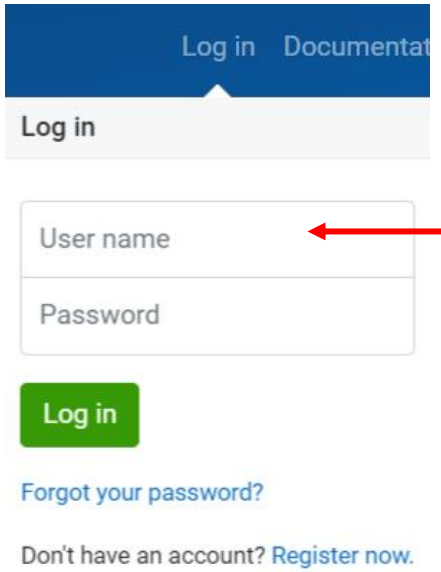
HAWQS 2.0

For detailed information on initial HAWQS development, please see the HAWQS User Guide Version 1.1

https://hawqs.tamu.edu/content/docs/HAWQS-User-Guide.pdf

HAWQS 2.0



- To begin, go to https://epahawqs.tamu.edu
- Log in using existing credentials or register for a new account. If registering for a new account, access may take up to a few days for processing
- For assistance with account settings and system errors, please contact eco.web@tamu.edu. For assistance with training and use cases, please contact hawqs@epa.gov

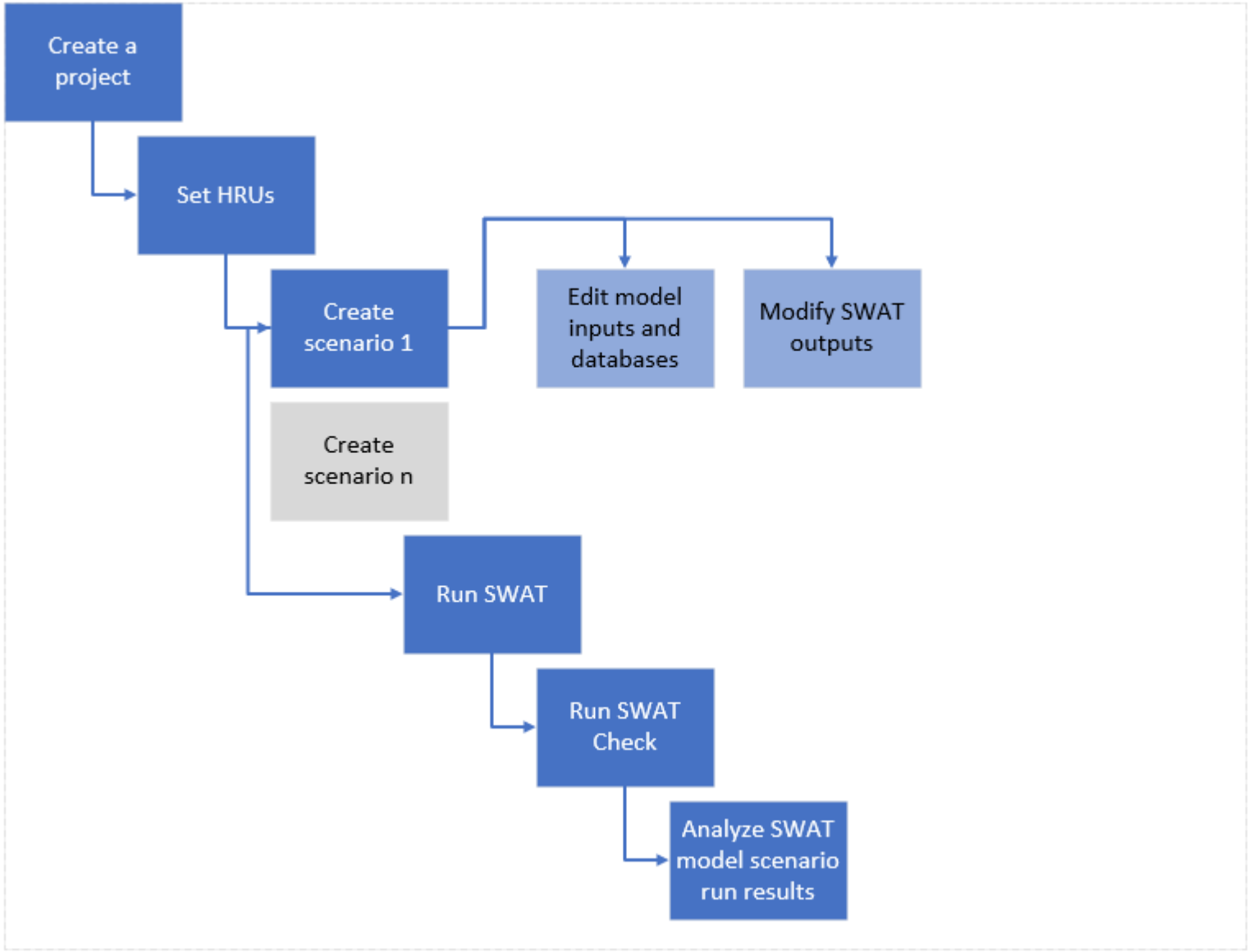
HAWQS User Tiers

All users are placed in **Tier I** upon registration. To access a higher tier, visit your account profile and click the Tier Limitations tab.

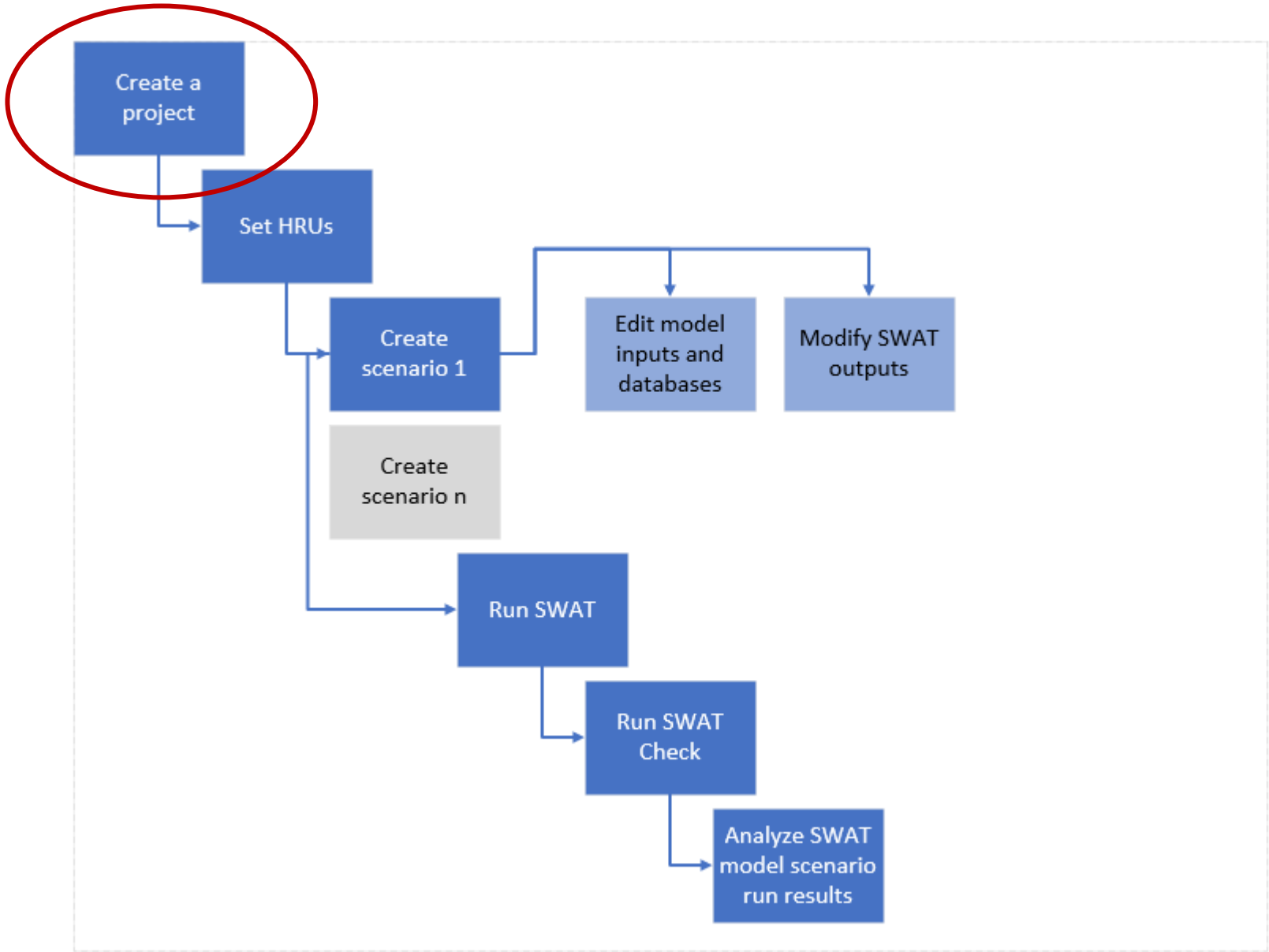
Tier	Max. Subbasins	Max. HRUs	Run Frequency	Run Concurrently	Queue Priority	Max. Project Uploads	Dataset Access
Tier I	200	15,000	3 per hour	1	normal	0	HUC8 v1, HUC10 v1, HUC8, HUC10
Tier II	500	100,000	5 per hour	2	higher	10	HUC8 v1, HUC10 v1, HUC12 v1, HUC8, HUC10, HUC12, HUC14
Tier III	unlimited	unlimited	unlimited	unlimited	highest	100	HUC8 v1, HUC10 v1, HUC12 v1, HUC8, HUC10, HUC12, HUC14

These are the current Tiers available.

User Steps

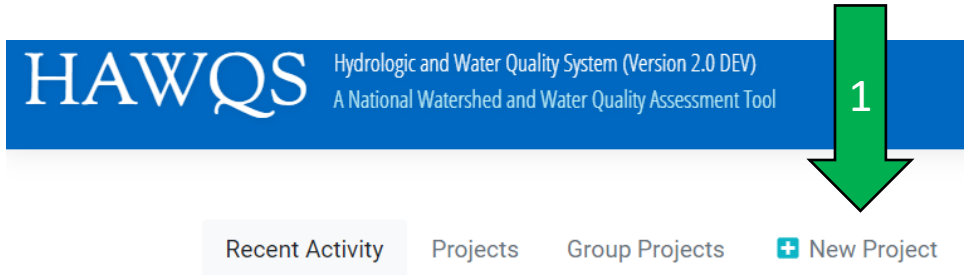

Create a project
Set HRUs
Create scenario 1
Edit model inputs and databases
Modify SWAT outputs
Create scenario n
Run SWAT
Run SWAT Check
Analyze SWAT model scenario run results

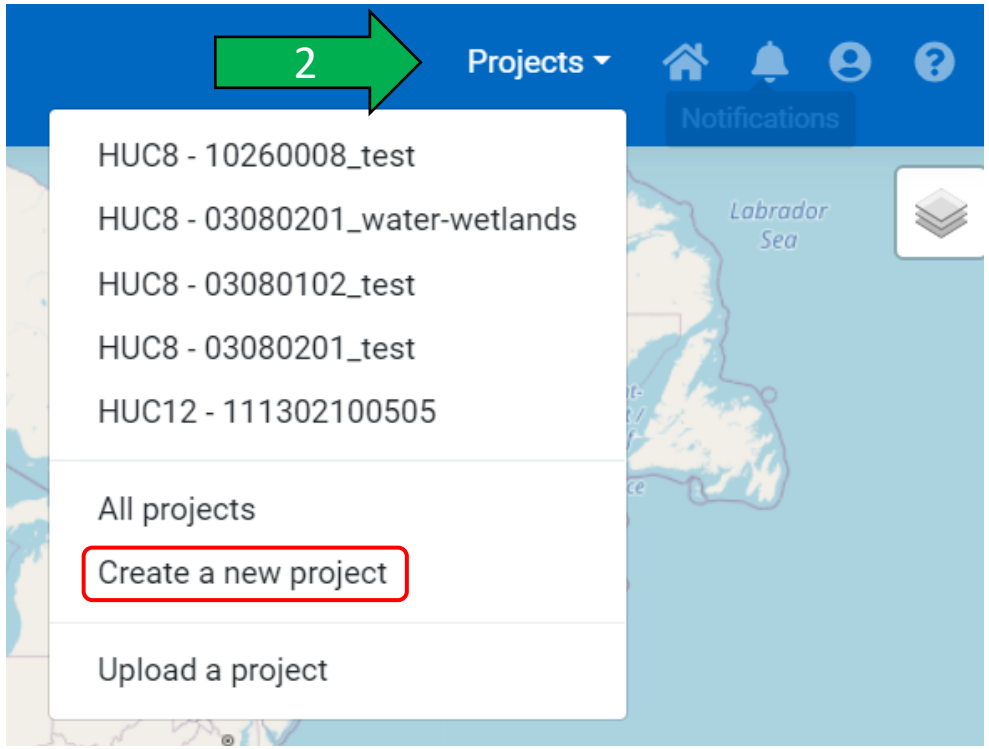
Create a project



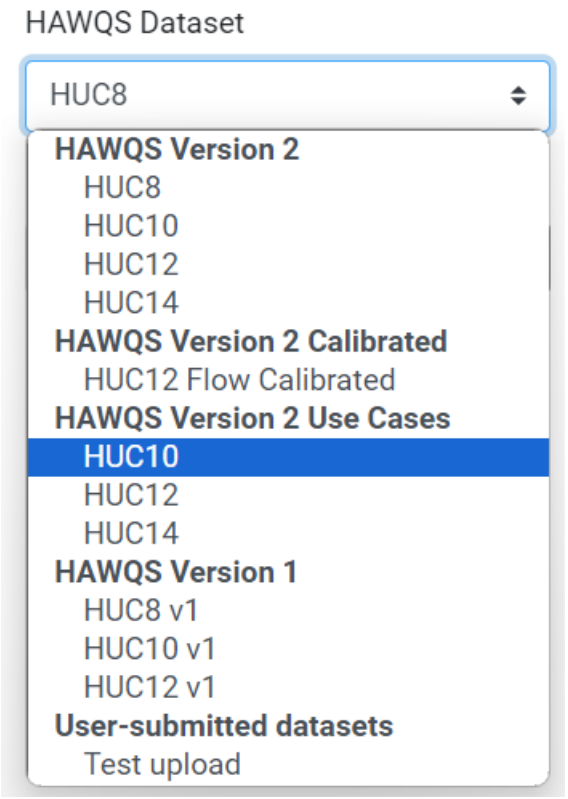
Step 1

There are two ways to create a new project: select from top list or use dropdown menu under projects





Example Use Cases

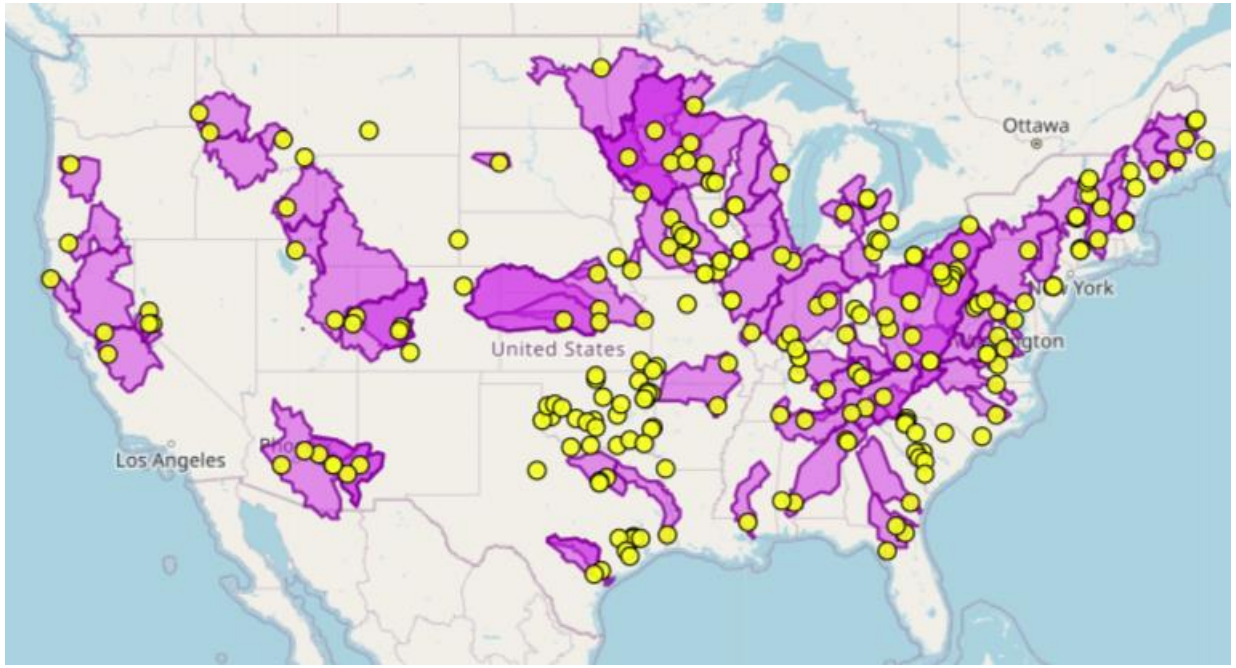


- Step by step walkthroughs for various use case scenarios specific to v2.0 can be found under the Documents and Support page.
  - Simulating Baseline Conditions
  - Simulating Land Use Changes
  - Simulating Point Source Changes
  - Simulating Changes to Agricultural Practices
- These scenarios can be used to familiarize users with the functionality of the HAWQS platform.
- The associated dataset are available to create projects under the Dataset dropdown menu.

Step 2 (a)

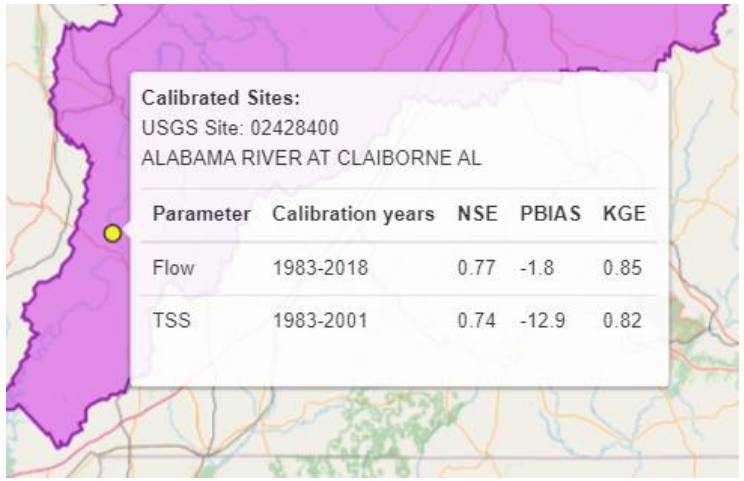
- There are multiple ways to select a watershed to model
- To view locations that have been calibrated select HUC8 or HUC12 from the first dropdown menu
- This will display all watersheds that have been calibrated at those scaled along with a symbol for the USGS gage location used for calibration

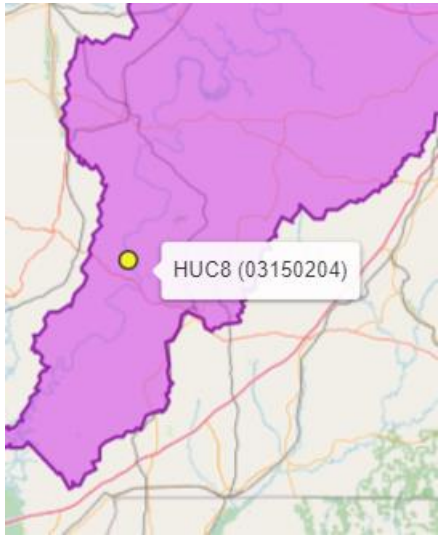


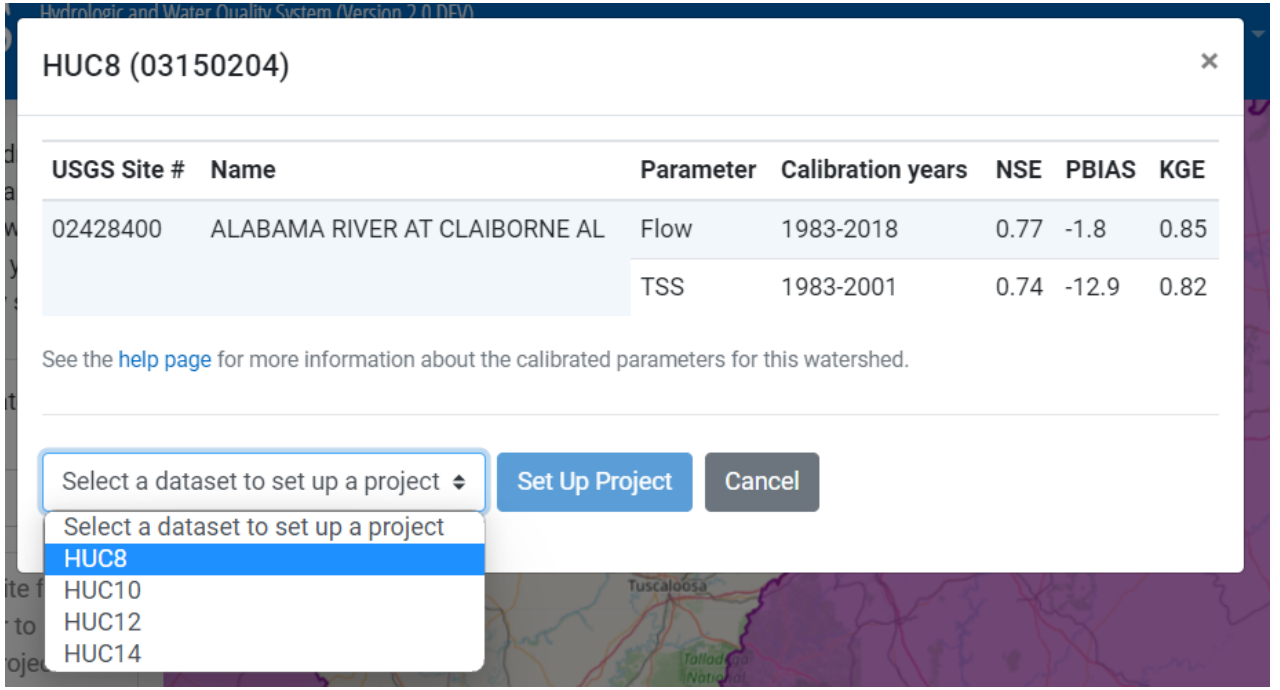


Step 2 (a) cont.

