



**Report from the  
Watershed Needs Assessment Team  
to the  
Mitigation Coordination Group**

**October 2003**

## **Acknowledgements**

The Watershed Needs Assessment Team (WNAT) would like to acknowledge a number of people who helped this project along. These include our facilitator, Chris Russo, NC Department of Environment and Natural Resources (NCDENR); Allan Axon, GIS Administrator for NC DENR; the Center for Geographic Information and Analysis and its employees, Colleen Kiley and Jeff Brown; the NCDENR Division of Environmental Health's Source Watershed Assessment Program; the US Federal Highways Administration for their financial support of the development of the Ecosystem Enhancement Program (EEP), part of which was used to help the team develop the GIS screening methodology; numerous individuals who provided feedback on the report; and Mollie Doll of Treefrog Resources who helped pull the document together into a polished product.

The WNAT team leader, Suzanne Klimek of the NC Wetlands Restoration Program (NCWRP), extends special thanks to all of the members of the team for their dedication and hard work on this challenging project. It was their commitment that brought this report to fruition.

## **Partnering for Watersheds**

This report is a product of an interagency workgroup from the following agencies:

- NC DENR Division of Coastal Management
- NC DENR Division of Water Quality
- NC DENR Natural Heritage Program
- NC DENR Wetlands Restoration Program
- NC Department of Transportation
- NC Wildlife Resources Commission
- US Army Corps of Engineers
- US Department of Agriculture, Natural Resources Conservation Service
- US Environmental Protection Agency
- US Federal Highways Administration
- US Fish and Wildlife Service
- US Forest Service

## The Executive Summary

As part of the establishment of a new program designed to provide compensatory mitigation for the NC Department of Transportation (NCDOT) road projects, three teams of state and federal resource agency professionals were convened to develop specific methodologies for application in the program. One of these teams, the Watershed Needs Assessment Team (WNAT), was charged with developing methods of watershed assessment for the Ecosystem Enhancement Program (EEP). The multi-agency workgroup met semi-monthly for one year to develop products outlined in the team's agreed upon charter.

There was broad agreement among WNAT members that the identification and implementation of compensatory mitigation projects through a watershed approach is a positive course to take. Members expressed a desire for team products that were comprehensive in nature with broad types of solutions identified, including those that would satisfy current compensatory mitigation requirements. The team recognizes that complementary projects beyond restoration done for mitigation purposes can act synergistically to restore the overall ecological health and function of a watershed.

The team's efforts resulted in two assessment methods designed to build on one another. The first, called the screening methodology, allows for a comparative analysis of 14-digit hydrologic units (HU) within an 8-digit catalog unit (CU) in order to select appropriate watersheds for detailed assessment and management plan development. This screening analysis relies heavily on GIS technology to evaluate watershed assets and problems with the intention of selecting watersheds that have a mix of assets and problems. These watersheds provide an opportunity for mitigation dollars and other resources to protect and improve existing assets (such as endangered species populations or intact riparian buffers) while addressing specific problems (such as degraded habitat or water quality impairment).

In developing the second method, the detailed watershed needs assessment methodology, the team determined that providing overall guidance and a general assessment framework was more appropriate than providing a highly prescriptive method. The reason for this lies in the uniqueness and complexity inherent in individual watersheds, and the variety and number of assessment tools available for watershed analysis. Effective watershed assessment must allow watershed planners and managers to apply the most appropriate tools available for a specific situation. The assessment framework reflects the team's definition of watershed needs assessment, which is "a comprehensive analysis of current watershed condition and identification of actions necessary to achieve desired watershed goals". The framework is organized around three questions inherent in the definition:

- 1) What do you have now? (current condition);
- 2) Where do you want to be? (desired future condition/goals and objectives); and
- 3) How do you get there? (watershed management solutions).

The team emphasizes several considerations regarding this product. First, the methodologies presented herein should not be viewed as static. Although it is envisioned that the EEP will adhere to the guidance, improvements should be made, as feasible, based on data availability,

changes in technology and other factors. The team intends to reconvene at appropriate junctures in the future to assess the performance of this guidance within the EEP.

Another important issue related to both methods is the importance of GIS data. GIS is a very powerful tool, but in order for its application to be maximized, the geographic data upon which it is based must be accurate and current. Therefore, the WNAT recommends general support for the maintenance and development of GIS data layers and makes specific reference to the importance of land use/land cover data among other coverages.

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## SECTION 1

# Background and Context

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## Background

In August 2002, a multi-agency team was formed to develop watershed assessment methodologies for a new program, the Ecosystem Enhancement Program (EEP). The Watershed Needs Assessment Team (WNAT) was one of three teams charged with developing specific features of the EEP. This program and the associated teams are an outgrowth of a process improvement initiative that sought to improve the current mitigation process for ecosystem impacts of transportation development [NCDENR, US Army Corps of Engineers (USACE), NCDOT, 2002].

## The Ecosystem Enhancement Program

The EEP, formally established in 2003, is within the NC Department of Environment and Natural Resources (NCDENR). It is charged with meeting the NC Department of Transportation's (NCDOT) compensatory mitigation needs statewide. These needs will be met in advance of the permitted impacts within a given 8-digit catalog unit (CU), will provide functional replacement of impacts in that CU and will address impacts through a watershed approach.

**EEP PURPOSE:** The purpose of the EEP is to provide a comprehensive, natural resource enhancement program that identifies ecosystem needs at the local watershed level and preserves, enhances and restores ecological functions within the target watersheds while addressing impacts from anticipated NCDOT transportation projects.

**EEP MISSION:** The EEP mission is to restore, enhance, preserve and protect the functions associated with wetlands, streams and riparian areas including, but not limited to, those necessary for the restoration, maintenance and protection of water quality and riparian habitats throughout North Carolina.

A Memorandum of Agreement (MOA) between the partnering agencies (NCDENR, USACE and NCDOT) was signed July 22, 2003. Key provisions of the MOA include:

- Execute the requirements placed on the NCDENR by the North Carolina Wetlands Restoration Program Act (NCGS 143-214.8, et seq.);
- Enhance the natural resources of North Carolina by addressing watershed needs;
- Satisfy compensatory mitigation requirements for authorized impacts on a programmatic, watershed-level basis;
- Provide in-ground, functioning compensatory mitigation for authorized impacts in advance of the actual impacts;
- Satisfy the compensatory wetland, stream and buffer mitigation needs of the NCDOT Transportation Program; and
- Provide a means for organizing, steering, funding and implementing ecosystem enhancement efforts in North Carolina.

The MOU can be viewed in full through the USACE Wilmington District web site at:  
<http://www.saw.usace.army.mil/wetlands/library.html#Memorandums%20of%20Agreement>.

## **Team Context**

The products of the WNAT will be used in conjunction with those from two other teams in support of the EEP. The WNAT was charged with developing watershed assessment methodologies for the EEP. The other two teams, the Stream Functional Assessment Team and the Wetlands Functional Assessment Team, were each charged with developing methods for measuring the functional impacts of road projects on streams and wetlands, respectively. Their methodologies, scheduled to be completed in late 2003, will include a GIS-based method to characterize functional impacts at a broad scale, and a field-based method that will provide a more detailed and accurate assessment of functional impacts at a project-specific scale. The Stream Functional Assessment Team and the Wetlands Functional Assessment Team products will also be used to measure functional replacement provided by compensatory mitigation projects implemented by the EEP.

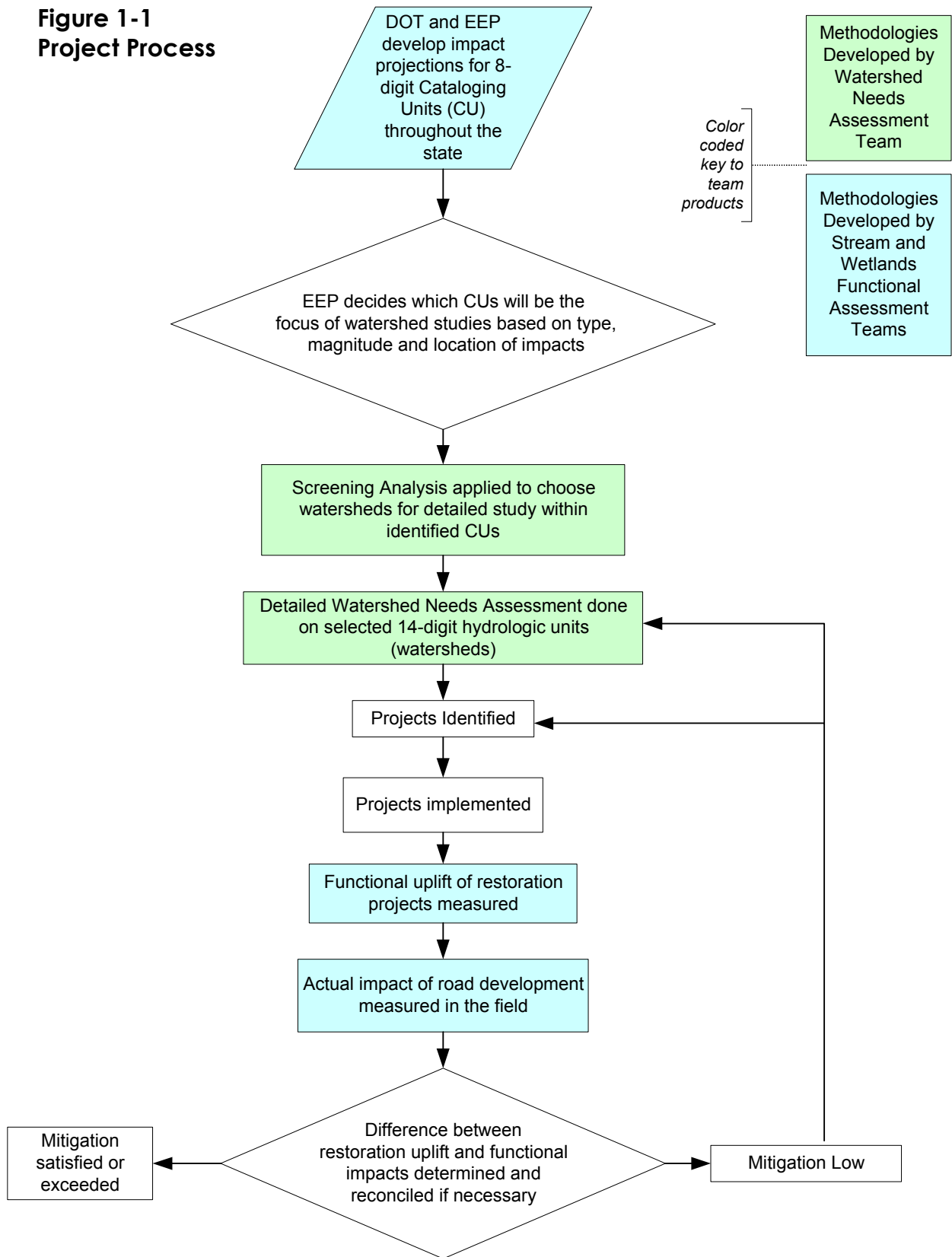
Figure 1-1 illustrates how all of these efforts fit into overall EEP processes. This diagram provides a general context for the methodologies in this report. It begins with the statewide assessment of functional impacts for 8-digit CUs, flows through watershed selection and detailed evaluation, and culminates with the specific measurement of road project impacts and the level of functional improvement associated with compensatory mitigation projects.

## **Team Charter**

To provide guidance on the development of EEP, a Coordination Group with representatives of participating agencies was established. The Coordination Group worked on the development of the WNAT's charter, which provided the team with direction for their work. The team's charter (see Appendix A) included the following key provisions:

- Develop methodologies to comprehensively assess the current conditions of watersheds related to water quality, aquatic and terrestrial habitat, land uses and overall ecosystem health;
- Ensure the consideration and incorporation of the environmental goals and priorities of applicable resource management agencies and stakeholders as appropriate; and
- Develop a comprehensive list of the types of projects that will address identified needs and problems, some of which must be suitable to meet the compensatory mitigation requirements of Section 404 permits.

