Recommendations for State of Delaware GIS Coordination and Governance

August 2021

Prepared by
Troy Mix, Policy Scientist
Marcia Scott, Policy Scientist
Ellen Schenk, Public Administration Fellow
Sade Bruce, Public Administration Fellow
Carolann Wicks, Senior Fellow

Institute for Public Administration
Biden School of Public Policy & Administration
University of Delaware

In coordination with
Delaware Department of Transportation
Office of State Planning Coordination

UNIVERSITY OF DELAWARE
BIDEN SCHOOL OF PUBLIC POLICY & ADMINISTRATION

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Preface

As the director of the Institute for Public Administration (IPA) at the University of Delaware, I am pleased to provide this report, *Recommendations for State of Delaware GIS Coordination and Governance*. This study was funded by the Delaware Department of Transportation (DelDOT) in support of the work of the State of Delaware's Government Efficiency and Accountability Review (GEAR) Board. The purpose of this study is to assess existing geospatial coordination practices in Delaware and recommend enhancements to the state's management and oversight of geospatial mapping and data integration for all state agencies. To complete this analysis, IPA staff and students surveyed GIS managers and practitioners in Delaware, conducted listening sessions with GIS stakeholders, and researched and analyzed policy and governance approaches relevant to Delaware.

IPA is committed to supporting the State of Delaware through collaborative, practical research that aides in the development of policies beneficial to all Delawareans. It is my hope that this report will help to structure future approaches to managing geospatial activities in Delaware.

Jerome R. Lewis, Ph.D.

Director, Institute for Public Administration

Acknowledgements

On behalf of the IPA project team, I want to extend thanks to the state agency coordinators of this study, Bruce Allen and Colton Phillips of the Delaware Department of Transportation (DelDOT) and Miriam Pomilio of the Office of State Planning Coordination (OSPC). They provided invaluable assistance in scoping this endeavor and organizing and advising on research and stakeholder engagement activities. I hope this study provides useful insights for enhancing the efficiency and effectiveness of the State of Delaware's geospatial activities.

Additionally, thank you to all the Delaware GIS stakeholders who responded to the survey for this study or engaged in listening session activities. I greatly appreciate their commitment to serving Delawareans. This report would not have been possible without their insights.

Troy Mix

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List of Abbreviations Used

Abbreviation	Meaning
CTO	Chief Technology Officer
DDA	Delaware Department of Agriculture
DelDOT	Delaware Department of Transportation
DGDC	Delaware Geographic Data Committee
DIDS	Delaware Integrated Data System
DNREC	Department of Natural Resources and Environmental Control, State of Delaware
DTI	Department of Technology & Information, State of Delaware
GEAR	Government Efficiency and Accountability Review Board, State of Delaware
GIC	Government Information Center, State of Delaware
GIO	Geographic Information Officer
GIS	Geographic Information System
IPA	Institute for Public Administration, University of Delaware
LIDAR	Light Detection and Ranging
LULC	Land Use/Land Cover
NSGIC	National States Geographic Information Council
OMB	Office of Management and Budget, State of Delaware
OSPC	Office of State Planning Coordination, State of Delaware
PLUS	Preliminary Land Use Service, State of Delaware
ROI	Return on Investment
TIC	Technology Investment Council, State of Delaware

Tables and Figures

Executive Summary

Project and Recommendations Summary

To address the lack of "consistent Geographic Information System (GIS) governance within the State," the University of Delaware's Institute for Public Administration (IPA) partnered with the Delaware Department of Transportation (DelDOT) and the Office of State Planning Coordination (OSPC) within the Office of Management and Budget (OMB) to complete a study of Delaware's approach to GIS governance.[1] This study considered Delaware's current and historic use and governance of geospatial data and applications; background research on GIS coordination and governance models used by other states; responses from a survey of Delaware GIS stakeholders; and findings from semi-structured interviews with Delaware Geographic Data Committee (DGDC) participants and other Delaware GIS stakeholders on the current and potential functioning of statewide GIS governance.

Based on this analysis, the IPA team agrees with the findings of a 2012 GIS business plan for Delaware: "collegial and cooperative efforts have gone as far as they can go."[2] The State of Delaware has achieved impressive outcomes through "ad hoc" GIS coordination, including leveraging investments in geospatial data and analysis for the more effective, efficient, and transparent delivery of many state programs and services. However, the current scale of geospatial investments across state agencies outstrips the capacity of Delaware's loosely coordinated GIS governance approach to prioritize, fund, monitor, and diffuse lessons from these investments.

Table 1 summarizes the alternatives that IPA developed and considered while formulating the recommendations for this study. While all the options present tradeoffs, ***IPA recommends that the State of Delaware establish a Geographic Information Officer (GIO) position in the Delaware Department of Technology & Information (DTI)***. Details of this recommendation and the analysis that led to it appear in the body of this report.

[1] "Annual Report," State of Delaware Government Efficiency and Accountability Review Board, December 1, 2018, page III, https://gear.delaware.gov/wp-content/uploads/sites/103/2018/12/2018-GEAR-Annual-Report.pdf.
[2] "Revised Business Plan for the Geospatial Coordination for Delaware State Government," State of Delaware Office of State Planning Coordination, 2012, https://stateplanning.delaware.gov/dgdc/strategic-plan/2012-geospatial-business-plan.pdf.

Table 1. Alternative Approaches for Enhancing GIS Coordination and Governance in Delaware

Approach	Benefits	Challenges
GIO in DTI *(PREFERRED OPTION)* Create a GIO position as a senior management role within DTI to lead the deployment and continued development of Delaware's enterprise GIS and direct strategic planning and statewide coordination efforts to prioritize, invest in, develop, support, and evaluate state GIS applications.	• Would represent clear centralization of core statewide GIS clearinghouse, IT architecture, procurement, and application development functions. • Leverages significant GIS expertise on DTI's FirstMap team. • Leverages ongoing IT centralization.	• Likely to require significant investment in building relationships with agencies less mature in GIS use. • Centralization of GIS staff has strained some GIS user/agency relationships with DTI. • Need to develop strategic visioning and planning expertise.
GIO in OMB/OSPC Appoint the OMB/OSPC employee serving in the role of state Geospatial Data Coordinator as the state's GIO, responsible for coordinating investments in and the development and evaluation of the state's GIS services and applications.	• OMB/OSPC already tasked with coordinating with other agencies. • Role of coordinating investments is closely aligned with OMB's mission. • Current Geospatial Data Coordinator role provides a platform for solid working relationships with users.	• Limited staff in OSPC would require significant interagency coordination to accomplish GIO functions. • Separation of GIS strategy and licensing/IT services will demand significant coordination.
GIO in Department of State Appoint a new employee within the Government Information Center (GIC) as the state's GIO, responsible for coordinating investments in and developing and evaluating the state's GIS services and applications.	• Leverages GIC expertise in promulgating statewide digital communications standards, enabling focus on statewide GIS initiatives. • Clear GIC mission could provide a suitable home for GIS evangelist.	• Limited GIS staff in GIC will demand significant interagency coordination. • Separation of GIS strategy and licensing/IT services will require significant coordination.
Status Quo with a Restructured DGDC Task a reinvigorated DGDC Executive Council, with rotating chair and appropriate task forces, with developing a GIS strategic plan and reporting on progress to the Governor.	• Leverages existing structure provided for in Delaware Code. • Clear workflows from technical task forces to Executive Council could aid in translating user experience to informed executive decisions.	• Robust DGDC participation will place significant demands on agency leaders and task force participants. • Lack of apparent decision-making authority may hinder coordination.

In summary, IPA recommends the following course of action for enhanced GIS coordination and governance in Delaware:

1. **Establish a Geographic Information Officer (GIO) Position** – The State of Delaware should create, recruit for, and fill a GIO position to:
    a. Lead the deployment and continued development of Delaware's enterprise GIS, including directing the FirstMap Team (approximately 25% of duties).
    b. Facilitate the coordination of GIS activities and resource needs among state agencies, counties, municipalities, educational institutions, and the federal government (20%).
    c. Lead the development and management of procedures and approaches to identify innovative geospatial practices, design and implement geospatial solutions relevant to the business needs of Delaware's agencies, and monitor, evaluate, and, as appropriate, replicate successful geospatial solutions statewide (20%).
    d. Coordinate with the state's executive leadership and agency stakeholders to develop and maintain strategic plans guiding investments and policies for geospatial data, applications, and human resource needs (10%).
    e. Partner with state agencies to create and implement a statewide GIS budget for the acquisition of core geospatial datasets and applications (10%).
    f. Identify and implement appropriate geospatial data sharing practices (10%).
    g. Assess and coordinate the delivery of GIS training for agency personnel to maintain and enhance the state's capacity to leverage geospatial applications for the efficient and effective delivery of programs and services (5%).

    Rationale: Why Establish a GIO for Delaware?

    - This study identified the need to institutionalize a centralized approach to funding core geospatial datasets, sharing data, and implementing and monitoring geospatial solutions.
    - The State of Delaware could realize economies of scale by centralizing the governance of investments in geospatial data and analysis capabilities.
    - A GIO could enhance efficiency and effectiveness gains from GIS by extending the use of geospatial applications beyond existing user agencies.
    - The formally authorized GIO position is a widely used model for GIS coordination, with 33 states adopting this model as of 2019.[3] Maryland's GIO experience offers an example of the form and potential benefits of this model.[4]

[3] "2019 Geospatial Maturity Assessment," National States Geographic Information Council, https://nsgic.memberclicks.net/assets/2019GMARawResults/2019GMAReportCards/2019%20GMA%20Report%20FULL.pdf.
[4] "Problem Solver Leads Pandemic Response by the State of Maryland," ESRI ArcNews, https://www.esri.com/about/newsroom/arcnews/problem-solver-leads-pandemic-response-by-the-state-of-maryland/.

2. **Place the GIO Position within DTI** – Building on DTI's experience in the design, acquisition, deployment, support, and monitoring of Delaware's IT systems, the GIO position should be placed within DTI.

   Rationale: Why Place Delaware's GIO within DTI?

   - DTI's broad involvement in the acquisition, development, and delivery of data, hardware, and software services for state agencies, including responsibility for FirstMap, creates considerable opportunities for leveraging this involvement for expansive GIS governance and coordination roles.
   - Ongoing state IT centralization has concentrated GIS personnel in DTI and created opportunities to leverage economies of scale in the governance of both IT and geospatial data and applications.
   - Formal GIOs within state IT departments represent the dominant model of state GIS coordination and governance.[5]

3. **Task the GIO with Senior Management Responsibilities** – In recognition of the responsibilities for frequent and effective coordination of executive, agency, and intergovernmental stakeholders, the State of Delaware should establish the GIO role as a director-level position reporting to DTI's Chief Technology Officer (CTO).

   Rationale: Why establish the GIO as a director position?

   - The responsibilities of a GIO will demand the skills of a seasoned professional to facilitate ongoing communication with the Governor's leadership team, Cabinet secretaries and other agency leaders, technical advisory groups, and other GIS stakeholders.
   - Incumbents in GIS and enterprise data management positions often share similar skills. However, GIS has developed as an independent field of work, and the successful application of geospatial techniques in public policy contexts requires specialized knowledge and experience. While coordination among those managing spatial and non-spatial enterprise data is critical, organizational structures that place GIS underneath data management—or vice versa—threaten to undermine geospatial applications' standalone importance for improved government service delivery. This positioning in the organizational structure could also undermine the ability of the GIO to facilitate ongoing, high-level communications.

[5] "2017 Geospatial Maturity Assessment Responses," National States Geographic Information Council, https://docs.google.com/spreadsheets/d/1MWOkmefvkTBJdDZhrbhdnzC1N581AELIa9Cz6ECrnGU/edit#gid=959838703.

