Great Lakes Watershed Management System (GLWMS) Tutorial

The Swartz Creek Watershed Management Plan (http://www.michigan.gov/documents/deq/wb-nps-swartz-wmp_293409_7.pdf) lists sediment, sediment born nutrients and phosphorus as the top three priority pollutants in the watershed. You want to target your technical assistance efforts on an at-risk land area for sediment and phosphorus and estimate pollutant loadings for that site.

Using the GLWMS, complete the following tasks:

    I.   Identify a high-risk site
    II.   Determine baseline nonpoint source pollutants loadings
    III.   Assess the impact of implementing a land cover change/BMP
    IV.   Update baseline HIT parameters using Compare 2 Scenarios Analysis
    V.   Review saved scenarios and run a report

Identify and digitize a high-risk site

Step 1: Creating a GLWMS account

- Creating a GLWMS account allows you to save all of the scenarios you run in the GLWMS and view or edit them at a later time. Reports can also be generated for your saved scenarios.

- Click on "login/logout" above the map within the GLWMS header. A popup window will appear with the "Login" tab open.

- Navigate to the "Create New Login" tab. Fill in the required information. Note that your password must be at least six characters long and include at least one letter and one number.

- Hit "Submit." Green text will appear indicating you have successfully created an account.

- Close out of the login window by clicking on the "X" in its top right corner.
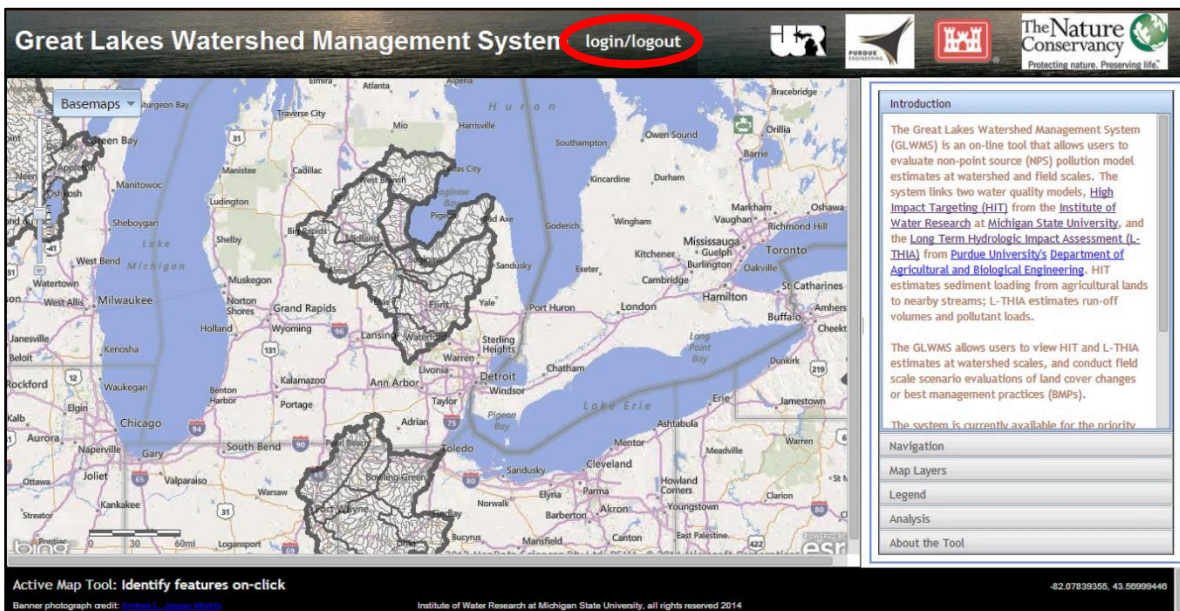
Default GLWMS Map with "login/logout" circled.

Step 2: Change the basemap

- Locate the "Basemaps" button in the top left corner of the map. Click on the button and select "Aerial."
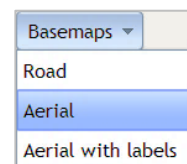
- Aerial imagery will now be displayed on the map. Note: most imagery in the Flint River Watershed was taken between 2011 and 2012.

Step 3: Search for a location

- The sidebar to the right of the map contains all of the tools within the GLWMS. To search for a location, click on the "Navigation" tab from the sidebar.

- The default search method allows you to input a street address. Click on the radio button next to "Lat./Lon." to search using coordinates.

