LOB #137:
GEOGRAPHIC INFORMATION SERVICES

Purpose

Geographic Information Systems (GIS) is a specialized, critical foundational and increasingly prevalent technology platform, used across most County agencies and is integrated in many County systems supporting a wide variety of County business processes, information and analytical needs. The GIS LOB is a competency center of excellence with the highest level subject matter expertise for mapping data with various attributes based County land parcels in a number of visual formats. The team provides the high quality geo-spatial infrastructure, curated data, innovative analytical applications and products, mapping, web and mobile services to Fairfax County government agencies and the public that have made the substantial GIS utilization across County agencies possible.

Description

The GIS LOB is a specific, county-wide discrete program that is the official office for county-wide digital mapping and provides the County's GIS architecture framework, infrastructure and tools, the maintenance and reporting in numerous data layers. The GIS office maintains a range of technologies, related products and data types that provide the foundation for rapid expansion of GIS enabling new developments in both public Web and field operations. GIS staff provide guidance, training, and assistance to County agencies' GIS analysts in the use and enhancement of geospatial technology in County operations and information needs. GIS has a GeoPortal page on the County's Website that is a single location to access the growing number of GIS enabled web-applications available for use. GIS is also the office for the County's master address repository that maintains and provides address checks against several County systems reliant on street addresses in conducting business. Often times, street addresses may be truncated in older systems or other alias names may have been used. GIS was created as a key program in the Department of Information Technology at its inception as recommended by an expert citizen business group regarding technology (ITAG).

GIS develops maps for a variety of agencies and the public, and integrates GIS technology in County systems. Sustaining and growing an enterprise GIS that serves many different and dynamic agency business needs requires a broad and deep range of GIS data, services, tools, and expertise. To do that the GIS office has a number of diverse functions:

- **Maintenance, update and development of enterprise-wide curated data**: The GIS office manages and maintains the County's enterprise GIS warehouse which currently comprises over 16 Terabytes of GIS data. GIS creates, maintains and publishes the official County Property (parcel) and Zoning maps, updating them daily on the web. Those digital property maps now go back to 1960 and zoning to 1976. There are a series of other maps as well (e.g., soils, stormwater and wastewater systems) to total 45,732 online maps which are downloaded 14,000 times/month. The office also manages the update to the planimetric data (the most heavily used data in the warehouse), regularly acquires the oblique and ortho imagery which are widely used in other applications. Parcel identifiers are issued and maintained by GIS along with the mapping and quality controlling of County addresses and their history. Street centerline data are maintained daily and provided to the CAD/911 system regularly for dispatch and use in the 1,500 emergency services vehicles.

- **Streamlined data dissemination to staff and the public**: To maximize availability and usability of GIS data to the public and minimize the need to come to the GIS offices, the GIS office has made most of its map data, and an increasing amount of its imagery available on the Web. The map data are published as Open Data through the OpenData portal while 8 years of historic imagery (1937, 1953, 1997, 2002, 2007, 2009, 2011, 2013) are available for viewing and researching through the new Historic Imagery Viewer; additional years will be added over the next several years. Previously constituents would need to come to the Government Center to access any of this imagery. The GIS web applications now generate over 5 million service encounters/year and are reducing the need to travel to the GIS offices for data.

- **Fostering growth of GIS capabilities and expertise across County agencies**: GIS provides hands on GIS training to County employees to further their knowledge and skills through a 16 class curriculum. The Branch also provides direct GIS support to agencies whether to assist their GIS staff or support agency staff. In 2015 the office carried out 55 GIS special projects for agencies such as the Board of Supervisors, Department of Management and Budget, Office of the Commonwealth's Attorney, Office of Public Affairs, Department of Public Works and Environmental Services (DPWES), Department of Family Services, and Office of Elections. Some of these requests can be for complex or extraordinary situations where GIS can significantly help them and the solution requires special GIS skills or effort. GIS worked extensively with DPWES to reroute refuse collections and reduce the number of trucks required; it developed a web-based rover application for the Office of Elections to help speed response to precinct voting issues and also developed a Web-based GIS elections results reporting app. Additionally GIS hosts the annual GIS Day excellence awards to recognize GIS achievement in county agencies and build awareness of GIS' role in furthering agency missions. 2015 will be the 17th annual GIS Day event.

