduced from $271M to $249M and ROI would be reduced from 24.21% to 24.08%.

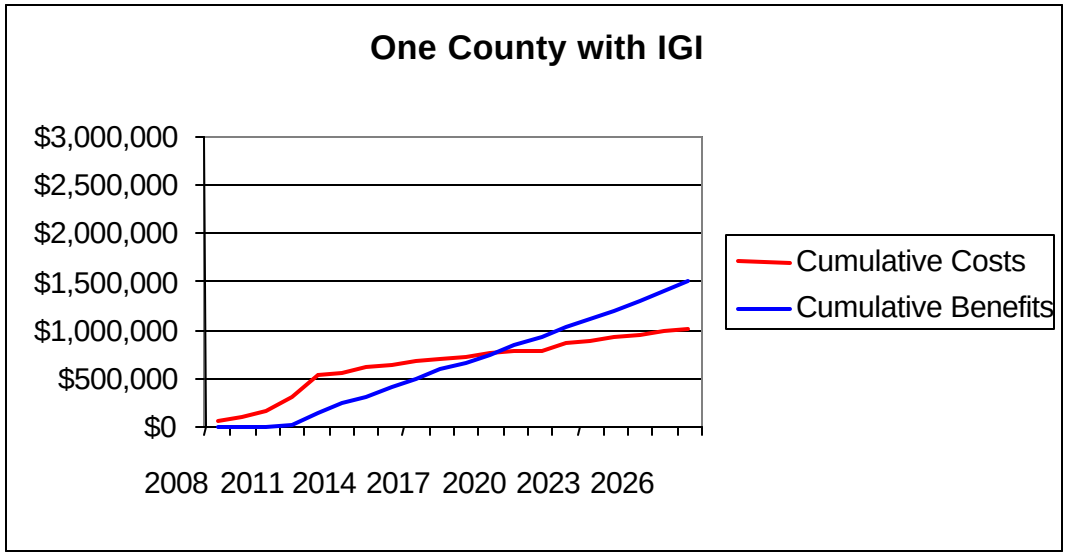


Analysis was performed on the difference between a county adopting GIS in a stand-alone mode vs. adopting GIS using the capacities provided by IGI. In the chart below, we see that benefits never exceed costs, and actually remain substantially lower than costs over the 20 year life cycle of the project. NPV is negative, -$1.19M. ROI is also negative, -2.46%. There is no payback period as the project does not break even.




Analysis for a county adopting GIS using the capabilities of IGI, including each county sharing offices and staff with two adjacent counties, shows slow but steady progress toward a breakeven point by 2020. NPV is $474,205 and ROI is 2.32%.



## SECTION 5: STRATEGIC ANALYSIS

The IGI project fits well with many of the 2008-2009 strategic goals of the IGIC. Relevant components include:

- **Define and lead on the development of the Iowa Geospatial Infrastructure (IGI)**
- **Data clearinghouse coordination**
- **Strategic Plan for GIS in Iowa (state level)**
- **Promote, develop, and encourage use of data standards for Iowa GIS data products**
- **Promote data sharing**
- **Serve an advisory role for GIS to state level decision-makers**
- **Help all 99 counties use GIS and coordinate GIS activities**

The IGI will have an impact on agencies and citizens in Iowa in a number of ways. Common benefits from IGI can be summarized as follows:

Statewide framework data layers will be made easily **accessible** at no cost to government agencies, the private sector, and the general public. Locating data will be much more **timely** than is the case today and ease of use will be greatly improved. Providing a single source for data and analysis tools will result in increased use of the data already being collected, provide a vehicle for the collection of new and better data, and will result in generally increased use of geospatial technology.

**Data quality** will be greatly improved through adoption of common standards, including metadata. Many data layers will be maintained by the central service agency, which will further assist in providing a single high-quality standard. More frequent use of the data due to greater accessibility will result in informal quality control and feedback to the data providers regarding inconsistencies in the data.

**Depth and breadth** of data will be provided across the seven framework layers (with the addition of two layers) and across the 99 counties of Iowa. Providing a structure for the creation of a seamless dataset opens up many opportunities for analysis and use of data beyond city, county, or regional boundaries.

Access to framework geospatial data and technology will be distributed more **equitably** throughout the state, as rural areas are encouraged to participate in the service offerings of the IGI. Providing more current, accurate and seamless data sets will result in better demographic analysis for government programs, providing more equitable distribution of resources throughout the state. Providing support to disciplines that have not yet embraced geospatial technology will result in better capabilities for these agencies and better service to the public.

**Economic development** will be improved through use of modern geospatial technology to attract new business to the state. Areas of Iowa currently experiencing rapid growth report that use of GIS technology is essential in making a professional presentation of their sites to potential developers and businesses. Underserved areas will have access to data, tools and expertise necessary to become competitive in attracting new business. The improved level of interagency communication will supported by IGI will allow local governments to be more responsive to all customers, including the development community and businesses that are considering relocation to the state or expansion of their operations within the state.

