Dam Decision Support Tool Instructions
Step-by-Step with Examples

Welcome! This set of instructions is designed to guide the user through the Dam Decision Support Tool and help the user troubleshoot, should problems arise.

1. Getting Started

Visit http://dams-mcda.gsscdev.com and you will see the following screen.

You will need to create an account and password to logon. Clicking "Create an Account" will bring you to the following registration screen (below). **Tips:** Passwords cannot be too close to the username or any personal information. Passwords cannot be entirely numbers.

Now that you've created an account, you will be asked to log in. Enter your brand new username and password before clicking "Sign In".

2. Enter Preferences

After you are signed in, this is the screen you will see (image below). The dialogue box will ask you whether you are entering individual or group preferences.
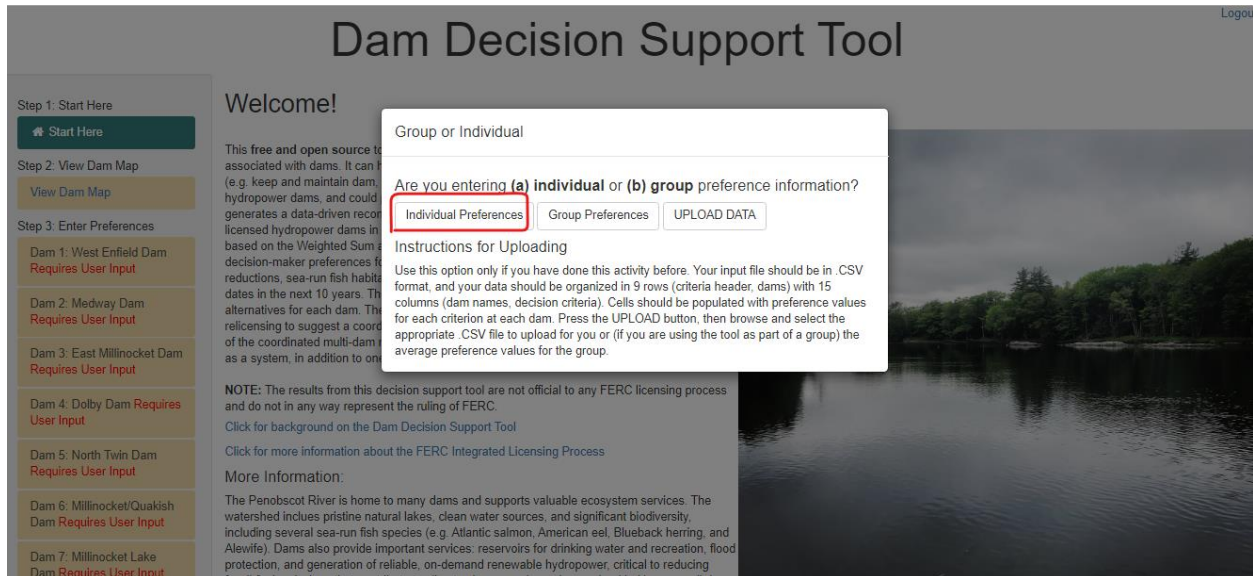
Unless you are working with a group or have done this activity before, you will select "Individual Preferences". Then, begin with Step 1. Read through the page, click on links to open the Background on the Dam Decision Support Tool document or learn more about the FERC Integrated Licensing Process.
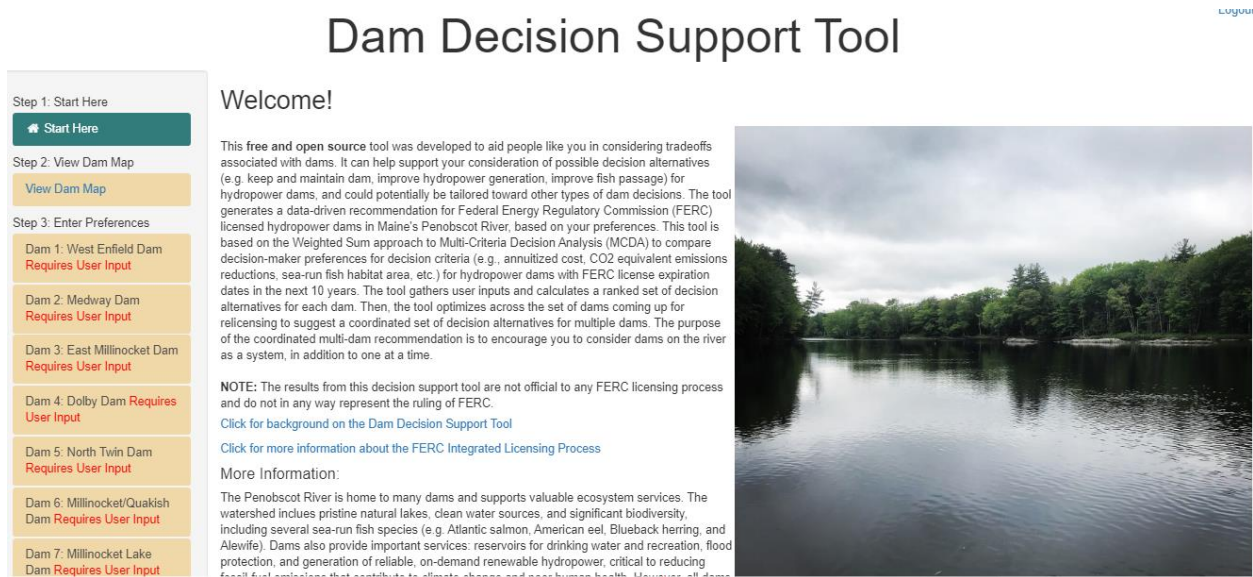
Read the welcome screen. Click links to open new tabs in your internet browser or download documents for additional information.

