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## **Building Capacity for Protection of Wetland Resources in Virginia - Track One**

Virginia Department of Environmental Quality

Center for Coastal Resources Management - Virginia Institute of Marine Science

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# **BUILDING CAPACITY FOR PROTECTION OF WETLAND RESOURCES IN VIRGINIA – TRACK ONE**

Final Report to the Environmental Protection Agency Region III  
(EPA Grant # BG98392505-9, DEQ Project 51415 Task 14)

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## Introduction

DEQ continues to make significant progress in the development of a comprehensive nontidal wetland regulatory program; refinement of our permitting/compliance database to track impacts, compliance, and compensation by watershed; and continued refinement of our wetland monitoring and assessment tools for use in management decision-making and integration within our water quality programs. This project focused on development of strategies and extension of outreach to improve understanding and protection of high ecological value aquatic resources such as headwater resources and wetlands that may provide added value in improving impaired waters in Virginia. Project activities specifically addressed three of the priority elements in Virginia's approved state wetlands plan. First, it has extended the current online Virginia Wetlands Condition Assessment Tool (WetCAT) to include data from the US Army Corps of Engineers (Corps) ORM database, a modification specifically requested by various user groups, and an upgrade of WetCAT to the Java Script platform. Second, the project provided reports for projects that impact high value aquatic resources, coordinated between aquatic stream biologists and wetland staff in wetland and stream surveys. Third, the project provided continued landuse/wetland calibration for wetland condition models. The WetCAT online tool is available for use by agency personnel and the general public <http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/MonitoringAssessmentStrategy.aspx>. In addition, new outreach strategies were developed targeting local government decision makers and the public. The overarching goal of this grant was to have the project outputs facilitate coordination across all levels of government, educate the public, and provide protection for high ecological value aquatic resources. The Center for Coastal Resource Management, Virginia Institute of Marine Science assisted the Virginia Department of Environmental Quality in the following work products.

## **A. Project Goals**

### **Project Background/Need**

The primary goal of this project was to improve the ability of DEQ to identify, regulate, and protect wetlands in Virginia. Despite no net loss policies and specific guidance for mitigation of wetland impacts, Virginia continues to lose wetlands and ecosystem service capacity through both permitted activities and natural processes. The Commonwealth's Wetland Program Plan (WPP) speaks directly to these threats, and includes a number of actions intended to both enhance regulatory efforts and promote more effective voluntary actions. A keystone in this effort was continued development and enhancement of the online Virginia Wetland Condition Assessment Tool (WetCAT) and promoting its widespread use. The WetCAT goal was to provide easily accessible, comprehensive information for permit decision-makers, and to deliver that information in locality-specific formats, designed to address the needs of planners, regulators, and the regulated public. Improving performance of the management programs will require continuing coordination efforts, and more attention to pre-application guidance for property owners, developers, local planners, and land use managers. The desired outcome is a reduction in impacts to wetland areas and functions resulting from permitted projects in and around wetlands. This is particularly true for high ecological value aquatic resources, such as headwater systems, where development decisions have significant water quality implications. The Commonwealth developed WetCAT as a step in addressing this issue as a comprehensive, spatially explicit data viewer to provide information and guidance for DEQ wetlands permit review staff. Utilization of the tool by DEQ and other regulatory staff has provided significant insight into additional data needs and the need to develop protocols and guidance for use of the tool by other regulatory agencies as well as local government planners and property owners. Enabling and promoting the type of informed planning and decision making desired required (i) software & data enhancements; (ii) continued wetland surveys for regular calibration of the WetCAT models to build reliable data; (iii) incorporation of stream and water quality data, (iv) specific project report generation, and (v) training and outreach materials for localities and the public.

## **B. Project Objectives**

This project directly addressed the EPA Region 3 priority for evaluation of success and monitoring progress on the ecological performance of wetland/stream restoration projects and incorporated the information into the Commonwealth's online tool. The information from this project utilized in the targeting and evaluation of future restoration projects. The project specifically targeted improvements in both regulatory and voluntary practices on a site specific basis in an effort to sustain acreage and function of Virginia's wetland resources, both natural and restored. The project builds on existing program elements, expanding and extending existing strategies for monitoring and assessment, and developing new strategies for planning and outreach/education.

## C. Results and Discussion

The project continues work on previous and ongoing analyses of wetland conditions and management performance. It specifically focuses on building capacity to enhance the Commonwealth's ability to protect wetland resources.

### *Task 1. Enhancements to WetCAT*

#### *Task 1.1: JavaScript Transition*

WetCAT was developed in Flash Builder 4.7 using the ArcGIS Flex API (Application Program Interface). The last release of the Flex API was in November 2014. ESRI discontinued maintenance of the technology and ended its technical support of the product in June 2016. It was necessary to transition WetCAT into the ArcGIS API for JavaScript environment. ESRI is focusing their efforts on developing this product and have created an API with powerful geospatial capabilities combined with modern web technology that will allow many improvements to WetCAT. Improvements include faster times for the geoprocessing tools and a more usable interface resulting in a better user experience. The transition from Flex to JavaScript took some effort, as the programming language is different. This task involved a rewrite of the interface and tools, and the testing of the various modules to make sure all parts work correctly. Reprogramming of the interface and tools is complete. Transition to Javascript has been completed and is now available online.

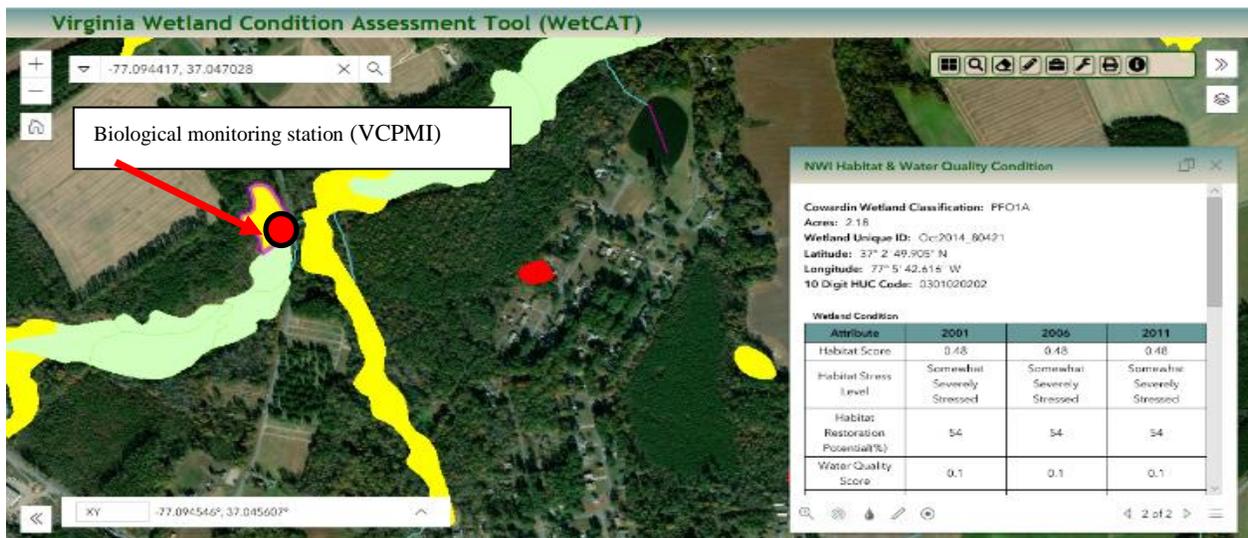
#### *Task 1.2: Expand On-Site Data Collection by DEQ Aquatic Biologist in Support of Wetland Condition Assessment Reporting (WPP Water Quality Standards for Wetlands Goal, WPP Regulatory Goal).*