In addition to supporting state-wide coordination, the IGI data sets will benefit each participating agency. By providing counties, state agencies and private entities with current, accurate data IGI will enable these organizations to develop beneficial GIS applications with minimal investment in data. Since the data investment is typically the most expensive part of a geospatial project, the agencies that use the IGI data will enjoy significantly higher returns on their investments than would otherwise be possible. Providing the expertise of a state service agency will enable many organizations to develop GIS skills that would have been difficult to acquire in isolation, as well as providing valuable forum for sharing experiences with GIS analysis for various programs. In addition, a need for a state service agency to provide geocoding services for state agencies has been identified. Fulfilling this need will enable a number of analysis activities at state agencies that currently cannot be realized.

Emergency Response activities provide a particularly rich area of strategic benefits. Interviews were conducted with 18 emergency response-related agencies, including dispatch, fire and amubulance response services as well as more comprehensive county, regional or statewide offices. In only one case, Iowa Homeland Security and

Emergency Management, a general agency was able to estimate tangible benefits. However, organizations involved in more consistently repeatable activities, such as fire, ambulance and dispatch, had success in quantification of benefits.

We received comments from comprehensive agencies indicating the reasons for their difficulty in quantifying benefits.

*"Struggling with street level data is a problem and has so far not been manageable statewide."*

*"The nature of response is ad hoc, and thus is it not defined as a business process. There is a culture of ad hoc response in emergency response."*

*"For incident response it's a matter of either looking at lots of paper maps or having GIS. It's more a matter of not being able to do the analysis at all in a timely fashion without GIS."*

*"We've heard from other parts of the country that HAZUS cuts disaster response in half. But the product is not heavily used in Iowa and it's difficult to get started with it."*

*"Early on, GIS just allowed emergency managers to see buildings and people. In a single community this was already known so the capabilities were not very impressive. Why is there a resistance in Emergency Management to using GIS? Lack of base map data and resistance to analytical procedures. Yet emergency response is all about accurate information, and thus metrics. We should use data gathering efforts as a catalyst to bring disparate interests together and encourage data collaboration efforts."*

*"I am not certain I can quantify hours saved as we are still building our GIS databases. There are many efforts to find the appropriate data to add to the system."*

*"We use GIS for analysis regarding special needs population. This is the only application we use directly. There are lots of GIS applications we would like to use but we don't have our own GIS software. We rely on the GIS department and don't do as much as we might."*

*"Most County Emergency Management Offices consist of one individual and maybe only half-time at that. They do not have the staff and time to devote to HAZUS. Another road block is that not only do you have to have Arc GIS, but you also have to have Spatial Analyst in order to run HAZUS. To be real honest with you, I don't see HAZUS being used that much at the local level due to the above reasons unless it is a larger community with GIS staff and the time to devote to HAZUS. I see more of a potential for the Regional Planning Commissions to utilize HAZUS in working with county government in the development and update of the local hazard mitigation plans."*

*"Data sharing is a huge issue for emergency management. The State (Wisconsin), through the State GIO Officer, has been working on the whole issue of data sharing and trying to develop agreements with the local governments. There is a long way to go."*

*"In the case of a large tornado event we modeled the tornado path using real time weather data to predict damage as tornado hit. With a tornado occurring at night it is more difficult to respond, reports coming in regarding damage are confusing. How to understand its path and tell first responders where to go? This is an ideal situation for GIS to provide benefits but difficult to deploy and thus to measure."*

*"FEMA Region VII is very interested in the IGI project because our constituents frequently have difficulty getting resources allocated for use of HAZUS. Having a business case for HAZUS would be of great value."*

Agencies engaged in more repeatable daily activities also experienced some difficulty in quantifying benefits, in many cases due to impediments to their full implementation of GIS. In other cases, simply no methodology for tracking benefits has yet been established.

Economic development is another area showing significant strategic benefits as well as potential for increasing tangible benefits. GIS is increasingly becoming a mandatory tool for economic development staff, particularly at the county level.

*"Having public GIS is important for a nonprofit. Otherwise, the agency must invest in one more tool. Upon occasion, we must get information out in 24 to 48 hours. Having everything online electronically really helps. Visitors came from Sweden because a drawing of the site was pretty and also identified infrastructure in detail. With no GIS competitors can be more impressive. Flexibility is important. Every project is unique. We must be able to show what the client wants to see."*

*"Benefits of GIS to a county: without GIS we would not be getting shots at projects. Without this capability, counties don't even know what they are missing out on. GIS is turning into a must have rather than a nice to have. Maps get the clients to come to town and then the economic development staff must make the sale. We always start with a picture. If you can get them to visit your town and the property, you are already on the short list."*

Comments regarding strategic benefits for each participating agency follow. Strategic benefits are categorized by benefits from statewide seamless data sharing and benefits from counties acquiring GIS capability.

### *STATEWIDE SEAMLESS DATABASE BENEFITS*

***County/City***

**Iowa City Fire Department Chief**

What are the impediments to GIS implementation for him? Staffing is the biggest deal, a much greater problem than funding for hardware and software. If the central state services could provide something for use by all fire departments to reduce the individual staffing overhead, that would be a great benefit.

**Johnson County Assessor**

They have a full GIS department and a web presence for making data publicly available. Johnson County residents all know how to access the county's data. But public and private entities outside the county won't easily know how to find their data. One central storehouse for the state would be helpful.