Welcome!

This **free and open source** tool was developed to aid people like you in considering tradeoffs associated with dams. It can help support your consideration of possible decision alternatives (e.g. keep and maintain dam, improve hydropower generation, improve fish passage) for hydropower dams, and could potentially be tailored toward other types of dam decisions. The tool generates a data-driven recommendation for Federal Energy Regulatory Commission (FERC) licensed hydropower dams in Maine's Penobscot River, based on your preferences. This tool is based on the Weighted Sum approach to Multi-Criteria Decision Analysis (MCDA) to compare decision-maker preferences for decision criteria (e.g., annuitized cost, CO_2 equivalent emissions reductions, sea-run fish habitat area, etc.) for hydropower dams with FERC license expiration dates in the next 10 years. The tool gathers user inputs and calculates a ranked set of decision alternatives for each dam. Then, the tool shows the top-ranked set of decision alternatives for multiple dams. The purpose of the combined output is to encourage you to consider dams on the river as a system, in addition to one at a time.

NOTE: The results from this decision support tool are not official to any FERC licensing process and do not in any way represent the ruling of FERC.

Click for background on the Dam Decision Support Tool

Click for instructions on how to use the Dam Decision Support Tool

Click for more information about the FERC Integrated Licensing Process

More Information:

The Penobscot River is home to many dams and supports valuable ecosystem services. The watershed includes pristine natural lakes, clean water sources, and significant biodiversity, including several sea-run fish species (e.g. Atlantic salmon, American eel, Blueback herring, and Alewife). Dams also provide important services: reservoirs for drinking water and recreation, flood protection, and generation of reliable, on-demand renewable hydropower, critical to reducing fossil-fuel emissions that contribute to climate change and poor human health. However, all dams need regular maintenance and older dams may need more extensive repairs as they age. Dams may interrupt flows and prevent sea-run fish passage, contributing to large population declines. They may also contribute to poor water quality downstream, increased predation, and climate change (decaying plant matter in reservoirs release methane into the atmosphere). Dams have long threatened indigenous cultural traditions, while at the same time helping to shape post-industrial town or city identities over the last two centuries.

Click HERE for more information about the tradeoffs involved in dam decision making

Total Progress: 0 %
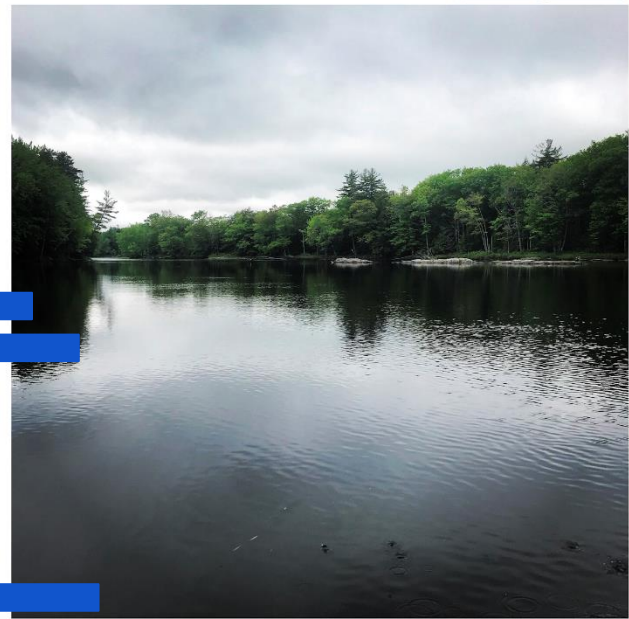
Now, Step 2. Click on "View Dam Map". This page will orient you to the hypothetical, but realistic, context for the Dam Decision Support Tool in Maine's Penobscot River. Eight dams, marked on the map in green, are coming up for relicensing in the next 10 years.