- **Enterprise system integration**: A number of key County systems now incorporate GIS functionality as part of their overall capability to add the spatial dimension to their data. The GIS staff have worked with other agencies to enable the implementation and integration of GIS. Currently, the Integrated Parcel Life Cycle System (IPLS), the Master Address Repository (MAR), DPWES Solid Waste Customer Service System, CAD/911, Land Development System/ MarkLogic, ICare, and IAS World all incorporate GIS capabilities. That number will continue to grow.

- **Enterprise software and system resources**: The GIS Branch manages the Enterprise GIS software licenses for most of the County as well as manages the GIS Data Warehouse including the Oracle Database component and the over 16 Terabytes of GIS data that the County now has. There are over 600 direct staff users of GIS and thousands of indirect users.

- **Application development and maintenance:** Delivery modes for GIS have evolved and grown. The GIS Office has lead the training for, implementation and maintenance of many of these systems. Currently the Web tools have become powerful, flexible and easier to use and some of the capability is available as Software as a Service (SaaS). GIS has implemented the GeoPortal on the County's web site and developed an ever growing number of web applications for constituents and staff. Some of the GIS Office's GeoPortal applications include the new My Neighborhood Report, Map Wizard, Historic Imagery Viewer, Virtual Fairfax, Digital Map Viewer, Police Calls for Service tool, Capital Projects, Road Maintenance (Who's Responsible), Leaf Collection areas, Deer Management and Elections Results along with many agency developed applications as well. The office has developed GIS applications for County Staff including the Geographic Exploration and Mapping Application (GEM), BOS Property Viewer, Cable and Consumer Affairs Verizon Build Out Mapper.

- **Public Safety/911 support**: The GIS Office provides all of the centerline and addresses used in the County's 911/CAD system which runs at the MPSTOC and all 1,500 emergency response vehicles. The system uses GIS at its core to optimize dispatch of the vehicles and provide situational awareness to its users. Data is updated daily and provided to the Department of Public Safety Communications (DPSC) when they update the map data. GIS also acquires the Oblique aerial imagery that is used 24x7 in the system to aid dispatchers. GIS also works with neighboring jurisdictions to provide centerline data to the 911/CAD system.

- **Emergency response services:** GIS staff provide 24x7 support to the Emergency Operations Center when activated and participates in the planning for emergency exercises and training. Staff are fully trained in the necessary federal emergency operations procedures (National Incident Management System (NIMS)). GIS technology is a principle feature to the County's EDGR system (emergency damage assessment situational awareness tool developed by DIT).

- **Involvement and coordination in regional, statewide and national initiatives**: Increasingly, the County interacts with its neighbors for important services like 911, environmental protection, and emergency response. GIS is essential in all of these activities because it provides the base mapping to visualize, plan and manage assets and resources. 911/CAD is a crucial driving force because of mutual and automatic aid across jurisdictional boundaries – GIS works with neighboring jurisdictions as well as the Virginia Department of Transportation (VDOT) to make centerline data interoperable regionally and state-wide. NextGen911 will be replacing current 911 services in the next several years and is wholly based on having interoperable GIS data across the National Capital Region – the GIS Branch is leading the regional GIS – NextGen911 efforts. GIS staff also manage the National Capital Region's Geospatial Data Exchange (NCR GDX) which facilitates sharing GIS data for emergency response across local jurisdictions. GIS staff also participate in committees setting national standards setting for NextGen911.

Benefits

GIS tools and data are directly available to the public via the County's web site, as well as embedded in internal systems used by County agencies to better deliver services to constituents. Benefits fall into the following categories along with some examples to illustrate the role that GIS plays:

Cost Savings

- GIS enables faster response 911/CAD calls since the closest vehicles are mapped and dispatched.

- Reduced field time for property assessments due to the use of oblique aerial imagery.