- Hover over a symbol to see the calibrated results
- Select the surrounding watershed to model
- A pop-up menu will display showing the calibration information
- From the drop-down menu select the desired dataset to set up a project
- After the selection in made select “Set Up Project” which will take you to Step 4 below

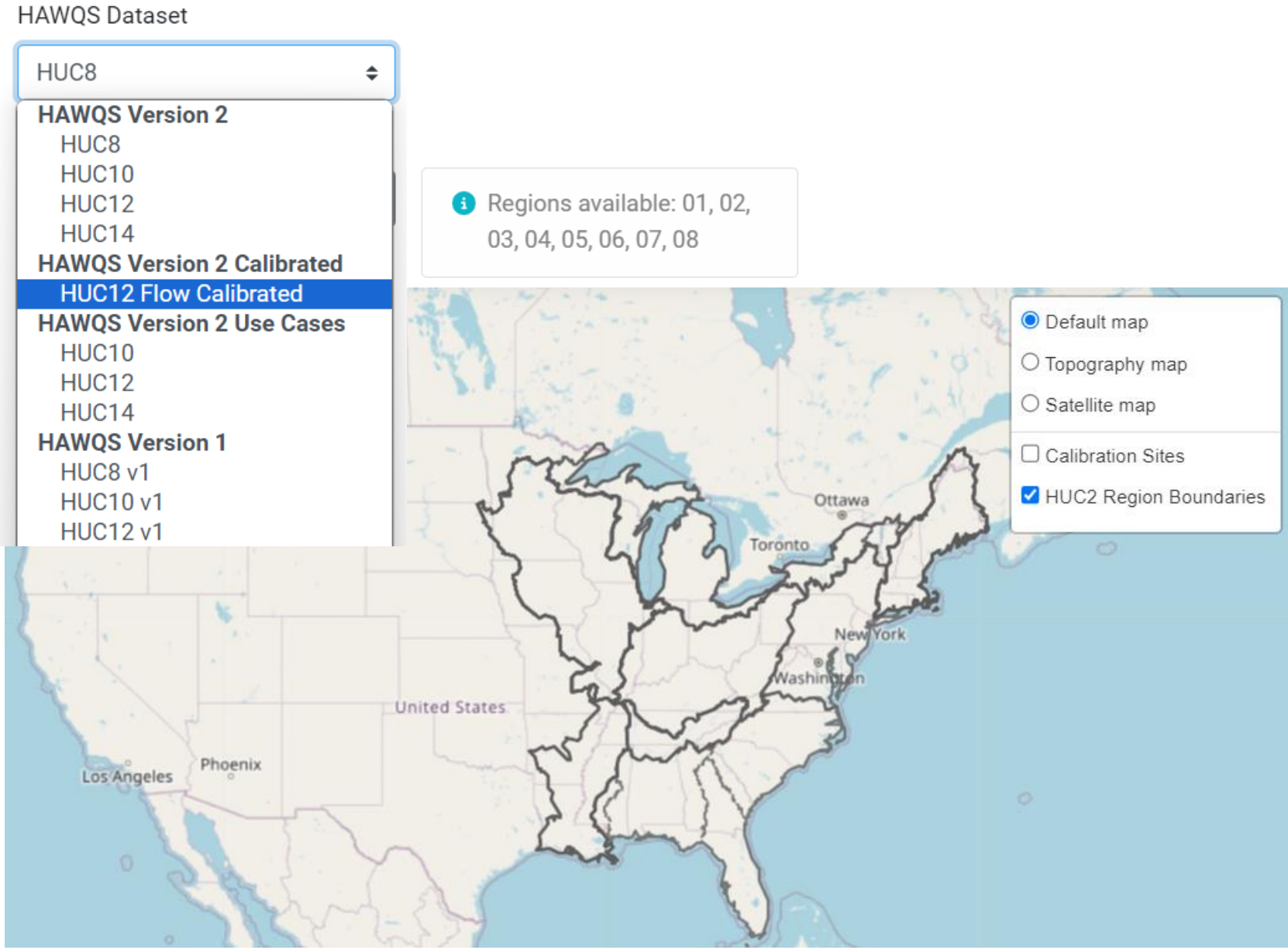






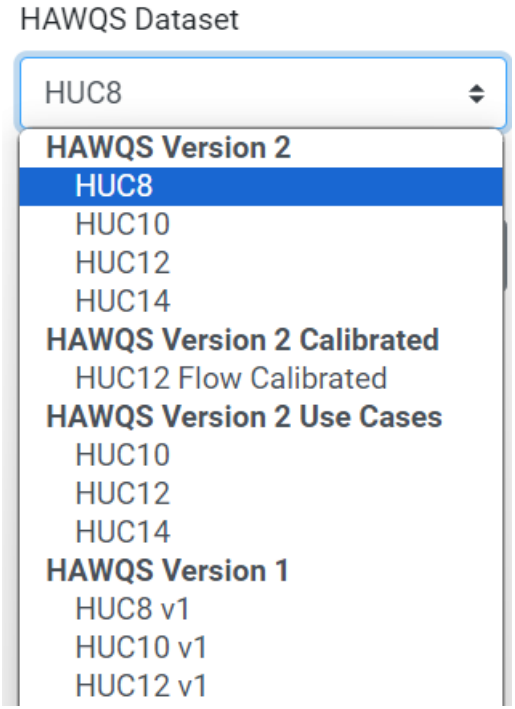
Step 2 (b)

- To create a project using HUC12 calibrated data, select the from the available datasets.
- A list of current available data by HUC02 regions will display after selection.
- To see the outline of the regions available, select “HUC2 Region Boundaries” from the layer dropdown menu on the map.
- To create a project, select an area within the region of interest from the map as shown in Step 3.



Step 2 (c)

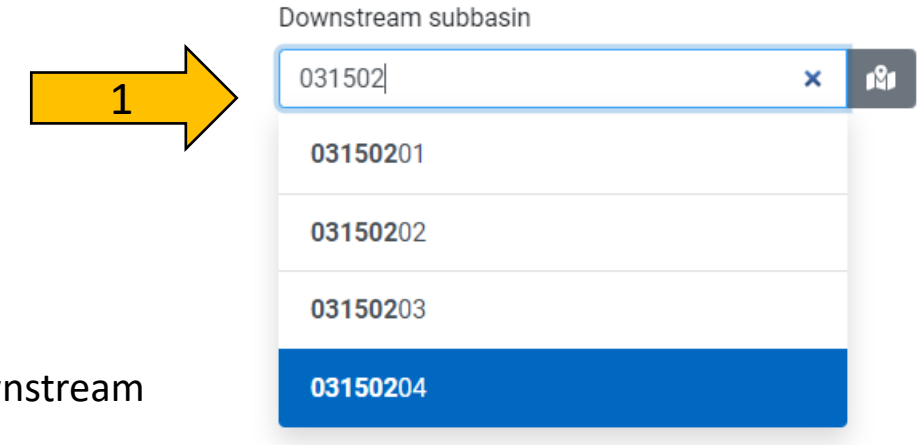
Select which hydrologic boundary dataset/subbasin scale to use

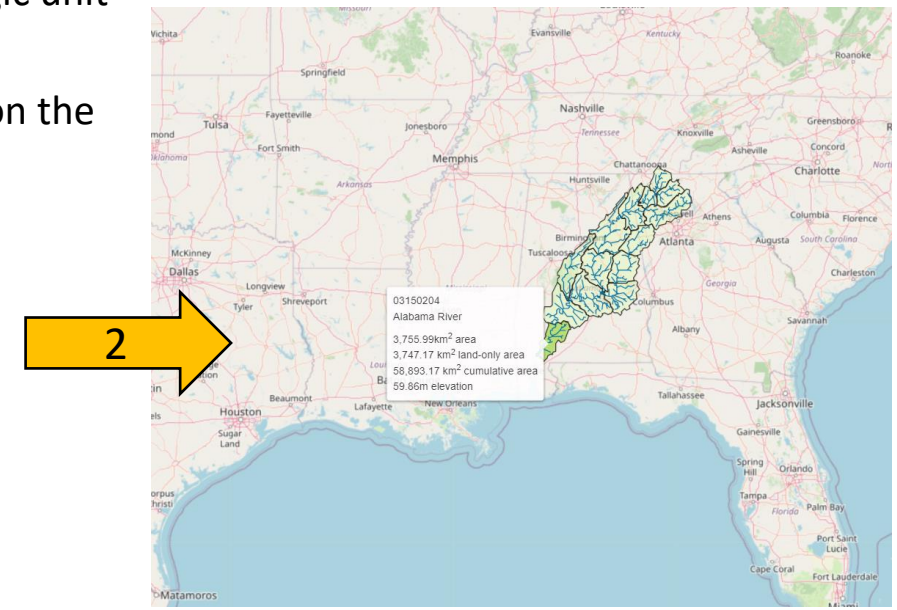


Step 3

There are two ways to select a downstream subbasin for project development:

1) Enter in the downstream hydrologic unit ID
2) Select the downstream subbasin on the map

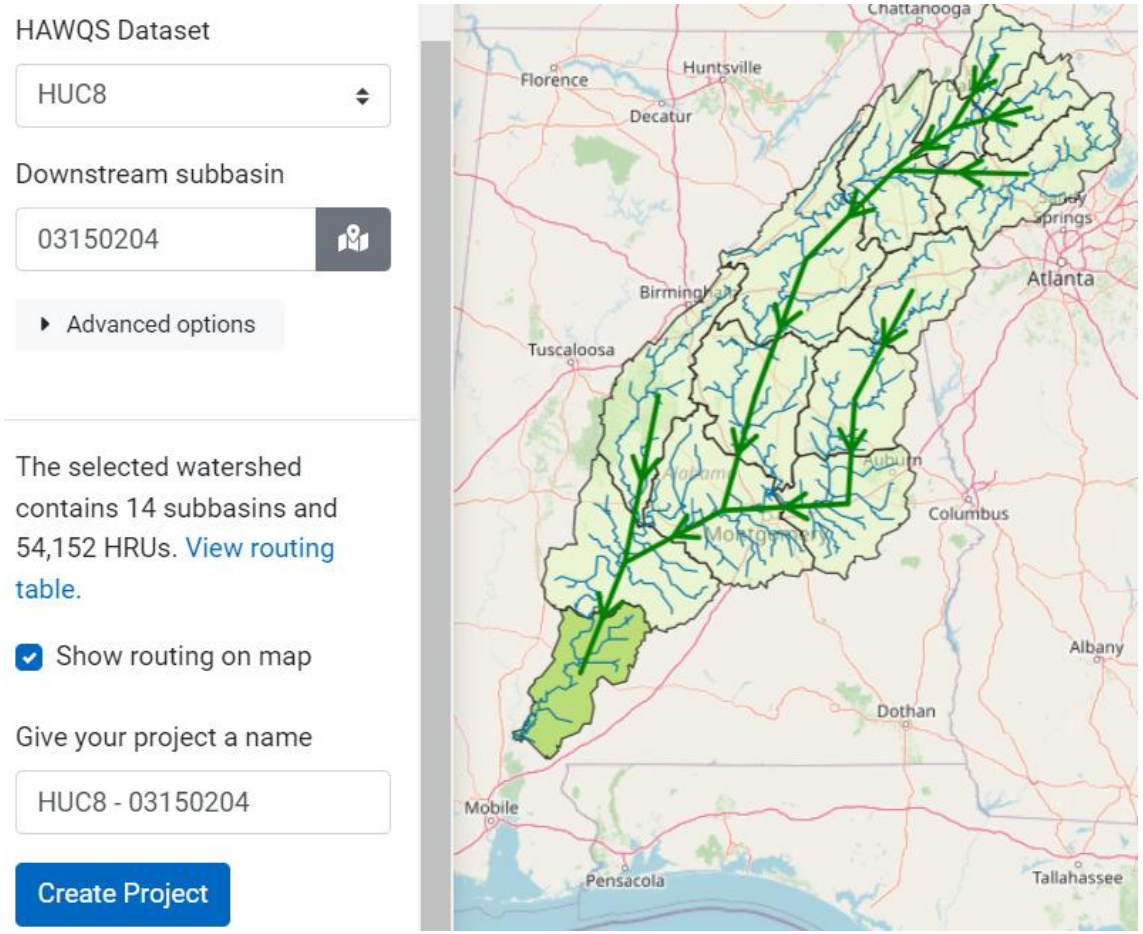


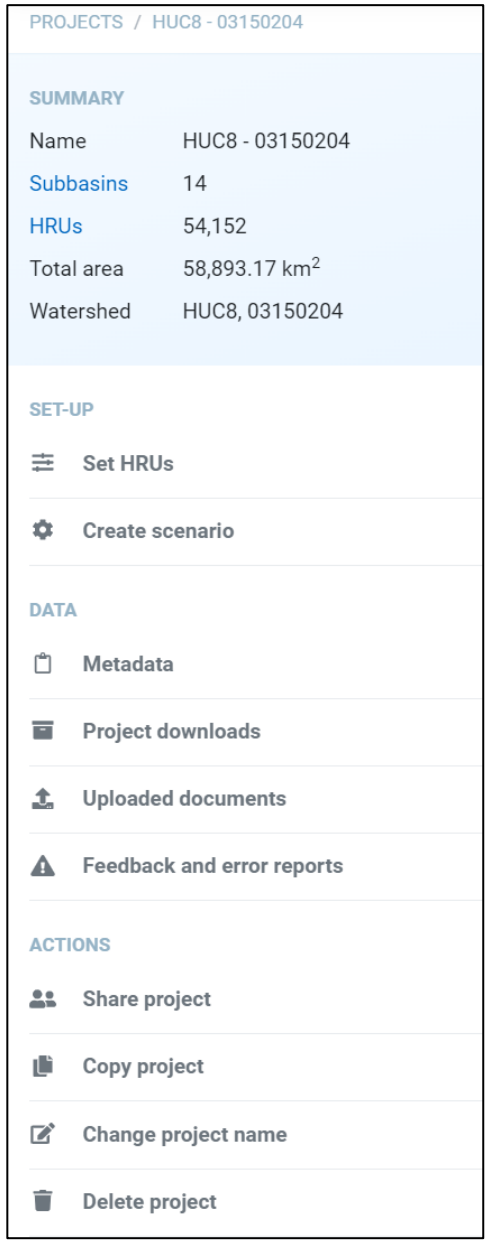


Step 4

Users can check a box to see the routing, name the associated project, and select “Create Project” to save and create the project.

Note: the light green subbasins are the upstream subbasins that drain to the darker green downstream subbasin





Project Summary

To the left, a project summary menu is available after you create a project.

You can view the number of subbasins, HRUs, and the total area of the watershed.

Under SET-UP you can set HRUs or create scenarios

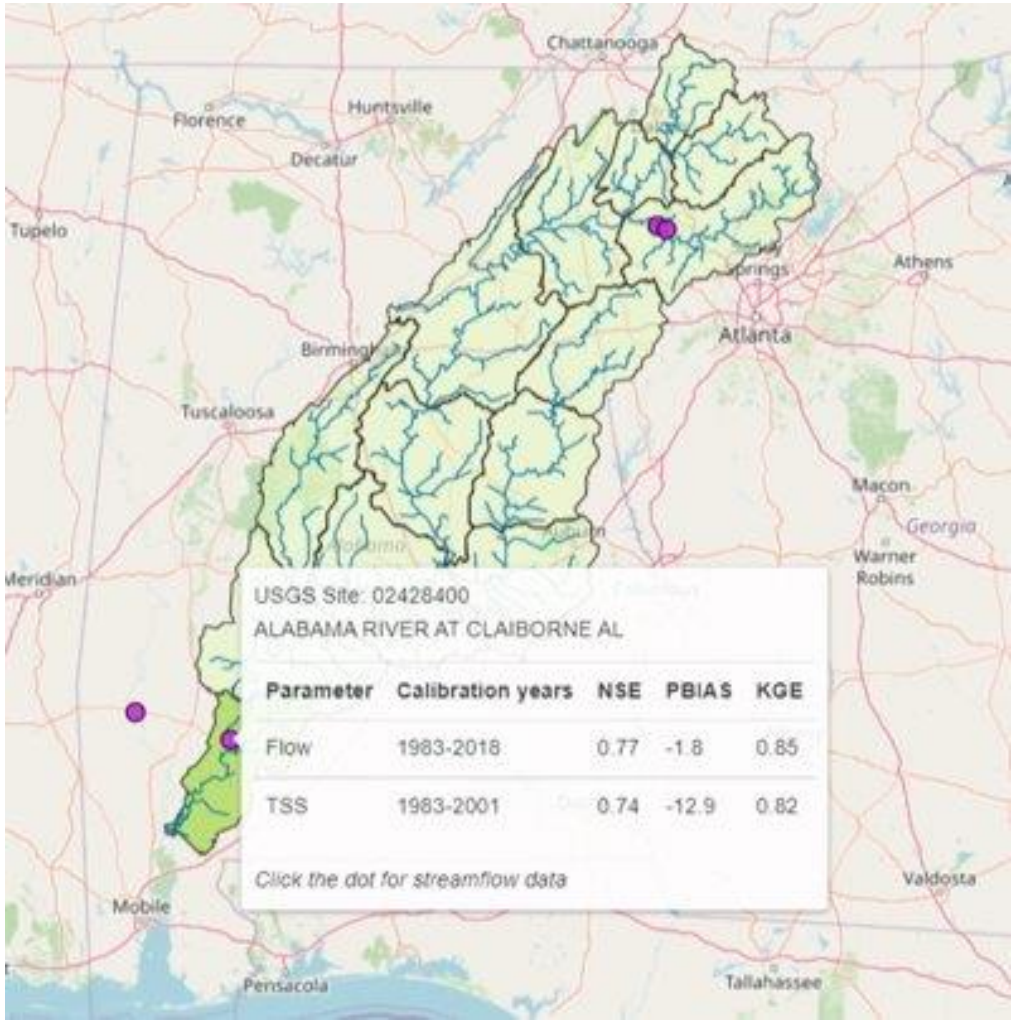
Under DATA you can download project files and metadata, upload documents, or provide feedback for the platform.

Under ACTIONS you can share, copy, change the name, or delete the project.

Project Summary

To the right is the map of the project.

You can hover the cursor over the purple circles on the map to see the calibration parameters and USGS site information.

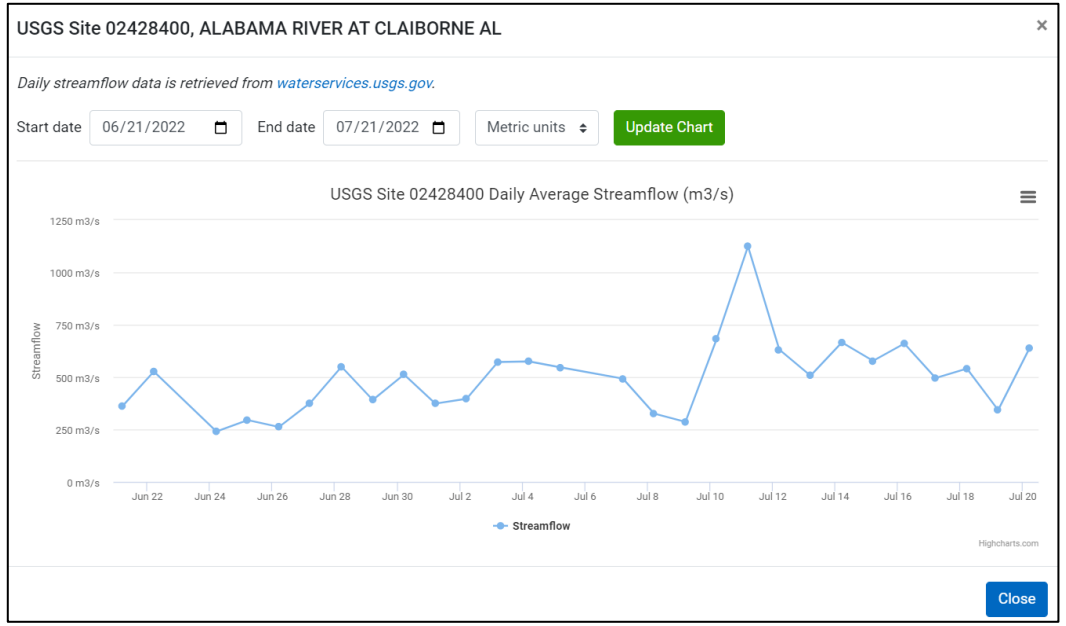


Streamflow Data

If you click on the purple symbols on the map, you can see the streamflow data from the USGS site.

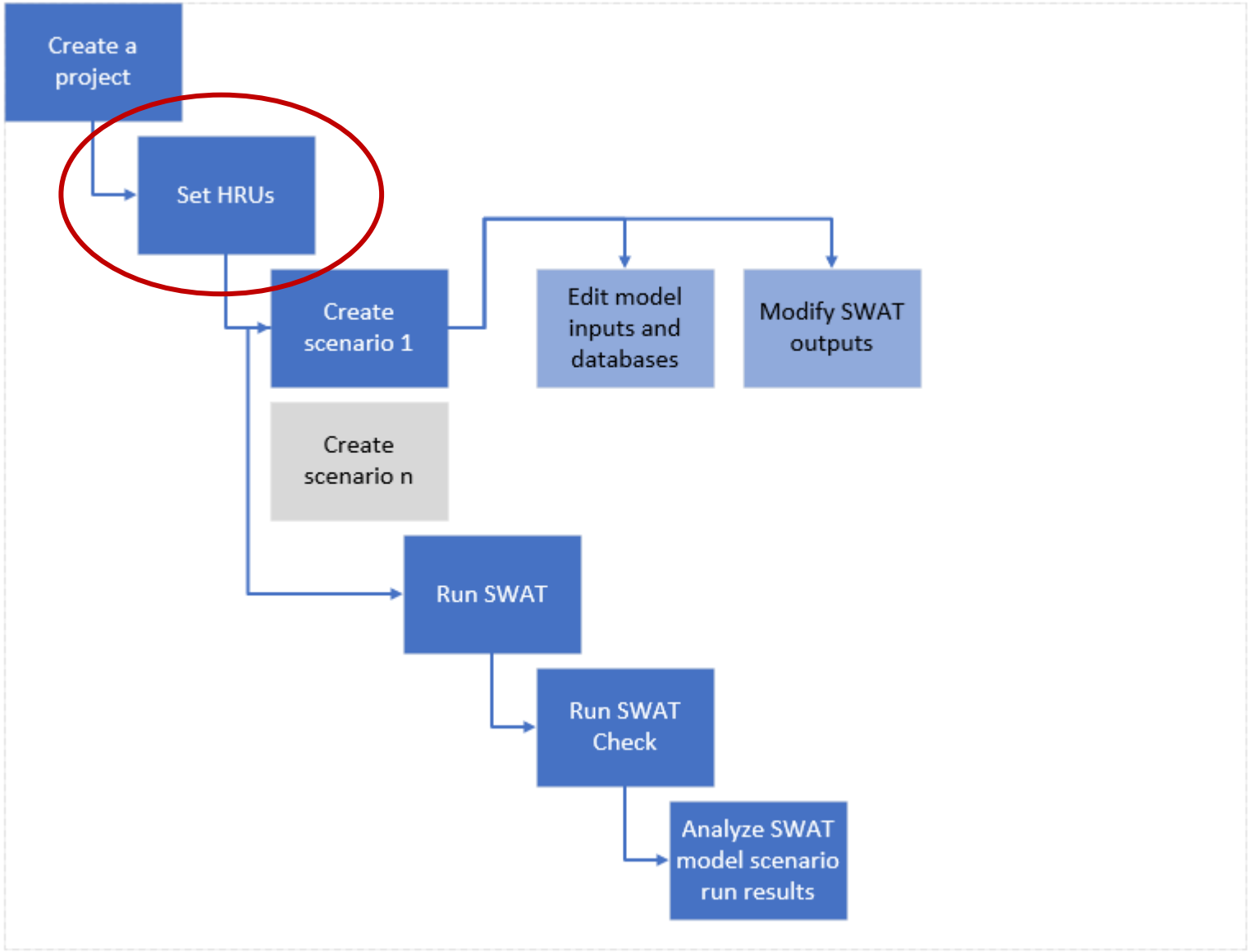
You can choose start and end dates and change the units. After selections are made press the "Update Chart" button to display the data.

Click the icon to display options to save the streamflow data.