He would like to have easy access to parcel information from adjacent counties so he could check values of adjacent properties. He does not go to the trouble to do this with current capabilities. Many counties don't have a good web presence. A universal interface would be helpful. Real estate, insurance, bankers, appraisers experience the data in a chopped-up fashion currently. He sees the greatest benefit for statewide parcel data being to the private sector.

**Linn County Planning and Zoning**

FEMA delineation. They will be able to use the new LIDAR to start LOMAs in house.

**Johnson County Conservation**

They have many uses for a statewide seamless database. The Iowa River is the second or third most impaired waterway in the country. There is a need to view statewide data on it.

**Winneshiek County**

Benefits of statewide seamless data layers to Winneshiek County:

1) aerial surveys
2) LIDAR

Aerial photography is crucial for assessors/engineers to reduce field visits. Every year they are supposed to assess everything in the county, but the county can only afford new photography every 6-10 years.

Benefits of photography: Traditionally use field surveys to map karst topography. They would use it with sanitarians for hog confinement, use for determining forested/non-forested land, use for row cropped vs. pasture. Better photos would help. They use color-infrared a lot. This county has lots of hills which results in lots of shadow on the photography. They would benefit from common software used for statewide layers

**Nevada Economic Development (Story County)**

Benefits from a statewide GIS: useful when negotiating to buy land. Often there are absentee owners who don't want to sell outright because that would create a tax occurrence, so they are looking for an exchange. Often there is nothing available in the county that meets their specifications. There's a need to search the state for properties, equate by CSRs, etc. to make comparisons. Currently the county could bring in a $130M project where only one property will suit. Property owner has specified certain locations where they would accept a trade.

**Story County Planning and Zoning**

With statewide data their department could give an analysis back to property owners sooner. They deal with this kind of situation 1-2 times/year. They have a case of a wind farm coming in where they need to notify property owners in a ¼ mile radius around the property. As it is a multi-county area, this may take a lot of time. Previously they have not notified beyond county boundary but this is bad practice.

They would appreciate shared services/service agency as budgets are in decline or stagnant.

Uses for LiDAR: They require all applicants to provide an existing resources inventory. Currently this is not well researched due to lack of data.

**Linn County Planning and Zoning**

LiDAR benefits for slope analysis. What about aboveground information? Viewshed analysis would be possible. They would use this for cell towers and wind farms. Have done this previously with USGS topo maps and arbitrarily assigned types.

**Black Hawk County Public Health Department**

Benefits of address points: many of their projects are multi-county but they don't have data for adjacent counties. The county does inspections of 1800 restaurants in 9 counties but maps only for Black Hawk

**Warren County, Indianola, IA**

With LiDAR will generate two foot contours to be used for economic development and to generate new floodplain maps. Currently have 10 foot contours from 2006 aerial photos.

Hydrography – what if a dam breaks and another holds? Analysis important as the effects would have a big impact to a county. Would like statewide analysis of rivers that feed into Des Moines River. County would like to see utility data, good for emergency management and public safety and dispatch**.**

**Jones County Surveyor**

They are relatively new to GIS. Had the county flown a few years ago. Tie all projects to State Plane coordinate system and wish everybody would go to that. Having standards to use for the statewide project would be helpful.

**Pottawattomie County GIS**

Statewide GIS would help large companies see opportunities in Iowa for economic development. Seeing the state as a whole would draw them in and might help give a kick in the pants to counties without GIS. Foster communication. Pottawattomie is in far SW corner of the state. There is not a lot else around this county. They would like to have a bigger GIS neighborhood

**Polk County Assessor**

The county commercial assessing staff will call all over the state to get assessed values. They would benefit from a seamless statewide parcel map.

Assessors tend to compare notes with each other more than auditors or other county offices, view beyond their county borders.

They would strongly advocate to other counties in Iowa to make their database seamless. Chopping up by the square mile or township hides lots of errors. Cedar Rapids went from chopped up to seamless and from city engineer maintenance to county-wide.

**Polk County Commercial Assessors**

Their office responds to many tax representatives, from HyVee and other chains, and need to compare values statewide. With GIS statewide data, able to develop more uniformity throughout the state. Or can compare values with a property unique to their county by pulling up one elsewhere in the state. Do they address these issues manually now? Only on a case by case basis by phone or viewing other assessors' website. Result would be more equitable assessments which would be a benefit to the public, by keeping assessors' offices more in line with each other. Potential time saving in justification of values when contested but not able to estimate extent of this. Access to the data would provide a good cross check of decisions.

**Johnson County Board of Supervisors**

Johnson is one of three or four growth counties. The rest of the state is drying up. This seems to be self-perpetuating—when counties don't invest in technology and move in a growth direction, others don't come there to do so either. Whole industries – real estate, engineering, appraisals, public health, conservation, human services, public safety – would go crazy without GIS.

**Emmet County Engineer**

DOT has developed a statewide virtual GPS layer. Counties now won't need to have a GPS reference station to have survey-grade GPS available. Biggest challenge for more rural counties is having good signal for GPS.

