

Quantitative Microbial Risk Assessment Tutorial

Publishing a Microbial Density Time Series as a TXT File

Gene Whelan

Kurt Wolfe

Rajbir Parmar

Michael Galvin

Marirosa Molina

U.S. Environmental Protection Agency
Office of Research and Development
National Exposure Research Laboratory
Athens, GA

Mark Gray

Paul Duda

AQUA TERRA Consultants, a Division of RESPEC, INC.
Decatur, GA

10/10/15

Summary

A SARA Timeseries Utility supports analysis and management of time-varying environmental data including listing, graphing, computing statistics, computing meteorological data and saving in a WDM or text file. File formats supported include WDM, HSPF Binary (.hbn), USGS RDB, and Text (txt) files (using the same import scripts as WDMUtil and BASINS). WDMUtil users will find that most of its functionality is included in this utility. In particular, the SARA Timeseries Utility is being used to publish a time series of microbial densities that can be viewed or consumed by other components, such as the Microbial Risk Assessment-Interface Tool (MRA-IT), which is a MathCad-based, integrated software tool based on the pathogen of interest, exposure, intake, and dose. MRA-IT consumes txt files using a Unicode Transformation Format using 8-bit code units (UTF-8), which is a character encoding capable of encoding all possible characters in Unicode using 8-bit code units. The SARA Timeseries Utility tool produces UTF-16, which is a character encoding capable of encoding all possible characters in Unicode using 16-bit code units. The objective of this effort was to modify the SARA Timeseries Utility to produce txt files in a UTF-8 format, which contributes to a seamless communication with components such as MRA-IT. This tutorial reviews some of the screens, icons, and basic functions of the SARA Timeseries Utility tool, which allows users to publish Hydrological Simulation Program – FORTRAN (HSPF) data as a UTF-8 txt file.

Publishing a Microbial Density Time Series as a TXT File

PURPOSE

Publish a microbial density time series as a Unicode Transformation Format using 8-bit code units (UTF-8) file.

OBJECTIVE

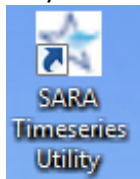
The objective is to publish a time series of microbial densities that can be viewed or consumed by other components, such as the Microbial Risk Assessment-Interface Tool (MRA-IT), which is a MathCad-based, integrated software tool based on the pathogen of interest, exposure, intake, and dose ([Whelan et al., 2014](#); [Soller et al., 2008, 2004](#)). A C++ version of MRA-IT also exists, called the Irrigation and Recreation Risk Assessment (IRRA) module ([Pelton, 2015](#)).

DEMONSTRATION

The SARA Timeseries Utility supports analysis and management of time-varying environmental data including listing, graphing, computing statistics, computing meteorological data, and saving in a WDM or text file ([Aqua Terra, 2011](#)). File formats supported include: WDM, HSPF Binary (.hbn), USGS RDB, and Text files (using the same import scripts as WDMUtil and BASINS). WDMUtil users will find that most of its functionality is included in this new utility. This tutorial reviews some of the screens, icons, and basic functions of the SARA Timeseries Utility tool ([Aqua Terra, 2011](#)), which allows users to publish HSPF data as a txt file.

SOFTWARE ACCESS, RETRIEVAL, AND DOWNLOAD

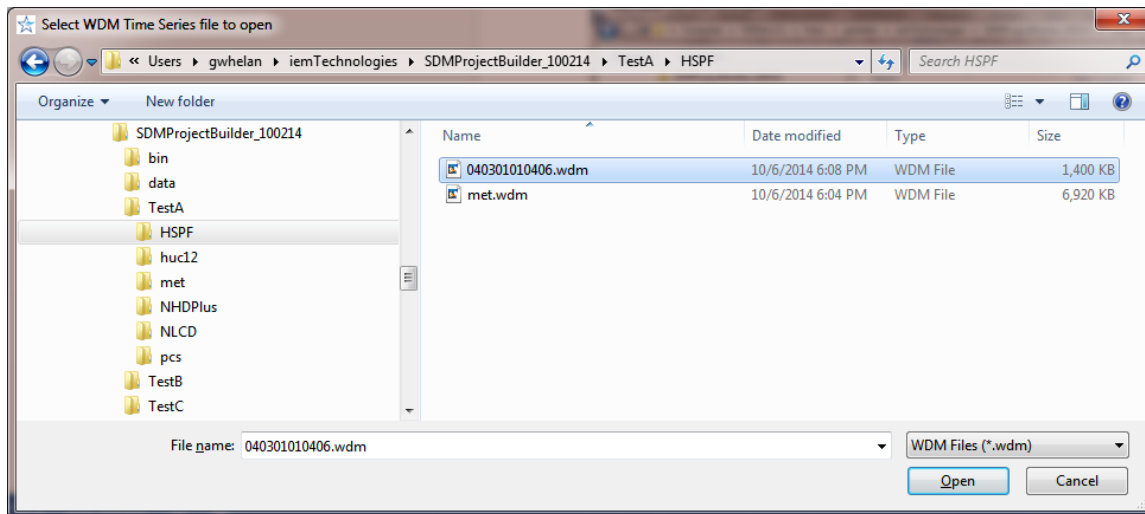
Instructions for access, retrieval, and download of the SARA Timeseries Utility software product are provided under the heading, titled SARA Timeseries Utility, in [Whelan et al. \(2015\)](#), Installation of Software for Watershed Modeling in Support of QMRA. When installed, a shortcut icon should now be on your computer screen for SARA Timeseries Utility:



TUTORIAL: USING THE SARA TIMESERIES TOOL TO SAVE DATA FROM AN HSPF MODEL AS A TEXT FILE

The SARA Timeseries Utility tool is an independent software tool that can read watershed WDM files created by HSPF and convert WDM binary information to provide multiple types of plots including txt files. Typically, a watershed WDM file is created when the user executes HSPF, and the file exists within the working folder (e.g., <working folder>\HSPF\). For example, if the user's working folder is titled "TestA", as in the example below, then the watershed WDM (e.g., 040301010406.WDM) would be located in the HSPF folder:

