

# **Aquifer Pumping Test Application**

## **User Manual**

Users can use the application in two ways.

- a) They can use the applet to run the test online.
- b) They can download the java application (nonleakyaquifer.jar) and run it from their own machine. The user will need the Java Runtime Environment installed in his machine. The command for running the application is.

*java -jar nonleakyaquifer.jar*

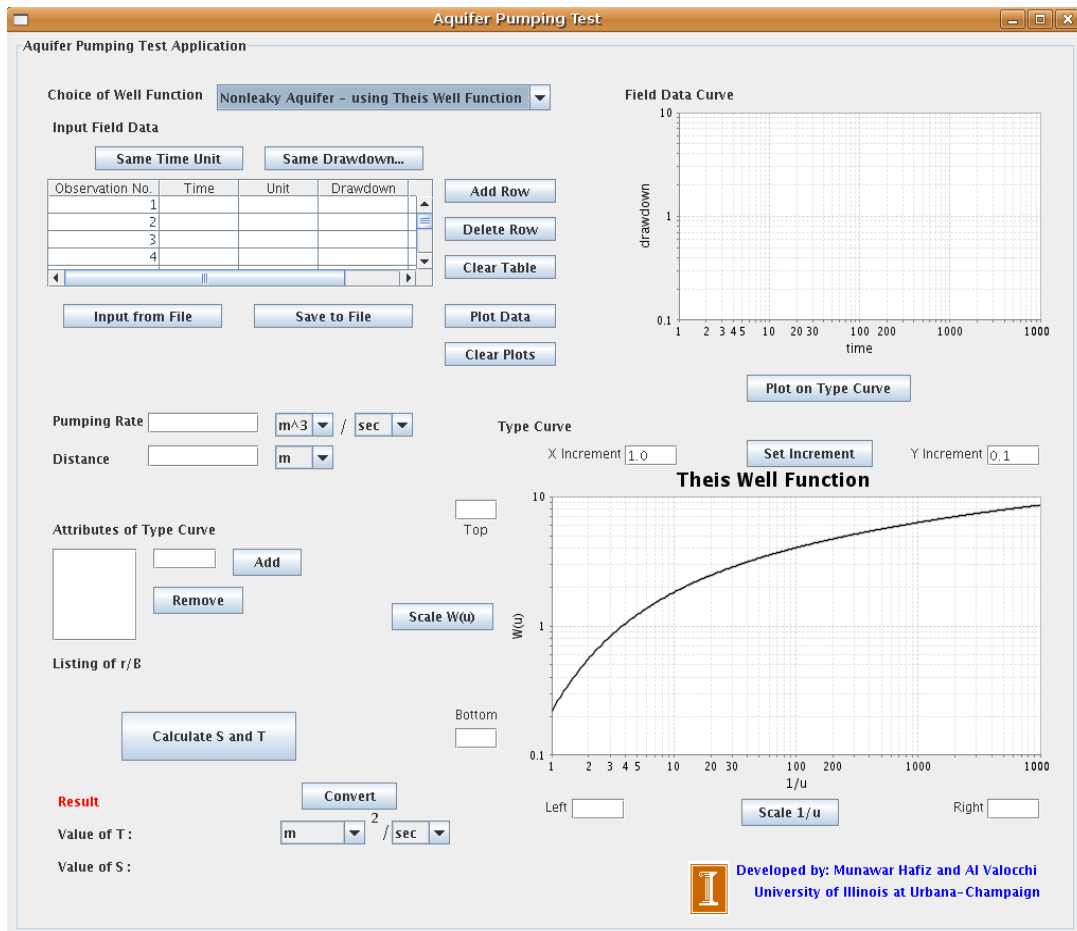
When users run this program as an application, they will be able to input the measured data (time and drawdown) from a disk file. The file has a special format. A user can manually create a data file following the format. Alternatively, a user can use the accompanying excel sheet to generate an input file (see Appendix A). Information about the file format and how to generate the file is available in Appendix B.