LiDAR – would use for drainage and agriculture and tiling, for better planning. There are many situations where work has been done over and costs absorbed by the county.

**Jones County GIS Manager**

There is a need for a software program for Environmental Health to use, something generic and statewide. Currently they ask field staff to collect GPS points, write down lat-long, and eventually data makes its way into the GIS. This system is not very streamlined.

**Taylor County Assessor**

The county conference board just voted to have bids for converting their data. They have increased the tax levy to fund this project but it will take three or four years to raise enough money for the project. Use of the state revolving loan fund would thus be of interest to them. They would be VERY interested in assistance at the state level regarding contracting, QA, project oversight. They would have an interest in the project being combined with neighboring counties in the same situation. No one at the county understands the technical issues of data conversation well enough to manage this project.

Their business model for operation would be to have no GIS Coordinator and to have each office able to work with the system for its own purposes. Thus, the model of having state support with data on the common server would be very attractive. Uncertain whether they would desire to maintain their own plat maps or would outsource.

**Warren County Economic Development**

Benefit of statewide GIS – show state transportation infrastructure.

Currently standards are disparate. A statewide data system would be helpful for landuse planning and development and for coordination between multiple jurisdictions. Being able to consolidate info all into one map instead of taping them together would be great.

*State Agency*

**Iowa Department of Public Safety**

He is interested in crime mapping data and would love to be able to go to a web application. Currently he does GIS queries by crimes using simple GIS software and plots incidences to the city level. Struggling with street level data is a problem and has so far not been manageable statewide. Example: plotting meth labs, where address might be three miles north of a city.

He has an idea of having Department of Public Safety providing GIS services for county and city public safety organizations. This could include services to fire departments, as requested by Iowa City.

Utilities layer is of interest, especially as it relates to Homeland Security needs.

**Iowa Department of Public Health**

Improved accuracy and timeliness would be key to data improvements for public health. They would very much like to have building footprints as an aid to determining critical infrastructure locations. They are concerned with planning for pandemic influenza and with bioterrorism and need reliable data to help in assessing risk.

**State Historic Preservation Office**

It would be very exciting to have addresses drop on top of buildings. That would be the really big win of this project for him. Building footprints from counties might help clarify if they had located the correct building in a search. There are over 100,000 buildings in their records, although some are not significant.

He is in the process of mapping their Standing Structure / Inventory locations (point locations). These are the historical buildings and sites that have been recorded with the State Historic Preservation Office. He used geocoding of addresses in this process for those structures that had known addresses. Better or more accurate address locations would be wonderful. Geocoded addresses matched with commercial address data tend to plot bunched up at the end of the block in urban areas.

Unfortunately many of the records do not have complete addresses and many rural locations have only township, range, section, etc. (recorded before 911 addresses were assigned). This is a long term ongoing project.

**State Historic Preservation Office**

Another benefit is people would have a better idea of what data is available. Those coming into the office would be better prepared. These people might be Federal reviewers for Section 106. Consultants and agencies could do a better job with this information access.

**DOT Trails**

Benefits of IGI: more timely updates. Latest update right now is 2004.

He sees it as an economic development tool for recreation. Information from locals not always best, but lots of money is being invested.

There is no link between spatial data and grant management. Creating this would be a great improvement.

Would be good communication for public to be aware of plans. Legislators want to know. Economic development would like access to current data and current plans.

**DOT Right of Way**

They have problems with disparate data. Auditors vary in how helpful they are. Their office must send someone to every courthouse every six months.

**DOT Office of Design**

Two foot, one foot, six inch orthos/LiDAR/hydrography/parcels/geodetric control would all be layers of interest.

1) Capture aerial photo and lay out flight lines. Higher quality would help regarding accuracy and currency, and placing targets.

2) Geodetic layer is critical. Lots of quality from counties but no one source.

3) Capture terrain and planimetric and utility information (1:100 scale). Culvert and bridge. Easy access to LiDAR would help by improving ortho quality and getting orthos earlier, because TIN would already be there.

**Iowa State FSA Office**

They use a common land unit layer, boundary around each tract in a county. Overall benefit would be accuracy of records and providing better customer service. They would not need constant updates. A minimum of once a year from the courthouses would be adequate. Would envision transitioning in to this methodology as county data became available.

**University of Iowa Urban Planning/Economic Development**

It is not possible to do joint planning between counties without a seamless dataset. Johnson and Lynn Counties are a good example**.**

**Iowa Department of Education**

District consolidation projects could require the use of multiple counties' plat maps. Generally simple consolidations will merge existing district shape files. Last time they had a complex consolidation was in 2004.

**Iowa Homeland Security & Emergency Management**

Benefits: Faster response time. There were four Federal declarations this year alone. Losing 4 hours of response time in an emergency ice storm due to data problems is typical and is a real problem. There was a flooding incident with old imagery and new subdivisions. They did not buy satellite imagery for that project due to cost.

**The Polis Center, Indiana University Purdue University**

Why resistance in Emergency Management to using GIS? Lack of base map data, resistance to analytical procedures.

Emergency response is all about accurate information, thus metrics. Use as a catalyst to bring disparate interests together. Encourage data collaboration efforts. By improving, you are meeting needs of many communities, meeting multiple goals.