4. **Review and Revise Delaware Code Provisions on Geospatial Data Coordination** – The State of Delaware should review and develop appropriate revisions to Title 29 Chapter 91 Subchapter IV of the Delaware Code, which addresses Geospatial Data Coordination.[6] At a minimum, the GIO should be "assigned the role of State Geospatial Data Coordinator." Amendments to the membership and duties of DGDC should also be considered.

Potential ROI from Enhanced GIS Coordination and Governance

While the State of Delaware has appreciated impressive ROI from agency use of GIS, Delaware's current approach to GIS governance has also contributed to:

- Uncoordinated data and software purchases resulting in excess expenditures and the potential for service and program disruptions.
- Inefficient, relationship-driven sharing of agency data that limits the ability to implement timely and accurate cross-agency analyses of programs and policies.
- Significant disparities across agencies in the use of geospatial applications for enhancing program effectiveness and efficiency in service delivery.
- Inconsistent and inadequate attention paid to monitoring the pace and direction of geospatial innovation, assessing opportunities to implement these innovations, evaluating implementation outcomes, diffusing lessons learned, and replicating projects across the state, as appropriate.

Based on this study, the IPA team feels that a more centralized and formally structured approach to geospatial governance is necessary to best leverage its considerable geospatial investments for efficient and effective program and service delivery.

What ROI Could Result from the Establishment of a Delaware GIO?

- Reduced expenditures on single-purpose or agency-specific geospatial applications or data products.
- Reductions in staff time spent on ad hoc, "pass the hat" approaches to fund mission-critical datasets across state agencies.
- Enhanced ability to efficiently and nimbly analyze, respond to, and communicate about public health, safety, and welfare concerns using geospatial information across numerous agencies, program areas, and geographic scales.
- Enhanced ability to systematically assess the ROI of existing and potential geospatial applications in Delaware and encourage transparency in budget and investment decision-making.

[6] "The Delaware Code Online – Title 29, Chapter 91, Subchapter IV. Geospatial Data Coordination," Accessed July 20, 2021, https://delcode.delaware.gov/title29/c091/sc04/index.shtml.

Introduction

At the request of the Delaware Department of Transportation (DelDOT), the University of Delaware's Institute for Public Administration (IPA) assessed and recommended practices relative to statewide geospatial coordination efforts and the management and oversight of geospatial mapping and data integration for all state agencies. This study responds to the need expressed through Delaware's Government Efficiency and Accountability Review (GEAR) Board to address the lack of "consistent Geographic Information System (GIS) governance within the state" by conducting "an independent survey looking at current [geospatial] practices and ways to improve management and coordination of all geospatial data and mapping efforts."[7]

While previous studies and plans have addressed geospatial coordination and governance in Delaware, this is the first completed within the context of GEAR, which aims to increase "the efficiency and effectiveness of state government...[and drive] the broad adoption of standard strategic planning processes, the use of metrics to guide resource allocation decisions, and the implementation of a culture of continuous process improvement."[8] In seeking to assess Delaware's current approach to geospatial coordination and governance and recommend potential practices for an enhanced strategy, the IPA team considered how Delaware and other states answer core GIS governance questions:

- How are sufficient funds for geospatial data and analytical capabilities secured and allocated?
- How are state agencies and personnel made aware of available geospatial data, analysis approaches, and potential efficiencies from the application of geospatial analyses?
- How are geospatial funding, coordination, and awareness activities integrated with a state's strategic planning and performance management processes?
- How is geospatial coordination and governance organized within a state?

To assess the variety of responses to these fundamental questions of GIS governance and the appropriateness of these responses to Delaware's context, the IPA team completed the following major tasks:

- **Conducted Background Research on Statewide GIS Coordination and Governance Models** – IPA's team reviewed existing assessments and plans focused on GIS coordination and governance in Delaware, including the 2010 "Business Plan for the Development of a GIS Office for Delaware State Government" and the 2012 revision of

[7] "Annual Report," State of Delaware Government Efficiency and Accountability Review Board, December 1, 2018, page III, https://gear.delaware.gov/wp-content/uploads/sites/103/2018/12/2018-GEAR-Annual-Report.pdf
[8] "About GEAR," State of Delaware Government Efficiency and Accountability Review Board, https://gear.delaware.gov/about-gear/.

this plan titled "Revised Business Plan for the Geospatial Coordination for Delaware State Government." Further, IPA drew from other states' websites and surveys conducted by the National States Geographic Information Council (NSGIC) to characterize the variety of approaches to coordinate and govern statewide geospatial resources.

- **Administered a Survey of GIS Managers and Practitioners in Delaware** – During November 2019, IPA administered a survey of GIS practitioners and managers in Delaware. Fifty-six of 90 stakeholders responded to the survey, offering their perspectives on the benefits of and barriers to GIS usage and how geospatial activities are supported statewide.
- **Facilitated Numerous Opportunities for GIS Stakeholder Engagement to Contextualize Current and Potential Approaches to Coordination and Governance** – IPA organized and facilitated: (1) a September 11, 2019, project kickoff meeting with GIS stakeholders to discuss the project work plan and solicit feedback on GIS coordination challenges and opportunities for Delaware; (2) eight GIS stakeholder listening sessions that engaged 55 participants in semi-structured discussions around the existing utility of geospatial applications, coordination with other agencies, future goals for the use of geospatial applications, and perceived coordination and governance needs to accomplish these goals; and (3) five interviews with a total of six GIS stakeholders involved in the state's COVID-19 response efforts to elicit feedback on geospatial coordination during this public health crisis.

The body of this report does not focus on a summary of these undertakings, per se. Instead, the results of these research and engagement activities are used as reference material to address the questions at the heart of this study:

- How are state agencies using geospatial data and applications, and what are the impacts of these activities?
- How is the State of Delaware funding geospatial data acquisition and application?
- How are geospatial activities integrated with strategic agency and statewide goals?
- How are Delaware's geospatial activities coordinated and governed?
- How can Delaware's approach to geospatial coordination and governance be enhanced to increase the efficiency and effectiveness of state government?

The remaining three sections of this report recommend a path forward for GIS governance in Delaware; summarize Delaware's current approach to GIS use, coordination, and governance; and outline opportunities for alternative approaches revealed through stakeholder engagement and background research. Appendices document the survey and stakeholder engagement components of this study.

Recommended Path Forward for GIS Coordination and Governance in Delaware

The IPA team's overall recommendation for enhanced GIS coordination and governance in Delaware is to establish a Geographic Information Officer (GIO) position within the Delaware Department of Technology & Information (DTI). This section describes the core activities suggested as part of this overall recommendation and summarizes the rationale for making this recommendation.

Description of Core Recommended Activities

A GIO within DTI should:

1. Budget for, develop, and deliver geospatial initiatives.
2. Coordinate, identify, and support existing and future geospatial data and service needs.
3. Develop and implement a framework for evaluating GIS investments.

Budget for, Develop, and Deliver Geospatial Initiatives

A core GIO function should be to coordinate the budgeting for, development or acquisition of, and delivery of critical geospatial data and analysis initiatives across Delaware. This study reinforced that, particularly around budgeting for necessary data, Delaware practices an ad hoc, "pass the hat" approach. While the practice of rigorous Return on Investment (ROI) analyses of GIS applications is not commonplace in Delaware, documented impacts indicate that GIS datasets and applications are necessary and should be budgeted for on a regular basis. Components to consider in institutionalizing efforts to budget for, develop, and deliver geospatial initiatives include:

- **Developing Interagency Procedures to Coordinate Geospatial Data and Service Purchases** – There is a widespread and ongoing need to regularly purchase updated orthoimagery (aerial photography), land use/land cover (LULC), and light detection and ranging (LIDAR) datasets to support critical planning and operations activities. The number of core datasets and applications is likely to grow as the availability of real- or near-time data and tools increases and the relevance to state services becomes clear. As such, the State of Delaware should deliberately plan for a shared approach to funding the acquisition and delivery of data and services. In the near-term, the GIO should work to develop an MOU with the significant users and typical funders of core GIS datasets and applications. This MOU should outline an agreed-upon update schedule and cost-sharing model and identify funding sources. As part of ongoing IT centralization efforts that call for a "consistent standardized service delivery model" for IT services, DTI and

the GIO should develop detailed cost-sharing or chargeback models for geospatial data and services, including FirstMap and relevant enterprise licenses.[9] This recommendation assumes a continuation of DTI's already intensive role in managing FirstMap—the State of Delaware Enterprise GIS system—and managing the state's enterprise license agreement for GIS software and services.

- **Incorporating Geospatial Investment Decision-Making into Technology Investment Planning** – Delaware Code already calls for coordination in the use and sharing of geospatial data through the Delaware Geographic Data Committee (DGDC). DGDC serves as an "open users' group of those working with geospatial data in Delaware" that is "to make regular recommendations to the Executive Council of the Delaware Geographic Data Committee on actions and policies relating to the use and sharing of geospatial data in Delaware."[10] Delaware Code also establishes the DGDC Executive Council, which stipulates Cabinet Secretary membership, to "oversee coordination of the use and sharing of geospatial data and information in Delaware."[11] However, while the DGDC meets and a staff member from the Office of State Planning Coordination (OSPC) serves as the DGDC Chair and State Geospatial Data Coordinator, participants in this study indicated that Executive Council activities have been sporadic at best. DGDC has not been able to marshal the high-level coordination of GIS data and services among state agencies.

  Rather than requiring a wholly separate area of coordination around geospatial activities for state agency leads, a suggested path forward is to provide the proposed GIO with a seat on the Technology Investment Council (TIC).[12] The GIO should assume the role of identifying ongoing and emerging statewide needs for geospatial data and services; translating these needs into recommendations for statewide funding; and reporting on the status and performance of significant state geospatial initiatives. Further, the GIO and DTI staff should incorporate geospatial resource needs and investment priorities into the statewide technology plan within TIC's purview.

  The State of Delaware should not abandon the role of DGDC in this effort to incorporate geospatial investment decision-making into technology investment planning. Instead,

[9] "Government Efficiency and Accountability Review Board: IT Efficiency," https://gear.delaware.gov/it-efficiency/.
[10] "The Delaware Code Online – Title 29, Chapter 91, Subchapter IV. Geospatial Data Coordination," Accessed July 20, 2021, https://delcode.delaware.gov/title29/c091/sc04/index.shtml.
[11] Ibid.
[12] "Technology Investment Council," Delaware Department of Technology & Information, Accessed July 20, 2021, https://dti.delaware.gov/about-dti/offices/office-chief-technology-officer/project-management/technology-investment-council-tic/.

Delaware Code should be revised to appoint the GIO as the "State Geospatial Data Coordinator and…nonvoting Chair of the Executive Council of the Delaware Geographic Data Committee."[13] Further, the GIO should reconstitute the Executive Council with a precise charge to advise on the statewide data and funding needs and geospatial initiative performance topics outlined in the preceding paragraph.

As routine Cabinet Secretary participation in Executive Council meetings has been elusive, initial efforts should focus on identifying proxies that will ensure broad, ongoing agency participation that is knowledgeable about GIS data and service needs. Armed with data from the reconstituted Executive Council, the GIO may further engage Cabinet Secretaries and other relevant agency leaders with clear decision points to consider in finalizing budget priorities. These engagements should occur through both the TIC and other outreach efforts that may be necessary and appropriate.