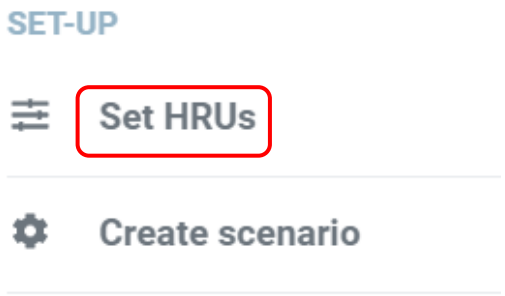
Set HRUs


Create a project
Set HRUs
Create scenario 1
Edit model inputs and databases
Modify SWAT outputs
Create scenario n
Run SWAT
Run SWAT Check
Analyze SWAT model scenario run results

**To learn more about HRU aggregation please read HAWQS 2.0 HRU Aggregation Guidance documentation.

Step 1

From project summary, select "Set HRUs" under "SET-UP"



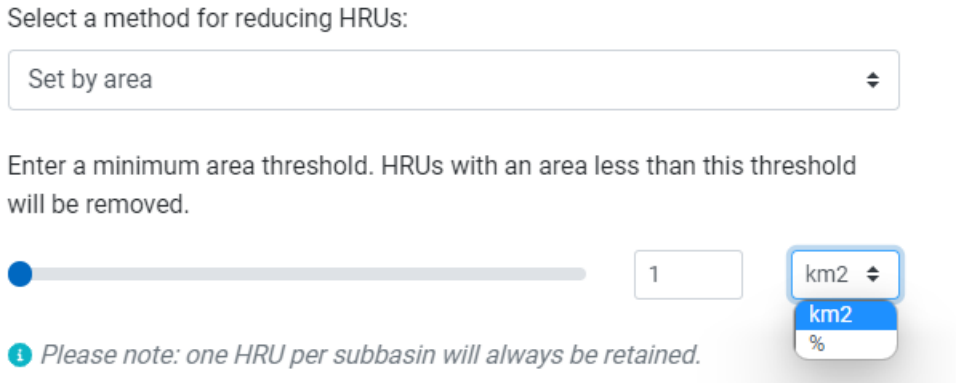
Step 2

There are two methods to choose from when reducing the number of HRUs:

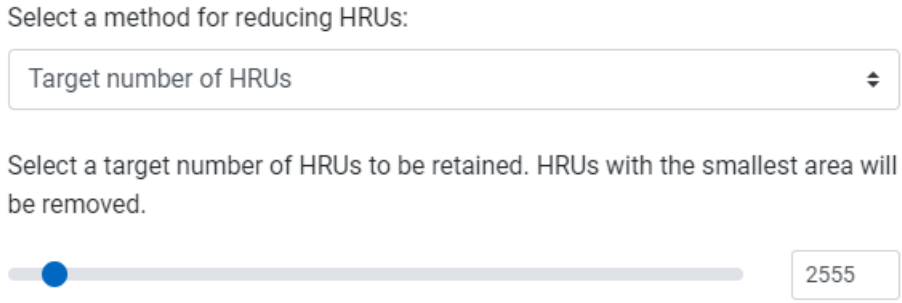
1) set by area of HRUs, this can be by size of HRUs or by percent (%) of area

2) set by target number of HRUs, this can be done by using the slider to find a value, or entering the value in manually

1



2

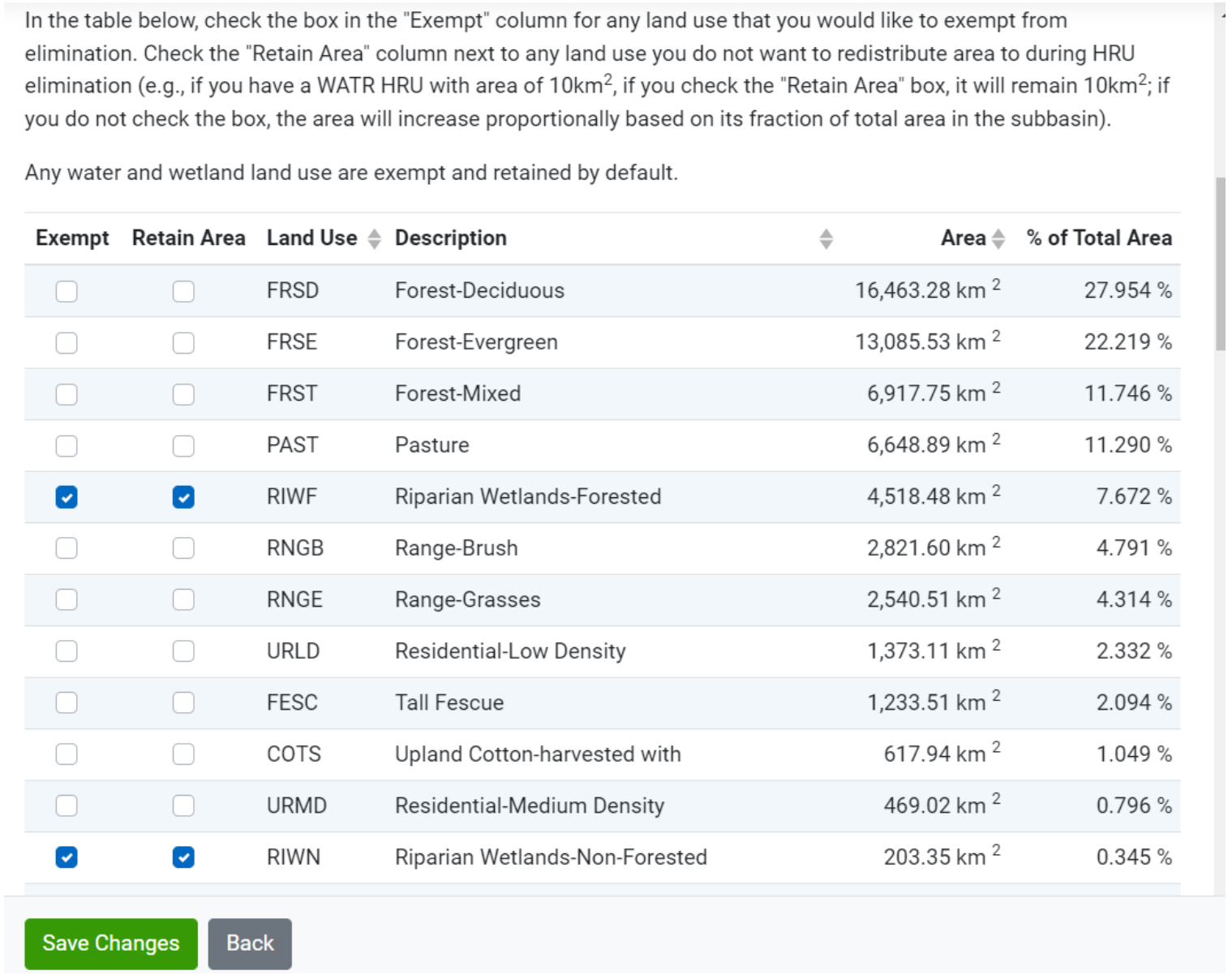


Step 3

Select the land use type to be exempt from HRU reduction, or land use type to retain the original area when the area is redistributed after elimination.

Note: All water and wetland land use types will automatically be selected to be exempt and retain area.

Select “Save Changes” to review new project HRUs.

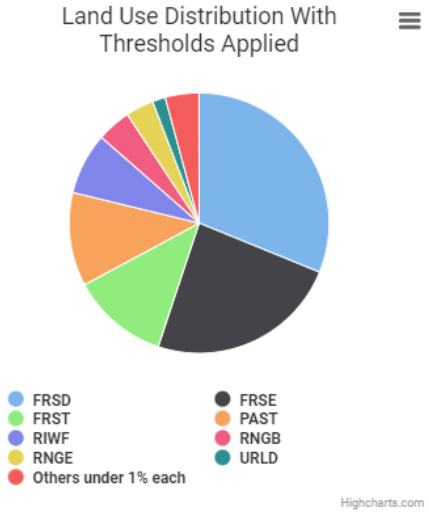


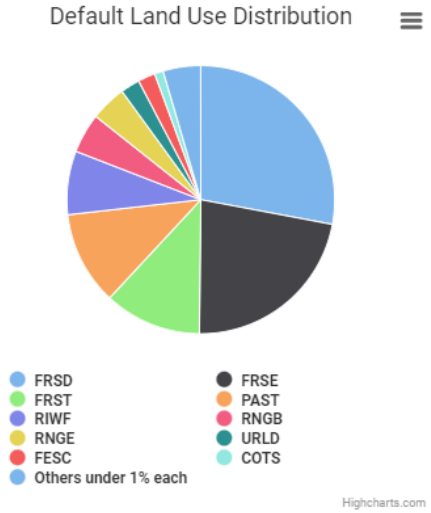
Step 4

After the HRU reduction threshold has been set, users can review the project land use distribution with the threshold applied and the default land use in two formats: pie charts and tables.

To adjust the threshold, select the “Reset/Clear Thresholds” button, or if satisfied, select the “Create a scenario” button.

Note: The three tabs (“Landuse”, “Soil”, and “Slope class”) become visible after the “Save Changes” button is pressed.





Distribution comparison tables

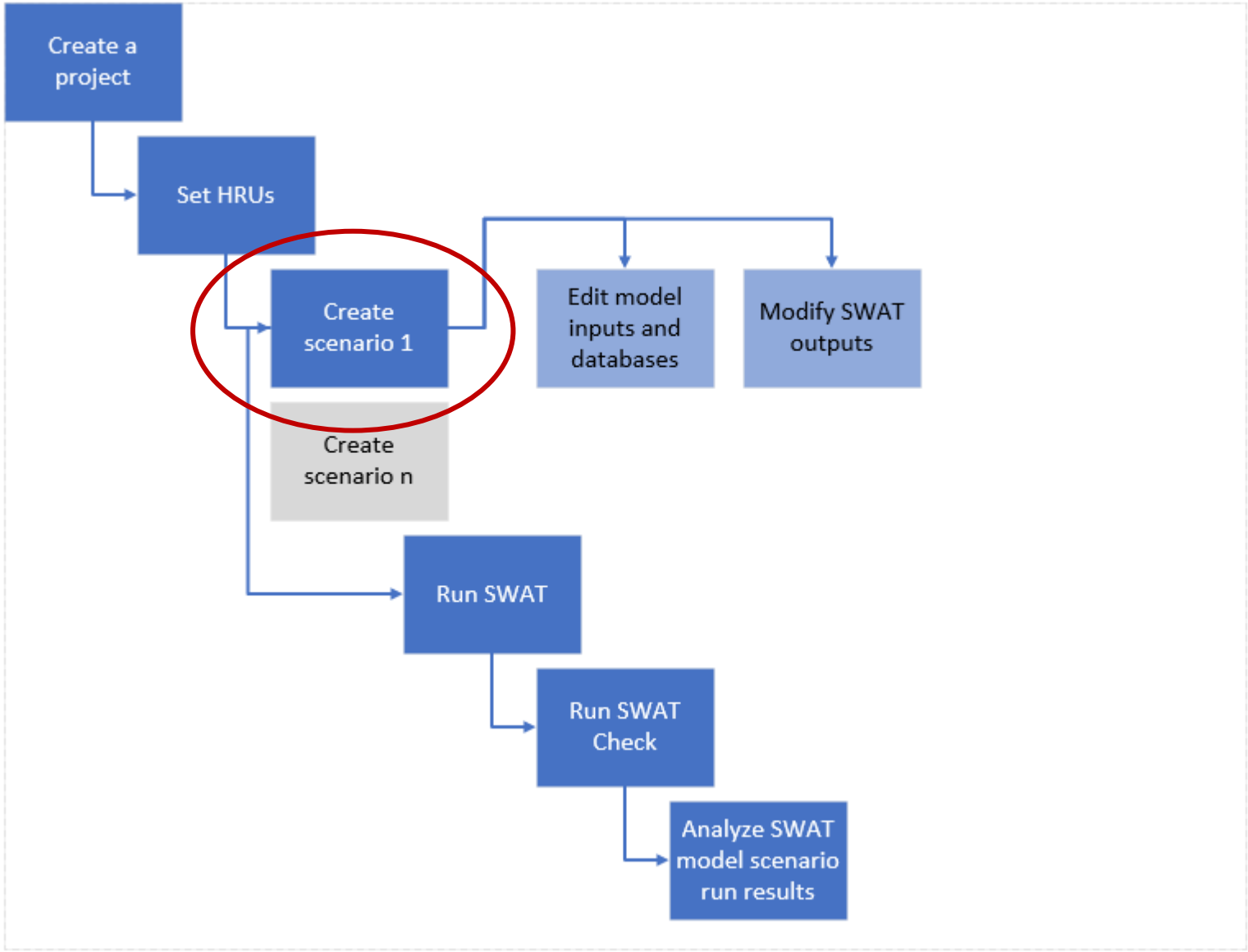
Reset / Clear Thresholds

Landuse | Soil | Slope class

	With thresholds applied		Original	
Land Use	**Area**	**% of Total Area**	**Area**	**% of Total Area**
FRSD	18,353.16 km^2	31.16 %	16,463.28 km^2	27.95 %
FRSE	14,106.41 km^2	23.95 %	13,085.53 km^2	22.22 %
FRST	7,096.51 km^2	12.05 %	6,917.75 km^2	11.75 %
PAST	6,850.61 km^2	11.63 %	6,648.89 km^2	11.29 %
RIWF	4,518.48 km^2	7.67 %	4,518.48 km^2	7.67 %
RNGB	2,488.06 km^2	4.22 %	2,821.60 km^2	4.79 %
RNGE	2,053.11 km^2	3.49 %	2,540.51 km^2	4.31 %
URLD	962.33 km^2	1.63 %	1,373.11 km^2	2.33 %
FESC	551.20 km^2	0.94 %	1,233.51 km^2	2.09 %
COTS	410.62 km^2	0.70 %	617.94 km^2	1.05 %
URMD	247.84 km^2	0.42 %	469.02 km^2	0.80 %

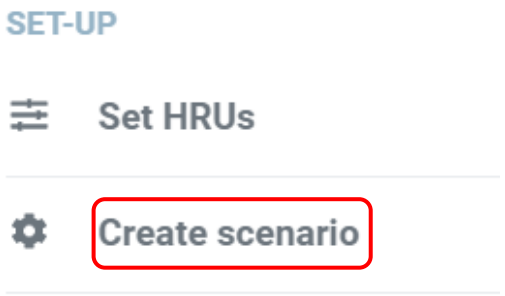
Create a scenario | Back

Create a scenario



Step 1

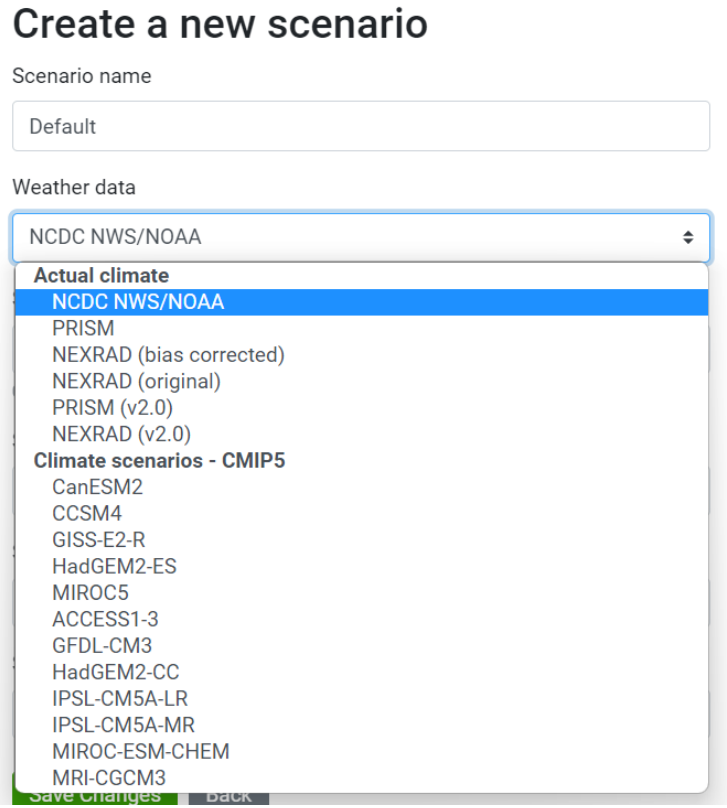
To create a new scenario, select “Create Scenario” from the set-up menu on the left if “Create a scenario” was not selected on the “Set HRUs” screen



Step 2

On the create a new scenario pop-out, first give the scenario a unique name. The scenario name is automatically set to “Default”.

Next, select a weather dataset. There are both historical climate data, and CMIP5 future climate scenario data available.



Step 3

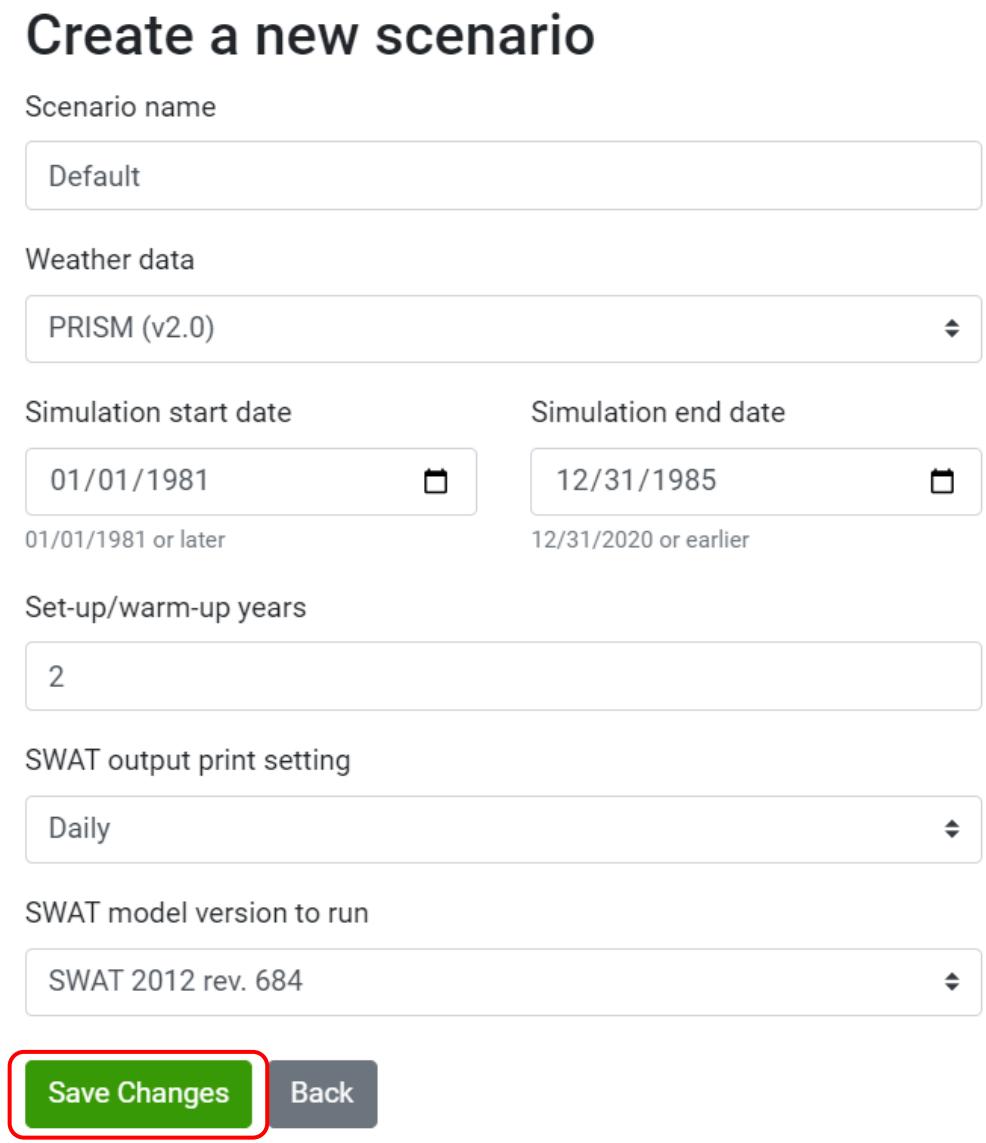
After selecting the weather data, select the simulation start and end dates.

Next, set the set-up/warm-up years. These years will not be printed in the output. For example, if the simulation start date is 01/01/1981 and there is a 2-year warm-up period, then the first year of data available in the output would be 1983 (with 1981 and 1982 as the model warm-up years).

Next, choose an output print setting: Daily, Monthly, or Yearly

Finally, select the SWAT model version to run. By default, the latest version available is selected.

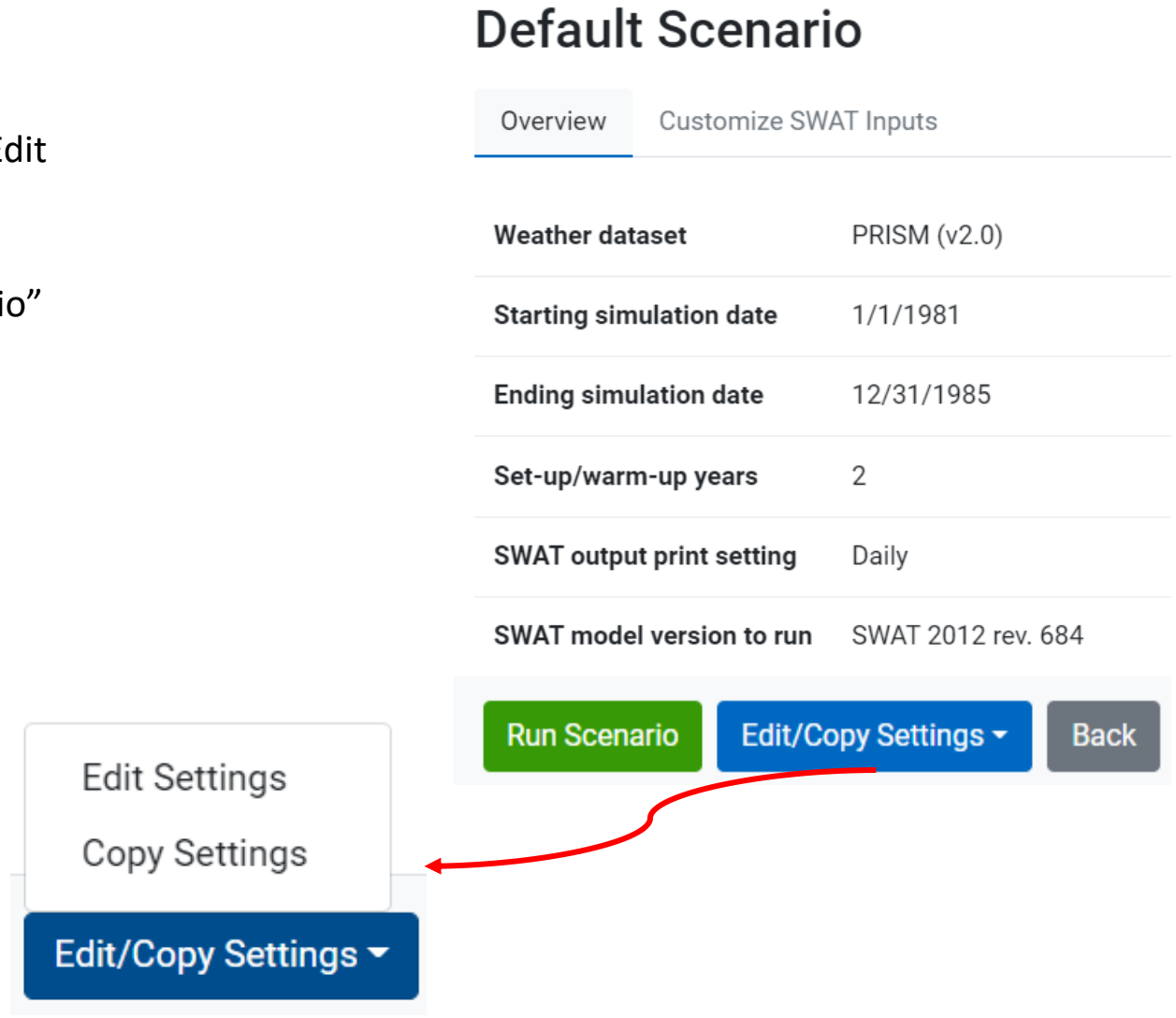
Select “Save Changes” when all the selections are made.



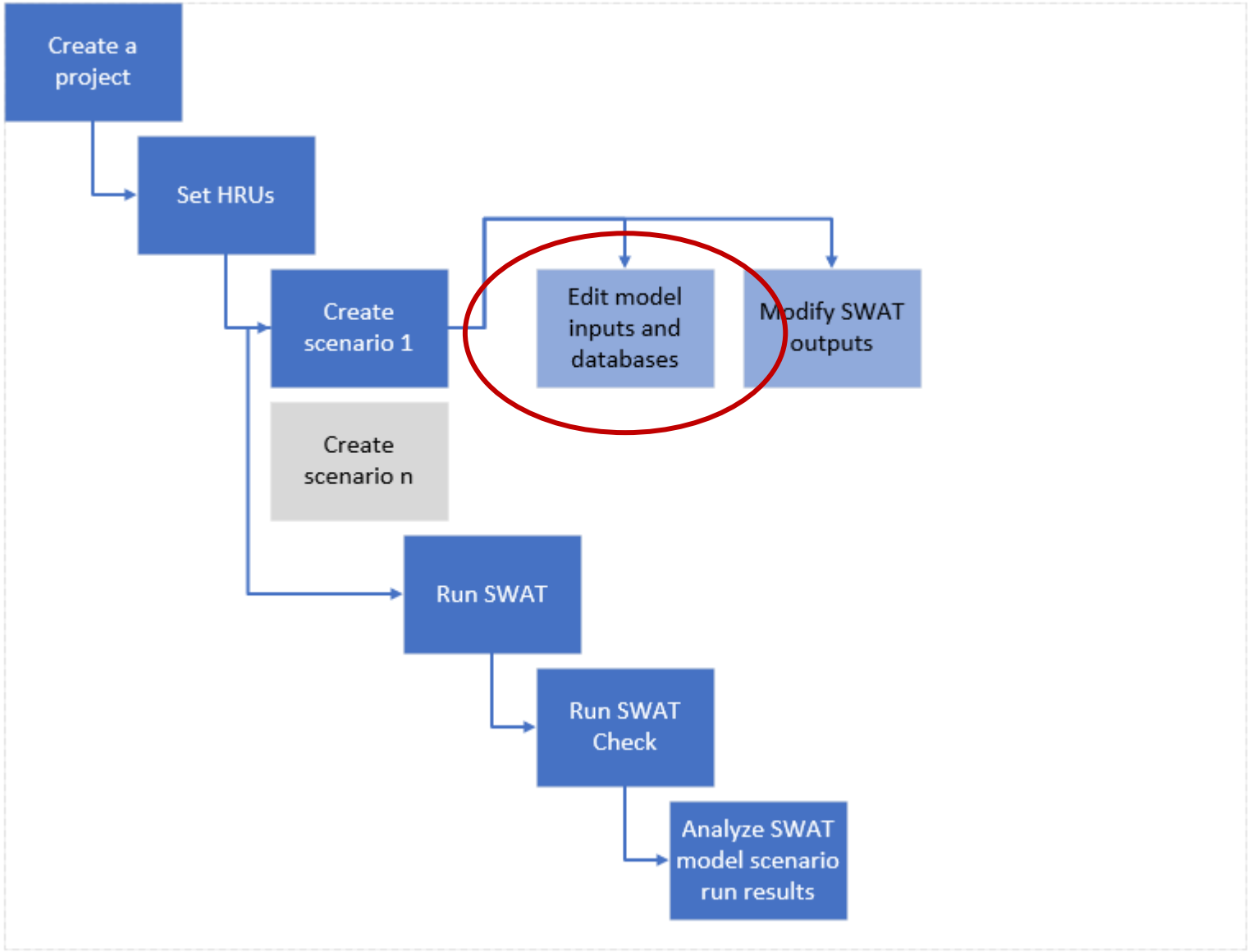
Step 4

After selecting “Save Changes”, review the selections made. Select the “Edit/Copy Settings” button, then “Edit Settings” to adjust any scenario settings.

