Virginia Association of Counties

ACHIEVEMENT AWARDS

APPLICATION FORM

All applications must include the following information. Separate applications must be submitted for each eligible program. **Deadline: June 2, 2017.** Please include this application form with electronic entry.

PROGRAM INFORMATION

County: County of Henrico

Program Title: Continuing, Cooperative and Comprehensive Transportation Report Process Improvements

Program Category: Community & Economic Development

CONTACT INFORMATION

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1. Program Overview

The Henrico County Continuing, Cooperative and Comprehensive (3-C) Transportation Report Process Improvements Program is an analysis and upgrade of the methods used to produce an annual report conducted by the Department of Planning. This report forms the basis for federal highway and transit assistance in urban areas. In the spring of 2015, after completion of the 2014 report, Planning staff thoroughly examined both the methodology and base data within the program and identified process inefficiencies and opportunities for greater data accuracy. By bringing together the expertise of staff and new tools (for this assessment and redevelopment of the report), a new, practical process was implemented in the fall of 2015, and new base data was utilized. The new process realized a savings in time and money while providing greater accuracy of data.

2. Problem/Challenge/Situation Faced by Locality

The Continuing, Cooperative and Comprehensive (3-C) Transportation planning process is required by the Federal Highway Administration/Federal Transit Administration (FHWA/FTA) for all urbanized areas with a population of more than 50,000 people. The report reflects changes in population, housing, and land use acreage for the calendar year and provides the Virginia Department of Transportation (VDOT), as well as other agencies, a snapshot of population and demographics to better plan for future needs of the region.

The process for completing the county's Continuing, Cooperative and Comprehensive (3-C) Transportation Report (3-C Report) and the base data utilized in that process had not been updated for some time. By incorporating newer technologies, staff was able to implement a more accurate and expedient process for compiling, analyzing, and disseminating data for the report.

The original data collection process for the 3-C Report takes about six months and involves a variety of sources. Part of the procedure includes the distribution and collection of survey letters to public and private schools and group quarters to obtain vacancy rates. Certificates of Occupancy and Demolition Permits are also collected in order to update and verify land uses (calculating use acreage, including water and creating parcel right-of-way acreage). All of the data is then analyzed and compiled into a report that compares population and land use to previous years. By having streamlined some of these processes, weeks of staff hours were realized, which then allowed staff to focus on other County needs.

3. How Program Fulfilled Awards Criteria

A need to streamline several of the sub-procedures of the 3-C process became the main program objective. As part of this objective, four areas of the 3-C process were identified as needing improvement in terms of time needed to process collected information and to increase accuracy: Outside Agency Data Collection; Accessing Demolition Permits and Certificates of Occupancy; Verifying Land Use Calculations; and Water Acreage Calculations. Each of the four focus areas had varying solutions, ranging from extremely simple, such as adding an email address to survey letters, to extremely difficult, such as creating layers in Geographic Information Systems (GIS) and additional processes (as with the water layer calculations). There was a need for each of these areas to have a well-communicated and documented process, so future iterations could follow the same protocols. While it was understood some of the updating could take more time than previous methods, staff recognized these would be one-time events with the promise of significant savings in time and resources in the future when compiling the data.

4. How Program Was Carried Out

Outside Agency Data Collection **-** Each fall, the original 3-C process mandated that surveys be sent to schools, apartment complexes, and other group quarters to collect population data. Information collected included capacity and vacancies to determine vacancy rates. The forms were to be returned via U.S. mail to the Department of Planning where the data would be entered into a Microsoft Access database to be utilized in compiling and calculating the necessary results. Staff realized this method of returning surveys was not the most efficient and decided electronic transmission would result in more survey returns. Transitioning to an electronic communication form helped eliminate misplaced letters and simplify reporting by associated agencies. The basic inclusion of an e-mail option for returning data significantly increased the initial participation and response speed, reducing the completion time of this task from approximately four weeks to two weeks. Additionally, the survey categories on the forms were streamlined, and this process update has also allowed for the eventual development of a survey website for future reports.

Accessing Demolition Permits and Certificates of Occupancy - Previously, Demolition and Occupancy Permits were imported into a Microsoft Access database after data from the countywide permitting database system, Tidemark, was received. This method was inefficient because it either required a request for data from another department or a separate username and password setup for access to the Tidemark data. Because the person compiling the report from year to year could change, having a way to directly connect the county's GIS to Tidemark for a read-only dataset was considered a more ideal method for data processing than utilizing separate user permissions and data requests. In order to access permit data throughout the year, dynamic feeds were created to bring Tidemark permit data directly into Planning's GIS system and spatially join them to parcel data. This allowed for the development of a simple query, which could display every parcel holding a Certificate of Occupancy or Demolition Permit in a given time period.