C:\Users\gwhelan\iemTechnologies\SDMProjectBuilder_100214\TestA\HSPF\



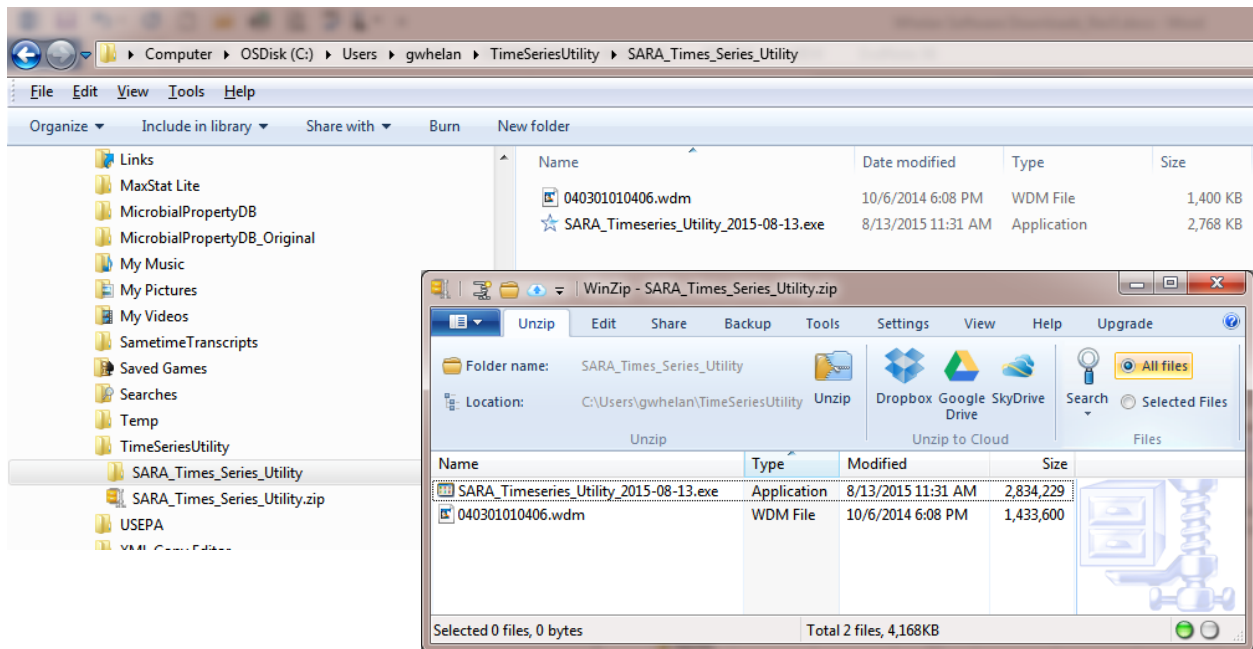
Note that there may be multiple WDM files, and the correct one has a watershed ID designation (e.g., 040301010406) as illustrated above.

For simplicity, a WDM file was created *a priori* (i.e., 040301010406.WDM), and it accompanied the software download described in Whelan et al. (2015): "040301010406.wdm". For the sake of this tutorial, it is assumed that the WDM is located in

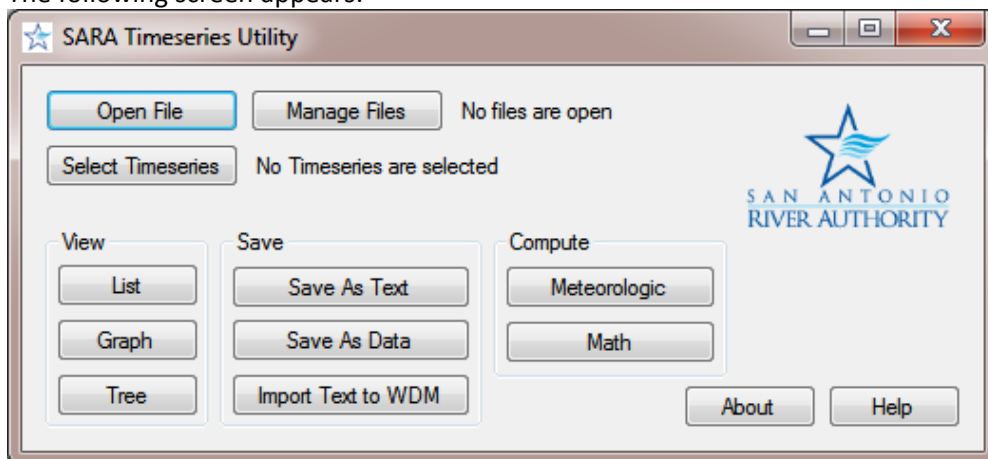
C:\Users\gwhelan\iemTechnologies\SDMProjectBuilder_100214\TestA\HSPF\

although in actuality, this particular file is located in the folder designated by the user during software installation.

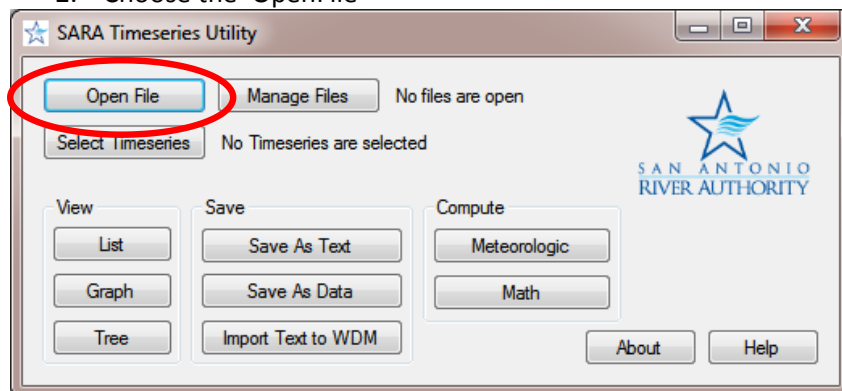
1. Run SARA Timeseries Utility, using the icon from the desktop, or double click the executable, titled TimeseriesUtility_2015-08-13.exe, located in the folder where the user saved the file, when the software was originally downloaded. See the example below, which is consistent with the information contained in the software download tutorial (Whelan et al., 2015).