If satisfied with the scenario settings, run the scenario with the default input settings by clicking “Run Scenario” or proceed to customizing the SWAT model’s input parameters.



Edit model inputs

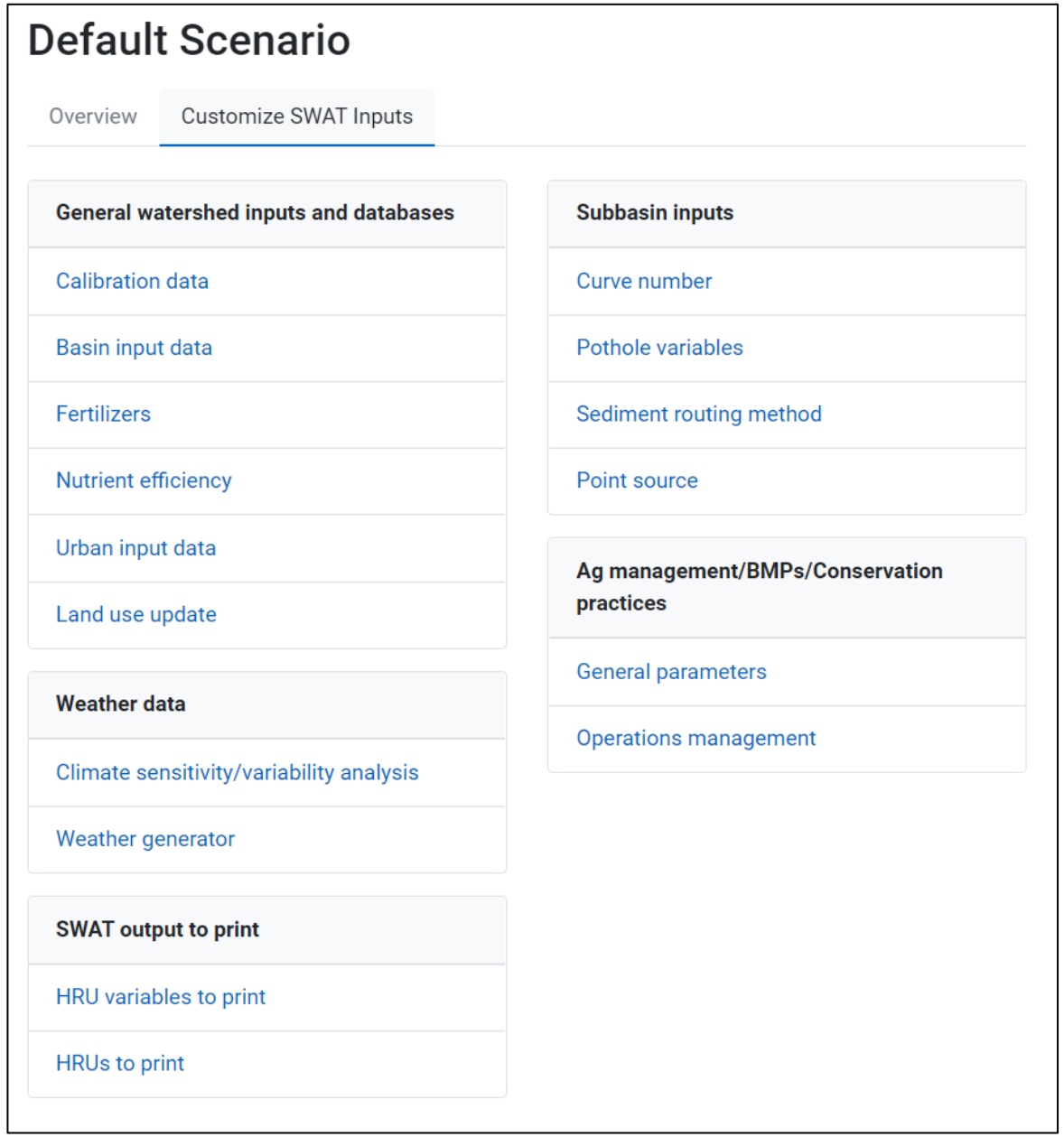


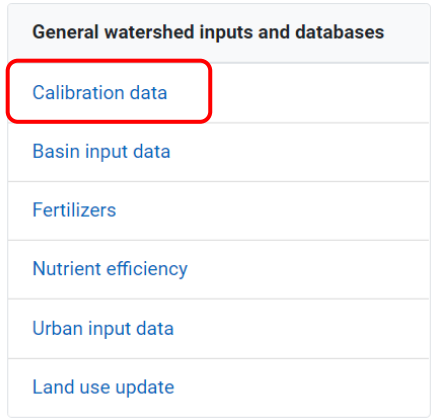
Customize SWAT Inputs

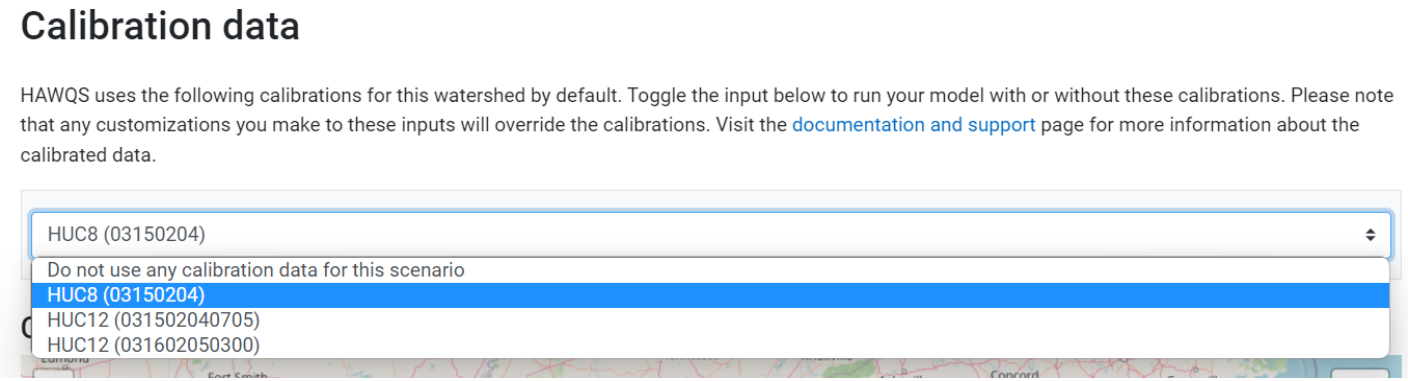
Select the “Customize SWAT Inputs” tab to find all the options available for modification.

Inputs available for modification include general parameters, weather data, subbasin inputs, and agricultural management strategies

This is also where users can adjust what SWAT outputs to print at the HRU level.







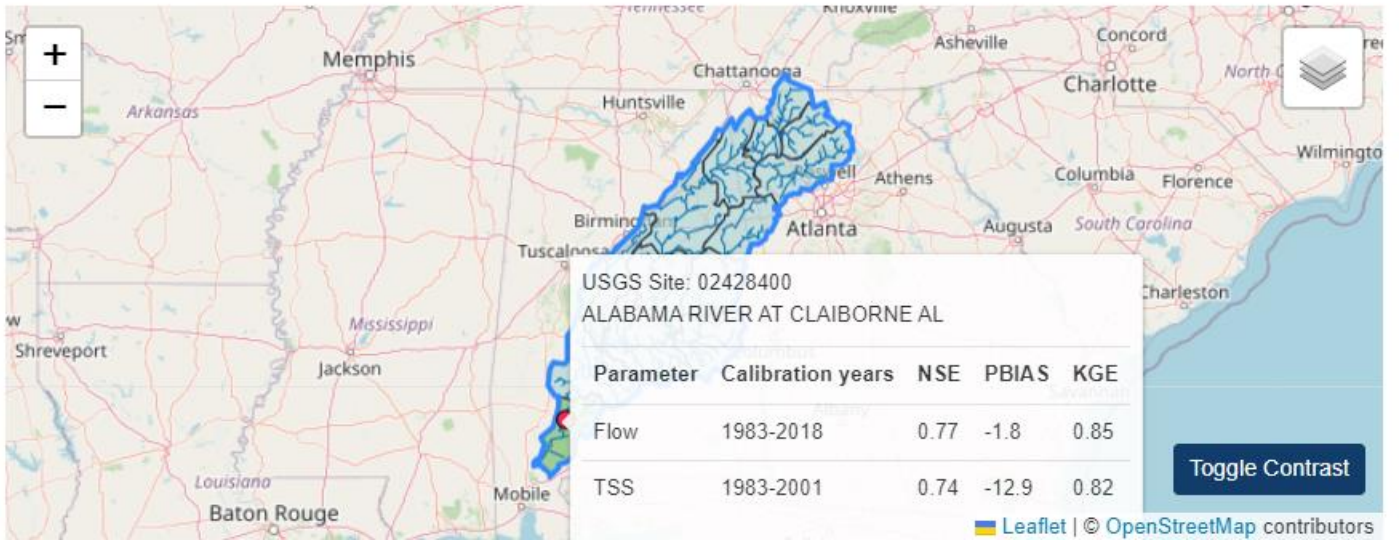
Calibration Data

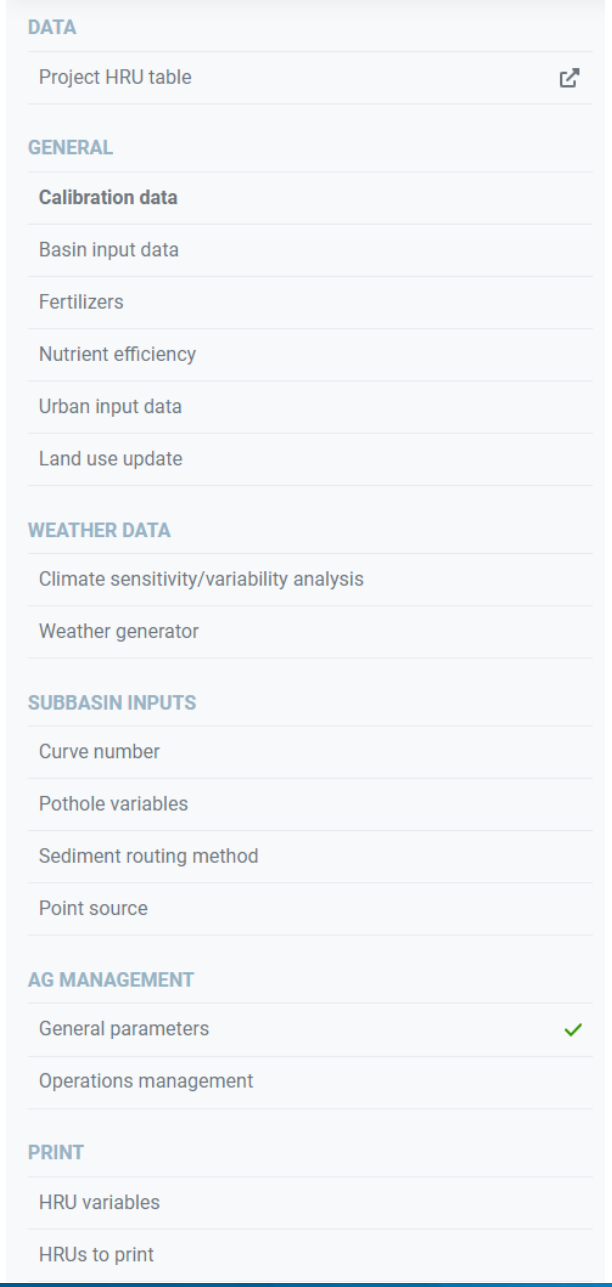
Users can select the calibration parameters used for modeling. If there has been a previous calibration effort in the watershed being modeled, there will be those options in the dropdown menu. If there have not been previous calibration efforts, then no options will be available in the dropdown menu and default parameters will be used.

If desired, users can select the option to not use any available calibration data for this scenario.

Once a set of calibration parameters are selected, the outline of the watershed calibrated will show on the map.

Hover over the gage symbol to display gage information and calibration details.





Calibration Data

Below the map, is the list of calibration parameters used.

After the calibration option is selected, select “Save Changes”.

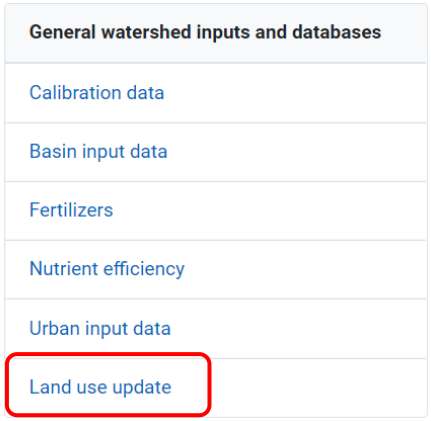
To return to the scenario summary screen select “Back”.

On the right-hand side of the screen is a menu with options available for customization.

Note: A Green Check mark will show when modifications are mode to default values.

V = Value used
A = Amount to add to baseline value
% = Percentage of baseline, i.e. (1 + x) * (baseline value)

Table/Field	Value	Type
HRU		
EPCO	0.543	V
ESCO	0.761	V
CANMX (RNGB, FRSE, FRSD, FRST)	8.906	V
SLSOIL	5.859	V
LAT_TTIME	2.078	V
MGT1		
CN2	-0.092	%
GW		
ALPHA_BF	0.083	V
GW_DELAY	81.563	A
GWQMN	-546.875	A
GW_REVAP	0.032	V
RCHRG_DP	-0.018	A
REVAPMN	-199.219	A
ALPHA_BF_D	0.617	V
SOL		
SOL_AWC	0.016	%
BSN		
SMTMP	0.141	V
SFTMP	-0.406	V
SMFMX	4.012	V
SMFMN	1.152	V
TIMP	0.570	V
SPCON	0.005	V
SPEXP	1.548	V
ADJ_PKR	1.116	V
PRF	0.078	V



Land Use Update

If users need to update modeled land use, there are easy to follow instructions available under the “Land use update” option.

First, download the project HRU .csv.

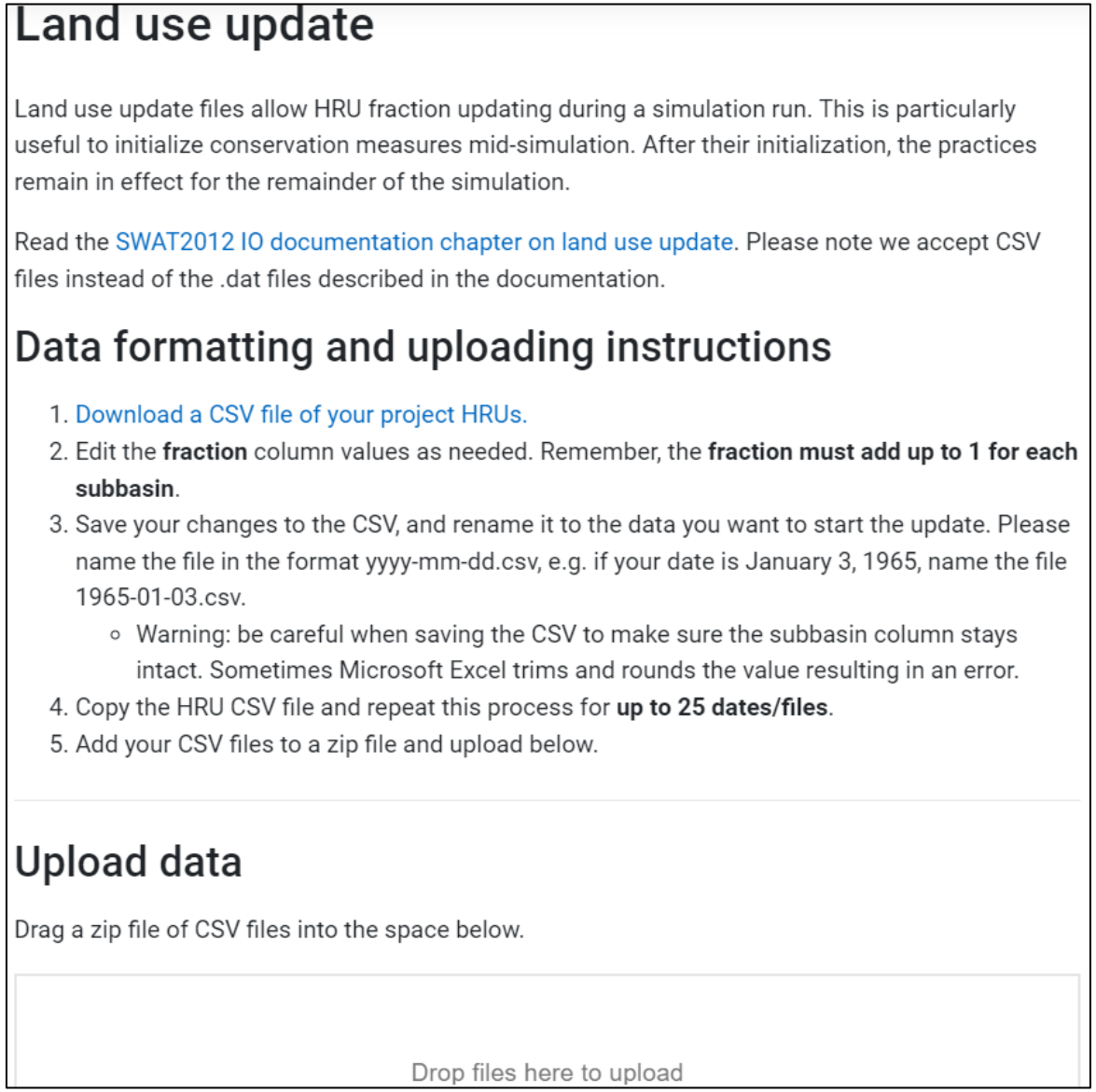
Next, modify the fraction of land use in each HRU.

Note: the HRU fraction must add to 1 for each subbasin.

Save the new .csv file in the format specified.

Users can add up to 25 land use update files per project.

Finally, zip all the .csv files together and drag to the “Drop files here to upload” region on the page.



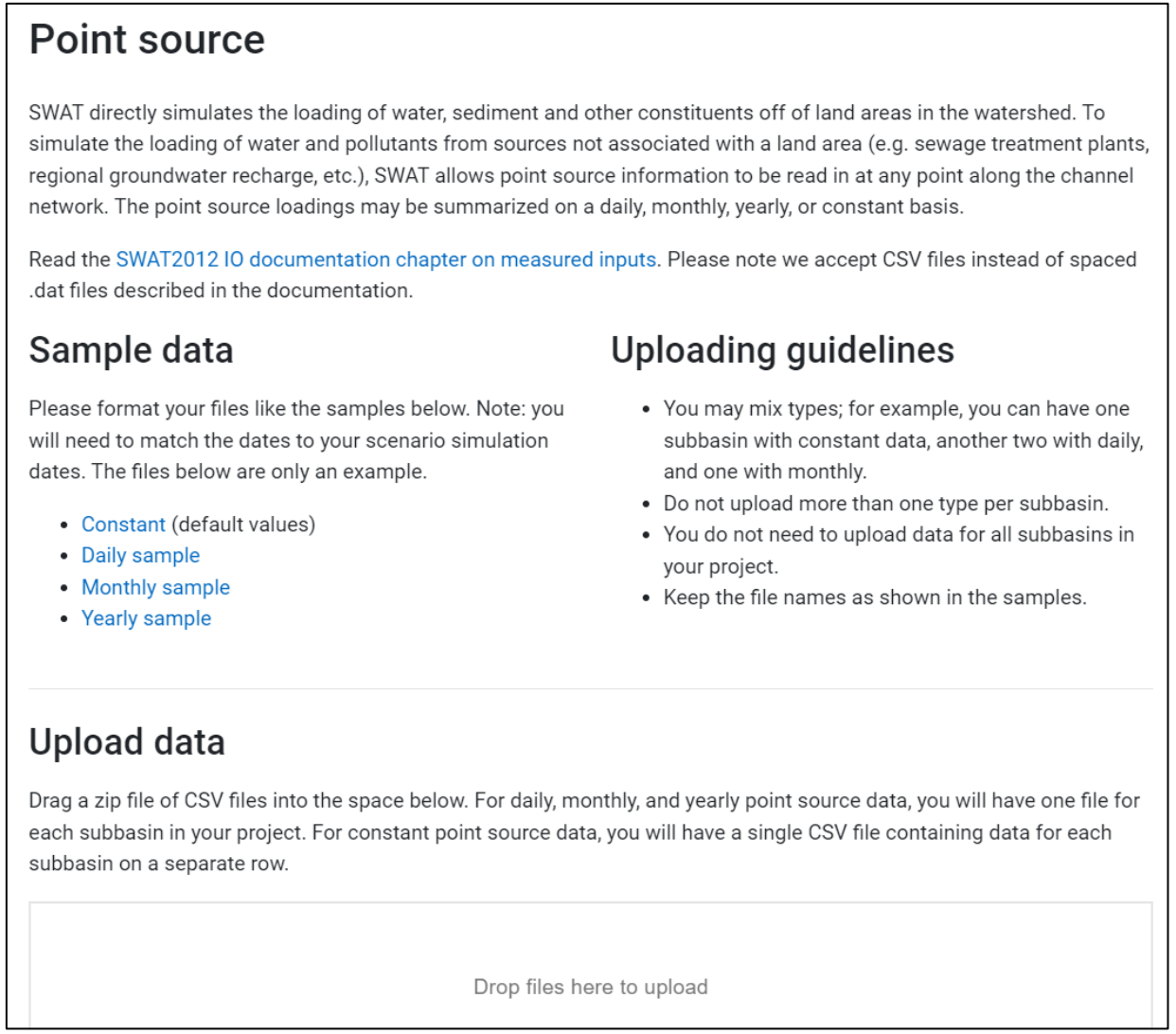


Point Source

If users need to update or add any point sources, navigate to the “Point source” option under “Subbasin inputs”.

Use the format provided in the sample data files (constant, daily, monthly, and yearly) as a guide to update or add point source information.

Once all files are modified or created, zip all the .csv files together and drag to the “Drop files here to upload” region on the page.



Point source

SWAT directly simulates the loading of water, sediment and other constituents off of land areas in the watershed. To simulate the loading of water and pollutants from sources not associated with a land area (e.g. sewage treatment plants, regional groundwater recharge, etc.), SWAT allows point source information to be read in at any point along the channel network. The point source loadings may be summarized on a daily, monthly, yearly, or constant basis.

Read the SWAT2012 IO documentation chapter on measured inputs. Please note we accept CSV files instead of spaced .dat files described in the documentation.

Sample data

Please format your files like the samples below. Note: you will need to match the dates to your scenario simulation dates. The files below are only an example.

- Constant (default values)
- Daily sample
- Monthly sample
- Yearly sample

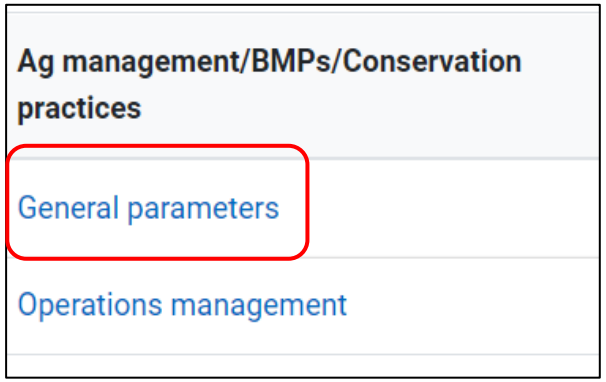
Uploading guidelines

- You may mix types; for example, you can have one subbasin with constant data, another two with daily, and one with monthly.
- Do not upload more than one type per subbasin.
- You do not need to upload data for all subbasins in your project.
- Keep the file names as shown in the samples.

