Instructions for Using the SWMI Interactive GIS Map

The Sustainable Water Management Initiative (SWMI) Interactive GIS map contains information on approximately 1,400 Massachusetts subbasins. The subbasins were delineated by the U.S. Geologic Survey (USGS) in their "Mass. Indicators" report (SIR 2009-5272). The map displays three hydrologic and biologic metrics developed for the subbasins through the SWMI process: Biological Category (BC), Groundwater Withdrawal Category (GWC) and Net Groundwater Depletion (NGD). The map also displays fluvial fish sampling data, modeled fish population data, designated Coldwater Fishery Resources, over 6,500 water use points, and sand and gravel aquifers. Links to the relevant USGS scientific investigation reports and supporting data are on MassDEP's SWMI Technical Resources webpage.

To use the SWMI Interactive Map:

The interactive map allows the user to view multiple data types by hiding or displaying different data layers using the "map contents" dialogue box (manila folder icon). Navigation tools (zoom and pan) are embedded in the left-hand side of the map. Click on the "About SWMI Data Viewer" located in the top right; then click on "Map Help" for further details.

Key concepts to help navigate and find information.

- There are seven significant layers of SWMI information presented: subbasins, biologic category (BC), groundwater withdrawal category (GWC), net groundwater depletion (NGD), water use points, generalized flow lines, DFW's coldwater fishery resources, and sand and gravel aquifers. You can turn each layer on and off by clicking the check box next to the layer title. Groundwater withdrawal categories, biologic categories and net groundwater depletion cannot be viewed at the same time.

- The level of detail changes as you zoom in and out. Zooming in generally provides more detail.

- Much of the information is for the entire upstream area of each subbasin. For example the GWC of a subbasin takes into account both the unaffected August stream flow and all groundwater pumping in the subbasin and all upstream contributing subbasins.

- Generalized flow lines show how the subbasins are hydrologically connected. Rivers and ponds are included in the map to help put this larger picture together.

Navigation: The navigation tool is always visible ion the top left-hand side of the map. It has buttons for zooming and panning.

Map Tools: The icons along the top of the map launch several map tools. More detail on these tools can be found in the "About SWMI Interactive Map" in the upper right corner of the map screen.

 The Identify icon provides the name and owner of the more than 6,500 water use points included in the map. These are public and non-public groundwater and surface water supplies (i.e. wells and reservoirs) and groundwater and wastewater discharge points. The Identify will list all the water use points within a rectangle drawn by the user.

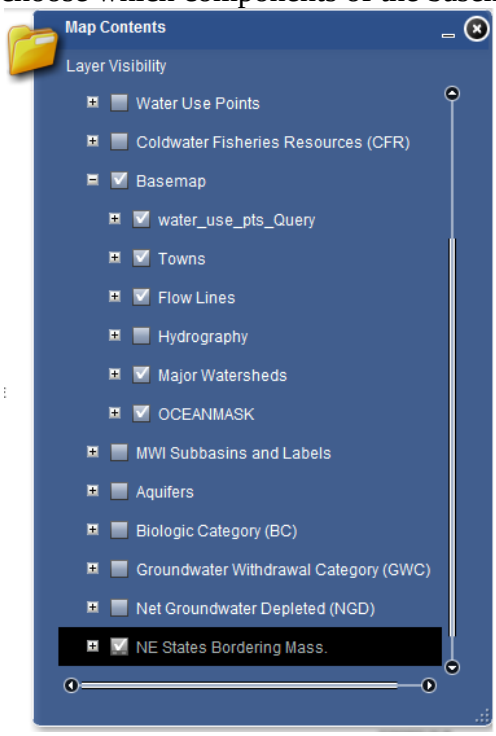
 The Bookmarks icon saves views (extent and zoom) of the map. This allows the user to save views of different parts of the state and go to those saved views when opening the map.

 The Find an address icon allows the user to zoom to a view centered on a street address.

 The Draw and Measure icon provides tools for drawing points, lines and polygons on the map and displaying their dimensions. This can be helpful for determining the distance between water use points, for example.

 The Print icon allows the user to print the map with the extent and layers shown.

