# Great Lakes Basin Riparian Opportunity Assessment

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New York Natural Heritage Program

Cover photos: Top: Plumb Brook, Whippoorwill Corners State Forest by Erin L. White, Bottom left: Indian River, Fort Drum by Kelly A. Perkins, Bottom Right: Orebed Creek, Orebed State Forest by Erin L. White

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# The New York Natural Heritage Program

The New York Natural Heritage Program (www.nynhp.org) is a program of the State University of New York College of Environmental Science and Forestry that is administered through a partnership between SUNY ESF and the NYS Department of Environmental Conservation. We are a sponsored program within the Research Foundation for State University of New York.

The mission of the New York Natural Heritage Program is to facilitate conservation of rare animals, rare plants, and significant New York ecosystems. We accomplish this mission by combining thorough field inventories, scientific analyses, expert interpretation, and a comprehensive database on New York's distinctive biodiversity to deliver high-quality information for natural resource planning, protection, and management.

Established in 1985, our program is staffed by 25 scientists and specialists with expertise in ecology, zoology, botany, information technology, and geographic information systems. Collectively, the scientists in our program have over 300 years of experience finding, documenting, monitoring, and providing recommendations for the protection of some of the most critical components of biodiversity in New York State. With funding from a number of state and federal agencies and private organizations, we work collaboratively with partners inside and outside New York to support stewardship of New York's rare animals, rare plants, and significant natural communities, and to reduce the threat of invasive species to native ecosystems.

In addition to tracking recorded locations, NY Natural Heritage has developed models of the areas around these locations important for conserving biodiversity, and models of the distribution of suitable habitat for rare species across New York State.

NY Natural Heritage has developed two notable online resources: Conservation Guides include the biology, identification, habitat, and management of many of New York's rare species and natural community types; and NY Nature Explorer lists species and communities in a specified area of interest.

NY Natural Heritage also houses *i*MapInvasives, an online tool for invasive species reporting and data management.

In 1990, NY Natural Heritage published *Ecological Communities of New York State*, an all inclusive classification of natural and human-influenced communities. From 40,000-acre beech-maple mesic forests to 40-acre maritime beech forests, sea-level salt marshes to alpine meadows, our classification quickly became the primary source for natural community classification in New York and a fundamental reference for natural community classifications in the northeastern United States and southeastern Canada. This classification, which has been continually updated as we gather new field data, has also been incorporated into the National Vegetation Classification was developed and refined by NatureServe, The Nature Conservancy, and Natural Heritage Programs throughout the United States (including New York).

NY Natural Heritage is an active participant in NatureServe (www.natureserve.org), the international network of biodiversity data centers. NatureServe's network of independent data centers collect and analyze data about the plants, animals, and ecological communities of the Western Hemisphere. The programs in the NatureServe Network, known as natural heritage programs or conservation data centers, operate throughout all of the United States and Canada, and in many countries and territories of Latin America. Network programs work with NatureServe to develop biodiversity data, maintain compatible standards for data management, and provide information about rare species and natural communities that is consistent across many geographic scales.

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A Partnership between the
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## Introduction

### *Project Background and Overview*

The Great Lakes Basin Riparian Opportunity Assessment began April 1, 2015 and spanned one year. The New York Natural Heritage Program (NYNHP) of the State University of New York College of Environmental Science and Forestry (SUNY ESF) completed this project for the New York State Department of Environmental Conservation's (NYS DEC) Great Lakes Watershed Program. The goal of the project was to strategically identify and prioritize sites for implementation in DEC's Trees for Tribs program (http://www.dec.ny.gov/animals/77710.html), which enlists the help of volunteers to plant native trees and shrubs in riparian buffers of streams to improve wildlife habitat, water quality, climate resiliency, and to provide flood protection during storm events. While this was the primary goal of our assessment, we maintained additional goals of riparian protection as well as other restoration efforts. This assessment directly supports multiple goals and actions included in New York's Interim Great Lakes Action Agenda (http://www.dec.ny.gov/docs/regions_pdf/glaai.pdf) and advances an ecosystem-based management approach to riparian restoration and protection work in the Basin by promoting strategic, science-based decision-making to achieve multiple benefits.

We, therefore, did not design the products to offer a stand-alone single prioritization of sites for specific restoration work. Rather, the products offer a suite of tools that conservation practitioners, watershed stakeholders, and others can use to inform their decisions about where to perform riparian restoration and protection work in their region. Finally, site-specific knowledge is imperative and field validation is a necessary step before actual implementation of conservation actions.

### *Study Area*

The project study area consisted of the Great Lakes Basin in New York State. We included all sub-watersheds and catchments falling within the following HUC 6's or sub-regions: Eastern Lake Erie, South Western Lake Ontario, South Eastern Lake Ontario, Oswego, North Eastern Lake Ontario, and St. Lawrence (Figure 1). The Great Lakes basin represents a portion of 20% of the Earth's fresh surface water held within the interconnected Great Lakes system. By analyzing the riparian areas within this region, we created robust conservation and restoration tools to help prioritize riparian plantings to improve water quality and protect water resources for the Basin.

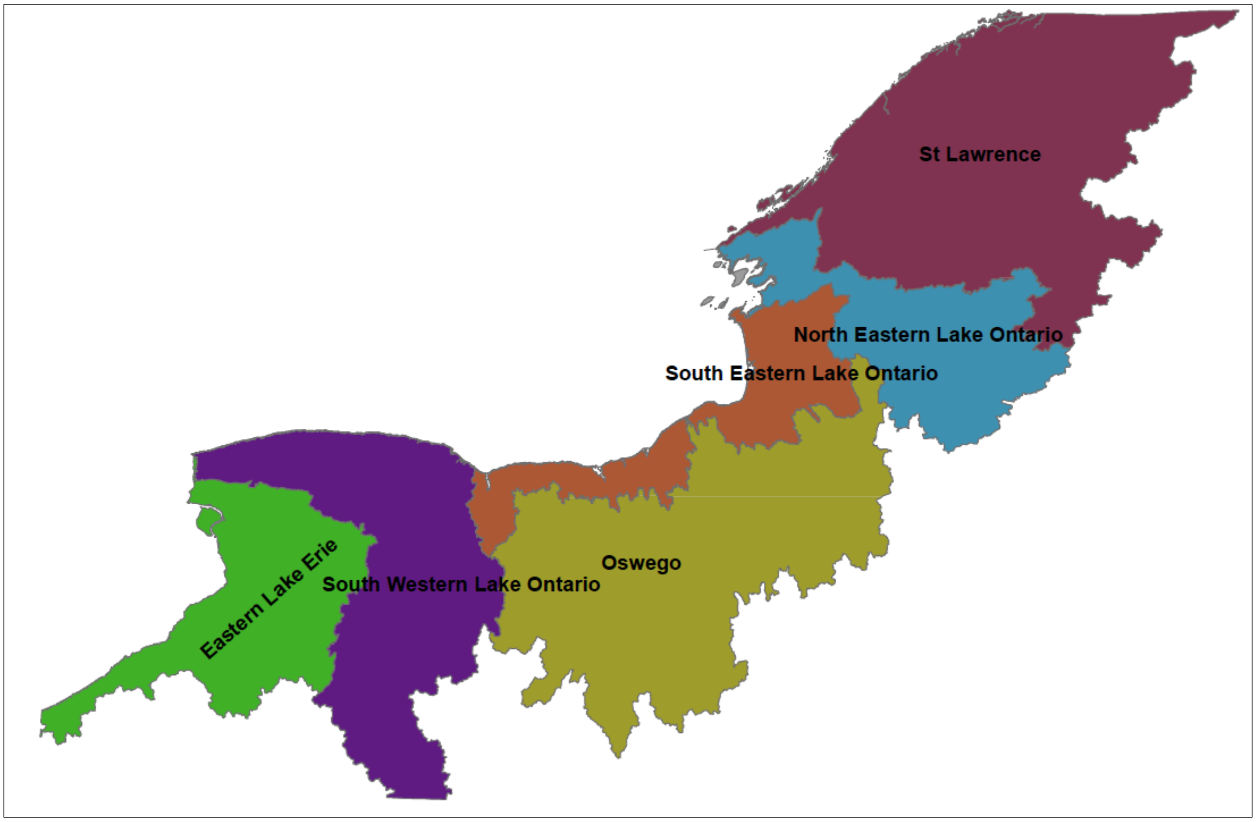


Figure 1. Project study area, the Great Lakes Basin within New York State. The six sub-basins labeled and indicated in different colors.

*Project Steering Committee*

We assembled a project steering committee to review and provide feedback on the methodology and interim results of this project. The committee was made up of NYS DEC staff as well as partner agencies and organizations with expertise in restoration and protection. All project steering committee members provided critical input at each stage of the development process. We met three times during the course of the project to review our methods and results from our sub-watershed and catchment analyses. Committee members included Shannon Dougherty, Emily Sheridan, Jennifer Dunn (NYS DEC Great Lakes Watershed Program), Sarah Walsh, Jeffrey Mapes (NYS DEC Division of Lands and Forests), Beth Roessler (NYS DEC Hudson River Estuary Program and Cornell University), Tracey Tomajer, Fred Henson (NYS DEC Division of Fish, Wildlife, & Marine Resources), Brian Duffy (NYS DEC Division of Water), Stevie Adams (Central and Western NY Chapter of The Nature Conservancy), Victor DiGiacomo, Gabriella Spitzer (NYS Department of Agriculture and Markets), and Greg McGee (SUNY ESF).

*Project Details*

In a landscape, the riparian zone has a large influence on water quality within, and downstream from, its adjacent streams, lakes, wetlands, and other water bodies (Brinson *et al.*

2002). Thus, maintaining or improving riparian areas in order to filter sediment, accumulate excess nutrients, and perform other important hydrologic, geomorphic, and biological functions is important for maintaining and improving the health of our inland water bodies. Identifying locations most important for riparian area improvements or maintenance, however, requires an understanding of the relative condition of sub-basin and riparian zones throughout an area of interest.

The first project task was to complete a literature review and to develop a methodology to assess the condition of areas within the Great Lakes Basin. We researched methods for delineating a riparian zone in our study area, appropriate habitat condition indicators to include in our analysis, how habitat indicators should be assembled, and which stratification units or scales were appropriate to use for this application. We then drafted a methodology for the project steering committee's review. With the committee's feedback, we revised the methods, detailed below, and began our assessment.

For this assessment, we decided to work at two scales or levels to allow for work within a watershed, to get a broad look watershed-wide and also at a more refined local level, and to highlight condition of lotic habitats at the stream level as well as relative condition of streams within a larger area. The first level of analysis was at the sub-watershed, or HUC 12 unit. At this scale, we developed a suite of indicators for relative ecological health and ecological stress within the sub-watershed (Table 1). Indicators included brook trout locations, a stream invertebrate health metric called Biological Assessment Profile, rare species locations, floodplain complex locations, presence within large forested areas, presence within a functional river network, the amount of canopy cover, and the amount of natural land cover. Indicators for ecological stress included the DEC priority waterbody list, high runoff areas, high erosion areas, dam storage ratio, impervious surface, and the Landscape Condition Assessment metric (a synthesis layer of many other stressors, Feldmann and Howard 2013).

Table 1. Ecological Health and Ecological Stress indicators used in our assessment.

| Ecological Health Indicators | Ecological Stress Indicators |
|---|---|
| Canopy Cover | Landscape Condition Assessment |
| Natural Cover | Impervious Surface |
| Matrix Forest Blocks | Erosion Index |
| Floodplain Complexes | Topographic Wetness Index |
| Presence of Rare Taxa | Priority Waterbody Inventory |
| Presence of Brook trout | Dam Storage Ratio |
| Biological Assessment Profile | |

We describe these indicators in more detail in the methods section below and Appendix A. Indicators are summarized so that practitioners can quickly grasp the sub-watersheds currently predicted as having higher or lower overall stream condition. Such a ranking does not necessarily determine the amount of action needed; however, it helps practitioners understand the likely type of action most applicable within each basin (such as restoration or protection).

The second level of the assessment was intended to help prioritize where *within* a sub-watershed to improve or maintain the riparian zone. At this level, we created catchments – very small watersheds the size of each high-resolution stream segment. We prioritized catchments based on the condition of indicators within each catchment and within its riparian zones. Again, this type of stream condition ranking will improve our understanding of the types of actions most appropriate for specific riparian areas, but does not necessarily exclude certain areas for potential future actions.

The assessment products are available in three formats: PDFs, an ArcGIS geodatabase, and an online data visualization tool. Users can approach these products with a specific conservation goal in mind and utilize certain aspects of the data (e.g., one or both scales of analysis, individual indicator scores or overall summary scores, etc.), depending on their goal, to help arrive at a prioritization scheme for their work. To assist you, case studies, or scenarios, have been examined in the discussion section below to offer examples of how this dataset may be used to answer specific questions. We further suggest all users read and understand the methods below to assist you in determining how best to use our tools.

## Methods

### *Units of Analysis*

#### Sub-Watershed

Analysis was carried out for two units of scale, the larger being the sub-watershed, and the finer scale being the catchment. Sub-watersheds were defined according to the National Hydrography Dataset (NHD) Watershed Boundary Dataset's HUC 12 units; each HUC 12 represented one sub-watershed. There are 687 sub-watersheds within the Great Lakes Basin, averaging 100 sq km in size.

#### Catchments

The catchment level analysis describes habitat quality at a much smaller scale than the sub-watershed level features. Each sub-watershed was divided into smaller units, which were scored similarly to the sub-watersheds. These scores reflect the quality of habitat within each catchment, to aid in prioritizing work at a smaller scale. Currently, the NHD does not provide catchment polygons that correspond to the High Resolution streams data, so we created our own for the purpose of this analysis. Catchment boundaries were based on a 10m digital elevation model and the high resolution streams, using the ArcHydro toolset. One catchment was created for every stream reach and there are over 50,000 catchments in the study area, averaging 1 sq km in size. Stream reach was defined using the NHD assigned "ReachCode" in the polyline feature class. The area defined by the catchment is the area which drains into each reach. For details on the ArcHydro work flow and parameters used to create the catchments, see Appendix B.

### *Riparian Buffer Delineation*

To specifically assess the quality of habitat within the riparian zone, the boundaries of the riparian zone needed to be defined. We chose to use a variable width riparian buffer. Variable width buffers take into account surrounding hydrology and can provide a more accurate delineation of riparian habitat than the more commonly used fixed width buffers (Lee *et al.* 2004, Polyakov *et al.* 2005), although they take longer to create.

We created a riparian buffer for qualifying streams in the National Hydrography Dataset (high-resolution NHD,

Figure 2). This riparian boundary was defined using the Riparian Buffer Delineation Model (Abood *et al.* 2012), an ArcGIS compatible tool that calculates the riparian boundary based on digital elevation data, a streams layer, a wetland layer, and an estimate of the 50 year flood height in the area. The 50 year flood height for each sub-watershed was estimated based on annual flow data and field measurements from gages within the Great Lakes Basin, acquired from the US Geological Survey's Surface-Water data points for the Nation, as well as additional data from the USGS Stream Stats service. For all scores and indicators described as "riparian," source data were first clipped to just those areas within the boundaries of the riparian layer. For full descriptions of methods and parameters involved in creating the riparian buffers, see Appendix B.

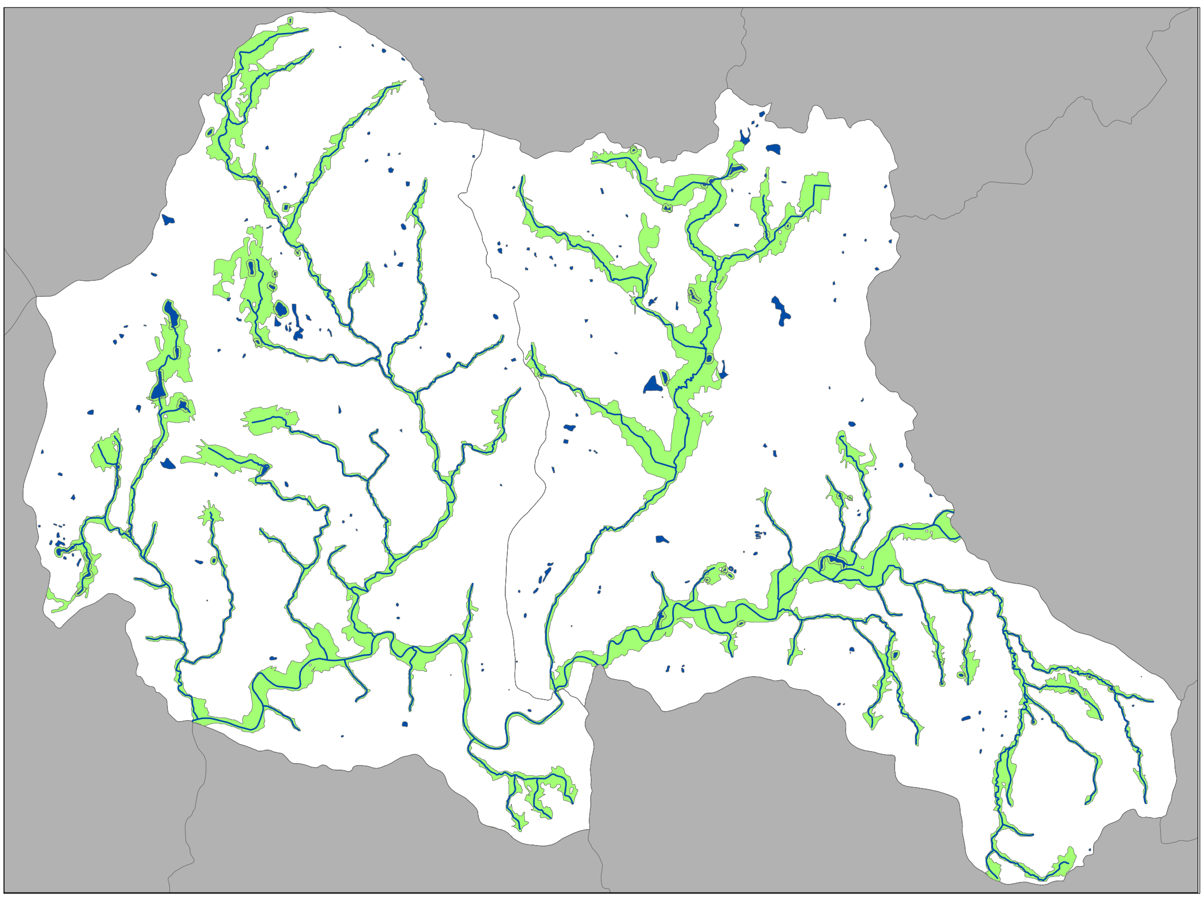

Figure 2. Example of two sub-watersheds with streams in blue and the variable width riparian buffer delineated in green.

## *Habitat Indicators*

When designing the model, the selection of indicator variables was focused on those aspects of habitat quality which could most directly inform the optimal placement of vegetative riparian buffers (Figure 3). We chose to present a suite of indicators to accommodate a range of conservation priorities instead of a single comprehensive score tuned for a specific purpose. Restoring riparian buffer habitat can be used to improve several aspects of stream health, and a partner interested in using buffers to shade streams for trout habitat may need to focus on a different set of riparian areas than a partner interested in ameliorating the impact of upland agriculture. Through creating a suite of indicators, we are able to meet the needs of multiple stakeholders who are interested in using this assessment to maintain and restore riparian areas.

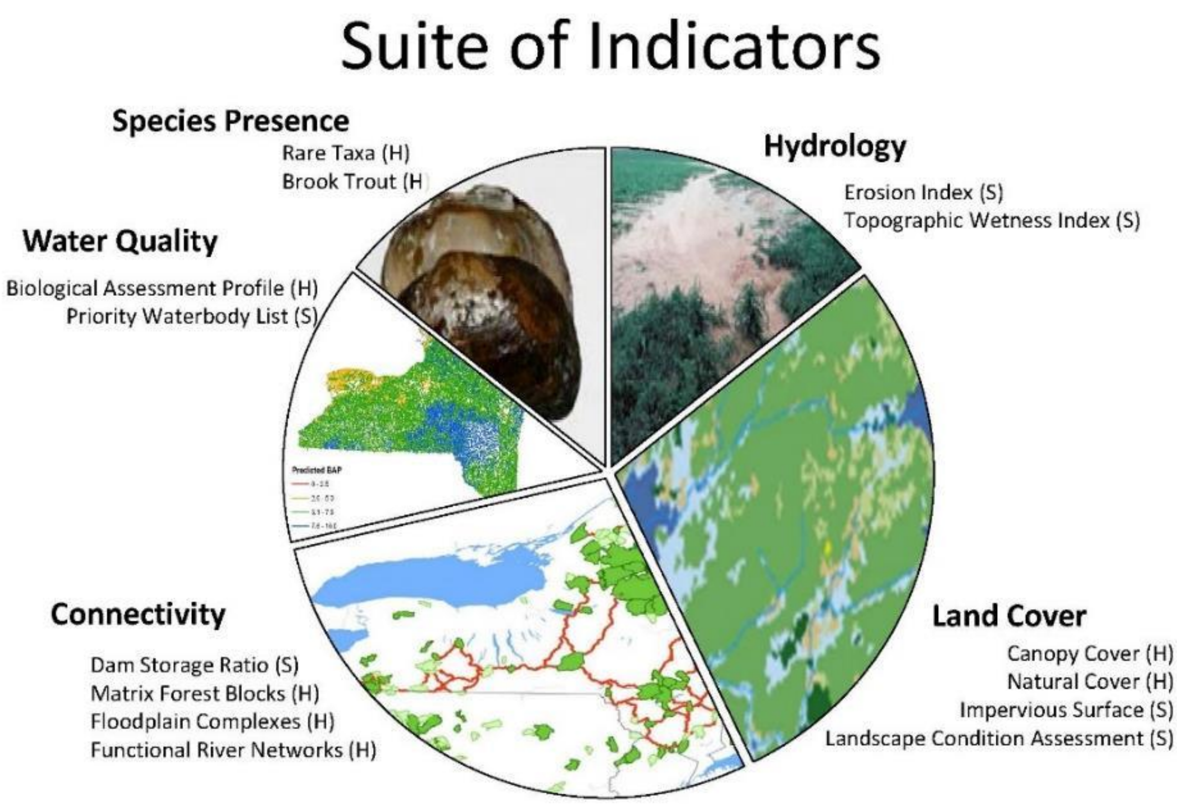


Figure 3. Set of ecological indicators used in assessment. “H” indicates an ecological health indicator, “S” indicates an ecological stress indicator.