- Stormwater analysis costs are reduced by using planimetric and topographic data.

- Refuse collection costs have been reduced due to optimizing routing of vehicles with GIS software.

- Field collection of data using mobile GIS applications by the Park Authority has significantly decreased field time and positively impacted resulting work efforts.

- DPWES geovisualizes citizen stormwater pipeline complaints to better prioritize areas requiring rehabilitation.

- DPWES Wastewater Management Division uses GIS to spatially index as-built documents to enable quick location and delivery of documents to the public 24x7 through the web.

- On voting day the Office of Elections has response staff (rovers) across the County to respond to hardware, software, and procedural issues. They are using GIS to optimize the dispatch of rovers to the closest incidents to speed response times.

Enhanced Public Safety

- In addition to quicker vehicle response, GIS is used to analyze crime data in order to anticipate potential incidents and prevent them.

- Constituents are able to view current and historic 911 Police Calls for service in selected areas of the County for enhanced public safety awareness.

- Fire and Rescue has developed a suite of web applications for personnel to help in analyzing incidents, analyzing vehicle travel times, and perform training exercises.

- Police are constructing 3-D models of schools and in the future of malls, government buildings and other buildings of interest to better respond in emergency situations.

- Carbon Monoxide incidents occur daily in the County. The Fire and Rescue Department is using GIS to analyze incident patterns and craft prevention approaches.
- The Police Department uses GIS to analyze incidents of K-9 response to optimize the location of the units.

Enhanced Environmental Management

- Field collection of invasive species data by the Park Authority has positively impacted the response efforts to remove invasive species.
- Satellite imagery has enabled the DPWES Urban Forestry Branch to better manage the County's tree population and canopy and help to reduce stormwater runoff.
- DPWES uses GIS to optimize its resources in support of cleaning County streams.
- Special Flood Hazard areas are mapped by DPWES and made available via the web.
- DPWES Stormwater Management uses GIS to help evaluate the status, and compliance with its crucial Municipal Separate Storm Sewer System (MS4) permit.

Optimizing County Development

- The Department of Planning and Zoning regularly uses GIS to track comprehensive plan amendments, as well as zoning change requests and makes the data available to the public on maps.
- Planners can easily access existing land use for all of the County parcels for their planning work via the Integrated Parcel Life Cycle system.
- The Office of Community Revitalization used GIS to develop walkshed analysis of proposed improvements to the Seven Corners area.

Enhanced Constituent Communication

- Leaf Collection areas and schedules are readily accessible via online maps.
- Constituents can easily determine road maintenance responsibilities of all County roads via web maps.
- Fairfax Department of Transportation uses web GIS applications to show Transportation project priorities and enables constituents to mark up a web map to show areas where pedestrian safety can be improved.
- Park Authority has developed mobile web maps to help optimize information about and use of bike trails and general park trails (BikeFairfax and Fairfax Trail Buddy).

More Efficient Delivery of Human Services

- The Office for Women & Domestic and Sexual Violence Service programs use GIS to optimize distribution of their staff and services to areas of highest need.
- Neighborhood and Community Services uses GIS to analyze and view migration to and from parts of the County to help agencies better plan and target County services.
- Health Department used GIS to best locate a new health care program access point and obtain first year federal funding for the center.

Department of Information Technology

Mandates

GIS provides data and mapping necessary to meet state mandates:

- Zoning Map – localities have to have an official map as part of managing their zoning requirements
  <u>Code of Virginia</u> §15.2-2233 & 15.2-2235

- Dam Break Inundation Maps – organizations that own state regulated dams must provide maps of inundation zones. Those maps are prepared using GIS.
  <u>Code of Virginia</u> §101.1-606.2

- All Virginia jurisdictions must provide e-911 services. GIS provides that street and address data used in the county 911/CAD dispatch system
  <u>Code of Virginia</u> §66-484.16

- The state requires that all properties, with exceptions, be taxed. GIS data and maps are a key component of the County's assessment process. Article X, Constitution of Virginia

Trends and Challenges

Budget pressure is a continuing challenge, which will drive the expansion in the adoption of GIS technology in agencies to carry out County operations more efficiently and cost-effectively. GIS already enables many County agencies to deliver services more efficiently and the number of services and agencies seeking efficiencies and innovations will continue to grow.   Doing that will require having the software tools, data, platform and expertise to realize those benefits.