VIMS-Center for Coastal Resources Management (VIMS-CCRM) worked with the DEQ aquatic biologists to incorporate enhanced data collection in support of WetCAT. This builds on ongoing work where DEQ aquatic biologists were outfitted with tablets with a Level II sampling protocol and trained to collect wetlands data when in the field. The DEQ freshwater probabilistic monitoring program is conducted twice a year on randomly selected stream sites. The WetCAT Level II survey was combined with the aquatic biologists' regular data collection of benthic macroinvertebrates on a subset of at least 30 sites to begin assimilation of wetland condition data adjacent to stream systems catalogued by the freshwater stream program. Field data from DEQ personnel has been collected and DEQ personnel are skilled in collecting stressor condition data. Correlations between wetland stress condition and stream health as defined by Virginia Coastal Plain Macroinvertebrate Index (VCPMI) scores were examined (Table 1) by matching the nearest wetland scored in WetCAT with the biological monitoring station (Figures 1 & 2). VCPMI scores were obtained from the *2014 Report on Toxics Reduction in State Waters*, Virginia Department of Environmental Quality, January 2015, Appendix H1.

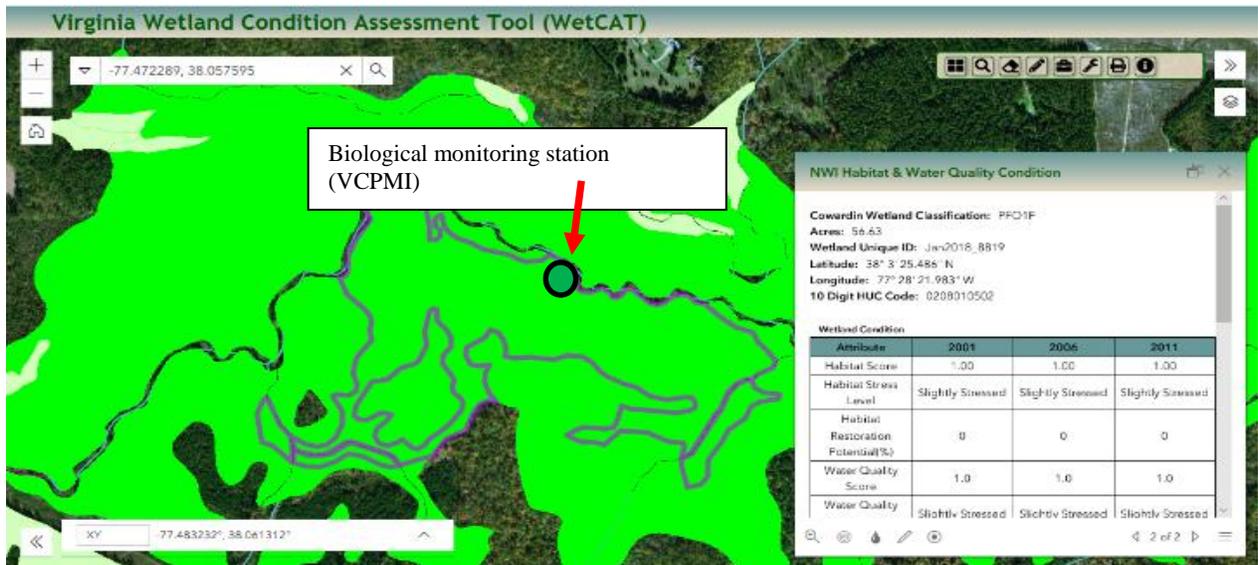
**Table 1.** Wetland stress condition rank matched with VCPMI rank.

Wetland Stress Condition	Rank	VCPMI	Rank
Slightly Stressed	1	Excellent	1
Somewhat Stressed	2	Good	2
Somewhat Severely Stressed	3	Moderately Impaired	3
Severely Stressed	4	Severe Impairment	4

There was a modest correlation between ranking class for WetCAT water quality stress condition and VCPMI (Spearman Rho correlation 0.33,  $p = 0.036$ ) and a stronger correlation between ranking class for WetCAT habitat stress condition and VCPMI (Spearman Rho correlation 0.46,  $p = 0.003$ ). When comparing continuous scores of the predictor variable, habitat stress condition, with the continuous scores of the response variable, VCPMI, there is a significant linear relationship between reduced habitat stress and reduced impairment ( $R\text{-sq (adj)} = 20.4\%$ ,  $p = 0.002$ ,  $n = 39$ ) (Habitat stress condition score =  $0.4791 + 0.003694$  (VCPMI score)). This suggests a relationship between adjacent and nearby wetland condition to stream health (as measured by the VCPMI).



**Figure 1.** Virginia Coastal Plain Macroinvertebrate Index score of “Severe Impairment”; WetCAT Habitat score of “Somewhat Severely Stressed” and a Water Quality score of “Severely Stressed”.

