Recovery System Evaluation Tool (ReSET)

User Manual

*The **Recovery System Evaluation Tool (ReSET)** is intended to assist recovery system users in estimating the potential of oil recovery system configurations to best recover floating oil. This tool is NOT intended to be used as a model for calculating system performance during an actual oil spill, which is affected by many factors such as the distribution of oil on the water surface, oil weathering, and other ambient on-scene conditions which are not included in this tool.*

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Purpose

The ERSP and its companion calculators, the EBSP and the EDSP, were developed as planning tools for estimating the potential of different oil spill response systems to mitigate (recover, burn or disperse) discharged oil relative to one another. These planning tools are NOT intended to be used as models for calculating system performance during an actual oil spill, which is affected by many factors such as the distribution of oil on the water surface, oil weathering, and other ambient on-scene conditions which are not included in these Calculators. In particular, ERSP was developed to allow users to estimate the potential for an oil recovery system to mechanically remove oil from the water's surface. (The ERSP Calculator and the ERSP User Manual are available at BSEE.gov).

The Recovery System Evaluation Tool (ReSET) was developed as a supplement to the ERSP Calculator. The oil removal potential (ERSP) of each skimming system is uniquely tied to its specific operating parameters that can be quantified. With ReSET, users can change and vary any of these operational parameters for their oil recovery systems, and examine how those changes affect their removal potential. ReSET provides users who would be designing or assembling mechanical recovery systems with feedback that may assist them in increasing the efficiency and overall effectiveness of their recovery systems.

This User Manual further describes ReSET and provides some limited guidance on its use. In ReSET, the user selects an operational parameter from a drop down list that will be isolated and treated as a variable. Its initial baseline value is entered, along with the number of iterations and the desired increment. The user inputs, algorithms, and assumptions operate the same way in ReSET as they do in the ERSP Calculator. The ReSET demonstrates how the ERSP results change as the selected variable is incremented and the other system parameters are held constant.

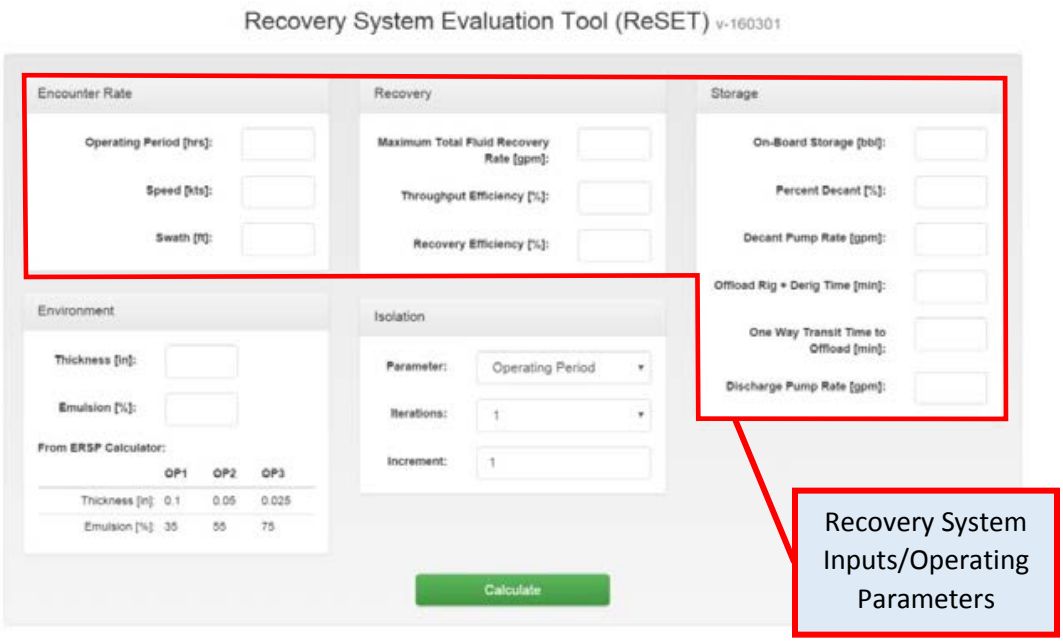
The ReSET is a small html file, ReSET-160225.html, which opens in the following Internet browser versions:

PC (Win-XP, Win-7 and Win-8 environments)
- IE - 9, 10, 11 or greater
- Chrome 38 or greater
- Firefox 31 or greater
- Safari 5.1 or greater

Mac (OS 10.6 and greater)
- Safari 8.0 or greater
- Chrome 38 or greater
- Firefox 35 or greater

Mechanical Recovery System Operating Parameters

Launching the ReSET .html file opens the main ReSET entry screen. The user inputs for each of the operating parameters of the mechanical recovery system are located across the top of the ReSET entry screen. The parameters are grouped and arranged in the same manner and order as on the ERSP Calculator (additional information and detail on these parameter inputs can be found in the ERSP User Manual):



NOTE: The "build" or version date of the calculator appears after the calculator name.

Encounter Rate Group

Operating Period [hrs] – The period of time that the skimming system will be operating. The Operating Period must be less than or equal to 24 hours.

Speed [kts] – The velocity of a skimming system with respect to the water. Increasing speed will increase the Encounter Rate which will affect the Maximum Effective Swath.

Swath [ft] – The width of advance over which oil/emulsion is intercepted on a skimming system.

Note: Swath entries are subject to Maximum Effective Swath, the upper limit determined by the Speed, Oil/Emulsion Thickness, and the Maximum Total Fluid Recovery Rate (see below).

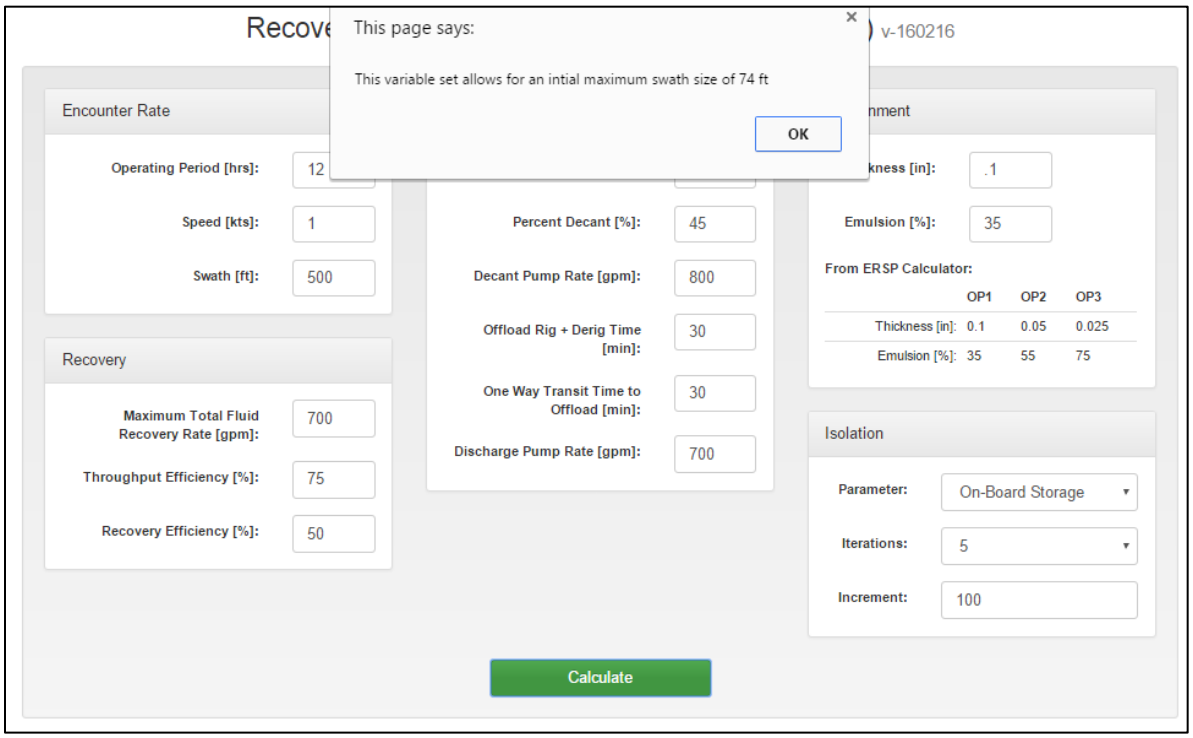
Recovery Group

Maximum Total Fluid Recovery Rate [gpm] – The maximum rate at which a skimmer system can recover fluids under ideal conditions.