- Enter in "42.9115" in the lat(Y) box and "-83.7743" in the lon(X) box. Hit the "Find Location" button. The map will zoom-in on a farm field. (Note: you may use an alternative address in the Saginaw Basin but the tutorial's screenshots and results will differ).

Step 4: Turn on the HIT *sediment* layer

- Click on the "Map Layers" tab on the GLWMS sidebar.

- Layers that are turned on and visible on the map have a checked box next to their name. Layers can be turned off by unchecking the box next to their name.

- Check the box next to *sediment* to turn on the layer. High risk areas for sediment loading as predicted by the HIT model will appear.

- For more information about a particular layer, click on the layer name to pull up a brief description.

Sediment layer turned on with a brief description of the layer open on the map

Step 5: Open the "Field-scale Analysis" window

- You need to access the "Field-scale Analysis" window to run calculations in the GLWMS. Click on the "Analysis" tab from the GLWMS sidebar.

- Select the "Field-scale Analysis" button. This will open up the "Field-scale Analysis" window.

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- There are three different types of calculations that can be run from this window. They are detailed in later steps.

- Click on the "?" icon for more information about any item within the "Field-scale Analysis" window.

Step 6: Digitize your site for analysis

- To run any calculation, you first must digitize a site. Digitizing refers to 'drawing' a site on the map.

- Click on the "Activate" button at the top of the "Field-scale Analysis" window. This activates the digitizer.

- The "Field-scale Analysis" window may block a portion of the map. Close out of this window by clicking on the "X" in the top right corner. You should now have a better view of the map.

- Within the map, outline the perimeter of a buffer strip by left-clicking along the high risk area. If you make a mistake, hit the "Escape" button and start over.

- When you're ready to complete your shape, double click. The completed polygon will be shaded in green.

- Return to the "Field-scale Analysis" window by clicking on the "Field-scale Analysis" button from the GLWMS sidebar.

- Deactivate the digitizer by clicking on the "Deactivate" button at the top of the window.
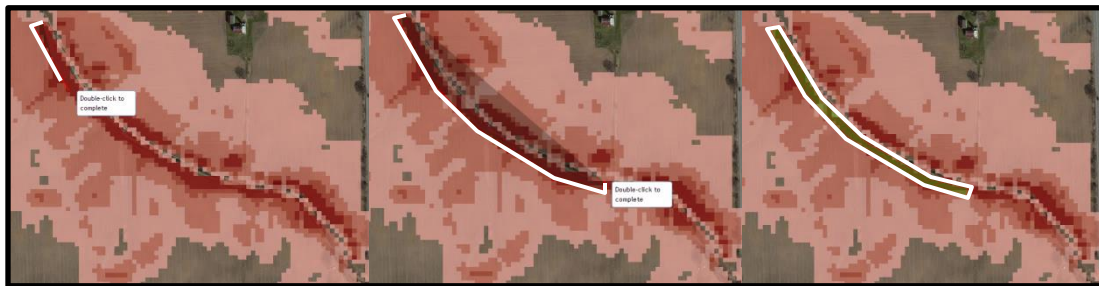
Process of digitizing a site. Double click to complete a polygon. Hit "Esc" to start over.

Determine baseline nonpoint source pollutant loadings

Step 1: Name your project

- You are within the "View Baseline NPS" tab. This type of analysis provides baseline estimates of nonpoint source (NPS) pollutant loadings (i.e., before a land cover change or implemented best management practice (BMP).

- You need to give your calculation a project name. Results of field-scale analyses are organized into *projects*. A single calculation can be saved as a *scenario* within a *project*.

- The default name is "Project 1" but it's recommended that you always assign a project name that's meaningful to you to help organize your results later.
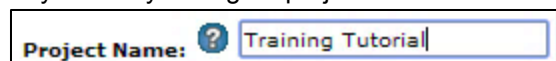

Step 2: Select which models to run

- You can choose to run the HIT or L-THIA model, or both at the same time.

- To select a model, check the box next to its name. Select both models.

- HIT estimates sediment loading from <u>agricultural</u> lands to nearby streams. The HIT model is <u>only</u> appropriate for agricultural areas.

- L-THIA estimates run-off volumes and pollutant loads from both urban and rural areas.

- Note: use caution when comparing results between HIT and L-THIA. They have varying methodologies, inputs and units.

