Improving Water Quality: Using Technology to Advance the Goals of Watershed Planning

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ABSTRACT

In 2003 the Pennsylvania Environmental Council teamed with Buchart-Horn, Inc. to conduct and prepare a Watershed Conservation Plan (WCP) for the 510 square mile Conewago Creek Watershed located in Adams and York Counties, Pennsylvania. The project was funded in part by a grant received from the Pennsylvania Department of Conservation and Natural Resources (DCNR), Community Conservation Partnership Program, Rivers Conservation Program. Typically a WCP would be a large paper document similar to a County Comprehensive Plan or Zoning Ordinance. Unfortunately, these documents often do not get used as they should. Therefore, Buchart-Horn created an interactive GIS tool that provides planners and other stakeholders the ability to easily access the information within the WCP without having to search through the document. This GIS tool was designed to be used by people with little to no GIS experience. It contains easy to use tools, buttons and drop down lists to assist the user with accessing valuable watershed information.

KEYWORDS

Watershed Management, GIS, Planning, ArcMap, Watershed Conservation

INTRODUCTION

The Conewago Creek is a large watershed in the Lower Susquehanna River watershed. The confluence of the Conewago Creek with the Susquehanna River lies just a few miles north of the Chesapeake Bay, Figure 1. As a result, proper planning and management of the watershed is imperative. The Conewago Creek Watershed is largely overlooked due to its close proximity to other large high profile watersheds. However, in recent years, the watershed in both York and Adams counties has seen significant increase in development and a subsequent decrease in water quality and increase in problem areas such as stream erosion. The Conewago Creek has many unique features, which, if left unmanaged, will face significant pressures from this growth and development. It is widely known that the Conewago Creek is a major contributor of sediment to the Susquehanna River and hence, the Chesapeake Bay. Additionally, a significant portion of the growth and development is in a water quantity stressed area. Yet, growth and development continues.

Recent directives from DCNR indicate a desire to develop long term watershed management plans that utilize new technology in an effort to reduce paper copies and present the plan in an easy to use, logical format. Buchart-Horn, Inc. has extensive experience in technology...
appropriate for watershed planning, the experience to conduct watershed assessments and subsequently the development of a long-term management strategy. Recognizing this experience and expertise, the Pennsylvania Environmental Council, with its own experience with similar plans, teamed with Buchart-Horn, Inc. to prepare the plan. The goal of the River Conservation Program and the subsequent development of Watershed Conservation Plans and River Conservation Plans (RCP) is to develop a long-term management plan for watersheds. The plans are to identify issues, concerns, and threats to resources; identify unique opportunities within the watershed to preserve, protect, and restore the watershed; identify cultural and historic resources including existing and needed recreational opportunities; and a comprehensive list of recommendations for municipalities within the watershed to adopt by way of resolution. Historically, WCPs/RCPs are text extensive technical reports that tend to alienate local stakeholders such as municipal representatives. These municipalities are often rural as well. One of the biggest benefits to the municipalities for supporting the development of such plans is the watershed’s listing on the Rivers Registry. Once the plan is listed on the Rivers Registry, the recommendations in the plan are then eligible for prioritized funding of those recommendations, thereby relieving the municipalities of the responsibility to fund the recommendations in the WCP.

Figure 1. Location Map.
THE CHALLENGE

In most cases, these plans have not been used as the tool for which they were intended. It has been long recognized that these plans contain much more valuable information than what the municipalities can utilize. This is mostly due to the large scale of the plans, which, although required and necessary, prevents municipalities from taking a closer look at their area. Traditionally, plans such as the WCP sit on a bookshelf collecting dust. If they are used at all, it is on a rare occasion that a planner might look at some of the mapping or recommendations within the plan. But even that can be cumbersome given the size of a typical plan. The challenge in the development of these WCP’s became one of format. What format was best for the final deliverable?

THE SOLUTION

To combat this fundamental lack of use and because GIS was already being used to develop the plan, Jayson Romig and Katie Wingerd of Buchart-Horn, Inc. developed an interactive GIS based watershed assessment and management tool whereby users, who don’t need experience, can surf the watershed similar to how internet users can surf websites. The Watershed Toolbox© was developed during to the preparation of the Codorus Creek River Conservation Plan. In 2002, Buchart-Horn, Inc. teamed with the Codorus Creek Watershed Association to prepare the Codorus Creek RCP, which was also funded through the River Conservation Program at DCNR. For the Conewago Creek Watershed Conservation Plan this tool is also being utilized and enhanced to provide a greater range of analysis tools.

