GIS EXCELLENCE AWARDS

2014

Fairfax County, Virginia

November 20, 2014
## West County Trail Route

- **Main Route**
- **Alt Route**
- **West County Trail Gaps**
- **SW Natural Surface**
- **SW Paved**
- **FCPA Park**

### Gap # | Description | Priority | Est. Cost
--- | --- | --- | ---
1 | Missing trail section along Compton Road and Cub Run SV crossing |  |  |
2 | Missing trail section and crossing at Poplar Tree |  |  |
3 | Missing trail crossing at Walney Road |  |  |
4 | Missing trail crossing at Stringfellow Road |  |  |
5 | Missing trail section along Fox Mill Road |  |  |
6 | Missing trail section in Fred Crabtree |  |  |
7 | Missing trail crossing at Lawyers Road |  |  |

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**Third Place**  
**West County Trail**  
**Pat Rosend, Liz Cronauer**  
**Fairfax County Park Authority**
Second Place
Tysons Park System Concept Plan
Gayle Hooper
Fairfax County Park Authority

Early concept for park types and placement of park spaces.

GIS data helped identify which park spaces had been removed from those shown in the 2010 Comprehensive Plan as well as note the new spaces that are recommended.

GIS has contributed extensively in the development of the Tysons Park System Concept Plan. The concept plan is the outgrowth of two years effort by the Park Authority to establish a reference to guide the integration of park spaces in the redevelopment of Tysons.

Throughout this process, GIS was instrumental for the analysis of data and the understandable presentation of the results. The final product document required a series of clear, coordinated graphics to convey the many aspects of the future park network.

A range of graphics were developed throughout the course of this project including:

- Graphics for work sessions with citizen advisory group and County staff to form a variety of departments.
- Analysis of GIS data on planned park spaces by type and district to evaluate achievement of goals.
- Evaluation of park service areas by type to balance availability of park space across the Tysons district.
- Graphics for community outreach.
- Graphics for final product to convey the integration of all research in a manner that is clear and understandable and visually cohesive.

The final product is a 407-page document, supported by numerous photographic and drawing and GIS-generated graphics.

This document will be used by County staff, developers, planners, landscape architects, and others looking for the site for a unified park network in Tysons into existence.

Buffers that define the service area for each park type help evaluate the distribution of new areas, helping ensure that a variety of park spaces are available to all residents and workers in Tysons.
Housing and Population through the Decades in Fairfax County

1/2 mile north—
the distance the center of population is forecasted to shift in 2040, mostly due to development in Tysons Corner.

5 miles west—
the distance the center of population has shifted since 1960.

131%—the percentage increase in housing units from 1970 to 1990. The number of new housing is forecasted only 31% from 1990 to 2000.

1 Dot = 3 Housing Units

First Place
Housing and Population through the Decades in Fairfax County
Paul Maliszewski
Neighborhood and Community Services
Targeting Accessible Waters for Volunteer Cleanups

John Burke, Ecologist (Watershed Planning and Assessment Branch)
Department of Public Works and Environmental Services – Stormwater Planning Division

Objective
- Fairfax County is required by its Municipal Separate Stormwater Sewer System (MS4) permit to monitor and remove "trashables (trash)" from its streams.
- Volunteer groups assist the county, but the location and condition of many streams make access for volunteer cleanups difficult or dangerous.
- This project determines which stream segments in Fairfax County are accessible to volunteers and also predicts which of these streams are most likely to have large amounts of trash.

What Stream Segment Characteristics Prohibit Volunteer Cleanups?
- This model excludes stream segments with the following characteristics:
  - Streams on private property or those which do not lie in a stormwater/floodplain easement or Fairfax County Park Authority Park.
  - Streams beyond 1/2 mile from a road.
  - Streams that do not drain the Municipal Separate Storm Sewer System (MS4).
  - Streams which have been cleaned after 2004.
  - Large streams with potentially fast/deep water and a high likelihood of advanced stream bank destabilization (degraded streams Order 4 or 5) and Non-tributary streams.