Step 3 (Optional): Include upland contributing areas

- You may choose to include the upland affected areas of your digitized site by checking the box next to "Scale." Leave this option blank.
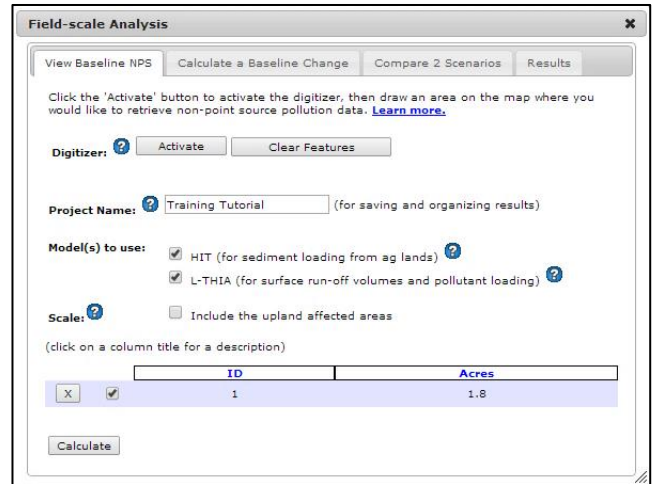

Filled out information for "View Baseline NPS"

Step 4: Calculate

- The table at the bottom of the window contains additional information about your scenario. Each digitized site is given an "ID" number and the system will automatically calculate the total acreage of your digitized site.

- You are ready to run the calculation. Click on the "Calculate" button at the bottom of the screen.

- The system will automatically bring up the "Results" tab when you perform a calculation. <u>Do not</u> hit the "remove" button for a calculation that hasn't finished running. This will generate an error within the system which will prevent you from performing other calculations unless you refresh the page and start over.

Step 5: Interpreting the Results

- The calculation type (Baseline NPS) is reported at the top of the results window, along with the total acreage of the digitized site.

- HIT estimates baseline NPS outputs for sediment loading and soil erosion in tons/year. Note that these numbers should not be interpreted as exact but used for relative comparisons only.

- The L-THIA output estimates several NPS pollutant loadings (lbs/year) including phosphorus, nitrogen, suspend solids, lead, copper, and zinc in addition to total runoff (acre-ft/year). Just as with HIT, these estimated loadings should be used for comparative purposes only. The "as chart" button will be discussed later in the tutorial.
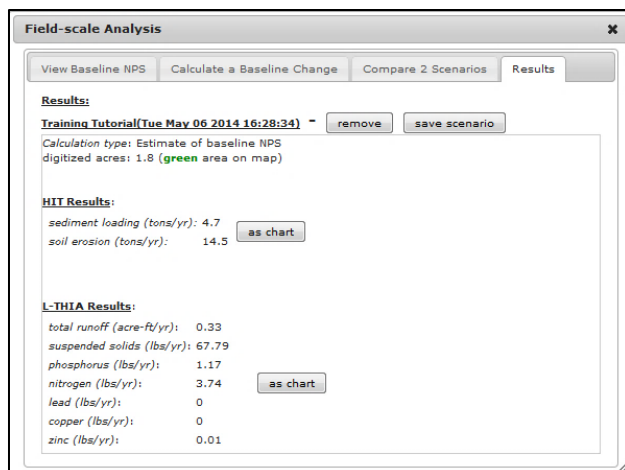
"View Baseline NPS" results for HIT and L-THIA.
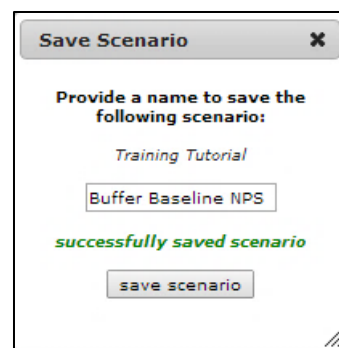
Step 6: Save your scenario

- Click the "save scenario" button. (If you are not logged in, the system will prompt you to login.)

- A popup window will appear asking you to enter in a name for the scenario. Enter a name and hit "save scenario." Your scenario has saved successfully when green text appears within the window. The map may zoom out and in again after saving.

- Alternatively, calculations can be removed by hitting the "remove" button at the top of the calculation. This will only remove the calculation, not the polygon.

