



Wastewater Assessment User Manual

Created By: Oak Ridge National Laboratory

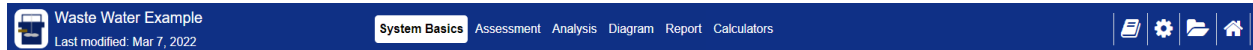
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Module Navigation

Use the top banner to navigate around the module. A footer bar with “Next” and “Back” button can also be used to move through the System Setup to the Report.



Main Tabs

System Setup – Establish your baseline by entering the existing data for your wastewater system.

Assessment – Modify system scenarios to find potential savings opportunities.

Analysis – Analyze system conditions over varying SRT days.

Diagram – Graphical visualization of a waste water treatment system.

Report – Full printable breakdown of the system and potential saving scenarios.

Calculators – Stand alone calculators for wastewater properties.

*Some of the tabs will be disabled until the System Setup is completed.

Additional Buttons

Book – The book will open a new window with the Wastewater User Manual you are reading.

Gear – The gear wheel will navigate you to MEASUR’s global settings page.

Folder – The folder will navigate you to the assessment dashboard folder this assessment is in.

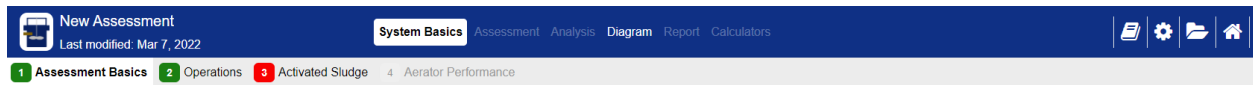
Home – The house will bring you to MEASUR’s home page.

System Setup

The system setup is where you enter the baseline data for your wastewater treatment system. The system setup is broken up into four tabs, each with a related set of input fields to be filled out. Field by field help text is provided for each input field, it will appear in the help panel when an input field is clicked on.

Navigation

Use the second bar to navigate to different sections of the Setup. The tabs will be color coded to indicate the state of the corresponding tab data. Tabs will be disabled in the previous steps have errors in their data.



Assessment Settings – Select the units for the assessment.

Operations – Data entry relating to cost and operation.

Activated Sludge – Data entry relating to field data.

Aerator Performance – Data entry relating to aerator specifications.

Tab colors:

Green - Valid data entered for tab.

Red – Invalid or missing data entered for tab.

Yellow – Data entered outside of expected range.

Gray – Disabled tab, previous tabs are incomplete.

Data Entry

The screenshots below show how to enter data for the System Setup. Input fields will highlight red and an error message will appear if the data that is entered is invalid.

AERATOR PERFORMANCE DATA	
Operating Dissolved O ₂ (DO)	<input type="text" value="4.5"/> mg/L
O ₂ Transfer Coefficient Ratio (α)	<input type="text" value="0.84"/>
Saturation DO Concentration Ratio (β)	<input type="text" value="0.92"/>
Aerator	<input type="text" value="Surface high speed"/>
Standard O ₂ Transfer Rate (SOTR)	<input type="text" value="2.7"/> lb O ₂ /(hp-hr)
Aeration Operating Power	<input type="text" value="150"/> hp
Site Elevation	<input type="text" value="200"/> ft
Aerator Operating Time	<input type="text" value="24"/> hr/day
Type of Aerator	<input type="text" value="Mechanical Aerator"/>
Aerator Speed	<input type="text" value="100"/> %
Do you have an anoxic zone with returned mixed liquor from the aerobic zone?	<input type="text" value="No"/>

Use the left panels in the System Setup to enter the data for your existing wastewater system.

The right sides of the panel contains help text. The panel will show help relating to the field you are currently focused on.

RESULTS	HELP
Aerator Performance Help	
➤ Savings Suggestions	
Aerator Operating Time	
Aerators operating time (hr/day) The number of hours per day the aerators are operating. In many cases, aeration equipment will run 24 hours per day.	
However, oxygen demand at night should be about 60% of daytime oxygen demand due to diurnal organic loading in most municipal wastewater treatment applications. Thus, less aeration equipment may be able to be used at night.	
In extended aeration processes (extended aeration activated sludge and oxidation ditches) not designed for biological nutrient removal, consider turning aerators off 4 to 6 hours per day. It will promote denitrification, save energy, generate alkalinity, and may improve sludge settleability. If hydraulic detention time in the reactor is less than 12 hours, if influent TKN concentration exceeds 40 mg/L, or if effluent ammonia-N limit (monthly average) is 1 mg/L or less, on-off operation may not be feasible.	