Throughput Efficiency (TE) [%] – The ratio, expressed as a percentage, of the volume of oil/emulsion recovered to the volume of oil/emulsion encountered.

Recovery Efficiency (RE) [%] - The ratio, expressed as a percentage, of the volume of oil/emulsion recovered to the total volume of fluids recovered.

The values entered for Thickness, Speed and Maximum Total Fluid Recovery Rate of the system will determine the Maximum Effective Swath. If the entered Swath is greater than the Maximum Effective Swath, a pop up will be displayed that lists the maximum swath. Enter a new swath less than or equal to the maximum swath to continue. The example in the graphic below is an illustration of this limitation.



An entered swath of 500 feet, a thickness of 0.1 inch, speed of 1 knot, and a Maximum Total Fluid Recovery Rate of 700 gpm in the figure above result in a calculated Maximum Effective Swath of 74 feet. ReSET will not provide results until the swath entry is changed to a value that is less than or equal to the maximum effective swath (in this case, from 500 feet to something less than or equal to 74 feet). Alternatively, the values for thickness, speed, total fluid recovery rate, RE, and TE may also be adjusted to effectively increase the calculated MES above the desired swath entry.

Storage Group

On-Board Storage [bbl] – The volume available on the skimming system for the collection of total fluids recovered.

% Decant [%] – The % of free water taken on-board that is to be decanted.

Decant Pump Rate [gpm] – The rated capacity of the pump used to remove free water from the fluids collected by the skimming system.

Offload Rig/Derig Time [min] – The time necessary for a skimming system to: 1) tie up to secondary storage, rig hoses, and complete paperwork in preparation for offloading, and 2) the additional time necessary at the end of offloading to derig hoses & lines.

One Way Transit Time to Offload [min] – The one-way time necessary to transit from the oil collection area to secondary storage for offloading.

Discharge Pump Rate [gpm] – The rated capacity of the pump used to offload the on-board storage tank(s) to secondary storage.

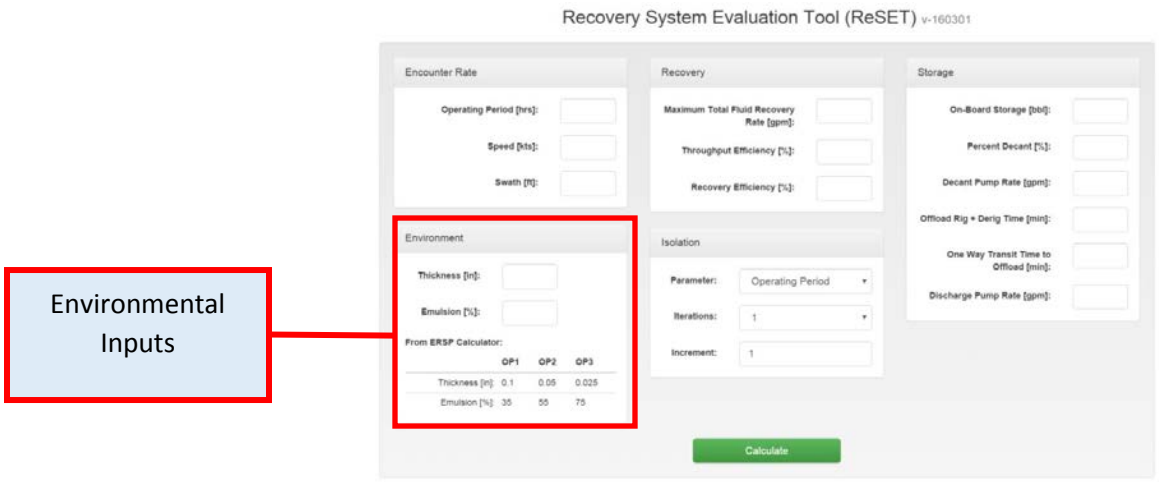
Environmental Inputs

In the ERSP Calculator, the oil thickness and percentage of emulsion are fixed values for each operating period that cannot be changed by the user. In ReSET, however, users may specify different oil thicknesses and emulsion percentages if desired as environmental inputs:

Thickness [in] – The nominal average thickness of the oil slick.