Toggle around in the map, zoom in or out, and move your cursor over the individual dam sites (as in the image below) to learn more about the dams.

Dam Decision Support Tool

The "Click to learn more" links provide information about the different decision alternatives (e.g. keep and maintain dam, remove dam, improve fish passage), as well as decision criteria (e.g. sea-run fish habitat area, river recreation, annuitized project costs) that you will be asked to consider in Step 3. These PDFs will open in a new tab, where you can read or download the file. It is recommended that you read through these documents closely to learn more about decision criteria and alternatives before proceeding.

There is also a "Click to download" link that will download a Microsoft Excel Workbook (.xlsx) with data for each dam. This "Dam Data" file has a data value for each of 5 decision alternatives under each of 14 decision criteria. The metadata (or, data about the data) tab in the workbook describes where the data come from (e.g. social/cultural criteria values are collected from a survey) or are calculated (e.g. reservoir storage is calculated using the cone volume method[1]).

Notice the red arrow in the image above. Toward the left-hand side of the page are the individual dam tabs in Step 3. They are marked with red text that reads "Requires User Input". As you enter your preferences for Dams 1-8, the text that reads "Requires User Input" will be marked as "Complete". You

will need to complete all dam tabs before generating your results under Step 4. If you try to generate the results without filling out preferences for all dams, you will see the following error message:
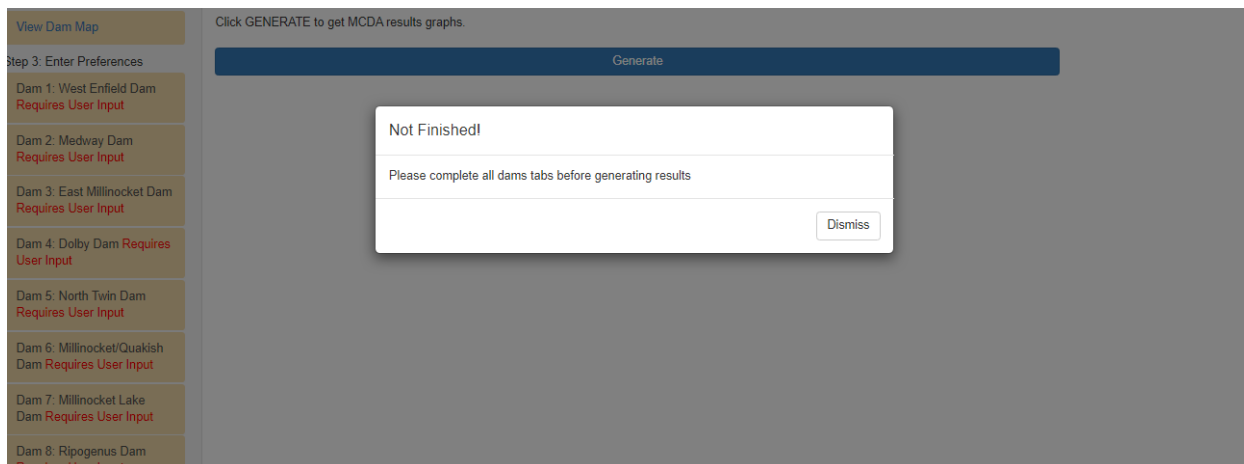
Moving on to Step 3, click Dam 1: West Enfield.

Move the slider bars to indicate your preference for the decision criteria for each given dam. You should set the slider bar to a position that represents the relative amount of preference you have for each decision criterion compared to others in the list. Once you have made your selections, click UPDATE at the bottom of the page when you are done moving the slider bars to mark this tab "Complete". Decision criteria ratings must sum to 100. The tracking indicator will help you keep track of the sum. Be aware that decision criteria are directly compensating (i.e., if the sum of all ratings is 100, then increasing the rating on one criterion requires another criterion rating to decrease to keep the sum equal to 100). For ratings, 0 = not at all important and 100 = extremely important.