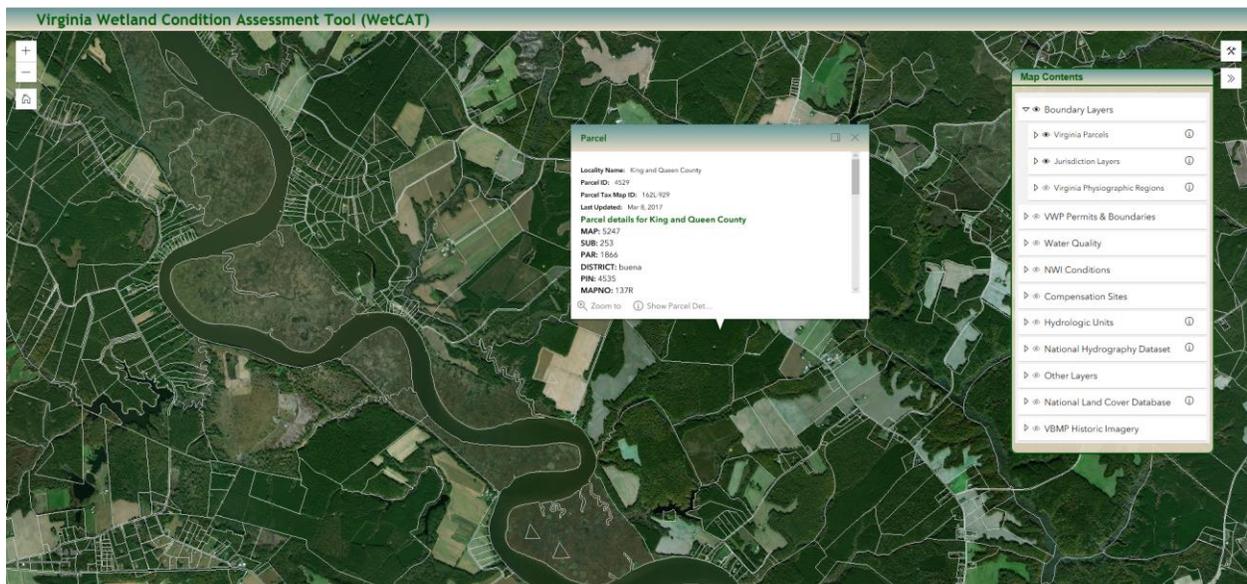


**Figure 2.** Virginia Coastal Plain Macroinvertebrate Index score of “Reference”; WetCAT Habitat score of “Slightly Stressed” and a Water Quality score of “Slightly Stressed”.

Training capabilities were completed allowing for continued data collection beyond project conclusion. Comparisons of stream health indexes with wetland stress condition will continue beyond project conclusion as more data is collected.

### ***Task 1.3: Incorporation of Parcel Maps***

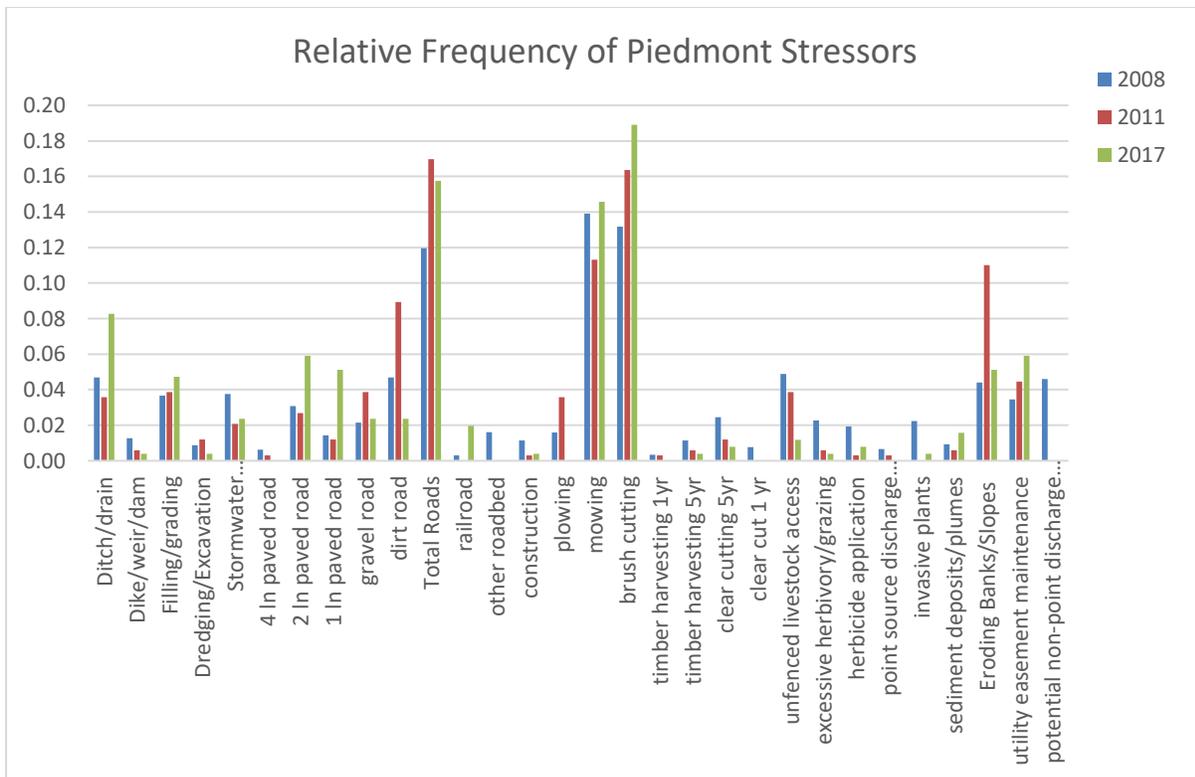
Parcel level maps have been incorporated as a layer in WetCAT, where available, to assist local governments in planning, avoiding and minimizing impacts to wetlands, targeting potential wetland restoration sites, and providing property level resolution for local governments.