Candidate Stream Reaches within 1 Mile of Areas with the Highest Likelihood of Trash

Fairfax County Streams and Trash Complaints

Results
- From this model, it was determined that 2,216 out of 29,962 possible stream segments in Fairfax County meet the requirements for safe, legal, and convenient volunteer access set forth by this project.
- From these 2,216 sites, 84 occurred within one mile of areas with the highest estimated likelihood of trash. These sites would be best suited for large volunteer groups or groups aiming to commit a large amount of time. Sites further away than 1 mile are recommended for smaller groups.
- The map and model generated from this project can now be consulted by the Watershed Planning and Assessment Branch staff when community service organizations request cleanup sites.

Future Work
- Percent impervious surface and population density within a given stream's drainage area will likely correspond to higher amounts of trash in the reach. To make the trash estimation more robust, I would like to include these variables in future analysis.
Christopher McCarthy
Public Safety Communications

Automating the Blue Books and Run Order Display in the Computer Aided Dispatch System Utilizing GIS Modeling and Scripting

Second Place

Automating the Blue Books and Run Order Display in the Computer Aided Dispatch System Utilizing GIS Models and Python Scripting
First Place
Development of a GIS Toolkit to support Hydrologic and Water Quality Modeling (HWQM) and drainage area characterization of ecological sampling sites

Joseph Riley-Ryan and John Burke

Development of a GIS Toolkit to Support Hydrologic and Water Quality Modeling (HWQM) and Drainage Area Characterization of Ecological Sampling Sites

Stormwater Planning Division

Joseph Riley-Ryan, John Burke

Background
- The overall goal of this effort was to develop a GIS toolkit for creating and streamlining workflows related to drainage area delineation and land use analysis performed by the Stormwater Planning Division (SPD).
- The data derived from these analyses are used in hydrologic and water quality modeling (HWQM), as well as drainage area characterization of ecological sampling sites to support watershed management efforts in the County.
- The toolkit developed as part of this project leverages the best available GIS data to support these functions, and provides a consistent methodology for performing these analyses.
- Prior to the development of this toolkit, drainage area characterization in HWQM was complex in a somewhat ad hoc manner with wide variety of input data and varying levels of GIS-based analyses.

Methods and Results
- A high resolution DEM was created utilizing the best available countywide terrain data, supplemented with the publicly available data outside the county (Figure 1).
- To improve the delineation capability for Green Infrastructure type projects, the stormwater infrastructure (pipes and other conveyance systems) was "burned" into the DEM, which allowed for explicit accounting of changes in microdrainage areas due to stormwater conveyance systems.
- The conditioned DEM was used to generate the FD and FA grids for drainage area delineation, and it was found that this significantly improved the drainage area delineations to SPD facilities (Figure 2).
- A model-builder tool was created to allow users to delineate drainage areas to any point of interest in the County using the new FD and FA grids (Figure 3).
- The model builder tools were used for random sample sites covering a range of area-impermeability values (Figure 5). Land use for the toolkit required the most current planimetric data for impermeability estimates derived from 2009 aerial imagery as well as a more recent raster land cover dataset derived from 2011 satellite imagery. Utilizing model builder tools for impermeability estimates as well as land-cover summaries (Figure 6), both datasets were analyzed to develop a methodology for estimating impermeability and characterizing land-use.
- A correlation analysis of the results indicated the planimetric and land-cover data yielded consistent results in cases where the land-cover derived impermeability was higher than planimetric data derived values (Figure 7).
- The results showed that the land cover layer provided good estimates of both impermeability and other land uses of interest. However, a correction factor was necessary to improve the impermeability obtained from the land cover layer (Figure 5).
- When planimetric impermeability values were higher (generally where impermeable features were obscured by tree canopy), the land cover impermeability had to be increased and the forested (tree canopy) area correspondingly reduced (Figure 8).
- Land cover data indicated areas of high impermeability (planted or natural vegetation). The planimetric values were corrected based on the land cover data (Figure 9).

Utilization
- Examples of how the GIS toolkit was used for HWQM at a processed retrofit site are shown in Figures 9 and 10.
- Examples of how the tools were utilized to project and analyze the drainage areas of 320 stormwater ecological sampling sites can be seen in Figure 11.
- Using a randomly selected subset, drainage areas of the ecological sample sites fell within an average of 4% of previous estimations.
- Overall, the GIS toolkit has resulted in a more than 50% reduction in the level of effort required to generate input data sets for HWQM and drainage area characterization of ecological sampling sites.
A CULTURAL HISTORY TOUR OF OLD COLCHESTER PARK AND PRESERVE

Colchester Archaeological Research Team, Cultural Resource Management and Protection Branch, Fairfax County Park Authority

http://bit.ly/1w2AAn

Interactive story map highlighting the cultural history of Old Colchester Park and Preserve using images, texts, and links to provide a virtual experience for visitors to explore the diverse history and stories through the material evidence left behind.