The applet does not support input from a disk file. Users will have to type their data in the table. The difference between the user interface of the applet and the application is that the applet does not have the two command buttons for reading and writing from a disk file.

In order to run the application, the screen resolution must be higher than 1024x768. At 1024x768 resolution, parts of the screen can not be accessed.

## Step by step guide:

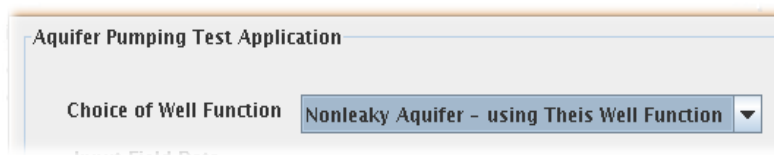
Here is a screen shot of the application.



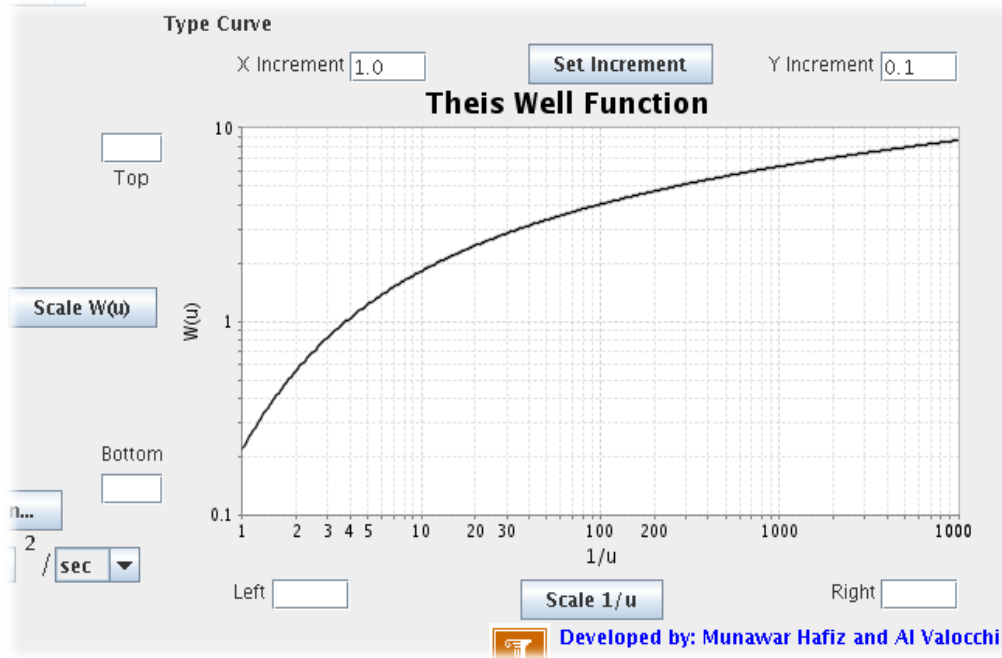
The following is a step by step guide for calculating transmissivity and storativity.

### Step 1: Choosing the Well Function

A user chooses between the Theis well function and the Hantush-Jacob well function using the combo box in the upper left corner.



When the user chooses his desired well function, the type curve at the bottom right changes. The graph follows a logarithmic scale (base 10 log) in the x-axis. The user can set different scales for both the X-axis and the Y-axis using the text input fields and the buttons for scaling. For changing the X-axis, the user has to set the left and right scale and press the 'Scale 1/u' button.



The scaling is rounded off to the next whole number in the logarithmic scale. The lower bound is rounded off to the nearest logarithmic whole number that is smaller than the value. The upper bound is rounded off to the nearest logarithmic value that is higher than the value. Hence, if the user selects 2 as the lower bound and 800 as the upper bound and presses the 'Scale 1/u' button, then the calculation is done as follows.

Log of lower bound (2) = 0.30103  
 Nearest whole number that is smaller = 0  
 Left bound starts at 0 raised to the power of 10, i.e. 1.