Communities collected data in isolated fashion in the past but emergencies don't work like that.

**Iowa Department of Human Services**

Their biggest gap is the time and expertise to do GIS. They need proper training and resources. It would make a world of difference to have a technical resource to go to. The first hurdle is reliable address information. Second hurdle is translating data into active GIS layers.

**District Conservationist - Clinton Field Office NRCS**

What would they like to have? Utilities would be great. Use One Call for this now. Cultural resources would be helpful. He knows well info is maintained by the state somewhere but not sure how to get it. Appreciates assorted DNR layers, such as bald eagle nest sites. They sometimes use older aerial photography. DOT has historical imagery, for instance 1937 layer. Wetland inventory process requires 1980s data. Still using old slides which would be expensive to rectify.

**Iowa Department of Agriculture and Land Stewardship, Water Resources Bureau**

LiDAR would be the largest benefit of IGI to CREP (Conservation Reserve Enhancement Program). They have a contract out for engineering services for surveys for wetland structures. Must determine if site meets their criteria. LiDAR will take out the guesswork.

**Iowa Department of Education, Community College Division**

Their operations are based on school district borders. The latest available borders are from 1998. Boundaries change a lot in 10 years. For some types of research, this outdated data is unacceptable, as the result will be incorrect analysis without the researcher even being aware of the error. 364 district boundaries are difficult to check manually. Results affect fund distribution and errors mean inequitable fund

distribution. School districts are often located in two counties, up to four counties. Often they are trying to interrelate with DHS data which uses county boundaries, brings up these issues.

Other data needs: specific structures related to urban development, industrial construction. They would use this to help determine what programs community colleges should support due to industry growth in the area. An example would be trades supporting ethanol plants. Research regarding technology development. Claims of 10,000 unfilled jobs for technology-related fields. How can DofE find those jobs? 22% of Iowa's adult population is currently enrolled in some type of community college class.

Discussion that the Iowa Geospatial Data Clearinghouse site could be a foundation for data sharing between Economic Development, educators, workforce development. Time for agencies to understand that everything is interrelated. Geographic location is the unifying theme. Workforce development is critical. Dept. of Education is interested in where alumni go and their economic wellbeing.

The Iowa Geospatial Data Clearinghouse site could provide a repository for statistical analysis tools. This would decrease cost and increase information sharing regarding what is available. He uses geodata package for spatial autocorrelation. This is free research software but he had to spend time to find it. Getting similar capabilities by activating a component of ArcInfo would be very expensive and probably provide way more capability than actually needed.

### *Utility*

#### Paetec

They provide telecommunication services in 96 counties in Iowa. He would use a county-based statewide system immediately. Right now he uses outdated street data as a base map for their utility networks. They purchase this data from a commercial service which prioritizes updates for metro areas, none of which are in Iowa. Even Cedar Rapids is years out of date.

#### MidAmerican Energy

Obtaining the last 10% of address and building footprint data takes as much time and effort as the first 90%. He is always looking for address information. Smaller

communities in the west part of the state didn't have much available. They would use this county data. Statewide addresses with parcels would be very useful data to them.

**Aquila GIS Support in Omaha**

They maintain centerlines, ROWs, easements, parcel data. They buy data from some counties and get some free. He would be interested in a single source for statewide data. Currently, they respond to problems identified in the field and fix minor to major problems all over their service territory. It would be great to get new updates directly from the counties.

**Des Moines Water Works and Iowa One Call Board**

Utility benefits: Considerable effort is devoted to bringing in new development base maps. IGI would save 1-2 months of a drafter's time if current county info could be provided. But we cannot claim this benefit without finding a way to improve on county timeliness regarding availability of data. Currently, data from even Polk County is not early enough for their purposes. General discussion that this is the case for all utilities.

**Iowa Communications Network**

They are new to the IGI project and to GIS. Somewhat amazed that it might be possible in the future to get all county-level data free of charge on publicly available website. Would consider providing utility data under appropriate circumstances. Sound like they might participate in IGI if invited and educated.

**Alliant Energy**

Benefits: Getting forecasting info from planning for new plats, yielding better data analysis and earlier information. Address points would be a resource for marketing staff. Ability to do more analysis than currently done. Synergy with others. Collaboration.

**Rathbun Regional Water Association**

Address matching that is accurate and yields results would be very beneficial to our organization, especially to be able to type in an address on an interface and get a point to pop up in the correct location. He knows this is available at the moment, but the layers used to match against aren't the greatest. There are a lot of address ranges missing in most of the data, especially in Southern Iowa. "No Location Found" or something along those lines is a frequent problem. Also, folks using just ArcGIS Explorer as a client would benefit greatly from this type of infrastructure and could add their own data to supplement what would be available in one package.

***Consulting***

**HR Green**

"I think this sort of database would be of tremendous use and save us quite a bit of time in terms of data acquisition. A statewide parcel database in particular would be very useful in many of our projects. The 3 – 6" resolution on urban aerial imagery would also be a significant improvement from what is currently available on NRGIS and save us time in acquisition. Having access to LIDAR data will also prove very handy in the future. This looks like an exciting development to me."