Indicator scores were aggregated at the level of the sub-watershed and the catchment to create the raw score. Aggregation methods for each indicator varied slightly depending on the source data (Table 2) and complete methods are presented in Appendix and B. All raw scores can also be found in the ArcGIS feature class.

Table 2. Habitat Indicators and Aggregation Methods. For each indicator (Indicator Name), the following are listed: Indicator Quality group (ES = Ecological Stress, EH = Ecological Health), where the indicator was Applied (R = at the Riparian Zone only, B = both Watershed/Catchment wide and Riparian Zone), the Data Type of the indicator (CR = continuous raster, BR = Binary raster, PT = point values, PY = polygon, LI = line), and the Aggregation Method. For more detailed information about the development and sources for each indicator, see Appendix A.

| Indicator Name | Quality | Applied | Data Type | Aggregation Method |
|---|---|---|---|---|
| Landscape Condition Assessment | ES | B | CR | Avg. value for cells in unit |
| Canopy Cover | EH | B | CR | Avg. value for cells in unit |
| Natural Cover | EH | B | BR | % Natural cover * |
| Impervious Surface | ES | R | CR | Avg. value for cells in unit |
| Erosion Index | ES | R | CR | Avg. value for cells in unit |
| Wetness Index | ES | R | CR | Avg. value for cells in unit |
| Dam Storage Ratio | ES | R | PT | Sum of values falling in unit |
| Floodplain Complexes | EH | B | PY | Proportion of unit area composed of Floodplain Complex |
| Matrix Forest Blocks | EH | B | PY | Proportion of unit area composed of Forest Blocks |
| Functional River Networks | EH | R | LI | Sum of total length of functional river network in unit |
| WI/PWL Status | ES | R | LI | Proportion of total stream length** |
| Eastern Brook Trout | EH | B | PY | Sum of patch area per unit |
| Biological Assessment Profile | EH | R | LI | Avg. value for cells in unit |
| Rare Taxa Presence | EH | R | PT | Count of rare species in unit |

* The NLCD classes included in this group are listed in Appendix A. **Calculated as the proportion of the total stream length in the unit (sub-watershed or catchment) classified as Impaired, Threatened, or with Minor Impacts.

*Scoring*

The results of this analysis are presented as a set of scores for each area, which vary in specificity and focus.

Raw and Normalized Scores

Raw scores were calculated for all indicators in the same manner at the sub-watershed and catchment scales. Scores were normalized before calculating composite values like the Ecological Health, Stress, and Comprehensive scores to account for the different scales of the individual indicator raw scores. All normalized scores ranged from 0-1. Scores presented in the PDFs and online data explorer all represent normalized values. (Raw scores for all indicators are available in the ArcGIS geodatabase, where a user could recalculate metrics based on a different methodology, if desired).

At the sub-watershed scale, raw score values were normalized relative to the scores of all other sub-watersheds in the Great Lakes Basin. Sub-watersheds with similar scores represent similar quality habitat. Two sub-watersheds that both have a Comprehensive score of 0.9, for example, both represent high quality habitat.

At the catchment scale, we normalized raw catchment score values relative to the scores of other catchments within the same sub-watershed. When interpreting these data, it is important to consider that the catchments are scored relative to the other catchments in the sub-watershed. This means that all sub-watersheds will have red and blue catchments, which reflect the best and worst quality habitat within that sub-watershed. However, this is not an indicator of absolute habitat quality. Catchments in different sub-watersheds with the same score do not necessarily contain the same quality habitat. A catchment with a score of 0.25 in a very healthy sub-watershed may, in fact, represent overall better quality habitat than a catchment with a score of 1 in a sub-watershed with very high stress scores.

Composite Scores: Ecological Health, Ecological Stress, and Comprehensive Score

The Comprehensive score describes the results at the most general level; it takes into account the contributions of every indicator, and allows for fast and simple identification of the best and worst habitats. Sub-watersheds and catchments with high comprehensive scores represent habitats with low levels of ecological stress and several positive indicators of ecological health. Areas with low comprehensive scores represent habitat with poor health and high stress. The Comprehensive score was calculated by first separately combining the normalized scores of all 8 ecological health and 6 ecological stress indicators into the Ecological Health and Ecological Stress scores. These scores were normalized to range in value from 0-1, and the Comprehensive score was calculated as the difference between the Ecological Health and Ecological Stress scores.

Indicator Scores

The most specific scores provided are the indicator scores, one for each habitat indicator (described in the section above). Indicator scores allow for visualization of very specific aspects of the data, e.g., “canopy cover in the riparian zone”. Raw scores for each indicator are available in the ArcGIS geodatabase. For details on how raw scores were aggregated, see Table 2. Normalized scores, that all range in value from 0-1, are presented in the PDFs and online data explorer.

Themes

At the catchment scale of analysis, several scores were developed that addressed specific questions of conservation concern. Some of these “theme” scores were combinations of sub-sets of our existing indicators, while a few required the input of additional data. The purpose of the theme scores is to provide information that is more comprehensive than that available from any single habitat indicator and more specific than the Comprehensive score.

Water Quality: The focus of the Water Quality Theme was to highlight locations where riparian protection or restoration activities could support water quality by using metrics both within the stream buffer and the stream catchment. Indicators used include impervious surface, Landscape Condition Assessment (LCA), natural cover (see Appendix B for classes included), wetness index, erosion index, Biodiversity Assessment Profile (BAP), the New York State Protected Waterbodies List (PWL), canopy cover, and floodplain complexes. All were weighted heavily except for canopy cover and floodplain complexes, which were weighted lightly.

Connectivity: The purpose of the connectivity theme is to support stream corridor connectivity and identify areas along streams with united forest tracks and those areas within riparian buffers with gaps in forest cover where planting trees could increase connectivity. We provide this theme with the caveat that any restoration efforts with the primary goal of improving connectivity or identifying critical gaps would benefit highly from further analyses of forest fragmentation and this type of analysis was outside the scope of this project. What we provide here is an indirect indicator of low scoring riparian areas within sub-watersheds with existing good riparian connectivity; possibly locations where restoring the riparian zone of low scoring catchments may eliminate gaps hindering connectivity.

Stream Temperature: The purpose of the Stream Temperature theme is to help identify areas where stream temperature might be decreased by planting trees in the riparian zone. Increasing the canopy cover along streams would make the habitat more suitable for cold-water fish and improve connectivity among already forested, cold-water segments. We used all ecological health and stress indicators within the riparian buffers of streams, but we weighted brook trout, BAP, and canopy cover more heavily than all other indicators.

Runoff Risk: The purpose of the Runoff Risk theme is to identify areas with potential erosion hotspots that occur on land-use classes with soils likely to contribute to excessive runoff that may be addressed by riparian buffers. We used the erosion index indicator and overlaid this with specific land cover classes from both the 2011 NLCD and the CropScape dataset (USDA National Agricultural Statistics Service 2014) to determine areas with non-natural or agricultural cover with high erosion potential that could benefit from planting. For more details on the specific categories used from these datasets, see Appendix B.

Wetland Resiliency: The purpose of the Wetland Resiliency theme is to identify those areas along streams with greater flood capacity due to the presence of intact wetland habitat. We compared the riparian buffers to the National Wetlands Inventory (NWI) dataset and estimated the relative contribution of wetlands to the area of buffer. The least resilient basins would be those with fewer wetlands in the riparian zone. Conversely, the most resilient basins would be those with the highest proportion of wetlands in the stream corridor.

Details on the formulas and precise weighting schemes involved in all score calculations can be found in Appendix B.

Filters

At the catchment scale, we also wanted to provide a simple screening method to allow users to quickly identify areas which meet specific criteria. These filters aren't like other scores in that they are not stress or health indicators nor do they reflect habitat quality. They are simply used to identify if a catchment is in one of two states, urban or agricultural.

Urban Areas Filter: We classified catchments in Urban Areas if they intersected with Urbanized Area Polygons or Urban Clusters as defined by the 2010 Census.

Agricultural Areas Filter: Catchments were classified in Agricultural Areas if their riparian zone was composed of more than 25% agricultural land use (Pasture/Hay [NLCD type 81] or Cultivated Crops [type 82]) according to the National Land Cover Dataset (NLCD, U.S. Geological Survey 2011).

*Prioritization*

The products of the assessment allow for several approaches to prioritizing restoration and preservation activities.

Prioritizing by a single score

Locations can be ranked according to their Comprehensive score, or the score of the habitat indicator of interest. Those locations with the lowest comprehensive score or high score for an ecological stress indicator represent areas that may benefit the most from restoration activities. Locations with the highest comprehensive score, or the highest scores for ecological health indicators, will represent locations that may benefit from preservation.

Prioritizing by multiple scores

Using plots is one method for prioritization based on multiple criteria (Norton *et al.* 2009), which provides more information than comparing the ranks of a single indicator of interest (Figure 4). This method provides a different kind of assessment from prioritizing the composite index, which incorporates all indicators. Plotting two indices, like Ecological Health and Ecological Stress, against each other allows for the distinction between watersheds with good health and low stress (pristine), poor health and high stress (high need for restoration, although potentially low chance of success); and the intermediate classes of good health and high stress (good habitat at high risk) and poor health and low risk (moderately valuable habitat). This is especially useful for prioritizing areas of overall moderate habitat quality.

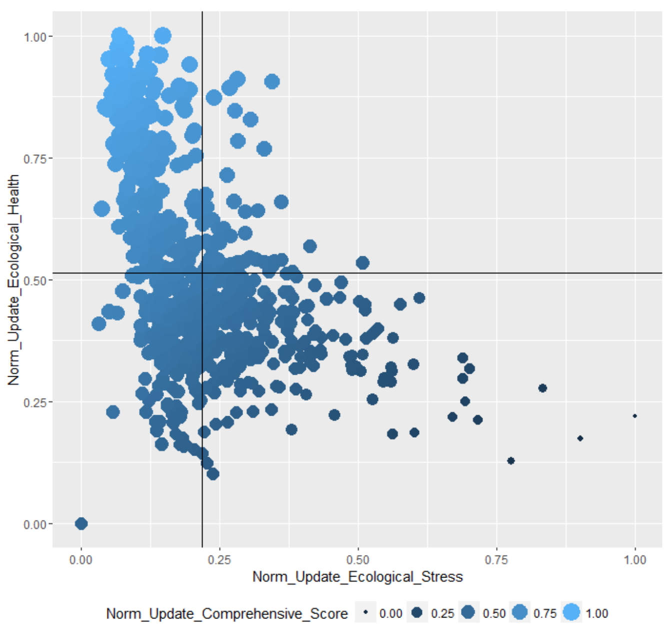


Figure 4. An example of comparing multiple criteria through visualization in a plot. Hecomponre, the Ecological Stress and Ecological Health scores are compared on the X and Y axes, while the Comprehensive score is displayed via dot color and size.

## Results

Our products are all available to download from the project website (nynhp.org/treesfortribsgl), where the final results are available in three formats: PDFs, an ArcGIS geodatabase, and a link to the online data explorer.

### *PDF Results*

Size limitations prevent providing the full set of results as a single PDF document to interested parties, so they have been divided by unit of analysis into two separate downloadable PDFs; one PDF containing the Sub-watershed results and one containing the Catchment level results. When accessing the PDFs, please be sure to download the document to your computer (and view it in Acrobat Reader) rather than view it in your browser, which is often the default. Within each PDF, maps displaying the results can be accessed as attached files. Each PDF opens with a primary document, which provides a written description of the contents of each map file and how to access them.

Sub-watersheds

Our analysis completed at the sub-watershed scale is available in "Sub-watershed_Scores.pdf". The overall ranking of each sub-watershed within the Great Lakes Basin in New York is provided in the Comprehensive Results Map. This map includes locator layers such as New York County boundaries and names and HUC 6 (Sub-region) boundaries. The initial view when opening the map displays the Comprehensive scores for the entire basin, with predicted poorest condition (red) to predicted highest condition (blue) sub-watersheds displayed. In addition, overall Ecological Stress scores (summary scores for all ecological stress indicators) and overall Ecological Health scores are layers within this map. All layers in each PDF map have the ability to be turned on and off.

The Component Scores map within the sub-watershed PDF contains calculated scores for each of our Ecological Health and Stress scores that went into the above analysis. Layers are displayed with a color ramp with the actual scores printed within the sub-watershed, as a separate layer that can be turned on and off. Again, HUC 6 and New York County boundaries and names are available layers in this map in addition to a color scheme and actual score layer for each of the 14 habitat indicators included in our assessment.

Catchments

The catchment-level analysis is available in "Catchment_Scores.pdf". Because of the fine scale of the catchment analysis, it was necessary to divide the study area into smaller sub-regions for displaying results in PDF files. This PDF includes six attached maps, one for each sub-region. To review the catchment analysis in a sub-region of choice, simply double-click on the corresponding map.

Reference or locator layers, such as County and HUC 12 boundaries, are available in each of these maps. Filter layers for urban and agricultural areas are available for the fine-scale analysis, as a way to identify and prioritize opportunities for collaboration and overlap with other urban or agricultural restoration efforts. When a filter layer is selected, all catchments that do not qualify will be turned gray. You can then turn on any score layer, and you will only see the values of catchments which meet the criteria described below.

Overall Comprehensive scores, Ecological Health scores, and Ecological Stress scores are also available as layers in the "composite scores" folder within each sub-region map. Remember, catchment level scoring is also scaled to range from 0-1, but this time *within each sub-watershed*. Therefore, catchments of equivalent color in different sub-watersheds may have different scores, so scorings should only be compared within sub-watersheds. Catchment colors for all indicators correspond to quantiles; those catchments whose scores fell into the lowest quantile (0-20) are colored red, while catchments falling into the highest quantile (80-100$^{th}$ percentile) are colored blue. It is important to remember when viewing the catchments that quantiles assign equal numbers of catchments to each class, so that all sub-watersheds will have blue catchments and red catchments, and equal numbers of blue catchments and red catchments, regardless of how pristine the habitat may be. The scores are meant to allow users to compare catchment scores relative to others *within the same area* and do not represent absolute values.

Theme layers for water quality, connectivity, stream temperature, wetland resiliency, and runoff risk are available as layers in each of the sub-region maps at the catchment level. Details on the scoring of these themes are found in the methods section and Appendix B.

### *ArcGIS Geodatabase*

For users with access to GIS software, the results of our analysis are also available as ArcGIS feature classes. A file geodatabase containing two feature classes, one for the sub-watershed level results, and one for the catchment level results, is available at our website.

#### Sub-Watersheds

The sub-watershed feature class ("Sub-Watersheds") contains polygons for all sub-watersheds in the Great Lakes Basin. The attribute table contains scores for all indicators used in the analysis, both raw scores (field name: "Raw_Indicator_Name") and normalized scores (field name: "Norm_Indicator_Name"), as well as the Ecological Health, Ecological Stress, and Comprehensive scores.

#### Catchments

The catchment feature class ("Catchments") contains the catchment polygons and their associated scores. In addition to the same raw and normalized scores found in the sub-watershed feature class, the attribute table associated with the catchment feature class contains a third set of scores for all indicators, with field names that begin "Quant_Indicator_Name". The values in these fields represent the percentile score of that catchment relative to the other catchments in its sub-watershed, and these values were used purely as a way to assign symbology to catchments for display purposes. Displaying the results within each sub-watershed by quantile is useful for comparing relative habitat quality, but is not possible to visualize in ArcGIS without first assigning the percentile scores. This step was not necessary when displaying the sub-watershed level scores because those scores did not need to be subdivided. Unlike the raw and normalized scores, quantile scores were not used in any calculations for theme scores or other composite scores, like Ecological Health or Comprehensive score. We provide them in the attribute table for users who wish to re-create the same symbology seen in the PDFs, but any further analysis should be based on the raw or normalized score values.

Layers

For users wishing to re-create the symbology of the PDF maps using the feature classes, a folder called Layers is available. Within the folder are layer files for the sub-watershed and catchment feature classes that will display the data using the same color schemes available in the PDFs. It is important to remember that the geodatabase needs to be downloaded as well, or layer files without data will not display properly.

*Data Explorer*

It is very important that users have the opportunity to explore patterns in the wide array of data developed through this project. To maximize the effectiveness of data exploration and make it as accessible as possible, a tool was created, which allows users to visualize and prioritize locations using our data and nothing more than a web browser. In our experience, any newer version of common web browsers will offer you functionality with this application. The Data Explorer, found online at http://lab.nynhp.org/trees_tribs_gl/data_explorer, allows users to prioritize sub-watersheds using multiple indicators, visualize those locations, and interact with a sortable data table to explore the full set of scores from the analysis (Figure 5). The application is based on the same data that is available in the attribute table attached to the ArcGIS feature class, but allows for visualization and prioritization to take place in a way that isn't possible using ArcGIS alone.

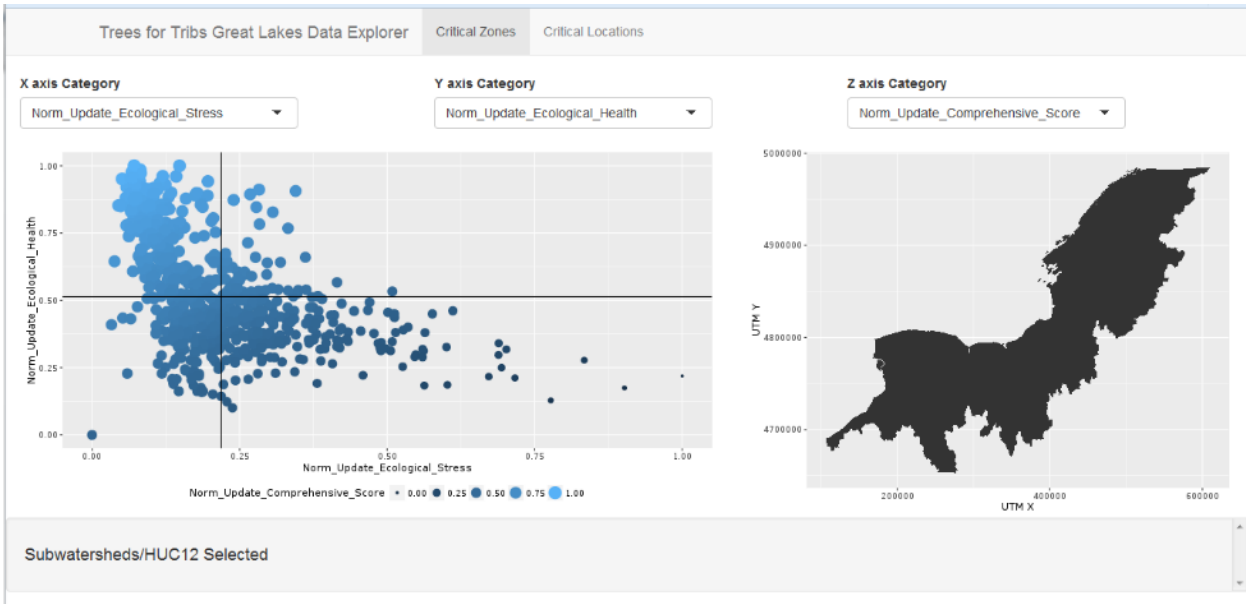


Figure 5. Trees for Tribs Great Lakes Data Explorer. Initial view upon opening. Vertical lines in the graph on the left represent the mean value for the Ecological Stress score among all 687 sub-watersheds. The horizontal line represents the mean Ecological Health score.