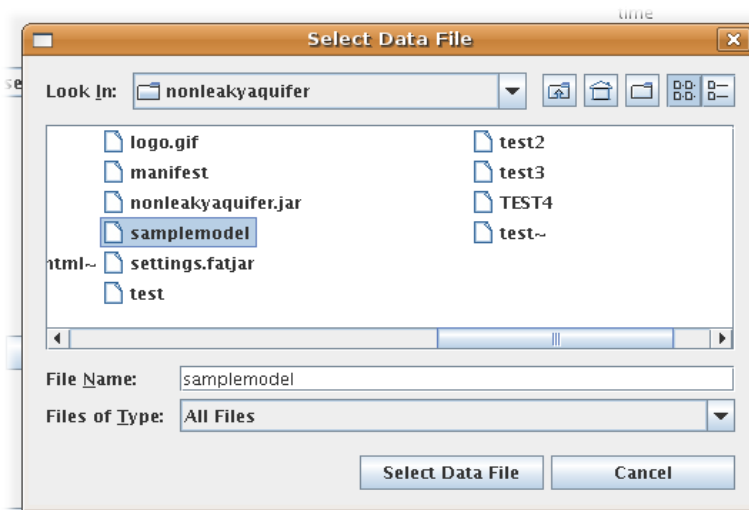
Log of upper bound (800) ~ 2.90  
 Nearest whole number that is larger = 3  
 Upper bound is 3 raised to the power of 10, i.e. 1000.

Hence the curve scales from 1 to 1000.  
 The scaling for Y-axis follows the same algorithm.

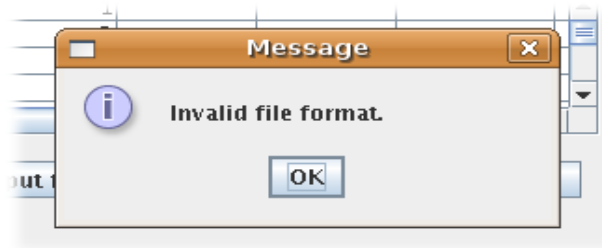
## Step 2: Input time and drawdown

A user can input field data in two ways. For the application, he can input from a formatted text file, or directly add data in the table. A user using the applet does not have the option to input data from a file; he can only add data by editing the table.

In order to select the Input file, the user has to press the 'Input From File' Button, select the file and the press 'Select Data File'.

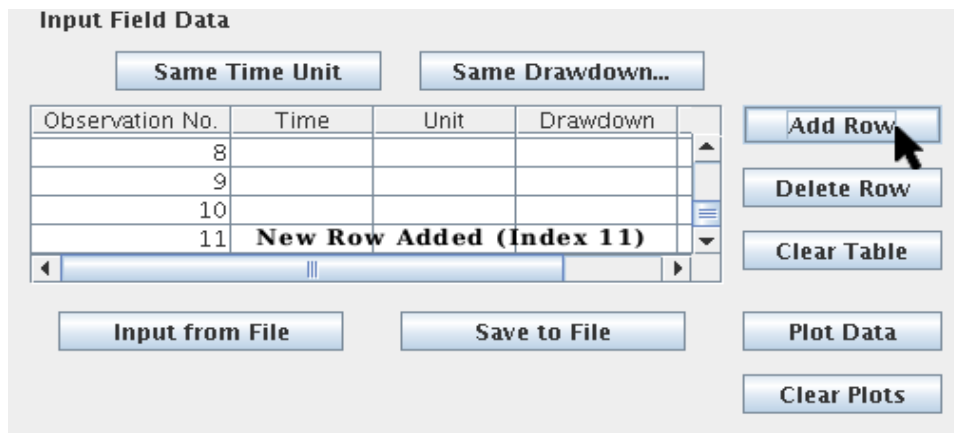


The Input file should be of a specific format, otherwise there will be an error message.



