# Fa.S.T

Fauquier Spatial Times

Quarterly Newsletter

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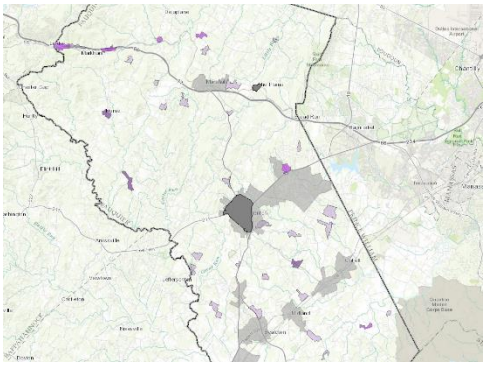
## Planning and GIS

By: Myles Bushing (Fauquier County Planning)

Traditional maps are inherently limited by their static nature. The information presented is constrained by decisions made at the time of printing. They cannot respond to the demands of the moment.

To overcome these limitations, Planning has partnered with Fauquier County's Geographic Information Systems department (GIS) to develop web mapping applications. Web maps allow for information to be manipulated in real time in response to the demands of viewers. These maps offer greater flexibility and are easily distributed for wider use.

Planning is developing both internal and public facing web mapping applications. The internally focused maps are used for presentations before the



Planning Commission and other bodies. These maps allow Staff to pull up map information as requested by the members of each board and facilitate more focused discussions.

External maps are developed to facilitate information sharing with the general public. These maps can be published online and accessed by residents of the county. As part of the rewrite of the villages' chapter of the Comprehensive Plan, for example, a map with a proposed hierarchy of communities was created and made available to the public on the county's website.

In providing web maps, Planning Staff is fostering public awareness of our work, and the planning process can be made increasingly transparent by allowing interested parties to review the data used in public decision-making.

## FIRESolv

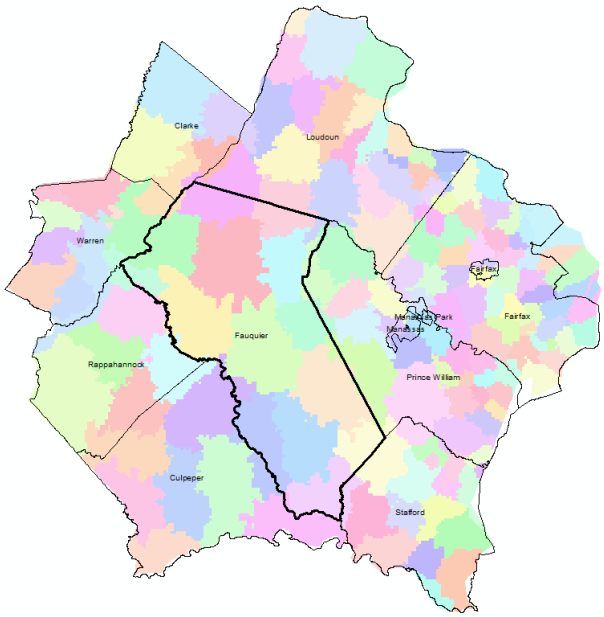
By: Drew Fioranelli, GISP (Fauquier County GIS)

One of the most basic operations of any fire station is the ability to receive a call for help and responding to that call as fast as possible. Historically, time and distance analysis have been generated leveraging the institutional knowledge of the responding fire fighters.

In developing new standards and integrating technology, Fauquier County Fire Rescue have partnered with Fauquier County GIS to create time and distance models for each fire station within Fauquier County, as well as all counties sharing a boundary with Fauquier County.

Much effort has gone into developing these time and distance models. Fauquier GIS spent several months developing the models in-house, but realized the resources for keeping the models current did not exist using this approach. The models need to account for expanding geospatial datasets as well as expanding the model outside of Fauquier County's boarders. This realization lead to the third party purchase of ArcBridge's FIRESolv software.

FIRESolv builds optimized service areas and call centers (call boxes) for fire departments based on street network coverage within the GIS. These resulting analyses present data as tables or as maps for visualization of the data. "Statistical techniques like regression analysis, standard deviation, are used to display results in an easy-to-read format" as stated by ArcBridge.




ArcBridge describes FIRESolv as an extension that "works with ESRI's ArcGIS ArcView 10.x (a product currently used by Fauquier County GIS) to calculate and determine answers to station location and call box area setups. In combination with current digital maps of streets, boundaries, and station and equipment locations, it is able to provide a variety of maps and tables that enable the fire department planner to easily and quickly calculate outputs with mathematical precision. Excel tables display and export run order information. This data can then provide department staff and government officials the accurate information they need to decide whether to realign staff and equipment locations, change hours of operation, or determine where to spend precious capital improvement dollars on new stations or equipment."