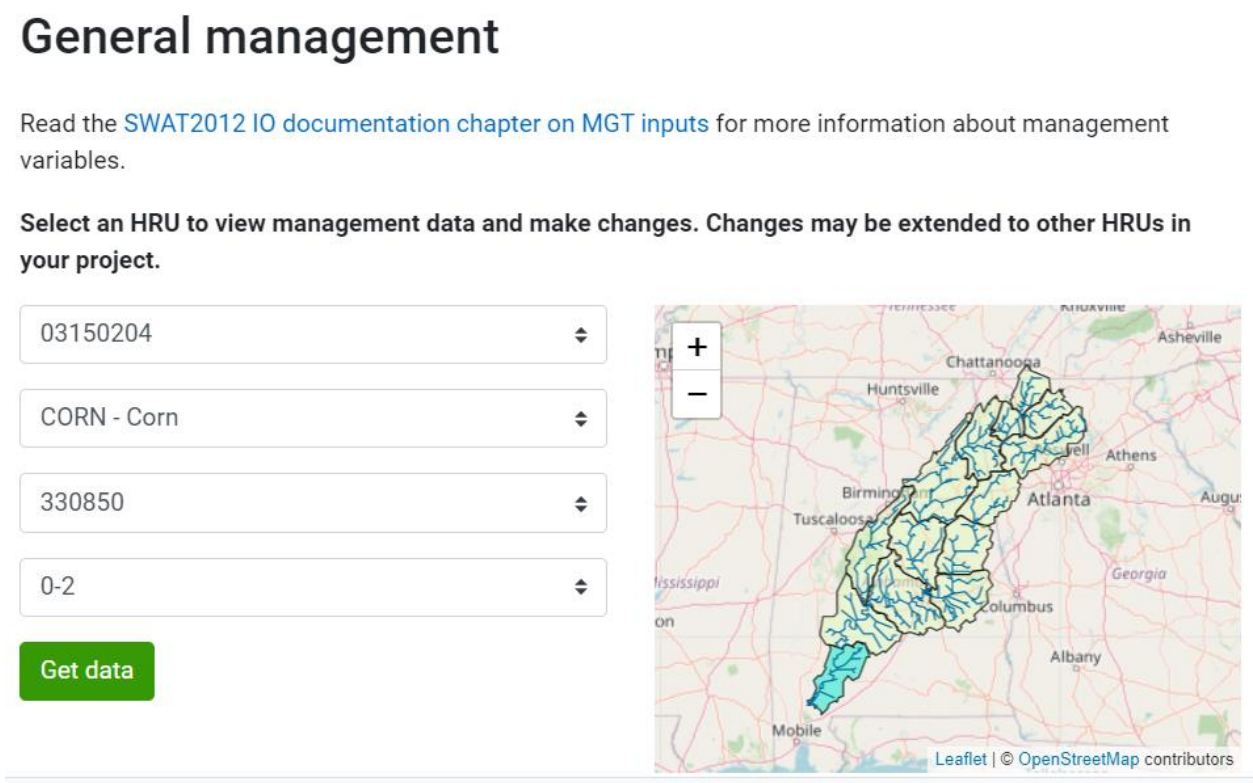
Upload data

Drag a zip file of CSV files into the space below. For daily, monthly, and yearly point source data, you will have one file for each subbasin in your project. For constant point source data, you will have a single CSV file containing data for each subbasin on a separate row.

Drop files here to upload



Agriculture Management, BMPs, and Conservation Practices - General Parameters

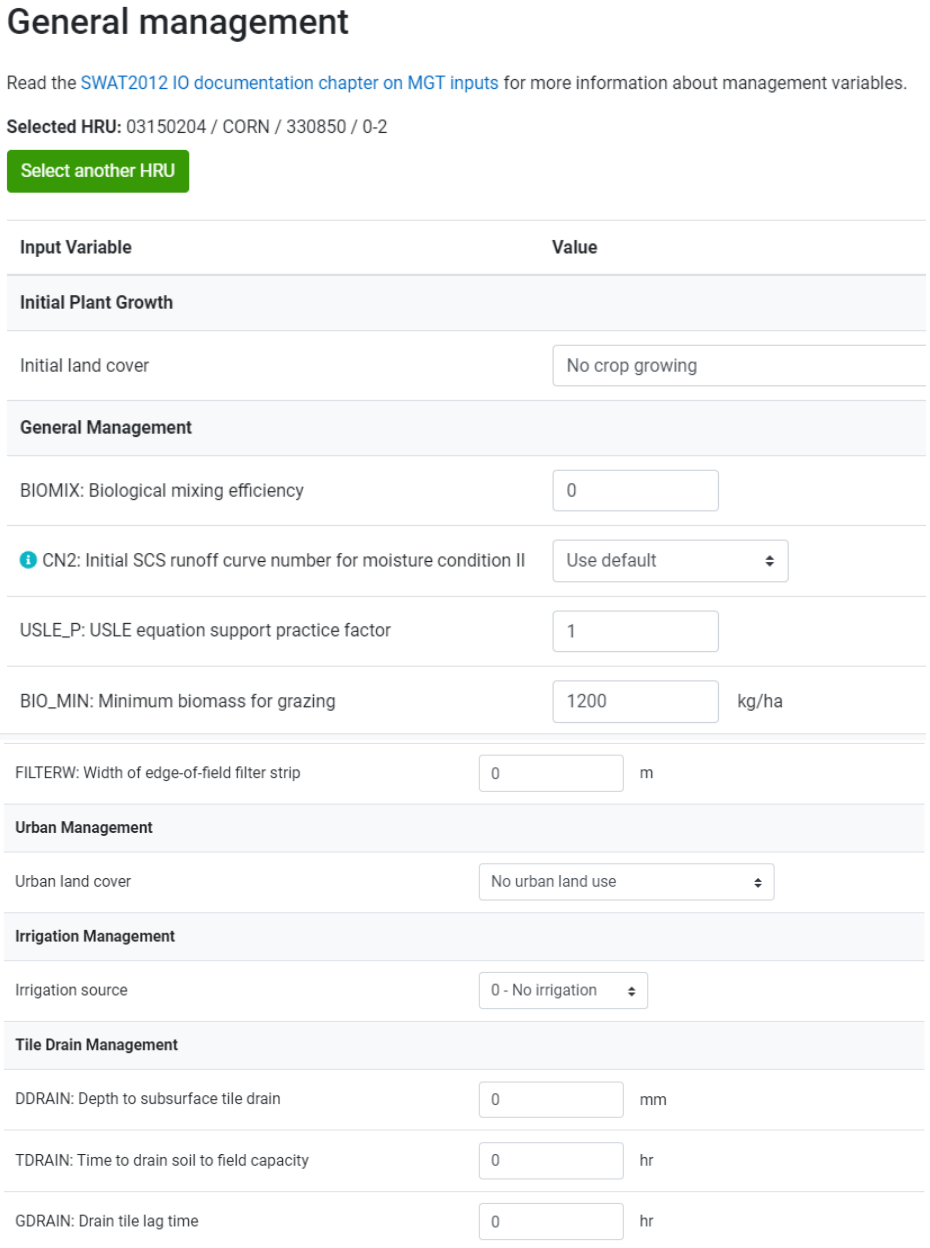


Step 1

To modify general parameters, select that option under the "Ag management/BMPs/Conservation practices" menu.

Start by selecting the subbasin of interest, the land use type, soil, and finally the slope, then select "Get data".

Note, users have the option to make the same changes to multiple subbasins, land uses, soils, and slopes in Step 3.



Agriculture Management, BMPs, and Conservation Practices - General Parameters

Step 2

Users can modify various general management parameters under categories of initial plant growth and general, urban, irrigation, and tile drain management.

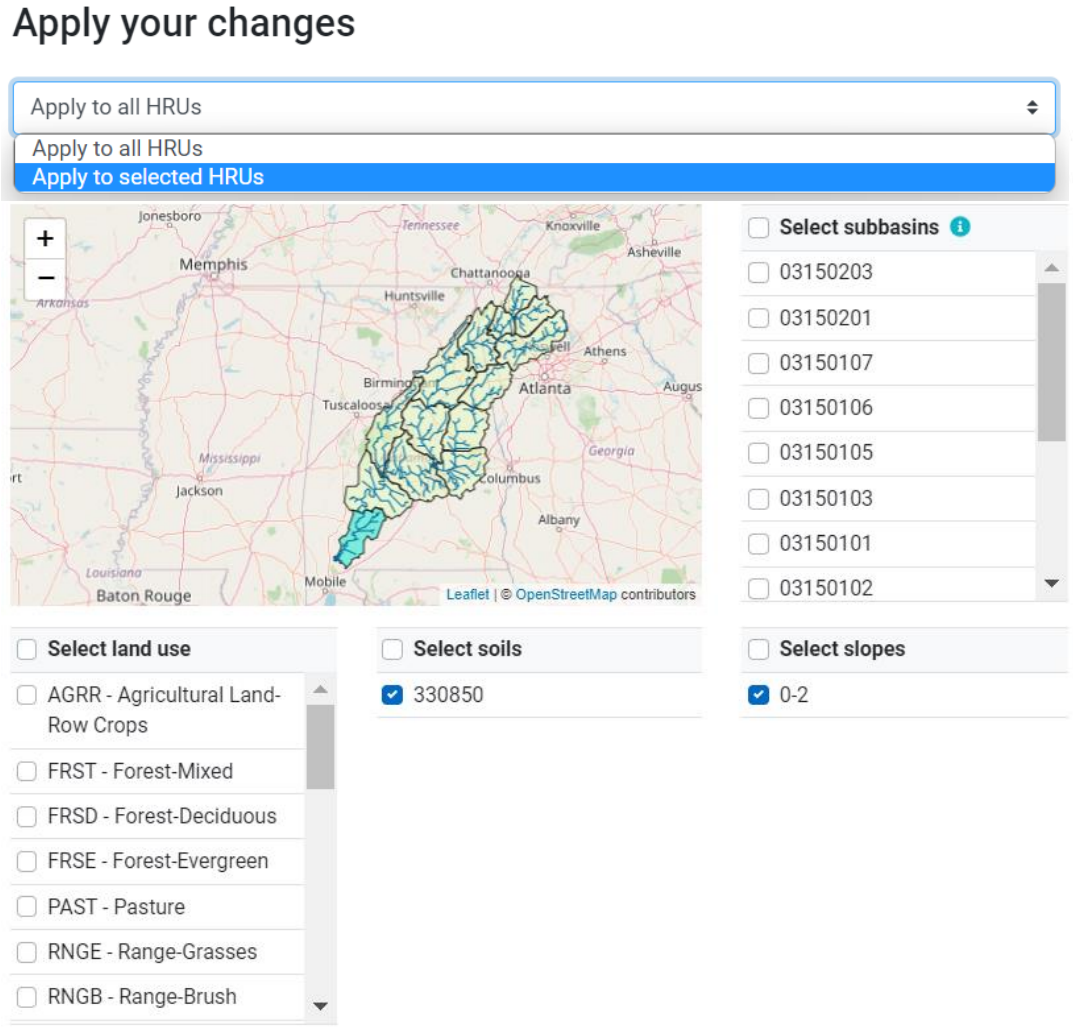
Agriculture Management, BMPs, and Conservation Practices - General Parameters

Step 3

After making the modifications to the parameters, users can decide how to save the management changes.

From the dropdown menu, users can apply the changes to all HRUs in the watershed or select HRUs in the watershed.

If applying the changes to select HRUs, additional dropdown menus will be available to select the relevant subbasins, land use types, soils, and slopes.



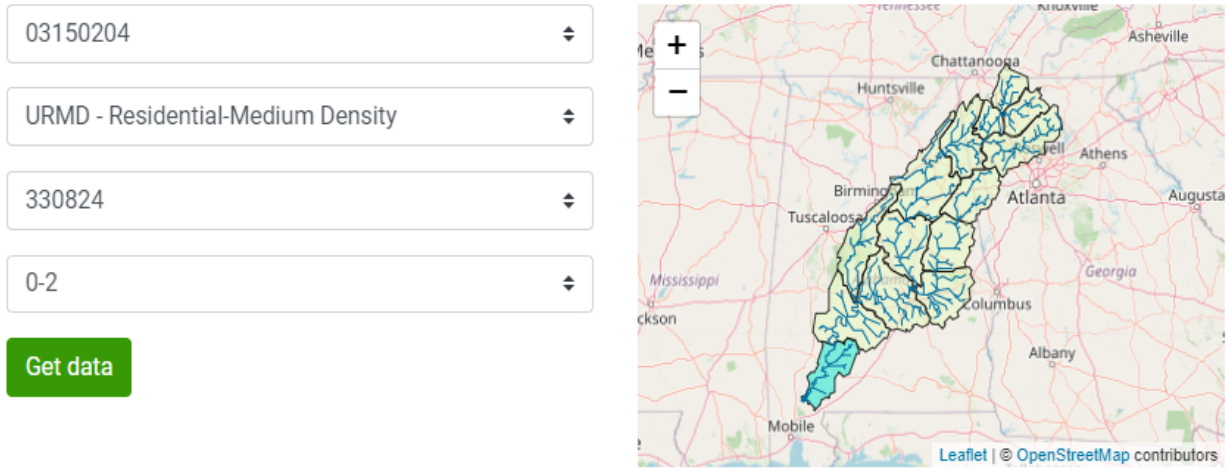
Agriculture Management, BMPs, and Conservation Practices - Operations Management



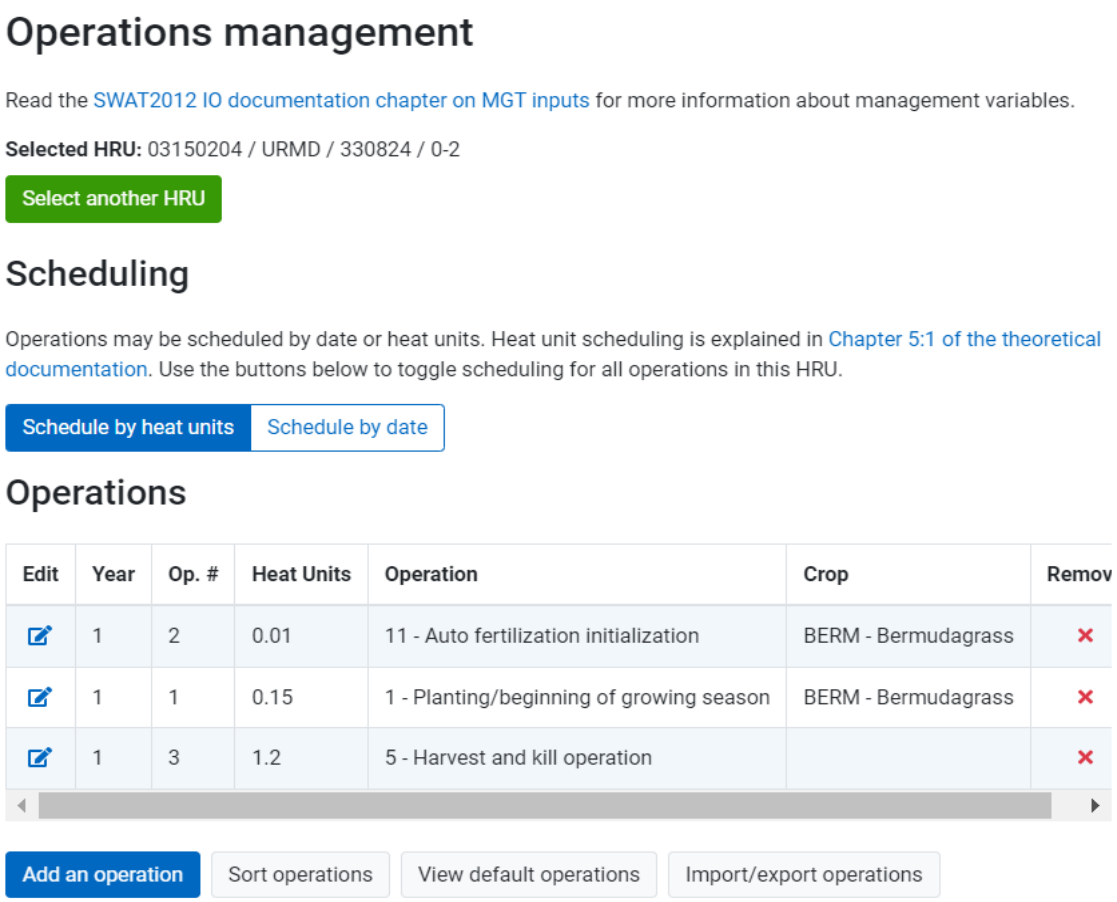
Step 1

To modify operations management, select that option under the “Ag management/BMPs/Conservation practices” menu.

Start by selecting the subbasin of interest, the land use type, soil, and finally the slope, then select “Get data”.



Agriculture Management, BMPs, and Conservation Practices - Operations Management

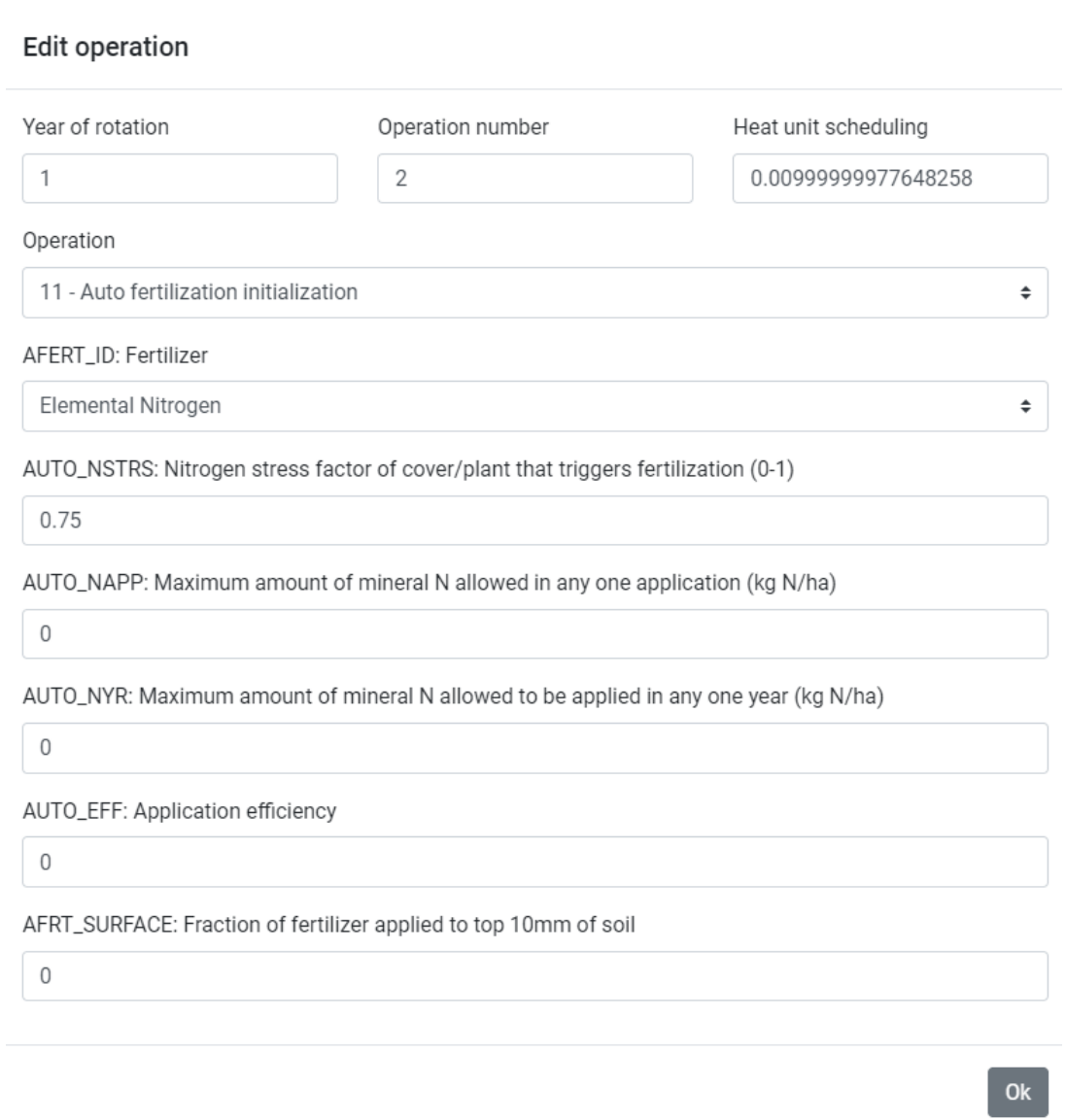


Step 2

The next screen displays the current operations for the selected HRU. Users can view operation by heat units or by date.

Here users can either edit a current operation by selecting the icon or select “Add an operation” to create a new operation.

There are also tabs to sort operations, view default operations, or open the input/export operations option (which will be discussed in the alternative Step 4).



Agriculture Management, BMPs, and Conservation Practices - Operations Management

Step 3

The next screen provides the options to edit an existing operation or create a new operation.

Agriculture Management, BMPs, and Conservation Practices - Operations Management

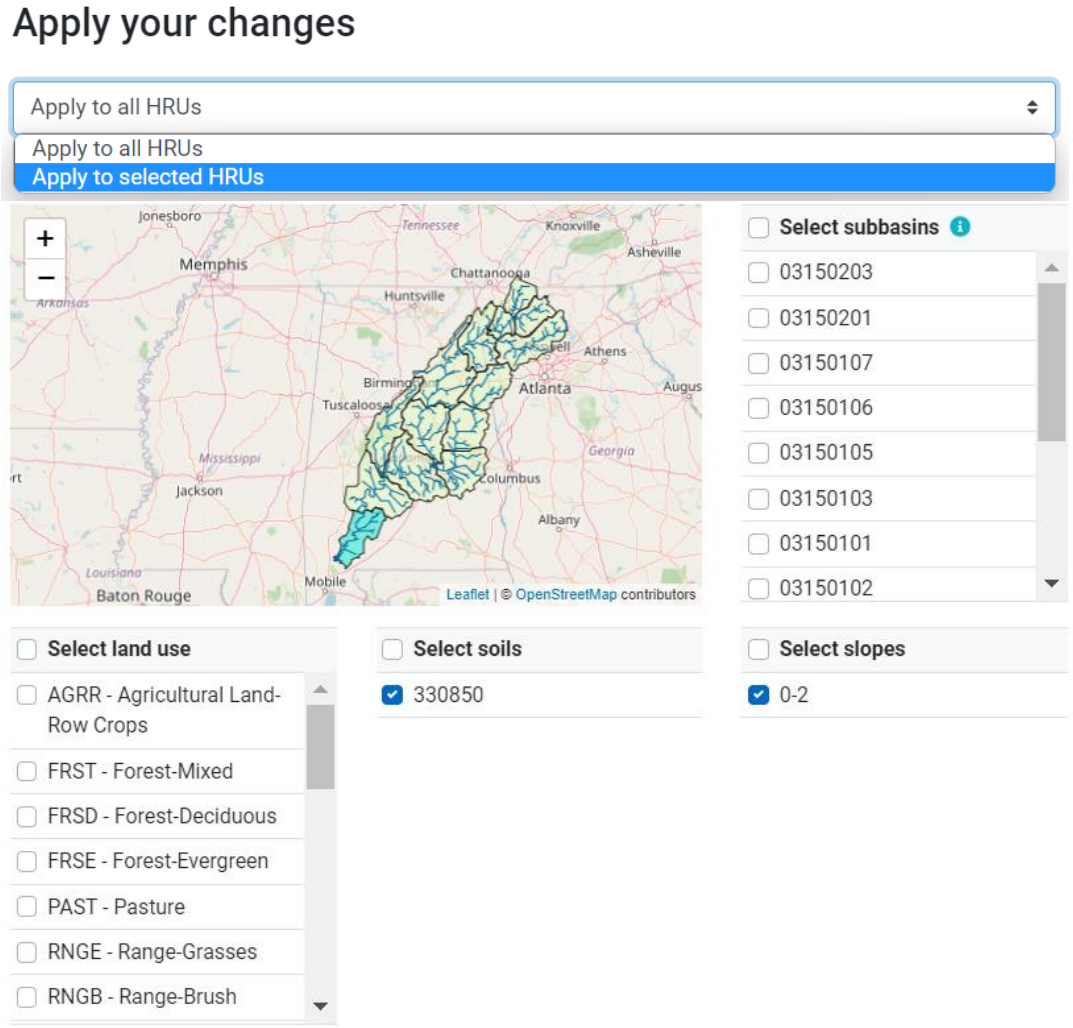
Step 3 (cont.)

From the dropdown menu, users can apply the changes to all HRUs in the watershed or select HRUs in the watershed.

If applying the changes to select HRUs, additional dropdown menus will be available to select the relevant subbasins, land use types, soils, and slopes.

After all the HRUs are selected to receive the changes, select “Ok”.

This will add the modified or new operation into the list on the previous screen.