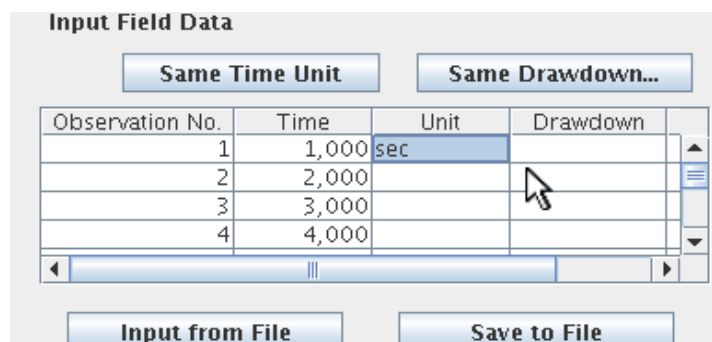
Input files in the appropriate format can be generated from the Excel sheet included with the package. (See Appendix B for generating appropriate input files without the Excel sheet).

The other option is to edit data in the table. By default, the table has at least ten rows for data input, but new rows can easily be added by clicking the 'Add Row' button. Similarly, the 'Delete Row' button deletes the currently selected row(s). If a user presses the 'Delete row' button that reduces the number of rows less than ten, then the number of rows is reduced to ten. As a policy, the minimum number of rows in the table is ten. This does not mean that there must be at least ten data observations. A user can plot data on the curve with any number of inputs. The minimum cap in the row count of the table is for table handling only.

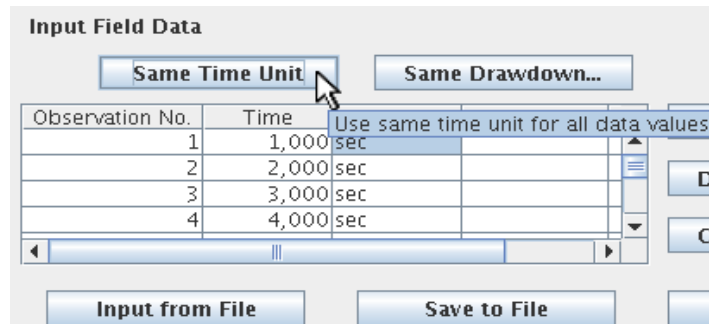


Note, the index column of the table cannot be changed. It is automatically generated by the application when new rows are added or deleted.

The user then enters the time and drawdown values and selects the units from the comboboxes in the unit columns. If all the values of time or drawdown have the same unit, the user can enter the first data row and click the 'Same Time Unit' or 'Same Drawdown Unit' to have all the values follow the same unit. For example,



When the user presses the 'Same Time Unit' button,

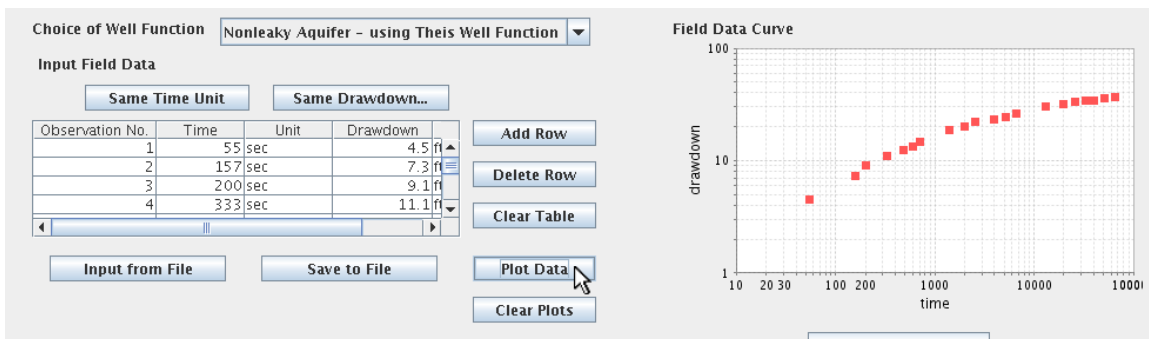


To save the input data to a file, the user clicks the 'Save to File' Button. Then he enters a file name and the data gets saved in the appropriate format in that file. The save option is only available for the application.