**Figure 3.** Parcel level data in new Javascript WetCAT platform.

**Task 1.4: Re-calibration of Piedmont & Ridge & Valley stressors with incorporation of Headwater wetland subcategory**

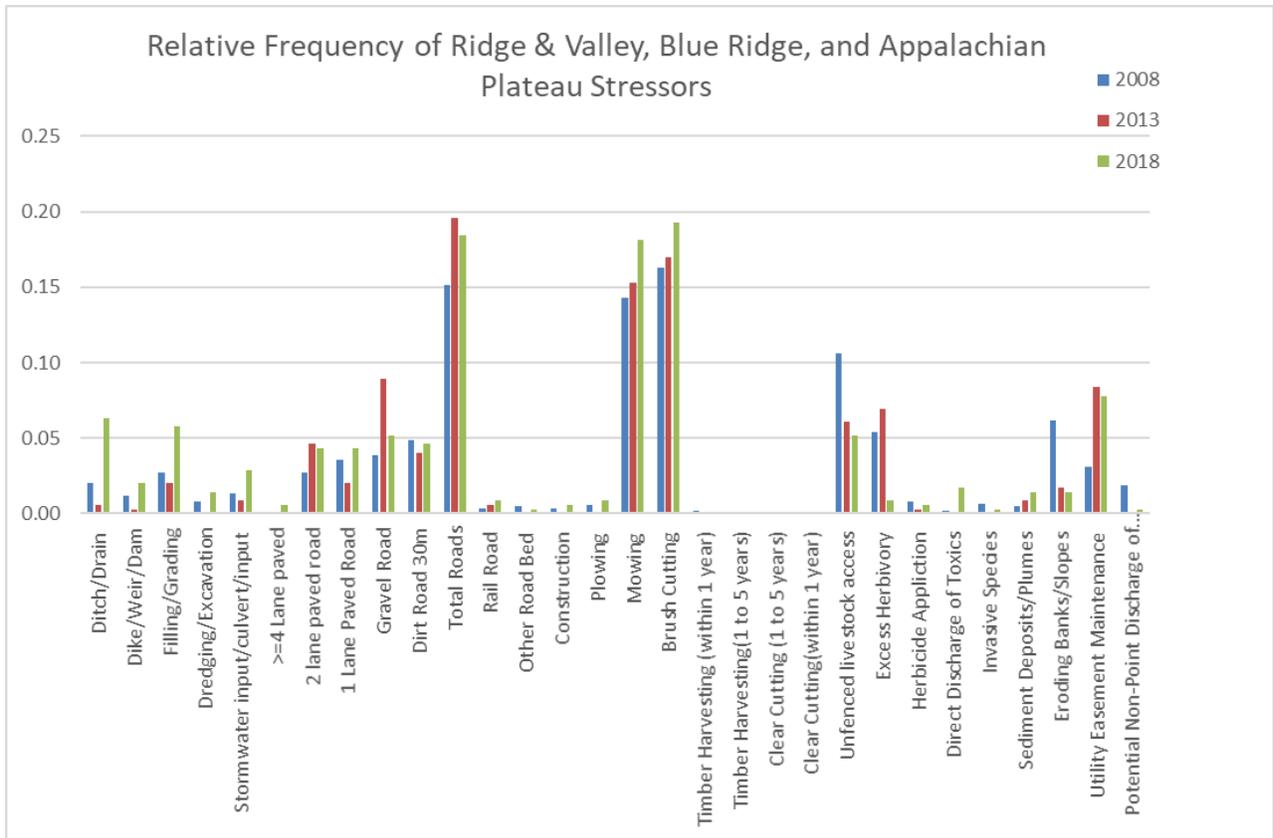
The Virginia assessment model hinges on an assumption about the stressors created by land development patterns. As agricultural practices and urban/suburban development practices evolve, it is essential that the model relationship be regularly recalibrated. Virginia has worked to develop a monitoring and assessment strategy for nontidal wetlands that can support regulatory decision making at the state level. In this task, the headwater sampling protocol developed in the previous EPA State Wetland Grant project (CD96316401-0) was extended as part of the Level II re-calibration process. This protocol considered a larger buffer area for the predictive algorithm in headwater systems. The stressor prediction algorithm requires field sampling to document stressor presence and landuse/landcover composition at enough headwater systems to characterize the relationship. From the previous work, these relationships are known to vary across the geomorphic provinces in Virginia (coastal plain, piedmont, and ridge and valley). This task included the re-calibration for the Piedmont and Ridge & Valley physiographic provinces. The purpose of the recalibration effort is to capture changes in surrounding landcover – stressor relationships at 3-5 year intervals to ensure that the condition assessment model remains statistically valid. The initial Level II Piedmont calibration sample was 600 sites with the re-calibration of 60 sites (10%) and Ridge & Valley calibration sample of 300 sites with re-calibration of 30 sites. Sample methods were identical to the previous re-calibration work (EPA Grant BG 98392503-7). This task resulted in enhanced model validation of wetland condition (habitat and water quality) in the Piedmont and Ridge & Valley physiographic regions of Virginia. Piedmont sampling and analysis has been completed (Fig. 4, 5). Ridge & Valley sampling and analysis has also been completed (Fig 6, 7).



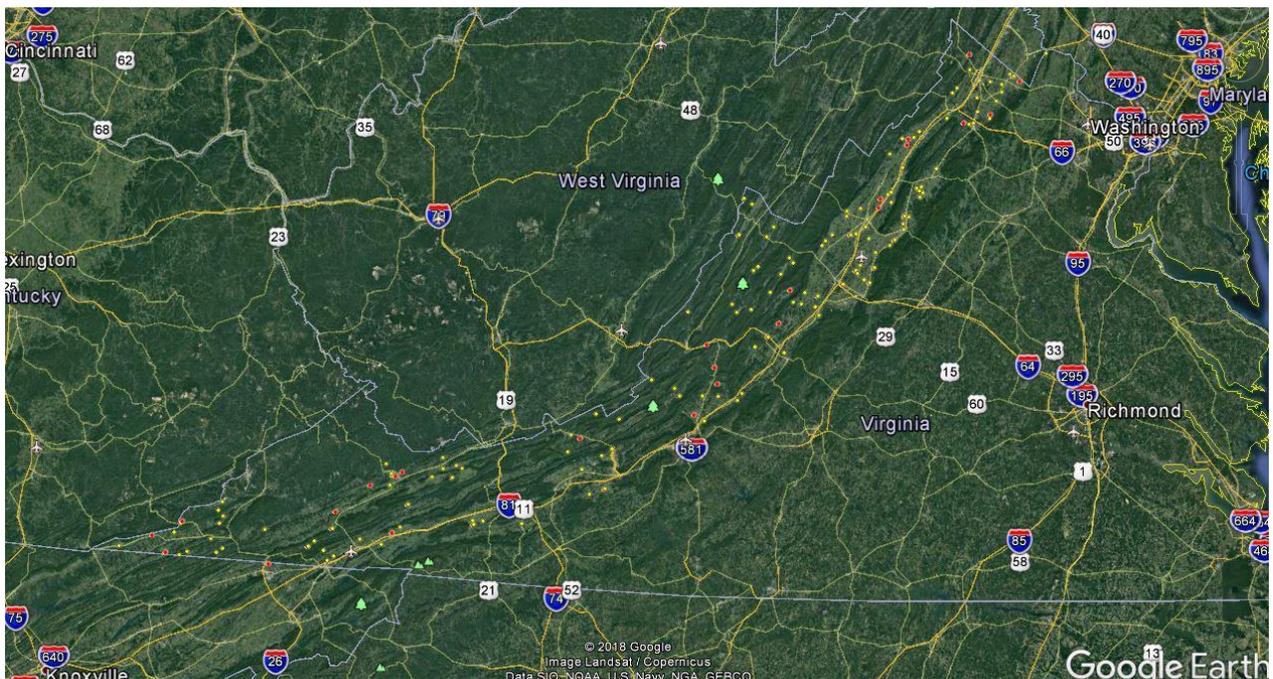
**Figure 4.** Piedmont stressors identified in 2008, 2011 and 2017.