Competition for development across the National Capital Region will continue to grow and be driven by budget pressure which is not limited to Fairfax. As developers have a wide area to consider for growth, streamlining the local regulatory process will be essential in enhancing the attractiveness of a jurisdiction. Fairfax has undertaken a strategic assessment of its land development process and it is clear that there is a need to streamline a complex legacy process. Future processes will have to be digital, and be structured to easily feed key information to reviewers, other County agencies and residents. GIS will be an important component of a new/revised process, to include 3-D which is being used in an increasingly large portion of the worldwide development industry.
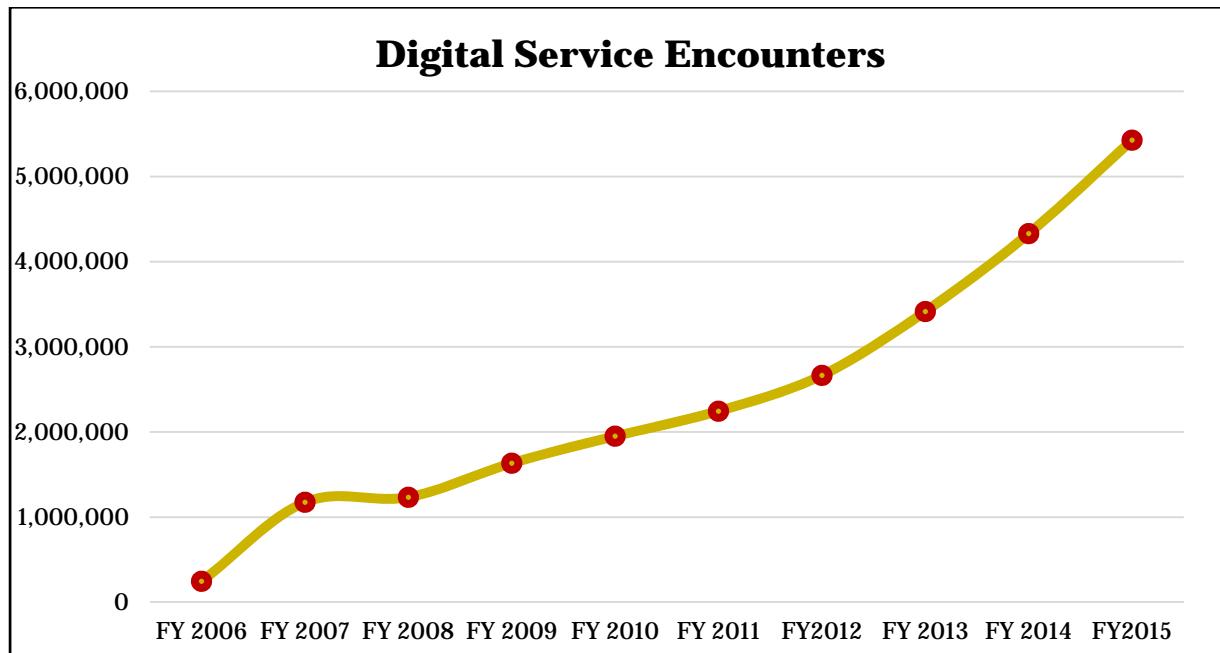
Fairfax County already has an aging and highly diverse population. Tracking and analyzing demographic data will help agencies plan for programs and services to fulfill Fairfax County needs. GIS has been and will continue to be an essential tool for County human services agencies as they face increasing and changing demands for effective services.