The 'Clear Table' Button clears the table and sets the number of rows to ten.

### Step 3: Plotting the Field Data Curve

After entering time and drawdown data in the table, the user plots the data using the 'Plot Data' button. The data is plotted on the chart in the Field Data Curve section.



The user can clear the plotted data by clicking on the 'Clear Plots' button. This clears the field curve and the type curve and also initializes the type curve.

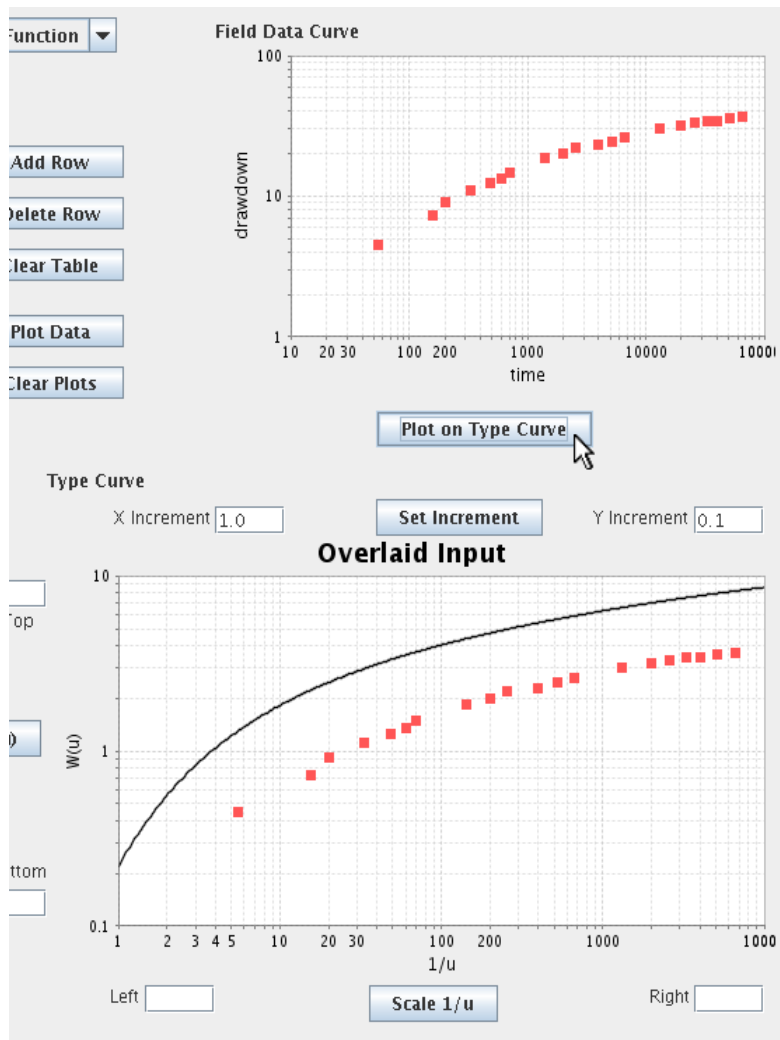
#### Step 4: Setting the values for Pumping Rate and Radius

The user now sets the value of pumping rate,  $Q$  and radius,  $r$ . The unit for  $Q$  and  $r$  can be selected from the associated combo boxes. The user is now ready to plot the Field Data Curve on the Type curve, and find a match point.