Figure 5. Piedmont sampling sites.



**Figure 6.** Ridge & Valley, Blue Ridge, and Appalachian stressors identified in 2008, 2013 and 2018.

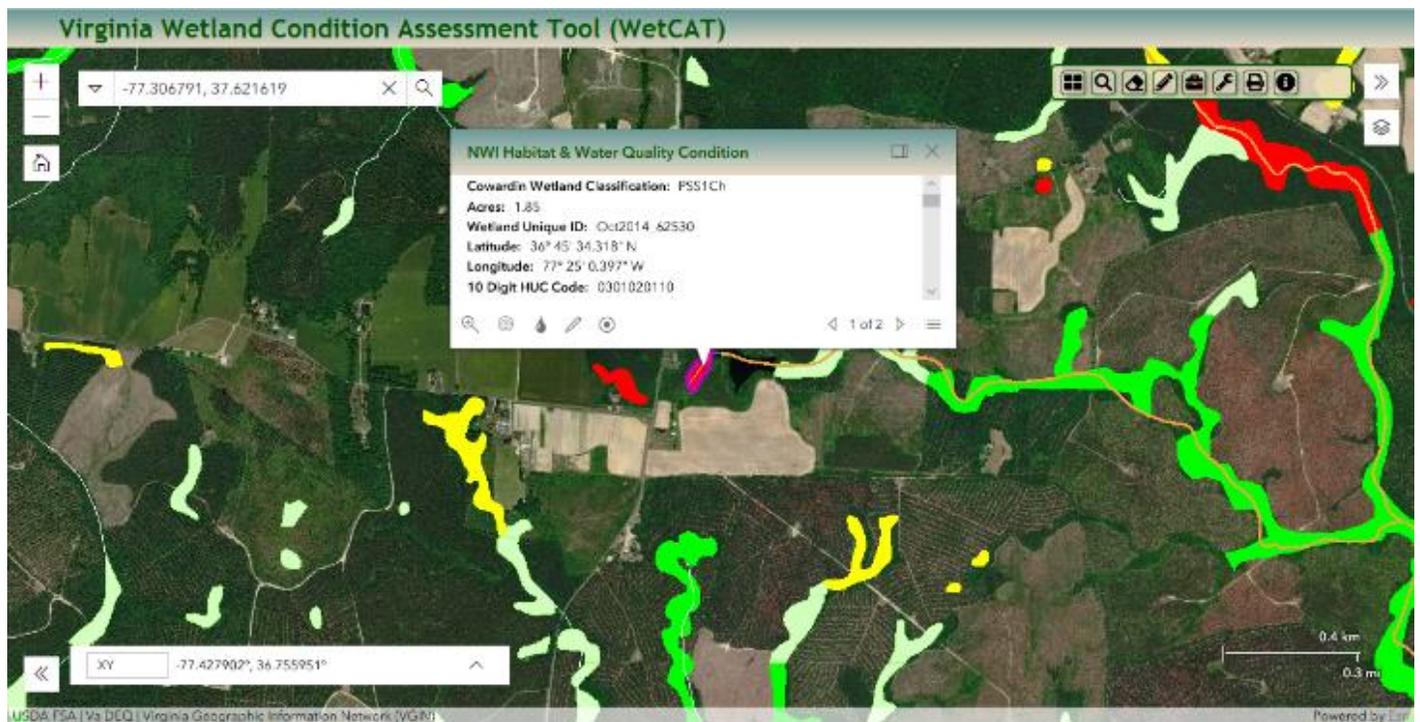


**Figure 7.** Valley & Ridge sampling sites.

**Task 1.5: Develop, Produce, and Deliver Wetland Condition Reports to DEQ and VDOT Permit Staff (WPP Regulation Goal), Including Training**

Generating information and guidance to facilitate better decision-making for DEQ and VDOT personnel is a crucial part of the utility of WetCAT for NEPA studies. VIMS-CCRM worked with DEQ staff in designing and implementing a reporting program to generate critical wetland condition assessment information for DEQ and VDOT staff as well as cumulative impact analysis. Sites selected for report generation prioritize high ecological value aquatic resources, such as headwater wetland systems, and projects that require a high degree of cumulative analysis, such as those associated with transportation corridors. As the reports are used, VIMS-CCRM will continue to assist DEQ in working with the permit staff and NEPA reviewers to further refine the most useful information needed to facilitate their decisions. This will increase the effectiveness of the reports and enhance the engagement of agency personnel in considering cumulative impacts to aquatic resources in both the planning and permitting stages.

Discussions with VDOT and the Corps provided suggestions for incorporation into WetCAT as part of the JavaScript transition. Additional discussions with the Federal Highway Administration and VDOT were conducted. Discussions with Corps took place and are ongoing regarding incorporation of functional assessment parameters and the Corps Norfolk District is presently working on utilizing WetCAT in their functional assessment guidance. A process for an automatic cumulative assessment of set buffers for a report for VDOT NEPA requirements have been incorporated into the new Javascript platform (Resource Manager Summary Report) (Fig. 8a, 8b, 8c). Discussions for continued refinement will continue beyond project conclusion.



