Watershed Tools for Local Watershed Organizations

In recent years, use of geospatial (GIS) data in evaluating and comparing watershed characteristics has increased dramatically, and this has happened not only in larger water quality programs of state and federal government agencies. It is now more common for local governments and local-scale watershed organizations to have the skills, knowledge and experience to use geospatial data to analyze their local environment, develop strategies and priorities, and communicate with others by using specially created maps. Below are some examples of watershed-based questions that local groups may want to answer and act upon:

- Which of the watersheds that make up our river basin are in the best condition? The worst condition?
- Where have polluted waters been found and reported?
- Are all our watersheds monitored? If some are not, do they contain possible sources of pollution?
- Can methods that have controlled pollution in some of our watersheds be applied in similar watersheds?
- What are our best watersheds for protection?
- Which of our watersheds may respond best to restoration?

Local groups and agencies need watershed-based information and analytical tools for a variety of water quality program decisions and plans. Many people, however, can't use advanced GIS software and thus are not able to interact with watershed data and maps easily on a day-to-day basis as they think about environmental management needs and alternatives. EPA is supporting watershed data and tools development across the nation, and this includes easy-to-use tools that far more people can use without advanced training or expense. The products of this effort – the **Recovery Potential Screening Tool** and the **Watershed Index Online** -- can help local-scale watershed management, restoration and protection at scales from local to national, anywhere in the country.

What watershed information and tools would help local groups?

Local groups need much of the same watershed information as state or national groups and agencies, and all users need easy to use tools for comparing watershed information in support of their decisions and actions. Hundreds of different watershed characteristics can be relevant to local environmental management activities. Ecological characteristics are important for providing insight into how healthy the watershed's natural environment may be. Stressor characteristics help identify what sources and effects of pollution are present. Social characteristics of watersheds can reveal a broad array of community, economic, regulatory, and other influences on watersheds' current and future condition. When these ecological, stressor, and social characteristics are measured on every watershed, they can be used as watershed indicators to provide a basis for consistent comparison. The most relevant ecological, stressor, and social indicators are selected depending upon the reason for the comparison.

EPA's Recovery Potential Screening (RPS) Tool was developed to support a wide variety of watershed comparative analysis tasks, on scales from local to national, using watershed indicators in a user-customized assessment process. Although originally created to help states compare and prioritize watersheds for restoration and protection, Statewide RPS Tools can be used to identify, assess and compare only those watersheds that are of interest to a more local-scale group (e.g., the subwatersheds within one river basin, or the watersheds within one county). Most of the watershed indicator data in RPS Tools comes from the Watershed Index Online (WSIO), an online watershed data library that houses hundreds of indicators on watersheds across the lower 48 states. WSIO contains a modified version of the RPS Tool that also supports local scale watershed comparative assessments on any user-defined project area.

What is Recovery Potential Screening?

Recovery Potential Screening (RPS) is a systematic, comparative method for identifying differences among watersheds that may influence their relative likelihood to be successfully restored or protected. It was developed by the EPA Office of Water as a flexible, user-driven tool to help compare impaired waters more quickly and efficiently and set priorities for investing limited restoration resources. The screening approach involves identifying a group of watersheds to be compared and a specific purpose for comparison, selecting appropriate indicators in three categories (Ecological, Stressor, Social), calculating index values for the watersheds, and applying the results as part of strategic planning and prioritization.

What is the Recovery Potential Screening Tool?

The RPS Tool is a custom-coded Excel spreadsheet that performs all RPS calculations and generates RPS outputs. It was developed several years ago to help users calculate Ecological, Stressor, Social, and Recovery Potential Integrated index scores for comparing up to thousands of watersheds systematically in a desktop environment using widely familiar software. The RPS Statewide Tool series includes individual tools for each of the lower 48 states with indicator data (on HUC12 watersheds, each approximately 35 sq mi in area) already embedded. Complete usage directions are included on all the Tool's worksheets, as well as in a user manual on the RPS website. Many of the indicators are landscape characteristics derived from GIS datasets, but other attributes derived from field monitoring and geo-referenced to water bodies or watersheds, such as selected impairment-specific 303(d) and TMDL data, are also included.

What kinds of skills and equipment does an RPS Tool user need?

Anyone with basic familiarity with Microsoft Excel (versions 2007 or later) and a personal computer can learn how to use the RPS Tool quickly at their own desktop. Directions for each step and worksheet are contained within the Tool file, and a user manual with more detailed directions is available on the RPS website.