Staff Scientist

" HRG is currently using many of these data layers in our project work. I would like to see these layers published in a state-wide context for many reasons, but the most important being for GIS analysis. We setup many of our projects to include these basic layers and if these layers used a common schema, consistent GIS analysis would much easier."

GIS Coordinator

"The diverse nature of the consulting business makes the seamless database of common, high-accuracy GIS coverage described for IGI a highly anticipated technical and planning resource. Such a framework would be of great benefit, especially aiding efficiency and reliability during the preliminary phases of our projects, as all of the data layers mentioned are typically brought into projects at their beginning and then used throughout the course of project completion. The framework described is desirable because it will facilitate preliminary assessment, planning, budgeting, and conceptual design of infrastructure. Nothing can replace the site-

specific requirements of project engineering but IGI would be a tremendous framework from which to begin. Clients and consultants, including scientists, engineers, planners, surveyors, GIS and CAD users, will all benefit from this resource."

**Kuehl & Payer Ltd.**

Many times GIS data is used for the preliminary stages of the project. A few ideas that come to mind are The Iowa CREP program, any City which would benefit for prelim planning and assessments. Also Drainage Districts would benefit for assessments and annexation, and even possibly research done for Land Surveying operations. The biggest benefit here would be the ability to access this data remotely (view or download from the internet) which would be very convenient for our business.

***BENEFITS TO COUNTIES WITHOUT GIS***

**Marion County GIS**

Assessors and auditors benefits: went from paper to GIS. Large portion of their time went to serving data requests from the public. With a web site, traffic dropped to nothing. Public can get CSR reports, aerial photos, sales data.

**Environmental Health, Cerro Gordo County**

There is long-term savings to be captured. For example, maintaining data on septic systems in GIS would be beneficial to everyone. But they don't have enough people in their department to do GIS work. Their next step is to hire someone full time for GIS so they aren't technically handicapped. At this point don't have staff understanding the technology well enough for GIS to be useful for them.

**Humboldt County E911 Dispatch**

Before GIS, couldn't track where a cell phone caller was. Now they can be tracked on a map. Benefit is ability to respond to a location. She uses this approximately 10 times/year.

Road closures are kept updated on the dispatch maps. Closures are common due to flooding, snow, construction. Using maps, they are able to reroute ambulances. She did this a week ago with flood closures, with this use for approximately 10 responses/year.

**Cerro Gordo County Health**

They have all county wells plotted in GIS. They are able to look at contaminated areas or areas of high lead housing. Would have never done these projects without GIS.

Use in environmental health regarding septic systems, wells. GIS products affect inspection activity. Flooding examples – wells affected by flooding. They generated a list to property owners. They would have worked with paper maps otherwise but would have missed some wells. They were able to notify affected population same day vs. several days delay and thus able to prevent people from drinking contaminated water.

They are able to do analysis based on plumes for planning evacuations, and thus able to be more precise with areas to be evacuated.

**Linn County Planning and Zoning**

Their Planning and Zoning Department saves time by having GIS. All of them use GIS. Mostly use for routine queries but also for analytical. GIS allows them to make better decisions—not allowing sprawl, saving money on infrastructure, forcing developers to pay for themselves. Long-term planning initiatives and policies are affected. These are difficult to quantify.

**Dane County, WI Emergency Management**

For a tornado incident in 2005 they collected addresses affected and color coded parcels for degree of damage. Hard to eliminate on-foot time but the GIS work could have made assessment go faster. Building inspectors spent a long time at each address. Quick and dirty estimate would have taken a couple of hours vs. couple of days. Using current procedures, they had really crude details for three days,

essentially no information, and then finally full assessment. Until this assessment is complete, they had no way to answer questions to the public.

For incident response they can either look at lots of paper maps or have GIS. It's more a matter of not being able to do the analysis at all (in a timely fashion) without GIS.

**Jones County E911/Landuse**

She says it is not the case that in rural and small town areas everyone responding knows where everything is. Volunteer services are losing volunteers all the time. Paramedics are hired from outside the area and will have no clue where things are. Having GIS available for dispatch matters every day. However, she does not know how much time the responders save daily as she serves 5 or 6 ambulance services and 7 or 8 fire departments.

**Johnson County Conservation**

GIS is a powerful tool regarding change in land use. Johnson County is talking about a ballot measure for land preservation. GIS makes the public aware graphically of changes. Species richness map are barometer of quality of the land.

Another use is in grant writing. A picture is worth a thousand words.

**Linn County GIS**

One benefit is helping election staff reduce improperly placed voters in districts and redistricting for county supervisors and council. Doing this manually would take a lot of time given the different scenarios. Before GIS, their process with Census Bureau maps took weeks. The beauty of doing redistricting in GIS is the ability to create alternate scenarios. Change to precincts happens every 10 years, following each census. Cedar Rapids had change in governance and added supervisors. This is an unusual event that might happen only every 50 years.

**Jasper County**

Strategic benefits: updated address ranges to centerline files would be helpful for dispatch.

**Marshalltown Chamber of Commerce**

Benefits of GIS to a county: without GIS they would not be getting shots at projects. Without this capability, they don't even know what they are missing out on. GIS is turning into a must have rather than a nice to have.