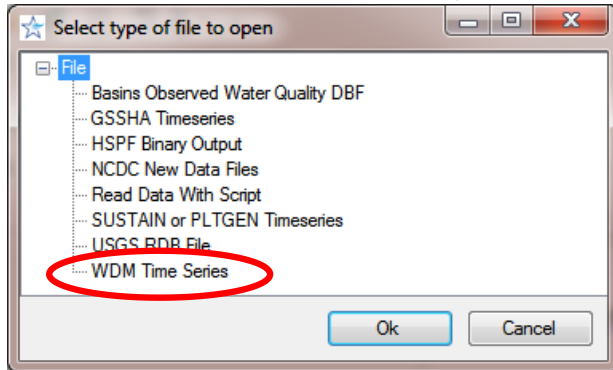
The following screen appears:



2. Choose the 'OpenFile'



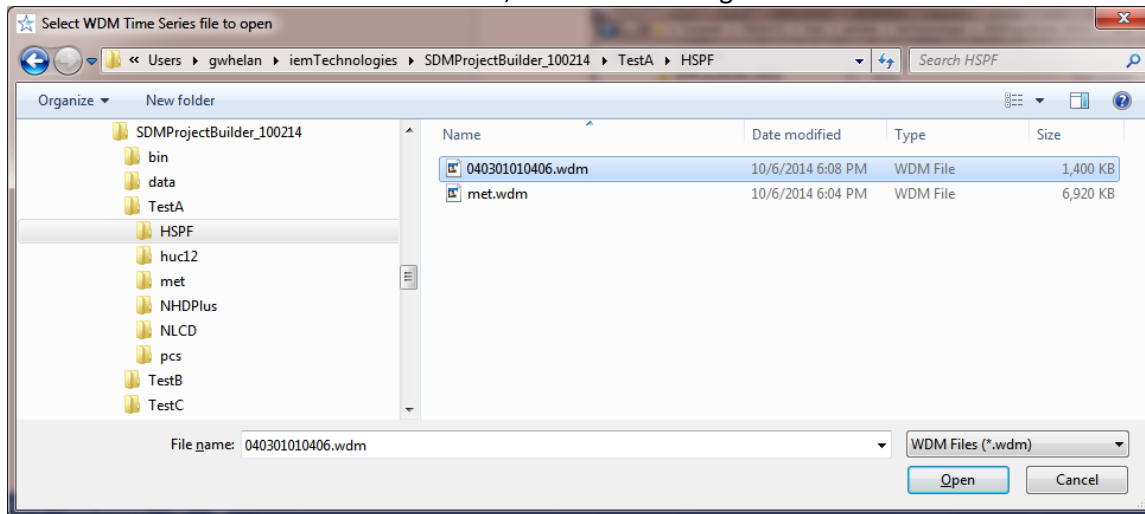
3. Select the 'WDM Time Series'; choose 'Ok'.



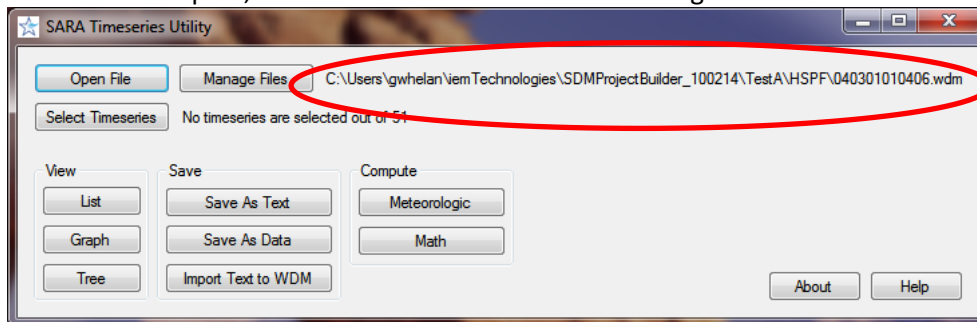
4. In the HSPF folder within your working folder, locate the WDM file referenced to the watershed ID. In this example, it is the WDM that accompanied the install (i.e., 040301010406.wdm). For simplicity, it is assumed that the WDM file is located within the working folder "TestA":

C:\Users\gwhelan\iemTechnologies\SDMProjectBuilder_100214\TestA\HSPF\

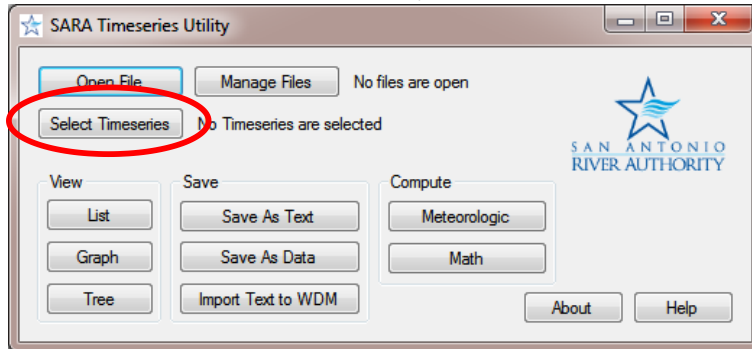
and the WDM file is 040301010406.WDM, as noted in the figure below:



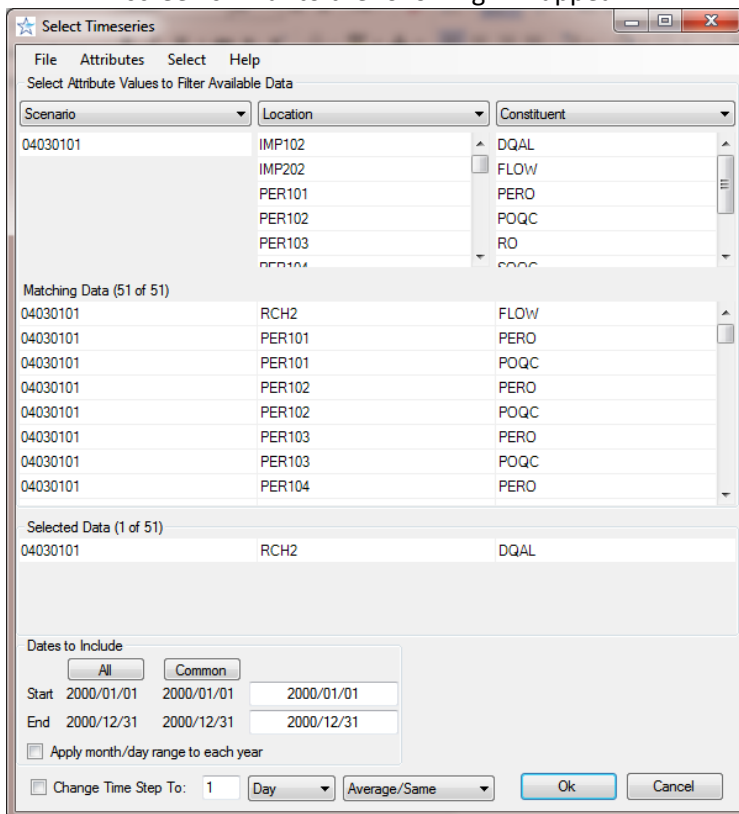
5. Click 'Open', and the name of the file becomes registered:



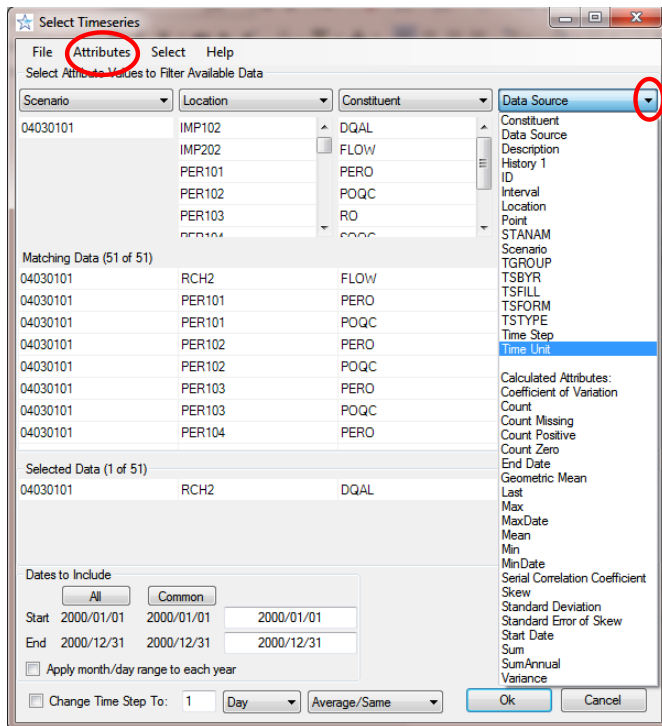
6. Choose 'Select Timeseries',



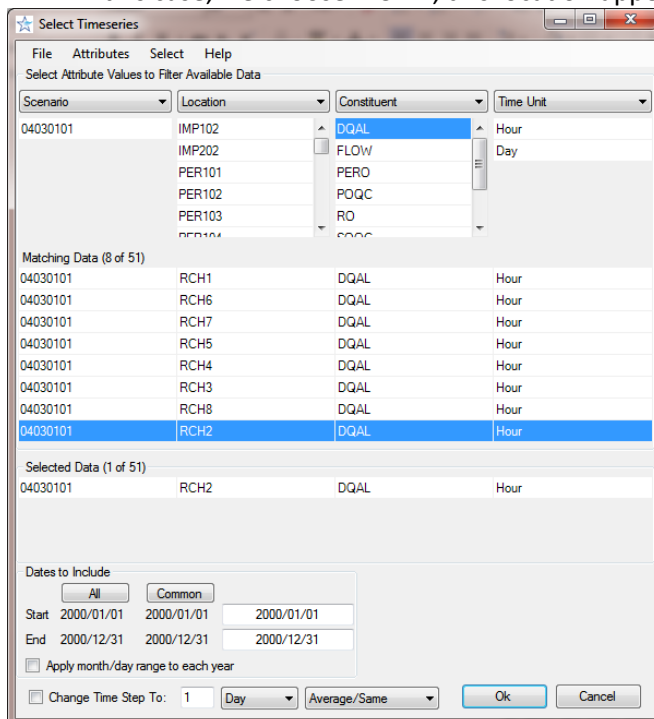
7. A screen similar to the following will appear:



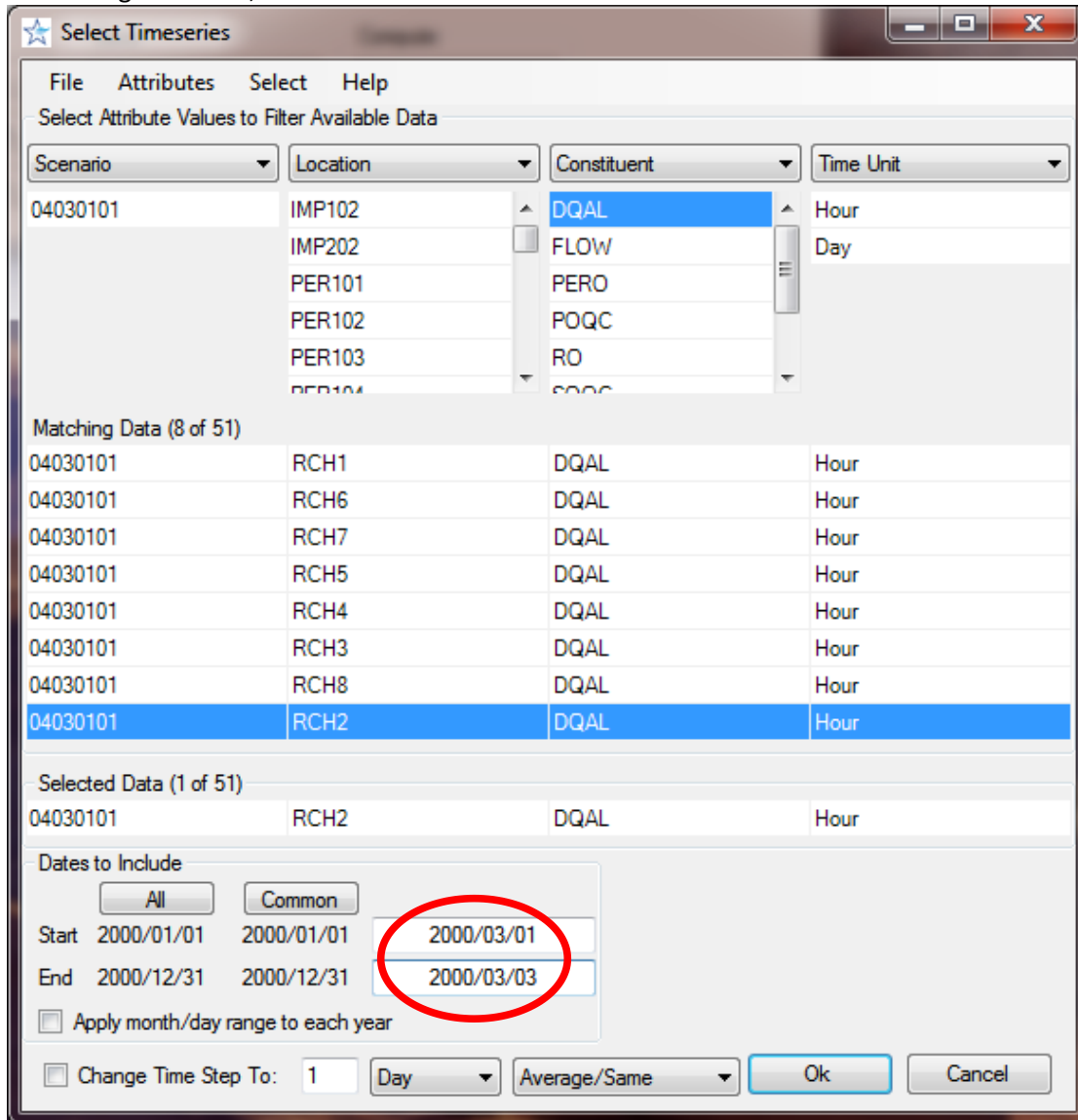
8. To add an attribute, such as the Time Unit (e.g., hour, day, month, etc.), choose 'Attributes', then 'Add'. Go to the down arrow, and choose 'Time Unit'. This is not a necessity, but it allows to user to ensure that they are choosing the data with the correct units. In this case, hourly output is needed.



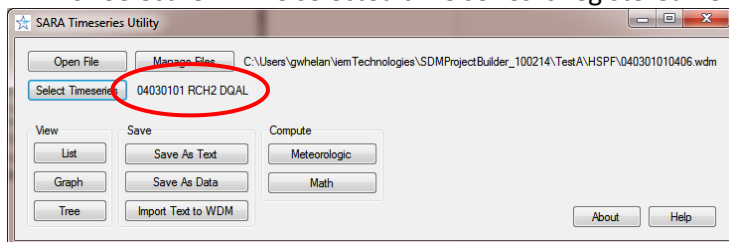
9. Within the 'Select Attribute Values to Filter Available Data' section, under the 'Constituent' heading, choose 'DQAL', as this is the constituent that provides the microbial density time series. Choose the location of interest under the 'Matching Data' section (i.e., click on 'RCH2'). In this case, we choose 'RCH2', this location appears in the 'Selected Data' section.



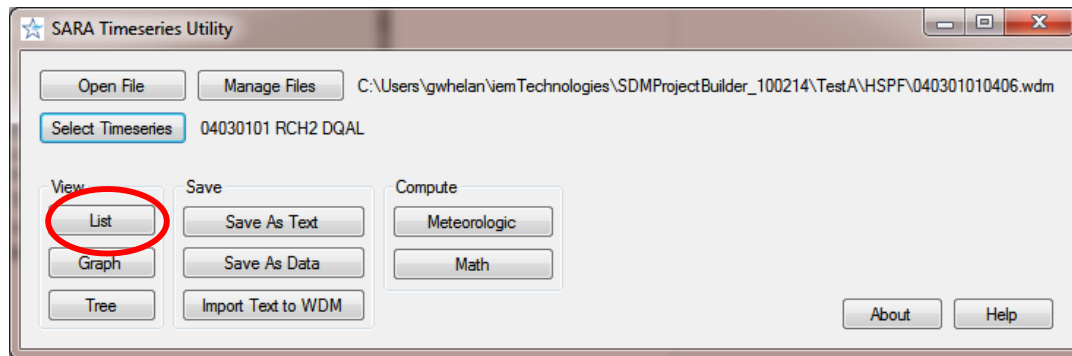
If the user wants to specify a subset of the time series, they can modify the 'Start' and 'End' dates located in the lower most section, titled 'Dates to Include'. In the example provided, the time series extends over one year (i.e., 2000). If the user is interested in a particular day or weekend (e.g., when a beach is being used), this is the place where the user chooses which days to assess. In this particular example, we would like to assess a three day exposure period from March 1, 2000 through March 3, 2000.