1: OLD COLCHESTER PARK AND PRESERVE

2: EARLY ARCHAIC

3: LATE ARCHAIC—EARLY WOODLAND

4: LATE WOODLAND

5: CEMETERY

6: TOWN OF COLCHESTER

7: TOWN DEVELOPMENT

8: MORRIS POUND (LOT 18)

9: MORRIS POUND (LOT 26)

10: JOHN MCINTOSH, TAILOR (LOT 20)

11: ROCHAMBEAU MAP

12: HANNAH P. CLARK HOUSE

An interactive 3D web scene using ArcGIS Online’s CityEngine web viewer where visitors can tour the reconstructed town of Colchester circa 1780. The web viewer is linked with tour point 6: Town of Colchester.
Demographic Interactive Mapper

Neighborhood and Community Services

Descriptions

The Demographic Interactive Mapper was created to make current Fairfax County demographic data easily accessible for public and internal users. The web application was designed to be easy for users to explore and download demographic data across Fairfax County at different levels of geography. The web application has been used by public citizens, students, internal Fairfax County agencies, and surrounding jurisdictions and governmental agencies among others. Since its release in June 2011 the Demographic Interactive Mapper has had about 5,000 web visits.

The Demographic Interactive Mapper summarizes the most current demographic data created by county demographers in Community, ZIP code, and Census Block Group levels across Fairfax County. These data include total population estimates, 5-year population forecasts, commercial gross floor area, and number of housing units by type, age, and market value. Users can zoom in and out, pan, search by location, select multiple features to summarize data by geography, and export the whole database or selected data. The Demographic Mapper can be found at http://www.fairfaxcounty.gov/demographics/ demographic_map.htm. The data this application provides are being used by different Fairfax County departments and agencies including Transportation, Planning and Zoning, Schools, Human Services, Fire & Rescue among others to help plan for programs and services to fulfill Fairfax County needs.

The Demographic Interactive Mapper was constructed to link to data compiled and summarized from seven tables from an Oracle database that is updated on an annual basis through the Integrated Parcel Livesite Process (IPLP). The map data is directly extracted from the tables using a query from ArcMap. As the IPLP process is run on an annual basis, the data that the interactive mapper produces will be updated automatically.

Fig. 1. Map of communities across Fairfax County with selected communities highlighted in red.

Fig. 2. Map of bubbles showing number of foreign born people across Fairfax County.

Fig. 3. Map of ZIP codes across Fairfax County with highlighted ZIP codes shown in red. The table below shows the corresponding data associated with the selected feature. A window pops open asking the user to save the selected data.

Fig. 4. Map of block groups across Fairfax County with selected block groups highlighted in red.

Census Explorer

The Demographic Interactive Mapper also includes U.S. Census Data through the “Census Explorer” that links to a U.S. Census Bureau API through an iframe window. The Census Explorer includes specific demographic variables at the county level or by census tract. Variables include median household income, 65 and over population, foreign born, high school graduate or more, bachelor’s degree or more, master’s degree or more, in labor force, professional, scientific and technical industry workers, owner occupied, and households income over $150,000. The Census Explorer also includes County Business Patterns including total wage employees, tech wage employees, average yearly employee wage, average yearly tech employee wage, total establishments, and tech establishments.

Source: Fairfax County Department of Neighborhood and Community Services. United States Census Bureau. 2012 American Community Survey.
Existing Land Use in Fairfax County

Fatima Khaja, Neighborhood and Community Services, Fairfax County, Virginia

Existing Land Use Layer in Integrated Parcel Lifecycle System

Existing land use and existing land use maps are used by planners and policymakers in determining where future growth should occur and where facilities and infrastructure may be needed. The primary purposes for automating the creation of the existing land use layer were to make it easier to keep this information up-to-date and to reduce the time it takes to produce an existing land use map. The automated Existing Land Use Layer Tool was built as a module in the Integrated Parcel Lifecycle System (IPLS).