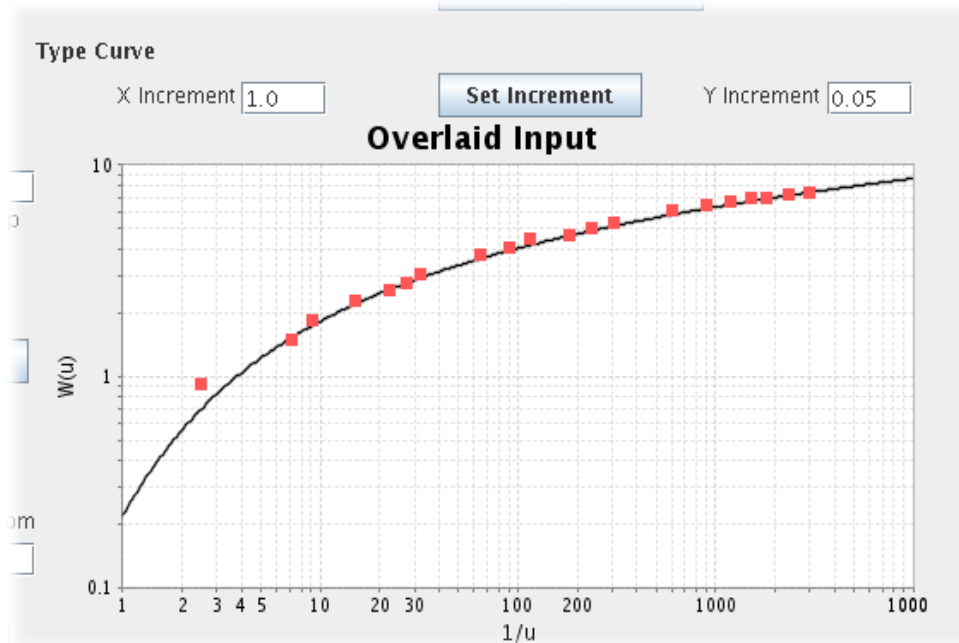
Pumping Rate  gal... / day  
Distance  m

#### Step 5: Finding the overlap

The user presses the 'Plot on Type Curve' button to plot the input data on the type curve.



In order to find the match point, the user has to select the type curve by clicking the mouse over it. The user can then use the arrow keys (Up, Down, Left, Right) to move the data curve to find an overlap to the type curve.



The movement can be controlled by changing the moving increment on the X axis and the Y axis. The default value of increment is 1 for both the X and the Y axes. In order to change the increment user has to set the X increment and Y increment value and then press the 'Set Increment' button.

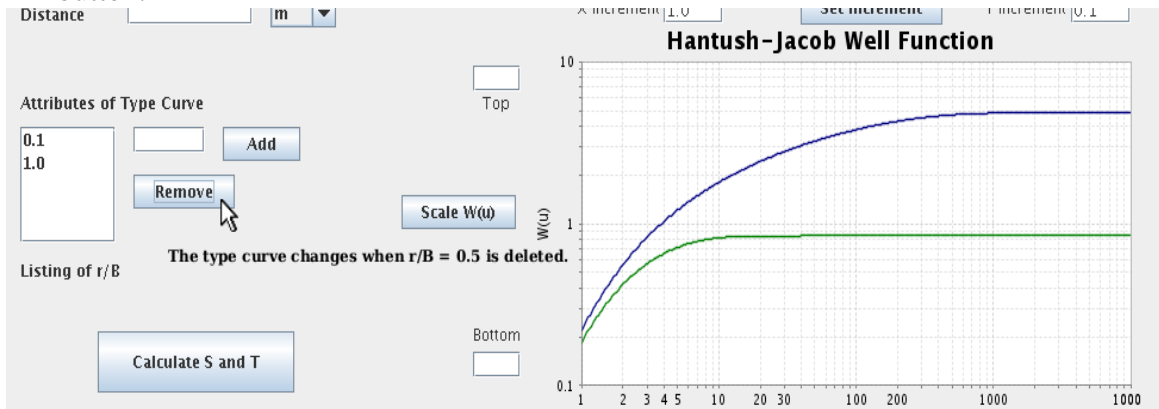
The plotted data moves based on the center data point. When the user needs to set the x and y increments, he sets them according to the center data