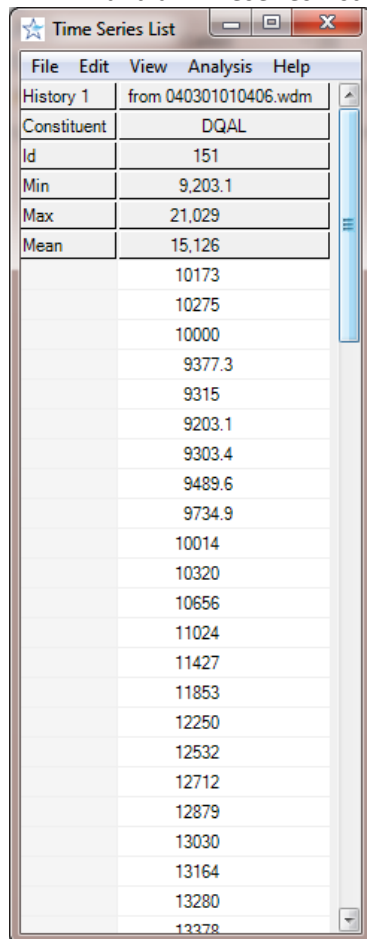
10. Select 'OK'. The selected time series is registered next to the label 'Select Timeseries':



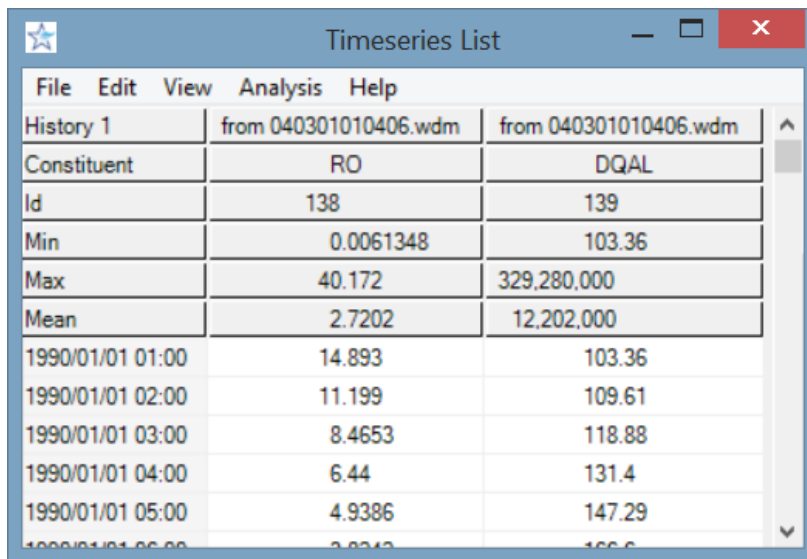
11. Select 'List'.



and a 'Timeseries List' appears:

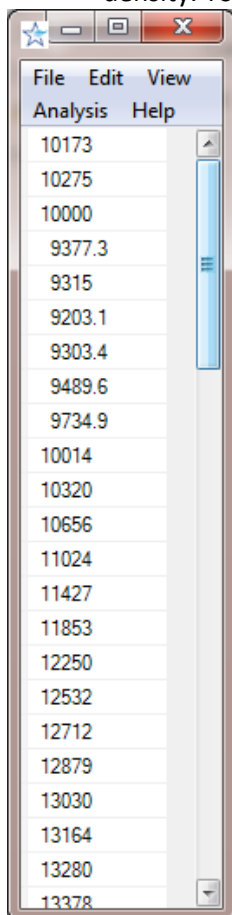


Note that the information between the pull-down menus and the data is denoted as "Attributes" (e.g., History, Constituent, Id, Min, etc.). The view may also appear as follows, because the last settings from your machine are saved, so one screen capture in this tutorial will not necessarily capture everyone's view.

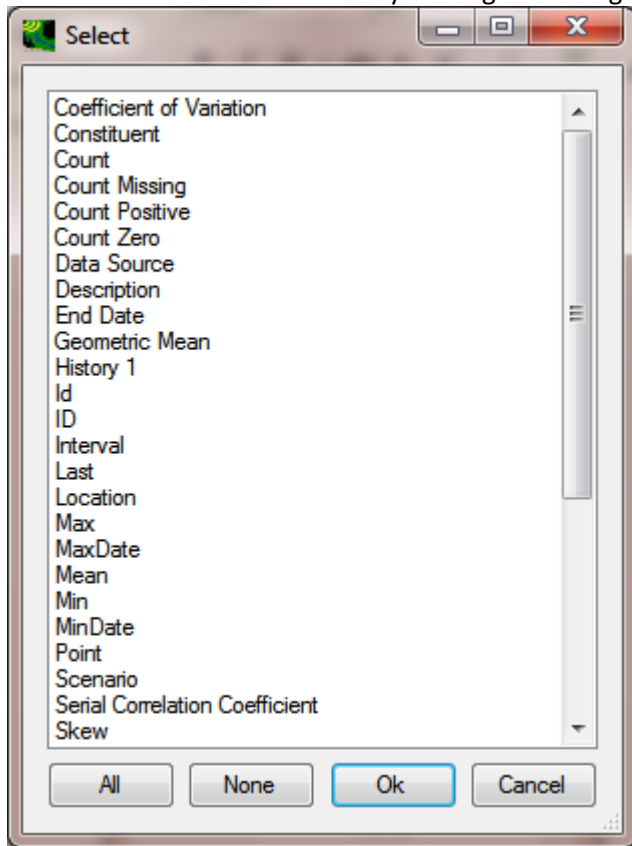


Timeseries List			
File Edit View Analysis Help			
History 1	from 040301010406.wdm	from 040301010406.wdm	
Constituent	RO	DQAL	
Id	138	139	
Min	0.0061348	103.36	
Max	40.172	329,280,000	
Mean	2.7202	12,202,000	
1990/01/01 01:00	14.893	103.36	
1990/01/01 02:00	11.199	109.61	
1990/01/01 03:00	8.4653	118.88	
1990/01/01 04:00	6.44	131.4	
1990/01/01 05:00	4.9386	147.29	

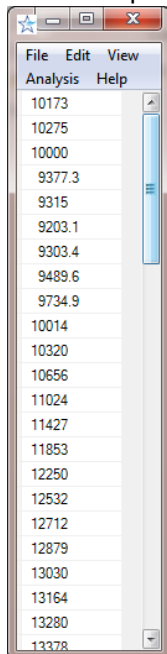
12. The output that will be saved to file can be customized. Because we will use this example to cater to the input needs of the MRA-IT model, it requires only a listing of the microbial densities without any other identifying information, such as headers or the times associated with each density. To produce such a txt file, choose 'File', then 'Select Attributes':