For example, if you care only about fish habitat, move that slider bar to 100, and leave all others at zero. If you care about fish habitat and hydropower generation equally, move the slider bar for each to 50. Use the data table for each dam (e.g. "Click here to view Ripogenus Data") to help you think about the importance of each decision criterion in the context of the specific dam site. The data table includes information on how the actual value of each decision criterion (for example, the actual sea-run fish habitat area) may change if different decision alternatives were implemented at the specific

dam site. Whether these changes would be small or large may help inform how you choose to represent your preferences below with the slider bars. For example, if you are not sure how much importance you should put on Number of Properties, and the decision matrix shows Number of Properties will not change much for any of the decision alternatives, you may choose to put less or no importance on this criterion when moving the slider bars. **Click UPDATE at the bottom of each page to make sure your slider bar values get submitted for results generation in-app.**

In this example (image below), we have used equal preferences, or preference values that are evenly distributed (100 percentage points) across each of 14 decision criteria. Notice the Tracking Indicator above the first decision criterion, labeled "Progress for Dam 8" marked 100/100. Also, all dams marked Complete in this example.

Now that all dam tabs in Step 3 are complete, you may move on to Step 4: Multi-Dam Results.

3. Results

The Step 4: View Multi-Dam Results "Combined Results Tab" is where you can generate the results. First, you should click on the "Save" button to save your preferences. This option is helpful if you plan to use the Dam Decision Support Tool as a part of a group. Be advised that pressing "Save" a second time will overwrite your previous save. Click "Generate" to view the multi-dam results.

Multi-Dam Results

Saving your preferences will load them automatically when you visit again. If you are using group mode saving will add your preferences to the groups total. Saving again will overwrite the old save.

🖫 Save Preferences

Click GENERATE to get MCDA results graphs.

Generate

Step 1: Start Here
🏠 Start Here

Step 2: View Dam Map
View Dam Map

Step 3: Enter Preferences

Dam 1: West Enfield
Complete

Dam 2: Medway Dam
Complete

Dam 3: East Millinocket
Dam Complete

Dam 4: Dolby Dam
Complete

Dam 5: North Twin Dam
Complete

Dam 6: Millinocket/Quakish
Dam Complete

Dam 7: Millinocket Lake
Dam Complete

Dam 8: Ripogenus Dam
Complete

Total Progress: 100 %

Then, visit the Step 5 dam tab to view your results. For example, the results in the figure below were generated using equal preferences (all slider bar values in Step 3: set equal to 7.143
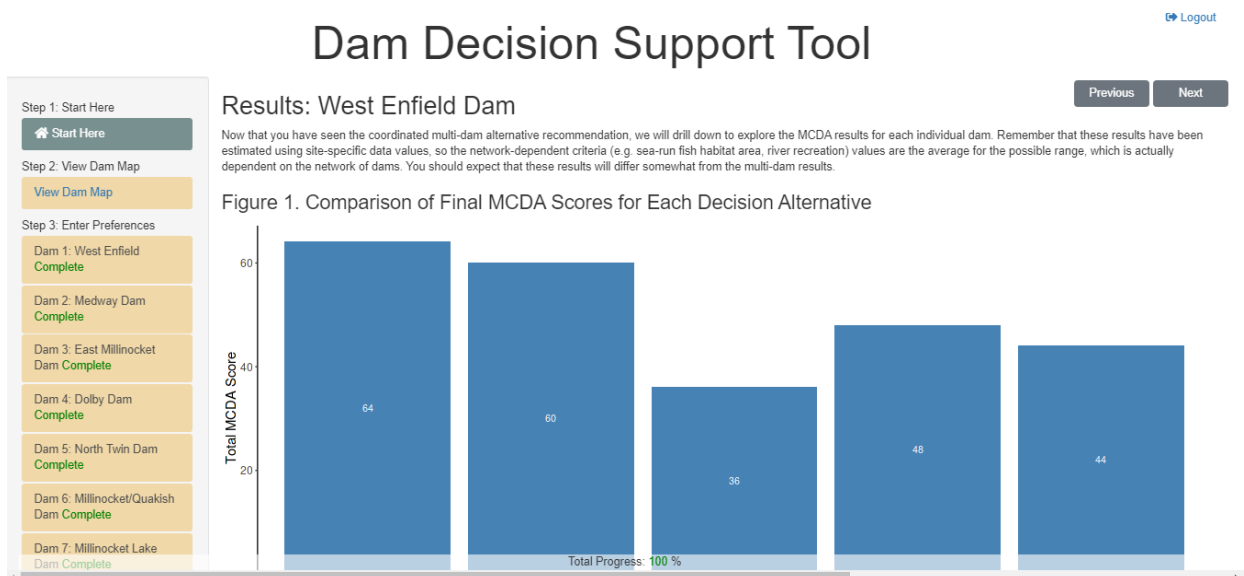
Keep in mind that the "save" function in the Dam Decision Support Tool only applies to your preference inputs from Step 3. Interested in keeping track of your results? There is a download button below every figure so you can save a .png file of your graphed output. There is also a download button below each table (see image below), so that you can download the tables of your results to explore the results of the calculations in greater detail.