In the past, the existing land use layer had to be created manually by using tabular data from the Department of Tax Administration (DTA). Each parcel in the DTA database has a designated land use. These data were joined with Fairfax County’s GIS spatial data. There are several hundred types of existing land uses and over 400,000 parcels in the DTA database. Because of the large number of specific land use codes, they needed to be categorized into general land use categories and then color coded based on the general use to make them usable for displaying visually in a map. In addition, land associated with condominium projects was not captured unless the analyst created a polygon for the complex.

With the automation of this process through IPLS, the existing land use layer can be created in a matter of minutes whereas the manual process took weeks to complete. The existing land use layer can now be easily updated as new data from DTA are loaded into IPLS. The layer can now be hosted in the GIS Dataloader for all county staff to use.

The existing land use layer contains ten general categories:
- Agricultural
- Commercial
- Low-density residential
- Medium-density residential
- High-density residential
- Industrial, light and heavy
- Open land, not forested or developed
- Public
- Recreation
- Surface water
- Utilities

The IPLS application is menu driven and the layer is created by using spatial joins and color coded by general category. It also recognizes areas with multiple land uses and creates polygons for condominiums. The resulting layer contains over 600,000 records and the following fields:
- ObjectID
- Pid: Parcel Identification Number
- Prims_LUC: Primary Land Use
- Secon_LUC: Secondary Land Use
- LUC_DESCR: Land Use Description
- TAX_EXEMPT_CODE: Tax Exempt Code
- TAX_EXEMPT_DESCR: Tax Exempt Description
- Acres: Acres of Land
- Categ: Categories of General Land Use
The Fairfax County Fire & Rescue Department’s ArcGIS Online Website is a “one-stop shop” for all of our personnel to quickly access the geographic data and information that they need. At this page, our personnel can access a suite of mapping applications that allow them to:

- View and filter incidents
- View estimated travel time data
- Access station planning and analysis tools (for Senior Staff)
- Access ever-changing data (for FRD and other agencies)
- Collect and verify hydrant data using ArcGIS Collector
- Perform training drills to test street knowledge
- Find station information

Another problem that we face is the large number of requests that we receive. With 38 fire and rescue stations serving a county of over 1.1 million people, the number of requests that we receive can be significant. Typically, these requests are for similar information but for different areas of the county. Fulfilling these needs is often a manual and time-consuming process, and can lead to additional questions and requirements. For example, creating and providing a pdf map of one firebox boundary may lead to further requests for maps of the neighboring boundaries, and so on.

To solve these problems and more, we created an ArcGIS Online website for our personnel to access commonly requested GIS data. All of our staff have access to web mapping applications on the Fire & Rescue Department ArcGIS Online website. They do not need previous GIS experience to find and view the information that they require, and they no longer have to wait for the GIS team to respond to their common mapping and spatial data requests. This new workflow is beneficial for the GIS team, too, as we now have more time available to focus on our core GIS projects and data efforts.
Creating a Survey Quality Cadastre

Land Survey Branch of the Department of Public Works and Environmental Services

Most Significant Progress

Creating a Survey Quality Cadastre

Land Survey Branch of the Department of Public Works and Environmental Services
The Fairfax Center Area Study

The Fairfax Center Area Study is a multi-phase planning study to ensure compatible urban development as described by the County's Comprehensive Plan. The Fairfax Center Area contains approximately 1,500 acres located in the City of Fairfax and the Town of Oakton. Beyond the planning phase, the study was also focused on implementation strategy. Challenges included urban design, traffic, and public access.

Public Hearing Dates

Planning Commission public hearing: Wednesday, October 22, 2014 at 6:30 p.m. on October 22, 2014. For public hearing and agenda, the agenda can be viewed at http://www.fairfaxforward.gov/ for more information on the hearing, please contact the Fairfax Planning Department at 703-291-8080.

For more information on the Fairfax Center Area Study, please visit the Fairfax Forward Website.