 The Map Contents icon is the most important tool in the map because it's where the user chooses which layers to display. Clicking on the box to the left of each layer's name makes the layer visible. Clicking on the plus sign expands the layer. For example checking "Basemap" and expanding the layer allows the user to choose which components of the basemap layer (Towns, Flow Lines, etc.) to display:



 The Legend icon displays the map legend, for those layers that are currently displayed.

 The Search SWMI Subbasins icon is a very useful tool for zooming to a subbasin by entering its unique subbasin ID number.

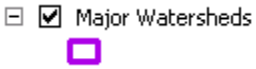
 Choose the middle icon in the screen "Select by attribute" and enter the subbasin ID. The map will then zoom to the subbasin and highlight it in light red.

Map Attributes

Below is a description of the important map layers and how they appear on the map.

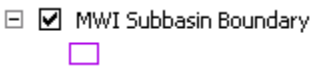
Major Basins

Refers to the major watersheds for 27 administrative basins in Massachusetts. All administrative basins are labeled.



MWI Subbasins and Labels

Approximately 1500 subbasins were delineated. Of these, 1,372 subbasins were analyzed for the fish and habitat analysis. Subbasins of the Connecticut and Merrimack River mainstems, coastal subbasins and southeastern Massachusetts were excluded from the fish and habitat analysis due to substantially different hydrological conditions from the rest of the state (white colored on map). The MWI subbasins are described in USGS SIR 2009-5272.

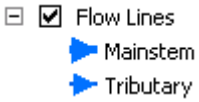


Water use points

The map displays approximately 6,500 water use points from the Sustainable Yield Estimator (SYE) (USGS SIR 2009-5227) for the period 2000-2004. The water use points include public water supply (PWS) sources (both Water Management Act and non-WMA PWSs), WMA non-public water supply sources (golf courses, industrial sources, etc.), groundwater discharges (GWD), and surface water discharges (NPDES). The map identifies the name and ownership of each source by using the "Identify" tool.

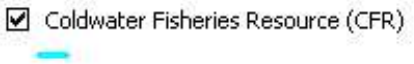
Generalized Flowlines

Generalized stream and river flowlines show how surface water flows from one subbasin to the next. Flowlines start in headwater basins (subbasin with no upstream contributing subbasins) and cross subbasin boundaries at the pour point of each subbasin. More flowlines become visible at smaller scales (when zooming in).



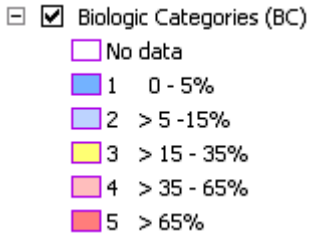
Coldwater Fishery Resource

The Coldwater Fishery Resource (CFR) source data is provided by the Department of Fish and Game's Division of Fish and Wildlife (DFW) and are presented as cyan-colored line segments of stream reaches.

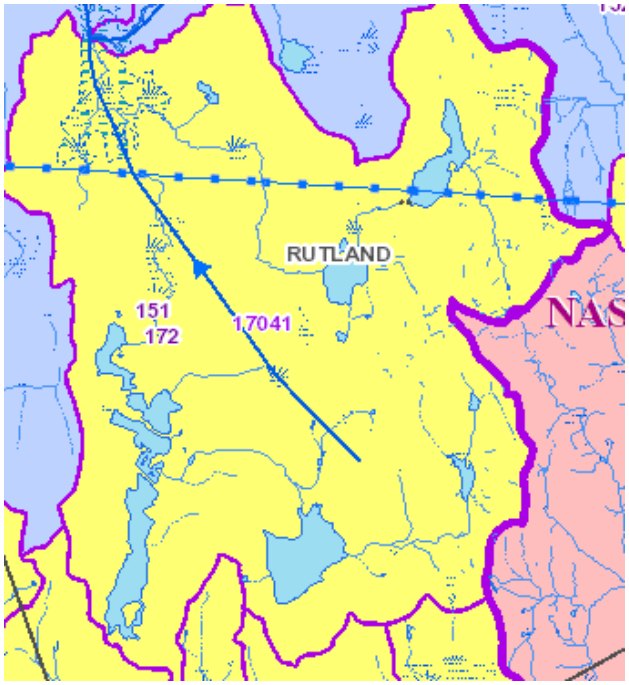


Biological Category (BC)

The BC layer is color-coded to reflect the five categories of modeled percent alteration of the fluvial fish population. BC categories of fluvial fish alteration ranges: 1 (0-5%); 2 (5-15%); 3 (15-35%); 4 (35-65%); 5 (>65%). Data revised 2013.