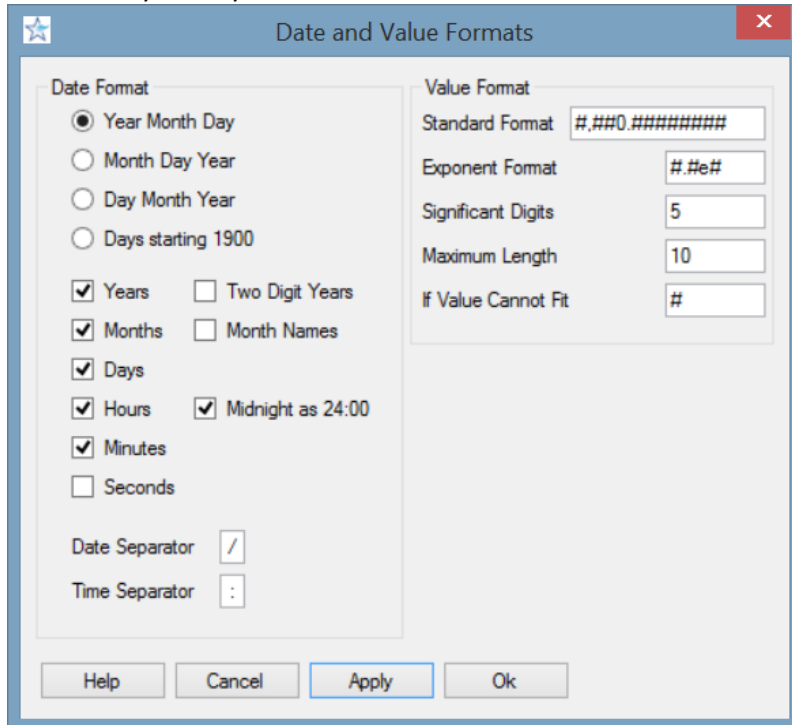
13. Deselect all Attributes by clicking on the highlighted ones, producing:



14. Choose 'OK'. Resulting in all Attributes being removed. It just so happens that this screen capture produces the same results as the previous one.

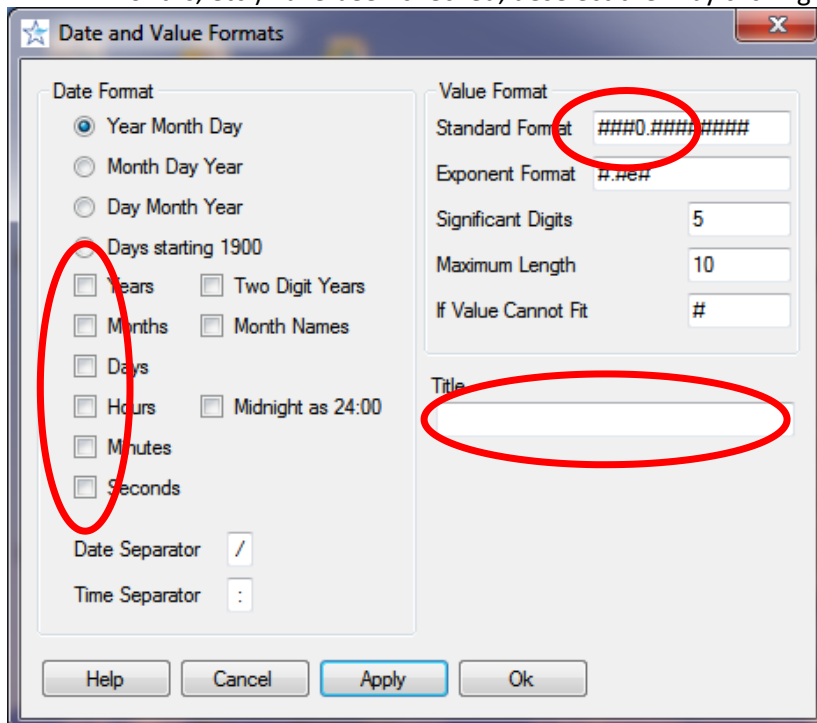


15. Choose 'View', then 'Date and Value Formats' to select/deselect formatting information. One may or may not receive a screen that looks like the following:



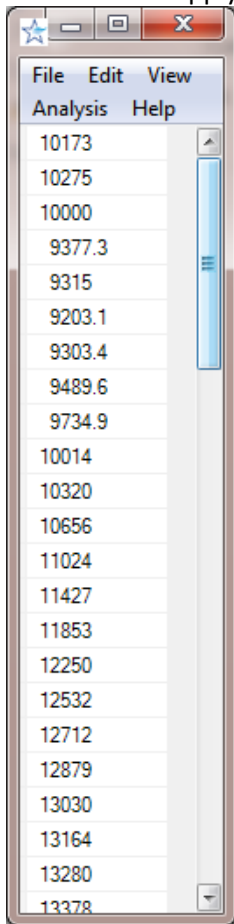
The screenshot shows the 'Date and Value Formats' dialog box. On the left, under 'Date Format', the 'Year Month Day' radio button is selected. Below it, checkboxes for 'Years', 'Months', 'Days', 'Hours', 'Minutes', and 'Seconds' are all checked. 'Two Digit Years' and 'Month Names' are unchecked. At the bottom, 'Date Separator' is '/' and 'Time Separator' is ':'. On the right, under 'Value Format', the 'Standard Format' text box contains '###0.#####'. Other fields like 'Exponent Format', 'Significant Digits', 'Maximum Length', and 'If Value Cannot Fit' are also present. At the bottom are 'Help', 'Cancel', 'Apply', and 'Ok' buttons.

16. Remove the comma in the 'Standard Format', if it exists. If the time formats (e.g., Years, Months, etc.) have been checked, deselect them by clicking on them. Finally, remove the title.