Verifying Land Use Updates - Over the course of a year, many changes can be made to the land uses throughout the county. These changes can be based on new developments, demolitions, splitting of parcels, or rezoning. Due to the constantly changing nature of this data set, quality assurance and quality control (QAQC) is difficult, and, therefore, was the main focus in the redevelopment of the process utilized to generate it. The original process was to check gridded areas of the county individually and to find any updates that may have occurred within that grid over the past year. This process was both time-consuming and prone to error.

By introducing edit tracking to GIS data, a user would be able to see exactly when layers were edited and by whom. Also, by pulling in both GIS-tracked edits and Tidemark data for Demolitions and Occupancy Permits, queries were created to pull land use edits against permits, zoning, and parcel updates to determine if land uses had been updated properly for a parcel or if additional research was needed. By using the dynamic feeds for demolition permits, Certificates of Occupancy and historical parcels, as well as using edit tracking on various GIS layers, the updated process made it much easier to track the land use changes and to monitor changes to other layers that may affect land use.

Water Acreage Calculations - Due to accuracy and differential delineation between water and wetland data, the decision to include revision of the process used to obtain water acreage presented itself as a necessary objective. Each time the data was generated, many manual edits were made to land use and water acreage counts because of water layer accuracy limitations within GIS.

The first step was to develop a new base data set. This portion of the process started by collecting widely available, public datasets that fell into one of three categories: wetland and water datasets were merged together as one, requiring additional cleanup to differentiate the two features; national stream and river datasets were represented as polyline datasets instead of polygon, so acreage calculations were not possible; or national or global datasets were created at a larger scale, so when zoomed into a county level, the accuracy was lacking. The main objective was to create a repeatable, well-documented process that would create a less generalized, local dataset to differentiate water versus wetland data, while maintaining accuracy.

After initial data collection and process generation, it was determined additional information was needed. The four band aerial imagery, which includes the infrared spectrum, was deemed necessary for the success of this program. By extracting the thermal properties of the objects in the imagery, using processes similar to those used for the Normalized Difference Vegetation Index (NDVI) and USGS's Global Ecological Land Units, water, wetlands, and other land cover were able to be extracted and categorized using the emissivity return values for each pixel. Every object, both man-made and natural, has an amount of spectral distribution of energy emitted. Its contrasts in thermal brightness are then used for feature identification. For example, at a constant temperature, dry soil will emit less heat than saturated soil, which, in turn, emits less heat than water. By using high resolution imagery, the image processing and analysis resulted in greater accuracy. In order to create the desired end result, several required steps were identified for the final process. Once those were outlined and tested, a final workflow was established, and those steps were able to be bundled into an ArcGIS model.

The process improvement program utilized a variety of software and existing databases during its development. The main software program in use was ESRI ArcGIS and its associated programs. It was very flexible and allowed for the integration of various technology components into one location. It also allowed for expedient graphic representations of the data to be produced.

Technology	Process	Type
ESRI ArcGIS	Permits, Land Use & Water	Software
Email	Outside Agency Collection	Software
Survey Monkey	Outside Agency Collection	Software
ESRI Spatial Analyst Extension	Water	Software
Microsoft SQL Server 2008r2	Permits, Land Use & Water	Software
High Resolution Imagery	Water	Software
SAFE Software FME Suite	Water	Software
ESRI ArcGIS Model Builder	Water	Software
GIS Grade Computer	Permits, Land Use & Water	Hardware
External Hard Drive	Water	Hardware

5. Financing and Staffing

Due to the existence of key resources already in place, especially GIS layers, the county did not incur extra costs outside of their normal operational budget. Almost all of the hardware and software used for this program was either already owned or had a license. The one exception was SAFE's Feature Manipulation Engine software, which was only used as a verification tool for the water layer process. In this case, it was only needed during the base data development verification process, so a free trial was used since it will not be necessary in future iterations.

Because there was no physical end-product beyond printing the final report for individual use from the county's website, all costs fell under operational costs. However, depending on existing equipment and available software (such as GIS and Microsoft Access 2007), a locality implementing this program may incur some capital costs to establish the capabilities to implement a similar program.

Operating costs for the program included staff time for a Planning Intern, Planner I, Planner IV, and a Department IT Manager.