Table 2. Data Values for West Enfield Dam

Show 10 ▾ entries   Search: [   ]

	FishHabitat ⇕	RiverRec ⇕	Reservoir ⇕	ProjectCost ⇕	BreachDamage ⇕	NumProperties ⇕	ElectricityGeneration ⇕	AvoidEm...
Remove Dam	86750	19	0	179	0	5	0	0
Improve Fish Passage	55480	12	0	1067	2	0	73	10
Improve Hydro	24200	12	0	949	2	0	73	10
Improve Hydro AND Fish Passage	55480	12	0	1067	2	0	73	10
Keep and Maintain Dam	24200	12	0	949	2	0	73	10

Showing 1 to 5 of 5 entries   Previous [1] Next

⬇ Download Table

Results Interpretation for Table 2. This table displays the raw data values we collected and/or calculated/generated through our research for each decision criterion and alternative. You may remember seeing these data when you clicked on the link for the data matrix for this dam during the preference elicitation in Step 3. We include the raw data values again here to help make the MCDA calculations more transparent, so you can clearly see what goes into the final calculation that produces Figures 1 and 2 above. In addition, you can use this table to sort decision alternatives in ascending or descending order in each column by clicking on the arrow next to the column header . Note: fish survival values shown here are discrete, but in reality, the values are

The tables have a few functions to help you explore the results. You can select how many values to show at one time:

Table 2. Data Values for West Enfield Dam

Show 10 ▾ entries   Search: [   ]

	FishHabitat ⇕	RiverRec ⇕	Reservoir ⇕	ProjectCost ⇕	BreachDamage ⇕	NumProperties ⇕	ElectricityGeneration ⇕	AvoidEm...
Remove Dam	86750	19	0	179	0	5	0	0
Improve Fish Passage	55480	12	0	1067	2	0	73	10
Improve Hydro	24200	12	0	949	2	0	73	10
Improve Hydro AND Fish Passage	55480	12	0	1067	2	0	73	10
Keep and Maintain Dam	24200	12	0	949	2	0	73	10

Showing 1 to 5 of 5 entries   Previous [1] Next

⬇ Download Table

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You can use the search bar to filter the results to row at a time:

Table 2. Data Values for West Enfield Dam

Show 10 ▾ entries   Search: [_____]

	FishHabitat ⬍	RiverRec ⬍	Reservoir ⬍	ProjectCost ⬍	BreachDamage ⬍	NumProperties ⬍	ElectricityGeneration ⬍	AvoidEm... Previous Next
Remove Dam	86750	19	0	179	0	5	0	0
Improve Fish Passage	55480	12	0	1067	2	0	73	10
Improve Hydro	24200	12	0	949	2	0	73	10
Improve Hydro AND Fish Passage	55480	12	0	1067	2	0	73	10
Keep and Maintain Dam	24200	12	0	949	2	0	73	10

Showing 1 to 5 of 5 entries   Previous 1 Next

⬇ Download Table

Or, you can use the "Next" button at the bottom of the table to show more decision criteria.

Table 2. Data Values for West Enfield Dam

Show 10 ▾ entries   Search: [_____]

	FishHabitat ⬍	RiverRec ⬍	Reservoir ⬍	ProjectCost ⬍	BreachDamage ⬍	NumProperties ⬍	ElectricityGeneration ⬍	AvoidEm... Previous Next
Remove Dam	86750	19	0	179	0	5	0	0
Improve Fish Passage	55480	12	0	1067	2	0	73	10
Improve Hydro	24200	12	0	949	2	0	73	10
Improve Hydro AND Fish Passage	55480	12	0	1067	2	0	73	10
Keep and Maintain Dam	24200	12	0	949	2	0	73	10