Assess the impact of implementing a land cover change/BMP

Step 1: Navigate to the "Calculate a Baseline Change" tab

- Navigate from the "Results" tab to the "Calculate a Baseline Change" tab. This type of analysis allows you to determine the impact implementing a land cover change or BMP will have on pollutant loadings for your digitized area <u>and</u> its upland contributing areas.

- The tutorial example will hypothetically convert the digitized area into a buffer strip. You will not need to digitize a new area or enter in a new project name.

Step 2: Select which models to run

- Select both the HIT and L-THIA models. The table should now have an additional column for each model that says "LC Change/BMP."

- Click in the cell that says "Click to edit" for HIT. Select "BUF (buffer strip)" from the drop-down menu. Click on the "OK" button that appears. The cell should now read "BUF."

- Repeat for the "Click to edit" area under L-THIA, but instead select "Riparian Buffer Strip" from the drop-down menu and select the "OK" button.
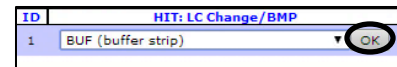
Step 3 (Optional): Input an estimated cost/acre

- The "Cost/acre $" column allows you to estimate the cost of the buffer strip. Underneath this column, click within the cell that says "Click to edit."

- Specify a price of $1,909.20 per acre. Hit the "OK" button to save this input.
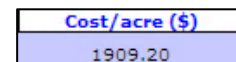

Step 4: Calculate

- Now you are ready to run another calculation. Hit the "Calculate" button.

Step 5: Interpreting the Results

- You should now see a blue area on the map, which represents the upland contributing area (area draining to digitized site). The system automatically generates the upland affected area and includes it in pollutant loading estimates when running this analysis or when comparing two scenarios.

- The GLWMS determines the upland affected area from a DEM (Digital Elevation Model). The DEM used in the GLWMS has a resolution of 10 meters and was digitized and developed by the USGS using topographic maps. The polygon that you digitize is converted into pixels and the GLWMS uses the DEM to look for uphill areas. Once these upland pixels have been identified, the system converts them into a smoother polygon shape.
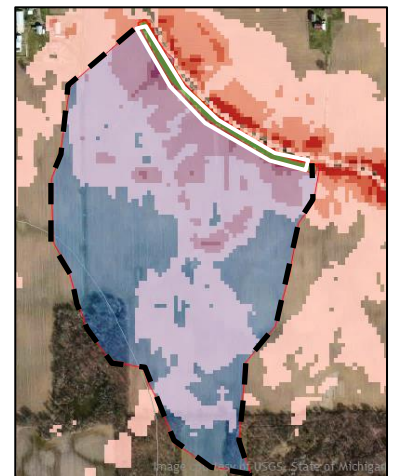
Note: black dashed line is the upland area.

– However, there is some uncertainty with the resulting upland affected area, especially regarding man-made structures such as tile drainage, culverts or storm drains. These structures may not be present in the dataset used to determine the upland area, and therefore may not be reflected in what you see on the map. Users that are aware of these man-made structures should consider whether they're accounted for in outputs from the system.

– At the top of the scenario's results, the GLWMS will report the calculation type, acreage of the digitized site, total acres for the calculation (digitized site and upland areas), the land cover change(s)/ BMP(s) selected, and the total cost of implementing the land cover change(s)/BMP(s).

– Initial erosion/sediment loading are baseline estimates for the total acreage of the digitized site and upland areas. Calculated erosion/sediment loading represent loading estimates given the new land cover change or implemented BMP. The system subtracts the calculated erosion/sediment loading from the initial erosion/sediment loading to determine whether the change will result in an *INCREASE* or *DECREASE* in erosion and sediment loading, and by how much.

– The cost per acre of implementing the land cover change/BMP per ton of erosion or sediment loading reduced will appear in green next to the HIT results.

– L-THIA model outputs only estimate the amount by which pollutant loadings and runoff have increased or decreased. The cost per acre of implementing a practice also appears in green next to the results.

– The "as chart" button provides a graphical display of the model results. Click on the "as chart" button next to the HIT model results. Check the box next to "erosion" and "sediment" at the bottom of the chart to display HIT estimates in graphical format.