The research and initial iterations of the water portion of the process were completed by a summer intern, for an estimated cost of approximately $2,640. The Planner I conducted the overall data collection, union of databases with the GIS system, and verification of the intern's work. The Department IT Manager worked on combining data sources with the GIS system and other troubleshooting with the more technical aspects of the program. The Planner IV was the project manager and oversaw the vision and general process flow of the program through completion. Other localities could complete this program using different staff as long as they have the technical skills required to complete the described tasks.

Operating Costs	
Planning Intern – Entire Summer Tenure	$2,640.00
Planner I (160 hours @ $21.23/hr.)	$3,396.80
Planner IV (40 hours @ $29.29/hr.)	$1,171.60
Department IT Manager (80 hours @ $33.94/hr.)	$2,715.20

6. Program Results

Overall, results from the program included a more accurate baseline dataset for both the water and existing land use segments, updated reporting processes, a detailed process outline and a model to aid in future iterations of the project. Because of the differentiation between water and wetlands, acreage calculation for the 3-C Report takes less manual categorization and the process is more streamlined, resulting in time and cost savings for the Department of Planning and the county. Following are more specific results by the areas of the program previously described.

Incorporating email and web options for survey returns reduced the time necessary to receive many group quarters' and schools' surveys. This also led to the reduction of staff time following up on outstanding surveys. A 30% increase from initial participation was realized.

With the setup of dynamic feeds into GIS, analysis of demolitions and occupancy were able to be updated and verified year-round instead of having the data accumulate at the year's end for updates and verification.

By using the dynamic feeds for Demolition Permits, Certificates of Occupancy and historical parcels, as well as using edit tracking on various GIS layers, it is now much easier to monitor land use changes that may have occurred over the past year. Also, the user is now able to immediately identify changes to other layers that may affect land use. Queries to retrieve data for changed land use parcels versus the parcels that have had demolitions, Occupancy Permits, or changed parcel tracts make the verification process easier, as the planner putting together the report has a targeted list of data to verify versus spot checking the entire county.

By running imagery analysis on the high-resolution imagery, approximately 1,000 acres of wetland data that previously were manually extracted from the water feature layer were automatically classified as wetlands. Creating a new layer will take approximately 40 hours of run time and quality analysis by a Technology Support Specialist whenever a new imagery dataset is purchased by the county. This saved approximately two weeks per year of staff time in terms of the report process.

7. Brief Summary

The newly defined processes and procedures of the Henrico County 3-C process meet several of the stated program criteria. First, by improving the administration of an existing county government program and providing information that facilitates effective public policy making. The new process displays a creative approach to meeting requirements set by federal regulation and achieves measurable results while demonstrating innovation. It is also consistent with acceptable government and financial management practices.

Data accessibility was redefined by inventive thinking. In addition, taking extra measures to create more accurate water and wetland calculations at a local level displayed a creative approach to meeting the requirements defined by a federally-mandated report.

By saving time and resources and increasing the accuracy of the final product, we saved money and were better able to measure results and positive impacts of these process changes. The innovation behind the accuracy and time savings of this endeavor has already sparked conversations as to how this and similar processes could be utilized in other areas of the department to streamline procedures. Using existing resources, including databases and GIS, to their full potential will create a more efficient, well-defined process for other projects well into the future.

Figure 1: Imagery of an area near the Chickahominy River. Over generalization of wetland data has much of this area classified as water, as shown in Figure 3.

Figure 2: Same imagery as before, with infrared band exposed. The closer the white dots are to one another, the higher the moisture content. With solid white representing water.