Link to Interactive Map of Study Area

Static Location map linking to Street Map

Fairfax Forward Website
Deer Management Interactive Map
Building the 3D “Virtual Representation of the 18th Century Port Town of Colchester” Virginia Web Scene

Marion Constante, Cultural Resource Management and Protection Branch, Fairfax County Park Authority

The script tool as seen in ArcMap using the specific parameters to create 3D structures.

The 3D terrain was created by digitizing the contours of Old Colchester Park and Preserve and surrounding area from the US Geological Society's 1920 Fort Humphreys and vicinity topographic map. The contours were given elevations and created into a Digital Elevation Model (DEM) using the "Topo to Raster" 3D analyst tool in ArcMap.

The town roads, fences, and outlying buildings were digitized from the geo-referenced 1783 Rochambeau "Camp-a Colchester" map.

An example of how the "create 3D Structure" works in ArcMap and the elements used to create a 3D model (elevation points and polygons). Below is the output in ArcScene.

Virtual Representation of the 18th Century Port Town of Colchester Virginia

The model of the tobacco funnel in Virtual Colchester, an example of the variety of structures that can be created.

Once all the elements were established in ArcScene (1754 town plat, roads, 3D buildings, trees, occupied dirt lots, extruded polylines for the fences and vineyard, Occoquan River, and shaded relief draped over the 1930 DEM) the scene was exported to a 3D web scene using the "Export to 3D Web Scene" tool in the ArcGIS CityEngine web viewer. The above image is the final scene using the ArcGIS online CityEngine web viewer. The web scene can be viewed here: [http://bct.ly/3wCa5Y](http://bct.ly/3wCa5Y)

(Browser requirements: Mozilla Firefox 16 and higher, Google Chrome 20 and higher, Internet Explorer 11 (limited support), Safari 5 or higher with WebGL enabled)

The Python script that is used for the custom ESRI ArcMap tool that requires the user to input point features, which contain elevations to be used to create Triangulated irregular Network (TIN) models for the roof and base of the structure. A polygon is required to extrude between the two TINs by using the tool "Interpolate Polygon to Multipatch" that outputs a 3D multipatch shapefile viewable in ArcScene and the CityEngine web viewer. The user also has the option to create two additions (for Virtual Colchester these were chimneys) using TINs for the base and top and a polygon for the dimensions. The additions are then combined with the main structure to create a single 3D object.
Constructing Interior 3D Models of Fairfax County’s School Buildings From CAD .DWG Files.

1. CAD drawings where obtained from Liz Hatcher, Functional Application Specialist II, Fairfax County Public Schools. CAD .DWG files were added to an ArcMap project. The tool Georeferencing was used to supply spatial data to the later, since .DWG files don’t include any spatial data. Without this data the .DWG layer won’t display correctly with other spatial data.

2. Areal photos of the schools were from the County’s shared SDE. These spatially known photos were used alongside the Geo-referencing tool to help identify known control point. Corners from the school in the areal photos were matched up with the corresponding corner of the .DWG layer. Once more then three control points were mapped the georeferencing tool could adjust the .DWG file and assign the correct spatial data to the layer.

3. Once all the control points have been assigned the georeferencing tool will adjust the .DWG layer to the correct spatial location that you determined. This spatially enhanced layer was saved and stored within a shared folder and posted to the GIS-Server for others to consume within their online projects.

4. With the .DWG File located accurately on top of the targeted school, a lines layer was generated to represent the walls within the school. Depending on what, when, how and who will be consuming the attribute can differ to the projects needs. This layer was also stored within a shared drive and posted to the GIS-Server for others to consume within their online projects.

5. Within ArcGlobe the school’s line layer were added and the Elevation of the walls where entered onto the properties of the line layer based off the information within the CAD files. These 3D models can be rapidly deployed within the Incident command center to size up an event and determine the best placement of resources around and/or within the structure. The Police are looking to utilities these models within training first to determine their usefulness within a live event.

6. With anticipation of the new Officer’s radios with GPS capabilities, the police department’s looking to utilize this information out in the field. Employing the Tracking Analysis tool within ArcGIS, the radio GPS information stored within the SQL database can be leveraged and displayed within the 3D models by analysis within an incident command center. Data can be relayed decision makers to aid them in visually identifying resources within the incident, potential threats, location of buildings, utilities, as well as the location and status of personal.
Giving The Power and Tools of GIS To The Users In The Field.