**Figure 1-1  
Project Process**



The WNAT charter also outlines the following deliverables to be produced by the team:

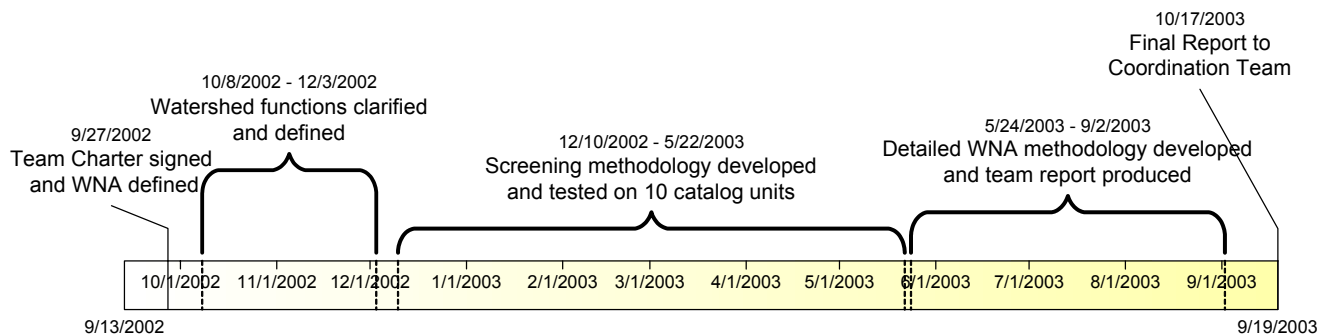
- A Watershed Needs Assessment Methodology accepted by applicable resource management agencies;
- The scale of watershed assessment for each ecosystem function of interest;
- A guidance manual outlining the watershed needs assessment process;
- Standard protocols to establish goals and objectives for each watershed;
- Protocols for the selection, evaluation and prioritization of projects, including compensatory mitigation;
- Recommendations concerning the frequency of review and revision of watershed plans including who should be responsible for long-term project implementation and monitoring strategies within the prioritized sub-watersheds;
- Recommendations for integrating the assessment outcomes/conclusions into a statewide GIS layer;
- Criteria to measure the ecological effectiveness and cost effectiveness of identified projects;
- Resources (staff and funds) necessary to implement the recommended watershed assessment procedures throughout North Carolina.

The WNAT met twice a month over the course of a year to develop the described products. This document presents the results of its work.

## Team History

Figure 1-2 provides a visual description and timeline of the team's major activities. Although there were clear focal points of the team's discussion, there was also simultaneous consideration of other aspects of the project. For example, as the team worked on the development of the screening methodology, there were times when attention would be given to the detailed assessment methodology.

**Figure 1-2: Overall Project Timeline**



There were several important milestones in the WNAT's efforts. These began with laying the basis for its work by understanding ground rules and agreeing on the charter. Effort was also expended in the beginning to make sure that the team composition included the appropriate representatives. By late September of 2002, the majority of members had signed the team's charter. The representative of the US Environmental Protection Agency elected not to sign due to

concerns regarding the status of the time and objectives of the EEP relative to the requirements of federal compensatory mitigation.

Once the group composition and direction was solidified, the first task was to develop definitions for critical concepts related to the overall project. By the end of the year, the team had defined the term “needs assessment” and the appropriate watershed functions of interest (presented in Section 2). Over the next several months, the team devoted its efforts to developing the screening methodology for selecting of watersheds for detailed analysis. During this time the team also reviewed products of detailed watershed assessments to prepare for targeted deliberations on the detailed needs assessment method. By the spring of 2003, the WNAT was on the front end of developing the detailed watershed needs assessment methodology.

Coordination with the Stream Functional Assessment and Wetlands Functional Assessment Teams has been ongoing since their launch in mid-2003. In addition, the Coordination Group has been kept abreast of WNAT progress and was provided timely updates at their meetings held in January, March and July of 2003.

### **Future Actions**

The WNAT acknowledges the need to reconvene as necessary to evaluate watershed planning products that have been developed and determine whether the methodologies are resulting in desired outcomes. The planning efforts currently underway for the Ecosystem Enhancement Program are scheduled for completion in late 2004. At an appropriate juncture, the WNAT team leader will set up a team meeting to review and evaluate the products of these efforts. This meeting is likely to occur in early 2005. At another time, the EEP will need to apply the screening analysis to select watersheds for detailed evaluation. At that point, the WNAT should be included in the described feedback process and allowed to evaluate the analysis’ performance. An addendum to this report describing the results of subsequent WNAT deliberations and conclusions will be provided as appropriate.

## SECTION 2

# Key Definitions and General Assessment Approach

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## Key Definitions

Before the WNAT could begin the development of assessment methodologies, it was important to establish working definitions for key aspects of the project. The team first clarified the meaning of ‘watershed needs assessment’. Then, because these methodologies will be used in the context of functional impacts and replacements, the team worked to clarify functions of interest at the watershed level. Additionally, some terms and concepts, such as assessment scale, were defined as requested through the charter. Key definitions developed by the WNAT are described below.

### *Watershed Needs Assessment*

The team defined watershed needs assessment as follows:

**A Watershed Needs Assessment is a comprehensive analysis of current watershed condition and identification of actions necessary to achieve desired watershed goals.**

This definition framed the work of the group by identifying three components of a watershed needs assessment: assessment of a watershed’s current condition (in terms of watershed function), the identification of desired watershed goals for the individual watershed and the identification of actions necessary to achieve those goals.

### *Ecosystem Structure and Function*

During the team’s early discussions, the concept of ecosystem structure and function was identified as critical to developing methodologies for watershed assessment. These terms were defined as follows:

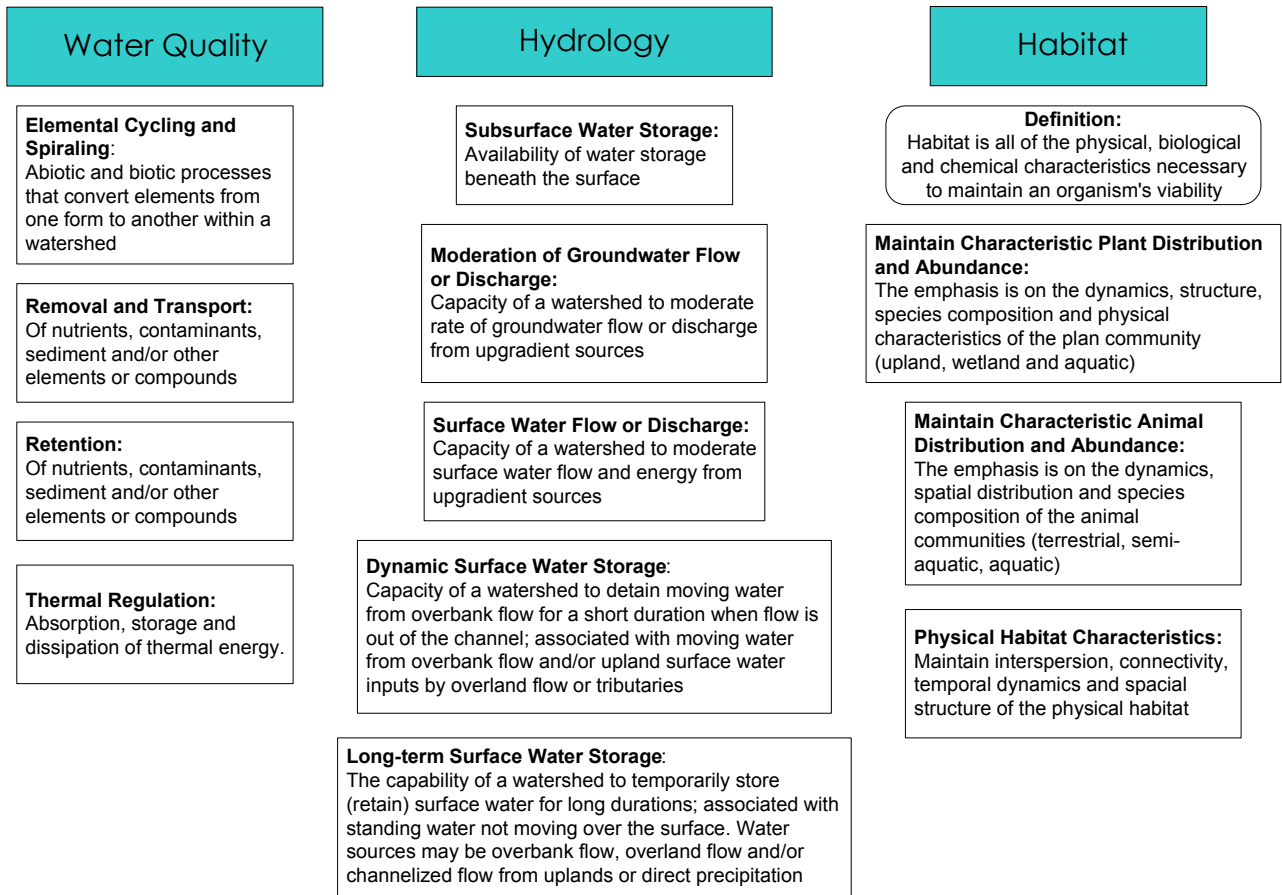
**Structure** – the distribution and characteristics of the physical, biological and chemical ecosystem components

**Function** – results/outputs of the interaction of the physical, biological and chemical (structural) components, including external factors of the ecosystem

### *Watershed Functions*

To establish a functional context for watershed assessment, the Coordination Group provided the team with four major functions, or functional categories, to consider during their work. These were water quality, hydrology, aquatic and terrestrial habitat. Relying heavily on functional definitions for wetland systems developed by Mark Brinson and his colleagues at East Carolina University (Brinson, et al., 1995), the team worked to describe the major functions provided in a watershed context. One result was that terrestrial and aquatic habitat were combined into one category for habitat. The team took a broad view of the habitat function inclusive of aquatic and terrestrial biology. The water quality function was defined more narrowly, focusing primarily on chemical attributes. Figure 2-1 presents the definitions of watershed functions upon which the team agreed.

**Figure 2-1: Watershed Functions as Defined by the WNAT**



The definitions helped the WNAT develop a common understanding of watershed functions. The description of the detailed needs assessment methodology (Section 4) should make apparent that there is a distinction between the definition of a function and indicators of function that can be measured as part of a watershed assessment.

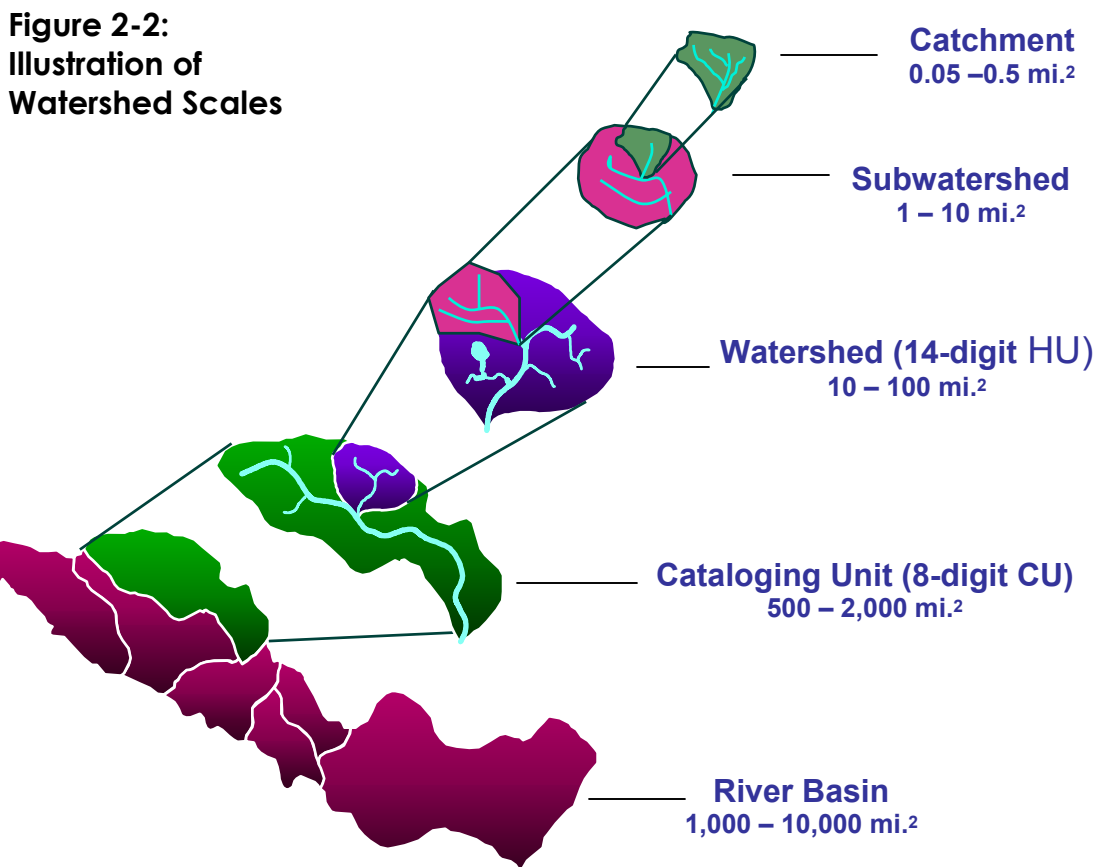
**Scale**

The WNAT’s charter specifies that the team will develop a scale for assessment of each function of interest. Early in the process, the team agreed that detailed watershed assessment should generally occur at the 14-digit hydrologic unit (HU) level although the team acknowledges that all HUs are not true watersheds (for example, some defined HU boundaries include only the mainstem section of large rivers). The functions of interest will be considered within those boundaries. The team agreed that there are some situations where it makes sense for a watershed study area to go beyond one 14-digit HU (such as when the HU of interest is downstream of a headwater HU) and that procedures should provide flexibility for these situations.

The team agreed that the assessment of a 14-digit HU should include dividing the management unit into smaller subwatersheds for evaluation. This is consistent with the approach recommended by the Center for Watershed Protection (1998).