What kind of outputs can an RPS Tool generate?

The RPS Tool generates the results from each screening run in tabular, graphic, and map format (Figure 1). Results from a RPS Tool include a table of index scores and rank orders (Ecological, Stressor, Social, and Integrated), a bubble plot display, and a HUC12 map display. Users can customize the bubble plot display and the map (e.g., use a color gradient on the HUC12 bubbles or the mapped HUC12s to represent value differences for one key indicator of interest), and different iterations of the map and bubble plot can be saved as JPG files for future use while iteratively changing settings and exploring options with screening results.

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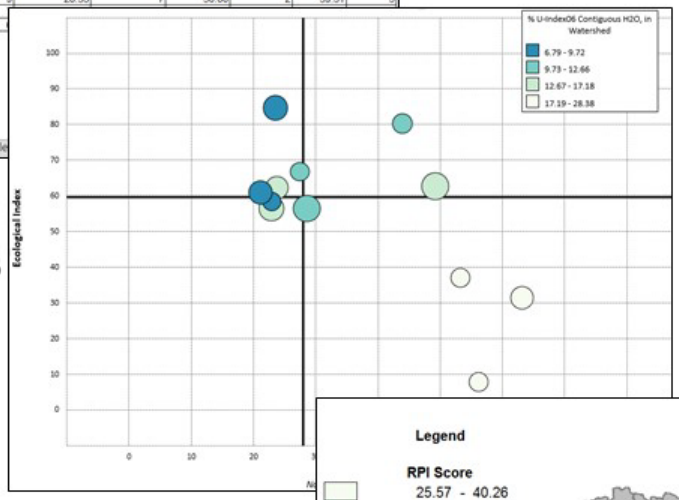
Watershed ID	Watershed Name	Ecological Index	Ecological Rank	Stressor Index	Stressor Rank	Social Index	Social Rank	RPI Score	RPI Rank
020700030102	Flintstone Creek	62.66	4	49.18	9	50.05	1	54.51	8
020700030103	Murley Branch	7.86	12	56.18	11	25.03	11	25.57	12
020700030104	Sweet Root Creek-Town Creek	62.30	5	23.75	5	38.03	6	58.86	4
020700030105	Peters Run-Town Creek	56.50	8	22.85	2	42.18	4	58.61	5
020700030106	Sawpit Run-Town Creek	84.74	1	23.50	4	42.63	3	67.96	1
020700030301	Upper Fifteenmile Creek	66.84	3	27.43	6	25.00	12	54.81	6
020700030302	Lower Fifteenmile Creek	80.38	2	43.88	8	27.88	8	54.79	7
020700030304	Crooked Run-Sideling Hill Creek	37.04	10	53.23	10	27.03	9	36.95	10
020700030305	Bear Creek-Sideling Hill Creek	31.42	11	63.18	12	36.90	7	35.05	11
020700030801	Purslane Run-Potomac River	56.44	9	28.53	7	50.00	2	59.31	3
020700030802	Rockwell Run-Potomac River	58.40							
020700030803	Willett Run-Potomac River	61.00							

Setup | Notes | Summary_Scores | Bubble_Plot | Bubble

B



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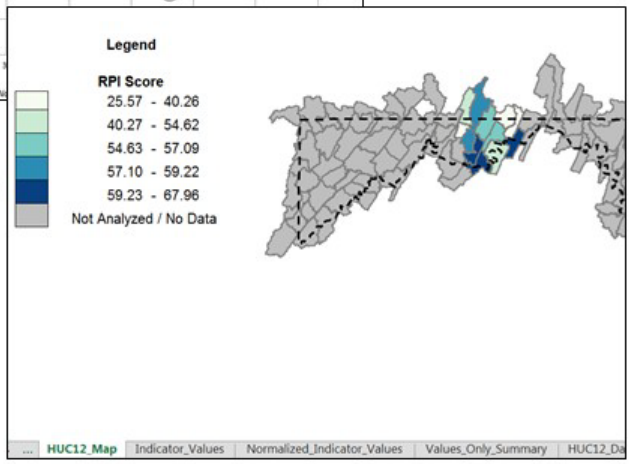

Figure 1. Recovery Potential Screening Tool outputs from a demonstration analysis of local-scale watersheds that compares their relative condition and restorability.

A: Ecological, Stressor, and Social Index values calculated and rank-ordered for a local subset of Maryland watersheds.

B: Bubble plot of the same watersheds (bubble symbols); position and size are determined by index score per watershed, and bubble color shows percent man-altered land near surface waters (darker blue implies less altered land).