Coordinate, Surface, and Support Geospatial Data and Service Needs

As a complement to a more formalized approach to planning for and delivering on the state's geospatial investments, the GIO function should incorporate several efforts to coordinate, surface, and support geospatial data and service needs. Recommended efforts include:

- **Convening an Interagency Technical Advisory Group** – While the State of Delaware has centralized a significant portion of its GIS expertise within DTI, considerable GIS capacity still exists within other agencies. A more centralized approach to coordinating and governing GIS should strengthen agency capacity to realize geospatial intelligence. To engage with existing, capable GIS users in state agencies, the GIO and DTI staff should periodically convene an Interagency Technical Advisory Group. This effort will allow the GIO to check in on customers' technical needs, discuss emerging geospatial trends and potential geospatial applications, and workshop approaches to developing and delivering geospatial solutions. As appropriate, the DGDC Executive Council may be enlisted to serve in this capacity.

  The GIO should also use the Interagency Technical Advisory Group to monitor and seek to address human resource needs relative to GIS expertise across agencies. Stakeholders engaged for this study pointed to the loss of GIS expertise within agencies that accompanied IT centralization. While this centralization has made DTI the logical home for a GIO, it may have simultaneously stressed DTI's ability to deliver geospatial services to agencies in a sustainable manner. While there are undoubtedly technical components to GIS expertise that often result in a natural overlap between IT positions and those

[13] "The Delaware Code Online – Title 29, Chapter 91, Subchapter IV. Geospatial Data Coordination," Accessed July 20, 2021, https://delcode.delaware.gov/title29/c091/sc04/index.shtml.

with GIS capabilities, a blanket assignment of all or almost all staff with GIS roles to DTI seems counterproductive. Effective design and delivery of GIS solutions requires considerable attention to agencies' policy goals and the relevance of data and analyses to these goals. Short of a much larger DTI staff with GIS expertise that could provide considerable one-on-one time to agencies, the most cost-effective way to ensure this policy relevance seems to require at least a small cadre of GIS-capable staff working directly for these agencies. For agencies mature in the use of GIS (e.g., DNREC and DelDOT), this cadre is likely to be larger than in agencies only beginning to explore the routine use of GIS. Over time, the GIO should work with the Interagency Technical Advisory Group and the Department of Human Resources to identify the need for GIS staff within agencies, including the appropriate job titles, descriptions, and salaries necessary to recruit and retain these staff.

- **Educating and Engaging Existing and Potential GIS Stakeholders** – Throughout this study, stakeholders identified DGDC as a valuable venue for networking and user education. The GIO should expand upon the user network and education components of DGDC. In addition to providing opportunities for educating on the technical aspects of GIS (e.g., through ESRI training modules), effort should be made to raise awareness of the potential applicability of geospatial solutions to numerous public policy and management topics. The goal should be to pique broad interest in geospatial applications' potential benefits while also surfacing potential roles for DTI assistance in further ideation of and eventual development of relevant solutions.

- **Organizing a DTI GIO Team with Clear Agency Assignments** – The current process of receiving GIS assistance from DTI seems overly driven by longstanding professional networks. While professional relationships among the GIS community have helped tremendously in advancing geospatial solutions for Delaware, they can also reinforce significant disparities. Due to a strong connection with the GIS community, agencies with a history of GIS applications are more seamlessly able to access DTI assistance than agencies that are new to GIS. Further, though it may run counter to the helpful nature of Delaware's GIS community, instituting new protocols for receiving and processing requests for GIS assistance should safeguard DTI staff time while ensuring opportunities to broaden the reach of meaningful geospatial applications to more agencies.

  One recommended protocol for routinizing agency requests for GIS assistance is to organize a DTI GIO Team with staff assigned to discrete state agencies or divisions. These assignments should cover both agencies with existing GIS use and those that have not yet developed applications. Ideally, each staff member would be assigned a healthy mix of mature and immature GIS agencies so that time is not unduly monopolized by

one agency relationship. This will allow staff to devote time to understanding agency missions and workflows and surface opportunities for geospatial applications. While DTI staff would still reactively respond to requests for assistance, an additional role would be to proactively and periodically reach out to all designated agencies to build rapport, assess existing GIS uses, and, as appropriate, ideate potential applications. While individual staff members would be responsible for managing select agency relationships, this relationship management activity should be conducted in the context of the Interagency Technical Advisory Group activities so that needs are placed in a broader context and shared service opportunities are maximized.

For examples of the division of this type of management structure, the proposed GIO could look to the OSPC circuit-rider planner model for inspiration on how ongoing agency relationships may be carried out. Further, and more specific to centralized approaches to GIS governance, Maryland's Geographic Information Office assigns staff both agency and regional responsibilities.[14]

- **Creating and Modeling Data Sharing Agreements** – The GIO and DTI staff should create and model data sharing agreements so that the State of Delaware can effectively leverage its geospatial data assets. Data collected and stored by state agencies are often subject to various legal and practical limitations on their usage. Even if these limitations are not legal prohibitions, perceptions around usage restrictions can derail well-meaning collaboration and result in siloed data universes that do not speak with one another. This derailment may result in hard feelings among state employees—who perceive the proverbial rug being pulled out from under them—or may lead to the contracting out of services that might otherwise have been provided in-house for less cost.

  A proactive approach to developing data sharing agreements is necessary to enable meaningful efforts to "connect the dots" in understanding how disparate datasets overlap and impact places and households in Delaware.[15] Further, adopting a reactive approach may increase the likelihood of "collaboration derailment" as the need to work out agreements on the fly stalls progress. DTI and the GIO should lead efforts to develop geospatial data sharing agreements and then model them to encourage other agencies to follow suit.

[14] "GIO Organizational Chart," Accessed July 20, 2021, https://imap.maryland.gov/Pages/gio-organizational-chart.aspx.
[15] For an example see "AISP Network: Delaware Integrated Data System (DIDS)," https://www.aisp.upenn.edu/network-site/delaware/.

Develop and Implement a Framework for Evaluating GIS Investments

There are limited formal examples of Return on Investment (ROI) analyses used to justify proposed geospatial investments or demonstrate after-the-fact impacts of geospatial applications in Delaware. In keeping with both the GEAR initiative's focus on the use of metrics in resource allocations and the more explicit and central role proposed for DTI in coordinating and governing GIS activities, DTI and the GIO should develop and institutionalize a framework for determining and evaluating the results of Delaware's future geospatial investments. Recommended efforts include:

- **Adopting and Modeling an ROI Template for Delaware's Geospatial Investments** – As a central purveyor of support for the state's geospatial initiatives, DTI should adopt an ROI template for evaluating GIS projects, apply and encourage others to use this template, and host and share the results of these evaluations. A four-part series in ESRI's *ArcUser* magazine provides comprehensive guidance for developing and implementing an ROI template.[16,17,18,19,20] Adopting an ROI template should provide DTI with a framework to prospectively assess the likely impacts of GIS investments and retrospectively evaluate the actual impacts realized through implementation. As DTI documents prospective and retrospective ROIs over time, these should help to finetune analytical approaches and provide support for proposed investment priorities considered through the TIC.

- **Developing a Library of Business Cases for Geospatial Applications in Delaware** – As an extension of the proposed effort to implement ROI analyses for geospatial applications, the GIO and DTI staff should create a library of GIS business cases implemented in Delaware. These applications should be catalogued and made readily available to state agency managers. The business case profiles should report the problem, the designed and implemented solutions, and the documented results. The library should provide material for the GIO's outreach activities to raise awareness of geospatial application opportunities while also supporting ongoing evaluation needs.

[16] "The ROI Mind-Set for GIS Managers," https://www.esri.com/about/newsroom/wp-content/uploads/2018/09/the-roi-mind-set-for-gis-managers.pdf.
[17] "Downsizing the ROI Report," https://www.esri.com/about/newsroom/wp-content/uploads/2018/09/downsizing-the-roi-report.pdf.
[18] "The Business Impact of GIS," https://www.esri.com/about/newsroom/wp-content/uploads/2018/09/the-business-impact-of-gis.pdf.
[19] "Best Practices for Generating GIS ROI Momentum," https://www.esri.com/about/newsroom/wp-content/uploads/2018/09/best-practices-for-generating-gis-roi-momentum.pdf.
[20] "ROI and Benefits Report Template," http://www.esri.com/~/media/Files/Pdfs/news/arcuser/0616/gis-roi-and-benefit-template.

Summary of Proposed GIO Responsibilities

Without the leadership of a seasoned professional manager, a simple centralization of GIS coordination within DTI is unlikely to yield the efficiencies outlined in this study. Frequent and effective coordination of executive, agency, and intergovernmental stakeholders will be a prerequisite if a GIO is to craft innovative, effective, and durable plans and procedures for GIS governance in Delaware. As such, the State of Delaware should establish the GIO role as a director-level position reporting to DTI's Chief Technology Officer (CTO), with responsibilities including:

a. Leading the deployment and continued development of Delaware's enterprise GIS, including directing the FirstMap Team (approximately 25% of duties).
b. Facilitating the coordination of GIS activities and resource needs among state agencies, counties, municipalities, educational institutions, and the federal government (20%).
c. Leading the development and management of procedures and approaches to identify innovative geospatial practices, design and implement geospatial solutions relevant to the business needs of Delaware's agencies, and monitor, evaluate, and, as appropriate, replicate successful geospatial solutions statewide (20%).
d. Coordinating with the state's executive leadership and agency stakeholders to develop and maintain strategic plans guiding investments and policies for geospatial data, applications, and human resource needs (10%).
e. Partnering with state agencies to create and implement a statewide GIS budget for the acquisition of core geospatial datasets and applications (10%).
f. Identifying and implementing appropriate geospatial data sharing practices (10%).
g. Assessing and coordinating the delivery of GIS training for agency personnel to maintain and enhancing the state's capacity to leverage geospatial applications for the efficient and effective delivery of programs and services (5%).

Context for These Recommendations

Strategic planning efforts in 2010 prioritized establishing a GIO position for Delaware in order to realize benefits and efficiencies through "protecting and leveraging Delaware's geospatial investments… [, the] development of shared resources…[, and] controlling the cost of geospatial technology growth."[21] Since that time, the efficiencies that could result from a GIO position have increased along with the volume, complexity, and utility of geospatial data and applications.

[21] "Business Plan for the Development of a GIS Office for Delaware State Government," State of Delaware, 2010, https://stateplanning.delaware.gov/dgdc/strategic-plan/2010-delaware-gis-business-plan-summary.pdf.

Stakeholders engaged for this study pointed to the:

- Considerable investments made in geospatial data and analysis capabilities.
- Impressive efficiency and decision-making returns from geospatial investments.
- Need for further investments to extend and strengthen these benefits beyond agencies relatively mature in their adoption of GIS.
- Need to institutionalize a shared, centralized approach to funding core geospatial datasets, enabling data sharing, and monitoring and implementing geospatial solutions in emerging areas such as big data and artificial intelligence.

The State of Delaware has achieved impressive outcomes through "ad hoc" GIS coordination, but the IPA team agrees with the sentiment that "collegial and cooperative efforts have gone as far as they can go."[22]

Rationale for Locating GIO Responsibilities within DTI

While the call for a GIO is not new, the recommendation to locate these responsibilities within DTI does depart from previous business plans. The IPA team concurs with the assertion in previous plans that fulfilling the promise of a centralized approach to GIS governance requires more than just "a focus that is solely on *technical administration* of GIS technology and software contracts."[23] However, at least three reasons speak to the suitability of a GIO's placement within DTI at this point:

1. The centralization of IT services within DTI has been a state focus for several years, with the GEAR initiative reinforcing the commitment to centralization to drive efficiency gains. While geospatial data and services are not entirely synonymous with IT, they share many components, including the need for acquiring and distributing software, challenges associated with storing and sharing data, and the potential for a proliferation of custom applications to result in unnecessary duplication of effort and an inefficient use of resources. To put it simply, there are enough similarities between the challenges of IT governance and the challenges of GIS governance that choosing to centralize GIS efforts outside of DTI is akin to unnecessarily choosing to swim upstream.
2. As part of IT centralization, DTI has absorbed GIS expertise from several agencies. This concentration of expertise seems to leave DTI well positioned to assume a significant role in coordinating a centralized approach to GIS governance.