Uses: bird's eye view, show utilities, show potential roads, slope, curb cuts. GIS takes days and weeks out of the decision timeframe.

He always starts with a picture. If you can get them to visit your town and the property, you are already on the short list.

**Marshalltown Schools**

School bus routing benefits: They have 40% annual student turnover which is difficult to manage. Route optimization to include load balancing routes. Analysis of which kids are entitled to ride the bus for free. Improved communication to families.

**Jones County Conservation Director**

"We do some things with GIS that allow us to perform our job better. Without GIS, we wouldn't consider doing these things as they are too time consuming. For example, we manage plant communities through burning every few years. GIS allows us to map burned areas, store the records for future reference and assessment of plant communities and calculate accurate acreages, which allows us to determine staff needs and allocation of time."

Each year they have emergency response issues. Have landowner overlays for private land along those 90 miles. Use info to access river from land and to contact owners. Old way of contacting would take too long.

They are in charge of over 90 miles of river system used for recreation. Project planning. Special and natural resources. Maps of river corridors used in meetings.

Show unique features (geology, plant communities, native American sites) on maps. Optimize opportunities to preserve resources and acquire areas. Use in management plan regarding decision to develop or preserve an area.

Mapping helps determine future direction of their program. Taxpayers can only be expected to fund a certain level of services. Helps identify priority areas.

"I have written many grant applications and proposals from the federal, state, local and private level. The competition is fierce for these grants and it is very important that proposals are professionally done. GIS gives us an edge over other applicants as it illustrates the information in a way the grant reviewers can understand it, is very accurate, and it is visually appealing to the grant reviewer. It is difficult to estimate the value of GIS in these grants, I compare it to graphics included in the application. In some cases it may make the difference between getting the grant and not getting it."

Mapping endangered and threatened species. Old way of keeping it in someone's head means that knowledge is lost over time as people go away.

"The mapping and analysis of special natural and cultural resource sites allows the Board to identify areas where public tax money is best expended. By mapping these sites and reviewing the data we can make better decisions about the future of our program, i.e., focus on areas that provide the most return in terms of recreational benefits, educational opportunities and preserving high quality resources, that benefit the majority of people over the long term. In summary, it allows decision makers more detailed and better information for use in the decision making process."

**Linn County Planning and Zoning**

Greatest GIS benefits come from the analytics aspect. Having data at a common scale for site review, environmental review, land use

Some projects are done now that previously would not have been done, for example, flood plain review. They sent out letters this spring based on queries to all properties in the flood area to remind them of availability of flood insurance. This effort took one day. Don't know how long otherwise to search records manually for property values greater than $5K. Bottom line is this search would not happen.

**Emergency Management, E911 Administration and Homeland Security Warren County**

Before GIS: did everything manually, drawing circles on paper. They couldn't identify people in an area without going to assessor's office. Now they have automatic updates and track people as they move about.

Iowa Code requires plan updates in a five year rotation. Her plan book is 6 to 7 inches thick.

**Jones County Surveyor**

Having aerials to look at results in better decision making in setting up surveys. He says it is reassuring to have the imagery confirm his ideas for setup and to be able to zoom in and out in the GIS and to see miles outside a project.

**Pottawattomie County GIS**

At the county level, the biggest benefit from GIS is public safety – 911, sheriff, police, fire. Also, benefits to citizens from not having to drive to their courthouse, which is not centrally located. They could have as much as a 30 mile drive to the courthouse.

**Polk County Assessor**

GIS is core requirement to getting their business done. Use GIS to review bad data. It provides tools for resolving problems. It enables projects that couldn't be done before. They use spatial analysis to develop surface model for sales and derive land rate models to make adjustments. GIS was used through two reassessment cycles with success. Stated goal of their department is equity. They are better able to defend values with procedures/processes and have fewer protests or cases where office doesn't look good**.**

**Linn County Emergency Management**

They use GIS for analysis regarding special needs population. This is the only application he uses directly. There are lots of GIS applications he would like to use

but they don't have their own GIS software so they rely on the GIS department and don't do as much as they might.

**Johnson County Ambulance**

For the past 4-5 years they've had GPS in all vehicles. They track vehicles from the office and send closest vehicle. Calls come in through sheriff's dispatch. Track time in trucks from a module of the GPS, which is effective from an operations standpoint.

They can replay tracking records, which is helpful if litigation were to result. Five years ago there was an incident with an ambulance running with lights and sirens. Car with a green light hit the ambulance and alleged no lights or sirens. At the time they were able to play back the recording of the hospital call, which included sound of sirens, but now the GPS system records when lights and sirens are on. It records speed also.

They recently put the county mapping system on tablets. Drivers can enter destination address and use for routing. Don't have to look something up manually.

**Warren County Economic Development**

She uses GIS to find information on a particular piece of property, assessor information, or building footprints. She also uses aerial photos. Photos taken from the side of the road of an empty field don't tell a prospective client much. Aerials help paint pictures. They often work with general land owners who are not involved in development. These people don't know their facilities information. Realtors often don't collect full information either. Need water, sewer, electric.