In the “Aerator Performance” screen, once your system setup is completed, the “Results” tab will give you the calculated results for your Baseline.

RESULTS	HELP
	Baseline
Percent Savings (%)	—
Total Average Daily Flow Rate (MGD)	1.00
RAS Flow Rate (MGD)	0.43
RAS Recycle Percentage (%)	42.9 %
WAS Flow Rate (MGD)	0.010
Total Sludge Production (lb/day)	893.5
Field O ₂ Transfer Rate (lb O ₂ /hp-hr)	0.94
VOLR (lb BOD/kft ³ -day)	12.48
Total O ₂ Requirements (lb/day)	3,121.4
Total O ₂ Supplied (lb/day)	3,394.2
Effluent TSS (mg/L)	8
Effluent Ammonia-N (mg/L)	0.38
Effluent NO ₃ -N (mg/L)	26
MLSS (mg/L)	3,000
Solids Retention Time (Days)	28
Mixing Intensity in Reactor (hp/Mgal)	150
Aerator Energy Use (MWh/yr)	842.4
Aerator Energy Cost (\$/yr)	75,816
Annual CO ₂ (tonne CO ₂)	338
Annual CO ₂ Savings (tonne CO ₂)	—
Cost Savings (\$/yr)	—
Energy Savings (MWh/yr)	—

Assessment

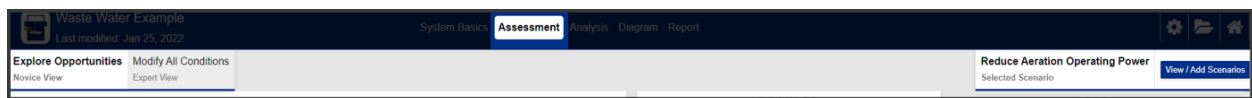
The assessment section of the module allows you to explore how modification scenarios for your system may provide cost, energy and emissions savings. Your baseline must be setup completely prior to making modifications.

There are two ways to conduct assessments which will be explained in further detail later in this section.

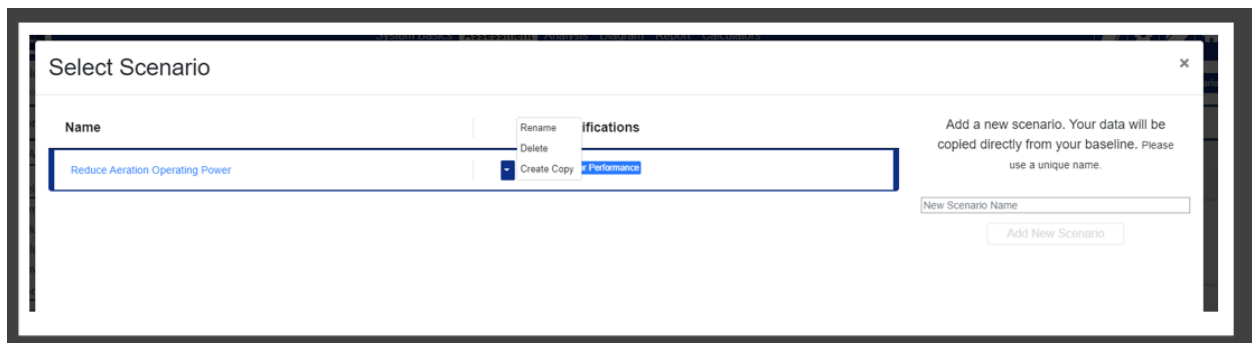
- Explore Opportunities (Novice View)
- Modify All Conditions (Expert View)

Navigation

As with the System Setup, there is a secondary set of tabs to navigate between the two assessment options.



Multiple scenarios can be created, the current “Selected Scenario” will be displayed on the right hand side of this bar. The “View / Add Scenarios” button opens up a modal used to manage your scenarios:



The modal can be used to:

- Create new scenarios
- Create copies of existing scenarios
- Delete or rename scenarios
- Selecting scenarios for viewing and modifying

Explore Opportunities (Novice View)

In “Explore Opportunities” there are fewer data entry fields to find savings opportunities. The page is split into two sections. The left hand side has a checklist of likely modifications to improve your system. The right hand side provides results, a sankey diagram and field by field help text.