[22] "Revised Business Plan for the Geospatial Coordination for Delaware State Government," State of Delaware Office of State Planning Coordination, 2012, https://stateplanning.delaware.gov/dgdc/strategic-plan/2012-geospatial-business-plan.pdf.
[23] "Business Plan for the Development of a GIS Office for Delaware State Government," State of Delaware, 2010, https://stateplanning.delaware.gov/dgdc/strategic-plan/2010-delaware-gis-business-plan-summary.pdf.

3. Outside of the GIS space, DTI's broader experience in the management of data and coordination of data sharing agreements—such as those associated with the Open Data Council and the Delaware Integrated Data System—suggests value in assigning DTI a more significant role in the centralized governance of GIS.

In sum, from a technical standpoint DTI's broad involvement in the acquisition, development, and delivery of data, hardware, and software services for state agencies creates considerable opportunities for leveraging this expertise for the GIS arena. Further, IT centralization has concentrated GIS expertise in DTI. This concentration has strengthened DTI's technical capacities while also lending it considerable credibility as the home of staff who have been directly involved in conceiving and developing impactful geospatial applications within and across state agencies.

Current GIS Use, Coordination, and Governance in Delaware

This section describes the current use, coordination, and governance of geospatial data and applications within the state of Delaware. To populate this section, the IPA team drew from existing GIS business plans, the survey of GIS stakeholders, and listening session results. In addition to the 36 survey respondents who identified as state agency representatives, Table 2 lists the extent of agency participation in the listening sessions. The material in this section provides an illustrative treatment of GIS use and coordination in Delaware, not an exhaustive review of all individual and agency efforts.

Table 2. Agency Participation in Stakeholder Engagement Activities

Agency	Number of Participants by Engagement Activity		
	Kickoff Meeting	Listening Sessions	COVID Response Discussion
Dept. of Agriculture (DDA)	-	1	1
State Historic Preservation Office	-	2	-
Dept. of Health and Social Services	2	2	-
Office of State Planning Coordination (OSPC)	1	2	1
Homeland Security	1	2	-
DEMA	1	1	-
Division of Libraries	-	1	-
DTI	1	6	4
DNREC	1	9	-
DelDOT	4	15	-

Geospatial Applications

The use of GIS by Delaware state agencies is widespread but not ubiquitous. Nearly all the managers and practitioners who responded to the GIS survey identified GIS applications as important for the mission of their organizations. Further, roughly 80 percent of respondents indicated that either their organization or they used GIS daily. The following tasks were commonly identified as the focus of agency GIS activities:

- Producing maps for internal or external documents.
- Developing organization-specific data and basemaps.
- Analyzing data for policy development, planning, or evaluation purposes.

- Generating public-facing data (e.g., FirstMap layers).
- Managing assets or infrastructure.
- Conducting field surveys or inspections.
- Developing applications to share or collect information with/from the public.

Within and across agencies, user types can be roughly categorized as "end users" and "power users." End-user agencies and individuals typically consume data produced by others and served through platforms such as the state's enterprise GIS, FirstMap. In some cases, agencies less mature in the use of GIS may conduct basic analyses in-house, such as when DPH's epidemiologists translate spreadsheet data on disease incidence into visualizations like simple, point-based maps. In other instances, lack of in-house expertise may require contracting for access to real-time data or sophisticated analyses or the development of more comprehensive dashboards.

Power users tend to have more significant capabilities built up through either the maturity of their organization or staff in GIS use or the investment in significant geospatial tools or platforms that enable online data access and analysis. The development, maintenance, and use of the DelDOT Gateway to share transportation data with the public, initiate project review, and analyze project and program impacts constitute one example of power-user activity. DNREC GIS capabilities date back to at least the 1990s, with applications related to well permitting in place since 1996. The range of DNREC applications includes analyzing the ecological value of potential open space acquisitions and generating and tracking data relative to the state's environmental features and programs. Similarly, DDA uses GIS across several programs that manage data relative to grants and land features and enable inspections related to the agricultural lands preservation program. OSPC uses GIS to administer the Preliminary Land Use Service (PLUS) process that involves sharing multiple layers of geographic information among state agencies, municipalities, and development interests.

FirstMap enables both end- and power-user activities by providing one location for regularly updated state data layers. Some power users indicated that FirstMap democratized mapmaking—making data layers more available to less sophisticated users and therefore freeing up more sophisticated users to focus on analysis activities. In some instances, power users said they did not rely on FirstMap as the first or most accurate source of information because time lags between agency updates and uploading to FirstMap made reaching out directly to agency contacts more desirable. FirstMap also does not capture certain purpose-built applications and datasets, such as the Delaware Criminal Justice Information System (DELJIS), public health information, or DelDOT TMC's real-time travel and incident information, that may have practical or legal restrictions on use and sharing.

Funding Data and Analytical Capabilities

Data Acquisition

Stakeholders engaged in this study consistently referred to the method of funding GIS data as "pass the hat." The minutes of the February 20, 2020, DGDC meeting identified orthoimagery, land use/land cover (LULC), and LIDAR as the primary GIS datasets, with "passing the hat" identified as part of the funding solution for the most recent update of orthoimagery and LULC.[24] In short, the approach to funding the GIS datasets considered critical to state agency operations is not routinized. DGDC offers a venue for communicating on the necessary update frequency and collaborating on funding solutions. However, funding for GIS datasets seems to be more directly linked to organizational relationships and access to grants than it is to either agency need or any official process. Participants in this study did note that this approach creates unpredictability around the continued funding for what have become mission critical datasets. In some instances, agencies have incurred duplicative expenses for datasets. Establishing a fair and clear process for identifying and funding GIS data needs—especially for core datasets—seems to be a key initial step for improved GIS coordination in Delaware.

Software and Applications

DTI manages the state's enterprise GIS software license and facilitates agency purchase of licenses. Some stakeholders engaged in this study indicated that, to avoid operational disruptions, there was a need for more predictability in the negotiation and renewal of software licensing. FirstMap infrastructure expenses have been largely borne by DTI, with minimal chargebacks to agencies. Unfunded aspects of FirstMap were alluded to by participants, with some indication that agencies lack the necessary resources to update and share GIS datasets in a timely manner.

Staffing

With the consolidation of IT staff in DTI, participants in this study indicated that agency-based GIS resources are often "one deep" and at risk of significant disruption if a particular staff person should leave their position. While many planner positions in the state may assume at least basic knowledge of GIS, stakeholders indicated that acquiring more substantial and technical GIS expertise can be a challenge. As such, GIS stakeholders indicated a tendency to rely upon outside consultants rather than test the waters of securing a new hire or submitting a business case to DTI.

[24] "DGDC Meeting Minutes," Delaware Geographic Data Committee, February 20, 2020, https://stateplanning.delaware.gov/dgdc/meeting-minutes/2020/0220-meeting-minutes.pdf.

Developing and Maintaining Staff Awareness of GIS

DTI formally administers GIS training in the state, including making training credits available as part of the state's enterprise license. Most participants in this study expressed dissatisfaction with the formally administered training, conveying a general feeling that these efforts have not been appropriately prioritized or publicized. As such, training tends to be informal, delivered via hands-on efforts within agencies or reliant upon YouTube-hosted tutorials. The user group and conference functions coordinated through DGDC also provide for substantial education and training opportunities, though participation in these activities often depends upon existing professional relationships. Finally, participants in this study pointed to one particular area of training that needs attention: the need to better document and share standardized GIS business processes across agencies.

Strategic Planning and Performance Management

Strategic Planning Tasks

While previous business plans for GIS in Delaware have been developed, these plans have little official standing. DGDC is established in Delaware Code and high-level coordination of GIS goals and resources was envisioned through the Executive Council. However, this coordination has proved elusive, with only sporadic executive participation in DGDC over time. As such, the establishment of overall goals for the use of GIS in Delaware has been limited. Further, while a dedicated subset of power users explores the frontier of geospatial applications, there is no established process for monitoring advances in GIS, ideating and designing potential business cases, or prioritizing hardware, software, and personnel investments necessary to realize forecasted efficiencies. Participants in this study identified substantial future advancements that the GIS community will need to consider, leverage, and adapt to, including artificial intelligence, real-time data integration and monitoring for incident management, and 3D data applications.

Return on Investment (ROI)

Though Delaware boasts numerous mature applications of GIS, few formal ROI analyses have been conducted. A significant majority of the GIS managers (85%) and practitioners (79%) responding to this study's survey indicated that their "organization realized a positive ROI from…use of GIS." Common areas of ROI reported through the survey include:

- Higher-quality research or analysis.
- Increased capacity for evidence-based decision-making.
- Improved customer service.
- Enhanced transparency.
- Reduced costs and faster completion of tasks due to more efficient workflows.

Many of the formally or informally documented GIS ROIs in state agencies focus on the automation of previously time-consuming tasks, the ability to efficiently share information, and the increased capacity to conduct sophisticated analyses that improve decision-making. Examples include:

- Allowing for efficient storage, retrieval, and updating of data on DelDOT's stormwater facilities.
- Significant reductions in time associated with field work, including use of GIS to monitor and inspect land and environmental features in connection with natural resources and agriculture programs.
- More effective analysis of potential contaminants in connection with well permitting reviews.
- Access to 24/7 digital historic property information, which saves staff time researching and pulling paper files and maps.
- Ability to quickly generate analytical maps for specific uses and topics.

Coordination and Organization

Though coordination through DGDC is provided for in Delaware Code, lack of consistent executive involvement in this effort has stymied its success. As such, Delaware's approach to GIS coordination and governance is best described as voluntary and decentralized. Voluntary efforts have borne considerable fruit in developing GIS capabilities and positive interagency relationships that result in cost-sharing arrangements. However, these efforts will likely be increasingly stressed as personnel turnover occurs.

DTI currently governs substantial portions of GIS activities in Delaware, including developing and maintaining FirstMap and managing the state's enterprise GIS license. As part of its broader IT support role, DTI also provides for the substantial IT architecture that allows for GIS applications.

Example coordination challenges identified by participants in this study include:

- Open data efforts coordinated in DTI tend not to be linked with the spatial datasets and applications coordinated by the FirstMap team.
- Lack of data sharing arrangements may limit coordination and result in unnecessary redundance of data and applications, particularly in instances where legal and privacy considerations apply.
- DTI's existing customer engagement approach for developing geospatial solutions was identified as lacking, with the business case process seen as disconnected from FirstMap solutions and knowledge of the specialized technology requirements of GIS users.

- Issues that span agency boundaries, including disasters, climate change, and public health emergencies, were seen as particularly likely to strain Delaware's informal approach to GIS coordination since representatives with functional authority to share critical information are not clearly established. During stakeholder engagement in late 2019, a comment was made that Delaware hasn't "had the crisis that has highlighted the gaps." Stakeholders engaged during the COVID response discussions portion of outreach confirmed that these informal coordination measures were put under considerable stress during the COVID-19 pandemic.

Options and Opportunities for Enhanced GIS Governance

Guided by NSGIC surveys of state approaches to GIS governance, this section presents information on how other governments have addressed GIS coordination and governance. This overview provides context for considering the recommendations presented in this study, along with references that may be consulted for further details on state approaches. The concluding portion of this section outlines alternative approaches that were considered in formulating this study's recommended path forward for Delaware.

Contemporary State Approaches to Geospatial Governance

Funding Data and Analytical Capabilities

There is no obvious formula for funding state GIS programs. Some states provide little to no fundraising assistance to their respective GIS agencies, and instead push these organizations to raise funds through federal grants or partnerships and ad-hoc, multi-agency partnership funding. Other states have more formal systems in place to fund their GIS programs, such as an annual appropriation process that involves a formal budget request. Standardized structures may allow states to provide more reliable and consistent levels of funding and enable greater stability in the provision of GIS services.