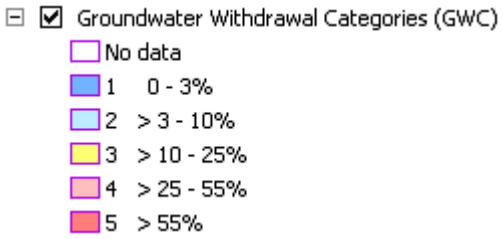


In the example below, the ***MWI Subbasins and Labels*** layer is on (to display subbasin unique ID #) and the ***Biological Category (BC)*** layer is on (to display the BC color and a pair of 2- or 3-digit numbers of modeled fish values). The ***Towns***, ***Hydrography*** and ***Flow Lines*** layers are also on. The subbasin ID number is 17041. The value 172 is the modeled fish number with no groundwater pumping and 1% impervious cover (the reference condition). The value 151 is the modeled number of fish with actual impervious cover and actual August 2000-2004 groundwater pumping rate. Both the pumping rate and impervious cover used in the calculations are for the entire area upstream of the subbasin's pour point (i.e. it includes all upstream subbasins).



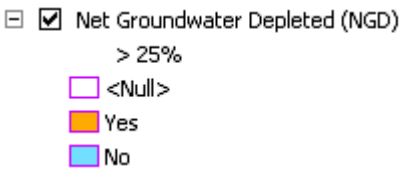
Groundwater Withdrawal Category (GWC)

The GWC layer is color-coded to reflect five categories of percent of unimpacted August median flow alteration. This is the percent of August flow represented by August groundwater withdrawals. The ranges for the percent of flow alteration are: 1 (0-3%); 2 (3-10%); 3 (10-25%); 4 (25-55%); 5 (>55%). Data revised 2013.



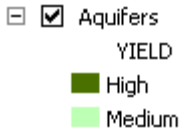
Net Groundwater Depletion (NGD)

The NGD layer is color-coded to identify subbasins whose unaffected August median flow is more than 25% depleted after accounting for groundwater withdrawals (from all public, private and domestic wells) and groundwater discharges (from treatment plant discharges and septic systems).



Aquifers

The map displays high and medium yield sand and gravel aquifers delineated by the USGS. Wells in high yield aquifers generally are able to produce more than 300 gallons per minute (gpm); medium yield aquifer wells generally produce between 100 and 300 gpm.



Fish Sampling Data Points

Fish Sample Data Points are shown as a fish inside an orange circle accompanied by a sampling site ID number. Above the site ID number are two numbers: the observed number of fish collected (2 in this example) over the expected number of fish (198 in this example). The numbers for both the "observed" and "expected" are defined as the catch-per-unit effort (one hour). Fish sample points are labeled as you zoom in, and to see all points may require maximum zoom. Fish data are further described in the USGS publication SIR 2011-5193.

Qualifier for the Fish Sampling Data Points

The map displays the observed and expected fish values for each fish sampling location. The expected fish values at each fish sampling location are the result of a statistical analysis reported in USGS publication SIR 2011-5193. The analysis of observed and expected fish values demonstrated a significant relationship between flow alteration due to groundwater pumping, impervious cover, two natural basin characteristics, and fish community characteristics. Increasing stream flow alteration due to groundwater pumping and increasing impervious cover both result in reductions in riverine fish numbers. The analysis used impervious cover and flow alteration of the entire catchment area upstream of all fish sampling locations.

In order to achieve the goal of establishing a statewide framework, the observed vs. expected statistical relationship was applied to the MWI subbasin outlets (as if each basin outlet were a fish sample point). The basin categorizations (BC and GWC) illustrate which basins have lower fish numbers due to increased impervious cover and higher streamflow alteration from groundwater pumping. Therefore, caution is advised when comparing observed data from the fish sampling locations with expected fish values subbasin categorizations because all the observed fish data were used to establish the relationship between subbasin characteristics and project fish populations.