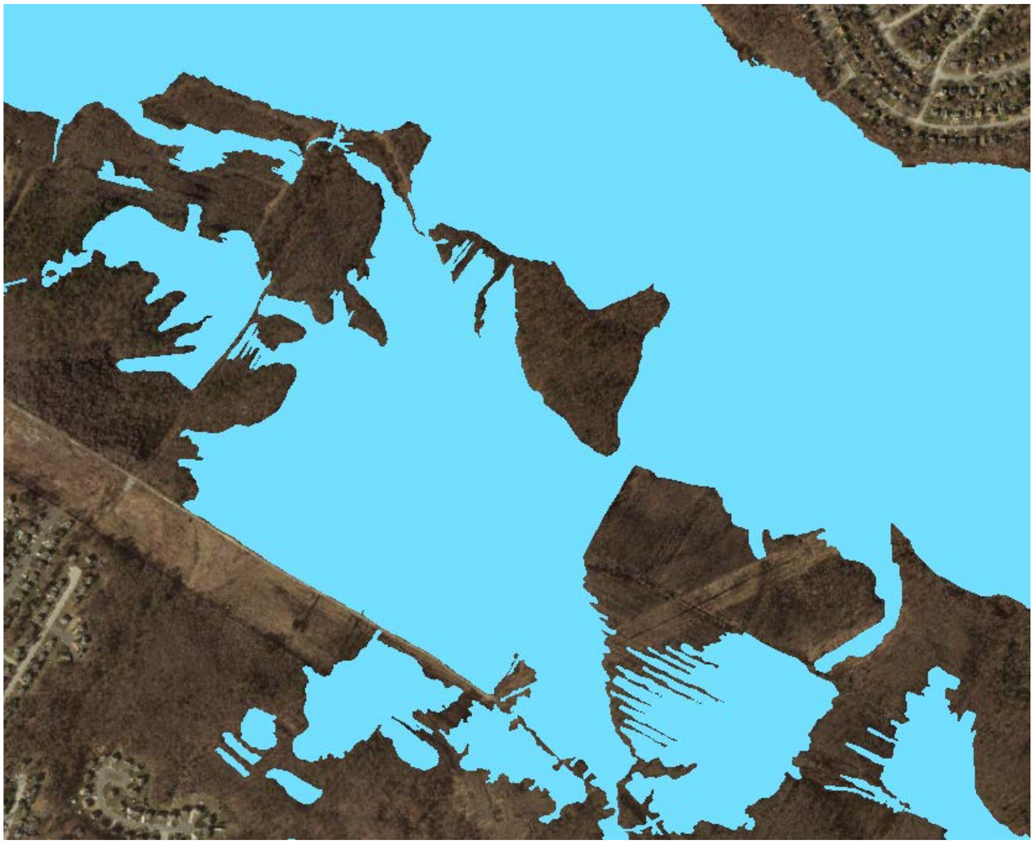

Figure 3: Water as defined by National Hydrology Datasets. The generalization of water merges large areas of wetlands into the water calculations.

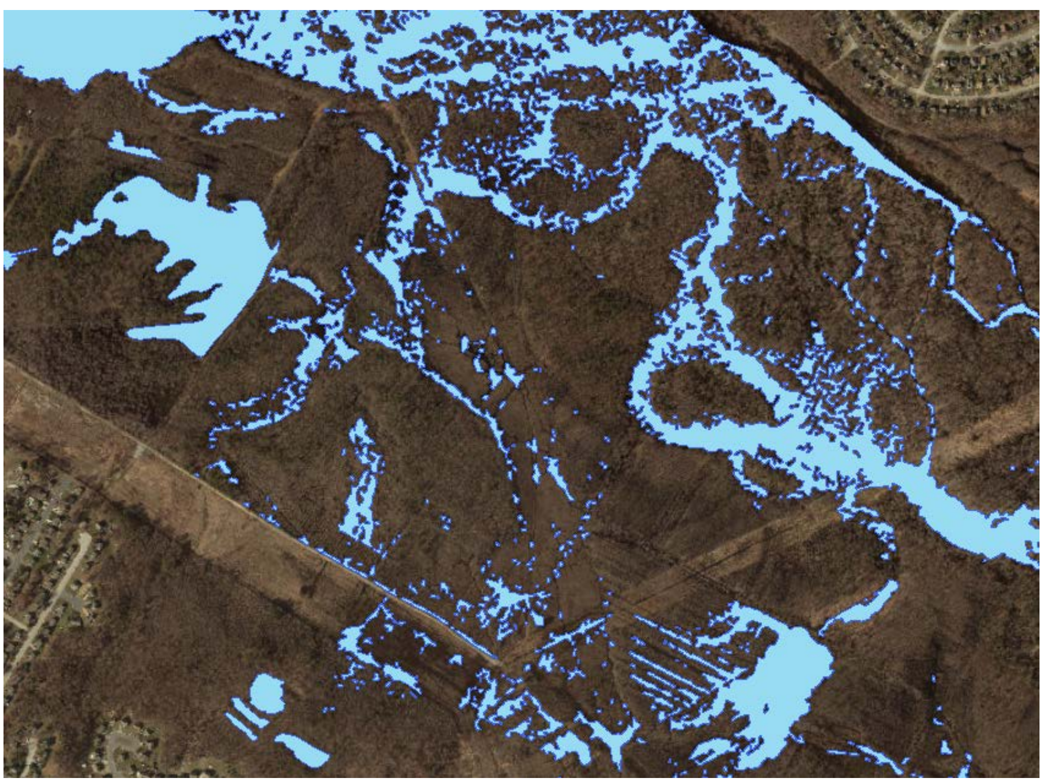

Figure 4: Water as defined by imagery analysis on high resolution local imagery. Notice the difference between water, as defined from a national dataset versus water defined on a local level.