Emulsion [%] – The percent water content in an oil emulsion.

If the user wants to know how changes to a mechanical recovery system would affect the ERSP Calculator's results, the user must use the pre-established values for oil thickness and emulsion that are also used in the ERSP Calculator (these values have been provided directly on the ReSET entry screen for quick and easy reference). Using different oil thickness and emulsion values will produce results may be of interest and value to a user; however, it is important to note that ReSET results will not align with the results obtained by using the ERSP Calculator for the same set of recovery system operating parameters.

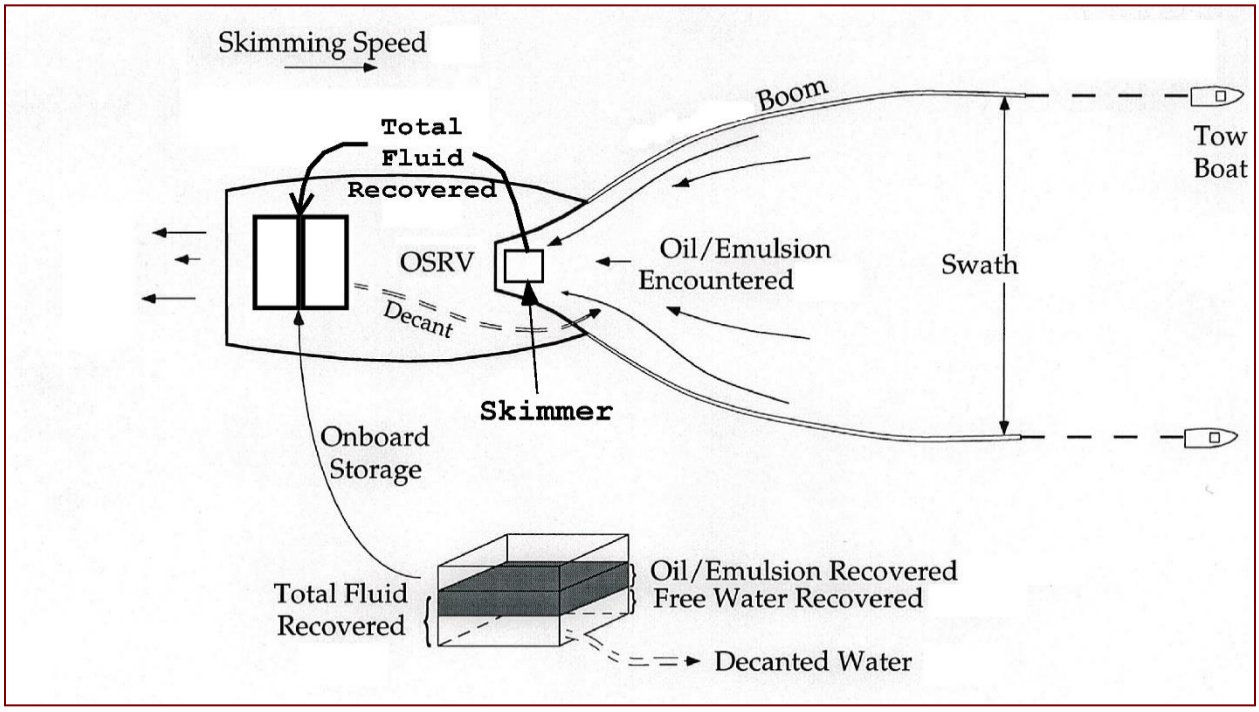


Using ReSET To Isolate and Vary A System Parameter

ReSET was developed as a supplement to the ERSP Calculator. The oil removal potential (ERSP) of each skimming system is uniquely tied to its specific operating characteristics that can be quantified. With ReSET, users can change and vary any of these operational parameters for their oil recovery systems, and examine how those changes affect the ERSP Calculator's estimates for their removal potential.