Table 3. Sources of Funding for Selected State GIS Programs

State	Sources of Funding
New York	Federal partnership, 911 tax/fee, state fuel or road tax/fee
New Jersey	Environmental protection tax/fee, federal grant, federal partnership, state general fund appropriation, assessment on state agencies, ad-hoc multi-agency partnership funding
Pennsylvania	Environmental protection tax/fee, federal grant, 911 tax/fee, property tax/fee, state general fund appropriation, assessment on state agencies (or state IT internal service fund), state fuel or road tax/fee
Maryland	911 tax/fee, state general fund appropriation, other: Chesapeake and Atlantic Coastal Bays Trust Fund
Arizona	Federal partnership, 911 tax/fee, state fuel or road tax/fee

Source: National States Geographic Information Council, "States," https://www.nsgic.org/states, accessed September 2019.

Developing and Maintaining Staff Awareness of GIS

To increase technical capabilities and provide consistent service across government agencies, many states identify education as a primary goal of their strategic and business plans for GIS. For example, Connecticut has sought to establish a GIS Coordination Unit that would provide educational support to staff in government agencies who regularly work with GIS.[25] Similarly, Wyoming's Technical Services Program aims to provide training in technology and data use.[26] Washington D.C.'s Office of the Chief Technology Officer provides direct educational opportunities and support to agencies working on projects with GIS.[27]

Many states have technical working groups to support end users. In Idaho, technical working groups include Cadastral Reference, Geodetic Control, Government Boundaries, and Parcels.[28] Pennsylvania's GeoBoard is responsible for interoperability standards for data sharing to allow all users to use necessary data, enhance government business, and provide cost-effective services.[29] Rhode Island uses their data-sharing standards to enhance the experience for power users, while providing end users with user-friendly and efficient access to geospatial data.[30]

Strategic Planning and Performance Management

Evaluation components such as cost effectiveness and ROI should be considered for any implementation of GIS coordination and governance. The results of these evaluation efforts can be used to assess how GIS is serving government agencies and whether resources should be redistributed or prioritized to better meet needs. In general, approaches to strategic and performance management for GIS can be classified relative to the following extremes:

- There is no framework in place to guide, measure, and evaluate GIS programming in the state, with reporting occurring intermittently, if at all; or
- There is a clear framework in place to guide, measure, and evaluate GIS programming in the state with clear instructions on the frequency and purpose of reporting.

Practically speaking, most state approaches fall somewhere between these extremes. States that trend toward a clear evaluation framework usually have detailed outcomes and outputs

[25] "Strategy for Connecticut Enterprise GIS," Applied Geographics, Inc., October 4, 2007, https://www.ct.gov/gis/lib/gis/StateOfCT_Strategic_Plan_final_10_04_2007.pdf.
[26] "State of Wyoming Geographic Information Systems (GIS) Business Plan," Applied Geographics, Inc., February 16, 2007, https://www.fgdc.gov/grants/2006CAP/relateddocs/095-06-3-WY-BusinessPlan.pdf.
[27] "Geospatial Strategic Plan for the District of Columbia 2016-2021," AppGeo, March 31, 2016, https://octo.dc.gov/sites/default/files/dc/sites/octo/publication/attachments/DC_GIS_Strategic_Plan%202016_FINAL.pdf.
[28] "Idaho State GIS Strategic Plan," Idaho Geospatial Council— Executive Committee, December 6, 2016, https://ita.idaho.gov/wp-content/uploads/sites/3/2018/10/GIS-Strategic-Plan-APPROVED-20161206.pdf.
[29] "GIS Strategic Plan Draft 2017," Pennsylvania State Geospatial Coordinating Board, May 8, 2017, https://www.oa.pa.gov/Programs/Information%20Technology/Documents/geoboard-050817-strategic-plan-outline.pdf.
[30] "Business Plan for Rhode Island Enterprise GIS," Applied Geographics, Inc., August 30, 2007, https://www.fgdc.gov/initiatives/50states/RIGISBusinessPlan.pdf.

attached to their GIS-related goals. This level of detail may act as a guidepost that helps coordinating bodies monitor progress. For example, Arizona uses a traffic light system (i.e., red, yellow, green) to report completion of strategic goals and related outputs.[31] Illinois uses a Gap Analysis to summarize strategic planning themes and quantify existing technology, IT skills, and organizational gaps.[32] Wyoming uses a programmatic scorecard to assess and quantify progress on proposed targets and goals.[33] Table 4 lists examples of relevant goals and outputs from Washington, D.C.'s GIS Strategic Plan.

Table 4. Selected Goals and Outputs from Washington, D.C.'s GIS Strategic Plan (2016–2021)

Goal	Output
Focus on geospatial data governance and delivery in alignment with district priorities.	Ensure that feature-level metadata is current, readily accessible, and easily discoverable.
Provide outstanding infrastructure and service delivery to the DC GIS stakeholder community.	Increase agency awareness of DC GIS services among both technical GIS users and executive-level leaders.
Be innovative and adaptive and maintain a multi-platform geospatial technology strategy.	Promote the availability of new tools and resources (e.g., street-level and oblique imagery) to the broader DC GIS community through the GIS Steering Committee and social media channels.
Sustain geospatial coordination through DC GIS Steering Committee and nurture new partnerships within the district.	Maintain dialogue with community-focused organizations and nonprofits and stay abreast of evolving needs for data and web services. Create opportunities to engage and build awareness with new organizations.
Support data-driven decision-making and performance measurement.	Leverage emerging geo-analytical and visualization tools to gain insight into events and patterns within the district and improve government responsiveness.

Source: "Geospatial Strategic Plan for the District of Columbia: 2016-2021," AppGeo for the DC Office of the Chief Technology Officer, March 31, 2016, https://octo.dc.gov/sites/default/files/dc/sites/octo/publication/attachments/DC_GIS_Strategic_Plan%202016_FINAL.pdf, accessed July 2019.

[31] "GIS Strategic Plan," Arizona Geographic Information Council, February 25, 2010, https://repository.asu.edu/items/42168.
[32] "Geographic Information Systems Strategic Plan," Coles County, Illinois, https://www.co.coles.il.us/GIS/strategicPlan.pdf.
[33] "State of Wyoming Geographic Information Systems (GIS) Business Plan," Applied Geographics, Inc., February 16, 2007, https://www.fgdc.gov/grants/2006CAP/relateddocs/095-06-3-WY-BusinessPlan.pdf.

Coordination and Organization

States differ in their use of centralized and decentralized approaches to geospatial coordination, outreach, and communication. Using the 2017/2019 NSGIC Geospatial Maturity Assessment as a guide, a centralized approach usually consists of a geographic information officer, or equivalent, who serves as the statewide GIS coordinator on a full- or part-time basis. The GIO office may have a professional staff and exert influence on matters of state and local policy, budgets, technology coordination, data administration, and intergovernmental coordination. Put simply, a centralized GIS model consists of a GIS coordinating unit responsible for geospatial technology investments, development of shared resources, and the management of costs associated with technological growth for state and local governments. Under a strictly decentralized approach, GIS is developed for a single department and used only for the applications and needs of that agency. While data sharing does exist, there are no data standards and no central clearinghouse for GIS resources.[34]

Decentralized Systems

States with more decentralized GIS governance systems tend to have multiple task forces, offices, or agencies carrying out the programmatic and administrative responsibilities required of a statewide GIS program. The State of Pennsylvania employs the Pennsylvania State Geospatial Coordinating Board (GeoBoard) to manage many of the high-level responsibilities typically carried out by a state GIS office or agency. GeoBoard members come from a variety of state agencies, relevant professional associations, and the legislature. Its responsibilities are broad and are best characterized as goal- and standard-setting. These responsibilities include:

- Establishing standards and priorities for interagency coordination and data sharing.
- Establishing strategic priorities.
- Developing task forces and/or committees to formulate recommended positions or actions.

More specific tasks are overseen and carried out by the task forces created by the GeoBoard, such as its Data Program Task Force, Governance Task Force, and the Service Delivery Task Force.

Centralized Systems

Centralized systems have permanent staff who carry out coordination and management activities. Though they have permanent staff, these offices are rarely standalone agencies. The office is typically housed within a state's main technology agency and overseen by, or coordinated through, a committee or council made up of personnel from related agencies.

[34] "Geographic Information Systems," Jan Coyne, William C. Bell, Mary Maureen Brown, Chad Rupert, and James Nolan, https://cviog.uga.edu/_resources/documents/publications/handbook-gis.pdf.

Examples of common stakeholders include other federal, state, and local government agencies; utility companies; the emergency management community; academia; and the law enforcement community. A state statute, executive order, or administrative rule defines the purpose, responsibilities, and authorities vested in the council or office by the state. Examples of coordination and governance activities carried out by such bodies include:

- Developing data standards and implementation procedures.
- Establishing requirements for identifying, reviewing, and acquiring new sources of data.
- Defining level of access for stakeholders.
- Maintaining Cloud- and Web-based mapping platforms.
- Developing task forces or committees to formulate recommended positions or actions.
- Establishing standards and priorities for interagency coordination and data sharing.

More centralized systems usually have a full-time GIO. A GIO is a specialized C-suite position with typical responsibilities that include:

- Establishing and improving communications regarding geospatial activities among state agencies.
- Coordinating with appropriate stakeholders to develop and promote data and technology standards.
- Implementing a process for prioritizing strategic goals.
- Establishing and maintaining relationships with the statewide GIS community.
- Facilitating the pursuit and distribution of resources from federal, private, and nonprofit sources to support geospatial activities in the state.

States that have a GIO or a centralized GIS organization typically have a framework in place that outlines the structure of the managing organization and its reporting relationships.

Framing Potential Approaches for Enhanced Geospatial Governance in Delaware

A successful enhancement of Delaware's approach to governing and coordinating GIS activities will depend on instituting clear measures for budgeting for, developing, and delivering geospatial initiatives; coordinating, surfacing, and supporting geospatial data and service needs; and developing and implementing a framework for evaluating state GIS investments. Table 1, presented in the Executive Summary section of this report, lists and briefly outlines alternative approaches that were considered in formulating this study's recommendations for enhanced GIS governance.

Appendix A. Project Kickoff Meeting Summary

State of Delaware GIS Coordination and Integration Kickoff Meeting

Wednesday, September 11, 2019

1:00 – 2:30 p.m.

Haslet Armory, Room 133, Dover, Delaware

Project Team:

IPA – Troy Mix, Marcia Scott, Carolann Wicks, Sade Bruce, and Tonisha Hurd

OSPC – Miriam Pomilio

DelDOT – Bruce Allen and Colton Phillips

List of Attendees:

Name	***Affiliation***
Stephanie Belinske	DHSS – Public Health
Sharon Dutton	DSHA
Ron Holmes	New Castle County
Stephanie Johnson	DelDOT
Matt Laick	Safety & Homeland Security
Danielle Lamborn	Kent County
Todd Reavis	DelDOT
Steve Smailer	DNREC
Olena Smith	UD
Debbie Sullivan	DTI – FirstMap
George Yocher	DHSS – Public Health
Josh Kelly	DEMA

Summary of Proceedings:

I. Welcome and Introductions

a. DelDOT's Bruce Allen and OSPC's Miriam Pomilio welcomed the group. Allen explained that this project aligns with Delaware's Government Efficiency and Accountability Review (GEAR) Board initiative. IPA was contracted to provide applied research, evaluation, and strategic planning services to assess and recommend potential practices relative to statewide geospatial coordination efforts and the management and oversight of geospatial mapping and data integration for all state agencies. The recommendations that come about as a result of this working group/report will be different from recommendations of the past because they (the recommendations) are going to GEAR. This increases the likelihood that there will be action taken after the final report is submitted.

b. Pomilio provided an overview of the GEAR initiative. She explained that this initiative has been prioritized through GEAR, addressing the lack of "consistent Geographic Information System (GIS) governance within the state" by conducting "an independent survey looking at current [geospatial] practices and ways to improve management and coordination of all geospatial data and mapping efforts."

c. Pomilio stated that the project goal is to incorporate better data integration and mapping, dedicated funding sources, and more efficient coordination for Delaware's state government. Through IPA's report, the group is expected to provide GEAR with an overview of how the state can better coordinate GIS efforts while also saving money.