***Nomenclature***

In an effort to use the same terms in our discussions, the team adopted a standard nomenclature for referring to watersheds of various sizes. These terms were promoted by Clements (Clements, et al., 1996) and have also been adopted by the Center for Watershed Protection. Moving from the larger to the smaller, important watershed management units include the river basin, watershed (14-digit HU), subwatershed and catchment. Figure 2-2 illustrates these units and describes their general size in square miles.



## General Assessment Approach

### *Introduction*

The WNAT was charged with the ambitious task of developing the methods by which watersheds would be assessed under the EEP. The team wanted to achieve the following key outcomes:

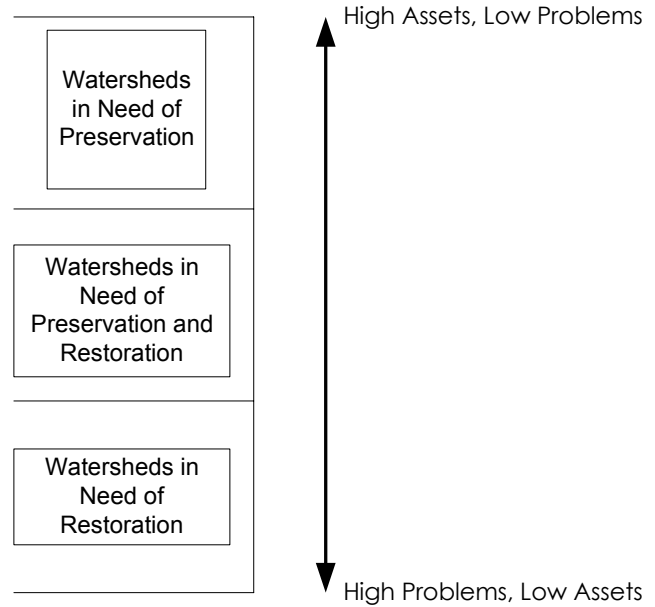
- Clear guidance on how to conduct watershed planning and project implementation under the EEP;
- Flexibility to allow for the application of appropriate tools in each unique watershed situation; and
- A framework to allow for the implementation of a variety of projects, not limited to those that will satisfy compensatory mitigation requirements.

The team worked to balance the need to have a comprehensive assessment tool and the need to provide for a certain level of flexibility in its application. Clearly, all watersheds are not created equal and there are numerous tools available to watershed planners to evaluate watersheds. With this in mind, the WNAT worked to provide a certain level of detailed guidance while allowing for the utilization of tools most appropriate to the watershed under study.

### *Team Vision for the Application of the Methodology*

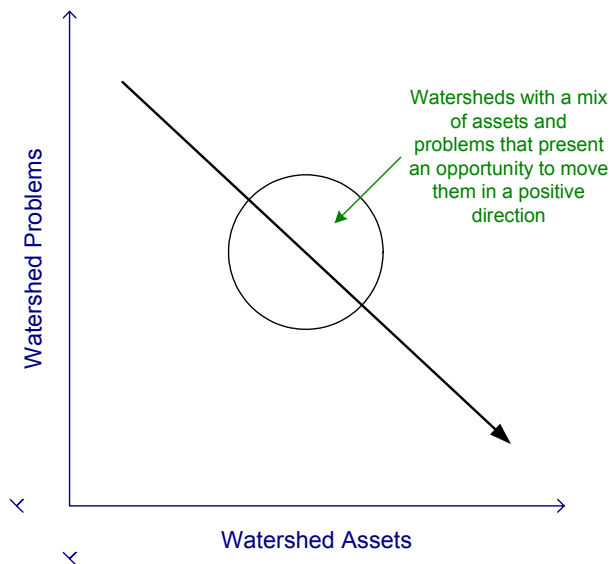
There was broad agreement that the methodologies produced would allow for comprehensive assessment of all aspects of a given watershed. All watersheds are comprised of both positive (assets and resources) and negative attributes (problems or deficits). Good qualities are generally characteristics such as excellent stream biology, the presence of protected species or vegetated riparian buffers; bad or negative qualities could include evidence of water quality or habitat degradation or large percentages of impervious surface. A general team goal was to move watersheds along a continuum such that negative aspects are addressed and minimized while positive aspects are protected. When viewed in these terms, watersheds fall into three broad groups for action: those primarily in need of conservation or preservation actions; those primarily in need of restoration; and those in need of a mix of those two basic types of actions (Figure 2-3).

**Figure 2-3: Major Groupings of Watershed Needs**



The team expressed interest in evaluating watersheds that are comprised of a mix of assets and problems. While arguments can be made for focusing on either highly degraded watersheds with few assets remaining or on pristine watersheds with many assets but few existing problems, the team felt it most appropriate for EEP to focus detailed watershed assessments on areas that have some of both. That is, where it can in the context of watershed needs assessment, EEP should try to select watersheds with both some degradation to address and some assets to protect or improve. For individual watersheds, the relative amount of assets or good qualities should be increased while the amount of watershed problems should be decreased (Figure 2-4). As assets improve and strengthen, the problems decrease and are less evident. Fostering positive changes within watersheds requires the implementation of a mix of projects or treatments concentrated in one watershed. Such projects could include restoration activities, preservation and conservation, various best management practices and land use/growth management at the local level.

**Figure 2-4: Problems and Assets Summarized Graphically**



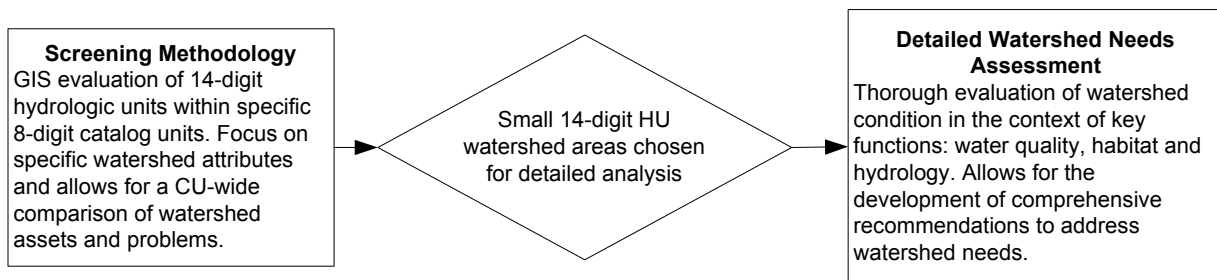
This approach is not intended to constrain the EEP from working in areas that are more strongly characterized solely by either assets or problems. It is the team’s belief that watersheds possessing a balance of assets and problems are those most appropriate for detailed planning and are more likely to yield measurable results.

The assessment approach presented herein, although comprehensive in nature, is not intended as an endorsement of any type of project for the purposes of mitigation. Assessment of what projects, or types of projects, will generate mitigation credit and how much is beyond the scope of the team’s effort and this report.

## Overall Process

The results of the team’s work yielded two methodologies that build on one another and travel from more broad evaluations to more detailed analyses. These are: 1) a screening methodology to be used in the identification of watersheds (14-digit HUs) for detailed study; and 2) a detailed watershed assessment framework that will be used to establish watershed needs and ecologically effective projects to address them. These methodologies, which are initiated after the EEP has selected the 8-digit CU of focus, are described individually in Sections 3 and 4. Figure 2-5 provides an overall illustration of how these methodologies fit together.

**Figure 2-5: Watershed Screening and Assessment Process**



The result is the implementation of recommendations inclusive of projects that can be used to meet compensatory mitigation requirements, as well as other appropriate solutions that complement and maximize the benefits of the restoration projects. The team believes that this approach will help the EEP maximize restoration dollars in areas where they will generate measurable results. Each of these methodologies is described in more detail in the Section 3 and 4.

## SECTION 3

# Watershed Screening Analysis

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## Basic Approach for Watershed Screening Analysis

During the discussion of the overall strategy to develop the products requested for this effort, the WNAT determined that there was a need to establish a process to select watersheds for detailed analysis. The team decided that the overall needs assessment process should include two different types of analyses at two different scales. The first step would be a high-level analysis at a coarser scale that could be conducted in a relatively efficient manner for many watersheds at once. This evaluation, termed ‘watershed screening analysis,’ is designed to allow EEP staff to make informed selections of watersheds that will be the subject of more detailed work. The approach would be applied to 14-digit hucs within 8-digit catalog units and rely heavily on GIS assessment. On average, there are approximately 40 14-digit hucs within 8-digit CUs. To identify the 14-digit watershed(s) that would be evaluated in detail, data for all watersheds would be generated and compared against one another. An abbreviated version of the approach was tested on 10 CUs for which the NC Wetlands Restoration Program needed to choose watersheds for Local Watershed Planning (LWP) activities (i.e. detailed watershed assessments). Insights gained from this exercise are shared in the description of the method as appropriate.

## Overall Process for Screening Methodology

The overall screening methodology is comprised of six distinct steps. These are:

1. The 8-digit CU is identified by EEP based on magnitude, type and location of projected NCDOT impacts;
2. Individual watersheds (14-digit hydrologic units) within the CU are evaluated based on specific attributes (or watershed statistics) defined by WNAT;
3. EEP planning staff identify high priority candidate watersheds for detailed needs assessment through analysis of the screening attributes;
4. Candidate watersheds are evaluated more thoroughly to gauge local interest and to verify that appropriate restoration opportunities are likely to exist;
5. EEP planning staff further refine candidates (develop a short list) and seek feedback from resource professionals and local interested parties;
6. EEP staff make a final choice for needs assessment area (watershed(s) that will be the subject of detailed needs analysis, also referred to as Local Watershed Planning.)

## Detailed Description of Major Steps of Screening Methodology

### *Step 1: EEP staff identify catalog units of interest*

The WNAT recognizes the programmatic context under which its products will be applied. Because EEP will provide compensatory mitigation for NCDOT projects statewide, it is the program’s responsibility to ascertain where in the state the needs assessment methodology should be applied. Compensatory mitigation is typically implemented in the context of 8-digit CUs. It is therefore envisioned that EEP staff will evaluate projected DOT development impacts within catalog units statewide. Data on the type, location and magnitude of forecasted impacts will be used to decide which areas will be the focus of watershed planning work. These data will

be generated in part based on the methodologies developed by the Stream Functional Assessment Team and Wetlands Functional Assessment Team for identifying functional impacts due to road projects.

***Step 2: Data for individual watersheds within the selected CUs are collected and generated based on specific attributes defined by WNAT***

The WNAT defined which watershed characteristics would be important for evaluating 14-digit scale watersheds. Team members identified a large amount of watershed data and data sources that would be of interest in the analysis. Similar data was grouped together and some data was deemed more suitable for the detailed level watershed evaluation. The remaining attributes were prioritized in terms of their importance to the watershed screening analysis. Data availability was also an important consideration as this part of the process is intended to be largely GIS-based.

Working through the process of defining attributes for the analysis revealed a categorical structure for the watershed statistics of interest. Five broad categories of information are recommended for evaluation for each 14-digit watershed within an 8-digit catalog unit (Table 3-1). These are: baseline watershed descriptors, watershed resources or assets, watershed problems, potential threats and stressors, and other factors of interest. The statistics associated with baseline descriptors, assets and problems are compiled and presented in a watershed attribute matrix (WAM) which provides these data for all 14-digit watersheds within the CU. Threats, stressors and other factors of interest are for consideration in Step 4 described later in this section. Data generation for the WAM was tested for 10 catalog units across the state, and the final list of attributes for analysis in Table 3-1 reflects that exercise by including attributes associated with readily available data. Data for resources and problem attributes are presented using percentages to allow for a relative comparison of data across all HUs within a CU. This table also indicates how the products from the Stream and Wetlands Functional Assessment Teams will be integrated into the screening analysis. During the test on the 10 CUs, the CGIA (who worked with the WNAT to generate the WAM) was not able to easily characterize wetland resources at the HU level. However, the WNAT strongly believes that such information is important to this process and that the GIS tool developed by the Wetlands Functional Assessment Team will fill this gap.

***Step 3: EEP staff identify high priority candidate watersheds for detailed needs assessment***

Using the data compiled in the previous step, tools are applied to compare the component watersheds assets and problems across the CU. The WNAT applied an approach during their evaluation of the 10 CUs. This includes displaying baseline data as well as the assets and problems data geographically to make those comparisons. The specific steps are summarized in Table 3-2.

**Table 3-1: Watershed Attributes Evaluated During Screening Analysis**

<b>Category</b>	<b>Attribute</b>
<b>Baseline Watershed Descriptors</b>	Area – square miles
	14-digit HU number
	River Basin
	Linear feet of stream
	Population density and distribution
	General land cover information
	Presence of Transportation Improvement Project (TIP)
<b>Resource Measures/Assets</b>	Percent of streams buffered within 100’
	Percent Rare, Threatened or Endangered species (RTE) and Critical Habitat in the HU
	Percent of stream miles with special designation (HQW, ORW, WS-I, WS-II, Tr, SA)
	Percent of watershed (acres) in conservation management
	Percent of stream miles designated WS-III, IV or V
	Amount of fully functioning wetlands (will rely on product of the Wetlands Functional Assessment Team to gauge this)
	Amount of fully functioning streams (will rely on product of the Streams Functional Assessment Team to gauge this)
<b>Existing Problems</b>	Percent of stream miles not buffered (100’)
	Percent of stream miles impaired
	Percent streams 303(d) listed waters
	Percent impervious surface
	Amount of functional wetland loss (will rely on product of the Wetlands Functional Assessment Team to gauge this)
	Amount of functional stream loss (will rely on product of the Streams Functional Assessment Team to gauge this)
<b>Future potential threats/impacts</b>	Significant anticipated growth – residential, commercial, industrial
<b>Other factors</b>	Presence of restoration projects (represents and opportunity to build on existing efforts)
	Previous Local Watershed Plan (LWP) study area? (If study was recent, it may be too early to return to that specific watershed.)
	Data rich area? (Areas with significant data are favorable.)
	Local interest?
	TMDL (total maximum daily load) study planned or under way? (Potential to partner with NC Division of Water Quality on development and implementation of a TMDL.)