As such, users may vary any of the operating parameters for a recovery system that are contained within the encounter rate, recovery, or storage input groupings. It should be noted that ReSET, by design, is limited to varying only one operating parameter at a time with each calculation. The user, however, can specify the increment to be tested and the number of iterations.

ReSET can also be used to vary oil thickness or emulsion percentages for a given set of operating parameters for any recovery system; however, the primary intended use for ReSET is to provide a means for varying the operating parameters within the recovery "system", and not the environmental inputs. The following diagram shows some of the major components of an advancing mechanical recovery system that can be isolated and varied using ReSET:



After entering in all the recovery system operating parameters and the environmental inputs, the user must choose which operating parameter will be isolated and varied, as well as the increment and the number of iterations. In order to do this, the user must select the operating parameter and number of iterations from the pick lists in the "Isolation" section of the ReSET screen, and enter the desired increment.

<u>The Isolation Variable</u>: User Selections for Operating Parameter, Iterations, and Increment Value

Parameter – The operating parameter that will be varied from iteration to iteration based on the increment selected. The operating parameter can be selected from any of the drop-down list items in the isolation group.

Iterations – The number of times the increment is added to the current value of the variable to isolate. One to 5 iterations can be displayed.

Increment – The value that will be added to the base value with each iteration of the parameter being isolated.

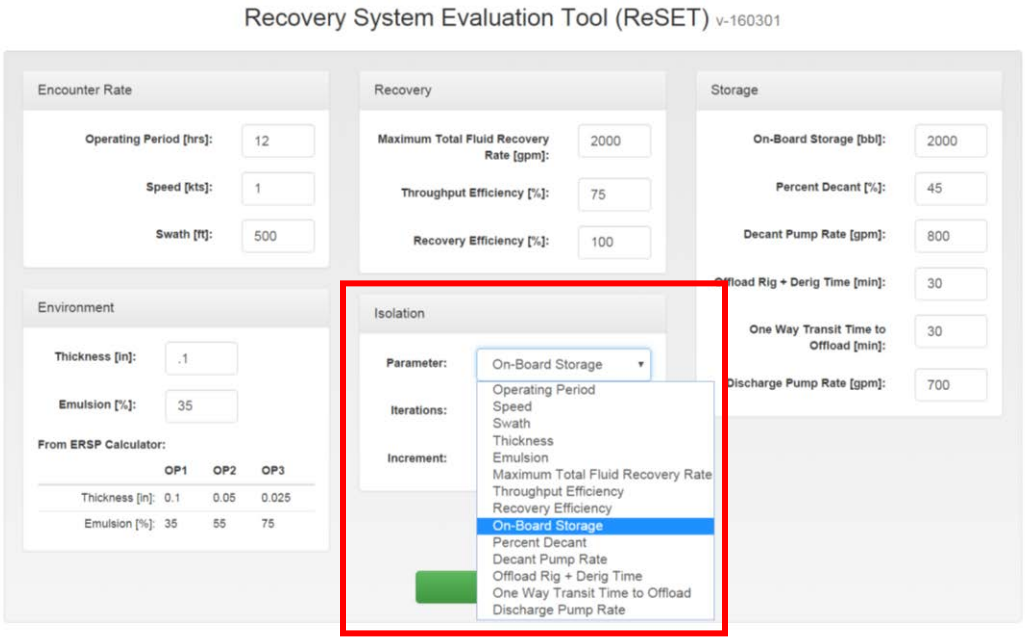


Figure showing drop down list for parameters that may be isolated and varied.