**Figure 8a.** Resource Manager Summary Report example.

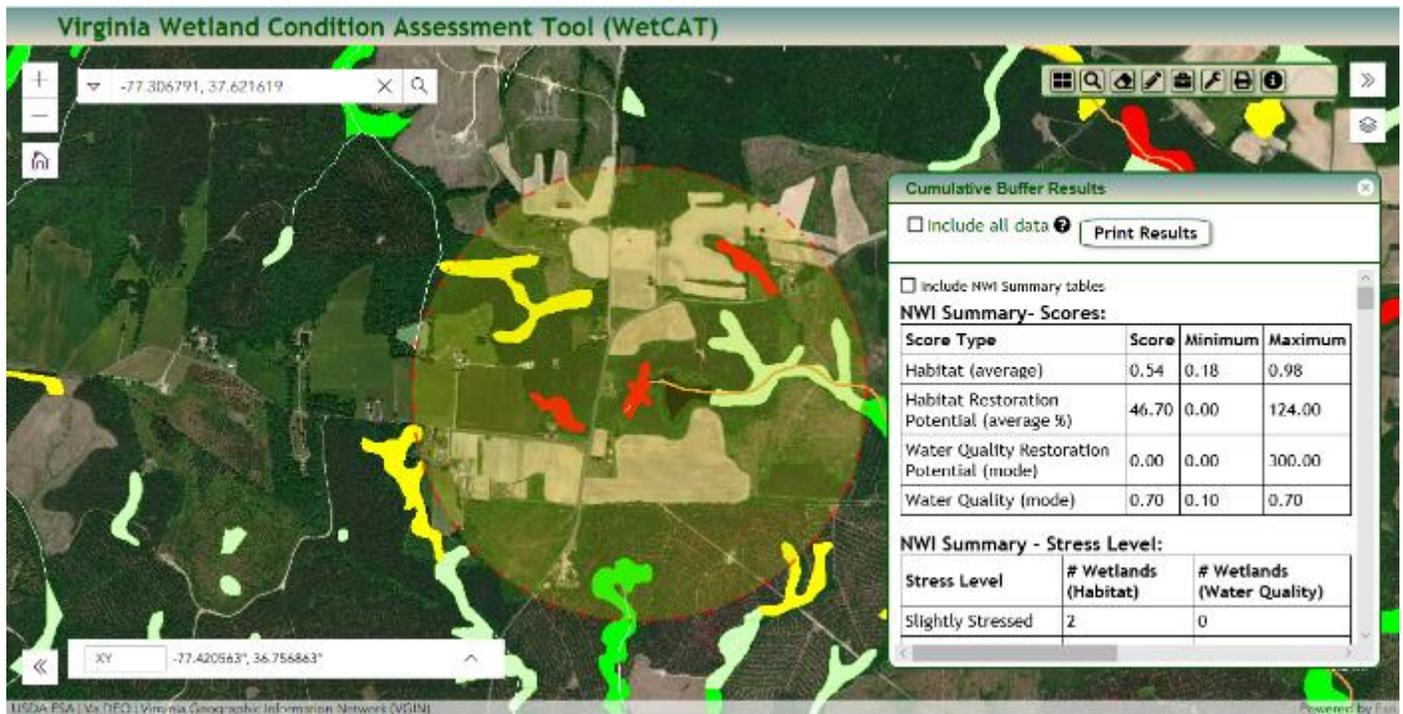


Figure 8b. Resource Manager Summary Report example.

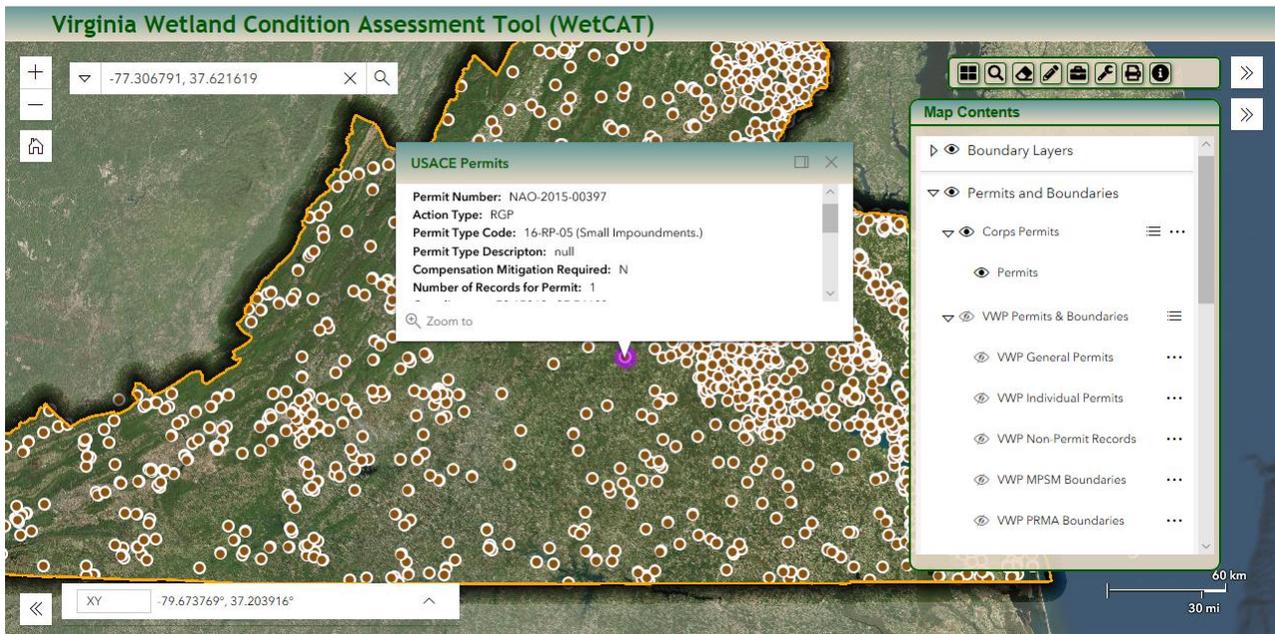


Figure 8c. Resource Manager Summary Report example.

**Task 1.6: Data Extraction & Compilation from EPA-funded ORM Permitting Database (WPP Information Acquisition Goal)**

The goal of this task was to incorporate the Corps' Operations and Maintenance Business Information Link (OMBIL) Regulatory Module (ORM) data into WetCAT. ORM was developed as a central database for standardization in all 38 Corps districts, and is used to support electronic permit applications. ORM is capable of recording and interlinking regulatory actions and storing associated data such as dates, acres, etc. It was apparent that access to the ORM data would be a valuable enhancement to WetCAT to increase capacity for wetland protection and management decisions. ORM data presently is limited in the ability to access the data at different spatial scales without specific data extraction programs. VIMS-CCRM worked with DEQ and Corps staff to enable protocols for incorporating and reporting out ORM data through WetCAT for use in the Commonwealth's wetland protection program. This protocol for ORM spatially explicit data can be transferable to other states and EPA regions.

Discussions were initiated with contacts at the Federal Highway Administration and the Norfolk Corps of Engineers. A Corps ORM contact person was identified. Multiple attempts at contact were initiated including assistance provided by the Norfolk District Engineer; the Chief of the Norfolk District Water Resources Division, Corps; and the Chief of the Norfolk District Regulatory Branch, Corps. Contact with principals at Corps Headquarters involved with ORM database occurred and a point person from the Norfolk District Corps has been designated to help with annual downloads of ORM data to WetCAT. Data from the ORM database has been provided for incorporation into WetCAT with a commitment from the Corps for an annual update. ORM data is now being provided, formatted, and incorporated into WetCAT. A Corps Permit layer has been added to WetCAT (Fig. 9).