Agriculture Management, BMPs, and Conservation Practices - Operations Management

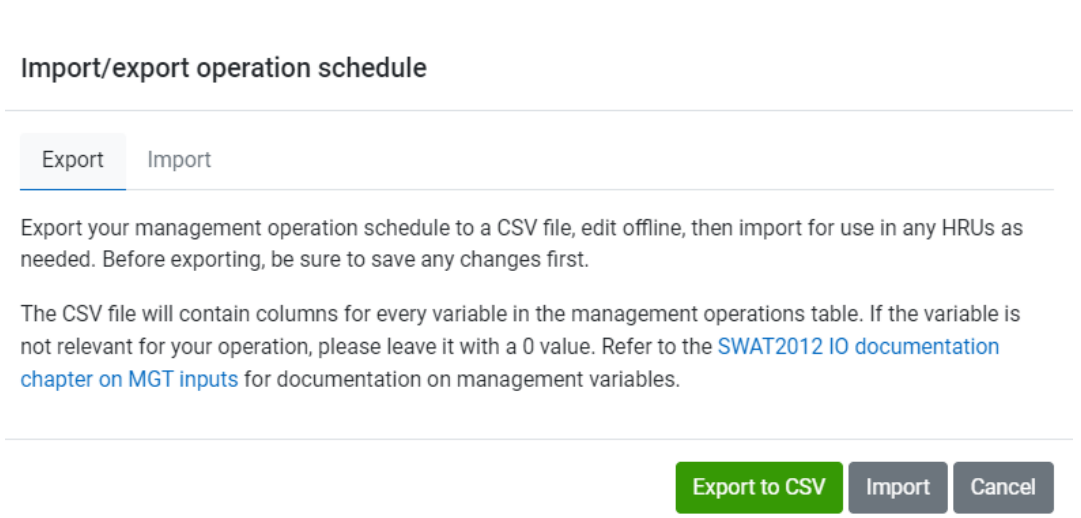
Alternative (Step 4)

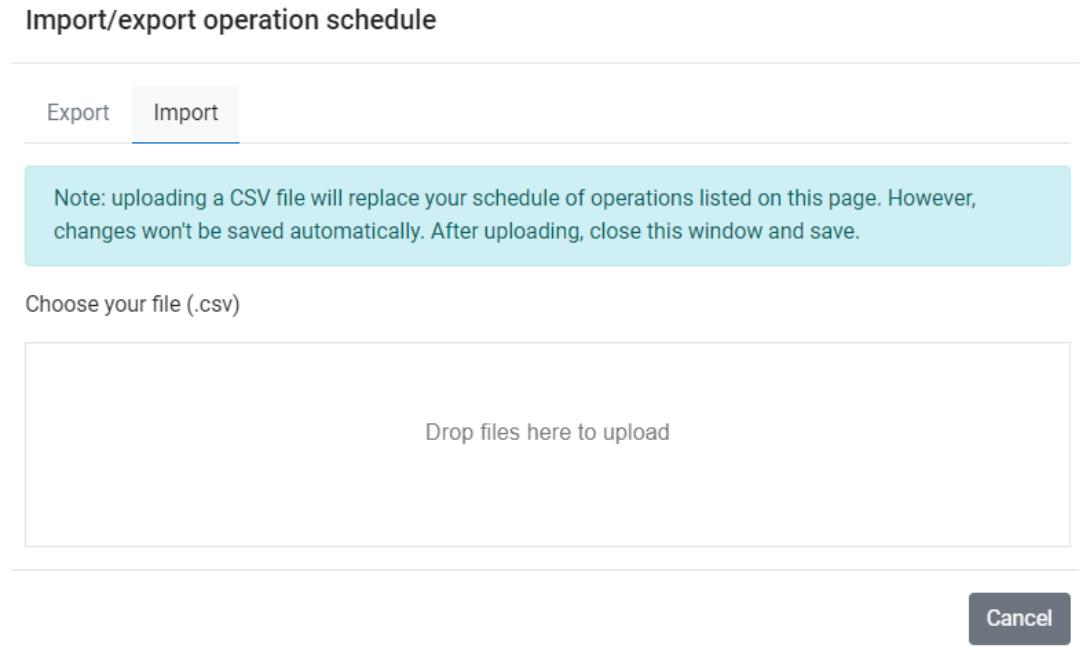
Alternatively, select the import/export tab under the operations management menu.

Here, users can export the project operations to a .csv file by selecting the “Export to CSV” button.

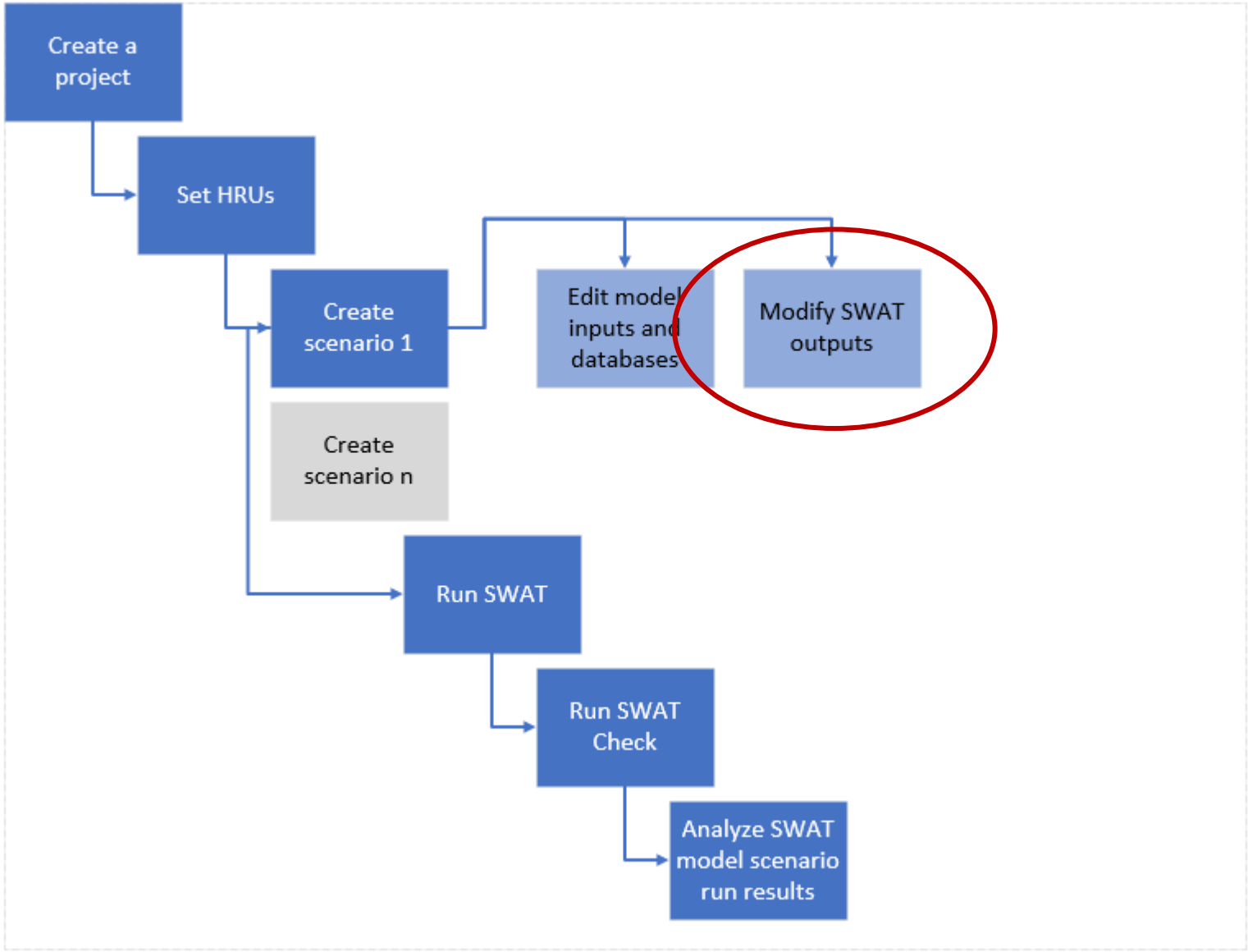
Users can modify or add operations to this file offline, then select the “Import” button to upload the new project operations schedule.

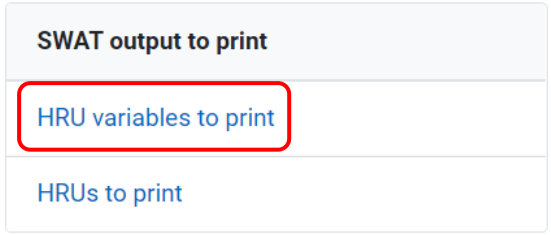
On the import page screen, drop the newly created .csv file into the “Drop files here to upload” region of the page.

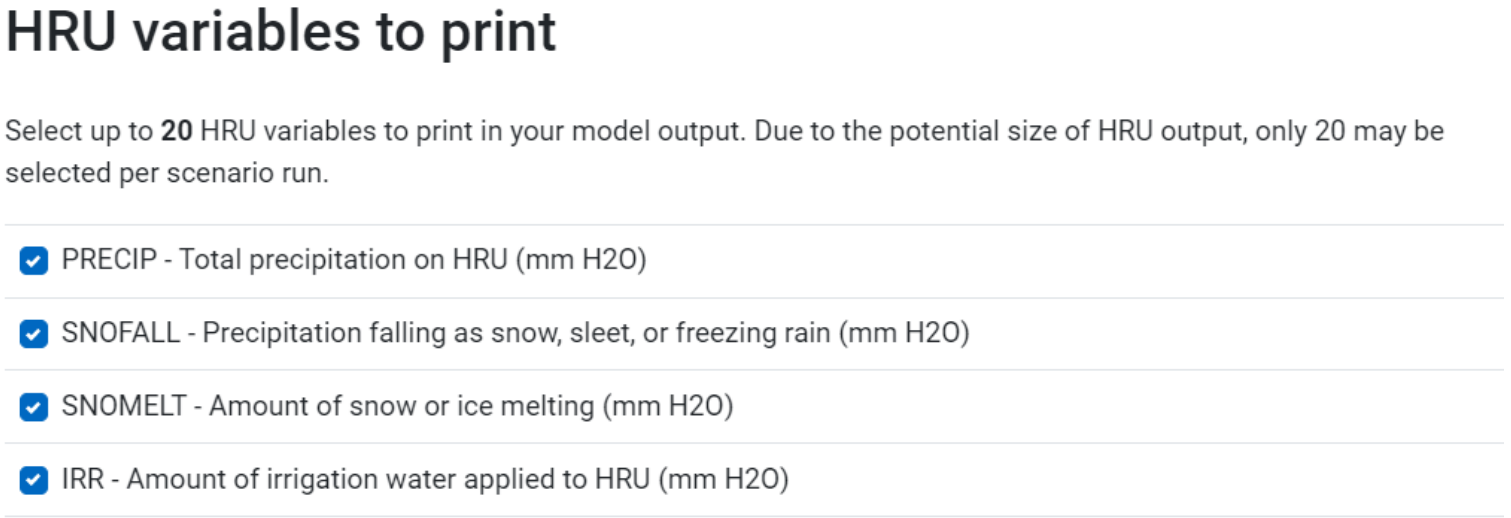




Modify SWAT outputs





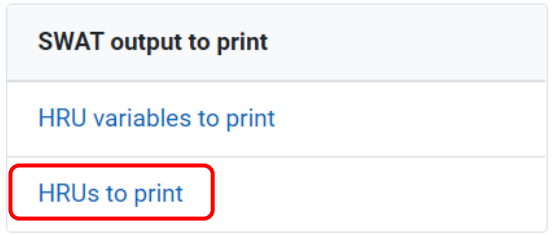


Step 1

If interested in printing HRU output from the scenario run, select “HRU variables to print” under “SWAT output to print”.

Users can select up to 20 variables.

Note: If no selection is made here, users will not have the option to view HRU outputs after the model finishes running.



Step 2

Next, select “HRUs to print” under “SWAT output to print”.

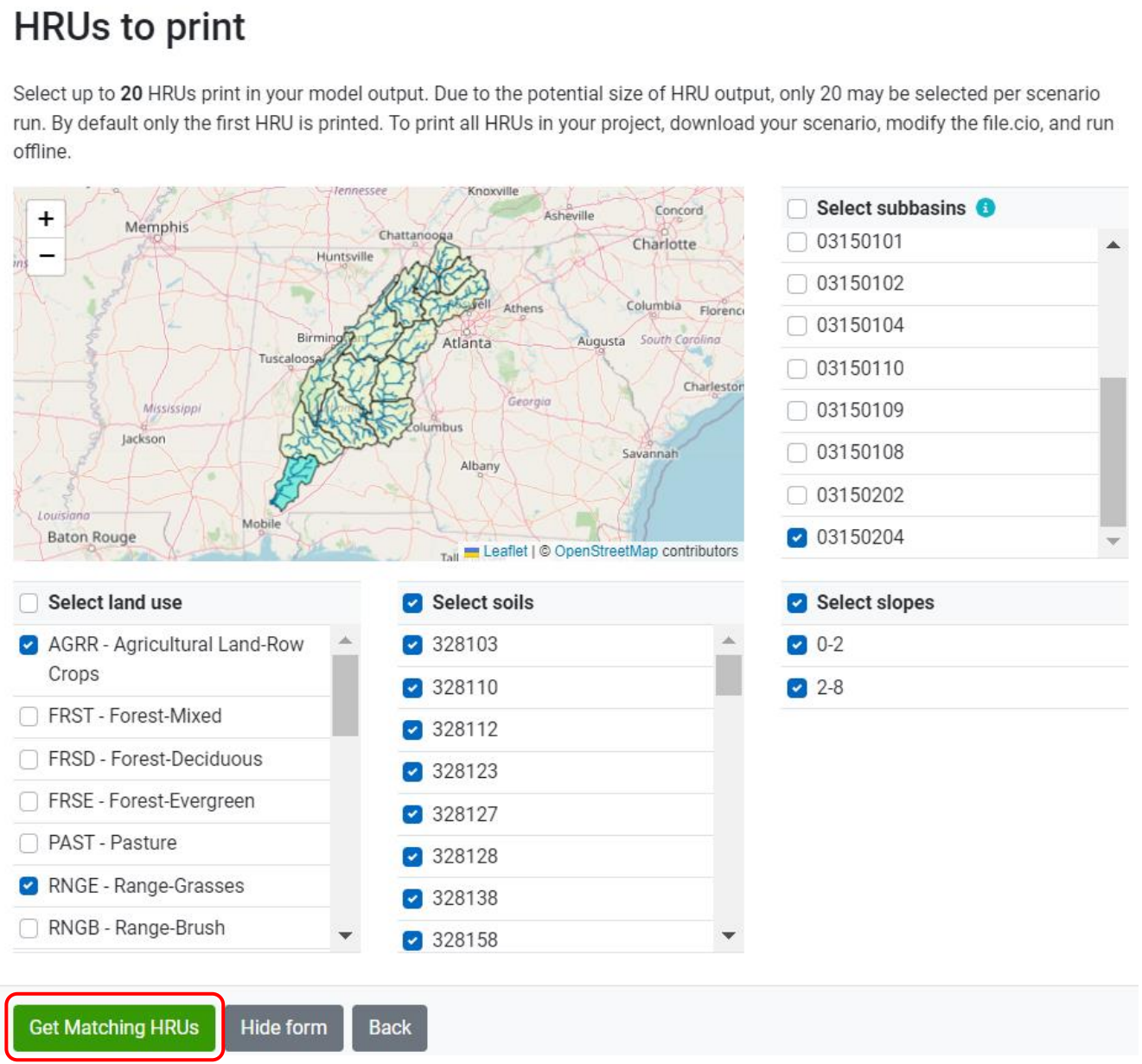
Select the subbasin(s) of interest.

Select the land use of interest.

Select the soils of interest.

Select the slopes of interest.

Select “Get Matching HRUs”.



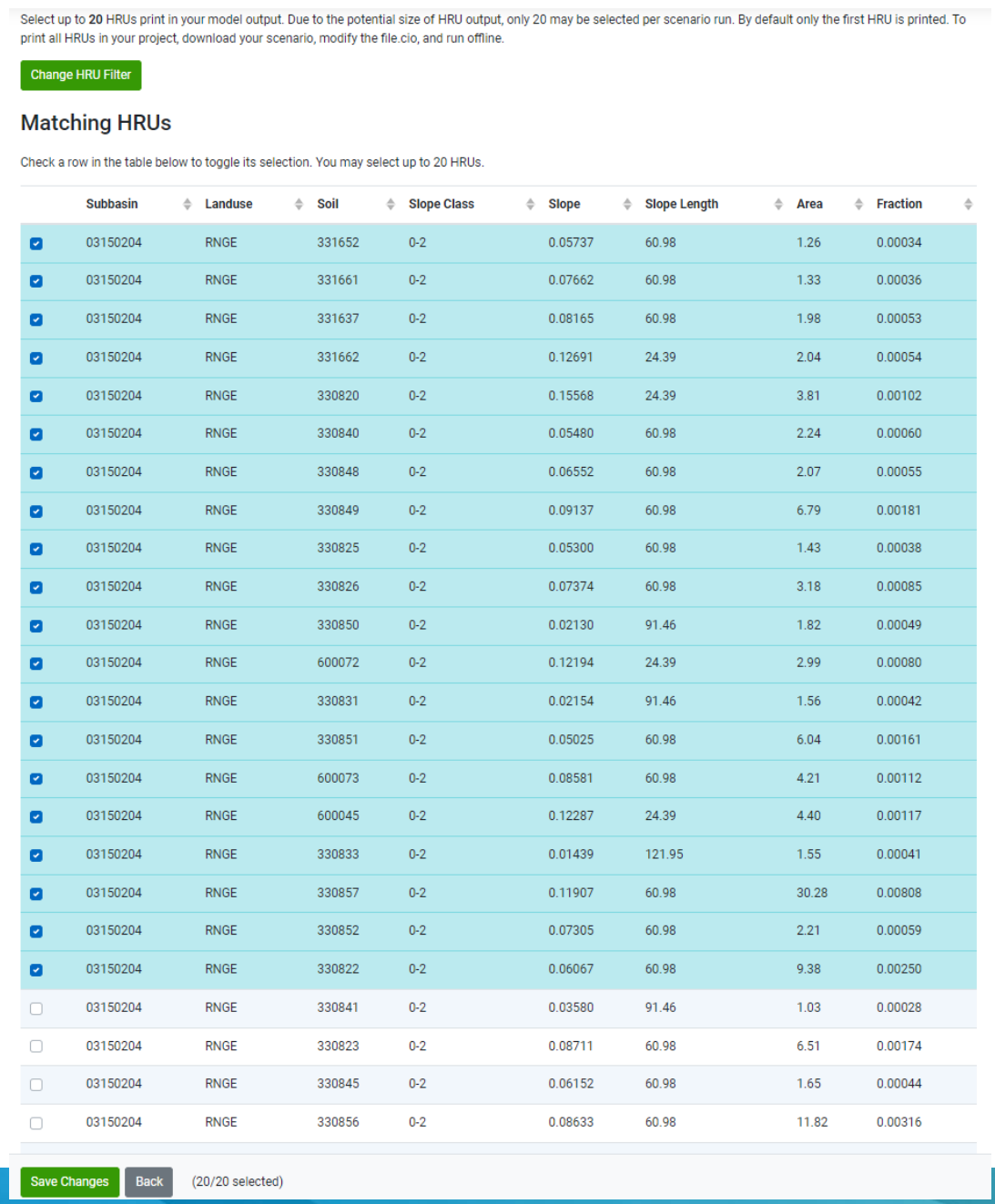
Step 3

From the list of matching HRUs, users can only select 20 total HRUs to print.

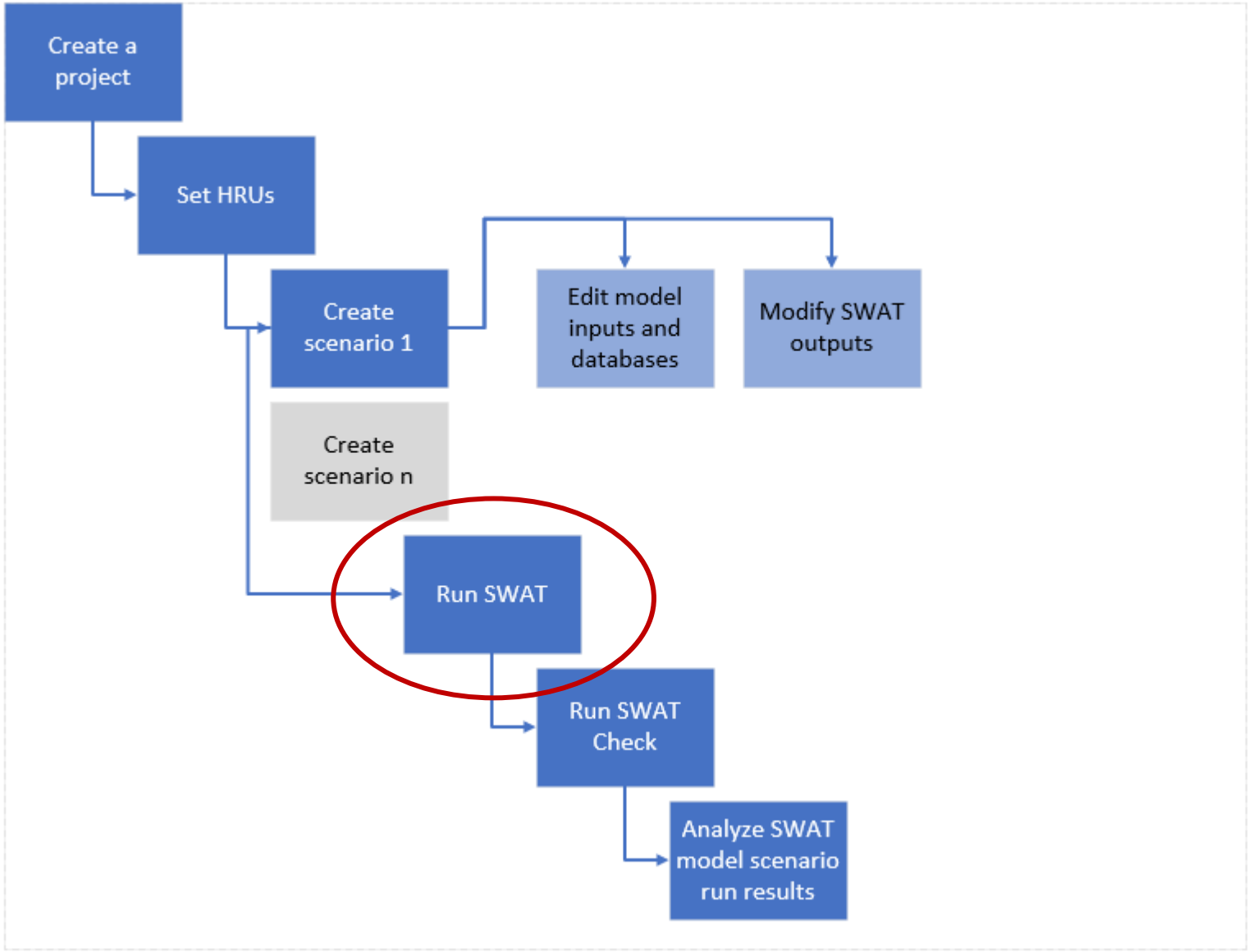
If all HRUs are desired, then download the scenario (from the Project Summary page), modify the .cio file, and run the model offline.

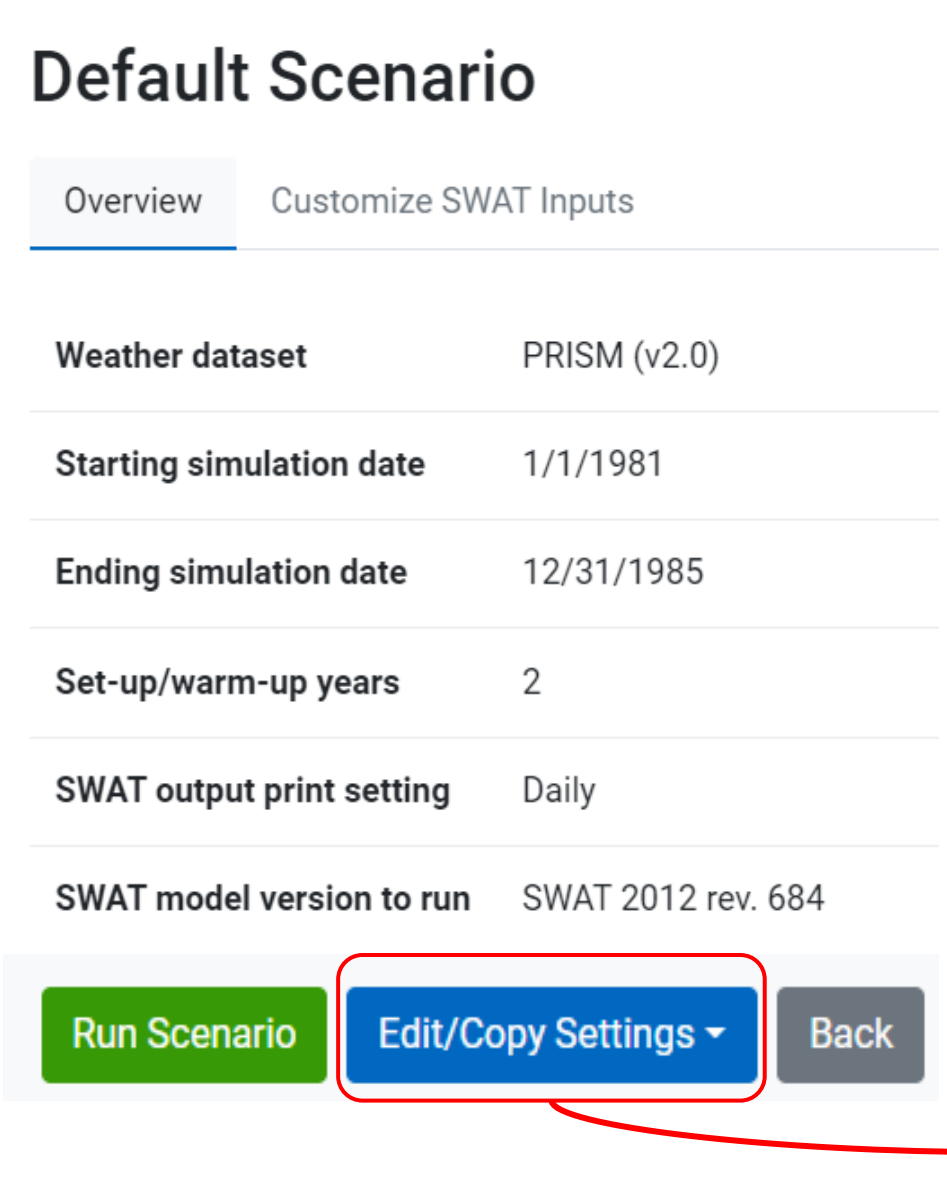
To change the HRU filter selected, select “Change HRU Filter” on the top of the screen, and reselect the criteria.