– Close out of that chart by clicking on the "X" in the top right corner and select the "as chart" button for L-THIA. Check the boxes next to the various outputs. Notice that since a baseline is not being calculated for L-THIA, the chart only displays the amount by which a particular pollutant is reduced or increased.
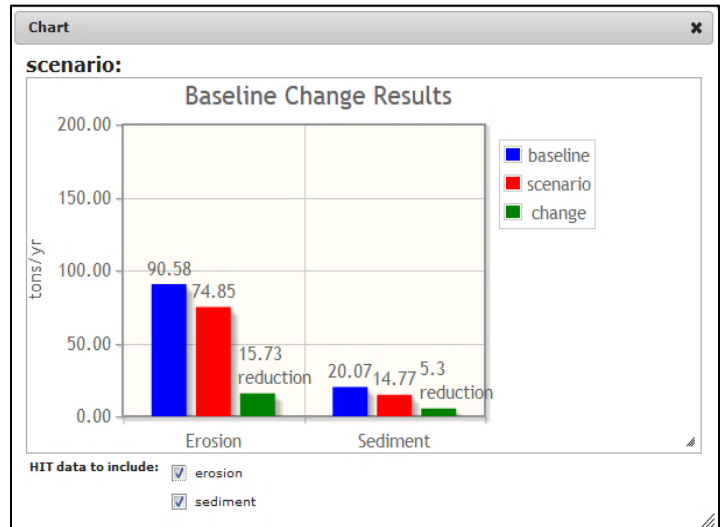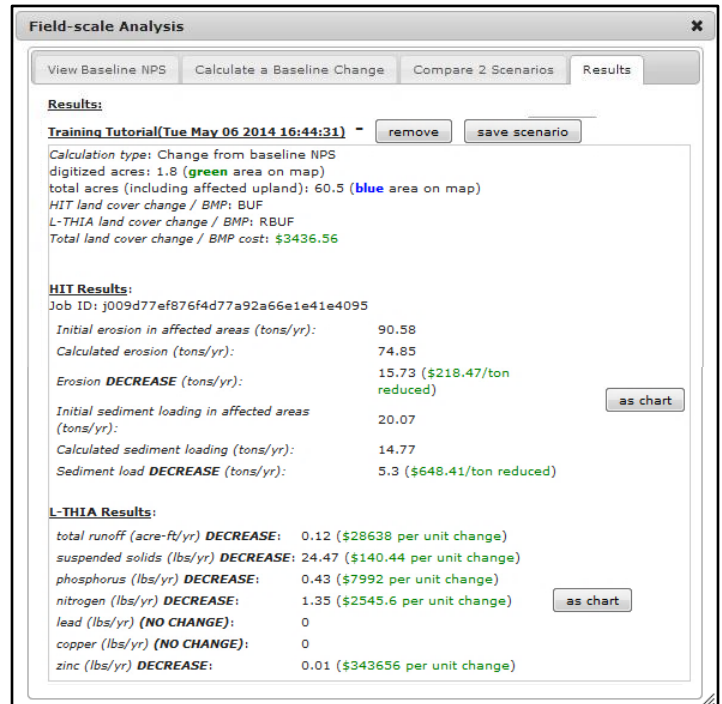
HIT data displayed using the "as chart" button for a baseline change scenario.

Step 6: Save your scenario

– Click on the "save scenario" button from the "Results" window. Enter in a scenario name in the popup window (e.g., Buffer Baseline Chg).

– Hit "save scenario." Green text that says "successfully saved scenario" will appear.

Update baseline HIT parameters using Compare 2 Scenarios Analysis

Step 1: Navigate to the "Compare 2 Scenarios" tab

– Navigate from the "Results" tab to the "Compare 2 Scenarios" tab. This type of analysis allows you to compare two different land cover changes or BMPs against each other. It can also be used to change the "baseline" for HIT calculations by editing the model's parameters.

– Again, you do not need to digitize a new area or enter in a new project name.

Step 2: Select which models to run

– Select only the HIT model. The table should now have an additional column for HIT that reads "HIT: LC Change/BMP" with two rows underneath. Click the cell that says "Click to edit" for Scenario 1-1.

– Select "RCA (row-crop agriculture)" from the drop-down menu and click on the "OK" button. The cell should now read "RCA."

– For Scenario 1-2, select "BUF (buffer strip)" and click the "OK" button. The cell should now read "BUF."
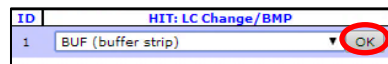
Step 3: Edit HIT parameters

– Above the table is text that reads "Edit optional HIT parameters +." Click on the "+" sign to expand a menu for HIT parameters.