The interface is titled "Explore Opportunities" with a sub-tab "Novice View". Below the title is a section "SELECT POTENTIAL ADJUSTMENT PROJECTS" with a note: "Select potential adjustment projects to explore opportunities to increase efficiency and the effectiveness of your system." A button "Add New Scenario" is present. The main area contains a checklist of modifications:

- ☐ Modify Plant Control Point
- ☒ Reduce Supplied O₂
 - Baseline Operating Dissolved O₂ (DO): 4.5 mg/L
 - Modification Operating Dissolved O₂ (DO): 2.93 mg/L (with an "Optimize DO" link)
- ☒ Modify Aerator Performance
 - Baseline Operating Hours: 24 hr/day
 - Modification Operating Hours: 24 hr/day (with an "Optimize Operating Hours" link)
 - Baseline Operating Power: 150 hp
 - Modification Operating Power: 100 hp
 - Baseline Aerator Speed: 100 %
 - Modification Aerator Speed: 100 % (with an "Optimize Speed" link)
- ☐ Upgrade Aerator

Each checklist item will provide input fields to modify the scenario. The data for your baseline is also displayed on the left.

The “Results” tab will show the calculated results and savings of the modified scenario.

Field by field help text will display in the “Help” panel as input fields are clicked on.

The "RESULTS" tab displays a comparison between the "Baseline" and "Reduce Aeration Operating Power" scenarios. A gauge shows a 33.3% savings. The table below provides detailed metrics for both scenarios.

	Baseline	Reduce Aeration Operating Power
Percent Savings (%)	—	33.3%
Total Average Daily Flow Rate (MGD)	1.00	1.00
RAS Flow Rate (MGD)	0.43	0.43
RAS Recycle Percentage (%)	42.9 %	42.9 %
WAS Flow Rate (MGD)	0.010	0.010
Total Sludge Production (lb/day)	893.5	893.5
Field O ₂ Transfer Rate (lb O ₂ /hp-hr)	0.94	1.33
VOLR (lb BOD/kt ³ -day)	12.48	12.48
Total O ₂ Requirements (lb/day)	3,121.4	3,121.4
Total O ₂ Supplied (lb/day)	3,394.2	3,194.7
Effluent TSS (mg/L)	8	8
Effluent Ammonia-N (mg/L)	0.38	0.38
Effluent NO ₃ -N (mg/L)	26	26
MLSS (mg/L)	3,000	3,000
Solids Retention Time (Days)	28	28
Mixing Intensity in Reactor (hp/Mgal)	150	100
Aerator Energy Use (MWh/yr)	842.4	561.6
Aerator Energy Cost (\$/yr)	75,816	50,544
Annual CO ₂ (tonne CO ₂)	363	242
Annual CO ₂ Savings (tonne CO ₂)	—	121
Cost Savings (\$/yr)	—	25,272
Energy Savings (MWh/yr)	—	280.8

Modify All Conditions (Expert View)

The “Modify All Conditions” tab allows you to adjust all aspects of the wastewater system that was entered in the System Setup, allowing more control of the changes you make to your baseline.

The screenshot shows the 'Modify All Conditions' interface with two main panels. The left panel is titled 'BASELINE' and has a green dot above it. The right panel is titled 'REDUCE AERATION OPERATING POWER' and has a blue dot above it. Both panels contain input fields for various parameters. The 'BASELINE' panel includes fields for Operating Dissolved O₂ (DO), O₂ Transfer Coefficient Ratio (α), Saturation DO Concentration Ratio (β), Aerator (Surface high speed), Standard O₂ Transfer Rate (SOTR), Aeration Operating Power, Site Elevation, Aerator Operating Time, Type of Aerator (Mechanical Aerator), Aerator Speed, and a checkbox for 'Do you have an anoxic zone with returned mixed liquor from the aerobic zone?'. The 'REDUCE AERATION OPERATING POWER' panel includes fields for Operating Dissolved O₂ (DO), Optimize DO, O₂ Transfer Coefficient Ratio (α), Saturation DO Concentration Ratio (β), Aerator (Surface high speed), Standard O₂ Transfer Rate (SOTR), Aeration Operating Power, Site Elevation, Aerator Operating Time, Optimize Operating Time, Type of Aerator (Mechanical Aerator), Aerator Speed, Optimize Speed, and a checkbox for 'Do you have an anoxic zone with returned mixed liquor from the aerobic zone?'. The 'REDUCE AERATION OPERATING POWER' panel also has a blue dot above it.

The left input panel will show the input data for the baseline setup. The right input side will show the input data for the selected scenario you are adjusting.

The tabs correspond to the tabs from the System Setup, with the color coded dots corresponding to the changes that have been made to that category of the wastewater system.