Prioritizing with Two Indicators:

The data explorer allows users to plot the scores for all sub-watersheds, using any indicator for the X and Y axis. The choice of indicators is available in drop down menus at the top of the screen. The default setting upon start-up will allow the user to compare the overall Ecological Health and Ecological Stress scores. The vertical and horizontal lines in the plot indicate the mean value for the X and Y axis variables, respectively. They divide the plot into quadrants, which allows you to focus on different sets of points based on your conservation goals. If your project is more targeted towards preserving habitat that is currently in great shape, you might examine the watersheds represented by the points in the upper left of the graph: these are areas that have high scores for health and low scores for stress. Points that fall in the lower right of the graph are the most stressed watersheds with the lowest scores for ecological health. These points represent habitats in dire need of restoration work. However, because they are likely experiencing multiple stressors, restoring them could be a significant challenge; one that riparian buffers alone may not address. Points in the lower left quadrant represent sub-watershed experiencing less stress, but scoring poorly for ecological health. Riparian restoration projects focused on sub-watersheds in this portion of the chart could be aimed at improving the below-average Ecological Health scores by planting native trees and plants in the riparian zone.

In any quadrant, sub-watersheds represented by points falling towards the middle of the graph, where the axes cross, score about average. While restoration may not be as urgent as in the extremes of the chart, these may be sounder investments because they face relatively fewer challenges. The ability to distinguish between the different classes of the vast numbers of watersheds “in the middle” is one advantage of using the data explorer over a single indicator prioritization method, like the PDFs, or sorting through the attribute table in the geodatabase.

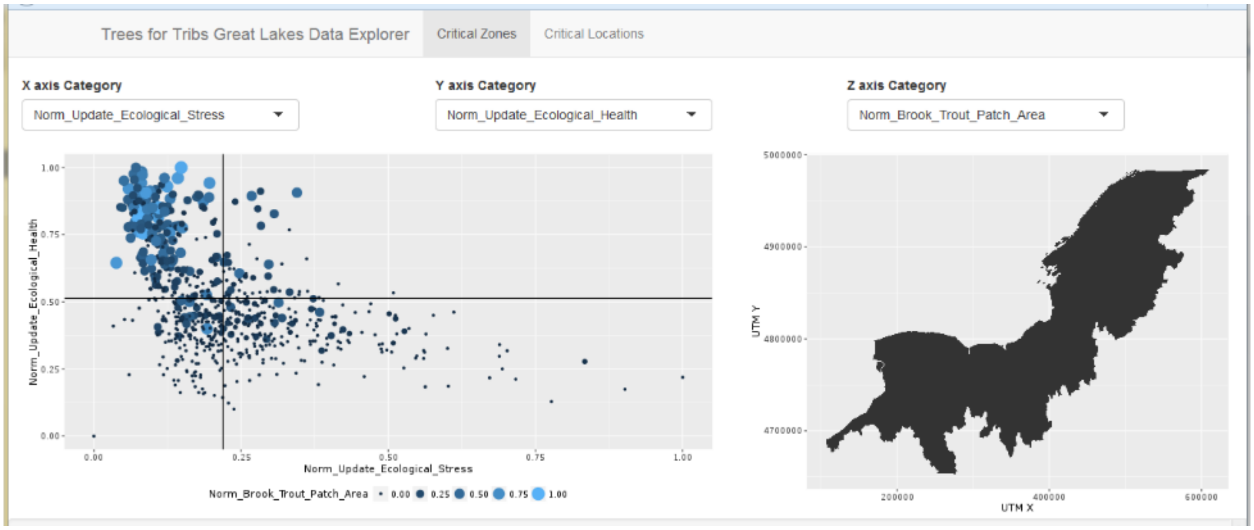


Figure 6. Data Explorer with default X and Y axis, with point size (Z axis) proportional to the presence of Brook Trout.

Prioritization Using Three Indicators:

The user can also select a third indicator, the Z axis, which will change the size of the points. Using the default X and Y axis and selecting an indicator from the Z axis allows you to quickly prioritize locations based on their overall health, as described above, while allowing you to quickly see locations that may be closely related to your area of interest (in this example, improving habitat for Brook Trout, Figure 6).

Interacting with Data:

The plot is interactive, so dragging your cursor over a set of points will select them in the graph. When points are selected, their corresponding sub-watersheds will be highlighted in red on the map to the right, and their associated scores and data will appear in the table at the bottom of the screen (Figure 7). Clicking on a sub-watershed will select its information in the table and will highlight the point in the table on the left (Figure 8).

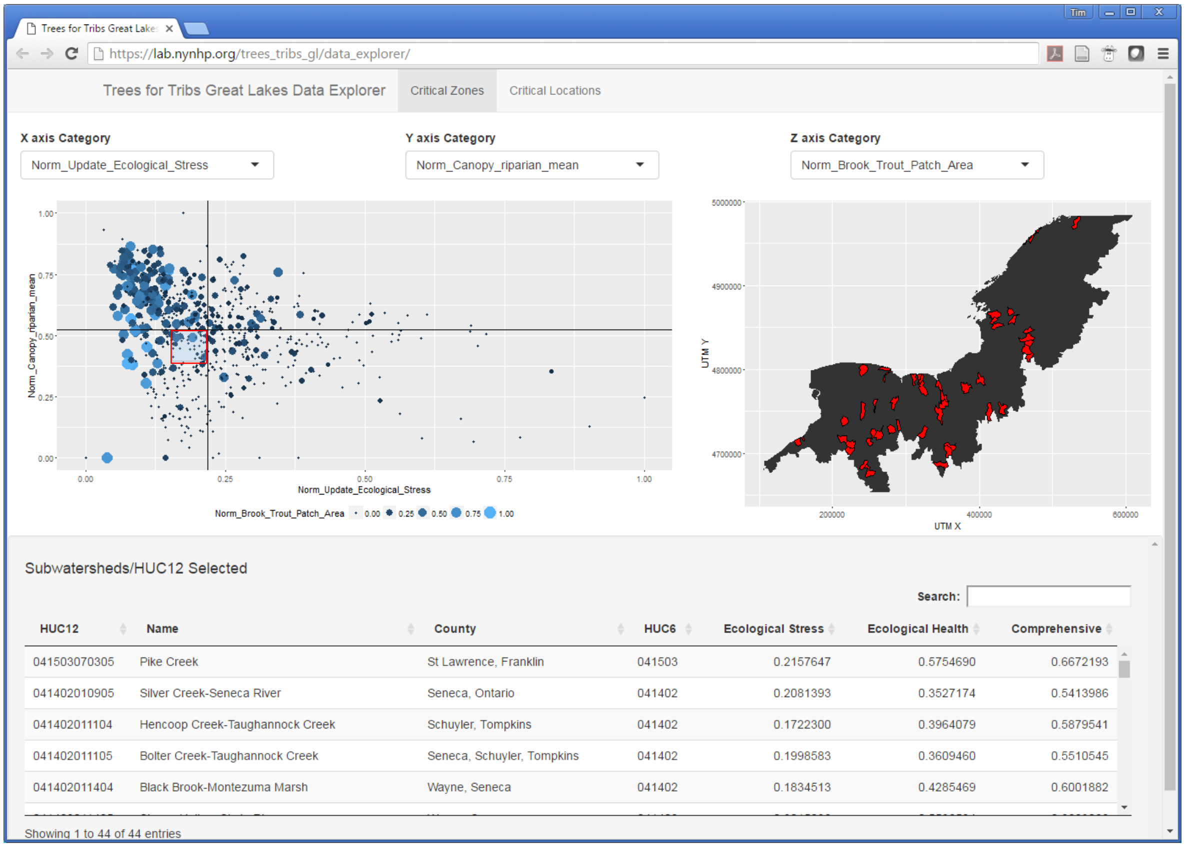


Figure 7. The data explorer with some relatively low stress, poor health sub-watersheds selected (red box- The box is highlighted red for emphasis here. Actual highlighting tool is blue). The sub-watersheds are highlighted in red and their information becomes searchable and sortable in the table below. Clicking on a sub-watershed on the map will highlight its data in the table, as well as highlight the point on the plot at the left.

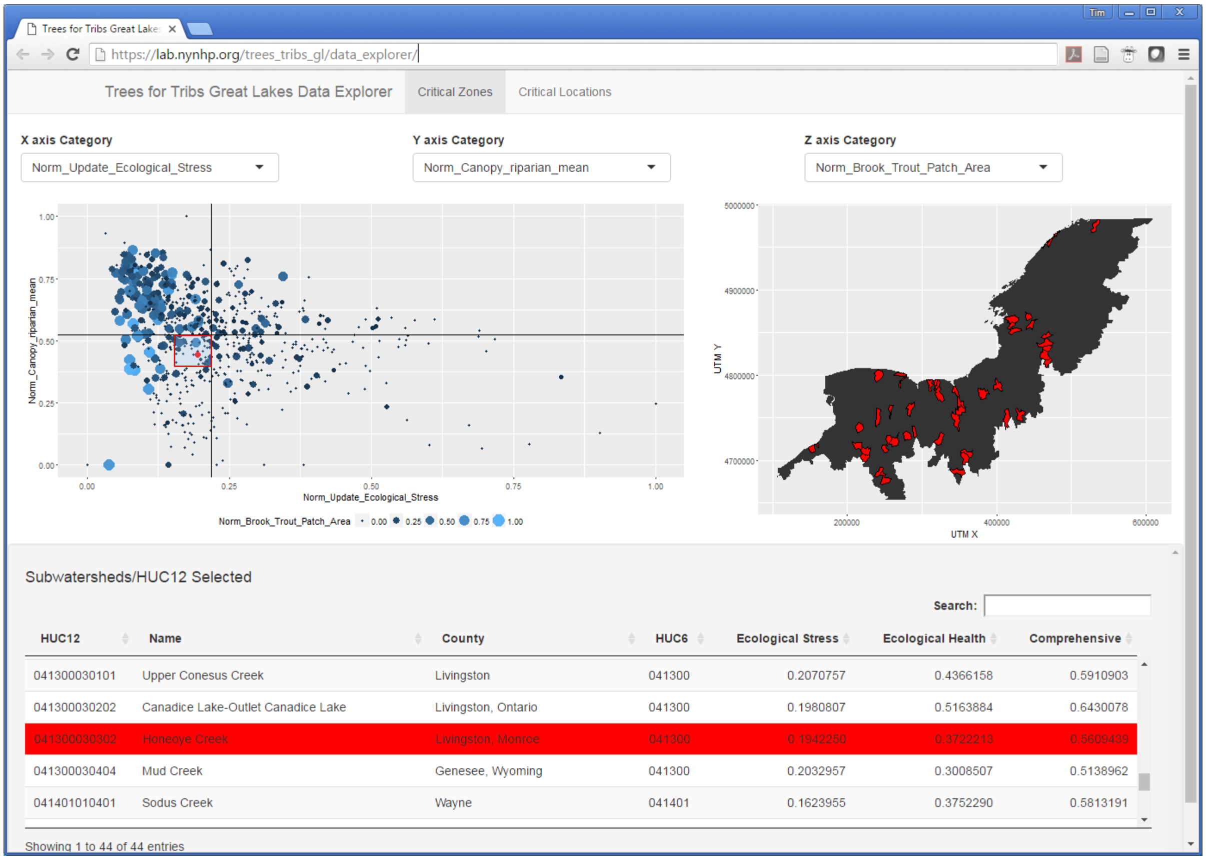


Figure 8. The data explorer with a sub-watershed selected. Clicking on a sub-watershed will select its information in the table below and will highlight the point in the table on the left.

## Discussion

We designed our project to provide an objective procedure of site selection for protection and restoration activities. Using our products for strategic planning for programs, such as the Trees for Tribs (Goal 5.10 in the Agenda below), will help ensure the success of such programs. In addition, we envision our products furthering several goals of New York's Interim Great Lakes Basin Action Agenda. More specifically, these products could be used to help identify priority areas for riparian buffer restoration and protection in the Great Lakes Basin (goals 2.8, 5.8, 8.2), areas for improving stream corridor connectivity (if improving canopy cover is a goal for targets identified, goal 5.6), and places to expand green infrastructure in flood-prone areas (goal 7.11).

Undoubtedly, users will approach our dataset with specific goals in mind and may only utilize certain aspects of the data, depending on their goal, to help arrive at a prioritization scheme for their work. It is important to keep in mind that depending on a user's goal or question, other datasets and spatial data layers may be necessary to identify priority areas. Therefore, we do not intend our dataset as a stand-alone product, but rather another suite of tools that can be helpful when making conservation decisions. To assist users, below we present specific examples or case studies, to demonstrate how our dataset can be used to answer specific questions and to support site prioritization in riparian zones.

*Data Uses*

While all the products from this project are available in GIS format, these examples are targeted towards non-GIS users and thus utilize the PDF products and publically available online resources. All of these examples could also be applied using the GIS data in a GIS environment.

**It is important to emphasize that in all scenarios and all uses of these products that any areas targeted must be checked with field visits in order to verify their condition and suitability for management actions.**

Scenario 1. Improve riparian zone condition in poor scoring sites

You are given the goal of finding a location for improving stream condition by increasing natural vegetation in the stream's riparian zone. You can target any stream in the basin; how do you choose? In this scenario, we will look for sub-watersheds scoring more poorly than others nearby assuming that this condition might offer the most success and highest return for a riparian restoration project.

*Step 1.1. Assess condition of sub-watersheds*

Use the "Sub-watershed_Scores.pdf" document for this step. This PDF is available as a download from the project's website (nynhp.org/treesfortribsgl). Be sure to download the document to your computer (and view it in Acrobat Reader) rather than view it in your browser, which is often the default. When opened in Acrobat Reader, you should see two attached map files as well as the primary document giving a written description of the contents of each file (Figure 9).

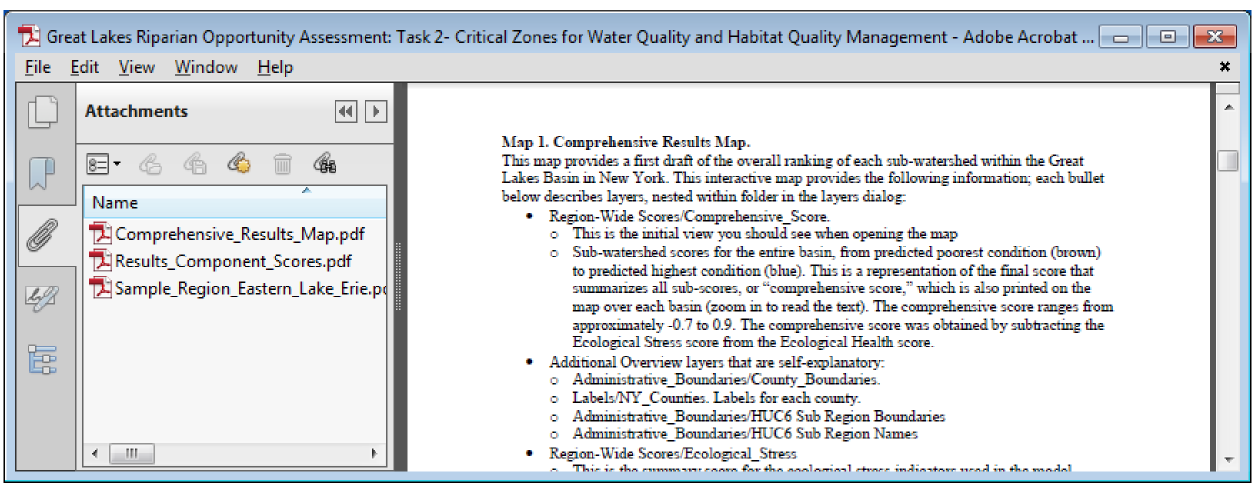


Figure 9. Initial view of the Sub-watershed_Scores.pdf document. Note the attached files (maps) in the left panel.

Within the *Sub-watershed_Scores* PDF (Figure 9), open the PDF named Comprehensive_Results_Map.pdf. The default display for this map is the Comprehensive score of sub-watersheds (Figure 10). This is a final score that incorporates both the health indicators and stressor indicators that we calculated for each sub-watershed and is described in more detail in the methods and results sections of this report, above.

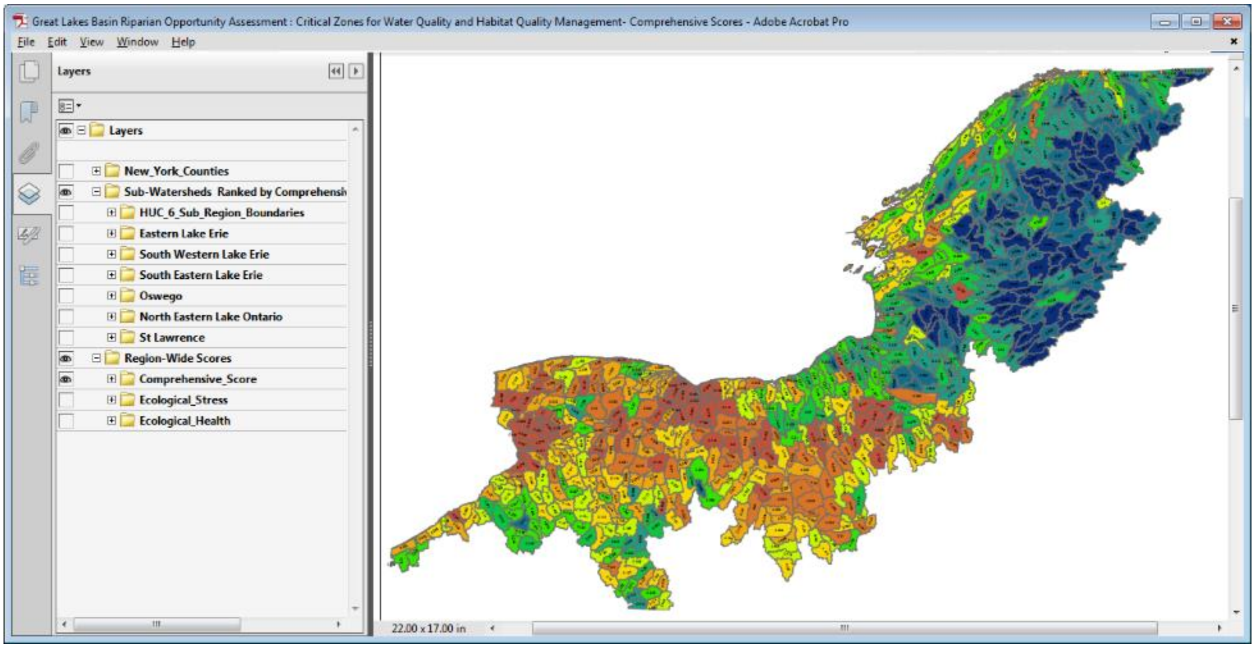


Figure 10. The default view of the Comprehensive Results map, with the folders expanded in the left panel to list the different layers.

Our goal in this scenario is to look throughout the entire basin for lower scoring sub-watersheds, which can be achieved by reviewing the Comprehensive score. The overall stress and health scores can also be viewed at this scale to help interpretation of the Comprehensive score. Looking at the Comprehensive scores for this exercise, we highlight a few low scoring sub-watersheds in the North Eastern Lake Ontario Sub-basin (Figure 11).

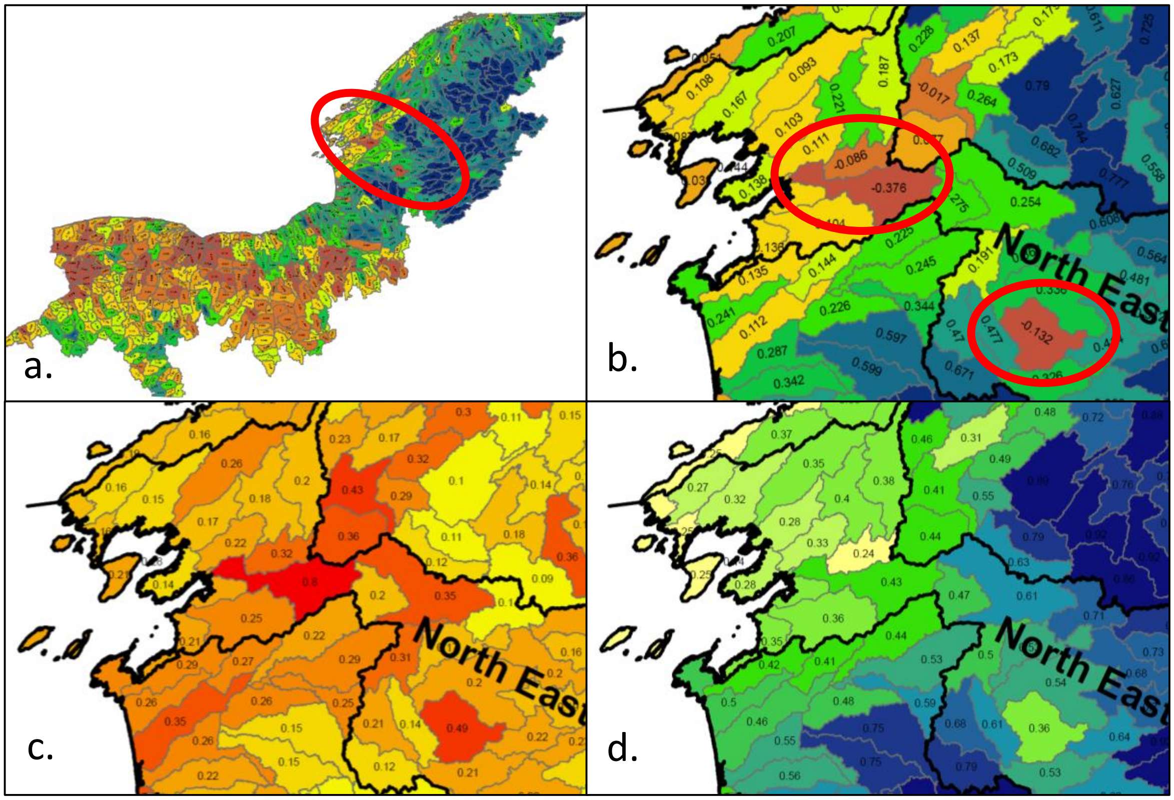


Figure 11. Evaluating scores for sub-watersheds. (a.) The focal area for the rest of the panels. (b.) Three sub-watersheds stand out as low scoring in the North Eastern Lake Ontario Sub-Basin. (c.) the Ecological Stress scoring. (d.) The Ecological Health Scoring.