After selecting the 20 HRUs of interest, select “Save Changes”.



Run SWAT

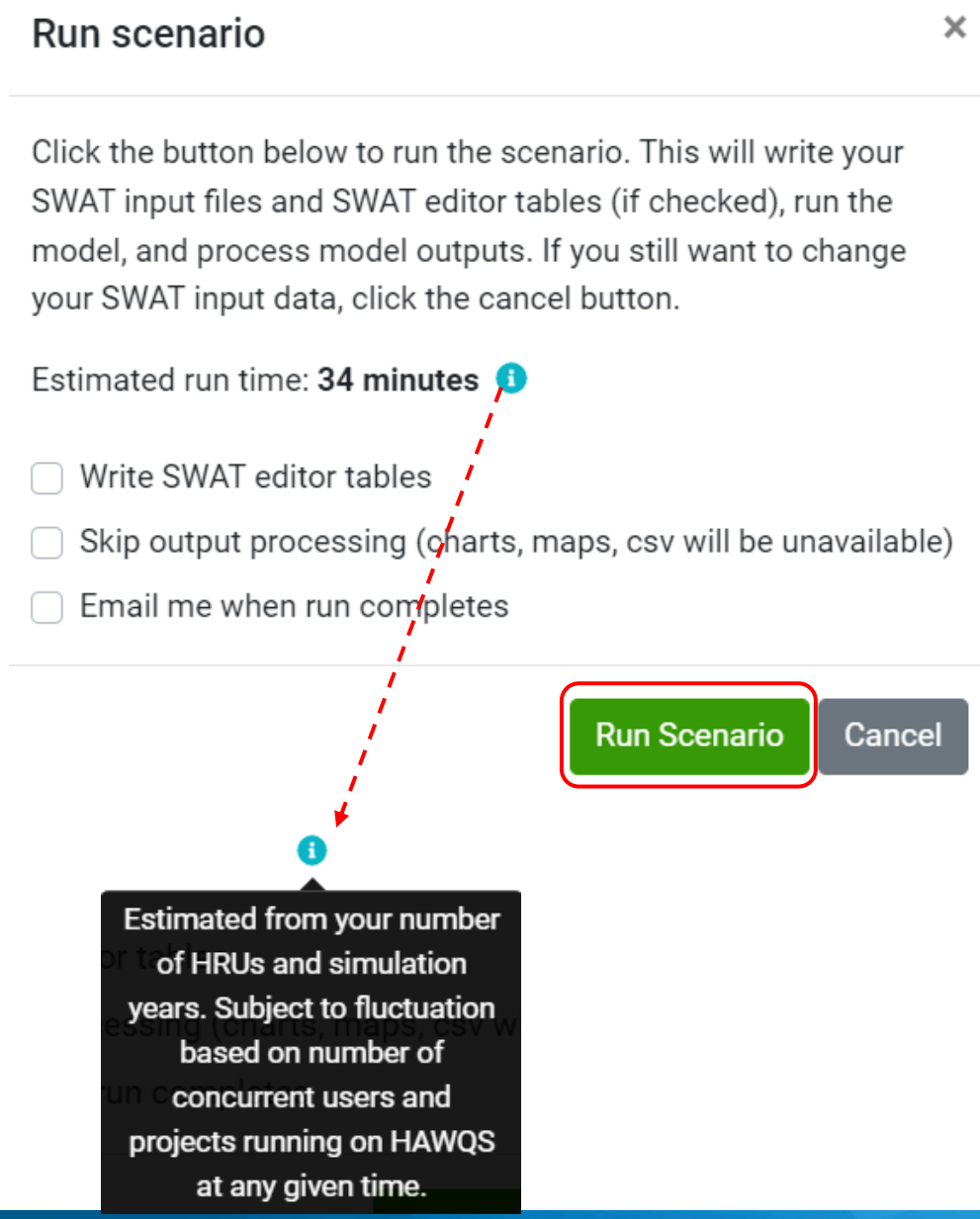

Create a project
Set HRUs
Create scenario 1
Edit model inputs and databases
Modify SWAT outputs
Create scenario n
Run SWAT
Run SWAT Check
Analyze SWAT model scenario run results



Step 1

After customizing all the desired SWAT inputs, return to the "Overview" tab of the scenario.

To edit any of the scenario settings or create a new scenario with the same modifications, select the "Edit/Copy Settings" button.



Step 2

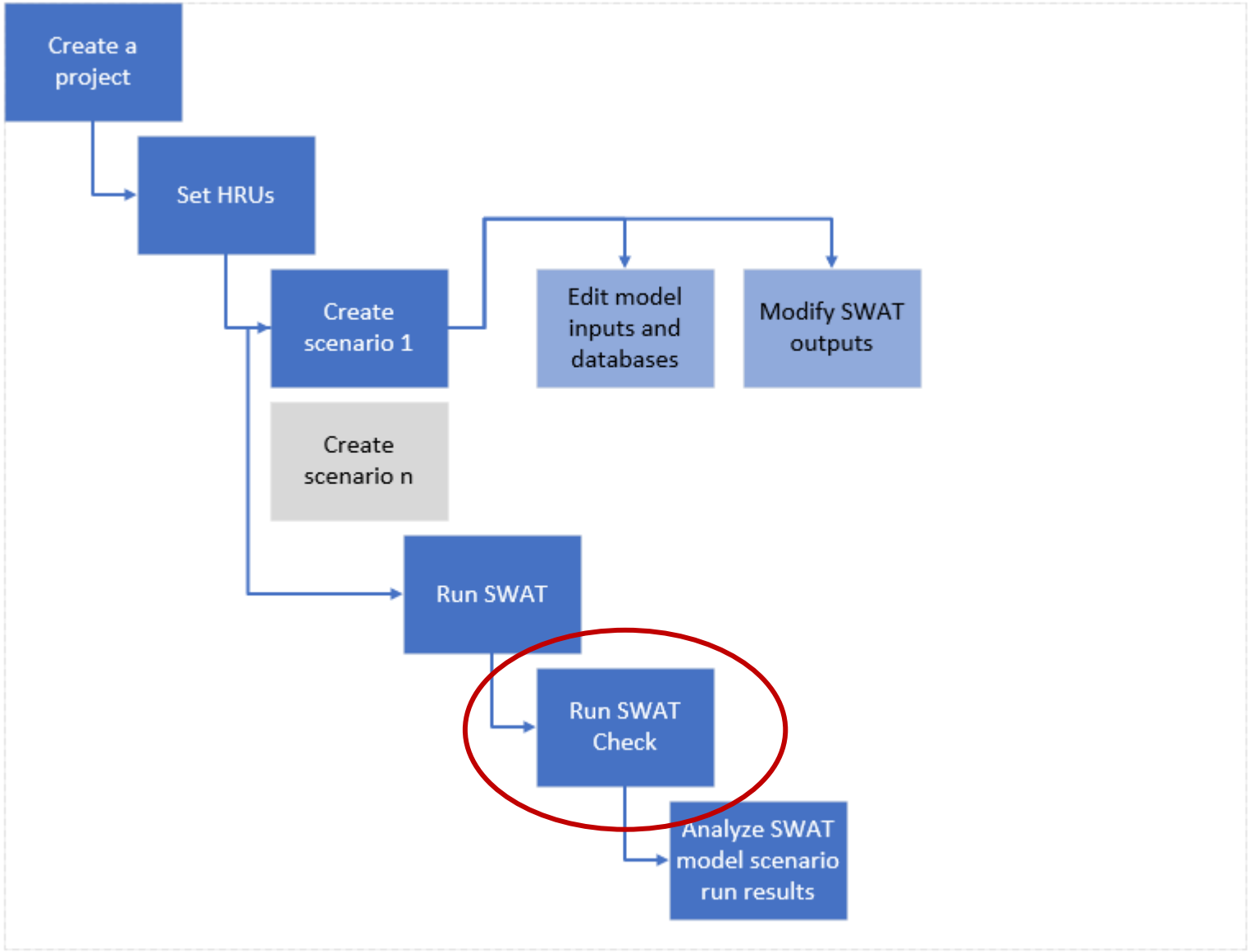
When ready to run the scenario, select the “Run Scenario” button.

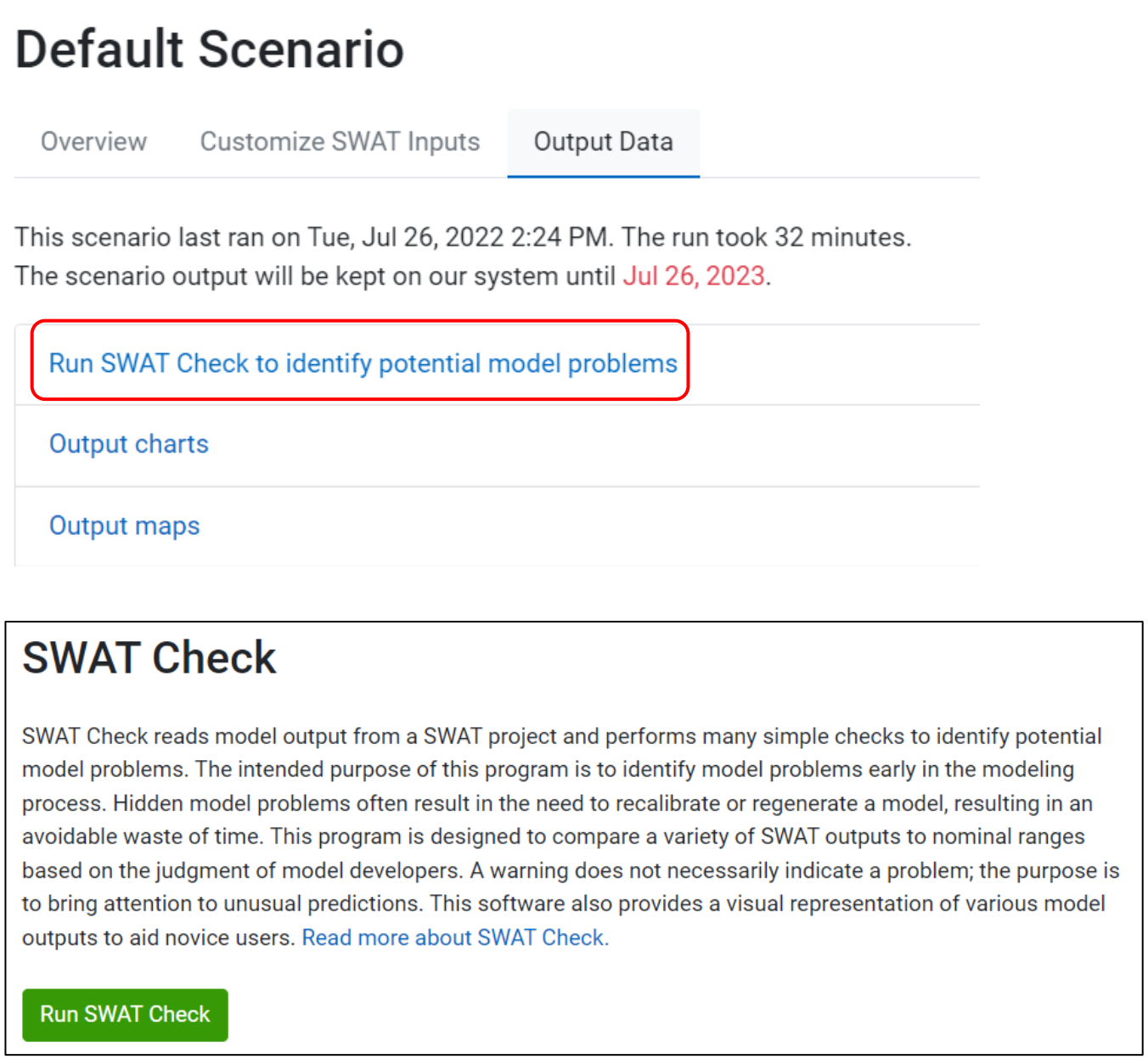
This will open a “Run scenario” menu. From here, as desired, select to write SWAT editor tables or skip output processing. Both options will impact the estimated run time.

In addition, users have the option to select the option to receive an email upon completion of the run.

Once satisfied with the selections, click the “Run Scenario” button to begin running the model.

Run SWAT Check





Run SWAT Check

After the run is complete, an “Output Data” tab will be available.

From that screen, there will be an option to run SWAT Check and create output charts or maps.

Select “Run SWAT Check to identify potential model problems”.

The next screen provides some details about SWAT Check.

Finally, select “Run SWAT Check” to run the software.

SWAT Check - Details

After SWAT Check is finished, the results will display with the "Simulation Details" tab shown by default.

SWAT Check

SWAT Check reads model output from a SWAT project and performs many simple checks to identify potential model problems. The intended purpose of this program is to identify model problems early in the modeling process. Hidden model problems often result in the need to recalibrate or regenerate a model, resulting in an avoidable waste of time. This program is designed to compare a variety of SWAT outputs to nominal ranges based on the judgment of model developers. A warning does not necessarily indicate a problem; the purpose is to bring attention to unusual predictions. This software also provides a visual representation of various model outputs to aid novice users. Read more about SWAT Check.

Results

Simulation Details | Hydrology | Sediment | Nitrogen Cycle | Phosphorus Cycle | Plant Growth | Landscape Nutrient Losses | Land Use Summary | Instream Processes | Point Sources | Reservoirs

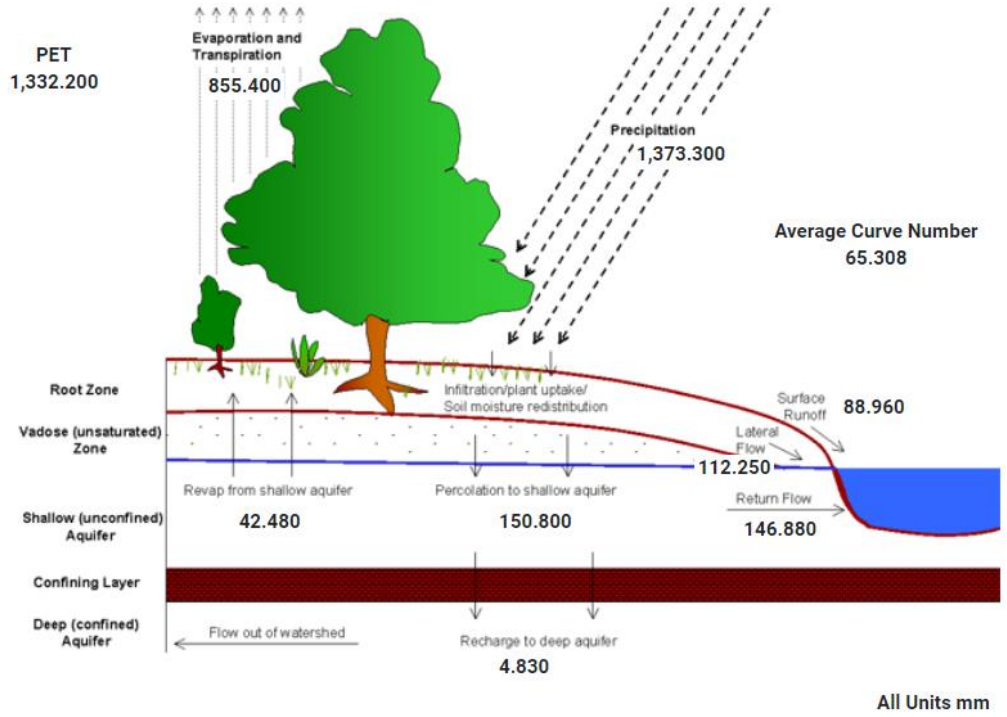
Version	SWAT May 17 VER 2022/Rev 684	**Output Timestep**	Daily
Simulation Length (yrs)	5	**Precipitation Method**	Measured
Warm-up (yrs)	2	**Watershed Area (km^2)**	58,205.36
HRUs	8,508		
Subbasins	14		

Results

Simulation Details | Hydrology | Sediment | Nitrogen Cycle | Phosphorus Cycle | Plant Growth | Landscape Nutrient Losses | Land Use Summary | Instream Processes | Point Sources | Reservoirs

Water Balance Ratios

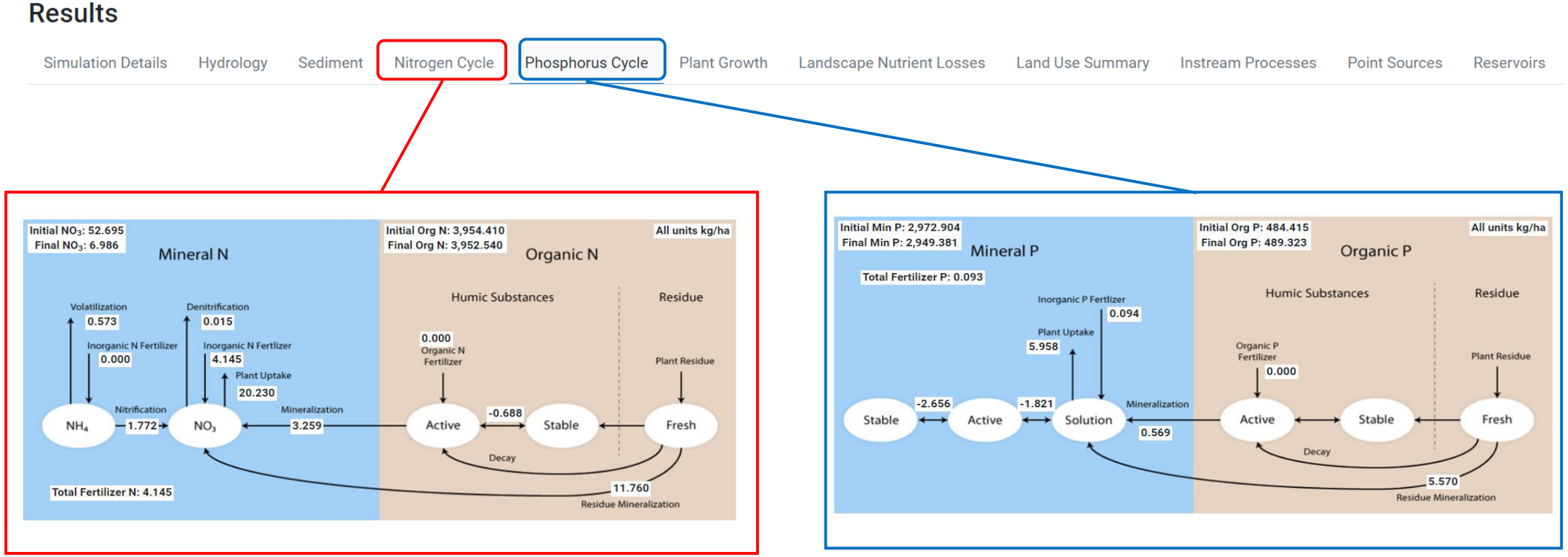
Streamflow/Precip	0.253
Baseflow/Total Flow	0.744
Surface Runoff/Total Flow	0.256
Perc/Precip	0.110
Deep Recharge/Precip	0.004
ET/Precipitation	0.623



SWAT Check - Hydrology

The model hydrology summary can be viewed under the "Hydrology" tab.

Water balance ratios are shown along with a schematic of the overall hydrology cycle and average watershed values.



SWAT Check – Nutrient Cycles

From the Nitrogen and Phosphorus Cycle tabs, users can view both the mineral and organic component for each nutrient within the watershed.

Results

Simulation Details | Hydrology | Sediment | Nitrogen Cycle | Phosphorus Cycle | Plant Growth | Landscape Nutrient Losses | Land Use Summary | Instream Processes | Point Sources | Reservoirs

Average Trapping Efficiency (%)

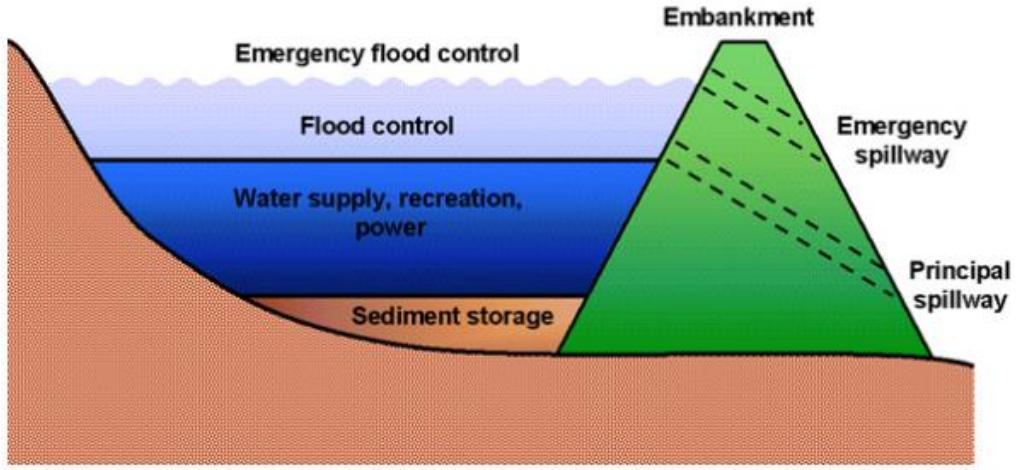
Sediment	-3,215.433
Nitrogen	3.275
Phosphorus	5.002

Average Water Loss (%)

Total Removed + Losses	-1.281
Evaporation	0.028
Seepage	0.000

Average Reservoir Trends

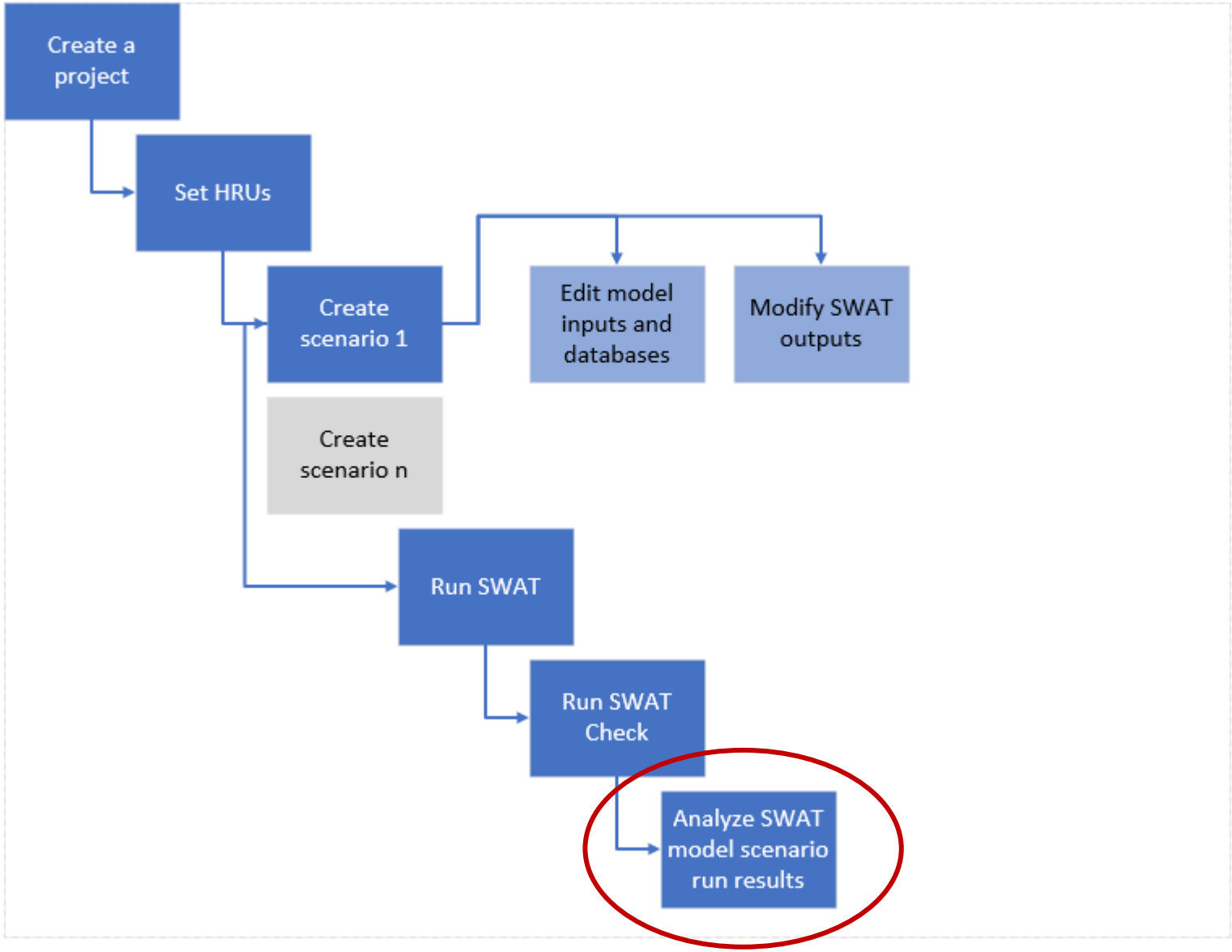
Number of Reservoirs	8.000
Final/Initial Volume (Max)	0.943
Final/Initial Volume (Min)	0.631
Fraction of Period Empty (Max)	0.000