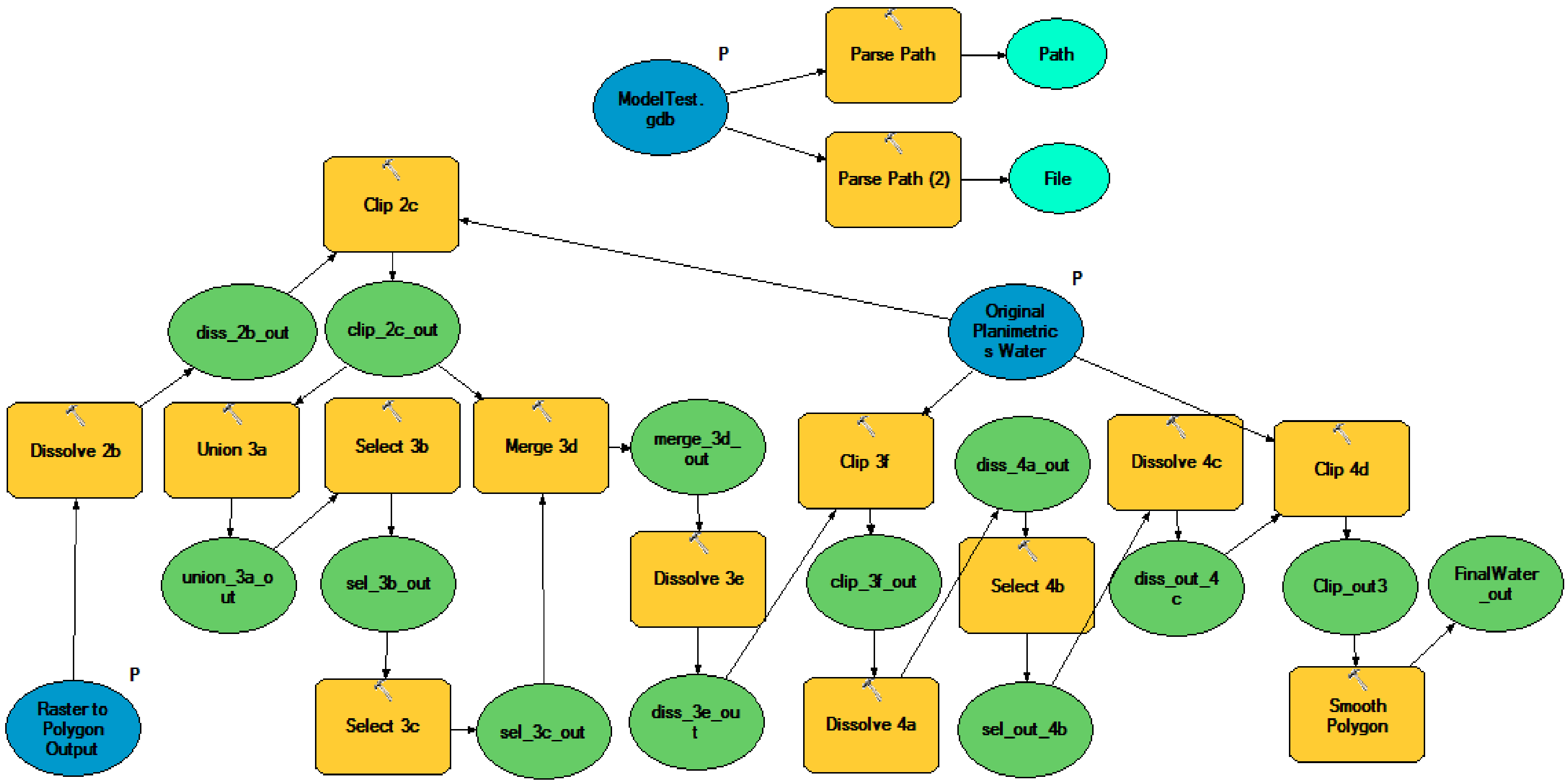

Figure 5: Model of geoprocessing functions used to build the vector portion of the water layer. The 3 parameters are (1) output from raster processing, (2) original Planimetrics layer, and (3) an output geodatabase.