**Table 3-2: Steps in Data Generation and Evaluation During Screening Analysis**

<b>Step</b>	<b>Description</b>	<b>Product</b>
<b>Display baseline data</b>	Take selected baseline from Watershed Attribute Matrix and convert to map. Selected data includes area, population density, TIP, land cover, hydro, local governments and roads.	Baseline attribute map (BAM)
<b>Display asset and problems data</b>	Data for each HU within the CU are displayed so that comparisons can be made between watersheds	Bar charts (or other appropriate comparative display tool) of assets and problems for all hucs in the CU
<b>Determine candidate watersheds</b>	<ul style="list-style-type: none"> <li>▪ Numerical data is reviewed to identify obvious errors or inconsistencies.</li> <li>▪ Watersheds are reviewed to identify those with a combination of assets and problems where restoration is needed and will be meaningful in the protection and restoration of assets</li> <li>▪ Two or more watersheds are recommended for consideration for a detailed analysis.</li> </ul>	List of candidate watersheds

***Step 4: Candidate watersheds are analyzed more thoroughly***

Once a short list of watersheds has been developed based on the GIS analysis, EEP staff should conduct a more detailed analysis of the candidates to further refine the selections. This additional analysis should include a field review of the watershed and discussions with local governments, resource professionals and interested parties. In addition, the future potential threats and other attributes described in Step 2 should be investigated. The goal of this step is to gauge local interest in a watershed planning effort and to evaluate whether it appears that the watershed of interest will yield restoration opportunities. This step and the next are very critical in CUs where there is little data to allow for solid targeting through the screening analysis.

***Step 5: EEP staff further refines candidates; seek feedback from resource professionals and local interested parties***

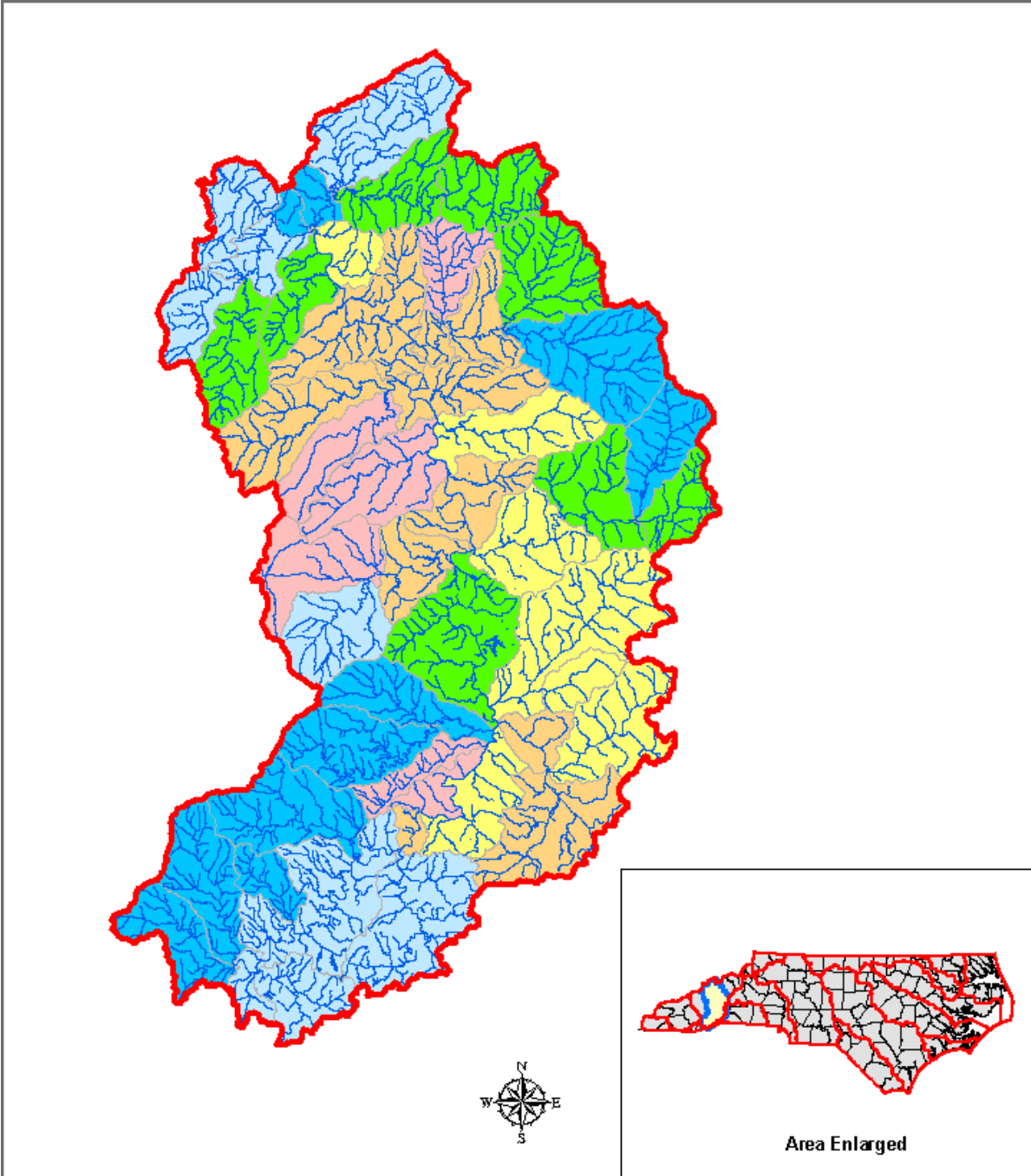
Once additional data is gathered for candidate watersheds, EEP staff should prepare a package of information on the watersheds of interest and seek feedback from interested parties such as local governments, local environmental groups and resource professionals at the state, federal and local level. The information package should include maps illustrating the location and key features of the watershed, the watershed statistics that were evaluated and a characterization of the local input received. This step could take the form of seeking feedback via email or by holding a meeting to allow for dialogue on the possibilities. EEP staff should seek to determine whether the program is targeting appropriate areas. It is important for the program to convey the goals of the planning effort to the targeted audience.

***Step 6: EEP staff makes final choice for LWP area***









The WNAT wanted the EEP to have the final authority for selecting which watersheds will undergo the detailed analysis; therefore, while the mechanics of how the decision-making should proceed are provided, constraints on the final decision are not. Over time, the EEP will be able to build on project selection experience and improve the basic screening approach.

**Application Screening Analysis in 10 Catalog Units**

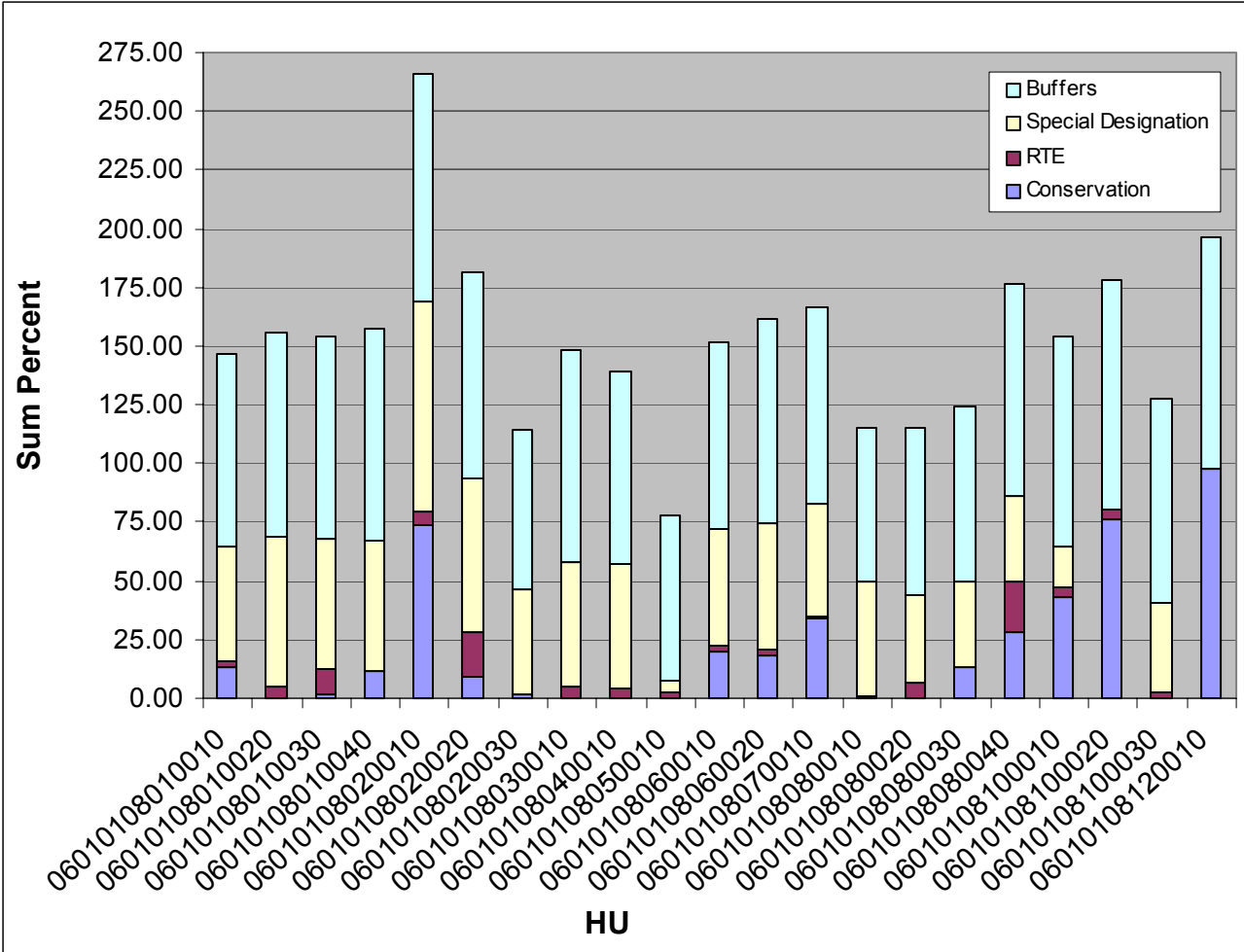
With help from the Center for Geographic Information and Analysis (CGIA), the team tested a comparative approach that derived composite scores for the two general categories of assets and problems. The statistics were represented in map and graph formats. Example outputs are presented in Figures 3-1 to 3-4. The methodology applied by CGIA is presented in Appendix B.