These three sub-watersheds stand out in the sub-basin, two have relatively high stress scores (11c), and the third has a lower health score than the others (11d). For illustrative purposes, we'll focus on the sub-watershed with the lower health score (0.24 in 11d).

To help understand patterns among sub-watersheds and assist in deciding which sub-watersheds to focus on, examine the individual habitat indicator scores to determine what is impacting habitat health and thus impacting the sub-watersheds low health score or high stress score. These are found in the other attached PDF map, named "Component_Scores_Map.pdf", and are described in Table 2.

*Step 1.2. Compare relative rankings of catchments*

Once one or more sub-watersheds have been chosen for further examination, the next step is to look at how scoring changes within a single watershed. The second PDF download, named "Catchment_Scores.pdf", provides the information for this purpose. As before, this document contains text describing the data in additional PDFs attached to the primary document (Figure 12). Scorings in the Catchment Scores maps should only be compared within sub-watershed.

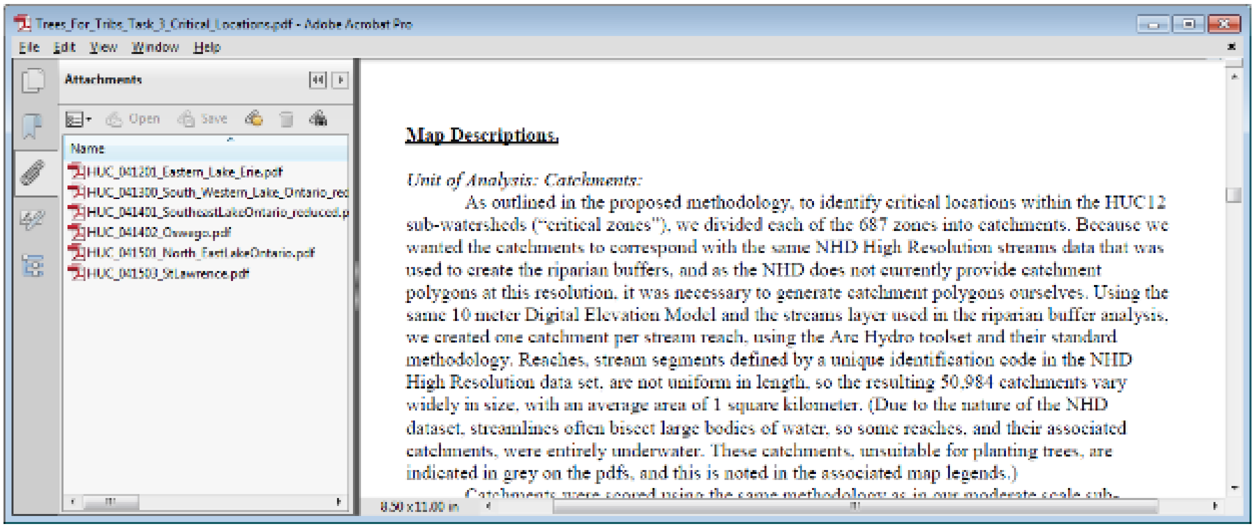


Figure 12. The initial view of the Catchment Scores document, with attached maps shown in the left panel, one map for each sub-basin.

For this scenario, we will open the map for North East Lake Ontario (HUC_041501_North_EastLakeOntario.pdf), and turn on the sub-watershed (HUC 12) boundaries to locate the sub-watersheds of interest (Figure 13). An important point to note about this new map is that it also depicts Health, Stress, and Comprehensive scores, but, in this case, these scores are applied to the catchment *and* the scaling of these scores are now scaled to range from 0-1 *within each sub-watershed*. This means that catchments of equivalent color in different sub-watersheds may have different scores. It also means that variation can be depicted within each sub-watershed, which is exactly the goal of this map.

Zooming in to our sub-watershed of interest (right-click -> marquee zoom in Acrobat Reader) shows lower scoring catchments on the eastern edge of this sub-watershed (Figure 14), particularly with the Comprehensive and Health scores (panels a and b). The water quality theme (panel d) also shows one of the eastern catchments as scoring poorly.

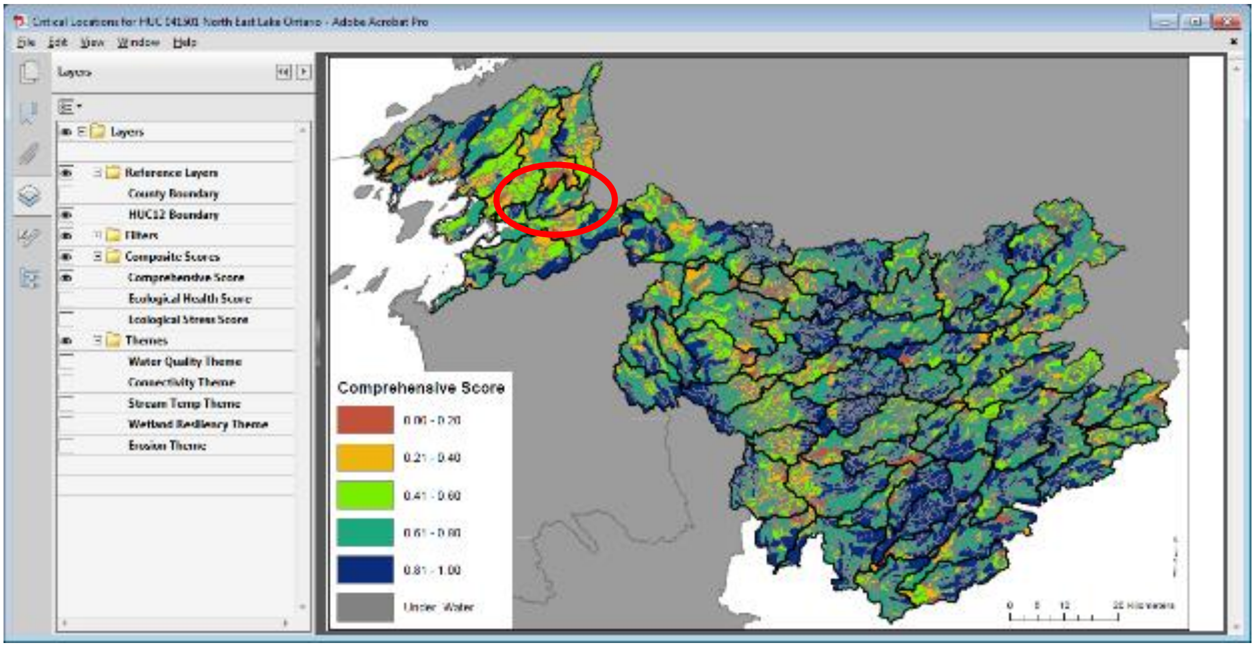


Figure 13. Catchment rankings for the North East Lake Ontario sub-basin. Sub-watershed (HUC 12) boundaries are turned on and many of the folders in the left panel have been expanded to show what layers are available for this map. The circled sub-watershed is the one targeted for further assessment in Step 1.1.

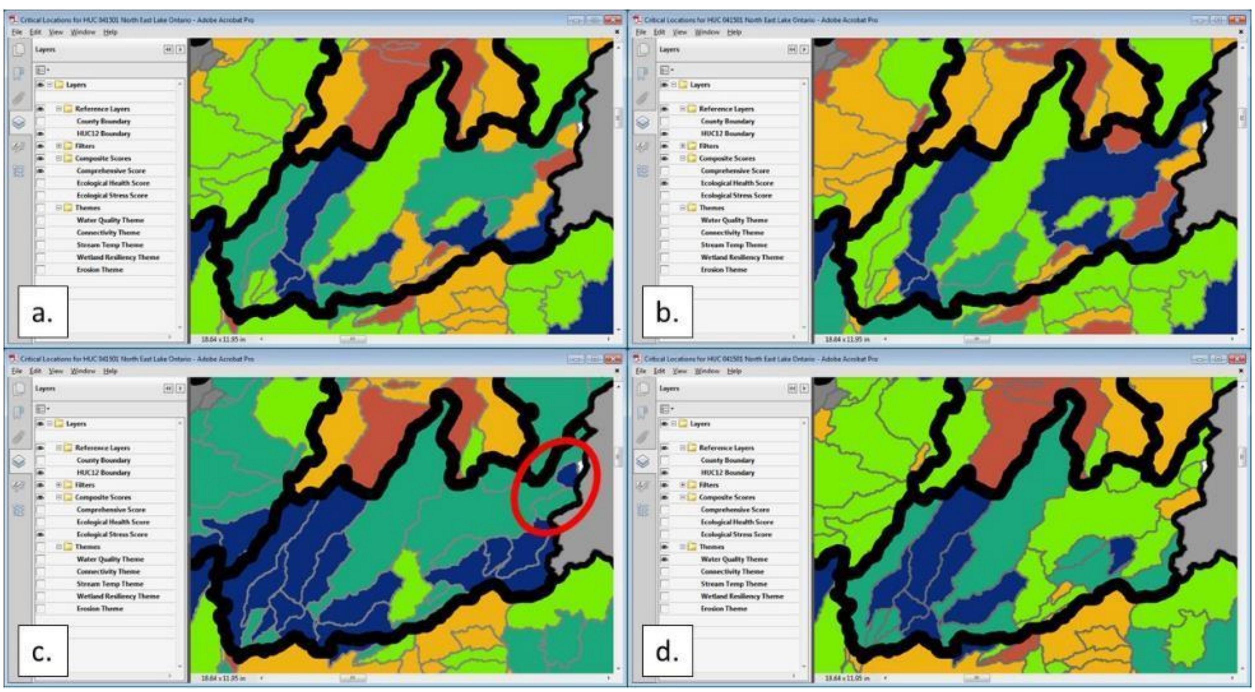

Figure 14. The relative variation in catchment scores within our sub-watershed of interest. (a) Comprehensive score, (b) Ecological Health score, (c) Ecological Stress score, and (d) Water Quality Theme. The two catchments discussed in the text are circled in (c).

The catchments along the eastern edge, then, *might* be good candidates for riparian restoration or management projects. Streams in these catchments are likely to have little natural habitat within their riparian zone (poor health metrics), but also have low development pressure or other stressors (scores relatively high in stress metrics).

A quick way to confirm this initial assessment would be to view the exact location with aerial imagery. One source that provides aerial imagery and watershed boundaries online is the national map viewer, available at [viewer.nationalmap.gov/viewer/](viewer.nationalmap.gov/viewer/).

Scenario 2. Identify sites comparing health and stress measures interactively

Another outcome of this project is an online tool that permits users to make score to score comparisons in order to identify patterns and potentially focus on restoring areas that might be more likely to succeed based on comparisons among scores. For example, a site receiving a relatively low stress score, and also a relatively low health score, may be easier to restore and maintain than a site with a low health score, but with a higher stress score.

*Step 2.1. Compare scores interactively*

The Trees for Tribs Great Lakes Data Explorer is located at [https://lab.nynhp.org/trees_tribs_gl/data_explorer/](https://lab.nynhp.org/trees_tribs_gl/data_explorer/). An initial view of the webpage is shown in Figure 15. The important items to note about this page are the plot of three scores on the left hand panel (X axis, Y axis, and dot size and color as the Z axis), the map of the basin on the right-hand panel, and, after some are selected, a table below both of these panels listing selected sub-watersheds. Future versions of this Data Explorer will also incorporate catchments.


Figure 15. The initial view for the Data Explorer.

Drop-down fields above these panels allow users to change the metrics viewed in the plot, but for this example we will stick to comparing Ecological Stress to Ecological Health on the primary (X and Y) axes. Note - in the plot the two black lines show the mean (average) score for each axis.

*Step 2.2. Selecting sub-watersheds for further exploration*

In this case, we are interested in the low-scoring sites for *both* ecological health and ecological stress measures. This scenario might be interpreted as sites that are more likely to succeed in restoration efforts because the current measured stressors are relatively low. The sub-watersheds under this condition would be those located in the lower left quadrant of the plot. A few of these points can be selected by dragging a box over them. The selected points are represented by sub-watersheds that are then highlighted in the map on the right, and a list of those sub-watersheds appears below (Figure 16). Clicking on one of these sub-watersheds on the map then highlights this sub-watershed in the list below the map. This information can, in turn, be used to find the sub-watershed in the catchment PDF, on the national map viewer, or in GIS.

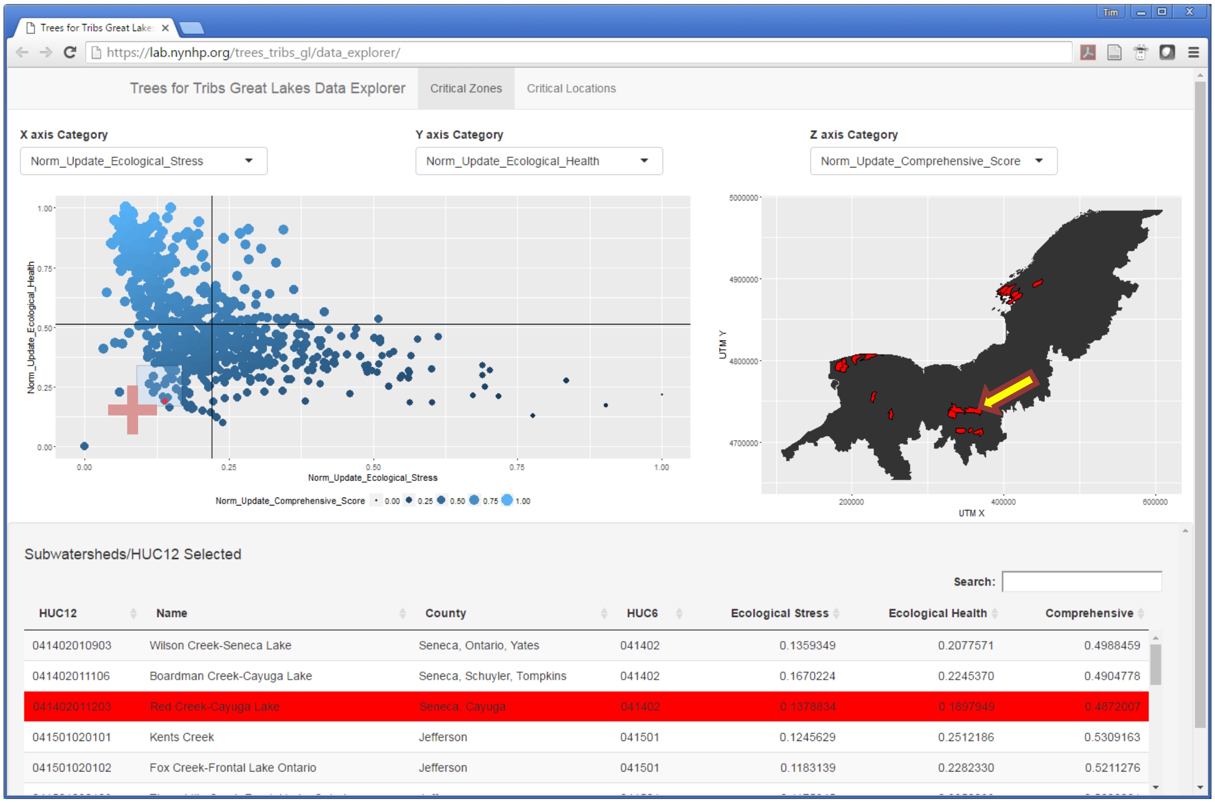


Figure 16. Selecting points in the left-hand panel (depicted with yellow cross), results in the selected sub-watersheds being highlighted on the map in the right-hand panel and listed below. Clicking on one of the selected sub-watersheds on the map (yellow arrow) highlights that specific sub-watershed in the list at the bottom.

### *Limitations and assumptions*

We recognize that the suite of habitat indicators included in our analysis was by no means comprehensive to all indicators that could prove important to documenting health or stress on an aquatic system. The Steering Committee refined this list throughout the beginning phases of the project, and we feel the list is representative of indicating important aspects of stream condition necessary for restoration and protection goals using an ecosystem based management approach.

Due to the timeframe and scope of our project, our data-gathering efforts were largely limited to data sources that were already prepared and available for the entire Great Lakes Basin, and that could be used to derive indicator scores at the sub-watershed and catchment scales.

While some of these indicators may be naturally correlated, those included in the final analysis were selected because they represent sufficiently distinct habitat features relevant to evaluating the health of the riparian zone. In one case, we dropped a potential water quality indicator because it was both highly correlated with another water quality indicator used in the assessment, the BAP, and because the two essentially describe the same particular habitat feature.

We anticipate, as practitioners begin to use these products, suggestions of additional indicators to include in the assessment. Ideally, we would periodically revisit the assessment so that such improvements, as well as new information on the current suite of indicators, can be included in future versions of this assessment. Further advancements could be made with indicator datasets available in the Northeast and these should also be assessed for their inclusion in future iterations.

We further recognize that the accuracy of our compiled Ecological Health, Ecological Stress, and Comprehensive scores are dependent upon the quality of the input data. While we believe all of our sources and input data are of high quality, we recognize that through use of this dataset and source datasets, as with any, errors may be revealed. We hope to have the opportunity to correct these in future versions as well.

Certain indicators, such as BAP, used predictive modeling to derive water quality metric values for previously unsampled streams. Thus, while over 1,700 stream samples were used to model the BAP score, and the model of BAP to stream environmental conditions was relatively robust (White et al. 2011), the only way this project could apply data such as these was to use the modeled dataset of predicted BAP scores. Having datasets such as this accessible greatly increases their use and applicability, but also introduces extra uncertainty. This also applies to the National Land Cover Dataset (NLCD), which is a model of land cover types based on satellite imagery and other similar datasets.

Indicator scores are displayed as static values for sub-watersheds and catchments. The analysis does not show the resulting impact of a particular restorative or protective action, but can highlight places where such actions could have the most impact, depending on conservation goals. Therefore, the specific impact of a particular restoration or protection effort is not calculated or provided as one of our products.

The lowest ranked sub-watersheds and catchments should not be interpreted as “bad”, and the reasons for a lower ranking can be revealed when looking at component indicator scores and other spatial data layers, such as aerial photography. Those areas scoring as poorer health, or higher stress, are relative ranks to other sub-watersheds and catchments in the basin, but may have ecological benefit or other value not detected by our analysis. In addition, we did not include any social, economic, or feasibility (including plant-ability) indicators in this analysis. These factors will need to be weighed with our dataset when making decisions about where to work.

Lastly, as aforementioned, these products are designed to be used in addition to other spatial data layers and information available to practitioners rather than as a stand-alone toolkit. The Steering Committee suggested the following additional data could be used with these products to help address specific project prioritization goals. This list in not comprehensive: Invasive species data, forest species data, public and protected lands, landowner property boundaries, FEMA flood data, drinking water municipalities/watersheds, and environmental justice underserved communities. Finally, site-specific knowledge is imperative and field validation will be a necessary step before actual implementation of conservation actions.

## Conclusion and Next Steps

In this project, we provide the Great Lakes Watershed Program of NYS DEC and other partners with maps detailing summary scores for ecological health, stress indicators and overall comprehensive scores for each sub-watershed and catchment in the Great Lakes basin. This information is accessible to users through the PDF maps and geodatabase (http://nynhp.org/treesfortribsgl). In addition, we provide a Data Explorer, an online prioritization tool, to help users visualize indicators score distributions of their choice. These products were designed to provide an objective procedure of site selection for protection and restoration activities, to be used in conjunction with other information and tools available to conservation practitioners. This report outlines the methodology, describes the products, and walks potential users through various scenarios and examples of how to use these products to answer specific conservation questions.