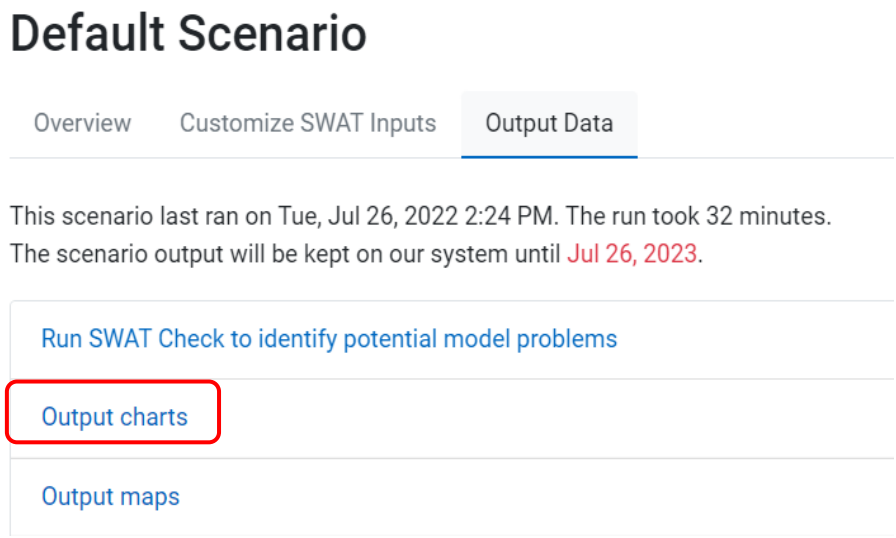


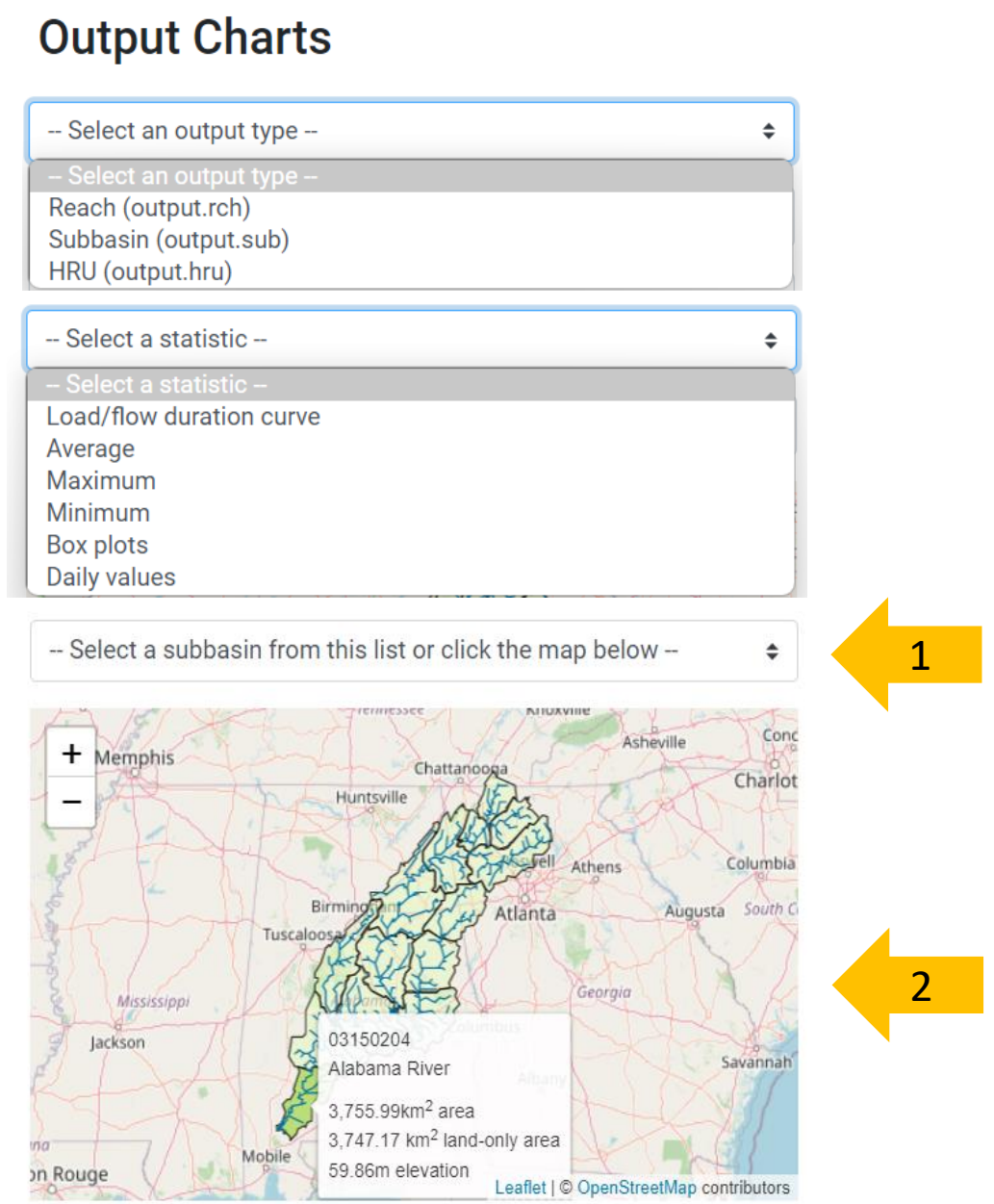
SWAT Check - Reservoirs

From the Reservoirs tab users can view the average trapping efficiency, water loss, and reservoir trends. A visual aid for interpretation is included.

Analyze SWAT outputs







Output Charts

Select the “Output charts” button under the Output Data tab.

Select the output type.

Select the statistic of interest.

There are two ways to select the subbasin of interest, from the drop-down menu, or by selecting it from the map.

Output Charts

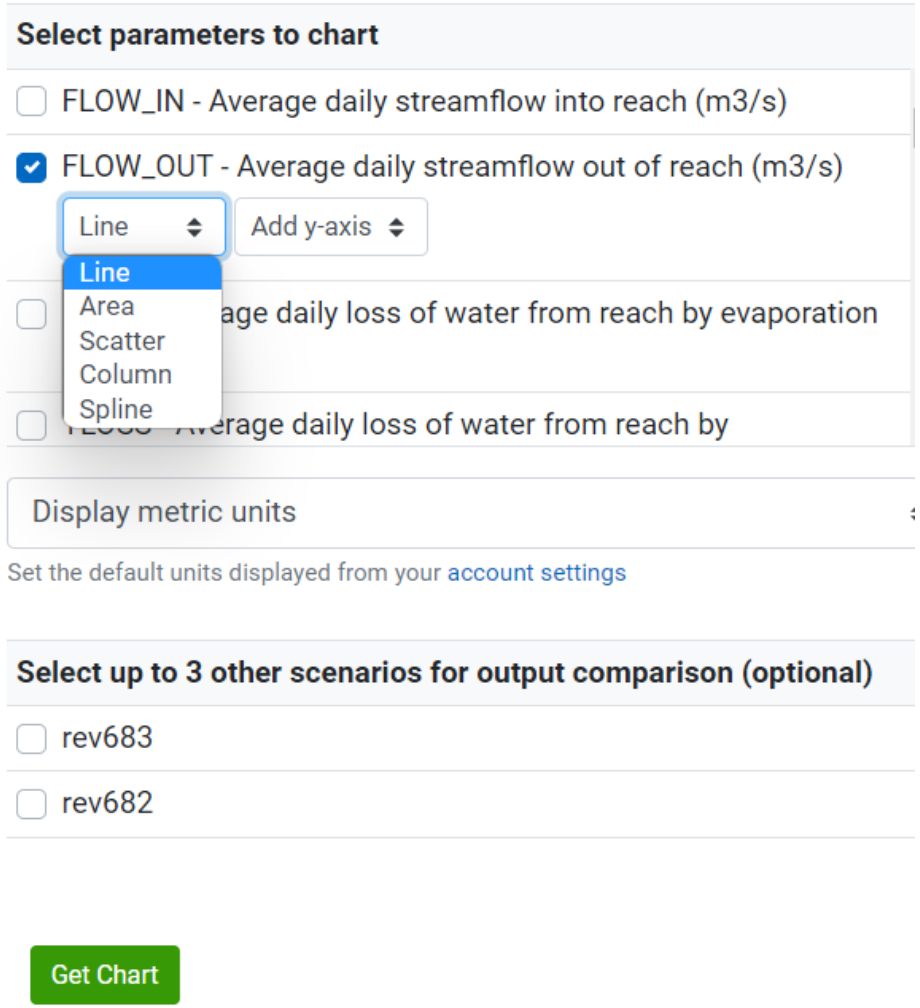
Users can select the parameters of interest to view in a chart.

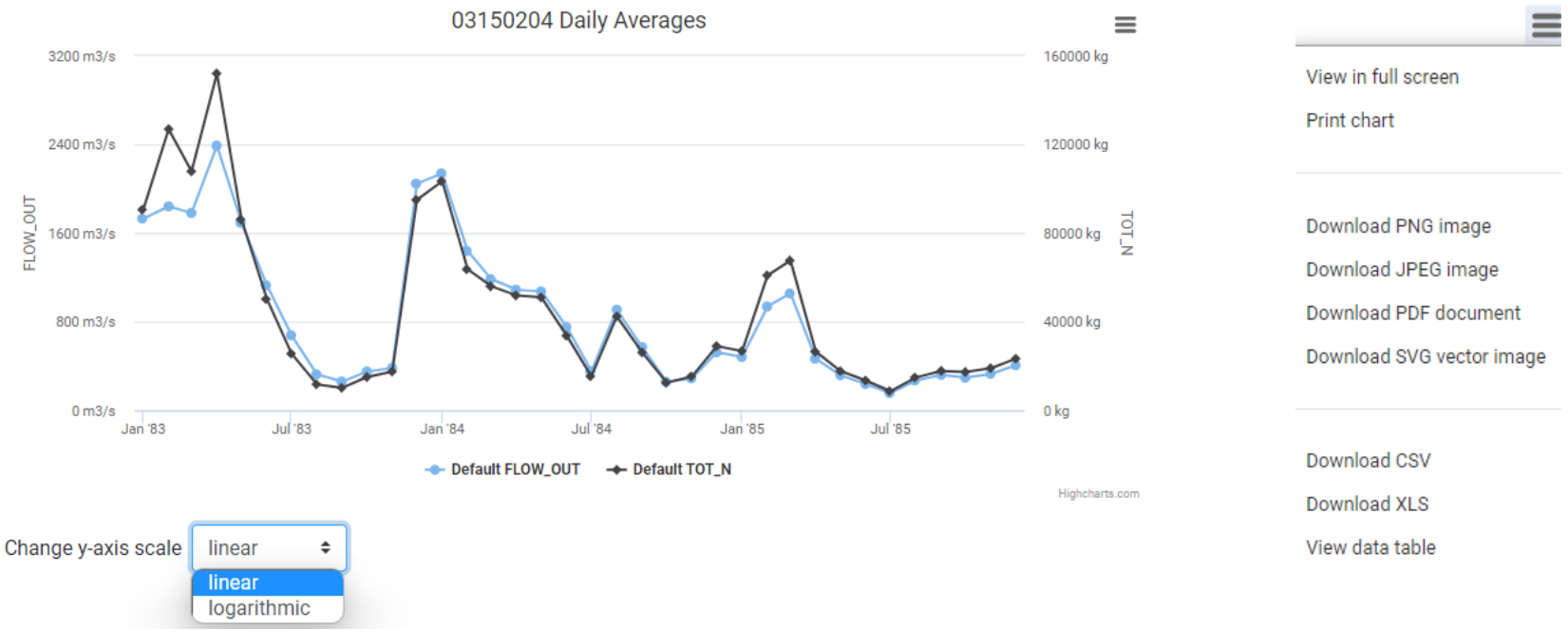
Select the type of chart (line, area, scatter, etc.) and add an additional y-axis label if desired.

Select metric or imperial units.

Users can select up to 3 other scenarios for comparison.

When satisfied with the selections, press the “Get Chart” button to display the chart.

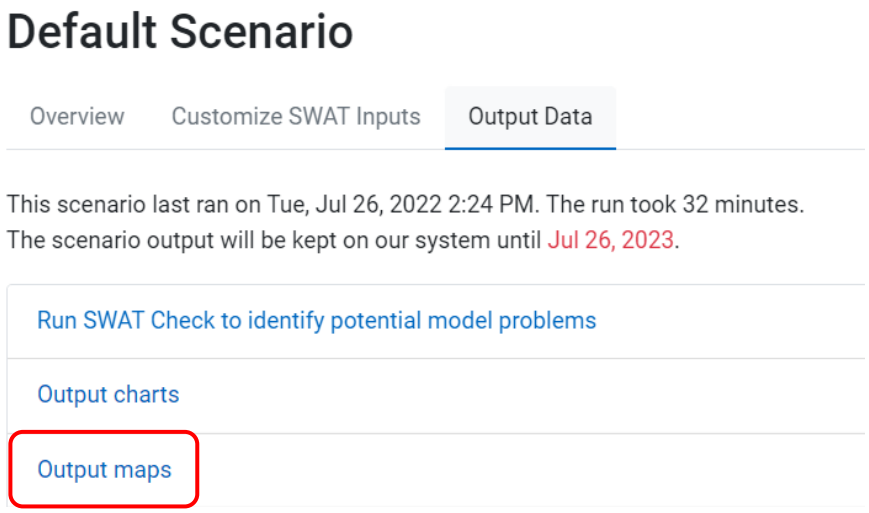


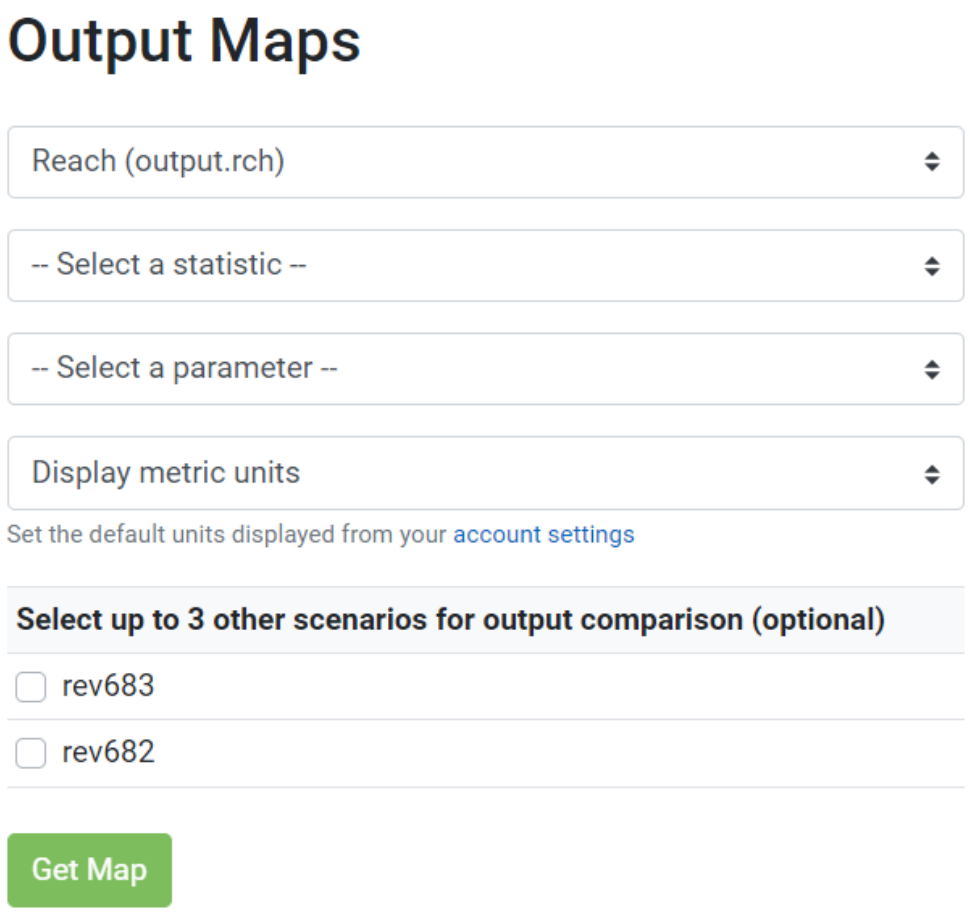


Output Charts

Once the data is displayed as a chart, users can adjust the y-axis scale from linear to logarithmic.

To download or print the chart, select the ☰ icon on the top to display a drop-down menu. From here, select the preferred way to download or view the data.





Output Maps

Select the “Output maps” button under the Output Data tab.

Select the output type.

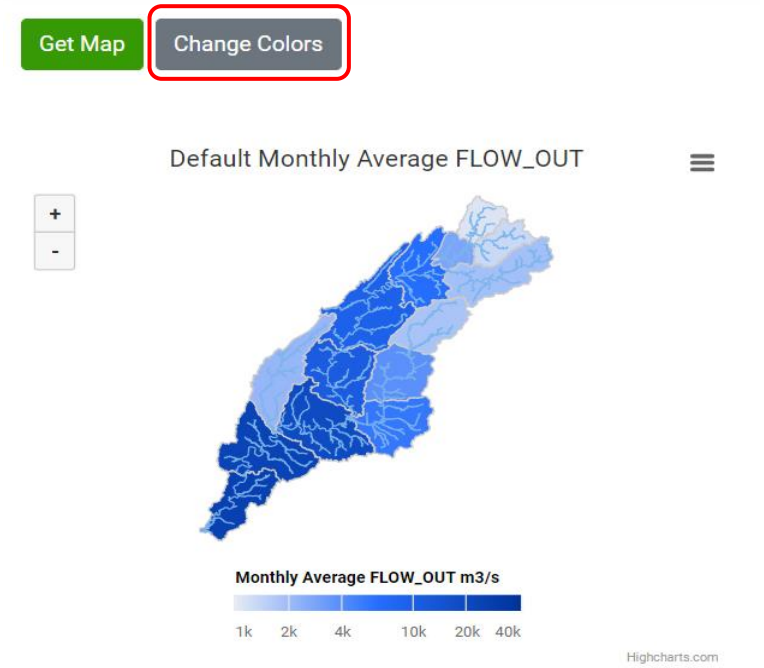
Select the statistic of interest.

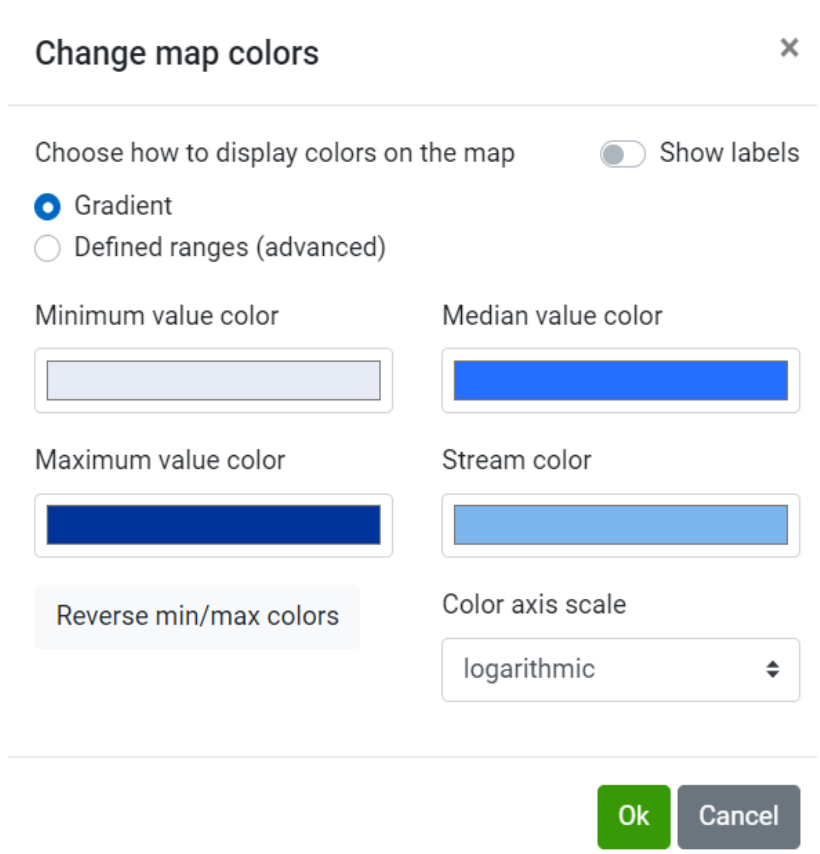
Select the parameter of interest.

Choose either metric or imperial units.

Users can select up to three scenarios for comparison.

When satisfied with the selections, press the “Get Map” button.





Output Maps

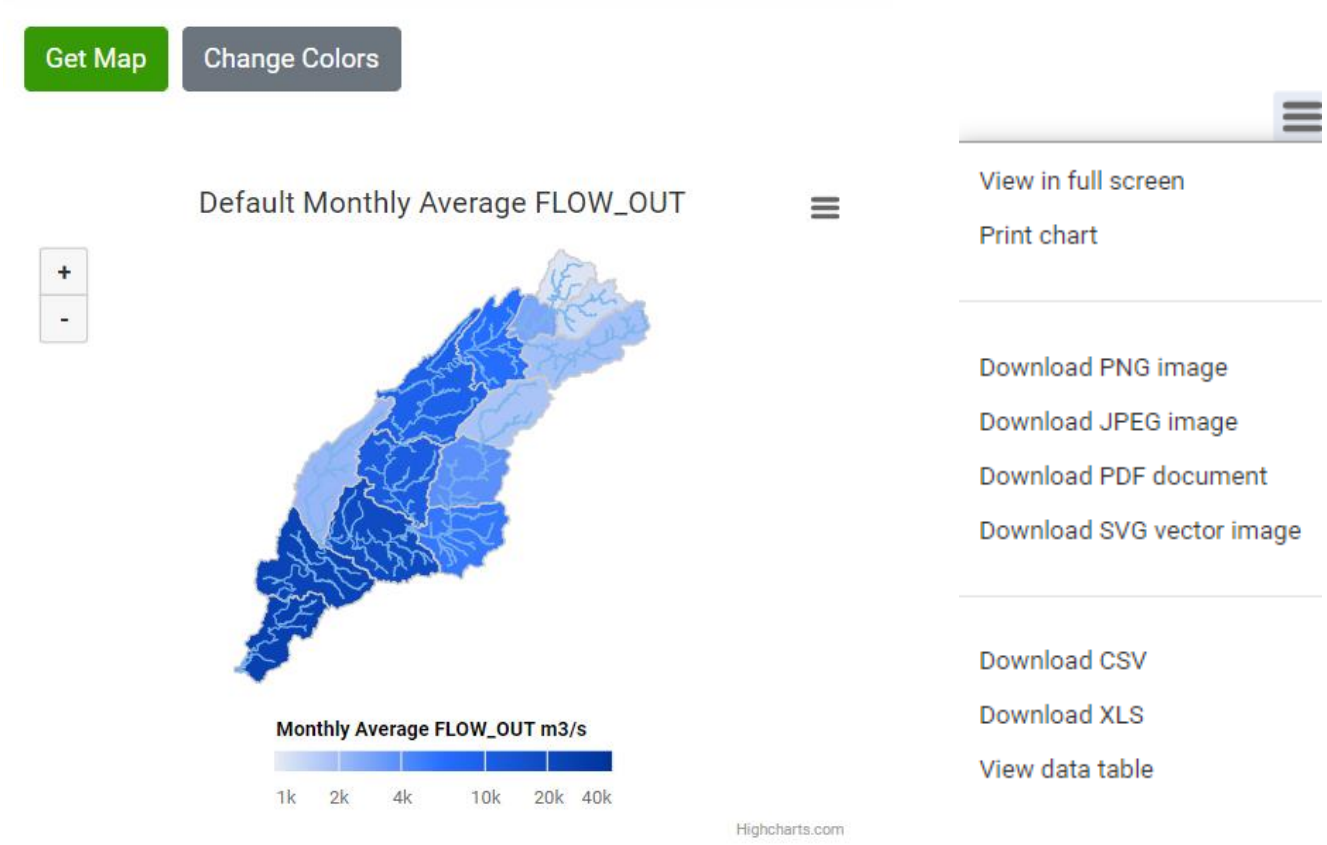
Once the map displays, select the “Change Colors” button to adjust the color scheme on the map.

Here users can choose to hide or show labels, and define the minimum, median, and maximum colors. Users can also choose the color of the streams and change the axis scale from linear to logarithmic.

Once satisfied with the selections, select “Ok” to view the changes on the map.

Output Maps

To download or print the map, select the ☰ icon on the top to display a drop-down menu. From here, select the preferred way to download or view the data.



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