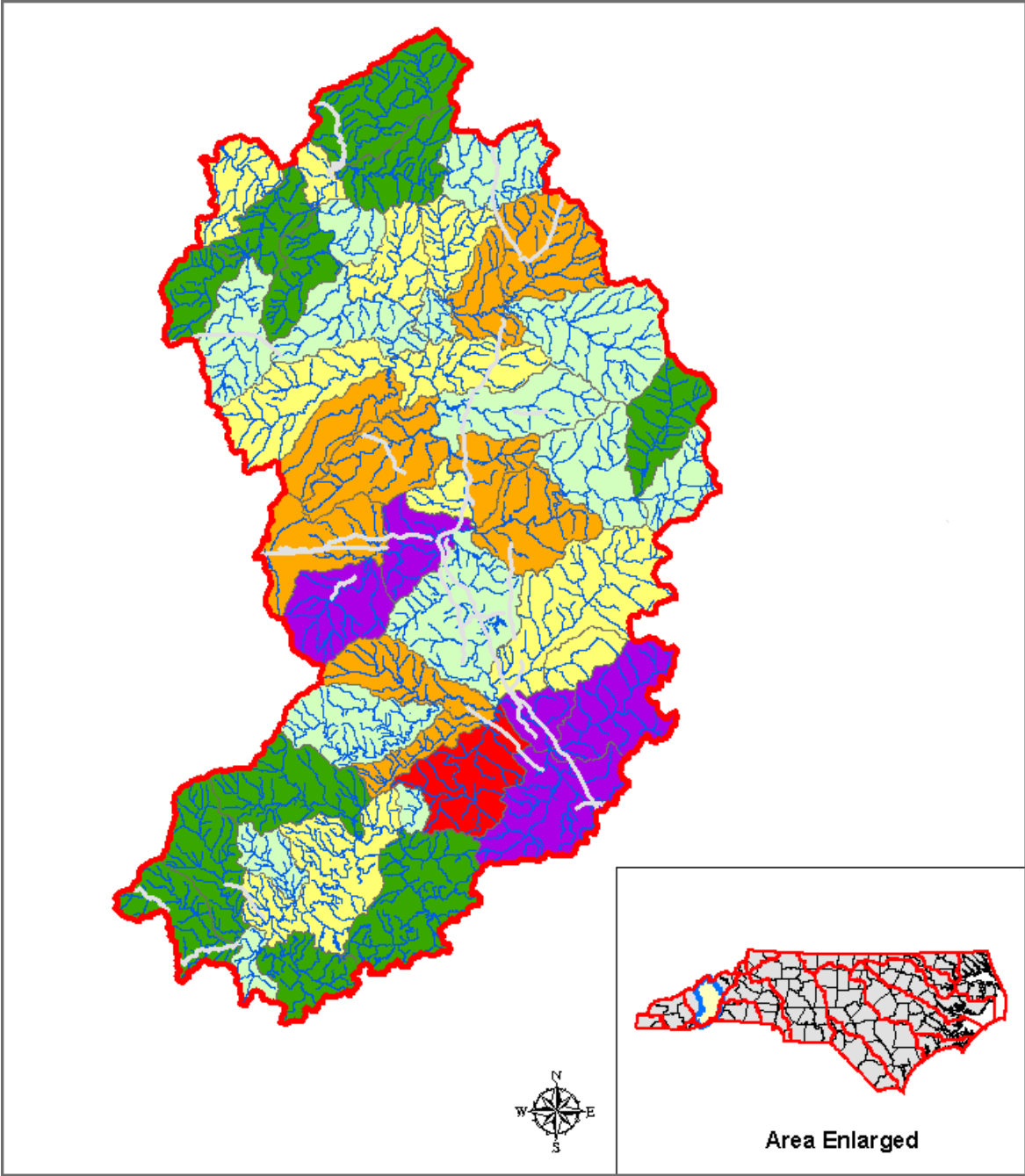


**Figure 3-1: French Broad River Basin – Assets**

 CU	 11.55 - 19.97	 25.80 - 32.27	 41.70 - 56.98
 Streams	 19.98 - 25.79	 32.28 - 41.69	 56.99 - 86.00

**Figure 3-2: French Broad River Basin – Assets**

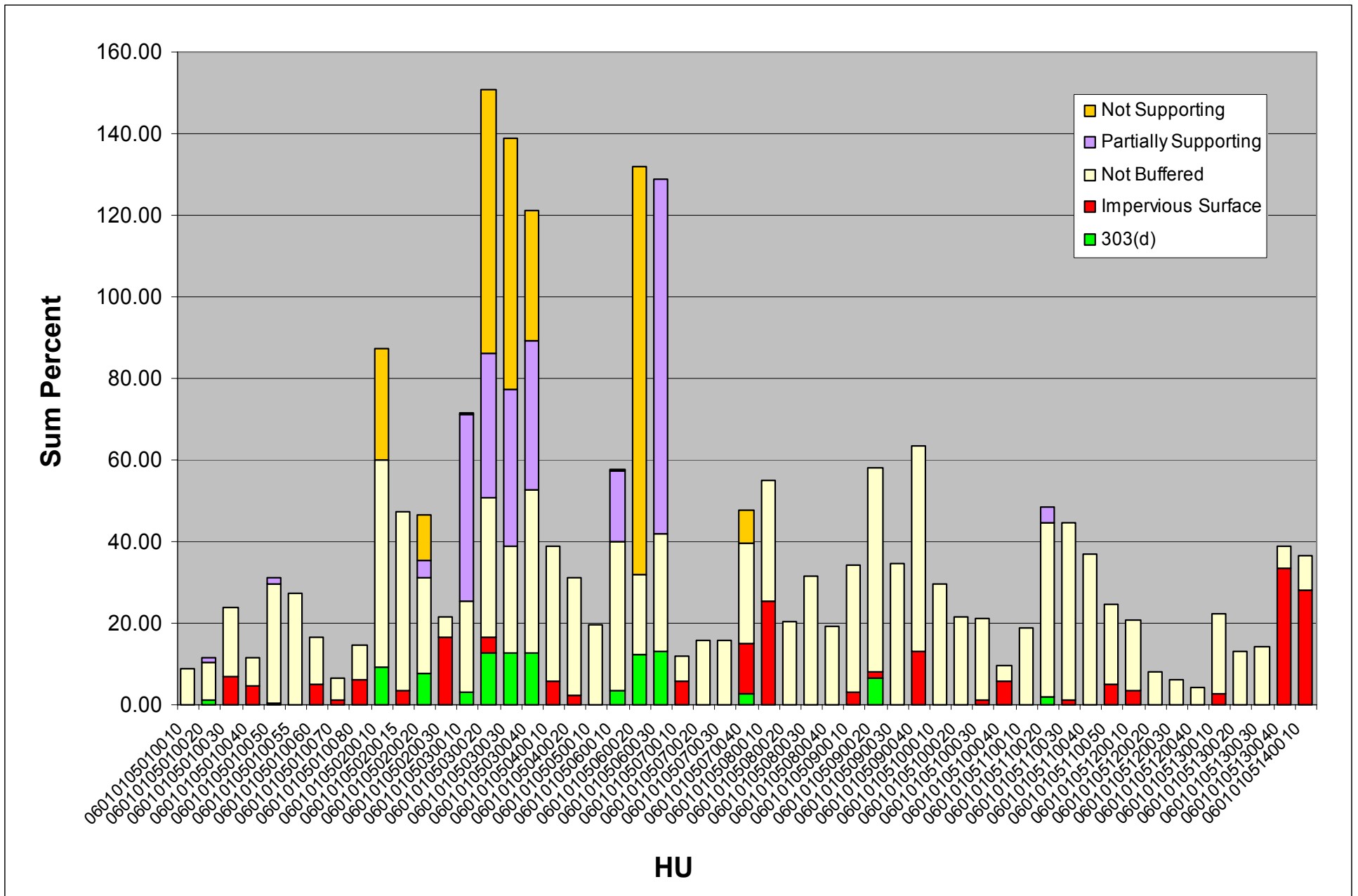




**Figure 3-3: French Broad River Basin – Problems**



Figure 3-4: French Broad Basin – Problems



### *Lessons Learned from the Test Analysis and Suggestions for Future Applications*

The WNAT tested the draft screening methodology in order to better grasp how the method would function and to help meet the NCWRP's need to identify watersheds for detailed analysis as part of their ongoing Local Watershed Planning Initiative. The benefits of this test were multiple in that the team was able to develop suggestions for refining the method as well as help the NCWRP choose watershed for 10 catalog units across the state.

The team found that the composite information generated by CGIA was somewhat helpful, but it was necessary to go back to the raw data to really understand what was causing a composite result to be high or low. The team encourages EEP to work with GIS experts for creative ways to comparatively display composite watershed attributes.

The short time frame under which the team was operating prevented the acquisition and manipulation of some data. Therefore, the team wants to stress that the screening process is not intended to be a static methodology. As additional data becomes available or methods to apply various data sets are developed, those should be used to improve this process. This includes the products of the Stream Functional Assessment Team and Wetlands Functional Assessment Teams whose methodologies will allow for characterizing stream and wetland function within watersheds. Specific recommendations related to data sources and manipulation are listed in Table 3-3. These should be considered by EEP staff prior to the application of the method.

**Table 3-3 Data Sources and Manipulation Recommendations**

Incorporate GIS products of Steam Functional Assessment Team and the Wetlands Functional Assessment Team into the screening analysis.
Incorporate Division of Coastal Management (DCM) NC Coastal Region Evaluation of Wetlands Significance (NCCREWS) data where available – for those CUs that have only partial DCM data coverage, determine how to compare watersheds against each other.
Benchmark within CUs as opposed to across those under consideration for comparative numbers. In other words, within a given CU, comparative statistics should be generated in relation to HUs within that CU.
Incorporate better, more detailed geographic data on Transportation Improvement Project (TIP) at the HU level. This should include information on whether the project is a new location or a widening.
Evaluate the possibility of applying a GIS-based wetlands planning tool recently developed by the DCM to estimate impacts of development activities.
Apply the most up-to-date and best land cover available.
Work with GIS staff to evaluate alternate methods to calculate imperviousness.
Incorporate the application of the product of the High Quality Resources Team to characterize the location and extent of critical habitat. (This team was also convened as an outgrowth of the permit improvement process to aid in the avoidance and minimization of development project impacts.)
Select streams that are rated excellent (on the assets side) and good-fair (on the problems side) as part of the assessment instead of relying solely on use support ratings.

## SECTION 4

# Watershed Needs Assessment Methodology

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Watershed assessment and planning is an ever-evolving field of study, and its application is dependent upon the characteristics of the watershed of focus. The WNAT decided to provide a framework for watershed assessments under the EEP, but specific tools and methods are not prescribed. This is intentional given the flexibility necessary to effectively and efficiently evaluate specific watershed problems.

This section describes key concepts regarding watershed assessment and planning, the recommended framework for the assessment, and items for consideration in the assessment of watershed functions.

## Key Concepts

The WNAT embraced several key concepts or principles related to watershed assessment that should be noted prior to presenting the approach. These include:

*Concentration of a variety of projects within 14-digit HUs* – watershed restoration can be more effectively accomplished through the identification and implementation of a suite of appropriate solutions. Implementing a broad mix of projects that address specifically identified issues and doing so within a relatively small watershed context will help North Carolina make significant strides in solving water quality and habitat problems related to nonpoint source pollution. Solution implementation should be accomplished through the maximization of available funding sources at the local, state and national level.

*Getting to the root problem* – it is important that the solutions identified are designed to address underlying causes of problems instead of treating symptoms. In other words, projects should not be implemented to ameliorate a symptom unless they are combined with other actions that address the root cause of the problem. For example, controlling stormwater through the implementation of a best management practice adjacent to a stream restoration project can improve restoration project viability by addressing the source of stream instability (storm flows).

*Importance of baseline data* – monitoring for and measuring the success of plan implementation will be critical to the overall approach and demonstrating its effectiveness. Therefore, it is important to establish baseline conditions such that changes or responses are measurable over time. The measurements necessary will vary depending upon the problems being addressed. An example would be accurately characterizing and documenting the abundance and distribution of aquatic life such that implemented habitat improvements can be measured by comparing those conditions before and after project implementation.

As is evident, the WNAT expressed strong support for comprehensive watershed assessment and comprehensive solution identification and implementation. The team's

charter called specifically for the development of a comprehensive list of the types of projects that will address identified watershed needs and problems. This was not undertaken, as the team believes that a multitude and variety of projects or strategies could be used. Solutions identified through the planning process should not be limited by a list generated through this effort.

## **Framework of the Methodology**

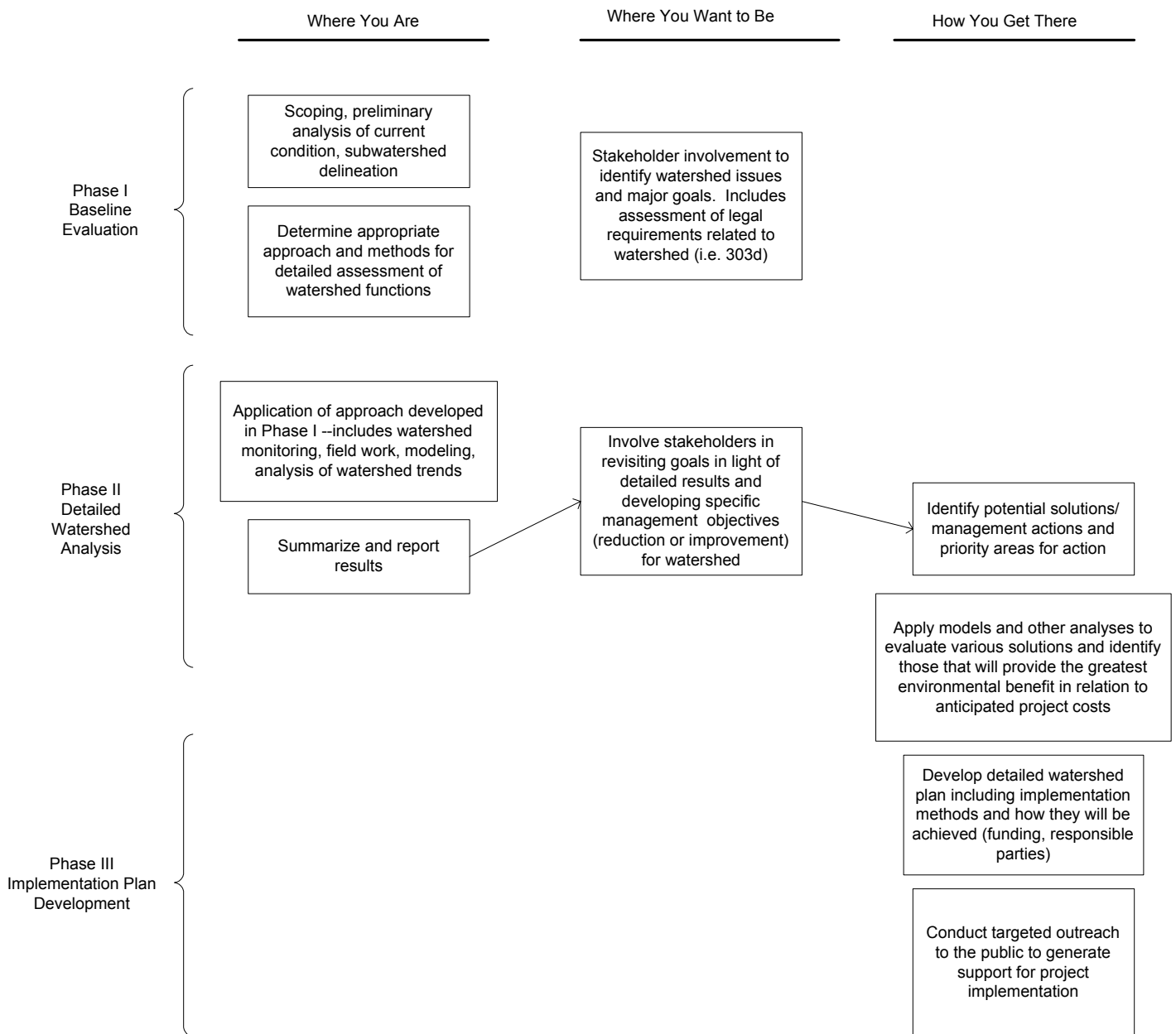
### *Revisiting the Definition*

In Section 2, the team's definition of watershed needs assessment was provided. It is reiterated here for reference:

***A Watershed Needs Assessment is a comprehensive analysis of current watershed condition and identification of actions necessary to achieve desired watershed goals.***

Inherent in the definition are three key components that comprise the needs assessment process. These include an analysis and description of current watershed condition; the determination of a desired watershed state or watershed goals; and the development of actions to achieve those goals. The needs assessment definition asks that a watershed evaluation define where you are, where you want to be and how you plan to get there. Figure 4-1 illustrates these major components in the context of the actions necessary to answer them. It also breaks these actions into phases that are consistent with the NCWRP's current approach to contracting local watershed planning projects. The actions and phases build on one another in the production of a comprehensive watershed restoration and protection plan. A narrative plan of the major phases of assessment and how they address the questions inherent in the definition of water needs assessment follows the figure.

**Figure 4-1: Detailed Watershed Needs Assessment – Phases, Questions, Components**



*Phases in Figure 4-1 correspond to the phases in current NCWRP local watershed planning approach*

## **Phase I of Watershed Assessment – Baseline Evaluation**

### *Where You Are*

The first phase of the assessment process is to evaluate available data sources and make a preliminary determination regarding the current watershed condition. At this early phase the watershed should also be divided into subwatersheds with data and information presented within those unit categories. This approach is fundamental and consistent with leaders in the field such as the Center for Watershed Protection. It is also relatively straightforward and has been described in detail by the NCWRP (Appendix C).

In addition to assessing the current condition, this phase includes the development of the plan for the more detailed assessment of the watershed. Based on the initial characterization, determination of the best assessment tools for the area can be made. For example, if the main pollutant is sediment, it is necessary to conduct analyses that will identify the primary source of that sediment. If the sediment is coming from streambank erosion, the solutions will be very different than if the sediment source is new construction. At this point, a monitoring plan to assess water quality, habitat and hydrological functions is also developed.

### *Where You Want to Be*

It is important to involve stakeholders in clarifying priority issues and identifying broad watershed goals during Phase I. Stakeholders can often provide specific information related to watershed condition to aid in basic characterization. A recommended approach to stakeholder involvement is provided later in this section. A determination of legal requirements (such as those listed as 303(d) waters or communities subject to Phase II stormwater regulations) that may be applicable to the watershed should be conducted now to insure that project products address those requirements as appropriate. The goal is to maximize the utility of the data and information to provide benefits across programs.

## **Phase II of Watershed Assessment – Detailed Watershed Analysis**

### *Where You Are - Continued*

In Phase II, more detailed data on the watershed are gathered. The monitoring and other detailed analyses planned during Phase I are carried out. (The monitoring and analyses plan was developed in Phase I.)

### *Where You Want to Be - Continued*

As the more detailed data become available, it is again appropriate to work with stakeholders to evaluate those data and further refine the broad watershed goals into specific objectives. When possible, these objectives should be numeric (such as a 20 percent reduction in sediment loads from streambank erosion or a measurable increase in habitat for a particular species of concern) in order to allow for the measurement of progress.

### *How You Get There*

During Phase II, some initial assessment on the types of projects that can address the identified issues should be developed. This should be a comprehensive list not limited to stream and wetlands restoration that meets requirements for compensatory mitigation; it should be inclusive

of actions that can be taken to preserve areas where assets are predominant as well as solve problems that were described. This can also include a prioritization of which types of projects should be pursued first and what areas (or subwatersheds) within the watershed are priorities for action.

In some cases, it will be appropriate to apply models or ranking methods to determine and justify these priorities. This information can be beneficial when interacting with the public and working to convince them of the merit of a particular project or solution. The priority analysis should include a general assessment of costs pertaining to identified solutions. This approach allows for the selection of those solutions that provide the greatest functional benefit per unit cost.

## **Phase III of Watershed Assessment – Implementation Plan Development**

### *How You Get There - Continued*

Phase III focuses on developing a detailed implementation plan based on the best solutions identified. This plan should include recommendations for the most appropriate entities to implement specific solutions as well as funding sources for those solutions. Implementing entities could be local governments, environmental organizations or other state agencies. In some cases, it will also be necessary to conduct targeted public outreach to generate support for specific projects.

### **After the Plan**

As indicated earlier in this report, the WNAT strongly believes that measuring progress toward goals and objectives is critical. At some point after solutions have been identified and results of those efforts are measured, it is appropriate to evaluate how well the priority solutions are achieving those goals. If the answer is ‘not so well’, adjustments are necessary. Determining those adjustments may require additional assessment of watershed characteristics, especially in fast growing and/or rapidly changing watersheds.

The WNAT charter calls for recommendations on plan review and update frequency. The team believes that the frequency for review will be driven by the nature of the watershed as well as projected EEP impacts in the particular catalog unit. Specific frequencies for plan review and update are not recommended.

Another important action that needs to occur once the plan is completed is working toward the implementation of the identified solutions. The EEP can take the lead on those projects that can be used to satisfy compensatory mitigation requirements, but solutions funded through other sources also need to be implemented. The EEP should strive to generate resources either internally or externally to secure implementation of the agreed upon watershed plan to the greatest extent possible.

## Recommended Approach to Stakeholder Involvement

Stakeholder involvement is an art unto itself and is dependent upon the individual environmental, social and political circumstances associated with the watershed of interest. For over two years, the NCWRP worked with a program out of North Carolina State University called Watershed Education for Community and Local Officials (WECO) to determine the most appropriate stakeholder approaches to watershed planning projects.

This partnership combined with in-house efforts resulted in the NCWRP applying a variety of processes, ranging from in-depth, grassroots local involvement to involving only technical resource professionals in a limited manner. Based on this experience, the following is recommended as an approach to stakeholder involvement.

- Each individual watershed planning project should be considered singularly to determine the best approach for stakeholder involvement using a publication entitled *Local Watershed Planning: Citizen Participation Guidebook* (Smutko, et al, 2003).
- Preference should be given to using a stakeholder involvement model that relies on local resource professionals in the early phases with targeted outreach to the public at later stages to generate support for specific solutions. Under this model, resource professionals participate in understanding and evaluating available and generated data to make management recommendations. Depending on the recommendations that result, outreach to specific stakeholder communities can be conducted in a targeted fashion.
- Boundaries and expectations must be made clear to stakeholders invited to participate. It should be apparent to participants that not all of their recommendations will be implemented through the EEP.

## Considerations for the Assessment of Watershed Functions

Ideally, a detailed functional assessment approach should include indicators for each specific function of interest as well as measures for each indicator. An **indicator** is a measurable characteristic that can be used to evaluate the level at which a particular function occurs in a watershed. **Measures** are the specific variables that are quantifiable characteristics which evaluate identified indicators measured in order to assess a particular function.

The WNAT generally did not attempt to identify specific measures, but focused on indicators of watershed functions. The team recommends that the assessments rely heavily on measures derived from existing data, including GIS analyses, especially during the initial phase of assessment work. However, the collection of additional field data will be important in some areas.

Indicators may be of several types:

- **functional indicators** that directly assess a particular watershed function or process;
- **structural indicators** that do not assess function directly, but measure ecological structural characteristics of the system that are known to be or assumed to be closely tied to a specific function;

- **surrogate indicators** that measure watershed characteristics that do not assess a specific function, but that are associated with a number of functions or with watershed functioning in general.

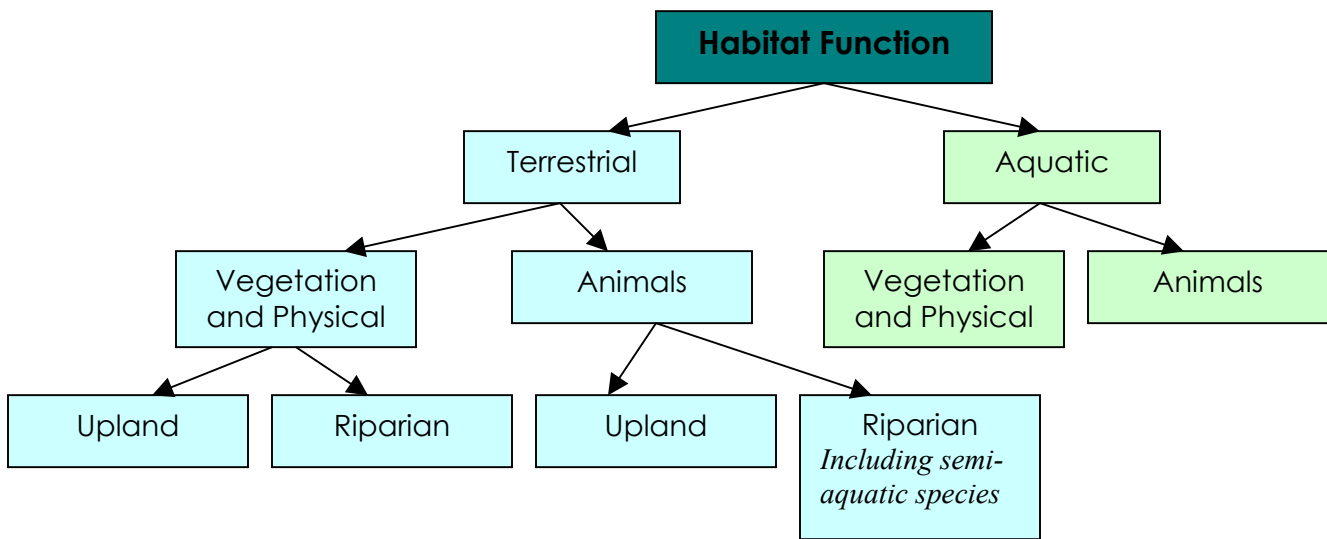
For example, sediment transport processes could be evaluated directly via long-term study of erosion, transport and deposition rates. It could be assessed using structural indicators that examine stream substrate composition or with surrogate indicators such as watershed imperviousness, which does not measure sediment transport but is associated with changes in many watershed processes, including sediment transport.

The team recognized that due to the resource constraints, the limited time frame for conducting analyses and in some cases limited scientific knowledge, measuring functions directly would seldom (if ever) be feasible during the watershed assessments conducted by the EEP. The team therefore focused on the use of structural and surrogate indicators. As detailed later, for some functional categories (e.g., habitat), the team recommended the use of structural indicators of individual functions. For other functional categories (e.g., hydrology), the team recommended the use of surrogate indicators to evaluate groups of functions. As new functional assessment methods become available (such as those being developed by the Stream Functional Assessment Team and Wetlands Functional Assessment Team), they may provide a more direct assessment of those functions. The following sections provide general guidance in the assessment of the functional categories considered by the team.

***Assessment of Habitat Condition/Function***

The functional category for habitat was broadly defined to include both physical and biological (plant and animal) components. The team divided the habitat function category into several subcategories (Figure 4-2), differentiating between terrestrial and aquatic habitat and differentiating between upland and riparian areas (within terrestrial habitat).