Showing 1 to 5 of 5 entries   Previous 1 Next
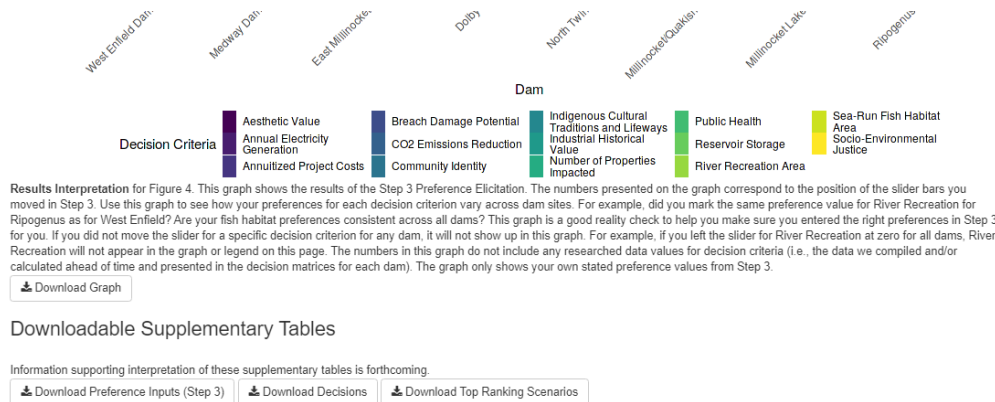
⬇ Download Table

Results Interpretation for Table 2. This table displays the raw data values we collected and/or calculated/generated through our research for each decision criterion and alternative. You may remember seeing these data when you clicked on the link for the data matrix for this dam during the preference elicitation in Step 3. We include the raw data values again here to help make the MCDA calculations more transparent, so you can clearly see what goes into the final calculation that produces Figures 1 and 2 above. In addition, you can use this table to sort decision alternatives in ascending or descending order in each column by clicking on the arrow next to the column header. Note: fish survival values shown here are discrete, but in reality, the values are

Note: There is interpretive text below each table and graph to walk you through the results and help explain what you are seeing, if it is not immediately clear.

4. Troubleshooting

If the results are really unexpected, or your preference values does not look familiar, go back to Step 3 and check your slider bar values for the appropriate dam. Remember, if you go back to change the slider bar values at any time, you will need to click UPDATE at the bottom of the dam page in Step 3. Then, navigate back to Step 4: View Multi-Dam results, Combined Results and click GENERATE to re-run the model.

Pro tip: If saving does not work, you may wish to refresh the page. Be aware that refreshing will erase all of your preference values you entered in Step 3 if the values are not saved. To make the preference-entry process faster, scroll to the bottom of the Step 4: Multi-Dam Combined Results and click "Download Preference Inputs (Step 3)".

Results Interpretation for Figure 4. This graph shows the results of the Step 3 Preference Elicitation. The numbers presented on the graph correspond to the position of the slider bars you moved in Step 3. Use this graph to see how your preferences for each decision criterion vary across dam sites. For example, did you mark the same preference value for River Recreation for Ripogenus as for West Enfield? Are your fish habitat preferences consistent across all dams? This graph is a good reality check to help you make sure you entered the right preferences in Step 3 for you. If you did not move the slider for a specific decision criterion for any dam, it will not show up in this graph. For example, if you left the slider for River Recreation at zero for all dams, River Recreation will not appear in the graph and legend on this page. The numbers in this graph do not include any researched data values for decision criteria (i.e., the data we compiled and/or calculated ahead of time and presented in the decision matrices for each dam). The graph only shows your own stated preference values from Step 3.

⬇ Download Graph

Downloadable Supplementary Tables

Information supporting interpretation of these supplementary tables is forthcoming.

⬇ Download Preference Inputs (Step 3)　⬇ Download Decisions　⬇ Download Top Ranking Scenarios