Having public GIS is important for a nonprofit. Otherwise, it must invest in another tool. Sometimes she must get information out in 24-48 hours. Having everything online electronically really helps. Visitors came from Sweden because a drawing of the site was pretty and also identified infrastructure in details.

With no GIS: others can be more impressive. Flexibility is important. Every project is unique. Must be able to show what the client wants to see.

## SECTION 6: CONCLUSIONS AND RECOMMENDATIONS

The IGI financial analysis is a unique, complex study of the costs and benefits of developing a central agency to support seamless statewide data sharing. The multi-agency analysis takes input from 18 individual spreadsheets representing costs and benefits for counties, some state agencies, and some private entities in Iowa. It is certain that, although the study represents a great number of affected organizations, it does not include all organizations nor has it captured all possible costs and benefits. A good area for further growth of this financial analysis would be incorporation of additional state agencies and the addition of federal agencies receiving benefits from the IGI.

The majority of costs for the project can be attributed to creation and maintenance of two central service agencies and adopting GIS for 20 counties. Benefits to counties, both those adopting GIS and those already having GIS, provide the majority of the benefits to the project. Although benefits to state agencies are surprising lower than those to counties, benefits to consulting firms are significant and would be passed on to state agencies through savings on contracts, providing a significant increase in state benefits.

An interesting finding using sensitivity analysis shows that delayed adoption of GIS, with the 20 counties phasing in GIS capabilities over 20 years instead of the desired 10 year span, does not result in extreme detriment to the project. NPV is reduced from $271M to $230M and ROI is reduced from 24% to 22%. Similarly, sensitivity analysis shows that if Imagery for the Nation contract mechanisms do not become available and the state must develop its own contracting mechanisms for aerial surveys, the project will not suffer inordinately. NPV would be reduced from $271M to $229M and ROI would be reduced from 24% to 16%. Sensitivity analysis demonstrates that a project of this magnitude and diversity of participants and benefits will be able to manage slow growth and other obstructions to progress and still achieve a very positive net benefit. However, sensitivity analysis shows that counties attempting to adopt GIS in standalone mode may find that their projects will not break even and are at a serious financial disadvantage when contrasted with counties making use of IGI capabilities.

Although primary tangible benefits shown in this analysis are to the counties, these benefits obviously roll up to the state as a whole. Additionally, it is possible that the type of benefits discovered for counties could be extended for use at state agencies. The use of LiDAR in place of preliminary surveys and to aid in preventative road maintenance provided a large savings to counties that could be extended to many state agencies. Interviews with economic development staff showed considerable tangible benefits in attracting business to a county. Clearly, state tax revenues benefit when counties are successful in attracting new business and it is likely that state organizations would also benefit from increased business activity. Similarly, emergency management agencies have been able to identify some tangible benefits, particularly at the local level and in sectors where the majority of tasks are recurrent, but this area of benefits is not

yet fully characterized. Benefits to consulting firms are large and these would be passed on primarily to state agency contracts with these firms.

Analysis of strategic benefits shows many areas which may become quantifiable as they are studied over time. The benefit to the public of having Internet-accessible statewide data in a common format is difficult to calculate accurately. This benefit begins with the cost avoidance of citizens and businesses traveling to individual county courthouses to obtain data and expands to the wide terrain of 24-hour data availability provided by all state organizations. State and county agencies interviewed for this project have cited the use of GIS to provide equitable services to the citizens of Iowa. More accurate and current data helps in more equitable distribution of resources and well as providing a potentially tangible benefit of more efficient distribution of resources.

Economic development benefits to the state from availability of geospatial data and analysis capabilities are potentially quite large. Interviews yielded comments from economic development staff that GIS capabilities have become essential for them to be competitive in attracting business opportunities. In the case of counties without GIS, the strategic benefit of moving proactively to attract new business through adoption of GIS could signify the type of attitude shift that is required for low-growth areas to take charge of their future. One Chamber of Commerce interview cited GIS as contributing more than 50% of the resources needed to bring in new business, with an estimation of $13.5M/year in benefits to a community of modest size. This benefit has not been captured in the spreadsheets as it is uncertain the degree to which counties adopting GIS would ramp up to this level of benefit, but it certainly estimates the potential for growth in this area.

Emergency response staff at the county and state level are just beginning to reap the rewards of GIS capabilities and will find much use for statewide data sets. The majority of these organizations do not currently have a means to track benefits during a natural disaster or other type of unique emergency. They describe their situation as ad hoc response mode and it has become clear that it will be necessary to work with them over time to devise methods for measuring the improvements in their processes through use of geospatial technology. Interviews with emergency response agencies indicated that lack of good base maps and need for expertise and tools for analysis are limiting factors in their continued adoption of GIS.

The interview process revealed that utilities in Iowa are not particularly familiar with IGIC or this project. However, utilities typically maintain their own set of base maps over a multi-county service territory and thus would be very interested in the plat map layer of the IGI. One limiting factor is utilities' need for plat maps very early in the design process of a new subdivision, as this is the time when new services must be designed in the utility GIS. If counties could begin to enter preliminary plat map

information into their publicly available base maps, this would provide a great benefit to utilities.