– You can now see editable inputs for RUSLE and SEDMOD.
– To learn more about a particular parameter, click on its column header. Accuracy of the HIT model will increase if customized values are used.

– Click in the cell underneath "K factor" for scenario 1-1 (row-crop agriculture) and specify a value of ".26". Hit the "OK" button. Repeat this for scenario 1-2.

– Click in the cell underneath "R factor" for scenario 1-1 and specify a value of "90." Hit the "OK" button. Repeat this for scenario 1-2.

|		Feature ID - Scenario	HIT: LC Change/BMP	Acres	Cost/acre ($)	C Factor	K Factor	LS Factor	R Factor	Surface Roughness	Delivery Ratio
X	✓	1-1	RCA	0.9	Click to edit	0.20	.26	Click to edit	90	0.15	Click to edit
		1-2	BUF	0.9	Click to edit	0.01	.26	Click to edit	90	0.24	Click to edit

Edited HIT parameters

Step 4: Calculate

– Now you are ready to run another calculation. Hit the "Calculate" button.

Step 5: Interpreting the Results

– Reported results are nearly identical to that of the "Calculate a Baseline Change" analysis, except that erosion and sediment loading estimates are provided for each scenario.

– The HIT outputs will differ from earlier results based upon the edited parameters.

– Note, you can view previous results by clicking on the "+" sign next to the "remove" button for a calculation. You can also view results in a graphical format using the "as chart" button.
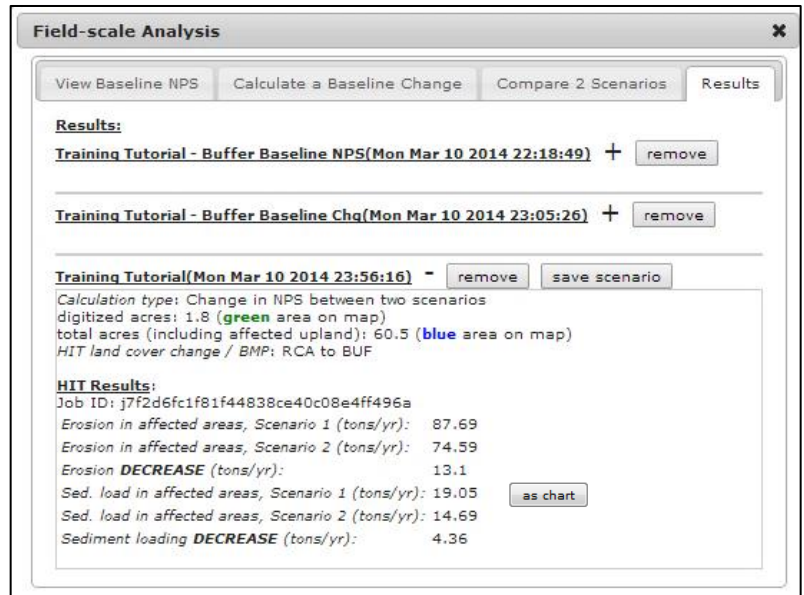
Step 6: Save your scenario

– Click on the "save scenario" button from the "Results" window. Enter in a scenario name in the popup window (e.g., Compare 2 Buffer). Hit "save scenario." Green text that says "successfully saved scenario" will appear.

Review saved scenarios and run a report

Step 1: Open the "My Projects" window

– Close out of the "Field-scale Analysis" window. Within the "Analysis" tab on the sidebar, click "My Projects."

– All saved projects and their associated scenarios are stored here. To bring up past calculations, select your project and then choose a particular scenario from the list on the left side of the window.

– You can click the link that says "View/edit in Field-scale Analysis window" under "Scenario Details" to bring up the results window for that calculation and load the digitized area on the map.

– Clicking the "edit scenario" button at the bottom of "Scenario Details" will allow you to specify an installation date for a land cover change/BMP and a contract period.
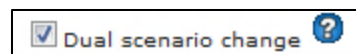
Step 2: Open the "Reports" window

– Close out of the "My Projects" window. Within the "Analysis" tab on the sidebar, click "Reports."

– The "Reports" function allows you aggregate practices and filter all of your saved scenarios. You can filter by projects, types of calculations, installation or contract dates, models, and land cover/BMP options.