In addition to being used by NYS DEC's Trees for Tribs program, the data products feed nicely into many other goals identified in New York's Great Lakes Basin Interim Action Agenda, including the identification of priority areas for riparian buffer restoration and protection (goals 2.8, 5.8, 8.2), areas for improving stream corridor connectivity (goal 5.6), and areas to expand green infrastructure in flood-prone areas (goal 7.11). We anticipate that the results of this project will help inform the strategic allocation of limited conservation resources for a variety of partner organizations and promote ecosystem based management approaches to restoration work.

There is great benefit to completing the above analyses in other watersheds in the state and we received additional funding from DEC's Trees for Tribs program to perform a statewide analysis beginning in April 2016. For this statewide effort, the work completed in the Great Lakes basin will be replicated, joining the two products together, and creating a single, consistent dataset for all of New York State. We will be proceeding under advisement of a Steering Committee, with whom we will explore modifications and improvements to the analysis.

## Acknowledgments

We thank the NYS DEC Division of Lands and Forests for supporting travel and administering the funding for this project, which came from the New York State Environmental Protection Fund under the authority of the New York Ocean and Great Lakes Ecosystem Conservation Act. We thank our Steering Committee for their enthusiastic advice and support throughout the project: Stevie Adams, Victor DiGiacomo, Brian Duffy, Jennifer Dunn, Shannon Dougherty, Fred Henson Jeffrey Mapes, Greg McGee, Beth Roessler, Emily Sheridan, Gabriella Spitzer, Sarah Walsh, Tracey Tomajer. Support from within NY Natural Heritage was provided by DJ Evans, Fiona McKinney, Matt Buff, and Matt Schlesinger and we thank you. We thank Shannon and Emily for the opportunity to present our products at the Great Lakes Action Agenda workgroup meetings in March of 2016.

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**Appendix A. Habitat Indicators: Descriptions, Data Sources, and Raw Score Calculations**
LANDSCAPE CONDITION INDICATORS

**Landscape Condition Assessment (LCA)** [Both watershed/catchment-wide and in riparian zone]:

*Ecological Stress*. The extent, quality, and distribution of alterations to the landscape surrounding a stream have profound impacts on the health of the habitat (Klein 1979). Runoff from agriculture can cause dangerous levels of sediments, nitrates, and phosphates to flow into rivers. The Landscape Condition Assessment (LCA) incorporates a suite of landscape stressors which describe the distribution and abundance of transportation, urban, industrial, and agricultural land use (Feldmann and Howard 2013). Areas with higher LCA scores correspond with more ecologically stressful landscapes. We calculated the average LCA score for each unit of evaluation.

**Impervious Surface*** [riparian zone]

*Ecological Stress*. Impervious surfaces, like roads and other paved areas, increase the speed and amount of runoff because water cannot be adsorbed into the soil. As such, they are an important indicator of ecological stress. We used the mean value of the Percent Impervious Surface product from the NLCD to score each unit.

*Note: In our original methodology, impervious surface was not included as an indicator because it is also used in the calculation of the Landscape Condition Assessment. Upon inspection, the two indices were not strongly correlated due to other contributors to the LCA, and impervious surface was considered by the committee to be of great enough importance to be included as a separate indicator.

**Canopy Cover** [Both watershed/catchment-wide and in riparian zone]:

*Ecological Health*. Streamside forests provide important ecosystem functions, protecting water quality by blocking pollutants, sequestering carbon, and metabolizing organic matter. Unforested streams experience higher maximum summer water temperatures than those under the shade of a full canopy (Sweeney and Newbold 2014). Streams with healthy canopy cover and low temperatures provide excellent habitat for trout (Barton *et al.* 1985). Distribution of areas with low canopy cover indicate areas where the addition of a vegetative buffer may have significant impacts on stream temperature. We used the tree canopy cover dataset from the National Land Cover Dataset (U.S. Geological Survey 2011) and calculated mean percent cover for each unit of evaluation.

**Natural Cover** [Both watershed/catchment-wide and in riparian zone]:

*Ecological Health.* All vegetation, not just forest, can potentially protect water quality by intercepting sediment from disturbances in the watershed (Dosskey *et al.* 2010). This indicator describes the proportion of the landscape composed of non-crop, non-impervious surface land use classes, but not necessarily forest. We extracted the following natural class types from the National Land Cover Dataset (U.S. Geological Survey 2011) and divided the area of natural land cover by total unit area to get percent natural cover for each unit of evaluation: Deciduous Forest (41), Evergreen Forest (42), Mixed Forest (43), Scrub/shrub (52), Grassland/herbaceous (71), Woody Wetlands (90), Emergent Wetlands (95). Thus, the following NLCD class types were excluded: Open Water (11); Developed, Open Space, Low Intensity, Medium Intensity, High Intensity (21, 22, 23, 24); Barren Land (31), Pasture/Hay (81), Cultivated Crops (82).

HYDROLOGIC CONDITION INDICATORS

**Topographic Wetness Index (TWI):** [riparian]

*Ecological Stress.* For the reduction of sediment and the amelioration of runoff, buffers will be most successful at slowing the speed of surface runoff when they are placed in areas where water collects from a large upslope area and moves across the riparian zone as a distributed flow, like a sheet. This wetness index targets these areas by identifying grid cells that both receive runoff waters from large upslope areas and have low slopes. Calculated as $W=\ln(As/\tan \beta)$, where As is the upslope contributing area and B is the slope. We calculated the TWI using a 10 m DEM in ArcGIS. After calculating flow accumulation ("flow_auc" and degree slope ("slope"), a twi raster was created using the formula:
twi=arcpy.sa.Ln((flow_auc*100.0)/(arcpy.sa.Tan(slope)*1.0))

**Erosion:** [riparian]

*Ecological Stress.* The Erosion indicator highlights cells that receive runoff waters from large upslope contributing areas and have steep slopes, at greater risk for erosion adjacent to the stream bank (Tomer *et al.* 2003). We weighted the erosion indices by soil erosivity, giving highest scores to areas with both soil types prone to erosion and hydrologic features with a high potential for erosion. We calculated the erosion raster from a 10 m DEM similar to how we created the topographic wetness index. After calculating flow accumulation ("flow_auc" and degree slope ("slope"), an erosion raster was created using the formula:

erosion_index=arcpy.sa.Power(flow_auc*10.0/22.1,0.4)*arcpy.sa.Power((arcpy.sa.Sin(slope*0.01745)/0.09),1.4)*1.4

We used the Soil Erosion Hazard class in the New York SSURGO data to get a rough indication of potential erosion hazards due to erodibility. The erosion raster was multiplied by the Soil Erosion Class to get the final erosion score.

RIPARIAN HABITAT CONNECTIVITY INDICATORS

**Dam Storage Ratio*:** [riparian]

*Ecological Stress.* Streams and rivers naturally meander, and progressive cycles of flooding lead to riparian habitat heterogeneity, making these areas of high diversity. Flow regulation can limit these flooding events. Without the disturbance cycle caused by flooding, there is a reduction in the input of nutrients and soil deposition, and upland species that otherwise would have been held in check by inundation of the shoreline, can begin to dominate, leading to a riparian zone indistinguishable from upland habitat. In addition to reduced diversity, these species are not adapted to flooding, making these areas potentially vulnerable to flooding risks from extreme weather related to climate change (Pringle 2001). We used dam storage ratio as an indicator of potential impacts on connectivity due to the presence and size of dams. Dam storage ratio estimates calculated by White *et al.* (2011) were joined to a table of existing dams in the GLB. This provided us with dam storage ratio information for 256 dams. The score was the sum of the storage ratio capacities for all dams in the unit.

*Note: In the original methodology for the project, we used total dam count instead of dam storage ratio. It allowed us to include data on the locations of more dams, but we lacked any qualitative information on dam size. The dam storage ratio was suggested as a better way to assess the relative impact of dams on the riparian zone.

**Functional River Networks:** [riparian]

*Ecological Health.* Another method for estimating stream connectivity, the Functional River Network, describes stream units which are unbroken by dams. This is a measure of longitudinal connectivity along streams, allowing for movement of organisms, water, sediment, and organic materials (Smith *et al.* 2008). The sum total length in kilometers of streams in the unit that were a part of a functional river network was used as the raw score (White *et al.* 2011).

**Matrix Forest Blocks:** [Both watershed/catchment-wide and in riparian zone]:

*Ecological Health.* The connectivity of vegetation is an indicator of habitat health. Forest blocks describe units of contiguous forest, and riparian zones with a higher proportion of area composed of part of a forest block are likely to have better connectivity, and be more resilient to disturbance (Shandas and Alberti 2009). We divided total area of MFB in the unit by total unit area to get the proportion of area covered by matrix forest blocks as the raw score.

**Floodplain Complexes** [Both watershed/catchment-wide and in riparian zone]:

*Ecological Health.* Floodplain complexes describe the connectivity of all wetland habitat, not just forest, and provide an indicator of vegetative connectivity independent of large tracts of forest. We obtained floodplain complex data from The Nature Conservancy (2016), and calculated the proportion of area for each unit covered by Floodplain Complexes in the same manner as for Matrix Forest Blocks.

WATER QUALITY INDICATORS

**WI/PWL status**: Impaired, Minor Impacts, or Threatened: [riparian]

*Ecological Stress.* The New York Waterbody Inventory/Priority Waterbodies List is a statewide compilation of water quality information that assesses overall water quality and sources of water quality impairment. Waters classified as “Impaired,” “Waters with Minor Impacts,” and “Threatened” are prioritized for intervention and restoration. “Impaired” waters have frequent and persistent water quality conditions which prevent, limit, or discourage the use of the waterbody. Waterbodies with “Minor Impacts” are considered stressed and have documented water quality impacts less severe than impaired waters. “Threatened” waters have no existing water quality problems but are included in the Priority Waterbodies List due to land use changes in the watershed that are known or strongly suspected to threaten water quality.

To combine these data into a single score, we calculated the proportion of stream length falling into each category and then calculated a cumulative watershed water quality score by weighting the scores for each category by the severity of the implied level of stream impairment: “Impaired” scores were multiplied by 4, “Minor Impacts” scores were multiplied by 2, and

“Threatened” scores multiplied by 1. (This assumption implies that “Impaired” waters should contribute twice as much to the impairment score as waters with “Minor Impacts,” and waters with Minor Impacts should contribute twice as much as Threatened Waters.) These weighted scores were summed to create the final score.

**Predicted Biological Assessment Profile (BAP)*** [riparian]

*Ecological Health.* Greater richness in certain macroinvertebrate communities is usually an indicator of good water quality and ecosystem health. The Biological Assessment Profile (BAP) is an overall water quality impact score calculated by the NYS DEC’s Stream Biomonitoring Unit from their sample data, obtained by plotting biological index values from five water quality indices (NYSDEC 2010). Predicted BAP values were modeled as part of the NYS Freshwater Blueprint Project (White *et al.* 2011) and were incorporated as an indicator into this analysis. The predicted BAP score for each stream segment was weighted by the length of the segment, and the sum of the weighted scores was divided by the total length of evaluated streams in the watershed, to produce an average score per kilometer of stream for each unit.

*Note: In our original methodology, we also included another product from the Freshwater Blueprint, the EPT (Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies)) richness, a stream invertebrate water quality metric. However, because the EPT was highly correlated with the BAP, we decided to only include the BAP in the final analysis.

BIOLOGICAL CONDITION

**Eastern Brook Trout Habitat Patches** [riparian]

*Ecological Health.* The confirmed presence of Eastern Brook Trout serves both as an indicator of healthy stream habitat, as well as a parameter of special interest for many potential partners whose work is focused on preserving cold-water fisheries. The brook trout occupied patches were obtained from the Eastern Brook Trout Joint Venture Catchment Level Assessment (2015) which may be viewed in its entirety here: http://ecosheds.org:8080/geoserver/www/Web_Map_Viewer.html. The sum of the areas of all patches occupied by brook trout within the unit constituted its raw score. Brook trout presence was inferred upstream from confirmed samples based on a set of logical rules and barrier dataset. We can provide a citation to lead the reader to those details online.

**Rare taxa presence**: [riparian]

*Ecological Health.* The presence within the riparian zone of rare taxa can be an indicator of a more functionally intact ecosystem. This indicator takes into account the presence of rare species throughout the riparian zone, not just invertebrates. The count of species with Element Occurrence records (New York Natural Heritage Program 2016) within the unit constituted its raw score.

## Appendix B. Analytical Methods

*Unit of Analysis*

Sub-Watersheds

Sub-watershed boundaries were defined using the HUC 12 unit from the National Hydrology Dataset's Watershed Boundary Dataset. It is available, along with the high resolution (1:24,000 scale) NHDFlowline data that we used in our analysis, here: http://nhd.usgs.gov/data.html

Catchments

We calculated catchments for the Great Lakes Basin using a 10 meter DEM and the ArcHydro tool set for ArcGIS. We defined streams using the high resolution NHDFlowlines. Before processing, to ensure creation of one catchment per reach, we used the "UnsplitLines tool" to dissolve all segments with the same ReachCode into a single feature. We then converted this feature class to a raster using the "Polyline To Raster Tool". Streams were "burned in" to the digital elevation model using the "DEM Reconditioning Tool" in ArcHydro; with the unsplit polyline class, a 5 cell stream buffer, a 10 unit smooth drop and a 1000 unit sharp drop. We filled this reconditioned raster using "Fill Sinks" to remove anomalies that occurred during the reconditioning step. We used the reconditioned, filled raster as input in the ArcHydro "Flow Direction Tool". We then used the rasterized stream layer and the flow direction raster as inputs in the "Catchment Grid Delineation Tool," which assigned the same value to all cells that drain into the same stream segment, resulting in a raster of catchments. We used the "Raster To Polygon Tool" to convert the raster into catchment polygons to be used in the analysis.

There is no standard length for a reach in the NHD High Resolution dataset, they can range in size from a few meters to a few kilometers; as a result, the catchments that drain into these reaches all vary considerably in size, much more so than the sub-watersheds.

Because of the fine scale of the DEM, memory limits prevented running this process on the whole of the Great Lakes Basin at once. We divided the area based on HUC 6 sub-regions. An unanticipated consequence of this was that due to differences in the scale of our elevation model and the scale at which the HUC 6 boundaries were defined, there are pieces of catchments along the borders between HUC 6s where no catchment was defined. They appear as white space in the ArcGIS feature class. These are likely areas that, despite falling within the boundaries of the HUC 6, didn't drain into the area we were processing at the time, so ArcHydro assigned it no value. In future versions of the assessment, we hope to fill these gaps.

*Riparian Buffer Delineation*

We utilized the Riparian Buffer Delineation Tool, created by Sinan Abood, to define the riparian boundary. You can request a copy of the tool here: http://www.sfi.mtu.edu/muses/GIS_Riparian.htm. The riparian boundary is defined based on input which includes: a 10 meter Digital Elevation model, a streams layer derived from NHDFlowlines, a lakes layer, a value for the 50 year flood height, a maximum transect length, and a wetlands layer. The tool is available as an ArcGIS toolbox, an example of the interface is shown in Figure 17.


Figure 17. Riparian Buffer Delineation Tool Interface. We used version 2.3.

*Calculating 50 Year Flood Height for Gages in the Great Lakes Basin:*

The Riparian Buffer Delineation Tool defines the riparian zone as the area within the 50 year floodplain. This requires an estimate of the 50 year flood height for each area of interest. Estimating the 50 year flood height for each sub-watershed in our study area required gathering flow data about streams throughout the Great Lakes Basin (GLB). The methods in Abood (2012) describe how to estimate the 50 year flood height from the annual flow data and field measurements available for gaged sites. These data are available from the US Geological Survey's Surface-Water for the Nation web interface: http://waterdata.usgs.gov/nwis/sw.

We downloaded the annual flow data and field measurements for 58 gages in the Great Lakes Basin and calculated the estimated 50 year flood heights. They are available in Table 3.

*Gathering Data on Stream Flow and Channel Width at Ungaged Sites:*

Because of the limited availability of gage data in the GLB, for many sub-watersheds, there was not a gage nearby. Assigning a 50 year flood height based on flow dynamics at the nearest gage, which could be relatively far away, perhaps on a much larger river than any that flows through that sub-watershed, would not likely reflect the flooding dynamics of that area well.

While a complete set of annual and field measurement data were not available for all 687 sub-watersheds, we were able to collect simple measures of stream size and flow using the USGS StreamStats service. StreamStats provides estimates of flow rates and channel width at ungagged sites throughout the region. StreamStats service can be found here: http://water.usgs.gov/osw/streamstats/.

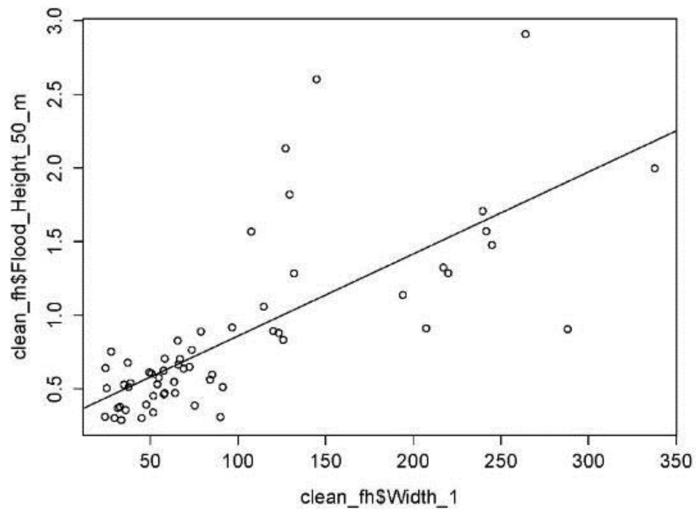
We generated 10 random points on streams in each sub-watershed, and submitted those points to StreamStats. We were returned data on 6669 points, which describe many estimates of flow rates and channel attributes, including the bankfull width.

*Estimating Floodheight from Bankful Width*:

We calculated the 50 year flood height for the gaged stations in the GLB and used the results to plot the relationship between 50 year flood height and 1 year flood event channel width.

This relationship was necessary because the kind of annual data and field measurements associated with the gaged data are not available for the stream stats points. In order to leverage the additional information the stream stats points provide us about the distribution of stream size in the region, we needed a way to estimate the 50 year flood height from one of the metrics Stream Stats provides.

Bankfull width was a stream metric delivered by Stream Stats that was most consistently populated for stream points submitted. It represents the stream channel width that contains the flow associated with 1.5 year flood events. From the gage data, we could estimate the relationship between the 50 year flood height and the 1 year channel width for the 50 gages in the area (Figure 18).




$$y = 0.0055717 * x + 0.3016949$$

Figure 18. Plot of 1 year channel width against estimated 50 year flood height based on annual flow data and field measurement for 59 gages in the Great Lakes Basin.

We used the equation of the best fit line to then estimate the 50 year flood height for each Stream Stats point by plugging in the bankfull width value for "x" to get an estimate of 50 year flood height. The estimated flood heights ranged in value from 0.3 to 3.3 meters.

*Assigning 50 Year Flood Height Value to HUC 12*:

Because the Riparian Buffer Delineation Tool currently uses only a single 50 year flood height to describe an area, we needed to assign a single flood height to each HUC 12 before we could run the tool. We did this using the set of points we had generated for StreamStats and their associated 50 year flood height estimates which we had calculated above. We subdivided the points based on HUC 8 (sub-regions). This was necessary to ensure each sub-set of points was sufficiently large so that it contained points that described flood heights for streams of varying size, while also ensuring that the flood heights were taken from streams in a sufficiently similar area (we wouldn't want the flow dynamics of the Genesee to be used to estimate floodplains in the Black River Basin).

Sub-dividing the points allowed us to see the range of estimated flood heights from the random points we had submitted. These came from streams of varying size. We chose to assign a flood height to a HUC 12 based on the size of the largest stream in the sub-watershed. To estimate relative stream size, we used the StreamOrder function in ArcGIS on the rasterized stream layer. Strahler stream order assigns stream order based on position in a network: the "tips," or headwaters receive a value of 1, and values increase as branches merge together. The highest order stream in our study area had an order of 10.

From the points in each sub-region, we calculated the 0 (min), 25th, 50$^{th}$ (mean), 75th, 90th, and 100 (max) percentile of estimated flood heights (Table 3). HUC 12s were assigned a flood height based on the highest order of stream contained in the HUC 12. The maximum stream order possible varied by sub-region, according to their position in the basin. So for HUC 8's further upstream, the largest stream order was 7, while downstream sub-regions had a maximum stream order of 10. Based on the maximum stream order of the HUC 12 and the maximum stream order of the HUC 8, each HUC 12 was assigned a flood height based on the distribution of estimated 50 year flood heights in its sub-region.