II. Project Purpose and Overview

a. IPA's Troy Mix introduced himself as the project coordinator and had other team members (Marcia Scott, Carolann Wicks, Tonisha Hurd, and Sade Bruce) introduce themselves. He explained that the purpose of this project is to assess and recommend practices for statewide geospatial coordination efforts (i.e., GIS governance). The assessment includes:

    i. Management and oversight of data acquisition/mapping.

    ii. Geospatial data integration for all agencies (into their practices).

b. Within the framework of the Government Efficiency Accountability Review (GEAR) Board, project tasks/activities will focus on:

i. Increased efficiency and effectiveness.

ii. Improved strategic planning.

iii. Metrics to inform resource allocation.

iv. Institutionalizing continuous improvement.

c. The approach includes a scan of best practices on governance in other states, but the focus is more on building and institutionalizing practical approaches that work for Delaware's context. Mix noted that we're not starting from scratch. From DataMIL forward, at least, Delaware's efforts have been recognized as high quality and these efforts have depended on formal/informal collaboration structures that evidently add value. What works depends on context (above) and what you want. The research, discussions, and deliberations will be bounded by the goals of GEAR. The goal is to set up an ongoing framework, not just addressing known or near-term needs. This includes:

i. Involving new partners through resource propagation.

ii. Incubating, testing, and refining new and existing applications.

iii. Moving from "what's seemed to work" to "evidence-based ROIs."

d. The project time frame was discussed. It is projected to take about nine months to complete. A questionnaire about the current state of GIS in Delaware will be sent out in late October/early November. IPA will need the working group's help identifying potential recipients. After reviewing the results of the questionnaire, stakeholder listening sessions will be held. These meetings will take place during November and December. In January, the first draft of the framing report will be submitted to the working group. This preliminary report will contain alternative approaches to reinvigorate GIS Delaware. It will frame questions around "what if… ?" in order to encourage dialogue within the working group. Example questions include:

i. What if Delaware did XYZ? How would it work? What would the challenges be? What people should be involved? How costly would this be (in terms of time and money)? What would the ROI be? What ROI already exists?

III. Group Discussion: What's Going Well?

a. The GIS community is tight knit.

b. FirstMap has been a positive shift for Delaware GIS and is a valuable source of data. It is easy to use for non-GIS users and raises the public's expectations for data transparency.

c. Many agencies have successfully integrated GIS to better fulfill their mission:

   i. DEMA – Using GIS apps instead of paper and cameras to speed up the reporting process after storm events.

   ii. State and counties do a good job of sharing information.

IV. Group Discussion: What Challenges Exist?

a. GIS data in FirstMap is static, so it is not usable in all situations.

b. The usefulness of GIS is not sold as a valuable resource at the highest level of the organization (in some executive agencies).

c. Customer demand is exceeding capacity/ability to produce. Customer expectations are not always in line with the reality of what it takes to maintain real-time data and create thorough maps or how much it costs to do so. The public also lacks an understanding about the privacy issues surrounding data sharing as it relates to personally identifiable information. The public's idea of transparency is different from how it is defined within the agencies.

d. Resources are limited:

   i. Contracting is relied on for more projects than agencies would like. This takes away from an organization's ability to build institutional knowledge.

   ii. Example: DNREC lost GIS staff after consolidation. Increased efficiency was the goal of consolidation, but it came at the cost of losing people with institutional knowledge and technical skills that were not necessarily part of their official job descriptions.

   iii. There is a funding gap for "big data" and real-time data, and it is also not clear who is supposed to manage the data.

   iv. There is a need for resources for additional personnel.

e. Housing GIS within centralized IT made sense in the beginning when GIS was a specialization that was not heavily utilized by any one agency, but that is not true

anymore. GIS has since become a tool for all agencies, and different agencies have different needs and data sets. (Question from working group: what datasets are important for all agencies?)

f. The legislation that consolidates IT positions into one agency is very broad. Positions categorized as IT positions don't always have explicit IT responsibilities. Sometimes they are management positions that oversee the IT work of a particular agency or department (i.e., technician vs. planner classification). As a result, many agencies have renamed positions to avoid losing people.

   i. Agency ability to develop GIS strategy plans was weakened.

   ii. There are loose agency/unit data requirements. Need more stringent requirements to make data sharing easier/more seamless.

   iii. There should be several GIS coordinators across agencies who talk to each other and work together. We currently lack people who understand the business analysis/business intelligence aspects.

V. How Are Needs Expressed within an Agency? Statewide? How Does It Impact the Competition for Resources?

a. There is no coordination for funding, so agencies tend to "pass the hat" to cover the costs of certain projects. This partnering is not sustainable or strategic.

b. It would be nice if the state had a dedicated fund to provide certain base layers to all agencies while also giving agencies the option to "buy up" for any extras they might need or want (e.g., increased resolution). Without a centralized strategy from the state, it is not clear what they will pay for and what the agencies need to provide for themselves. Sometimes agencies pay for data that another agency or unit already has.

c. People don't know what they don't know. Managers don't know what to ask for if they don't know what GIS is capable of. There is a need for some sort of basic training to provide staff with an understanding of what GIS can accomplish.

VI. What Would Success in GIS Coordination and Integration Look Like?

a. Funding for the three big datasets: LIDAR, aerial imagery, and LULC.

b. Dedicated funding for GIS positions and better position classification systems.

i. Full-time GIS positions in every agency: Many people who have GIS duties do so unofficially and on top of their core job responsibilities. If this person is lost, there is no position to fill to get those skills back.

ii. Need to fill potholes left by missing technical people.

c. People who are familiar with GIS business process and coordination needs at all levels (i.e., GIS coordinators).

d. GIO position.

e. A way to facilitate better data sharing across agencies:

i. Creation of applications to share and leverage data strategically.

ii. Data quality objectives and standards needed as part of governance process. What are critical data framework elements?

iii. Way to identify multi-agency data needs.

f. Universal templates to document ROI to provide finance with the information they want and need.

g. More real-time data.

h. Education on how to use GIS and what it is for.

i. For example, by digitizing the fieldwork, the Department of Agriculture was able to save time and money in its farmland preservation project.

i. Agile partnerships.

j. Going paperless as a result of digital maps.

VII. Project Path Forward

a. Marcia Scott talked about the questionnaire as a way to find out if there are other units or agencies that IPA needs to include in the conversation. Participants expressed a desire to collaborate on and coordinate the collection of this data.

Appendix B. Summary of GIS Coordination in Delaware Survey

The GIS Coordination in Delaware Survey was administered online between November 13 and 22, 2019, to approximately 90 individuals who were identified as GIS stakeholders in the state. Fifty-six of these 90 GIS stakeholders completed the survey—a 62 percent response rate.

The 18 questions in the survey focused on characterizing the respondents, understanding the usage of GIS, cataloguing the benefits of GIS use, and gathering perspectives on existing coordination and integration approaches in Delaware.

Respondent Characteristics

Survey questions 3 and 4 asked respondents to best describe their organization/agency and their professional role. Most respondents were from state agencies (64%), with responses also collected in descending frequency from municipalities, counties, institutions of higher education, MPOs, and federal agencies.

When asked to identify their professional role, 21 respondents self-identified as GIS Managers, while 35 respondents identified as GIS Practitioners.

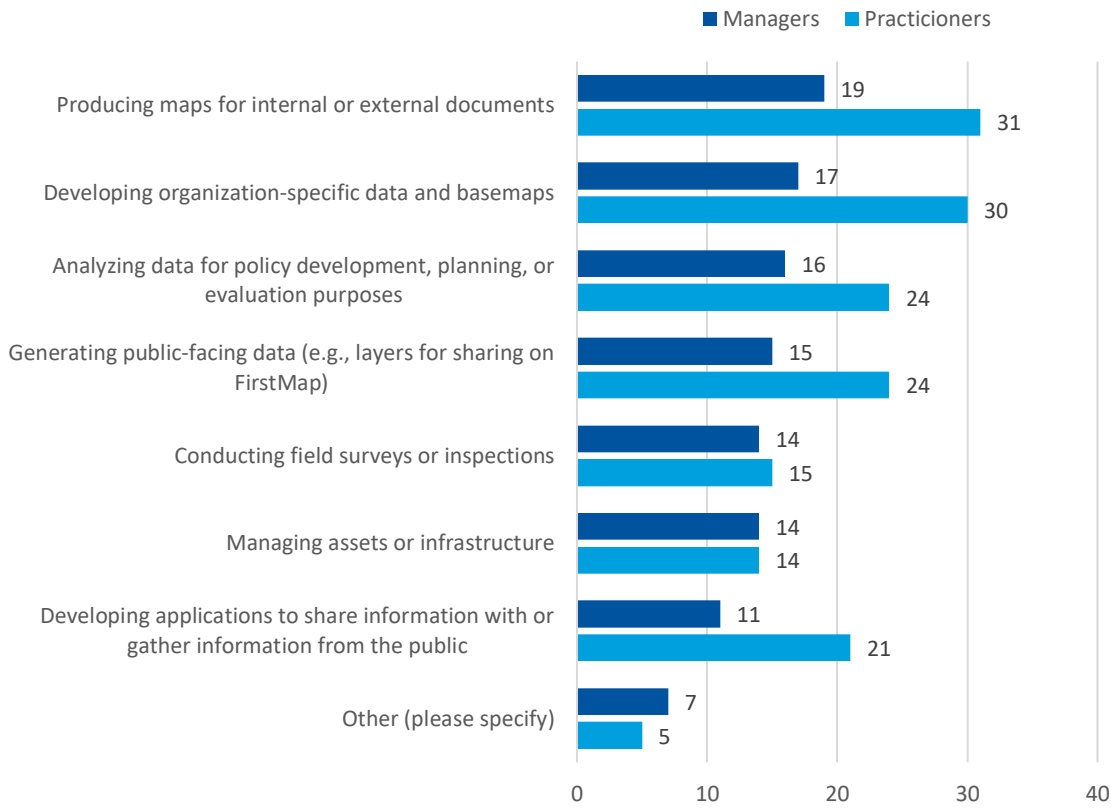
GIS Use

Questions 5–8 asked respondents about the frequency and the importance of GIS usage within a respondent's organization. The majority of managers' organizations (80%) and practitioners (76%) use GIS on a daily basis. With the mission of their organization in mind, 90 percent of managers believe the use of GIS is important, while 91 percent of practitioners believe the use of GIS is important.

Question 9 asked, "What tasks does your organization use GIS for?" Respondents indicated that GIS is used for a wide variety of tasks. Managers and practitioners concurred on the following top tasks: (1) producing maps for internal or external documents, (2) developing organization-specific data and basemaps; and (3) analyzing data for policy development, planning, or evaluation purposes.

Figures B-1 shows the breakdown of GIS uses within organizations, as indicated by managers and practitioners.

Figure B-1. GIS Tasks Indicated by Managers (n=113) and Practitioners (n=164)



Benefits of GIS Applications

Question 11 asked respondents, "How effective is your organization in using GIS technology to achieve its mission?" Among the 54 responses, 44 percent deemed GIS as effective while 39 percent chose somewhat effective, and 12 percent thought it was neither effective nor ineffective.