ESRI's ArcMap mapping suite is a group of useful software to collect and build data that users are requesting to utilize out in the field. Before any layers should be collected or built, it's important to understand the needs of the users. What type of data is needed? How is the data going to be collected? What devices are available to the users? And what types of attributes does the user need to have access to?

A GIS Server or an ArcOnline account is needed within the County to publish your data for online distribution. Published layers can be made public or privately within a group, depending on the security that you project needs. FlexViewer or ArcOnline can be used to create and manage these published layers. Additional widgets or tools can be added to your map to give the users more options and/or increase their productivity.

Free GIS online apps (ArcCollector, ESRI Online, etc.) are available for download on most mobile devices. These apps allow the user to view and edit layers within the field. Most mobile devices used in the field have GPS capabilities and can be used to collect and display your position within the application. With the mobile devices connected to a network any changes made to the layers within the app, are live and can be viewed by all other connected devices. Operations Dashboard is a standalone application on a computer that allows supervisors and/or commanders the ability to have a broad overview of the project, but not the ability to edit. Preloaded widgets performs basic analysis to provide a quick snapshot of the overall scope of the operation, allowing supervisor or commanders the ability to make real-time decisions.
Spatiotemporal Geovisualization of Repeated Sinkhole Complaints 1984-2014 for the Determination of Storm Pipe Rehabilitation Priority
Snow Plow Route
determined by
Optimized Route Planning

| Facility Type | Route Order | ROUTE 1 | ROUTE 2 | ROUTE 3 | ROUTE 4 | ROUTE 5 | ROUTE 6 | ROUTE 7 | ROUTE 8 | ROUTE 9 | ROUTE 10 | ROUTE 11 | ROUTE 12 | ROUTE 13 | ROUTE 14 | ROUTE 15 | ROUTE 16 | ROUTE 17 | ROUTE 18 | ROUTE 19 | ROUTE 20 | ROUTE 21 | ROUTE 22 |
|---------------|-------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| START / END   |             |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| COMMUNITY CENTER |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| FIRE STATION  |             |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| HEALTH CENTER |             |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| LIBRARY       |             |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| OTHER         |             |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| POLICE        |             |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
BOUNDARY
LINE ADJUSTMENT AGREEMENT
by and between the City of Falls Church
and Fairfax County

This Boundary Line Adjustment Agreement is entered into as of the 3rd day of January, 2023, by and between the City of Falls Church ("City") and Fairfax County ("County").

The City and County have agreed to adjust the boundary between the City and the County in accordance with the terms and conditions set forth herein.

1. Adjustment of Boundary

The boundary between the City and County is hereby adjusted as shown on the attached map.

2. Effective Date

The adjustments to the boundary shall become effective on the date of this Agreement.

3. Enforcement

This Agreement shall be enforced by the respective governing bodies of the City and County.

4. Amendments

This Agreement may be amended by mutual agreement of the City and County.

5. Ratification

This Agreement is ratified and confirmed by the respective governing bodies of the City and County.

IN WITNESS WHEREOF, the City and County have caused this Agreement to be executed.

City of Falls Church
_____________________
[Signature]
_____________________
[Date]

Fairfax County
_____________________
[Signature]
_____________________
[Date]
Non-Native Invasive Assessment Prioritization

- **NNIAP**
  - 3 Categories:
    - Ecosystem Score
    - Non-Native Invasive Species Score
    - Cultural Score
  - Total Scores Range from 3 to 16
  - Determines where to spend limited funding

Old Methodology

- Paper Map & Score Sheet
- Hand draw boundaries
- Create GIS data back at the office
- Time spent manually entering the information and creating polygons
  - Introduces Error

New Methodology: Collector

- New Technology
- Syncs w/ Remote Server
- Ready to go GIS Data
- No need to transfer or convert
- Works with Existing Datasets
- iOS & Android

Advantages of Collector

- Data entry:
  - Enter it once!
  - Form reduces incorrect data entry
- Location Accuracy:
  - Surveyor actually knows where they are in a park
- Ease of use:
  - Users don’t need to be GIS pros
Maximizing Battalion Chief Coverage in Fairfax County using Location-Allocation

Introduction

Background

Fairfax County, VA is located just to the west of Washington, D.C. It has a population of over 1 million people, making it one of the most densely populated counties in the United States. The Fairfax County Fire & Rescue Department, tasked with providing fire and EMS services to the county, has 57 fire and rescue stations dispersed across Fairfax County.