C: The same HUC12 watersheds in map format with their RPI score shown by color shades (darker blue is higher).

What should I do to use an RPS Tool to analyze my local area watersheds?

Please follow the instructions below. For more information or assistance, please contact norton.douglas@epa.gov.

1. *Download a Statewide RPS Tool.* First, decide on the full extent of your project area. For the state or states within which this area occurs, find the statewide tools at the public website http://www2.epa.gov/watershed-index-online/watershed-index-online-wsio-download-statewide-tools.

2. *Open the Tool in Excel*. First, always save the RPS Tool by a different name so you always have the original copy unchanged and unused. Scroll to the right along the list of worksheet tabs (bottom of the screen), and go to the tab marked HUC12_DATA. Identify all of the HUC12 scale watersheds that are needed to completely cover your area of interest; you can do this by the watershed names and ID numbers in the data table. One easy way to identify the HUC12 watersheds in your project area is to base your project area on one or more larger HUC8 watersheds (also listed in the data table) and including all of the HUC12s within them.

3. *Create a list of your local area's watershed IDs*. From column A of the RPS Tool's DATA tab, copy all of the HUC12 ID numbers that you want to include in your project area. Move to the SUBSETS tab and paste the column of IDs there, leaving the top cell blank for the name of this list. If you want to create other subsets of watersheds, either from other areas or different subsets from within your original list (e.g., urban group, suburban/rural group, mixed group), repeat this process and name each subset.

4. *Set yourself up to do a watershed screening*. In the RPS Tool, select and copy one subset of HUC12 IDs from the SUBSETS worksheet without the subset name. Then paste the list into the left-most column of the SETUP worksheet (left end of the tabs). You are now ready to compare these watersheds to one another based on indicators you will select from the dropdown menus for Ecological, Stressor, and Social indicators. Select at least one indicator in each of the three categories, but ideally not more than 10 in each. You can choose countless combinations of indicators to compare your watersheds for different purposes. Click on the button "RUN SCREENING" when you are ready.

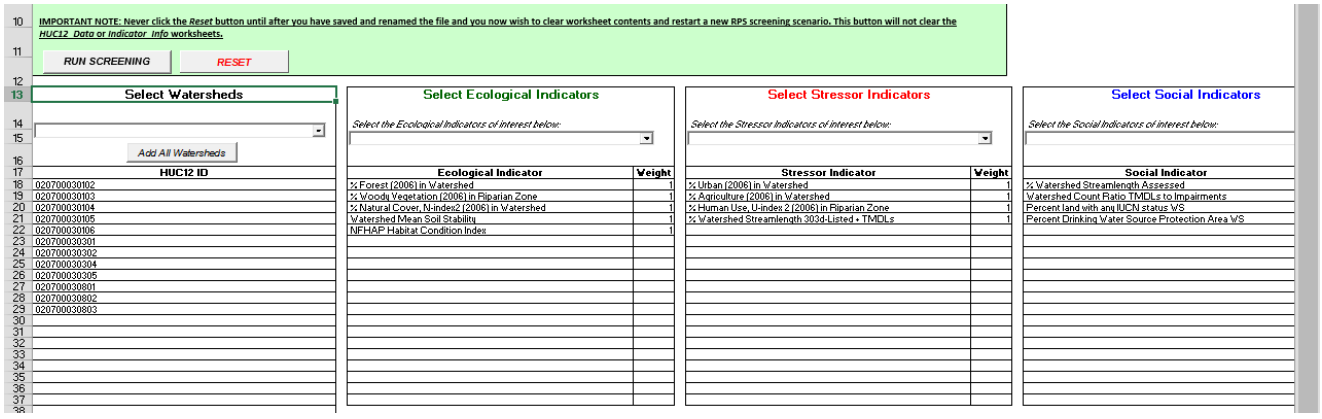

Figure 2: On the SETUP tab, enter the watershed IDs at left and select indicators from each of three pull-down menus. Click "RUN SCREENING" at upper left and all the tabular, graph, and map results are auto-calculated.

5. *View your results*. After seeing the pop-up "Project Successfully Created" you can find the complete results of your watershed comparison in three different formats: tabular rank-ordered indexes, a bubble plot graphic, and a map graphic. Examples of each appear below (data for demonstration only). The RPS Tool results are all based on the four indices it calculates: Ecological, Stressor, Social, and Integrated (RPI) scores; the indices are presented in different ways that may serve different purposes, but they are all based on the same data.