This idea of an interactive GIS tool came from other projects that were using field computers to record facility inspection results and edit CAD drawings. The thought of our watershed planners was that if the field computers could be used to record the facility inspection information, then we could develop something similar to be used for watershed assessment and planning. Typically watershed assessment information was collected on paper and then transferred to databases and maps in the office. If data could be collected directly into the databases, efficiency would be greatly improved. The watershed planners wanted to develop something that would record data into a database and then link it to the GIS information. After many brainstorming sessions, the idea of a separate database was dropped and it was determined that the best option would be to record the information directly into the GIS. Thus, the Watershed Toolbox © was created.

The Watershed Toolbox© was initially developed as a separate initiative and then adapted to specific watersheds such as the Codorus Creek and Conewago Creek. As a result, there are assessment functions and planning functions already built in, even though the municipalities only need and require the planning functions as part of the watershed conservation planning process. The toolbox was developed as an ESRI ArcMap interface using Visual Basic programming, which contains a separate toolbar for watershed assessment and watershed reporting. These
toolbars contain several buttons that allow a non-GIS user to easily perform quick map
manipulations, queries and reporting, Figure 2.

Figure 2. Watershed Toolbox© ArcMap interface.

The assessment functions include zooming to a location, layer toggle, map creation and
assessment. The zoom to location button allows the user to create a locational query to refresh
the map to a specific location of interest. It contains methods for searching by sub-watershed,
municipality, grid, or even parcel address, owner or number. The layer toggle provides the user
with a list of layers within the tool and prompts the user to select which layers to view. Map
creation creates a map with a few customized legend items so that the user does not have to add
these items to the map themselves. The assessment portion of the toolbox contains customized
forms designed to prompt the user in the field to assess such features as riparian buffers,
wetlands, problem areas, stream stability, stormwater issues, erosion and sediment control, etc.
The forms are geographically connected in the Toolbox to the actual location in the field and
contain many drop down lists so that the amount of typing required by the user is limited.
Samples of the Forms are displayed in Figures 3 - 4.
Figure 3. Basic Assessment Information Form.
The planning end of the Toolbox includes the same functions for zooming to a location, layer toggle and map creation as the assessment toolbar. However, it also contains functions for developing reports based on the subwatersheds within the main watershed. In order to create a subwatershed report, the user selects the tool and then clicks on the subwatershed of interest within the map. The tool then uses that subwatershed as a cookie cutter to analyze many different layers within the tool. Some of the items that the tool reports are total stream length within the subwatershed, a breakdown of land use by percentage by acre, zoning information, impaired waters, assessment site rankings, etc. The reporting tool also presents the recommendations for that subwatershed, which were developed through the planning process, Figure 5. This reporting functionality and the Watershed Toolbox in general provides planners the ability to easily access information and plan recommendations in the area where they are working; either reviewing a subdivision plan or a zoning ordinance change. While none of the
planning functions are necessarily unique to someone who has experience with GIS, the Toolbox has been designed to perform the same tasks with the click of one button, as opposed to going through multiple steps. As a result, a user doesn’t need GIS training to use the Toolbox.

Figure 5. Subwatershed Reporting within Watershed Toolbox©.
DISCUSSION

Through the development of the Watershed Conservation Plan and the Toolbox, the information collected including, but not limited to: zoning, land use, soils, problems areas, stream instability, soils suitable for infiltration, roads, wetlands, water resources, critical habitat and recreational opportunities are valuable data sets for local municipal planners. Being able to access this data in an easy to use electronic format is valuable in addressing the goals of the Watershed Conservation Plan. Additionally, the Toolbox includes all of the recommendations of the plan so that a user can access that data via the interactive format. For instance, if a municipality wishes to install a recommended boat access, the boat access location is on the Toolbox. The user can click on the location and information on that recommendation will be presented. The Toolbox can easily be updated with new or more current layers. Therefore planners, stakeholders and watershed professionals will be able to monitor progress within the watershed as plan recommendations are implemented.

FUTURE DEVELOPMENT

Because of the usefulness of the Watershed Toolbox©, plans are underway to further enhance its functionality and accessibility. Some of those plans include more customized mapping, automatic layer updating and a web-based version. The web-based version will be developed using ESRI’s ArcIMS internet mapping software. By moving to a web-based version, the user will not need GIS software to access the information, mapping and reports.

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