Table 3. Rubric for Assigning 50 Year Flood Heights to HUC 12 Sub-Watersheds based on Stream Order

| | Highest Stream Order in HUC 12 | | | | | |
|---|---|---|---|---|---|---|
| Highest Stream Order in HUC 8 | **10** | **9** | **8** | **7** | **6** | **5 and under** |
| **10** | MAX | 90th | 75th | MEAN | 25th | MIN |
| **9** | | MAX | 90th | MEAN | 25th | MIN |
| **8** | | | MAX | MEAN | 25th | MIN |
| **7** | | | | MAX | Mean | MIN |

MAX= Maximum of Observed 50 Year Flood Heights from StreamStats Points Within the Same HUC 8
90th= 90th percentile of 50 Year Flood Heights from StreamStats Points Within the Same HUC 8
75th= 75th percentile of 50 Year Flood Heights from StreamStats Points Within the Same HUC 8
MEAN= MEAN of Observed 50 Year Flood Heights from StreamStats Points Within the Same HUC 8
25th= 25th percentile of 50 Year Flood Heights from StreamStats Points Within the Same HUC 8
MIN= Minimum of Observed 50 Year Flood Heighta from StreamStats Points Within the Same HUC 8

The assigned flood heights for each HUC 12 can be found in Appendix C.

This method involves considerable estimation and extrapolation; however, we considered it the best compromise possible given the nature of the available data, the size of our study area, and the ultimate purpose for the riparian zone we use them to define. It is important to stress that the estimated flood height values have not been verified. **We provide them here to give as much information and transparency as possible about the development of the riparian buffer layer, but they should not be used for other purposes.**

*Stream, Wetland, and Lake Selection for Riparian Buffer Delineation Tool:*

The NHDFlowlines include some stream segments for waterbodies we considered unsuitable for modeling the riparian zone, such as pipelines and aqueducts. When running the tool, we included only streams with the following "Ftype" codes from the NHDFlowlines data set: Stream/River (460), Coastline (566), Connector (334), and Artificial Path (558).

The Riparian Buffer Delineation Tool takes several additional input layers to describe the riparian zone. We included a wetlands layer from the National Wetland Inventory, including all polygons which were classified as "Riverine", "Freshwater Emergent Wetland", and "Freshwater Forested/Shrub Wetland". Whenever the buffer estimated by the tool intersects an existing wetland polygon, the buffer is expanded to incorporate the entire wetland polygon.

All lakes were supplied as a separate polygon class.

*Running the Riparian Buffer Delineation Tool:*

We used a filled, 10 meter digital elevation mode, which we subset by HUC 12 as our DEM source. We also subset our streams, lakes, and wetlands layers by HUC 12, and a feature class containing a single HUC 12 polygon was used as the Watershed boundary. We set a sampling distance of 200 meters for the transect vector and assigned 50 year flood heights according to the values in Table 3. We used the recommended lake buffer distance of 30.48 for most lakes and ponds.

The tool was run once for each HUC 12 in the GLB and the resulting polygons were merged to create the riparian zone layer.

*Scoring*

*Raw and Normalized Scores*

Before we could combine scores for individual indicators, we first normalized them. This made it easier to properly work with indicators with raw scores on different scales. We normalized scores using the formula:

$$Normalized\ (x) = a + \frac{(x - A)(b - a)}{B - A}$$

Where: A is the minimum raw score value, and B is the maximum raw score value.

We normalized all scores so they ranged in value from 0-1, so a=0 and b=1.

So for all raw scores, x, the new value = $Normalized(x) = \frac{x - minimum\ Raw\ Score}{Raw\ score\ range}$

This method does not change the distribution of scores, only scales them so that they have the same maximum and minimum.

For sub-watersheds, values of 0 and 1 represent the lowest and highest quality habitat in the Great Lakes Basin. Normalization was based on the values of all 687 HUC 12s.

For catchments, values of 0 and 1 represent the lowest and highest quality habitat in the sub-watershed. Catchment scores were sub-divided based on their HUC 12, and that subset was normalized only relative to each other. So 687 separate normalizations, which means that values of 1 in separate HUC 12s do not represent similar raw score values.

*Composite Scores: Ecological Health, Ecological Stress, and Comprehensive*

To calculate the Ecological Health score, we added together the normalized scores for all Ecological Health indicators.

To calculate the Ecological Stress score, we added together the normalized scores for all Ecological Stress indicators.

The Comprehensive score = Normalized Ecological Health score- Normalized Ecological Stress score. It had a potential minimum of -1 and a potential maximum value of 1. This was normalized to also range from 0-1 for easier plotting on the online data explorer.

*Theme Scores*

Theme scores were only calculated at the catchment level, because they addressed smaller scale variations and would have been essentially meaningless if aggregated to the level of the sub-watershed. When a theme involved combining multiple pre-existing scores, we used a weighting scheme in which moderately weighted variables counted twice as much as lightly weighted variables, and heavily weighted variables counted twice as much as moderately weighted variables.

"Lightly" weighted variables were multiplied by 1
"Moderately" weighted were multiplied by 2
"Heavily" weighed variables were multiplied by 4
Stress indicators were all multiplied by -1
"Riparian" refers to indicators that were only scored within the riparian zones. "Catchment" refers to scores that incorporated the entire catchment area.

**Water Quality Theme:**

- $\boldsymbol{Water\ Quality\ Theme\ Score} = (-4) * \{Impervious\ Surface\ (riparian) + LCA\ (catchment) + LCA(riparian) + TWI + Erosion + PWI\ Water\ Stress\ Score\} + 4 * \{Natural\ Cover(riparian) + BAP\} + 2 * \{Natural\ Cover\ (catchment)\} + 1 * \{Canopy\ Cover\ (riparian) + Canopy\ Cover\ (catchment) + Floodplain\ Complex(riparian) + Floodplain\ Complex\ (catchment)\}$

Scores ranged in value from -20 to 13. Normalized scores are presented and range from 0-1.

**Connectivity Theme:**

We first identified qualifying sub-watersheds: Those with high existing riparian connectivity and a few gaps, based on mean riparian canopy cover scores. The mean riparian canopy score for the catchments in all 687 sub-watersheds was 47%, with a standard deviation of 14%, so we selected only sub-watersheds with mean riparian canopy scores of 61% or higher (greater than 1 standard deviation above the mean) that had at least one catchment with a mean riparian canopy score of less than 25%.

We excluded catchments where greater than 50% of the riparian zone was classified as "Open Water" (according to the National Land Cover Dataset). This reduced the likelihood that gaps were due to the presence of ponds, which planting trees would not ameliorate). After also removing catchments that were entirely under lakes, the resulting dataset used for this part of the analysis was 48,349 catchments.

The upper cutoff value was high enough to identify higher quality sub-watersheds and low enough that it did not limit the qualifying sub-watersheds to solely those found in the Adirondacks. The lower value of 35% was used to identify sub-watersheds with at least 1 catchment with a gap (area of low canopy cover).

Within the qualifying sub-watersheds, we selected those catchments with mean riparian canopy cover of 35% or less. Catchments that did not qualify are classified as "Excluded" and colored grey. Qualifying catchments are scored according to their riparian canopy cover score, red representing lower canopy cover, blue representing higher. Because of the cutoff, normalized scores that appear range in value from 0 to 0.25, the higher the score, the higher the existing canopy coverage. It should be emphasized that any catchment that isn't grey, or "excluded", has already qualified as a potential connectivity gap, the colors are included to provide a little additional information.

Because of the nature of this theme, not all sub-watersheds qualified, and not all catchments are scored. 448 catchments within 77 sub-watersheds qualified.

**Stream Temperature Theme:**

$$\begin{aligned}\textbf{\textit{Stream Temperature Theme Score}}\\ = 4 * \{&Canopy\ Cover(riparian) + Functional\ River\ Network + BAP\\ &+ Brook\ Trout + Floodplain\ Complex(riparian)\\ &+ Forest\ Matrix\ Block\ (riparian) + Natural\ Cover(riparian)\}\\ &+ (-1)\\ &* \{LCA(riparian) + Impervious\ Surface\ (riparian) + Erosion\\ &+ TWI + PWI\ Water\ Stress\ Score + Dam\ Storage\ Ratio)\}\end{aligned}$$

Raw scores ranged from -4 to 13. Normalized scores are presented, and range from 0-1

**Wetland Resiliency Theme:**

We computed the area of the riparian buffer for each catchment, and the area of riparian buffer for each catchment that intersected a wetland in the NWI. The ratio of wetland riparian area to buffer area constituted the raw score.

**Runoff Risk Theme:**

Using the National Land Cover Dataset, we extracted the developed classes (Developed, Open Space [21]; Developed, Low Intensity [22]; Developed, Medium Intensity [23]; Developed, High Intensity [24]) and the Barren (31) class). From the CropScape 2014 dataset (USDA National Agricultural Statistics Service 2014), we extracted all the classes indicating cover types that suggested regular tilling (Table 4). Classes not used from the CropScape dataset include orchards, more perennial cover crops (clover/wildflowers, sod, and switchgrass), and classes not occurring in New York State. All the extracted raster cells were merged and assigned a value of 1; the remaining cells were assigned a value of 0. We multiplied this binary layer by the Erosion indicator, which resulted in a range of values for erosion risk that highlights catchments with both high erosion risk and land use likely to contribute to runoff within the riparian zone. (As a reminder, the values for the Erosion indicator are only calculated inside the riparian buffer).

Table 4. CropScape cover types used in the Runoff Risk Theme.

| | | | |
|---|---|---|---|
| Alfalfa | Millet | Speltz | Dbl Crop Barley/Corn |
| Asparagus | Mustard | Spring Wheat | Dbl Crop Barley/Soybeans |
| Barley | Oats | Squash | Dbl Crop Corn/Soybeans |
| Broccoli | Onions | Strawberries | Dbl Crop Oats/Corn |
| Buckwheat | Other Crops | Sugarbeets | Dbl Crop Soybeans/Oats |

| | | | |
|---|---|---|---|
| Cabbage | Peas | Sunflower | Dbl Crop WinWht/Corn |
| Carrots | Peppers | Sweet Corn | Dbl Crop WinWht/Soybeans |
| Cauliflower | Potatoes | Tomatoes | Fallow/Idle Cropland |
| Corn | Pumpkins | Triticale | Misc Vegs & Fruits |
| Cucumbers | Radishes | Turnips | Other Hay/Non Alfalfa |
| Dry Beans | Rye | Vetch | Pop or Orn Corn |
| Flaxseed | Sorghum | Watermelons | |
| Herbs | Soybeans | Winter Wheat | |

*Filters*

Urban Areas: We used the 2010 Census designated Urbanized Areas or Urban Clusters data, available from https://www.census.gov/geo/maps-data/. Any catchment which intersected an urban area or urban cluster polygon will still appear when this filter is selected. In the attribute table they are given a value of "1". All other catchments appear in grey in the PDFs and have an attribute table value of "0".

Agricultural Areas: Any catchment that has greater than 25% of the area of its riparian buffer covered by crops or pasture according to the NLCD was considered "In Agriculture".