Managers and practitioners were asked a series of questions regarding return on investment from using GIS. Question 12 asked, "Has your organization realized a positive return on investment (ROI) from its use of GIS?" Both managers (85%) and practitioners (79%) indicated that their organizations have realized a positive ROI from its use of GIS.

If a respondent answered "yes" to the presence of a positive ROI, a follow-up question asked, "In which of the following areas do you feel your organization has realized a positive ROI from its use of GIS?" Managers highlighted evidence-based decision-making as a top ROI area, whereas practitioners indicated that higher-quality research was a top ROI area. Figure B-2 displays the positive ROI responses as indicated by managers and practitioners.

Figure B-2. Positive ROI as Indicated by Managers (n=84) and Practitioners (n=121)

Barriers to Optimal GIS Usage

Question 14 asked respondents, "Has your organization experienced barriers to its optimal use of GIS?" Managers (79%) and practitioners (74%) have experienced barriers to optimal use of GIS in their organizations. If a respondent identified GIS barriers, a follow-up question asked, "Which of the following factors are barriers to your organization's optimal use of GIS?" Managers responded that both staffing resources (27%) and funding (27%) are top barriers. Practitioners indicated that support from agency/organization management (21%) and staffing resources (20%) are leading barriers.

FirstMap Benefits

Question 16 asked respondents to, "Indicate the extent to which you agree or disagree with the following statements: FirstMap has enabled my organization to be more efficient; FirstMap has increased support for GIS usage in my organization; FirstMap offers an easily navigable portal for finding geospatial data; FirstMap enables my organization to share data with citizens and

collaborating agencies; FirstMap saves my organization time or money by providing a centralized source for accessing GIS data."

Most respondents completely agree or generally agree that FirstMap provides benefits to their organizations. Managers either completely agree (42%) or agree (42%) with the statement that FirstMap has enabled their organizations to be more efficient. Forty-seven percent of managers generally agree that FirstMap offers an easily navigable portal for finding geospatial data. Practitioners indicated significant levels of "complete agreement" with the following statements regarding FirstMap: (1) It saves their organization time or money by providing a centralized source for accessing GIS data (53%); (2) It has enabled my organization to be more efficient (47%); and (3) It offers an easily navigable portal for finding geospatial data (44%).

GIS Coordination and Integration

To better understand how GIS is coordinated and integrated in Delaware, Question 17 asked, "To what extent do you agree or disagree with the following statements regarding the current state of GIS coordination and integration in Delaware." A detailed accounting of managers and practitioner stances on the provided statements are listed in tables B-1 and B-2.

Table B-1. Managers' Stance on Coordination and Integration Statements (n=19)

	Completely agree	Generally agree	Neither agree nor disagree	Generally disagree	Completely disagree
There are sufficient opportunities for GIS training.	1	8	5	4	1
GIS staffing levels are adequate.	0	2	8	8	1
Access to needed GIS datasets is sufficient.	0	9	7	3	0
Available Delaware GIS datasets are accurate.	1	11	5	1	1
Funding for acquiring GIS data is adequate.	0	4	4	7	4
Decision makers in your organization provide sufficient support for GIS technology and applications.	2	8	2	4	3

Table B-2. Practitioners' Stance on Coordination and Integration Statements (n=33)

	Completely agree	Generally agree	Neither agree nor disagree	Generally disagree	Completely disagree
There are sufficient opportunities for GIS training.	6	10	11	5	1
GIS staffing levels are adequate.	4	3	14	11	1
Access to needed GIS datasets is sufficient.	5	15	10	3	0
Available Delaware GIS datasets are accurate.	5	21	6	1	0
Funding for acquiring GIS data is adequate.	3	1	11	9	9
Decision makers in your organization provide sufficient support for GIS technology and applications.	5	7	10	8	3

Additional Comments

Lastly, participants were given the opportunity to, "Make any additional comments you would like to provide regarding the current state of and future opportunities for GIS coordination and integration in Delaware." The following lists provide abstracts of top responses provided by managers and practitioners.

Summary of Comments – Managers

- DGDC is functioning well for data sharing.
- Some agencies are limited in knowledge of FirstMap benefits.
- Organizational structures do not support continuity with GIS capabilities (e.g., staffing changes).
- Not all agencies share data well (e.g., lack of data access).
- Lack of upper management support.
- Lack of adequate funding and staff training.

Summary of Comments – Practitioners

- Lack of data sharing from municipalities.
- Lack of consistent, adequate funding for statewide uses such as aerial photography.
- Not sharing costs equitably (e.g., passing the hat; DTI maintenance agreements).
- Lack of consistent job titles/responsibilities.
- Data sets are inconsistent among users.
- No data maintenance/management protocols.
- Delaware open data legislation? No coordination with GIS community. Less successful open data portal?
- DTI needs a more active role to reduce one-off solutions.
- Inadequate and unorganized training.
- Lack of knowledge on upcoming technology trends.
- Practitioners and managers lack access to cabinet level/directors for critical GIS decisions.
- No marketing of FirstMap to agencies/external partners.
- Ineffective executive council – not their area of expertise.
- Need to move from seeing GIS as a nice tool to a mission-critical technical resource.

Appendix C. GIS Coordination in Delaware Survey

Q1 Dear Delaware GIS Stakeholder -

Many state agencies and external partners use geospatial technology, data, and applications for the public good. Through Delaware's Government Efficiency and Accountability Review Board (GEAR) initiative, a study has been commissioned to evaluate the efficacy of the existing structure for the management and oversight of geospatial data and applications across state agencies, as well as the coordination of geospatial efforts among state agencies and external partners.

The University of Delaware's Institute for Public Administration (IPA) has been contracted to complete research that assesses and recommends practices relative to statewide geospatial coordination efforts and GIS governance practices. As part of this research, IPA is conducting an online survey of Delaware state agencies and external entities that use geospatial data. The purpose of this survey is to understand what's working well, what current challenges exist, and what needs to be done to collectively work toward a more coordinated and integrated GIS system for Delaware. Follow-up interviews and listening sessions will be scheduled to detail and refine findings from this survey.

The survey is voluntary and should take about 15 minutes to complete. All individual responses will remain confidential. The information you share will be reported in the aggregate only and will contain no references to individual respondents. For more information about this survey or project, please contact IPA Policy Scientist Troy Mix (mix@udel.edu) or (302) 831-6191.

Please select **"Yes"** (below) if you have read and understand this informed-consent statement and agree to take the survey. If you elect not to participate in the survey, select **"No."**

- ○ Yes, I consent to participate in the survey
- ○ I do not consent, I do not wish to participate

Q2 Which of the following best describes your organization?

- ○ Delaware state agency (please specify) _____
- ○ Federal agency
- ○ Metropolitan Planning Organization
- ○ Municipality
- ○ County
- ○ College/University
- ○ Other (please specify) _____

Q3 Which of the following best describes your professional role?

- ○ I supervise GIS analysts or specialists, or manage an organization where GIS work is completed
- ○ I am a GIS practitioner and use GIS for my professional work

Q4 About how frequently is GIS used in your organization? (Please select one)

- ○ Daily
- ○ Weekly
- ○ Once or twice a month
- ○ Several times per year
- ○ Once or twice per year
- ○ Never

Q5 About how frequently do you use GIS for your organization's work? (Please select one)

- ○ Daily
- ○ Weekly
- ○ Once or twice a month
- ○ Several times per year
- ○ Once or twice per year
- ○ Never

Q6 When thinking about the mission of your organization, how important is the use of GIS?

- ○ Important
- ○ Somewhat Important
- ○ Neither important nor unimportant
- ○ Somewhat unimportant
- ○ Unimportant

Q7 When thinking about your job duties and responsibilities, how important is your use of GIS?

- ○ Important
- ○ Somewhat Important
- ○ Neither important nor unimportant
- ○ Somewhat unimportant
- ○ Unimportant

Q8 What tasks does your organization use GIS for? (Select all that apply)

- ☐ Developing organization-specific data and basemaps
- ☐ Generating public-facing data (e.g., layers for sharing on FirstMap)
- ☐ Analyzing data for policy development, planning, or evaluation purposes
- ☐ Producing maps for internal or external documents
- ☐ Developing applications to share information with or gather information from the public
- ☐ Managing assets or infrastructure
- ☐ Conducting field surveys or inspections
- ☐ Other (please specify) _____

Q9 What tasks do you use GIS for as a part of your work? (Select all that apply)

- ☐ Developing organization-specific data and basemaps
- ☐ Generating public-facing data (e.g., layers for sharing on FirstMap)
- ☐ Analyzing data for policy development, planning, or evaluation purposes
- ☐ Producing maps for internal or external documents
- ☐ Developing applications to share information with or gather information from the public
- ☐ Managing assets or infrastructure
- ☐ Conducting field surveys or inspections
- ☐ Other (please specify) _____

Q10 How effective is your organization in using GIS technology to achieve its mission?

- ○ Effective
- ○ Somewhat effective
- ○ Neither effective or ineffective
- ○ Somewhat ineffective
- ○ Ineffective

Q11 Has your organization realized a positive return on investment (ROI) from its use of GIS?

- ○ No
- ○ Yes

Q12 In which of the following areas do you feel your organization has realized a positive ROI from its use of GIS? (Select all that apply)

- ☐ Reduced costs due to more efficient workflows
- ☐ Faster completion of tasks due to more efficient workflows
- ☐ Increased capacity for evidence-based decision-making
- ☐ Higher quality research or analysis
- ☐ Cost avoidance and savings from improved monitoring and maintenance of assets
- ☐ Improved customer service
- ☐ Enhanced transparency to the public or organizational stakeholders
- ☐ Other (please specify) _____

Q13 If your organization has experienced a positive ROI from its use of GIS, please provide one or more specific examples.

_____

Q14 Has your organization experienced barriers to its optimal use of GIS?

- ○ No
- ○ Yes

Q15 In your opinion, which of the following factors are barriers to your organization's optimal use of GIS? (Select all that apply)

- ☐ Access to GIS data
- ☐ Access to hardware and software resources
- ☐ Staffing resources
- ☐ Funding levels
- ☐ Support from agency/organization management
- ☐ Other (please specify) _____

Q16 FirstMap is Delaware's self-service Enterprise Geographic Information System that is designed to support the GIS needs of all state agencies, counties, municipalities, higher education, and the public. Indicate the extent to which you agree or disagree with the following statements.

	Completely agree	Generally agree	Neither agree nor disagree	Generally disagree	Completely disagree
FirstMap has enabled my organization to be more efficient.	○	○	○	○	○
FirstMap has increased support for GIS usage in my organization.	○	○	○	○	○
FirstMap offers an easily navigable portal for finding geospatial data.	○	○	○	○	○
FirstMap enables my organization to share data with citizens and collaborating agencies.	○	○	○	○	○
FirstMap saves my organization time or money by providing a centralized source for accessing GIS data.	○	○	○	○	○

Q17 To what extent do you agree or disagree with the following statements regarding the current state of GIS coordination and integration in Delaware.

	Completely agree	Generally agree	Neither agree nor disagree	Generally disagree	Completely disagree
There are sufficient opportunities for GIS training.	○	○	○	○	○
GIS staffing levels are adequate.	○	○	○	○	○
Access to needed GIS datasets is sufficient.	○	○	○	○	○
Available Delaware GIS datasets are accurate.	○	○	○	○	○
Funding for acquiring GIS data is adequate.	○	○	○	○	○
Decision makers in your organization provide sufficient support for GIS technology and applications.	○	○	○	○	○

Q18 Please make any additional comments you would like to provide regarding the current state of and future opportunities for GIS coordination and integration in Delaware.