**Figure 9.** Corps permit layer added to WetCAT.

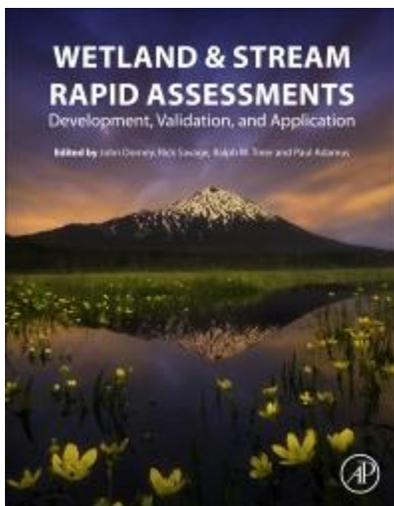
**Task 2. Outreach and training for local government and public on utilization of WetCAT (WPP Outreach/Education Goal, WPP Planning and Sustainability Goal)**

DEQ Wetland staff provided policy documentation for local government and public use of WetCAT. Generating all of the information and guidance to facilitate better decision-making at the local level is only part of the process. In this task, a curriculum was developed for local government staff providing spatially explicit guidance to local planners, the public, and regulators on land use conversions that are most likely to degrade or enhance a wetland's functional capacity. With this information, strategies to minimize potentially significant impacts, and/or compensate for impacts elsewhere can be developed at both the state and local level.

An online curriculum was developed and meetings have taken place with the Corps for utilizing WetCAT as a tool for functional assessment. WetCAT was presented to the Federal Highway Administration in January 2017 and DEQ and VIMS personnel were invited speakers at the Association of State Wetlands Managers 2017 annual meeting and, at the request of the Federal Highway Administration, presented WetCAT as part of a transportation panel. WetCAT was presented to multiple local governments, state agencies, regional agencies, and nonprofits.

The Help/Information (Fig. 10), Curriculum (Fig. 11) and Tutorials (Fig. 12) development has been modified to meet the new JavaScript format.

Information about the WetCAT has been published in the book *Wetland & Stream Rapid Assessments: Developments, Validation, and Application* edited by John Dorney, Rick Savage, Ralph Tiner, and Paul Adamus:



**ACKNOWLEDGMENTS**

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Havens, K.J., Hershner, C., Rudnický, T., Stanhope, D., Schatt, D., Angstadt, K., Henicheck, M., Davis, D. and Bilkovic, D.M., 2018. Virginia Wetland Condition Assessment Tool (WetCAT): A Model for Management. In *Wetland and Stream Rapid Assessments* (pp. 135-149). Academic Press.

## Help/Information

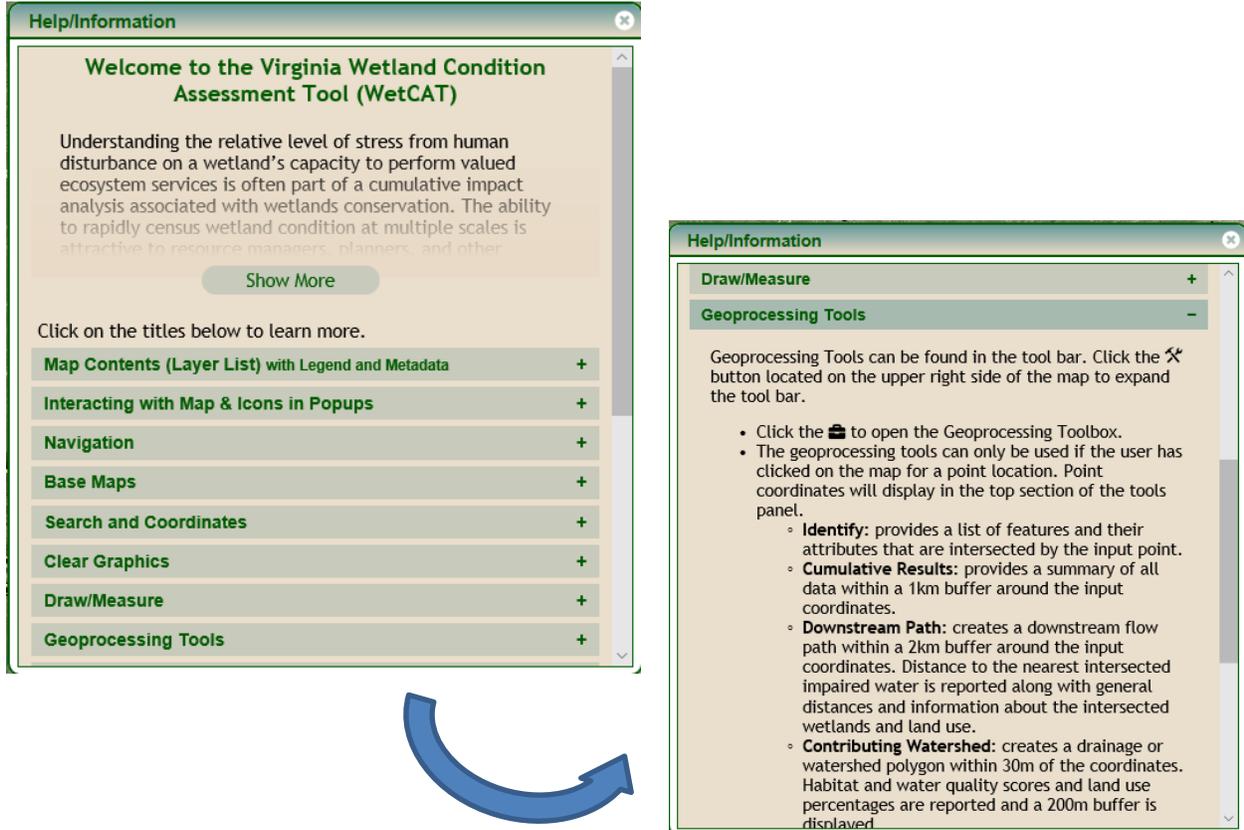


Figure 10. Help / Information guidance.