## Appendix C. Flood Height by Sub-watershed (HUC 12)

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041201010101 | Silver Creek | 04120101 | 6 | 8 | 0.479711 |
| 041201010102 | Walnut Creek-Frontal Lake Erie | 04120101 | 8 | 8 | 1.53304 |
| 041201010201 | Beaver Creek-Frontal Lake Erie | 04120101 | 8 | 8 | 1.53304 |
| 041201010202 | Scott Creek-Frontal Lake Erie | 04120101 | 5 | 8 | 0.383042 |
| 041201010203 | Canadaway Creek | 04120101 | 6 | 8 | 0.479711 |
| 041201010204 | Little Canadaway Creek-Frontal Lake Erie | 04120101 | 6 | 8 | 0.479711 |
| 041201010301 | Slippery Rock Creek-Frontal Lake Erie | 04120101 | 6 | 8 | 0.479711 |
| 041201010302 | Bournes Creek-Frontal Lake Erie | 04120101 | 5 | 8 | 0.383042 |
| 041201010303 | Chautauqua Creek | 04120101 | 7 | 8 | 0.579723 |
| 041201010401 | Freelings Creek-Frontal Lake Erie | 04120101 | 7 | 8 | 0.579723 |
| 041201010402 | Twentymile Creek | 04120101 | 7 | 8 | 0.579723 |
| 041201010403 | Sixteenmile Creek-Frontal Lake Erie | 04120101 | 6 | 8 | 0.479711 |
| 041201020101 | Clear Creek | 04120102 | 6 | 8 | 0.479711 |
| 041201020102 | Headwaters Cattaraugus Creek | 04120102 | 7 | 8 | 0.579723 |
| 041201020103 | Headwaters Elton Creek | 04120102 | 6 | 8 | 0.479711 |
| 041201020104 | Lime Lake Outlet | 04120102 | 7 | 8 | 0.579723 |
| 041201020105 | Elton Creek | 04120102 | 7 | 8 | 0.579723 |
| 041201020106 | Hosmer Brook-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020107 | Dresser Creek-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020108 | Buttermilk Creek | 04120102 | 7 | 8 | 0.579723 |
| 041201020109 | Spring Brook-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020201 | Connoisarauley Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020202 | Spooner Creek-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020203 | Mansfield Creek | 04120102 | 6 | 8 | 0.479711 |
| 041201020204 | Headwaters South Branch Cattaraugus Creek | 04120102 | 7 | 8 | 0.579723 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---:|---:|---:|
| 041201020205 | South Branch Cattaraugus Creek | 04120102 | 7 | 8 | 0.579723 |
| 041201020206 | Waterman Brook-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020207 | North Branch Clear Creek | 04120102 | 6 | 8 | 0.479711 |
| 041201020208 | Clear Creek | 04120102 | 7 | 8 | 0.579723 |
| 041201020209 | Thatcher Brook-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201020210 | Big Indian Creek-Cattaraugus Creek | 04120102 | 8 | 8 | 1.53304 |
| 041201030101 | Headwaters Cayuga Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030102 | Upper Cayuga Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030103 | Little Buffalo Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030104 | Middle Cayuga Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030105 | Lower Cayuga Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030201 | Headwaters Buffalo Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030202 | Beaver Meadow Creek-Buffalo Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030203 | Hunter Creek | 04120103 | 5 | 8 | 0.308228 |
| 041201030204 | Sheldon Creek-Buffalo Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030205 | Pond Brook-Buffalo Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030206 | Buffalo Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030301 | Sprague Brook-West Branch Cazenovia Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030302 | Headwaters East Branch Cazenovia Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030303 | West Branch Cazenovia Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030304 | East Branch Cazenovia Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030305 | Cazenovia Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030306 | Buffalo River-Frontal Lake Erie | 04120103 | 8 | 8 | 1.28789 |
| 041201030401 | Smoke Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030402 | Rush Creek-Frontal Lake Erie | 04120103 | 5 | 8 | 0.308228 |
| 041201030501 | Headwaters Eighteenmile Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030502 | Upper Eighteenmile Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030503 | Headwaters South Branch Eighteenmile Creek | 04120103 | 6 | 8 | 0.396414 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041201030504 | South Branch Eighteenmile Creek | 04120103 | 6 | 8 | 0.396414 |
| 041201030505 | Middle Eighteenmile Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030506 | Lower Eighteenmile Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030601 | Little Sister Creek-Frontal Lake Erie | 04120103 | 6 | 8 | 0.396414 |
| 041201030602 | Headwaters Big Sister Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030603 | Big Sister Creek | 04120103 | 7 | 8 | 0.516927 |
| 041201030604 | Delaware Creek-Frontal Lake Erie | 04120103 | 7 | 8 | 0.516927 |
| 041201040101 | East Fork Tonawanda Creek-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040102 | Stony Brook-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040103 | Crow Creek-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040104 | Baker Brook-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040105 | Little Tonawanda Creek | 04120104 | 6 | 9 | 0.448231 |
| 041201040106 | Village of Alexander-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040107 | City of Batavia-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040108 | Bowen Creek-Tonawanda Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040201 | Upper Murder Creek | 04120104 | 6 | 9 | 0.448231 |
| 041201040202 | Middle Murder Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040203 | Lower Murder Creek | 04120104 | 8 | 9 | 1.0288 |
| 041201040301 | Galloway Swamp-Tonawanda Creek | 04120104 | 8 | 9 | 1.0288 |
| 041201040302 | Black Creek-Tonawanda Creek | 04120104 | 8 | 9 | 1.0288 |
| 041201040303 | Beeman Creek | 04120104 | 6 | 9 | 0.448231 |
| 041201040304 | Whitney Creek-Mud Creek | 04120104 | 6 | 9 | 0.448231 |
| 041201040305 | Mud Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040306 | Saint Stephens Church-Tonawanda Creek | 04120104 | 8 | 9 | 1.0288 |
| 041201040401 | Elevenmile Creek | 04120104 | 5 | 9 | 0.310148 |
| 041201040402 | Spring Creek-Ellicott Creek | 04120104 | 6 | 9 | 0.448231 |
| 041201040403 | Hamlet of Peters Corners-Ellicott Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040404 | Village of Williamsburg-Ellicott Creek | 04120104 | 7 | 9 | 0.508126 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041201040405 | Town of Amherst-Ellicott Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040406 | Ellicott Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040501 | Got Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040502 | Headwaters Ransom Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040503 | Ransom Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040504 | Bull Creek | 04120104 | 6 | 9 | 0.448231 |
| 041201040505 | Bear Ridge-Tonawanda Creek | 04120104 | 8 | 9 | 1.0288 |
| 041201040601 | Twomile Creek-Niagara River | 04120104 | 8 | 9 | 1.0288 |
| 041201040602 | Grand Island-Niagara River | 04120104 | 7 | 9 | 0.508126 |
| 041201040603 | Cayuga Creek | 04120104 | 7 | 9 | 0.508126 |
| 041201040604 | City of North Tonawanda-Niagara River | 04120104 | 9 | 9 | 1.2990299 |
| 041201040605 | Niagara Falls-Niagara River | 04120104 | 9 | 9 | 1.2990299 |
| 041300010101 | Round Pond Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300010102 | Larkin Creek-Frontal Lake Ontario | 04130001 | 7 | 9 | 0.508126 |
| 041300010103 | Northrup Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300010201 | Salmon Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010202 | Brockport Creek-Otis Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010203 | Moorman Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010204 | West Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010205 | Salmon Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300010206 | Cowsucker Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300010301 | West Branch Sandy Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010302 | East Branch Sandy Creek-Sandy Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010303 | Sandy Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010304 | Yanty Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300010305 | Bald Eagle Creek-Frontal Lake Ontario | 04130001 | 7 | 9 | 0.508126 |
| 041300010401 | Headwaters Oak Orchard Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010402 | Brinningstool Creek-Oak Orchard Creek | 04130001 | 8 | 9 | 1.0288 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041300010403 | Iroquois National Wildlife Refuge-Oak Orchard Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010404 | Fish Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010405 | Glenwood Lake-Oak Orchard Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010406 | Otter Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010407 | Town of Knowlesville-Oak Orchard Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010408 | Outlet Oak Orchard Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010501 | Jeddo Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010502 | Upper Johnson Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010503 | Middle Johnson Creek | 04130001 | 8 | 9 | 1.0288 |
| 041300010504 | Lower Johnson Creek-Frontal Lake Ontario | 04130001 | 8 | 9 | 1.0288 |
| 041300010601 | Marsh Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300010602 | Golden Hill Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010603 | Keg Creek-Frontal Lake Ontario | 04130001 | 6 | 9 | 0.448231 |
| 041300010701 | Headwaters East Branch Eighteenmile Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010702 | East Branch Eighteenmile Creek | 04130001 | 6 | 9 | 0.448231 |
| 041300010703 | Headwaters Eighteenmile Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010704 | Eighteenmile Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010801 | Hopkins Creek-Frontal Lake Ontario | 04130001 | 7 | 9 | 0.508126 |
| 041300010802 | East Branch Twelvemile Creek-Frontal Lake Ontario | 04130001 | 6 | 9 | 0.448231 |
| 041300010901 | Twelvemile Creek | 04130001 | 7 | 9 | 0.508126 |
| 041300010902 | Fourmile Creek-Frontal Lake Ontario | 04130001 | 9 | 9 | 1.2990299 |
| 041300020101 | Middle Branch Genesee River | 04130002 | 6 | 9 | 0.444052 |
| 041300020102 | West Branch Genesee River | 04130002 | 6 | 9 | 0.444052 |
| 041300020103 | Headwaters Genesee River | 04130002 | 7 | 9 | 0.525678 |
| 041300020201 | Upper Dyke Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020202 | Middle Dyke Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020203 | Lower Dyke Creek | 04130002 | 8 | 9 | 1.13467 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041300020301 | Marsh Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020302 | Cryder Creek | 04130002 | 8 | 9 | 1.13467 |
| 041300020303 | Marsh Creek-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020304 | Chenunda Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020305 | Ford Brook-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020401 | Black Creek-Angelica Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020402 | Baker Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020403 | Angelica Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020501 | Vandermark Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020502 | Knight Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020503 | Brimmer Brook-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020504 | Phillips Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020505 | West Branch Van Campen Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020506 | Van Campen Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020507 | Gordon Brook-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020601 | Black Creek-Genesee River | 04130002 | 6 | 9 | 0.444052 |
| 041300020602 | White Creek-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020603 | Headwaters Caneadea Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020604 | Caneadea Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020605 | Crawford Creek-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020701 | Trout Brook | 04130002 | 6 | 9 | 0.444052 |
| 041300020702 | Headwaters Wiscoy Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020703 | Headwaters East Koy Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020704 | East Koy Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020705 | Wiscoy Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020801 | Cold Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020802 | Shongo Creek-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020803 | Rush Creek | 04130002 | 7 | 9 | 0.525678 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041300020804 | Village of Fillmore-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300020901 | Headwaters Canaseraga Creek | 04130002 | 6 | 9 | 0.444052 |
| 041300020902 | Sugar Creek | 04130002 | 5 | 9 | 0.338914 |
| 041300020903 | Bennett Creek-Canaseraga Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020904 | Mill Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020905 | Stony Brook-Canaseraga Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020906 | Bradner Creek | 04130002 | 8 | 9 | 1.13467 |
| 041300020907 | Twomile Creek | 04130002 | 8 | 9 | 1.13467 |
| 041300020908 | Mud Creek-Canaseraga Creek | 04130002 | 8 | 9 | 1.13467 |
| 041300020909 | Headwaters Keshequa Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020910 | Keshequa Creek | 04130002 | 7 | 9 | 0.525678 |
| 041300020911 | Canaseraga Creek | 04130002 | 9 | 9 | 2.0344901 |
| 041300021001 | Hamlet of Portageville-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300021002 | Wolf Creek-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300021003 | Eastover Brook-Genesee River | 04130002 | 8 | 9 | 1.13467 |
| 041300021004 | Silver Lake | 04130002 | 6 | 9 | 0.444052 |
| 041300021005 | Outlet Silver Lake-Genesee River | 04130002 | 9 | 9 | 2.0344901 |
| 041300030101 | Upper Conesus Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030102 | Middle Conesus Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030103 | Lower Conesus Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030201 | Honeoye Inlet | 04130003 | 5 | 9 | 0.350057 |
| 041300030202 | Canadice Lake-Outlet Canadice Lake | 04130003 | 7 | 9 | 0.496426 |
| 041300030203 | Hemlock Lake | 04130003 | 7 | 9 | 0.496426 |
| 041300030204 | Outlet Hemlock Lake | 04130003 | 7 | 9 | 0.496426 |
| 041300030205 | Honeoye Lake-Honeoye Creek | 04130003 | 8 | 9 | 1.0343699 |
| 041300030206 | Bebee Creek-Honeoye Creek | 04130003 | 8 | 9 | 1.0343699 |
| 041300030301 | Spring Brook-Honeoye Creek | 04130003 | 8 | 9 | 1.0343699 |
| 041300030302 | Honeoye Creek | 04130003 | 8 | 9 | 1.0343699 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041300030401 | Headwaters Oatka Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030402 | Pearl Creek-Oakta Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030403 | White Creek-Oatka Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030404 | Mud Creek | 04130003 | 6 | 9 | 0.441545 |
| 041300030405 | City of Le Roy-Oatka Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030406 | Oatka Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030501 | Beards Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030502 | Jaycox Creek-Genesee River | 04130003 | 9 | 9 | 2.60232 |
| 041300030503 | Browns Creek-Genesee River | 04130003 | 9 | 9 | 2.60232 |
| 041300030504 | Christie Creek-Genesee River | 04130003 | 9 | 9 | 2.60232 |
| 041300030505 | Dugan Creek-Genesee River | 04130003 | 9 | 9 | 2.60232 |
| 041300030601 | Spring Creek | 04130003 | 6 | 9 | 0.441545 |
| 041300030602 | Headwaters Black Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030603 | Robins Brook-Black Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030604 | Hotel Creek-Black Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030605 | Mill Creek-Black Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030606 | Black Creek | 04130003 | 7 | 9 | 0.496426 |
| 041300030701 | Little Black Creek | 04130003 | 9 | 9 | 2.60232 |
| 041300030702 | Red Creek | 04130003 | 6 | 9 | 0.441545 |
| 041300030703 | Town of Gates-Genesee River | 04130003 | 9 | 9 | 2.60232 |
| 041300030704 | Genesee River | 04130003 | 9 | 9 | 2.60232 |
| 041401010101 | Rice Creek-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010102 | Eightmile Creek-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010103 | Ninemile Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010201 | Sterling Valley Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010202 | Headwaters Sterling Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010203 | Sterling Creek | 04140101 | 7 | 7 | 0.886723 |
| 041401010204 | Blind Sodus Creek-Frontal Lake Ontario | 04140101 | 7 | 7 | 0.886723 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041401010205 | Red Creek-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010301 | Wolcott Creek-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010302 | Mudge Creek-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010401 | Sodus Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010402 | Sodus Bay-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010501 | Headwaters Salmon Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010502 | Salmon Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010503 | Mink Creek-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010601 | Town of Williamson-Frontal Lake Ontario | 04140101 | 6 | 7 | 0.48584 |
| 041401010602 | Bear Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010603 | Mill Creek-Frontal Lake Ontario | 04140101 | 7 | 7 | 0.886723 |
| 041401010604 | Fourmile Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010701 | Headwaters Irondequoit Creek | 04140101 | 7 | 7 | 0.886723 |
| 041401010702 | Railroad Mills-Frontal Lake Ontario | 04140101 | 7 | 7 | 0.886723 |
| 041401010703 | Allen Creek | 04140101 | 6 | 7 | 0.48584 |
| 041401010704 | Thomas Creek-Irondequoit Creek | 04140101 | 7 | 7 | 0.886723 |
| 041401010705 | Irondequoit Creek | 04140101 | 7 | 7 | 0.886723 |
| 041401010706 | Irondequoit Bay-Frontal Lake Ontario | 04140101 | 7 | 7 | 0.886723 |
| 041401020101 | Headwaters Stony Creek | 04140102 | 6 | 8 | 0.541835 |
| 041401020102 | Stony Creek | 04140102 | 6 | 8 | 0.541835 |
| 041401020103 | Little Stony Creek-Frontal Lake Ontario | 04140102 | 6 | 8 | 0.541835 |
| 041401020201 | Raystone Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020202 | Headwaters South Sandy Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020203 | South Sandy Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020301 | Gulf Stream | 04140102 | 6 | 8 | 0.541835 |
| 041401020302 | North Branch Sandy Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020303 | Headwaters Sandy Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020304 | Fish Creek-Sandy Creek | 04140102 | 8 | 8 | 1.20988 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041401020305 | Sandy Creek | 04140102 | 8 | 8 | 1.20988 |
| 041401020401 | Skinner Creek | 04140102 | 6 | 8 | 0.541835 |
| 041401020402 | Lindsey Creek | 04140102 | 6 | 8 | 0.541835 |
| 041401020403 | Little Sandy Creek | 04140102 | 6 | 8 | 0.541835 |
| 041401020404 | North Pond-Frontal Lake Ontario | 04140102 | 7 | 8 | 0.626247 |
| 041401020405 | Deer Creek | 04140102 | 6 | 8 | 0.541835 |
| 041401020501 | Headwaters Mad River | 04140102 | 6 | 8 | 0.541835 |
| 041401020502 | Mad River | 04140102 | 6 | 8 | 0.541835 |
| 041401020503 | Mill Stream | 04140102 | 6 | 8 | 0.541835 |
| 041401020504 | North Branch Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401020601 | Headwaters Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401020602 | Prince Brook-Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401020701 | Beaverdam Brook | 04140102 | 6 | 8 | 0.541835 |
| 041401020702 | Salmon River Resevoir-Salmon River | 04140102 | 8 | 8 | 1.20988 |
| 041401020703 | Trout Brook | 04140102 | 6 | 8 | 0.541835 |
| 041401020704 | Orwell Creek-Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401020705 | Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401020801 | Headwaters Grindstone Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020802 | Grindstone Creek | 04140102 | 7 | 8 | 0.626247 |
| 041401020803 | Sage Creek-Frontal Lake Ontario | 04140102 | 6 | 8 | 0.541835 |
| 041401020901 | North Branch Little Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401020902 | South Branch Little Salmon River | 04140102 | 6 | 8 | 0.541835 |
| 041401020903 | Little Salmon River | 04140102 | 7 | 8 | 0.626247 |
| 041401021001 | Butterfly Creek-Frontal Lake Ontario | 04140102 | 8 | 8 | 1.20988 |
| 041401021002 | Catfish Creek | 04140102 | 8 | 8 | 1.20988 |
| 041401021003 | Otter Branch-Frontal Lake Ontario | 04140102 | 8 | 8 | 1.20988 |
| 041401021004 | Wine Creek-Frontal Lake Ontario | 04140102 | 6 | 8 | 0.541835 |
| 041402010101 | Upper Mud Creek | 04140201 | 6 | 10 | 0.400314 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041402010102 | Middle Mud Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010103 | Lower Mud Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010201 | Naples Creek | 04140201 | 8 | 10 | 0.6505 |
| 041402010202 | West River | 04140201 | 8 | 10 | 0.6505 |
| 041402010203 | Bristol Springs-Canadaigua Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010204 | Deep Run-Canadaigua Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010205 | Sucker Brook-Canadaigua Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010301 | Upper Flint Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010302 | Middle Flint Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010303 | Lower Flint Creek | 04140201 | 8 | 10 | 0.6505 |
| 041402010401 | Upper Canadaigua Outlet | 04140201 | 8 | 10 | 0.6505 |
| 041402010402 | Black Brook | 04140201 | 6 | 10 | 0.400314 |
| 041402010403 | Middle Canadaigua Outlet | 04140201 | 8 | 10 | 0.6505 |
| 041402010404 | Lower Canadaigua Outlet | 04140201 | 8 | 10 | 0.6505 |
| 041402010501 | Red Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010502 | Red Creek-Ganargua Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010503 | Butternut Run-Ganargua Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010504 | Military Run-Erie Canal | 04140201 | 7 | 10 | 0.493361 |
| 041402010601 | Headwaters Catherine Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010602 | Sleeper Creek-Catherine Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010603 | Seneca Lake Inlet | 04140201 | 8 | 10 | 0.6505 |
| 041402010701 | Sugar Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402010702 | West Branch Keuka Lake | 04140201 | 7 | 10 | 0.493361 |
| 041402010703 | Keuka Inlet | 04140201 | 6 | 10 | 0.400314 |
| 041402010704 | South Branch Keuka Lake | 04140201 | 7 | 10 | 0.493361 |
| 041402010705 | East Branch Keuka Lake | 04140201 | 7 | 10 | 0.493361 |
| 041402010706 | Keuka Lake Outlet | 04140201 | 8 | 10 | 0.6505 |
| 041402010801 | Hector Falls Creek-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041402010802 | Big Stream | 04140201 | 8 | 10 | 0.6505 |
| 041402010803 | Rock Stream-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010804 | Breakneck Creek-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010805 | Indian Run-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010806 | Mill Creek-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010807 | Indian Creek-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010901 | Kashong Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402010902 | Wilcox Creek-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010903 | Wilson Creek-Seneca Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402010904 | Castle Creek-Seneca Lake | 04140201 | 9 | 10 | 0.86778 |
| 041402010905 | Silver Creek-Seneca River | 04140201 | 9 | 10 | 0.86778 |
| 041402010906 | Sucker Brook-Seneca River | 04140201 | 9 | 10 | 0.86778 |
| 041402011001 | Upper Fall Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011002 | Middle Fall Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011003 | Headwaters Virgil Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011004 | Egypt Creek-Virgil Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011005 | Lower Fall Creek | 04140201 | 8 | 10 | 0.6505 |
| 041402011006 | Upper Cayuga Inlet | 04140201 | 7 | 10 | 0.493361 |
| 041402011007 | Enfield Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011008 | Middle Cayuga Inlet | 04140201 | 7 | 10 | 0.493361 |
| 041402011009 | Headwaters Sixmile Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011010 | Lower Cayuga Inlet | 04140201 | 8 | 10 | 0.6505 |
| 041402011101 | Big Salmon Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011102 | Salmon Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011103 | Willow Creek-Cayuga Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402011104 | Hencoop Creek-Taughannock Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011105 | Bolter Creek-Taughannock Creek | 04140201 | 8 | 10 | 0.6505 |
| 041402011106 | Boardman Creek-Cayuga Lake | 04140201 | 8 | 10 | 0.6505 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041402011107 | Lively Run-Cayuga Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402011201 | Shelldrake Creek-Cayuga Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402011202 | Paines Creek-Cayuga Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402011203 | Red Creek-Cayuga Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402011204 | Yawger Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011205 | Demont Creek-Cayuga Lake | 04140201 | 9 | 10 | 0.86778 |
| 041402011301 | Headwaters Owasco Inlet | 04140201 | 6 | 10 | 0.400314 |
| 041402011302 | Mill Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011303 | Hemlock Creek-Owasco Inlet | 04140201 | 7 | 10 | 0.493361 |
| 041402011304 | Dutch Hollow Brook | 04140201 | 6 | 10 | 0.400314 |
| 041402011305 | Owasco Lake | 04140201 | 7 | 10 | 0.493361 |
| 041402011306 | Owasco Outlet | 04140201 | 7 | 10 | 0.493361 |
| 041402011401 | Pond Brook | 04140201 | 6 | 10 | 0.400314 |
| 041402011402 | Black Brook | 04140201 | 6 | 10 | 0.400314 |
| 041402011403 | Melvin Brook-Clyde River | 04140201 | 8 | 10 | 0.6505 |
| 041402011404 | Black Brook-Montezuma Marsh | 04140201 | 9 | 10 | 0.86778 |
| 041402011405 | Sleepy Hollow-Clyde River | 04140201 | 9 | 10 | 0.86778 |
| 041402011406 | Crane Brook | 04140201 | 10 | 10 | 1.99753 |
| 041402011407 | Kipp Island-Seneca River | 04140201 | 10 | 10 | 1.99753 |
| 041402011408 | Black Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011409 | Howland Island-Seneca River | 04140201 | 10 | 10 | 1.99753 |
| 041402011501 | Otisco Lake | 04140201 | 6 | 10 | 0.400314 |
| 041402011502 | Tyler Hollow-Ninemile Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011503 | Geddes Brook-Ninemile Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011504 | Headwaters Onondaga Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011505 | West  Branch Onondaga Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011506 | Hemlock Creek-Onondaga Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011507 | Furnace Brook-Onondaga Creek | 04140201 | 7 | 10 | 0.493361 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041402011508 | Ley Creek Branches | 04140201 | 6 | 10 | 0.400314 |
| 041402011509 | Onondaga Lake | 04140201 | 8 | 10 | 0.6505 |
| 041402011601 | Putnam Brook | 04140201 | 7 | 10 | 0.493361 |
| 041402011602 | Cold Spring Brook | 04140201 | 7 | 10 | 0.493361 |
| 041402011603 | Muskrat Creek | 04140201 | 6 | 10 | 0.400314 |
| 041402011604 | Grout Brook-Skaneateles Lake | 04140201 | 6 | 10 | 0.400314 |
| 041402011605 | Outlet Skaneateles Lake | 04140201 | 7 | 10 | 0.493361 |
| 041402011606 | Skaneateles Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011607 | Stark Pond - Seneca River | 04140201 | 10 | 10 | 1.99753 |
| 041402011608 | Carpenters Brook | 04140201 | 6 | 10 | 0.400314 |
| 041402011609 | Dead Creek | 04140201 | 7 | 10 | 0.493361 |
| 041402011610 | Cross Lake-Seneca River | 04140201 | 10 | 10 | 1.99753 |
| 041402011611 | Crooked Brook-Seneca River | 04140201 | 10 | 10 | 1.99753 |
| 041402020101 | Alder Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020102 | Headwaters East Branch Fish Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020103 | Point Rock Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020104 | Mud Brook-East Branch Fish Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020105 | Florence Creek | 04140202 | 5 | 10 | 0.343037 |
| 041402020106 | Fall Brook-East Branch Fish Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020107 | East Branch Fish Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020201 | Headwaters Mad River | 04140202 | 8 | 10 | 0.721523 |
| 041402020202 | Upper West Branch Fish Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020203 | Mad River | 04140202 | 8 | 10 | 0.721523 |
| 041402020204 | Middle West Branch Fish Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020205 | Little River | 04140202 | 7 | 10 | 0.575923 |
| 041402020206 | Lower West Branch Fish Creek | 04140202 | 8 | 10 | 0.721523 |
| 041402020301 | Canada Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020302 | Headwaters Wood Creek | 04140202 | 7 | 10 | 0.575923 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041402020303 | Stony Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020304 | Fish Creek | 04140202 | 8 | 10 | 0.721523 |
| 041402020305 | Wood Creek | 04140202 | 8 | 10 | 0.721523 |
| 041402020401 | Headwaters Oneida Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020402 | Sconondoa Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020403 | Taylor Creek-Oneida Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020404 | Oneida Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020501 | Upper Cowaselon Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020502 | Middle Cowaselon Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020503 | Lower Cowaselon Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020504 | Canaseraga Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020601 | Upper Limestone Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020602 | West Branch Limestone Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020603 | Middle Limestone Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020604 | Headwaters Butternut Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020605 | Butternut Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020606 | Lower Limestone Creek | 04140202 | 8 | 10 | 0.721523 |
| 041402020701 | Headwaters Chittenango Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020702 | Cazenovia Lake-Chittenango Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020703 | Brinkerhoff Hill-Chittenango Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020704 | Pools Brook-Chittenango Creek | 04140202 | 8 | 10 | 0.721523 |
| 041402020705 | Chittenango Creek | 04140202 | 8 | 10 | 0.721523 |
| 041402020801 | Hall Brook-Frontal Oneida Lake | 04140202 | 8 | 10 | 0.721523 |
| 041402020802 | Black Creek-Frontal Oneida Lake | 04140202 | 7 | 10 | 0.575923 |
| 041402020803 | Scriba Creek | 04140202 | 7 | 10 | 0.575923 |
| 041402020804 | Threemile Creek-Frontal Oneida Lake | 04140202 | 6 | 10 | 0.429008 |
| 041402020805 | Big Bay Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020806 | Little Bay Creek-Frontal Oneida Lake | 04140202 | 6 | 10 | 0.429008 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041402020807 | Mead Creek-Frontal Oneida Lake | 04140202 | 8 | 10 | 0.721523 |
| 041402020808 | Oneida Lake | 04140202 | 9 | 10 | 0.931297 |
| 041402020901 | Caughdenoy Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020902 | Mud Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020903 | Sixmile Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020904 | Fish Creek | 04140202 | 6 | 10 | 0.429008 |
| 041402020905 | Oneida River | 04140202 | 10 | 10 | 1.99549 |
| 041402030101 | Ox Creek | 04140203 | 7 | 10 | 1.8189501 |
| 041402030102 | Village of Phoenix-Oswego River | 04140203 | 10 | 10 | 3.2992699 |
| 041402030103 | Waterhouse Creek-Oswego River | 04140203 | 10 | 10 | 3.2992699 |
| 041402030201 | Lake Neatahwanta | 04140203 | 6 | 10 | 0.564679 |
| 041402030202 | Headwaters Black Creek | 04140203 | 6 | 10 | 0.564679 |
| 041402030203 | Black Creek | 04140203 | 7 | 10 | 1.8189501 |
| 041402030204 | Oswego River | 04140203 | 10 | 10 | 3.2992699 |
| 041501010101 | North Branch Black River-Black River | 04150101 | 6 | 9 | 0.47776 |
| 041501010102 | Twin Lakes Stream-Black River | 04150101 | 7 | 9 | 0.598667 |
| 041501010103 | Little Black Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010104 | Pine Creek-Black River | 04150101 | 8 | 9 | 1.13745 |
| 041501010201 | Bear Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010202 | Little Woodhull Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501010203 | Stonybrook Creek-Woodhull Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010301 | Cummings Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010302 | East Kent Creek-Black River | 04150101 | 8 | 9 | 1.13745 |
| 041501010303 | Sugar River | 04150101 | 6 | 9 | 0.47776 |
| 041501010304 | Moose Creek-Sugar River | 04150101 | 7 | 9 | 0.598667 |
| 041501010305 | Fall Brook-Black River | 04150101 | 8 | 9 | 1.13745 |
| 041501010401 | Bradley Brook-South Branch Moose River | 04150101 | 6 | 9 | 0.47776 |
| 041501010402 | Otter Brook | 04150101 | 6 | 9 | 0.47776 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041501010403 | Sumner Stream | 04150101 | 6 | 9 | 0.47776 |
| 041501010404 | Indian River | 04150101 | 7 | 9 | 0.598667 |
| 041501010405 | Red River-South Branch Moose River | 04150101 | 8 | 9 | 1.13745 |
| 041501010406 | Limekiln Creek-South Branch Moose River | 04150101 | 8 | 9 | 1.13745 |
| 041501010407 | Nicks Creek-South Branch Moose River | 04150101 | 8 | 9 | 1.13745 |
| 041501010501 | Constable Creek-North Branch Moose River | 04150101 | 7 | 9 | 0.598667 |
| 041501010502 | Lake Rondaxe-North Branch Moose River | 04150101 | 7 | 9 | 0.598667 |
| 041501010503 | Fulton Chain Lakes-Middle Branch Moose River | 04150101 | 7 | 9 | 0.598667 |
| 041501010504 | Okara Lakes-Middle Branch Moose River | 04150101 | 8 | 9 | 1.13745 |
| 041501010601 | Twin Sister Creek-Moose River | 04150101 | 9 | 9 | 1.83948 |
| 041501010602 | Pine Creek-Moose River | 04150101 | 9 | 9 | 1.83948 |
| 041501010701 | Upper Independence River | 04150101 | 6 | 9 | 0.47776 |
| 041501010702 | Middle Independence River | 04150101 | 7 | 9 | 0.598667 |
| 041501010703 | Lower Independence River | 04150101 | 7 | 9 | 0.598667 |
| 041501010801 | Mill Creek-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501010802 | Fish Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501010803 | Big Otter Lake-Otter Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010804 | Otter Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010805 | Whetstone Creek-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501010806 | Roaring Brook-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501010901 | Mill Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501010902 | Harvey Creek-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501010903 | Crystal Creek | 04150101 | 9 | 9 | 1.83948 |
| 041501010904 | Capidon Creek-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501011001 | Shingle Shanty Brook-Beaver River | 04150101 | 7 | 9 | 0.598667 |
| 041501011002 | Alder Creek-Beaver River | 04150101 | 7 | 9 | 0.598667 |
| 041501011003 | Terror Lake | 04150101 | 6 | 9 | 0.47776 |
| 041501011004 | Twitchell Creek | 04150101 | 6 | 9 | 0.47776 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041501011005 | Beaver River-Stillwater Reservoir | 04150101 | 7 | 9 | 0.598667 |
| 041501011101 | Beaver Lake-Beaver River | 04150101 | 7 | 9 | 0.598667 |
| 041501011102 | Alder Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501011103 | Balsam Creek-Beaver River | 04150101 | 7 | 9 | 0.598667 |
| 041501011104 | Murmur Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501011105 | Black Creek-Beaver River | 04150101 | 9 | 9 | 1.83948 |
| 041501011201 | Upper Deer River | 04150101 | 6 | 9 | 0.47776 |
| 041501011202 | Mud Creek | 04150101 | 7 | 9 | 0.598667 |
| 041501011203 | Middle Deer River | 04150101 | 7 | 9 | 0.598667 |
| 041501011204 | Lower Deer River | 04150101 | 7 | 9 | 0.598667 |
| 041501011301 | Swiss Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501011302 | Stony Creek-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501011401 | Pleasant Lake-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501011402 | White Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501011403 | Philomel Creek | 04150101 | 6 | 9 | 0.47776 |
| 041501011404 | Kelsey Creek-Black River | 04150101 | 9 | 9 | 1.83948 |
| 041501020101 | Kents Creek | 04150102 | 6 | 9 | 0.501719 |
| 041501020102 | Fox Creek-Frontal Lake Ontario | 04150102 | 4 | 9 | 0.440987 |
| 041501020103 | Three Mile Creek-Frontal Lake Ontario | 04150102 | 0 | 9 | 0.440987 |
| 041501020201 | Chaumont River | 04150102 | 6 | 9 | 0.501719 |
| 041501020202 | Horse Creek-Frontal Lake Ontario | 04150102 | 6 | 9 | 0.501719 |
| 041501020203 | Sherwin Creek-Frontal Lake Ontario | 04150102 | 9 | 9 | 1.57043 |
| 041501020301 | Upper Perch River | 04150102 | 7 | 9 | 0.59393 |
| 041501020302 | Middle Perch River | 04150102 | 7 | 9 | 0.59393 |
| 041501020303 | Lower Perch River | 04150102 | 7 | 9 | 0.59393 |
| 041501020401 | Mill Creek | 04150102 | 7 | 9 | 0.59393 |
| 041501020402 | Muskellunge Creek-Frontal Lake Ontario | 04150102 | 7 | 9 | 0.59393 |
| 041503010101 | French Creek | 04150301 | 7 | 9 | 0.59393 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503010102 | Wheeler Creek-Frontal Saint Lawrence River | 04150301 | 0 | 9 | 0.440987 |
| 041503010103 | Mullet Creek | 04150301 | 6 | 9 | 0.501719 |
| 041503010104 | Cranberry Creek-Frontal Saint Lawrence River | 04150301 | 6 | 9 | 0.501719 |
| 041503010105 | Crooked Creek-Frontal Saint Lawrence River | 04150301 | 6 | 9 | 0.501719 |
| 041503010106 | Chippewa Creek | 04150301 | 6 | 9 | 0.501719 |
| 041503010107 | City of Morristown-Frontal Saint Lawrence River | 04150301 | 7 | 9 | 0.59393 |
| 041503010201 | Tibbits Creek | 04150301 | 6 | 9 | 0.501719 |
| 041503010203 | Little Sucker Brook-Sucker Brrok | 04150301 | 7 | 9 | 0.59393 |
| 041503010204 | Brandy Brook | 04150301 | 6 | 9 | 0.501719 |
| 041503010205 | Coles Creek-Frontal Saint Lawrence River | 04150301 | 9 | 9 | 1.57043 |
| 041503010301 | Dodge Creek-Frontal Saint Lawrence River | 04150301 | 5 | 9 | 0.440987 |
| 041503010302 | Raquette Creek-Frontal Saint Lawrence River | 04150301 | 3 | 9 | 0.440987 |
| 041503020101 | Robinson River-Oswegatchie River | 04150302 | 7 | 9 | 0.59393 |
| 041503020102 | Buck Brook-Oswegatchie River | 04150302 | 7 | 9 | 0.59393 |
| 041503020103 | Cranberry Lake-Oswegatchie River | 04150302 | 8 | 9 | 1.31296 |
| 041503020201 | Tamarack Creek | 04150302 | 6 | 9 | 0.501719 |
| 041503020202 | Upper Little River | 04150302 | 6 | 9 | 0.501719 |
| 041503020203 | Lower Little River | 04150302 | 7 | 9 | 0.59393 |
| 041503020301 | Sand Lake Outlet-Middle Branch Oswegatchie River | 04150302 | 6 | 9 | 0.501719 |
| 041503020302 | Wolf Creek-Middle Branch Oswegatchie River | 04150302 | 6 | 9 | 0.501719 |
| 041503020303 | Fish Creek | 04150302 | 6 | 9 | 0.501719 |
| 041503020304 | Browns Creek-Middle Branch Oswegatchie River | 04150302 | 7 | 9 | 0.59393 |
| 041503020401 | Headwaters West Branch Oswegatchie River | 04150302 | 6 | 9 | 0.501719 |
| 041503020402 | Blanchard Creek-West Branch Oswegatchie River | 04150302 | 6 | 9 | 0.501719 |
| 041503020501 | Jenny Creek | 04150302 | 6 | 9 | 0.501719 |
| 041503020502 | Big Creek | 04150302 | 7 | 9 | 0.59393 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503020503 | Meadow Brook-West Branch Oswegatchie River | 04150302 | 8 | 9 | 1.31296 |
| 041503020504 | West Branch Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503020601 | Peavine Creek-Oswegatchie River | 04150302 | 8 | 9 | 1.31296 |
| 041503020602 | Stammer Creek | 04150302 | 6 | 9 | 0.501719 |
| 041503020603 | Welch Creek-Oswegatchie River | 04150302 | 8 | 9 | 1.31296 |
| 041503020604 | Pork Creek-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503020701 | Sawyer Creek | 04150302 | 7 | 9 | 0.59393 |
| 041503020702 | Hawkins Creek-Matoon Creek | 04150302 | 7 | 9 | 0.59393 |
| 041503020801 | Turnpike Creek-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503020802 | Malterna Creek-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503020803 | Boland Creek | 04150302 | 7 | 9 | 0.59393 |
| 041503020804 | Vrooman Creek-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503020901 | Anderson Creek-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503020902 | Indian Creek | 04150302 | 7 | 9 | 0.59393 |
| 041503020903 | Beaver Creek | 04150302 | 7 | 9 | 0.59393 |
| 041503020904 | Barter Creek-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503021001 | Town of Flackville-Lisbon Creek | 04150302 | 9 | 9 | 1.57043 |
| 041503021002 | Village of Heuvelton-Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503021003 | Oswegatchie River | 04150302 | 9 | 9 | 1.57043 |
| 041503030101 | Weatherhead Creek-Indian River | 04150303 | 6 | 9 | 0.501719 |
| 041503030102 | Bonaparte Creek | 04150303 | 6 | 9 | 0.501719 |
| 041503030103 | Blanchard Creek-Indian River | 04150303 | 7 | 9 | 0.59393 |
| 041503030201 | Rockwell Creek-Indian River | 04150303 | 7 | 9 | 0.59393 |
| 041503030202 | West Branch Black Creek | 04150303 | 6 | 9 | 0.501719 |
| 041503030203 | Buck Creek-Black Creek | 04150303 | 7 | 9 | 0.59393 |
| 041503030204 | Beaver Meadows Creek-Black Creek | 04150303 | 7 | 9 | 0.59393 |
| 041503030205 | Hunter Creek-Indian River | 04150303 | 7 | 9 | 0.59393 |
| 041503030301 | West Creek | 04150303 | 6 | 9 | 0.501719 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503030302 | Otter Creek | 04150303 | 6 | 9 | 0.501719 |
| 041503030303 | Trout Brook-Indian River | 04150303 | 8 | 9 | 1.31296 |
| 041503030401 | Soapstone Creek-Indian River | 04150303 | 8 | 9 | 1.31296 |
| 041503030402 | Muskellunge Lake-Indian River | 04150303 | 8 | 9 | 1.31296 |
| 041503030403 | Bostwick Creek-Indian River | 04150303 | 8 | 9 | 1.31296 |
| 041503030501 | Jewett Creek | 04150303 | 7 | 9 | 0.59393 |
| 041503030502 | Butterfield Lake-Black Creek | 04150303 | 6 | 9 | 0.501719 |
| 041503030503 | Birch Creek | 04150303 | 7 | 9 | 0.59393 |
| 041503030504 | Fish Creek | 04150303 | 7 | 9 | 0.59393 |
| 041503030505 | Black Creek-Black Lake | 04150303 | 9 | 9 | 1.57043 |
| 041503040101 | Dead Creek | 04150304 | 6 | 9 | 0.501719 |
| 041503040102 | Massawepie Lake-South Branch Grass River | 04150304 | 7 | 9 | 0.59393 |
| 041503040201 | Pleasant Lake Stream-Middle Branch Grass River | 04150304 | 6 | 9 | 0.501719 |
| 041503040202 | South Branch Grass River | 04150304 | 7 | 9 | 0.59393 |
| 041503040203 | North Branch Grass River | 04150304 | 7 | 9 | 0.59393 |
| 041503040204 | Deerskin Creek-Middle Branch Grass River | 04150304 | 8 | 9 | 1.31296 |
| 041503040301 | Grannis Brook | 04150304 | 6 | 9 | 0.501719 |
| 041503040302 | Van Rensselaer Creek-Little River | 04150304 | 7 | 9 | 0.59393 |
| 041503040303 | Tracy Brook-Little River | 04150304 | 7 | 9 | 0.59393 |
| 041503040401 | Tanner Creek | 04150304 | 6 | 9 | 0.501719 |
| 041503040402 | Elm Creek | 04150304 | 7 | 9 | 0.59393 |
| 041503040403 | Plumb Brook-Grass River | 04150304 | 8 | 9 | 1.31296 |
| 041503040404 | Nettle Creek | 04150304 | 6 | 9 | 0.501719 |
| 041503040405 | Line Creek | 04150304 | 6 | 9 | 0.501719 |
| 041503040406 | Harrison Creek-Grass River | 04150304 | 8 | 9 | 1.31296 |
| 041503040501 | Town of Madrid-Grass River | 04150304 | 8 | 9 | 1.31296 |
| 041503040502 | McConnell Creek-Grass River | 04150304 | 9 | 9 | 1.57043 |
| 041503050101 | South Inlet | 04150305 | 7 | 8 | 0.559108 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503050102 | Marion River | 04150305 | 7 | 8 | 0.559108 |
| 041503050103 | Raquette Lake | 04150305 | 8 | 8 | 2.1331601 |
| 041503050104 | Moose Pond | 04150305 | 6 | 8 | 0.478875 |
| 041503050105 | Forked Lake-Raquette River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050201 | Upper Cold River | 04150305 | 7 | 8 | 0.559108 |
| 041503050202 | Ermine Brook-Moose Creek | 04150305 | 6 | 8 | 0.478875 |
| 041503050203 | Lower Cold River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050301 | Salmon River | 04150305 | 6 | 8 | 0.478875 |
| 041503050302 | Big Brook | 04150305 | 7 | 8 | 0.559108 |
| 041503050303 | Raquette River-Long Lake | 04150305 | 8 | 8 | 2.1331601 |
| 041503050401 | Moose Creek | 04150305 | 6 | 8 | 0.478875 |
| 041503050402 | Stony Creek | 04150305 | 6 | 8 | 0.478875 |
| 041503050403 | Palmer Brook-Raquettte River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050404 | Follensby Pond-Raquette River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050405 | Bog Stream | 04150305 | 6 | 8 | 0.478875 |
| 041503050406 | Round Lake Stream | 04150305 | 7 | 8 | 0.559108 |
| 041503050407 | Bog River | 04150305 | 7 | 8 | 0.559108 |
| 041503050408 | Wolf Pond | 04150305 | 6 | 8 | 0.478875 |
| 041503050409 | Jenkins Brook-Tupper Lake | 04150305 | 8 | 8 | 2.1331601 |
| 041503050501 | Dead Creek | 04150305 | 6 | 8 | 0.478875 |
| 041503050502 | Mountain Brook-Raquettte River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050503 | Willis Brook-Jordan River | 04150305 | 7 | 8 | 0.559108 |
| 041503050504 | Potter Brook-Jordan River | 04150305 | 7 | 8 | 0.559108 |
| 041503050505 | Ellis Brook-Raquettte River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050506 | Joe Indian Inlet | 04150305 | 6 | 8 | 0.478875 |
| 041503050507 | Cold Brook-Raquette River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050601 | Cold Brook | 04150305 | 8 | 8 | 2.1331601 |
| 041503050602 | Dead Creek-Raquette River | 04150305 | 8 | 8 | 2.1331601 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503050603 | Parkhurst Brook | 04150305 | 6 | 8 | 0.478875 |
| 041503050604 | Stafford Brook-Raquette River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050701 | Upper Trout Brook | 04150305 | 6 | 8 | 0.478875 |
| 041503050702 | Lower Trout Brook | 04150305 | 8 | 8 | 2.1331601 |
| 041503050703 | Village of Potsdam-Raquette River | 04150305 | 8 | 8 | 2.1331601 |
| 041503050704 | Plum Brook | 04150305 | 8 | 8 | 2.1331601 |
| 041503050705 | Squeak Brook | 04150305 | 8 | 8 | 2.1331601 |
| 041503050706 | Hutchins Creek-Raquette River | 04150305 | 8 | 8 | 2.1331601 |
| 041503060101 | Hays Brook | 04150306 | 6 | 9 | 0.48389 |
| 041503060102 | Osgood River | 04150306 | 7 | 9 | 0.662741 |
| 041503060103 | Pleasant Brook-East Branch Saint Regis River | 04150306 | 7 | 9 | 0.662741 |
| 041503060201 | Windfall Brook-West Branch Saint Regis River | 04150306 | 7 | 9 | 0.662741 |
| 041503060202 | Long Pond Outlet | 04150306 | 7 | 9 | 0.662741 |
| 041503060203 | Black Brook-West Branch Saint Regis River | 04150306 | 7 | 9 | 0.662741 |
| 041503060204 | Stony Brook | 04150306 | 8 | 9 | 1.12909 |
| 041503060205 | Alder Meadow Brook-West Branch Saint Regis River | 04150306 | 8 | 9 | 1.12909 |
| 041503060206 | Dan Wright Brook-Trout Brook | 04150306 | 7 | 9 | 0.662741 |
| 041503060207 | Tucker Brook-West Branch Saint Regis River | 04150306 | 9 | 9 | 1.26003 |
| 041503060301 | Mile Brook-Deer River | 04150306 | 6 | 9 | 0.48389 |
| 041503060302 | Trout Brook | 04150306 | 7 | 9 | 0.662741 |
| 041503060303 | Kingston Brook-Deer River | 04150306 | 7 | 9 | 0.662741 |
| 041503060304 | Lawrence Brook | 04150306 | 7 | 9 | 0.662741 |
| 041503060305 | Redwater Brook-Deer River | 04150306 | 8 | 9 | 1.12909 |
| 041503060401 | Headwaters Saint Regis River | 04150306 | 6 | 9 | 0.48389 |
| 041503060402 | Quebec Brook-Saint Regis River | 04150306 | 6 | 9 | 0.48389 |
| 041503060403 | Goose Pond Brook-Saint Regis River | 04150306 | 7 | 9 | 0.662741 |
| 041503060404 | Lake Ozonia Outlet | 04150306 | 6 | 9 | 0.48389 |
| 041503060405 | Long Pond-Saint Regis River | 04150306 | 8 | 9 | 1.12909 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503060406 | Hopkinton Brook | 04150306 | 6 | 9 | 0.48389 |
| 041503060407 | Miller Brook-Saint Regis River | 04150306 | 8 | 9 | 1.12909 |
| 041503060408 | Bell Brook-Saint Regis River | 04150306 | 9 | 9 | 1.26003 |
| 041503060409 | Town of Hogansburg-Saint Regis River | 04150306 | 9 | 9 | 1.26003 |
| 041503070101 | Hatch Brook | 04150307 | 7 | 8 | 0.65104 |
| 041503070102 | Ingraham Stream-Salmon River | 04150307 | 7 | 8 | 0.65104 |
| 041503070103 | Duane Stream | 04150307 | 6 | 8 | 0.602288 |
| 041503070104 | Winslow Brook-Salmon River | 04150307 | 8 | 8 | 1.21545 |
| 041503070201 | Headwaters Little Salmon River | 04150307 | 5 | 8 | 0.459374 |
| 041503070202 | East Branch Little Salmon River | 04150307 | 6 | 8 | 0.602288 |
| 041503070203 | Develin Brook-Little Salmon River | 04150307 | 7 | 8 | 0.65104 |
| 041503070204 | Farrington Brook | 04150307 | 6 | 8 | 0.602288 |
| 041503070205 | Town of Bombay-Little Salmon River | 04150307 | 7 | 8 | 0.65104 |
| 041503070301 | Branch Brook | 04150307 | 6 | 8 | 0.602288 |
| 041503070302 | Plum Brook-Salmon River | 04150307 | 8 | 8 | 1.21545 |
| 041503070303 | East Branch Deer Creek | 04150307 | 6 | 8 | 0.602288 |
| 041503070304 | West Branch Deer Creek | 04150307 | 7 | 8 | 0.65104 |
| 041503070305 | Pike Creek | 04150307 | 6 | 8 | 0.602288 |
| 041503070306 | Town of Fort Covington-Salmon River | 04150307 | 8 | 8 | 1.21545 |
| 041503080101 | Middle Kiln Brook | 04150308 | 6 | 8 | 0.476089 |
| 041503080102 | Separator Brook | 04150308 | 7 | 8 | 0.516484 |
| 041503080103 | Mountain Pond Stream-Upper Chateaugay Lake | 04150308 | 8 | 8 | 0.975871 |
| 041503080104 | Bailey Brook-Chateaugay River | 04150308 | 8 | 8 | 0.975871 |
| 041503080201 | Marble River | 04150308 | 7 | 8 | 0.516484 |
| 041503080202 | Hinchinbrook Brook | 04150308 | 6 | 8 | 0.476089 |
| 041503080203 | Collins Brook | 04150308 | 6 | 8 | 0.476089 |
| 041503080204 | Allen Brook-Chateaugay River | 04150308 | 8 | 8 | 0.975871 |
| 041503080205 | Beaver Pond Brook-Chateaugay River | 04150308 | 6 | 8 | 0.476089 |