Then, refresh the page. Refreshing will return you to this screen, where you will select "UPLOAD DATA" (image below).
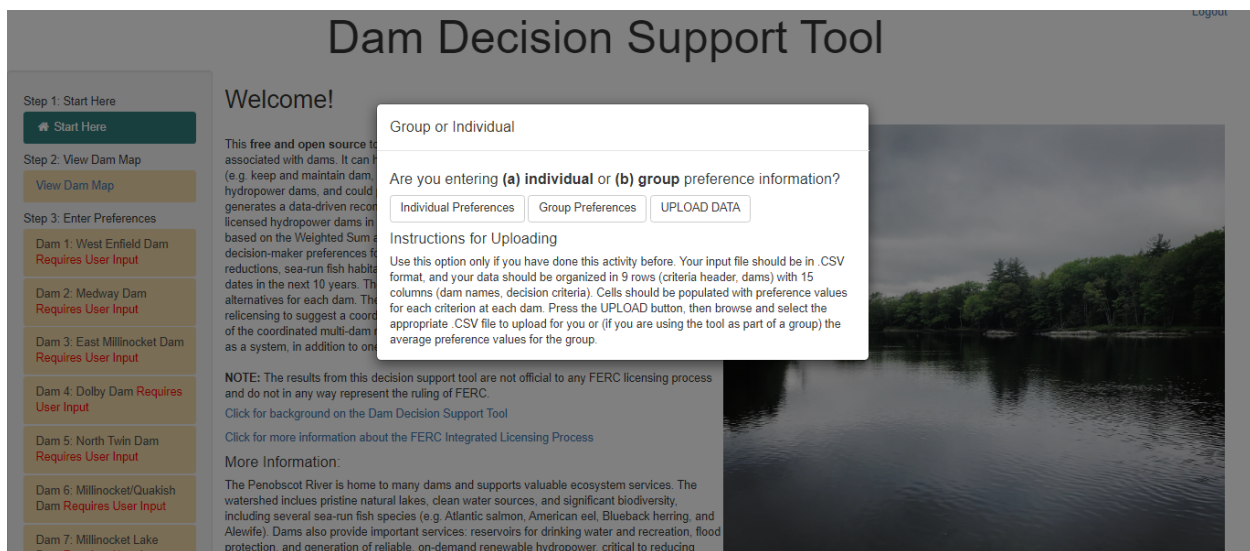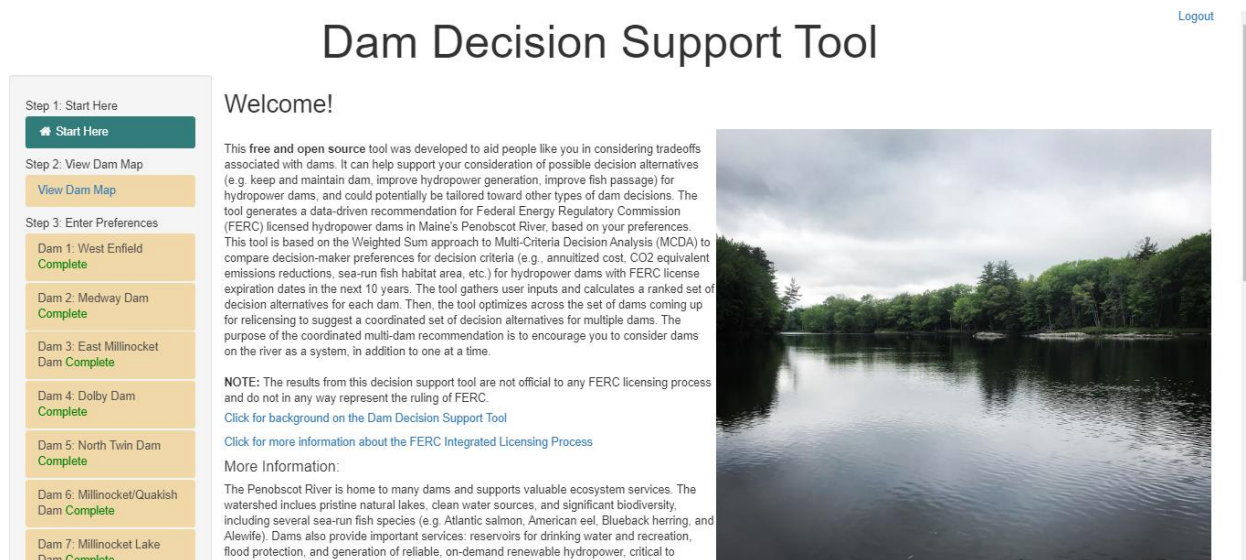