Step 3: Filter saved scenarios

– On the left side of the "Reports" window, select the name of your project for the scenario you just ran (e.g., "Training Tutorial).

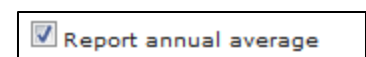– Specify dual scenario change as the calculation type.

– On the right side of the "Reports" window, choose the scenario you just ran from "Eligible Scenarios" (e.g., Compare 2 Buffer).

– Click the "Include Selected" button underneath "Eligible Scenarios."
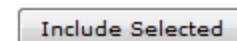
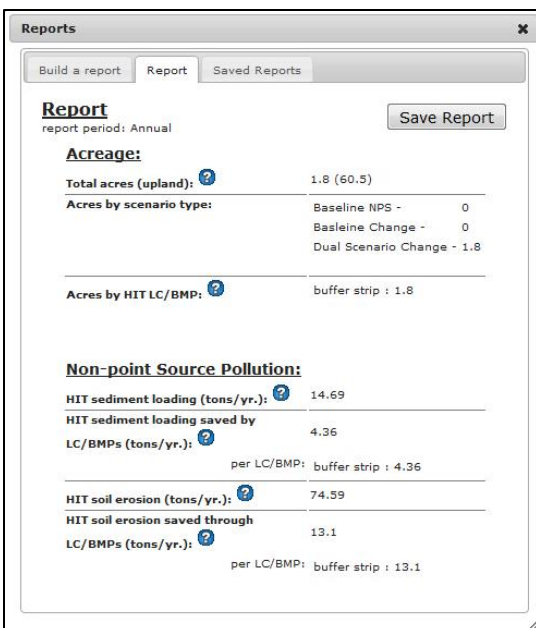– Under "Reporting Period," check the box next to report annual average.

– Hit "Generate Report."   Generate Report

– The GLWMS will direct you to the "Report" tab.

Step 4: Save your Report

– Click on the "Save Report" button. Enter in a report name and hit "Save report."

– Saved reports can be accessed under the "Saved Reports" tab.
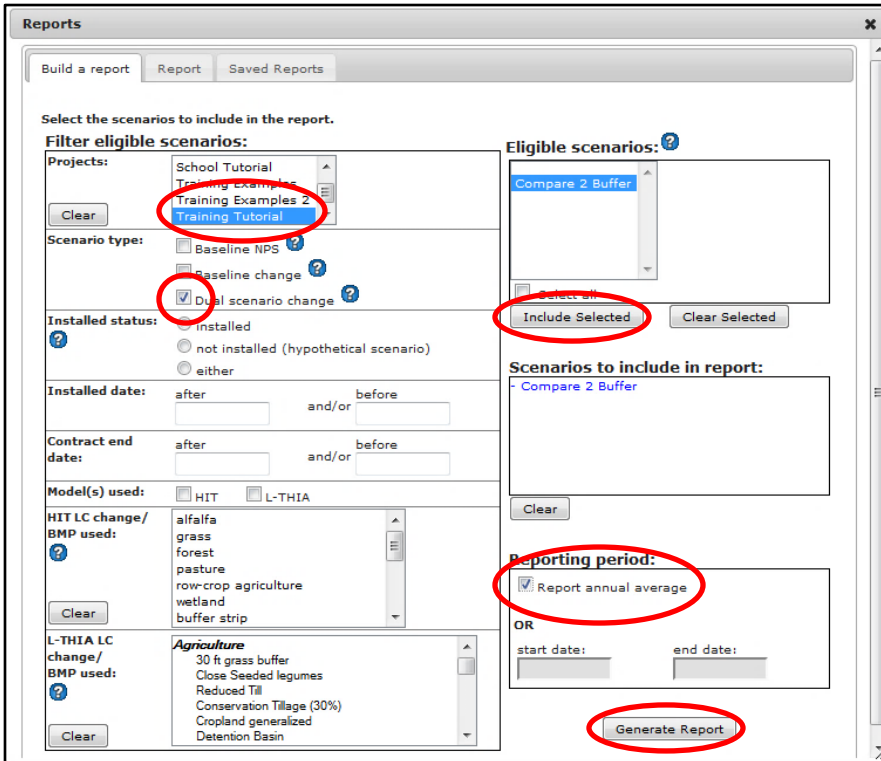
Filtering scenarios for a report in the "Build a report" tab

Generated report.