This screenshot shows the same dialog box after modifications. In the 'Date Format' section, the 'Days starting 1900' radio button is selected, and the checkboxes for 'Years', 'Months', 'Days', 'Hours', 'Minutes', and 'Seconds' are all unchecked. In the 'Value Format' section, the 'Standard Format' text box now contains '###0.#####' (the comma has been removed). At the bottom right, the 'Title' text box is empty. Red circles highlight the 'Days starting 1900' radio button, the 'Standard Format' text box, and the 'Title' text box. The 'Apply' button is highlighted in blue.

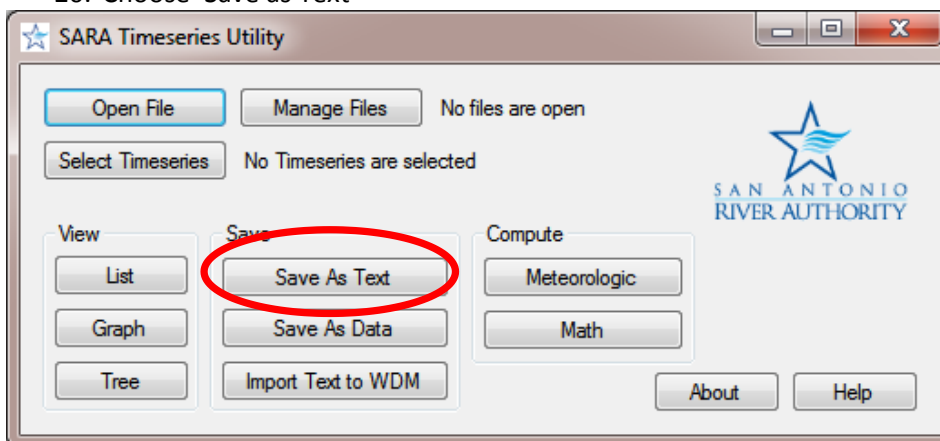
17. Click 'Apply', then 'Ok', and the commas will be removed as well as Attributes:



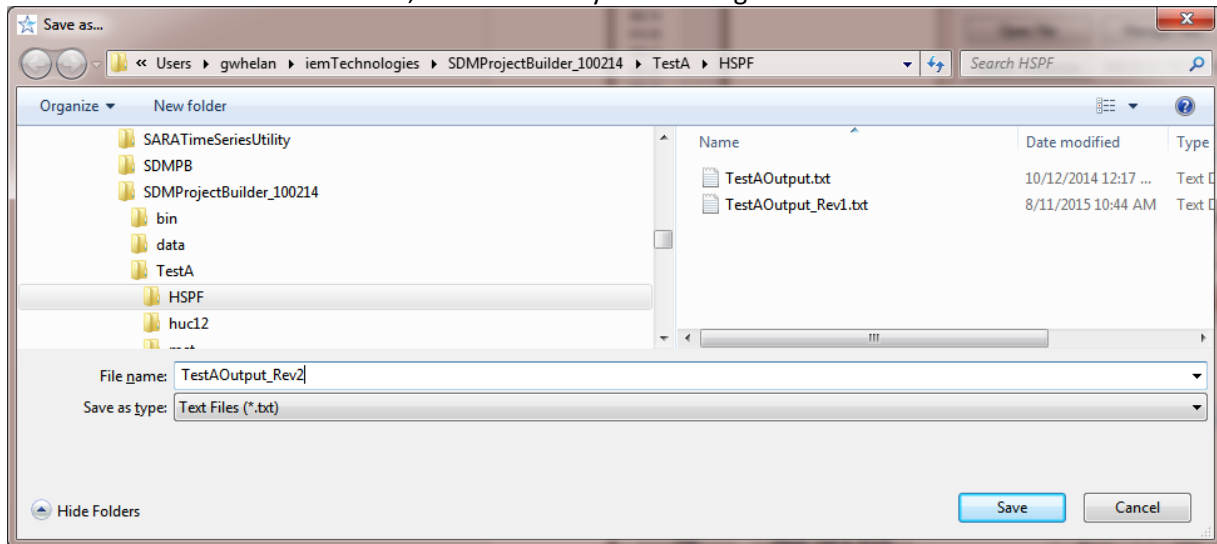
18. When satisfied with the selected data, attributes, and format, Choose 'File', then 'Save Changes'.

19. Close by clicking on the X in the upper right hand corner.

20. Choose 'Save as Text'



21. Create a name for the file, and Save it to your working folder:



After carefully choosing the format the first time using the 'Timeseries List' form, the 'Save As Text' button on the main window can be used to save other data using the same format without having to open the 'Timeseries List' form again.

22. Close by clicking on the X in the upper right hand corner. This file is ready to be consumed by other modules. In this case, by the MRA-IT risk assessment module.

DISCLAIMER

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication.

REFERENCES

Aqua Terra. 2011. SARA Timeseries Utility
<<http://www.aquaterra.com/resources/downloads/saratsutility.php>> (last accessed 12.08.15).

Pelton, M.A. 2015. IRRRA Requirements, Design and Specifications Documentation. Battelle, Pacific Northwest Division, Richland, WA (Draft)

Soller, J.A., Olivieri, A.W., Eisenberg, J.N.S., Sakaji, R., Danielson, R., 2004. Evaluation of Microbial Risk Assessment Techniques and Applications, 00-PUM-3. Water Environmental Research Foundation, Alexandria, VA.

Soller, J.A., Seto, E., Olivieri, A.W., 2008. Microbial Risk Assessment Interface Tool: User Documentation. Water Environmental Research Foundation, Alexandria, VA.

Whelan, G., K. Kim, K. Wolfe, R. Parmar, M. Galvin. 2015. Quantitative Microbial Risk Assessment Tutorial: Installation of Software for Watershed Modeling in Support of QMRA. EPA/600/B-15/276. U.S. Environmental Protection Agency, National Exposure Research Laboratory, Athens, GA.

Whelan, G., K. Kim, M.A. Pelton, J.A. Soller, K.J. Castleton, M. Molina, Y. Pachepsky, J. Ravenscroft, R. Zepp. 2014. An Integrated Environmental Modeling Framework for Performing Quantitative Microbial Risk Assessments. *Environ Modell Softw*, 55:77-91.