These 57 stations are grouped into seven geographic areas, called service areas. A battalion chief represents a hierarchical management structure that oversees one of the battalion chiefs. The battalion chief is in charge of all stations in that battalion. Ideally, the seven battalion chiefs are distributed across the service areas that provide the most coverage (as determined by discrepancies in the number of fire and rescue stations across each service area).

Objective

In an effort to maximize coverage of the battalion chiefs in Fairfax County, the CORE team at the Fairfax County Fire & Rescue Department was tasked with identifying the seven fire and rescue stations in the county that would serve in the most ideal locations to house a battalion chief. To achieve this, they employed the use of a GIS Network Analysis tool to identify service areas of the 57 existing fire and rescue stations that would maximize the coverage of battalion chiefs.

The assessment was completed using a location-allocation algorithm, which maximizes coverage of facilities such that no demand point is unmet. The location-allocation algorithm was run to see which fire and rescue stations would maximize coverage based on total area and total number of buildings.

Methodology

Location-Allocation Analysis

This assessment was performed in ArcGIS Desktop 10.2.2 using the location-allocation algorithm available as part of the ArcGIS Network Analysis extension. The purpose of the location allocation algorithm is to identify facilities that maximize coverage in a set of demand points within a specified catchment area and distance.

Two location-allocation analyses were completed as part of this assessment, one to maximize coverage and one to minimize coverage to serve stations. For each location allocation analysis, the facilities were defined as all fire stations in Fairfax County (including 11 lattice service areas) and the demand points were the 2010 census block centroids in Fairfax County. Both analyses used a 0.01 minute response time criteria.

In the first location-allocation analysis, only the location of census block centroids were used as the demand point inputs. This was completed in order to select seven fire stations that maximize coverage based on total area only. In the second analysis, the census block centroids and the demand points were weighted by the total number of buildings in each census block. For 2010, the purpose of the analysis was to refine the battalion chief coverage based on where the most demand is likely to occur.

10 Minute Service Areas

For this assessment, battalion chief coverage was defined as the area that a battalion chief can travel to in ten minutes from any given location. To identify these areas, ten minute service areas polygons were created for each station using the Network Analyst service area solver and an in-house network dataset.

Once the service areas polygons were generated, maps were produced to illustrate the ten minute service area coverage of the seven battalion chief stations according to the results of each location allocation analysis. To allow for easier data viewing and comparison for non-GIS staff, these data were also distributed via a web map layer hosted on ArcGIS Online.

Results

Maps of results are presented at the bottom of this paper. In terms of area coverage, the results show that the existing battalion chief stations cover 35.3% of the area of Fairfax County. The location allocation analysis that maximized buildings resulted in an increase in building coverage to 38.9%. The location allocation analysis that minimized area coverage also resulted in an increase in building coverage to 38.9%.

The service areas selected to maximize area or building coverage are presented in the table below. These existing battalion chief stations (25, 29, and 32) were chosen in areas that would maximize area, while four existing battalion chief stations (9, 23, 29, and 32) were chosen in stations that would maximize building coverage.

<table>
<thead>
<tr>
<th>Existing Battalion Chief Stations</th>
<th>Proposed Battalion Chief Stations Based on Ten Minute Service Area Coverage</th>
<th>Proposed Battalion Chief Stations Based on Minimizing Area Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>25, 10</td>
<td>25, 10, 22</td>
</tr>
<tr>
<td>09</td>
<td>23, 21</td>
<td>23, 21, 22</td>
</tr>
<tr>
<td>09</td>
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Conclusions

This assessment suggests that both area and building coverages can be improved by modifying location, if the location is ideal. To maximize ten minute coverage in the greatest demand, battalion locations, it is recommended that the battalion chief be stationed at stations 25, 29, and 32 to serve stations 17, 22, and 23.

Acknowledgements

Thank you to Eric Fisher, Kay Good, and Justin Taylor for your data compilation, ideas, and other feedback on this project.