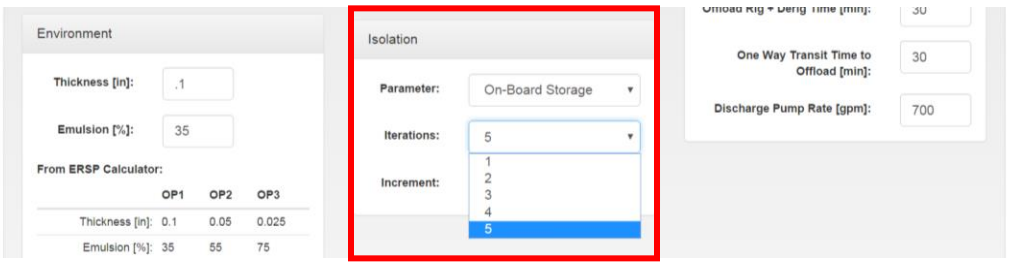


Figure showing drop down list for number of iterations (maximum 5).

ReSET Output Results

Once the "Calculate" button is clicked, ReSET displays the outputs as a set of simulation notes, bar graphs, cycle timelines, and columns of tabular data (see the following example below).

Simulation Notes

This section contains alerts and notes that are displayed when specific conditions are met. Note that some of these alerts are merely notifications; others will require the user to take corrective action.

One alert always appears in the Simulation Notes and begins with an asterisk which matches the asterisk next to the Swath input field: "*If the entered Swath > MES, the calculator uses the Swath = MES for that iteration."

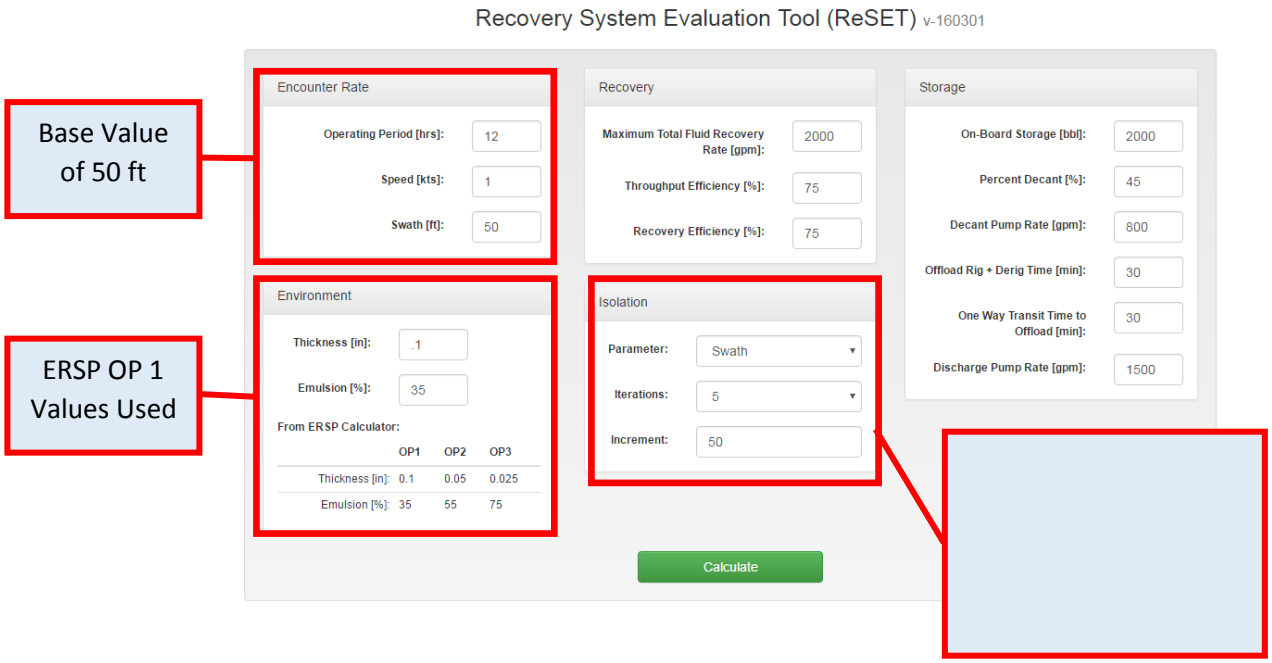
When Emulsion % is set to zero, the alert is: "Emulsion % = 0, all references to Emulsion are for oil only."