In the new dialogue box, select "Browse" and select the file.
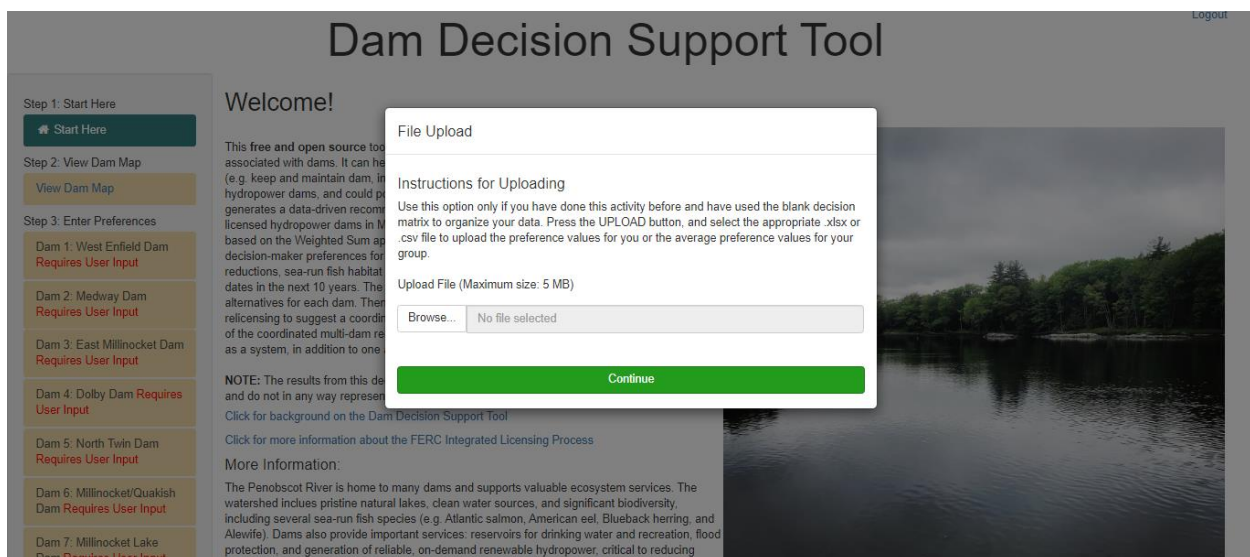
If you saved the preference inputs file you downloaded, locate the file on your computer and upload it now. Then, click "Continue".
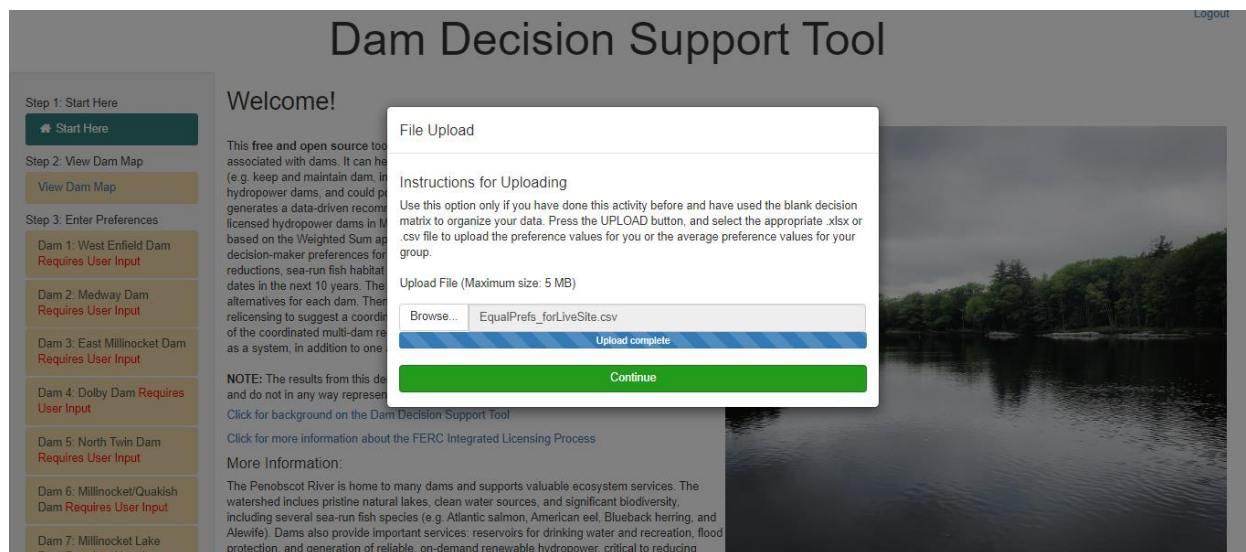
When you upload your file with preference information, all of the tab labels will change from "Requires User Input" to "Complete" automatically.

Pro tip: If you are interested in exploring the impacts of different model inputs on the results, save your preference input file on your computer (e.g. UserPrefs1) and then modify your preference input values directly in the file, saving again with a new file name (e.g. UserPresfs2).

Resources

[1] Hollister J, Milstead WB (2010) Using GIS to estimate lake volume from limited data. *Lake Reserv Manag* 26(3):194–199.