Further Information

For questions and comments, contact Shelby@fairfaxcounty.gov
Introduction
The Fire and Rescue Department sought to expand the successful Safety in Our Community Program with a new initiative, Wellness in our Community (WIOC). The main focus of WIOC is to distribute the File of Life and educate residents on the benefits of completing the form; however, an additional component of the WIOC program is specifically directed at the education and prevention of Carbon Monoxide (CO) hazards as a means to avoid illness and death. In order to be most efficient with the outreach program a geospatial analysis was needed to target the appropriate places and populations with CO prevention and education.

Methodology
First, data was extracted from the I/CAD database (main tables stored in FRD data warehouse) to identify all the dispatched carbon monoxide incidents (event types ACOD and ECOD) occurring between January 1, 2010 and May 31, 2014. Then another query was run to extract all reported carbon monoxide incidents (incident type code 424), carbon monoxide detector activation from malfunction (incident type code 736) and carbon monoxide detector activations with no carbon monoxide detected (incident type code 746) from the FireRMS database. ArcGIS was then used to analyze any spatial patterns that may exist. An optimized hotspot analysis was used, aggregating incident counts within fishnet polygons using the Fairfax County fire boxes (released 12/2013) as bounding polygons. The hot spot analysis was repeated for each incident type and the results were compared.

Results
The FRD responds to approximately two carbon monoxide incidents a day, with increasing frequency in the winter months (November through February). Over 90 percent of the CO incidents occurred within residential properties during the evening hours (between 6 and 8 pm).

The initial hot spot analysis identified an area of approximately 44.8 square miles as statistically significant hot spots of CO events (99% confidence). Approximately 2 of every 10 dispatched CO events were confirmed as an actual CO event, and approximately 5 of every 10 dispatched CO events were reported as false calls, such as detector activations due to a malfunction or detector activation with no CO detected.

Conclusions
Dispatched CO events as well as confirmed CO emergencies were noted within the areas surrounding stations 1, 2, 5, 9, 10, 11, 13, and 17. The hot spot areas are consistent with known higher call volumes and higher population density. The blue areas, shown as cold spots, are areas with traditionally less call volume and less population density. As a result of this analysis, the Fire Chief, the FRD’s Fiscal Services, Life Safety section and Operations Bureau were able to devise strategies for the CO portion of the WIOC initiative.
THE ELECTIONS ROVER TRACKING APPLICATION SHOWING ROVER 8 ACTIVITY WITH POP-UP AND MAP OPTIONS DISPLAYED.
The Fairfax County Fire & Rescue Department: Significant Progress in 2014

The Fire & Rescue Department has made great strides in our use of GIS over the past year. We've extended our GIS capabilities in a number of ways: we've increased our GIS staff, revamped our data creation and maintenance processes, and introduced our entire department to web mapping applications that we have created using ArcGIS Online. Here's a snapshot of the progress we've made this year:

**Increased GIS Staff**

Due to increasing demands for GIS support over the years, the department saw a need for an additional full-time GIS staff member. In March, we hired a third full-time GIS Analyst to our team!

**Data Improvements**

This year we have made significant progress towards cleaning up our in-house data and making it more readily accessible to all GIS users. As part of this process, we have made all of our master datasets accessible via SDE.

**Creation of our ArcGIS Online Website**

Our primary accomplishment this year has been our move to ArcGIS Online. Our GIS team receives a large number of mapping and spatial analysis requests from our personnel, and often this is further complicated by the time-sensitive nature of fire and rescue. To address these issues and more, our GIS team created an ArcGIS Online website. This website serves as a “one-stop shop” for our personnel to quickly access the geographic data and information that they need. At this site, our staff can:

- Access station planning and analysis tools (Senior Staff)
- View estimated travel time data
- Access ever-changing data (for FRD and other agencies)
- Find station information
- View and filter incidents
- Collect and verify hydrant data using ArcGIS Collector
- Perform training drills to test street knowledge

This year, we've not only improved our day-to-day GIS tasks, but we've made GIS accessible to every staff member in our department. Our efforts have been extremely well-received by Fire Chief Bowers and the rest of our Senior Staff, who are excited about GIS and the prospect of what we can accomplish in the future. This year has been an excellent milestone for us, but we will continue to make great strides in the use of GIS for our department in the future as well.