| HUC 12 ID | HUC 12 Name | HUC 8 | MAX Stream Order HUC 12 | MAX Stream Order HUC 8 | 50 yr. Estimated Flood Height (m) |
|---|---|---|---|---|---|
| 041503080301 | Collins Brook-Trout River | 04150308 | 7 | 8 | 0.516484 |
| 041503080302 | Little Trout River | 04150308 | 6 | 8 | 0.476089 |
| 041503080303 | Briggs Creek | 04150308 | 6 | 8 | 0.476089 |
| 041503080304 | Town of Trout River-Trout River | 04150308 | 7 | 8 | 0.516484 |
| 041503080401 | Crystal Creek | 04150308 | 7 | 8 | 0.516484 |
| 041503080402 | Taylor Brook-English River | 04150308 | 7 | 8 | 0.516484 |
| 041503080403 | Allen Brook | 04150308 | 5 | 8 | 0.374127 |
| 041503080404 | Kellas Creek-English River | 04150308 | 7 | 8 | 0.516484 |
| 041503080501 | Ruisseau Noir | 04150308 | 5 | 8 | 0.374127 |
| 041503080502 | Riviere aux Outardes Est | 04150308 | 4 | 8 | 0.374127 |
| 041503080503 | Riviere aux Outardes | 04150308 | 4 | 8 | 0.374127 |