- Green = Everything is the same as the baseline
- Blue = Something has been changed from the baseline
- Red = There is invalid data somewhere in the baseline or modification scenario
- Orange = A data field has a valid value but is outside of an expected calculated range

The furthest right hand side will have a panel with a set of tabs.

“Results” shows the live results of the baseline and selected scenarios with savings results calculated.

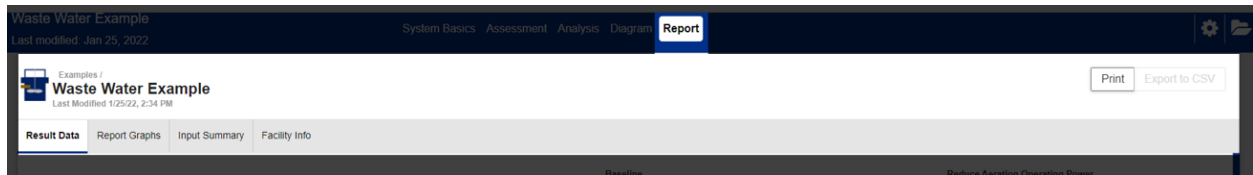
“Help” again provides field by field help text for each input field.

The screenshot shows the 'RESULTS' panel with two tabs: 'Baseline' and 'Reduce Aeration Operating Power'. The 'Reduce Aeration Operating Power' tab is selected. At the top, there is a 'Percent Savings (%)' gauge showing 33.3% savings. Below the gauge is a table comparing various parameters between the Baseline and the selected scenario. The table includes parameters such as Total Average Daily Flow Rate (MGD), RAS Flow Rate (MGD), RAS Recycle Percentage (%), WAS Flow Rate (MGD), Total Sludge Production (lb/day), Field O₂ Transfer Rate (lb O₂/hp-hr), VOLR (lb BOD/ft³-day), Total O₂ Requirements (lb/day), Total O₂ Supplied (lb/day), Effluent TSS (mg/L), Effluent Ammonia-N (mg/L), Effluent NO₃-N (mg/L), MLSS (mg/L), Solids Retention Time (Days), Mixing Intensity in Reactor (hp/Mgal), Aerator Energy Use (MWh/yr), Aerator Energy Cost (\$/yr), Annual CO₂ (tonne CO₂), Annual CO₂ Savings (tonne CO₂), Cost Savings (\$/yr), and Energy Savings (MWh/yr). The 'Reduce Aeration Operating Power' column shows significant savings in energy use, energy cost, and CO₂ emissions.

	Baseline	Reduce Aeration Operating Power
Percent Savings (%)	—	33.3%
Total Average Daily Flow Rate (MGD)	1.00	1.00
RAS Flow Rate (MGD)	0.43	0.43
RAS Recycle Percentage (%)	42.9 %	42.9 %
WAS Flow Rate (MGD)	0.010	0.010
Total Sludge Production (lb/day)	893.5	893.5
Field O ₂ Transfer Rate (lb O ₂ /hp-hr)	0.94	1.33
VOLR (lb BOD/ft ³ -day)	12.48	12.48
Total O ₂ Requirements (lb/day)	3,121.4	3,121.4
Total O ₂ Supplied (lb/day)	3,394.2	3,194.7
Effluent TSS (mg/L)	8	8
Effluent Ammonia-N (mg/L)	0.38	0.38
Effluent NO ₃ -N (mg/L)	26	26
MLSS (mg/L)	3,000	3,000
Solids Retention Time (Days)	28	28
Mixing Intensity in Reactor (hp/Mgal)	150	100
Aerator Energy Use (MWh/yr)	842.4	561.6
Aerator Energy Cost (\$/yr)	75,816	50,544
Annual CO ₂ (tonne CO ₂)	338	225
Annual CO ₂ Savings (tonne CO ₂)	—	113
Cost Savings (\$/yr)	—	25,272
Energy Savings (MWh/yr)	—	280.8

Report

The report is a printable summary of the baseline and scenarios you have created in the assessment. Tables and graphs are provided to analyze the impacts the changes have on each scenario comparatively. There is a secondary set of tabs to navigate to different pieces of the report. The “Print” button in the top right hand corner will generate a PDF report.



- Result Data: Provides a table of calculated results and summary of the selected energy projects in each scenario.
- Report Graphs: A set of graphical representations of the energy in the system.
- Input Summary: A table of the input data for the baseline and each scenario.
- Facility Info: The facility information provided for the folder that this assessment was created in.