If the swath exceeds 1,000 feet, the alert is: "Swath used for calculation may not be achievable."

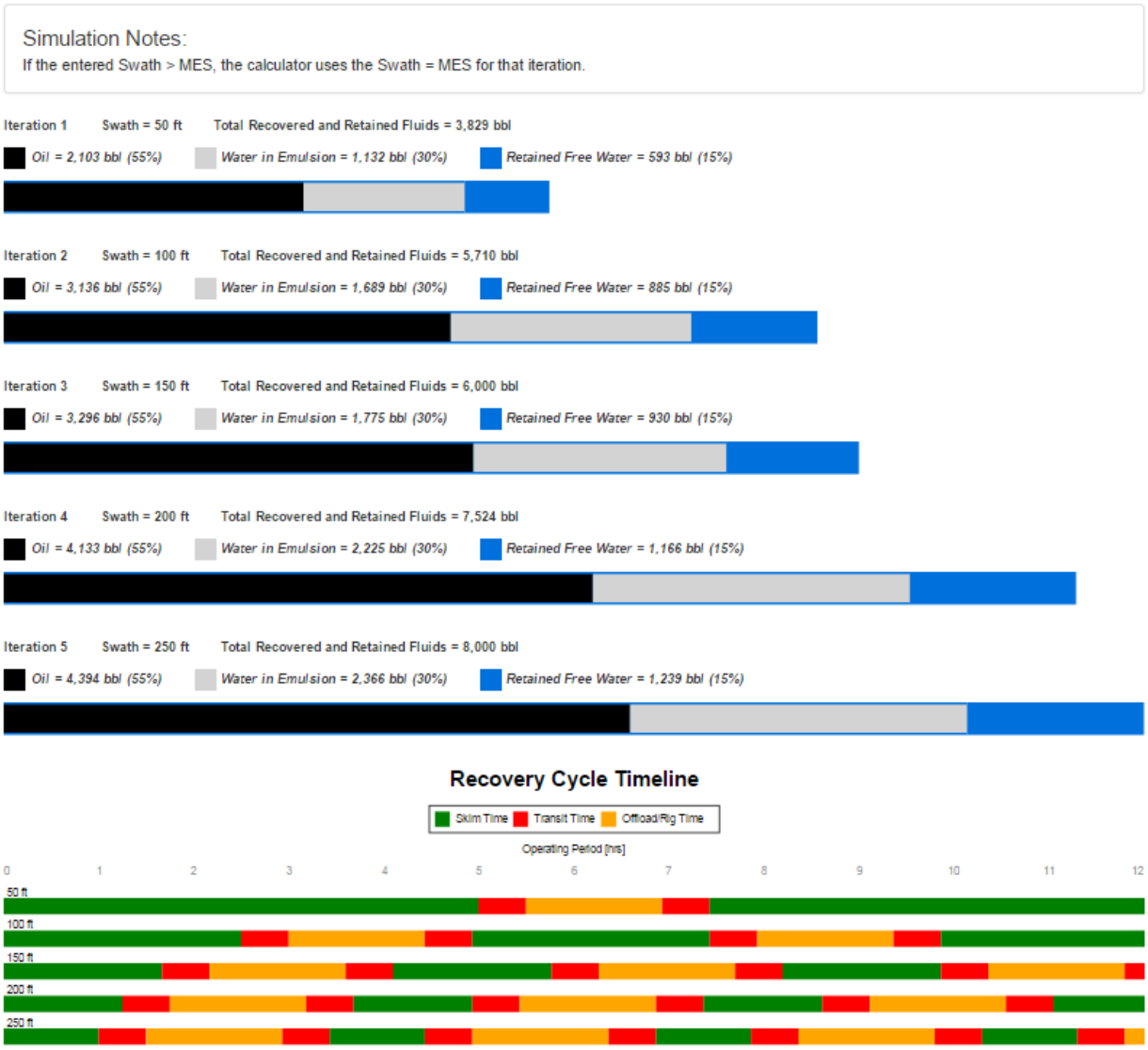
If the calculated decant rate needed for a desired "% decant" is greater than the system's decant pump rate the alert is: "Calculated Decant Rate is greater than Decant Pump Rate."