**Figure 4-2: Differentiating Between Terrestrial and Aquatic Habitats**



### Terrestrial Habitat

For each of the components of the habitat function identified, the team listed characteristic indicators that assist in evaluating functional components. These characteristics fall into the following broad categories:

- General landcover (used to derive statistics related to habitat)
- Presence of Rare, Threatened or Endangered Species (terrestrial, aquatic, plant and animal)
- Presence of Significant Natural Heritage Areas
- Species composition and diversity (terrestrial, aquatic, plant and animal)
- Presence of invasive species
- Integrity of the riparian area and corridor (floodplain, streambank and channel)
- Integrity and extent of wetland areas

The team envisions a general characterization of the types and conditions of habitats in a watershed using available data and input from resource professionals. These data can be ground-truthed and augmented during field assessments and watershed monitoring. This information would be used to identify key issues in the watershed related to habitat, and further, more detailed evaluation of those issues would be pursued. For example, if invasive aquatic vegetation was identified as an issue, information and data regarding its history and extent would be gathered that would lay the groundwork for making management decisions. The following general steps would apply:

1. Map the extent of various land cover types within the local watershed using existing data, including but not limited to ariel photos, satellite imagery, and Natural Heritage data. Limited ground truthing may be needed to determine the quality of the habitats, but this will be determined on a case-by-case basis. Fieldwork will be targeted to specific locations and carefully defined data collection will be recommended.
2. Identify animals associated with these habitats through consultation with biologists and other experts.
3. Identify target habitats and target animal species. (For example, a keystone species, the understanding and protection of which would generally provide for the protection of other species of interest in the watershed).
4. Identify watershed goals for the targets.

### *Indicators of Terrestrial Vegetation and Physical Habitat*

- Percentage of forested, agricultural and developed land (including amount of impervious surface) will be derived from the land cover information or other existing information and will be as specific as possible.
- Percentage of natural composition will be based on the extent of vegetation types described in *The Natural Communities of North Carolina* (Schafale and Weakley, 1990).

- Sensitive plant species for the watershed will utilize Natural Heritage Program data including Threatened and Endangered species and other species identified by the stakeholder group as conservation targets.
- Percentage Significant Natural Heritage Area will be obtained from GIS data.
- Floodplain condition will utilize available FEMA maps in combination with land cover information. Floodplain condition will incorporate riparian buffer considerations. A procedure for scoring the subwatershed condition of the riparian buffer is needed. (This procedure should allow comparison between sub-watershed units.)
- Percentage of Conserved Land (including state and federally owned land) will be measured using the DENR Million Acre data layer that is currently being developed.
- Landscape functions (including connectivity, contiguousness, spatial distribution and patch size) will be evaluated in relationship to the list of conservation targets identified earlier.
- Invasive species information is almost non-existent. Efforts can be made to identify target species from regional lists and resource professionals, confirm their presence and determine the degree of infestation through limited field data collection. A method to consistently quantify is needed.

*Indicators of Terrestrial Animals and Semi-aquatic Animals (upland and riparian):*

- Habitat types can be derived from land cover and the associated animal species and guilds can be identified from existing data. Target species including Threatened and Endangered (T&E) and others identified by stakeholders and the habitat conservation goals can be built around them.
- Invasive species goals can be addressed as described above.

*Aquatic Habitat*

*Aquatic vegetation and physical components*

Vegetation. The group could not identify a source of information for algae, aquatic plants or semi-aquatic plants other than T&E species although limited information may be available for invasive aquatic species from the Division of Marine Fisheries and the Division of Water Resources. Overall, aquatic vegetation should be assessed on a case-by-case basis, and if there is evidence of rare aquatic plants or invasive species, further evaluation may be warranted.

Rare, Threatened and Endangered (RTE) species habitat. The Stream Functional Assessment Team is developing methods to evaluate substrate composition and complexity. Comparison of actual condition versus expected or desired condition may be possible as a result of their recommendations. It may also be possible to identify habitat

barriers or critical corridors that merit protection. The physical habitat will need to be evaluated as it relates to the target species that have been identified in a particular watershed.

General aquatic habitat. Division of Water Quality (DWQ) staff conducts a habitat assessment when benthic macroinvertebrate or fish community samples are collected. These assessments exist for hundreds of sites in North Carolina and can be used to characterize general aquatic habitat conditions. In some watersheds, limited aquatic habitat data may be available, and the collection of additional data may often be warranted. Since all streams in a watershed cannot be evaluated, a representative selection should be made. Evaluation of available data and involvement of stakeholders should lead to selection of sample locations. DWQ's habitat protocol (NCDWQ, 2003), the habitat evaluation protocol included in EPA's Rapid Bioassessment Protocol (USEPA, 1999) or other instruments can be used for this purpose. Wetland assessment should also be undertaken where warranted based upon wetland extent and other watershed characteristics.

### Aquatic life

RTE species. Identify target species from existing data. Check with the recommendations of the Scientific Council on Fishes to the Non-Game Wildlife Advisory Committee of NC Wildlife Resources Commission for specific information on invasive fishes.

Community Indicators. The DWQ has collected benthic macroinvertebrate and/or fish community data for hundreds of sites in the state. While this monitoring does not relate specifically to RTE species, results provide an assessment of overall biological integrity. Monitoring is ongoing as part of North Carolina's water quality program. Where available, these data should be used to characterize stream communities. In watersheds where biological assessment data are lacking, such sampling should be conducted as part of the detailed watershed needs assessment.

### ***Assessment of Water Quality Condition/Function***

As discussed earlier, water quality functions were narrowly defined to include elemental and thermal processes. Unlike the approach taken for habitat assessment, the evaluation of water quality condition was not considered in terms of its component functions.

The team recommends that water quality be assessed as follows:

1. Compile and evaluate all available chemical and biological data for the watershed.
2. Identify potential issues of concern and data gaps and use this information to develop a monitoring plan.
3. Implement monitoring plan that may start with a broad sampling regime that is narrowed based on initial results.
4. Evaluate data to determine condition of water quality within context of local stakeholder objectives for the watershed.

From a water quality perspective, most waters of the state are managed primarily for aquatic life uses rather than organized recreation, water supply or other uses. Team members believe that in

many watersheds, biological community data (benthic macroinvertebrates and fish) will provide a more practical and useful assessment of overall water quality conditions than water chemistry data, especially given the short time frame available for monitoring during the EEP planning process. However, water chemistry should not be ignored during development of the monitoring plan. Resource allocation for chemical monitoring should consider the specific questions water chemistry is intended to address, and whether useful answers to those questions are likely to be obtained during the period available for data collection.

Assessment of water quality will also entail additional types of sampling depending upon the issues observed. For example, if sediment is a problem pollutant in a watershed, assessment of stream morphology may be necessary to determine if system instability is the root cause of the problem (i.e. the stream banks may be eroding).

### ***Assessment of Hydrologic Condition/Function***

The WNAT concluded that most of the individual hydrologic functions it identified were closely interconnected. Team members believed that developing indicators for specific functions was not practical, especially for the type of assessment that was to be conducted (as opposed to longer term research studies). The team therefore recommends that hydrologic functioning be assessed by using surrogate indicators that view the extent that hydrologic modifications have occurred in a watershed.

Potential indicators of hydrologic change include:

- Presence of drainage districts
- Flood prevention projects
- Channel and stream bank modification
- Land use
- Impervious surface extent
- Storm sewer mileage
- Floodplain encroachment
- Repetitively flooded structures
- Impoundments
- Withdrawals
- Floodplain disconnected from the creek (important but hard to get at)
- Instream habitat surveys

The WNAT recommends that growth and development trends (zoning, population) also be considered in evaluating watershed hydrologic condition. These factors will be especially important in evaluating the likely extent of future hydrologic change.

There was discussion about the need to apply models to understand watershed hydrology such as Hydraulic Engineering Center (HEL). The team felt that such models would be most valuable in urban settings where they could help identify areas where stormwater control would be most useful, and could contribute to a better understanding of stream instability and flooding issues.

Assessment of the storage capacity of natural or constructed wetlands can also help characterize the hydrologic function of a watershed. The extent and location of wetlands in the watershed, including their type and degree of alteration, is an important factor in assessing their functional value.

After discussing groundwater flow and discharge, the team agreed that addressing groundwater functions would generally be beyond the scope of watershed needs assessments.

## SECTION 5

### Other Issues

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The charter for the Watershed Needs Assessment Team called for the team to consider specific aspects of implementing their methodologies that have not been addressed in the previous portion of this report. These include:

- Recommendations for integrating the assessment outcomes/conclusions into a statewide GIS layer.
- Resources (staff and funds) necessary to implement the recommended watershed assessment procedures throughout North Carolina.

This section presents the team's response to these issues as well as additional thoughts on related subjects.

#### **Issues Related to GIS and other Data**

The importance of GIS technology and data cannot be overstated. The WNAT recommends that the EEP be equipped to maximize this technology in all of its applications including watershed assessment and project implementation. Specifically, the team recommends that CGIA conduct continuous, scheduled land cover updates for the state to allow for effective use of this critical data layer. In addition, data layers that are updated by other agencies, such as the Division of Water Quality use support and water quality data, should be regularly updated into the GIS Corporate Database. The EEP should work with GIS professionals to determine the most effective means to catalog and track detailed plan development and implementation.

The WNAT identified particular types of data that were of principle importance to watershed planning but were currently incomplete, relatively inaccurate or unavailable. These data are highlighted below:

- **Wetland Data** – the state of North Carolina currently has access to Division of Coastal Management (DCM) data in the coastal part of the state that provides reliable information on wetland condition and function. Elsewhere, reliance on the National Wetlands Inventory (NWI) is necessary, but this data source is considered less accurate and consequently less useful. The team believes that it is important to have reliable data statewide for the accurate characterization of these resources and their condition (type, function, historical losses, status and trends) at the 14-digit watershed level. It is anticipated that the product of the Wetlands Functional Assessment Team will allow EEP to move in this direction.
- **Impervious Surface Data** – currently, in order to assess the presence and magnitude of impervious surfaces at the 14-digit watershed level through GIS analyses, a reliance on proxies (such as road density or population data) is necessary. The team believes that amounts and locations of impervious surface are important data for watershed screening. The WNAT encourages EEP to support the development of reliable impervious surface data for the entire state. The Center for Geographic Information and Analysis has a grant to develop a tool to generate this data set. EEP should stay informed of their efforts and support the application of the tool that is produced statewide.

- The WNAT also recommends the development of an RTE species database that includes locations that have been investigated where no RTE species were found (sometimes called a ‘negative data set’). Data cataloged should include area, date, agency information and level of effort expended for all studies.

An overall data gap in the methodologies presented herein is related to the functional assessment of streams and wetlands. The importance of the methodologies, both GIS and field-based, that are currently being developed by the Stream and Wetlands Functional Assessment Teams is emphasized by the WNAT. It is envisioned that their products will be applied as part of the screening analysis and the detailed needs assessment. The success of the WNAT’s products relies, to a great extent, on the methods developed by the other teams. As a result, the WNAT team leader will continue to participate in the deliberations of the Stream and Wetlands Functional Assessment teams and stay abreast of their progress.

## **Resources Necessary to Implement Recommended Procedures**

In an effort to understand anticipated resource needs of EEP with respect to watershed planning, and evaluation of costs associated with detailed assessments and staff resources needed to oversee them was conducted.

### *Detailed Watershed Project Costs*

In general, the cost of watershed planning and analysis varies considerably. Factors such as geographic size of the study area, temporal length of the study and the complexity of issues in need of evaluation (i.e. variety of land use types, number of jurisdictions) can considerably influence those costs. In addition, watershed assessment components (GIS analyses, stakeholder involvement, monitoring, modeling) must be considered, as all assessments are not comparable depending upon the components included. An analysis of watershed projects similar to those currently being conducted by the NC Wetlands Restoration Program (NCWRP), which include biological and chemical monitoring, watershed modeling and stakeholder involvement, revealed a range between \$600,000 and \$3,000,000 per watershed assessment for projects in the Southeastern United States (based on data provided to the NCWRP by environmental consultants in North Carolina). Average costs for watershed planning efforts initiated by the NCWRP (those funded solely through the program and comparable in assessment components to the projects included in costs provided by consultants) range between \$200,000 and \$400,000. Variability in these costs is attributable to the size and complexity of these studies.

The WNAT recommends that EEP continue NCWRP’s current efforts to evaluate the costs of watershed assessment projects and work toward streamlining expenditures per project to allow for the implementation of more projects. The team believes that the assessments need to be detailed enough to allow for the effective comparison of identified solutions in terms of costs and environmental benefits. Sampling and fieldwork are vital to this effort. The phased approach to conducting Detailed Needs Assessments (Figure 4-1) should help in making the best use of available EEP resources.

### *Staff Resources*

It has been the NCWRP's experience that a professional environmental staff member can effectively manage two watershed planning projects per year. Given that these projects last around 18 months, that translates into a carrying capacity of four projects per staff member at any given point. Ideally, in a given calendar year, a planner would be initiating two projects and finalizing two projects. As with cost estimates, the amount of effort required of a staff member will in part depend on other variables including the complexity of the project.

To ensure the success of the watershed planning efforts, the EEP must acknowledge the generous amount of effort necessary to secure project implementation. Applying the most effective solutions will inevitably require the implementation of projects on private lands. Therefore, working directly with landowners to garner their commitment in the form of easement or property acquisition will be necessary. On a number of occasions during their deliberations, the WNAT noted the importance of landowner support for identified solutions and stressed that sufficient resources should be allocated to secure their backing. In addition to this key element for successful implementation, the EEP should work to maximize the implementation of projects outside of the realm of mitigation in order to provide for effective watershed solutions and to augment the effectiveness and viability of mitigation projects. This will require the identification or allocation of individuals or internal personnel to secure additional funds and commitments to implement high priority solutions. In many cases this will take the form of grant-writing and project management. The WNAT also promotes the maximization of the many existing funding sources available to achieve overall watershed plan implementation.