_____
_____
_____
_____
_____

Appendix D. Synopsis of Survey and Listening Sessions

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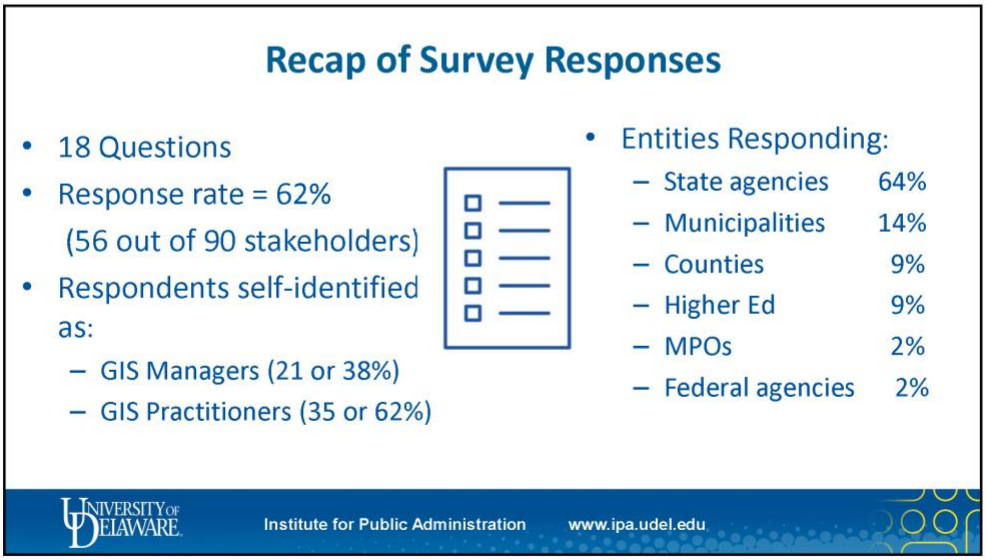

2

Survey Recap – Managers vs. Practitioners

General agreement on:

- ✓ Importance of GIS use
- ✓ Organizations realize a positive ROI on use of GIS
- ✓ Organizations experience barriers to optimal use of GIS
- ✓ GIS staffing levels are inadequate
- ✓ Sufficient opportunities for training exist
- ✓ Insufficient access to datasets
- ✓ Inadequate funding of datasets

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Survey Recap – Managers vs. Practitioners

General disagreement on:

- Benefits of FirstMap
- Decisionmakers provide sufficient support for technology and applications

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4


Synopsis of 2020 GIS Coordination and Integration Listening Sessions
Listening Session Metrics
Emergent Themes
End Users vs. Power Users
Key Takeaways
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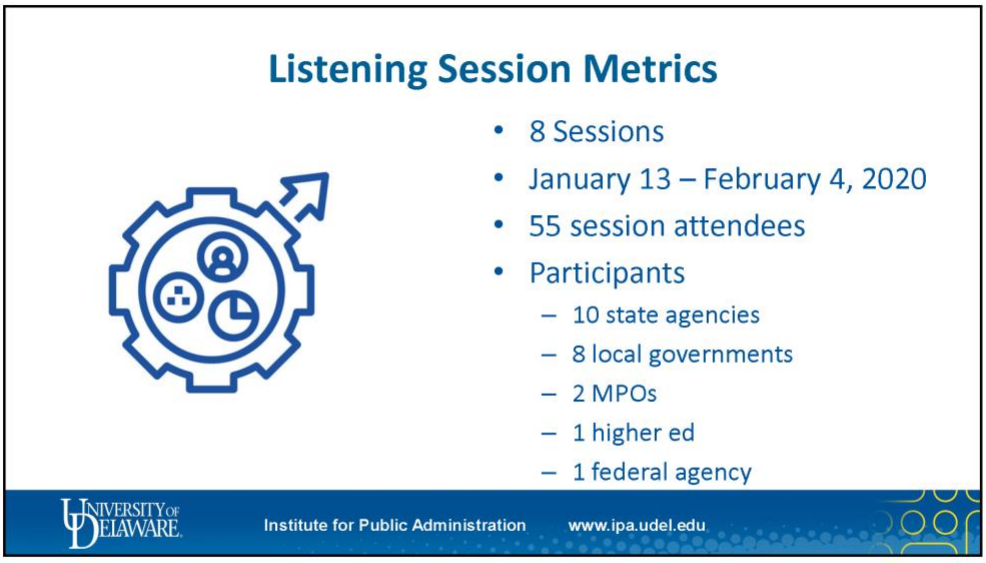
Listening Session Metrics
8 Sessions
January 13 – February 4, 2020
55 session attendees
Participants
10 state agencies
8 local governments
2 MPOs
1 higher ed
1 federal agency
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6

End Users vs. Power Users

End Users (non-technical)

- Consumers of Data/FirstMap
- Lack:
  - Technical expertise
  - Resources
  - Funding
  - ArcGIS licenses
  - Involvement with DGDG and GIS conferences

Power Users (technical)

- Data producers and GIS experts

Have technical expertise/resources to:

- Plan
- Create datasets
- Conduct in-house analysis
- Manage data
- Produce products
- Manage assets
- Conduct onsite surveys/inventories

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Emergent Themes

- Barriers to entities achieving GIS goals
- Changes to State's Coordination/Governance:
  - Leadership
  - Training
  - Technical Resources
  - FirstMap/Data Sharing
  - Funding

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Emergent Themes –
Barriers to Entities Achieving GIS Goals
• Administrative, policy, technical, training, financial, and staffing constraints
• Concerns with data being held hostage by consultants (local govts)
• Pass-the-hat funding of critical datasets
• Data-sharing constraints
• Stability (or lack thereof) of GIS technical resources
• Lack of leadership to coordinate groups, identify skillsets, and advance vision for GIS coordination
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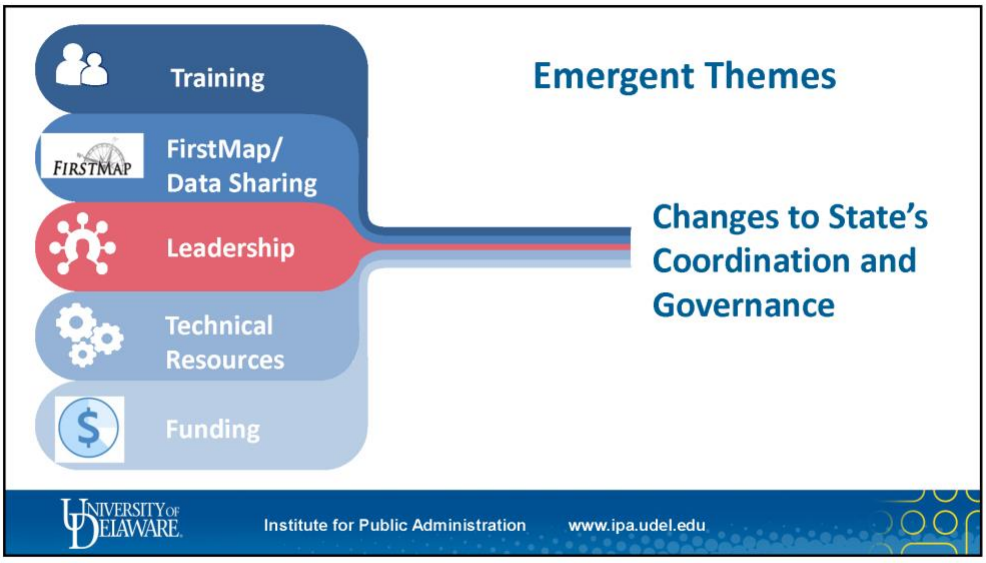
9


Training
FirstMap/ Data Sharing
Leadership
Technical Resources
Funding
Emergent Themes
Changes to State's Coordination and Governance
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10


Leadership
Serve as an advocate to guide coordination across state – both internally and externally
Establish a GIS strategic vision and plan
Identify GIS needs/resources, establish a budget, and methods of funding
Centralized process/entity to take ownership of GIS function—beyond managing IT services
Authority to work across state agencies
Address needs for datasharing & agreements
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Training
Oversight of statewide GIS training and education programs
Targeted training that is specific to state agencies/departments and external GIS community
Building skillsets/capacity of non-technical GIS users
Decrease over dependency on outsourcing (ESRI) and outside consultants
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12

FirstMap/Shared Datasets

- Establish statewide coordinator to oversee FirstMap team and respond to new geospatial initiatives/demands
- Address needs for up-to-date and accurate data
- More real-time data
- Address datasharing constraints (firewall rules, credentials, and proprietary access)
- Recognize difference between needs for public consumable data and raw data for analysis by power users
- Improve management of system (training, outreach, business development, organization)
- Need for "power-user" shared portal
- Produce critical cross-sector datasets for emergency preparedness

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Technical Resources

- Stability (or lack thereof) of GIS technical resoures
- Restructure DGDC
- Establish a GIS Technical Advisory Group
  - Strategic vision for GIS
  - Discussion of issues and solutions
  - Advance partnerships
- Establish group of state agency GIS experts
- Provide support/guidance to "end users" lacking GIS expertise, resources, and ArcGIS licenses

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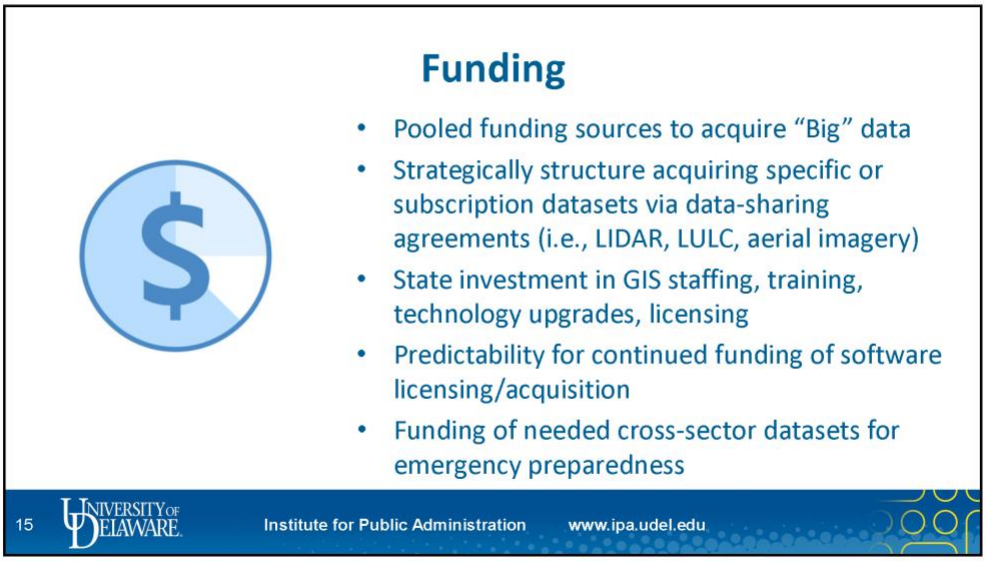
14


Funding
Pooled funding sources to acquire "Big" data
Strategically structure acquiring specific or subscription datasets via data-sharing agreements (i.e., LIDAR, LULC, aerial imagery)
State investment in GIS staffing, training, technology upgrades, licensing
Predictability for continued funding of software licensing/acquisition
Funding of needed cross-sector datasets for emergency preparedness
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Key Takeaways
Explore GIO role
Strategic visioning/planning
Determine shared funding needs/mechanisms
Oversight and coordination role
Fund core critical datasets
Address FirstMap and datasharing issues
Recognize distinct barriers and needs of end users vs. power users
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Biden School of Public Policy & Administration
University of Delaware

180 Graham Hall University of Delaware Newark, DE 19716-7380
phone: 302-831-8971 *email:* ipa@udel.edu *fax:* 302-831-3488

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