Public Safety demands will continue to grow and evolve. As the County continues its transition to an urban environment, population demographics continue to change and technology demands evolve at a rapid pace GIS will be an increasingly important and essential component. Today GIS is used 24x7 in the dispatch of public safety personnel. County public safety agencies (Police, Fire and Rescue, Sheriff, DPSC) use GIS to analyze incident trends, plan equipment and personnel placement, and speed incident responses. As the County becomes more urban, with larger, more complex buildings, location accuracy within buildings will become crucial to quick response. Today that capability is not available but it will in the future. GIS will be key to that, as will having 3-D building information from the land development process. Most significantly, over the next 5-7 years, the County (and National Capital Region) will transition to the Next Generation 911 system which is GIS based (as is the 911/CAD system already). NextGeneration 911 will provide more web features (text to 911, video, photo, more accurate incident locations).

The relentless expectation and demand for web-based and mobile and real-time data and services for the general public and ounty staff will continue. Increasingly County agencies are incorporating mobile technology to field crews to enable them to view current data, capture field data and have it be available in near-real time to other agency personnel. GIS is essential in mobile data collection since location is a core component of field operations. The public also wants data accessible and discoverable geographically via the web.

GIS provides data and a range of services for web applications. The use of these tools can be seen in the increasing use of GIS web services by the public and county staff.   Figure 1 shows the steady increase in usage of GIS data via web and desktop applications, reflecting the increasing utilization of GIS data and GIS tools.

Digital Service Encounters

Open data is another growing trend in the industry. GIS recently made a range of County data available through the Esri OpenData portal and is experiencing growing utilization of the data and portal in just the first month with no publicity.   These data are key in the development of third party web applications as well as enabling more detailed data analysis by constituents.

The jurisdictions that comprise the National Capital Region are increasingly interdependent for Emergency Response, NextGen911, Environmental Management and Stormwater management. Today Fairfax County is sometimes the emergency responder to locations within Arlington, Alexandria and Loudoun County, and similarly those jurisdictions are first response into some locations in Fairfax. Doing this requires shared, interoperable GIS data not just for Fairfax but the region. Similarly NextGen911 will require a standard, high-quality set of GIS data for the entire National Capital Region in order to direct 911 calls to the correct jurisdiction.   Environmental management (particularly stormwater) requires GIS data of adjoining jurisdictions in order to carry out stormwater modeling and planning.   Cost pressure and the demand for quicker and enhanced emergency services will continue.   GIS is at the core of all of these regional interactions.

Department of Information Technology

Resources

Category	FY 2014 Actual	FY 2015 Actual	FY 2016 Adopted
LOB #137: Geographic Information Services			
FUNDING			
Expenditures:			
Compensation	$1,707,331	$1,595,743	$1,626,365
Operating Expenses	268,751	247,791	402,507
Work Performed for Others	(12,386)	(9,156)	0
Total Expenditures	$1,963,696	$1,834,378	$2,028,872
General Fund Revenue	$34,148	$20,072	$23,088
Net Cost/(Savings) to General Fund	$1,929,548	$1,814,306	$2,005,784
POSITIONS			
Authorized Positions/Full-Time Equivalents (FTEs)			
Positions:			
Regular	20 / 20	20 / 20	20 / 20
Total Positions	20 / 20	20 / 20	20 / 20

Metrics

Metric Indicator	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual	FY 2016 Estimate	FY 2017 Estimate
Number of Digital Map Viewer Downloads	156,864	172,959	178,667	187,600	196,980
Number of GIS Digital On-line transactions	3,415,359	4,330,139	5,427,022	5,698,373	5,983,292

Use of on-line GIS transactions and downloading maps has increased dramatically. This shows that more people are using the GIS platform for visualized data, for example, supporting location of polling places, school attendance, Trail Buddy & Bike Fairfax, Police Event viewer, seeing election results by precinct, 3-D visualization of areas in Fairfax such as Tysons Corner, and downloading this valuable data for the public's use in creating custom purposed maps, any many more. There are over 1,000 layers of GIS data supporting all agencies, and about 45,732 pre-made maps. This includes 55 years of property maps, going back to 1960.

This is extremely efficient and cost effective for the county and constituents, reducing the need for users to come to the GIS office to get information and data since it available 24x7 from any computer. Printing costs are also reduced.