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## Acronyms

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BAM	Baseline attribute map
BMP	Best Management Practices
CGIA	Center for Geographic Information and Analysis
CU	Catalog Unit
DCM	Division of Coastal Management
DWQ	Division of Water Quality
EEP	Ecosystem Enhancement Program
HEC	Hydraulic Engineering Center
HEL	Hydraulic Engineering Center
HU	Hydrologic Unit
hucs	HU codes
LWP	Local Watershed Plan
NCCREWS	North Carolina Coastal Region Evaluation of Wetlands Significance
NCDENR	NC Department of Environment and Natural Resources
NC DOT	NC Department of Transportation
NCWRC	NC Wildlife Resources Commission
NCWRP	NC Wetlands Restoration Program
NWI	National Wetlands Inventory
RTE	Rare, Threatened and Endangered

### Stream Designations:

HQW	High Quality Waters
ORW	Outstanding Resource Waters
WS-I	Water Supply I
WS-II	Water Supply II
Tr	Trout Waters
SA	Waters classified for Shellfish Harvesting
WS-III	Water Supply III
WS-IV	Water Supply III
WS- V	Water Supply III

T&E	Threatened and Endangered
TIP	Transportation Improvement Project
TMDL	Total Maximum Daily Load
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
WECO	Watershed Education for Community and Local Officials
WAM	Watershed Attribute Matrix
WNAT	Watershed Needs Assessment Team

Appendix A  
**Team Charter**

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**The following two pages of this report contain a scanned copy of the original charter signed into effect by Watershed Needs Assessment Team members.**

## WATERSHED NEEDS ASSESSMENT CHARTER

**Project Mission Statement:** To adopt a methodology to:

- comprehensively assess the current conditions of watersheds related to water quality, aquatic and terrestrial habitat, land uses and overall ecosystem health;
- identify watershed needs and problems related to water quality, aquatic and terrestrial habitat, land uses and overall ecosystem health;
- consider and incorporate the environmental goals and priorities of applicable resource management agencies and stakeholders as appropriate; and,
- develop a comprehensive list of the types of projects that will address identified needs and problems, some of which must be suitable to meet the compensatory mitigation requirements of Section 404 permits.

**Opportunity/Problem Statement:** To ensure that the priorities and goals of applicable resource management agencies and stakeholders are incorporated as appropriate, and to improve the outcome of our environmental stewardship mission, the State should develop a watershed assessment process that:

- Assesses watershed needs and problems concerning water quality, aquatic and terrestrial habitat, land uses, local stakeholder concerns, and overall ecosystem health;
- Fosters development of watershed planning by resource management agencies and stakeholders;
- Fosters collaborative communication among resource management agencies and stakeholders to identify common goals and objectives, and synergistic approaches to address watershed needs;
- Establishes a strategy for implementation of resource management goals and objectives at the watershed level;
- Identifies those types of projects or strategies that will provide the greatest ecological benefit and that are consistent with the resource management goals and objectives established for the watershed; and
- Includes methods for evaluating the costs and benefits of various projects and management strategies.

**Process Description:**

**Scope:** The Team will:

- Compare, contrast, and evaluate existing watershed assessment methods, including, but not limited to the methods utilized by the Wetlands Restoration Program to develop Watershed Restoration Plans and Local Watershed Plans, that will assess those ecosystem functions provided by the Coordination Group.
- Determine the appropriate scale (e.g. ecoregion, river basin, 8-digit cataloging unit, 14-digit cataloging unit, etc.) for watershed assessment for each ecosystem function of interest.
- Identify the assessment methodology that will be used for each ecosystem function with the goal of identifying the fewest methods possible that can assess all ecosystem functions of interest.
- Adopt standard protocols that will be used to establish goals and objectives for each watershed.
- Adopt standard watershed assessment protocol(s) for identifying traditional restoration/enhancement opportunities and other actions such as preservation and best management practices that are consistent with the goals and objectives developed for each watershed.
- Identify criteria to measure the ecological effectiveness and cost effectiveness of identified projects.
- Determine the resources (staff and funds) necessary to implement the recommended watershed assessment procedures throughout North Carolina.

**Deliverables include but are not limited to the following:**

- A Watershed Needs Assessment Methodology accepted by applicable resource management agencies.
- The scale of watershed assessment for each ecosystem function of interest.
- A guidance manual outlining the watershed needs assessment process.
- Standard protocols that will be used to establish goals and objectives for each watershed.
- Protocols for the selection, evaluation, and prioritization of projects, including compensatory mitigation.
- Recommendations concerning the frequency of review and revision of watershed plans.
- Recommendations for integrating the assessment outcomes/conclusions into a statewide GIS layer.
- Criteria to measure the ecological effectiveness and cost effectiveness of identified projects.
- Resources (staff and funds) necessary to implement the recommended watershed assessment procedures throughout North Carolina.

## WATERSHED NEEDS ASSESSMENT CHARTER

**Time Frame for Project Completion:** January 31, 2003

**Date for Team Launch:** September 13<sup>th</sup>, 2002

**Date for Initial Team Meeting with Sponsor:** To be determined by Team Leader

**Process Owner:** USACE, DENR (DWQ, DCM), Resource Agencies, and DOT

**Sponsor:** DENR/DOT/USACE Coordination Group Liaison (Principle: Bill Gilmore)

**Team Leader(s):** Suzanne Klimek (DENR/WRP)

**Facilitator:** Chris Russo (DENR)

**Team Members:** Department of Transportation  
Division of Water Quality  
Division of Coastal Management  
U.S. Army Corps of Engineers  
Environmental Protection Agency  
Wildlife Resources Commission  
U.S. Fish and Wildlife Service  
Natural Heritage Program  
Natural Resources Conservation Service  
Federal Highway Administration

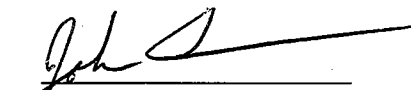
**Potential Stakeholders:** EPA, USFWS, Marine Fisheries, other states implementing NEPA/404 Merger Process, DENR permitting divisions, USACE/DOT/DENR Senior Management, academics, consultants, as required.

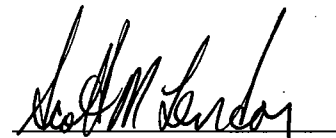
**List of Resources:** EPA, USFS, USFWS, US Marine Fisheries, other state environmental agencies, DENR permitting divisions, USACE/DOT/DENR Senior Management, consultants, as required.

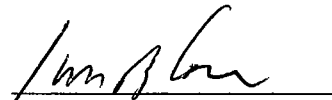
**Team Contract:** We have read and understand this team charter, understand our roles, and have come to agreement with the Sponsor on the opportunity to be addressed, the actions to be taken, and the limitations on the project. If at any time it becomes apparent that the Team Charter needs to be modified (including additional members), we will consult the Sponsor and come to agreement on the modifications.

**Signatures of Team Members and Sponsor:**

  
Suzanne Klimek, DENR/WRP  
Team Leader

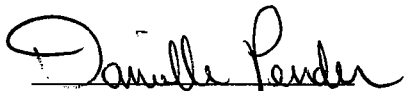
  
John Alderman, DOT

  
Scott McLendon, USACE

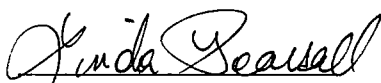
  
Jim Blose, DENR/DWQ

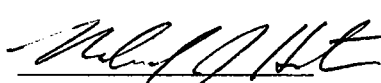
  
Guy Stefanski, DENR/DCM

\_\_\_\_\_  
Jennifer Derby, EPA

  
Danielle Pender, DENR/WRC

  
John Ellis, USFWS

  
Linda Pearsall, DENR/NHP

  
TBD, NRCS

  
Ron Lucas, FHWA

  
Bill Gilmore  
Coordination Group Representative

## CGIA Methodology

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### Watershed Selection Analysis Summary For the North Carolina Wetlands Restoration Program

The Center for Geographic Information and Analysis (CGIA) has prepared a set of GIS data for the North Carolina Ecosystem Enhancement Program (EEP) to assist in their selection of 10 hydrologic units for in-depth investigations. The attached spreadsheet outlines the steps involved in the creation of the data.

CGIA analyzed all 14 digit hydrologic units (huc) in 10 selected cataloging units (CU). Data were divided into three major categories for reporting purposes: baseline data, assets and problems as requested by EEP. Baseline data were reported as-is, but additional manipulation was required for the asset and problems datasets.

Based on recommendations provided by a watershed team the problem and asset datasets were normalized using the procedure described as follows. Four datasets were normalized for the asset dataset:

- 1) RTE and critical habitat percentages (rte)
- 2) Percentage of streams with buffers (sb)
- 3) Percentage of stream miles with special designation (excluding WS-III-IV streams) (sd)
- 4) Percentage of watershed acres in conservation management (cm)

Five datasets were normalized for the problem dataset:

- 1) Percentage of partially supporting streams (ps)
- 2) Percentage of not supporting streams (ns)
- 3) Percentage of 303(d) streams (303)
- 4) Impervious surface percentage (is)
- 5) Percentage of stream miles not buffered. (nb)

The percentage points for each category were added for each huc. This gave a sum of the percentage points for the asset category and sum for the problem category for each huc. This was called “asset total” and “problem total.”

**Asset total**<sub>(huc#)</sub> = rte+sb+sd+cm (for each huc)

**Problem total**<sub>(huc#)</sub> = ps+ns+303+is+nb (for each huc)

For example, if a huc had an rte of 30%, a sb of 40%, a sd of 36% and a cm of 14%, the sum of the percentage points would equal 140 for assets.

To better express assets and problems for comparative purposes, CGIA normalized the results using the following method. The highest overall percentage (based on all numbers for all 10 cataloging units) for each of the nine categories listed above was noted. The single highest percentage for each dataset was added to the others for the asset and problem datasets.

**Sum Highest Assets** = high rte+ high sb+high sd+ high cm (based on single highest number for all 10 CUs. This was not done for each CU. One overall Sum Highest Asset was calculated and used for all huc normalizations)

**Sum Highest Problem** = high ps+ high ns+ high 303+ high is+ high nb (for all CUs)

The sum of the highest percentages for the asset and problem datasets was used to normalize the asset and problem totals. Asset and problem totals were divided by the highest percentage sums. This provided a number called “weighted percent problem total” or “weighted percent asset total.”

$$\frac{\text{Asset Total}_{(huc\#)}}{\text{Sum Highest Assets}} = \text{weighted percent asset total}_{(huc\#)}$$

$$\frac{\text{Problem Total}_{(huc\#)}}{\text{Sum Highest Problems}} = \text{weighted percent problem total}_{(huc\#)}$$

A map showing the weighted percent assets and problems for each CU was provided to EEP in addition to graphs showing the stacked percents of each problem and asset, and the raw data for each huc.

## Appendix C

# Description of Phase I Analysis

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Phase I of Local Watershed Planning as described by the NCWRP is comprised of four major steps as described below:

- A. **Compilation & Review of Existing Data and information**
  - GIS coverages, maps, aerial photos and other data resources available through state, federal and local sources
  - Historical trend analysis (primarily land use/land cover; past land disturbance activities; hydromodifications; channel evolution; population & development trends)
  - Review and analysis of local zoning/land use, sediment control and stormwater-related ordinances/rules & programs
  - Identification of critical data gaps
  - Integration of water quality and aquatic habitat analysis based on available information
- B. **Initial Visual Assessment of the Watershed**
  - Initial watershed investigation, including “windshield survey” of stream conditions at road crossings and other accessible points, with written and photo-documentation of conditions
  - Initial cataloging (in atlas-type format, with maps and accompanying summary tables) of restoration, preservation and BMP/retrofit opportunities
- C. **Subwatershed Delineation (and possible Initial Modeling)**
  - Subwatershed delineation (delineation of subdrainages within the HU(s) selected for assessment based on hydrology, land use/cover, municipal boundaries, etc.). Be sure to clearly identify subwatershed delineation criteria used; the area of subwatersheds should range generally from 0.5 to 5.0 square miles in size. Basic watershed statistics should be provided for each subwatershed delineated.
  - Initial model set-up and watershed-wide water quality (NPS) modeling (e.g., use of export coefficients to predict pollutant loads under various land use/land cover and imperviousness conditions), if determined necessary to meet the objectives of Phase 1 characterization. Generally speaking, any modeling conducted during Phase 1 would be basic spreadsheet-type models or similar relatively simple analyses suitable for predicting spatial variations in non-point source pollutant loadings across the watersheds and subwatersheds.
- D. **Development of Preliminary Findings and Recommendations**
  - Identification of working hypotheses regarding major causes/sources of watershed problems (e.g., water quality impairment; habitat degradation; flooding; etc.)
  - Identification of potential solutions best suited to address identified problems based on initial assessment (e.g., wetland, stream and riparian buffer restoration, agricultural or urban Best Management Practices or BMPs, preservation, enhancement, etc.)
  - Scoping of functional indicators and assessment & modeling methods for detailed assessment [Phase II]
  - Recommended monitoring plan for sampling & analysis to be conducted