6. *Compare the watersheds within your project area in different ways.*
    a. *Index scores and rank orders.* The index values, which are also used to rank-order the watersheds, can be used to compare watershed to watershed based on four different scores found on the SUMMARY SCORES tab. Although watersheds adjacent in rank order may not differ significantly, substantial

differences in rank may be meaningful. It is also useful to see how best-scoring watersheds differ based on ecological, stressor, and social index scores, and how these individually affect their overall RPI score.

b. *Bubble plots.* An alternative way to view and compare watersheds is available on the BUBBLE PLOT tab, where the screening run automatically creates a graph based on each watershed's index scores. Ecological and stressor scores determine the X and Y location of each watershed and social score determines the watershed 'bubble' symbol's size. Your watershed subset's median scores for the ecological and stressor indices further divide the graph into quadrants that can be useful for comparison; for example, the upper left quadrant holds watersheds that have lower stressors and higher ecological scores, possibly good candidates for protection, and the upper right quadrant combines high ecological and high stressor scores, which may be the watersheds that more urgently need restoration actions before degradation gets worse. The bubble plot can be further customized to provide more information such as name labels or adding a color range based on any watershed indicator of choice. Bubble plot images can be saved as image files for reports and presentations.

c. *Maps.* On the HUC12 MAP tab there is a simple map of HUC12 watershed boundaries within the state, color coded with the results of the RPI score from the current screening. If you have screened your subset of watersheds rather than all watersheds statewide, only those watersheds will be colored in. The map can be customized to represent any index or single indicator, and can be saved as images.

7. *Provide a broader context: compare your local watersheds to watersheds statewide*. RPS users working at local scales must always remember that RPS provides a *relative, not absolute, comparison of watersheds*. Whether your watersheds are exceptionally healthy, very degraded, or a mix, your local screening will provide you only with results from the highest to lowest scores. In fact, your lowest score could still be a healthy watershed – unknown to you, unless you compare your local screening results to a larger number of watersheds with a wide range of conditions (see Figure 3). The Statewide RPS Tools offer an opportunity to check the scores of a watershed subset against the backdrop of all statewide scores, in the Bubble Plot. As described in 6b above, the default settings for any bubble plot set the median lines based on the subset's range of values only. When viewing only the subset's watersheds, some appear to score very high and others low. On the tab called BUBBLE PLOT OPTIONS, select "ALL WATERSHEDS SCREENING" at lower left, then return to the bubble plot – now, the subset watersheds are plotted against the median ecological and stressor scores statewide. A second method for providing context for a subset is to identify and use reference watersheds for which conditions are known to be very good (or poor) in the screening along with the subset.

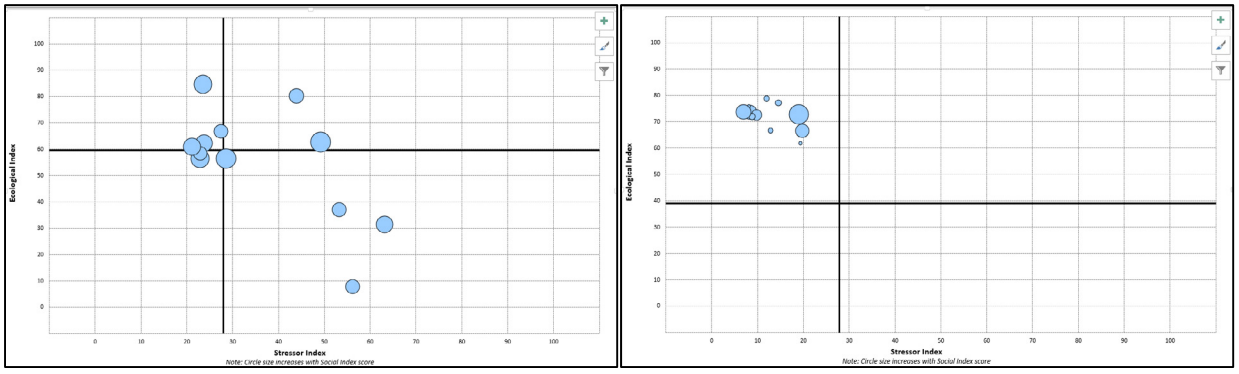

Figure 3: Screening of the same group of watersheds plotted alone (left) and relative to statewide scores (right). Comparing the watershed scores only to one another seems to imply significant differences in watershed condition, but comparison to statewide scores reveals these watersheds all have good scores.