The resulting analysis is a very colorful display of 140+ fire station response areas as defined by time. Once complete, the analysis will be reviewed and studied by fire department personnel to test the accuracy of the model. This is done to ensure the technology has properly accounted for all roads, road outages, etc… While the model can handle large datasets, it cannot account for human interaction.

# Hydrology Calculation for Dummies

By: Emily Melton (Fauquier County Community Development) and Dan Stell (Fauquier County GIS)

Problem solving exists in many facets of our daily lives, especially in a profession like Civil Engineering. Planning for the unknown and developing solutions to unknown problems is a major role for a civil engineer, such that many in the profession need tools to assist in calculating and quantifying information to properly design or engineer structural features such as a culvert, ditch or dam.

Geographic Information Systems (GIS) Department and Fauquier County's Civil Engineers within the Department of Community Development are working together to create tools and spatially based solutions to combat this unknown. Often times, we run into the issue where the County Engineer has to break out his dusty design tools to calculate the amount of water that gets to a site and how fast it gets there. For a moment, imagine a raindrop falling out of the sky onto the top of a mountain. If we

apply the snowball effect, we can visualize the direction this droplet would roll (think gravity), how fast it will roll, how much liquid will be picked up as it rolls down the mountain, and how big the droplet will be at the bottom of the mountain.

Civil Engineers have to figure out the size of these liquid snowballs in order to offer technical assistance to county staff, the general public, and identify the necessary hydrologic calculations in order to assist the private sector through reviews. This basic information lays the groundwork for how large a ditch, dam, or culvert etc. needs to be to accomplish its purpose.

The important criteria needed is:

- how much land area drains to the site,
- how steep the land is from the top of the hill to the bottom where our site is located,
- how long the channel is where the water collects as it flows down the hill,
- how much water will never make it to our site because it goes into the soil (to water a tree or grass), and
- how big the channel is along its length. Channels get bigger as they get longer and collect more water from more hills

Calculating all of these parameters by hand takes a lot of time. The process begins by mapping the topography, soil types, and land cover information. Engineers would need to estimate how much area is covered by woods, grass, parking lot and roof tops in each soil type in present in the area draining to the site. (The amount of land in forest cover, grass cover, and covered by rooftops and parking lots can be estimated from the zoning of the property.) This information has to be drawn on a paper map at a known scale (think rulers) in order to use what is called a planimeter (or some serious geometry calculations) to measure lengths and areas by hand.

These steps can be extremely time consuming and need to be calculated consistently and accurately. With the development and integration of spatial technologies, archaic and time consuming hand estimates are no longer necessary for day to day tasks.

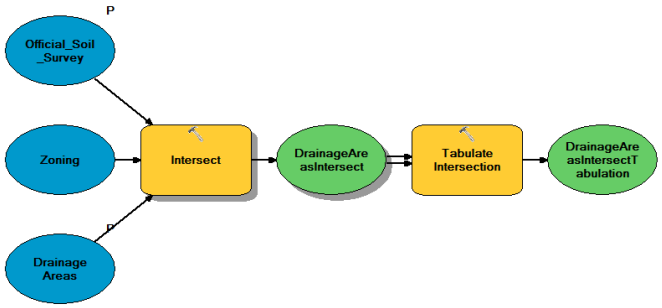
When using GIS software applications, the user can calculate how much of one soil type is within a specific area or how many linear feet of a river are within another physical feature on the earth. The available geoprocessing tools in a GIS application can provide consistently accurate calculations but using these tools one by one can still be time consuming and create potential for error if steps are overlooked.

To address the issues highlighted above and ensure this process could be duplicated in a timely manner, Fauquier County GIS developed a new tool for Fauquier's civil engineers using Model Builder. Model Builder empowers a user to string together multiple geospatial processes to achieve one goal, in essence consolidating several steps into just one tool.

Models have three basic components; tools, variables and connectors. In this example a model was built to calculate in acres the amount of soils within various land use (zoning) and within a water drainage area. The resulting calculations assist the engineer in determining the size a culvert, ditch or dam needs to be to safely pass the water it receives. Depending on the size of the area draining to a site, calculating the relationship of land cover to soils by hand can take between a couple of hours and several days. A properly designed model can streamline steps into one easy click of the mouse and rerun over and over as needed.

Below is an example of the model developed –

Blue = Variable
Yellow = Tool
Arrows = Connectors
Green = Calculated Results reported in Output Table




In addition to analyzing the relationship of land cover to soils within a set area draining to a site, the map provided by GIS provides enough information so that the slopes and lengths of channels can quickly and easily be determined — providing the County Engineer with all of the important criteria listed above to determine the size of a liquid snowball, as imagined above.

This is an example of how GIS has been integrated and has helped turn what was once a multi-step, time consuming task into an efficient operation compressed into some quick and easy steps.