WetCAT was presented to the following entities:

### Local Governments

City of Chesapeake  
City of Hampton  
City of Newport News  
City of Norfolk  
City of Poquoson  
City of Portsmouth  
City of Suffolk  
City of Virginia Beach  
Isle of Wight County  
James City County  
King George County

Middlesex County  
Stafford County  
Town of Cape Charles  
York County

**Regional Entities**

Hanover-Caroline Soil and Water Conservation District  
Northern Neck Planning District Commission

**State Agencies**

Virginia Department of Conservation and Recreation  
Virginia Department of Transportation

**National**

Federal Highway Administration  
Association of State Wetland Managers

**Nonprofits**

Elizabeth River Project  
James River Association  
Nansemond River Preservation Alliance  
Northern Neck Master Gardeners  
World Wildlife Fund

# Tutorial and Curriculum

The Wetland Condition Assessment Tool (WetCAT):  
A Curriculum for Users

Module 1: Navigating the Website



**The Virginia Wetland Condition Assessment Tool (WetCAT)** is a method that uses different levels of onsite data collection intensity to calibrate and validate remotely-sensed data to develop a model that assesses wetland capacity to perform ecosystem services.

Each wetland is scored for its capacity to perform habitat or water quality ecosystem services based on anthropogenic stress condition. WetCAT provides information for assessing comprehensive and cumulative wetland stress condition at multiple scales.

This curriculum is best used while viewing WetCAT online at [http://cmap2.vims.edu/WetCAT/WetCAT\\_Viewer/WetCAT\\_VA\\_2D.html](http://cmap2.vims.edu/WetCAT/WetCAT_Viewer/WetCAT_VA_2D.html)



- Topics**
- Opening Page
  - Getting Started
  - Example of Different Base Maps
  - Viewing Layers
  - Existing Permits
  - Looking at Individual Wetlands
  - Viewing Parcel Data
  - Using the Geoprocessing Tools
    - Cumulative Results
    - Downstream Pathway
    - Contributing Watershed
  - Printing Information

**Figure 11.** WetCAT Curriculum: Navigating the Website



**Figure 12.** WetCAT online tutorials: Getting Started and Assessing a Wetland, Adding Layers and Using Geoprocessing Tools.

**Table 2.**  
**Project Schedule**

<b>Timeline</b>	<b>Task Schedule</b>
October 1, 2016	Project initiation; Tasks 1.1, 1.5, 1.6, and Task 2 initiated
<i>April 15, 2017</i>	<i>Semi-annual status report to EPA</i>
<i>September 15, 2017</i>	<i>Semi-annual status report to EPA; Task 1.4 (Piedmont) initiated</i>
October 1, 2017	Task 1.2 initiated,
December 15, 2017	1.4 (Piedmont) <b>completed</b> , Task 1.3 initiated
<i>April 15, 2018</i>	<i>Semi-annual status report to EPA</i>
April 30, 2018	Task 1.1 <b>completed</b> , 1.3 <b>completed</b>
June 1, 2018	Task 1.4 (Ridge & Valley) initiated
August 30, 2018	Task 1.4 (Ridge & Valley) <b>completed</b>
<i>September 15, 2018</i>	<i>Semi-annual status report to EPA,</i>
October 1, 2018	All remaining tasks <b>complete</b> ; all draft products reviewed; begin final report
December 31, 2018	Final report prepared and submitted to EPA within 90 days of grant closing.

***Strategic Priorities Addressed by the Work Accomplished in the PPG:***

- The overall outcome of this multi-year grant is the continued progress in the development of a comprehensive nontidal wetland regulatory program; refinement of our permitting/compliance database to track impacts, compliance, and compensation by watershed; and continued refinement of our wetland monitoring and assessment tools for use in management decision-making and integration within our water quality programs.

***Benefits Derived from the PPG Process:***

- The wetland monitoring and assessment program has benefited from streamlined reporting.
- Better project/program coordination has been an asset.

***Any problems, delays or conditions which materially affected the recipient's ability to meet the PPG objectives:***

- **All tasks under this work plan have been completed.** No problems, delays, or conditions were encountered that materially affected our ability to meet the PPG objectives. A timing issue involving project funding required a no-cost one year project extension request. The request was not granted which required a re-scheduling of field sampling efforts. While a delay in obtaining the ACOE ORM database occurred, the task was still completed on time.

***Improved Environmental Results and Improved EPA-Recipient relations that Resulted from the PPG:***

Outputs

- Upgrade WetCAT to JavaScript for wider public use, software enhancements, and dissemination (Task 1.1). **Completed**
- Development of protocols for DEQ aquatic biologists in wetland data acquisition, and linking additional stream ecological data to WetCAT and wetland condition assessment (Task 1.2). **Completed and ongoing as additional data will continue to be collected in the field beyond project completion.**
- Incorporation of parcel maps into WetCAT for higher resolution at the tax map scale and improved local planning and wetland restoration targeting (Task 1.3). **Completed**
- Conduct wetland surveys for re-calibration of the wetland assessment models (Piedmont & Ridge & Valley wetlands with headwater subcategory) – this will maintain the accuracy and scientific credibility of the monitoring program data and support its use in regulatory decision-making (Task 1.4). **Completed**
- Development of a protocol for, and the generation of, project specific WetCAT reports for DEQ and VDOT personnel to demonstrate the efficiency of the tool's capacity for targeting high ecological value aquatic resources (i.e. headwaters) and cumulative impact analysis to aid in mitigation and restoration needs (Task 1.5). **Completed**
- Development of a process to access the Corps' ORM data at a regional or local scale via WetCAT (Task 1.6). **Completed with commitment from Corps for annual updates.**
- Development of protocols and training materials to help local decision-makers and outside agencies utilize WetCAT and integrate wetland protection and restoration into watershed planning (Task 2). **Completed**

Outcomes

- ✓ Improved software platform for WetCAT.
- ✓ Improved wetland protection efforts through the incorporation of the Corps' ORM spatially explicit data into WetCAT.
- ✓ Increased internal agency coordination in wetlands protection and assessment.
- ✓ Increased use of WetCAT in permit decisions across agencies.

- ✓ Increased coordination between local, state, and federal agencies in wetlands management programs (based on use of shared information and assessment protocols).
- ✓ Increased use of WetCAT to avoid high ecological value aquatic resources in pre-application planning.
- ✓ Increased the understanding of a wetland's condition and improve evaluation of environmental impacts to wetlands during permit reviews as part of Virginia's regulatory program.
- ✓ The project will advance the effort to provide accurate and timely data on wetland losses/gains in the regulatory program for multiple stakeholders.

***Project Quality Assurance Report:***

**Project Data Collection Problems**

*Prevented:* NA.

*Discovered:* There were difficulties with obtaining federal ORM data but these were rectified with multiple contacts with USACOE at multiple organizational levels.