Example Case

The following example illustrates the use and outputs of ReSET. In this case, oil thickness and emulsion values are from Operating Period 1 of the ERSP Calculator. The recovery system inputs have been entered (as shown below), and swath width has been selected as the operating parameter to be isolated and varied. The isolation function has been set to five iterations using an increment of 50 feet.



For the example case, ReSET estimated and displayed the data below for the recovery system using a base value for the swath width of 50 ft, and four subsequent iterations where the swath width is 100 ft, 150 ft, 200 ft, and 250 ft :



ReSET Graphical Output and Recovery Cycle Timeline

Swath	50 ft	100 ft	150 ft	200 ft	250 ft
Encounter Rate Results					
Maximum Effective Swath	317 ft	317 ft	317 ft	317 ft	317 ft
Swath Used For Calculation	50 ft	100 ft	150 ft	200 ft	250 ft
Oil/Emulsion Encounter Rate	316 gpm 451 bbl/hr	631 gpm 902 bbl/hr	947 gpm 1,354 bbl/hr	1,263 gpm 1,805 bbl/hr	1,578 gpm 2,256 bbl/hr
Areal Coverage Rate	0.12 acres/min	0.23 acres/min	0.35 acres/min	0.47 acres/min	0.58 acres/min
Area Covered (acre) in Op Period	67 acres	100 acres	105 acres	131 acres	139 acres
Area Covered (sq mi) in Op Period	0.1 sq mi	0.16 sq mi	0.16 sq mi	0.2 sq mi	0.22 sq mi
Recovery Results					
Total Fluid Recovery Rate	316 gpm 451 bbl/hr	631 gpm 902 bbl/hr	947 gpm 1,354 bbl/hr	1,263 gpm 1,805 bbl/hr	1,578 gpm 2,256 bbl/hr
Emulsion Recovery Rate	237 gpm 338 bbl/hr	473 gpm 677 bbl/hr	710 gpm 1,015 bbl/hr	947 gpm 1,354 bbl/hr	1,184 gpm 1,692 bbl/hr
Oil Recovery Rate	154 gpm 220 bbl/hr	308 gpm 440 bbl/hr	462 gpm 660 bbl/hr	616 gpm 880 bbl/hr	769 gpm 1,100 bbl/hr
Free Water Recovery Rate	79 gpm 112 bbl/hr	158 gpm 225 bbl/hr	237 gpm 338 bbl/hr	316 gpm 451 bbl/hr	395 gpm 564 bbl/hr
Storage Results					
Water Retained Rate	43 gpm 62 bbl/hr	87 gpm 124 bbl/hr	130 gpm 186 bbl/hr	174 gpm 248 bbl/hr	217 gpm 310 bbl/hr
Decant Rate	36 gpm 50 bbl/hr	71 gpm 101 bbl/hr	107 gpm 152 bbl/hr	142 gpm 203 bbl/hr	178 gpm 253 bbl/hr
Time To Fill Onboard Storage	5 hr	2.5 hr	1.7 hr	1.2 hr	1 hr
Time for One Full Cycle (skimming, transit, rig + derig, offload, transit)	7.4 hr	4.9 hr	4.1 hr	3.7 hr	3.4 hr
Skimming Time in Operating Period	9.6 hr	7.1 hr	5 hr	4.7 hr	4 hr
Skimming Time in Operating Period %	80 %	59 %	42 %	39 %	33 %
Total Number of Fills in Operating Period	1.9	2.9	3	3.8	4
Volume Results					
Total Volume Oil/Emulsion + Free Water Recovered / Operating Period	3,829 bbl	5,710 bbl	6,000 bbl	7,524 bbl	8,000 bbl
Total volume of Oil/Emulsion Recovered / Operating Period	3,235 bbl	4,825 bbl	5,070 bbl	6,358 bbl	6,761 bbl
Total Volume Oil Recovered / Operating Period	**2,103 bbl**	**3,136 bbl**	**3,296 bbl**	**4,133 bbl**	**4,394 bbl**

ReSET Tabular Results