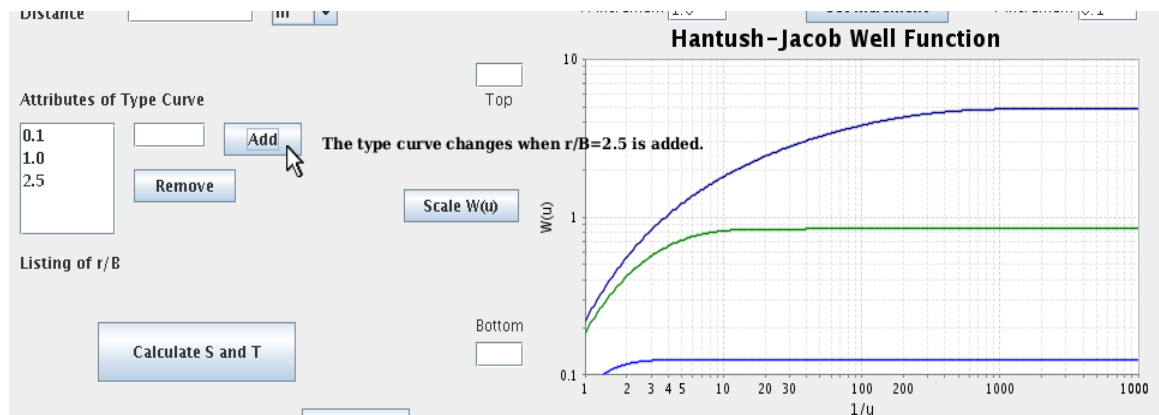
### Step 6 (optional): Setting the $r/B$ value of the Hantush-Jacob curve

For the Hantush-Jacob Curve, the  $r/B$  values for the curve can be changed to generate more lines.

The default set of values for  $r/B$  is  $\{0.1, 0.5, 1.0\}$ . In order to delete a value, the user has to select the value in the Attributes of Curve section, and then click the Remove button.

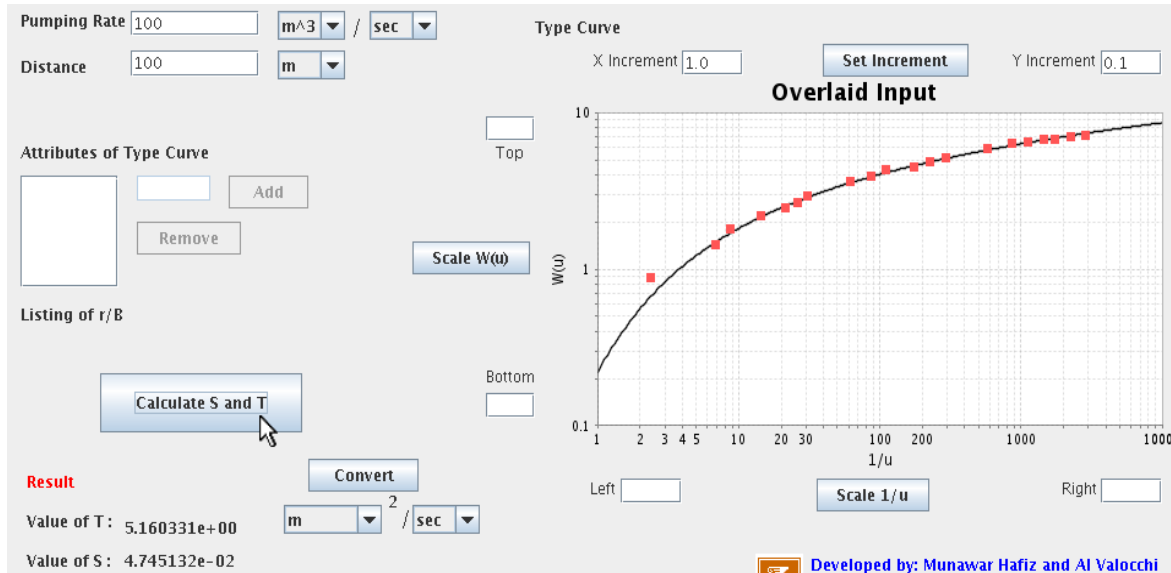


In order to add a new  $r/B$  value to the set, the user has to insert the new value in the text field next to the list of values and then click the Add button. The type curve gets updated accordingly.

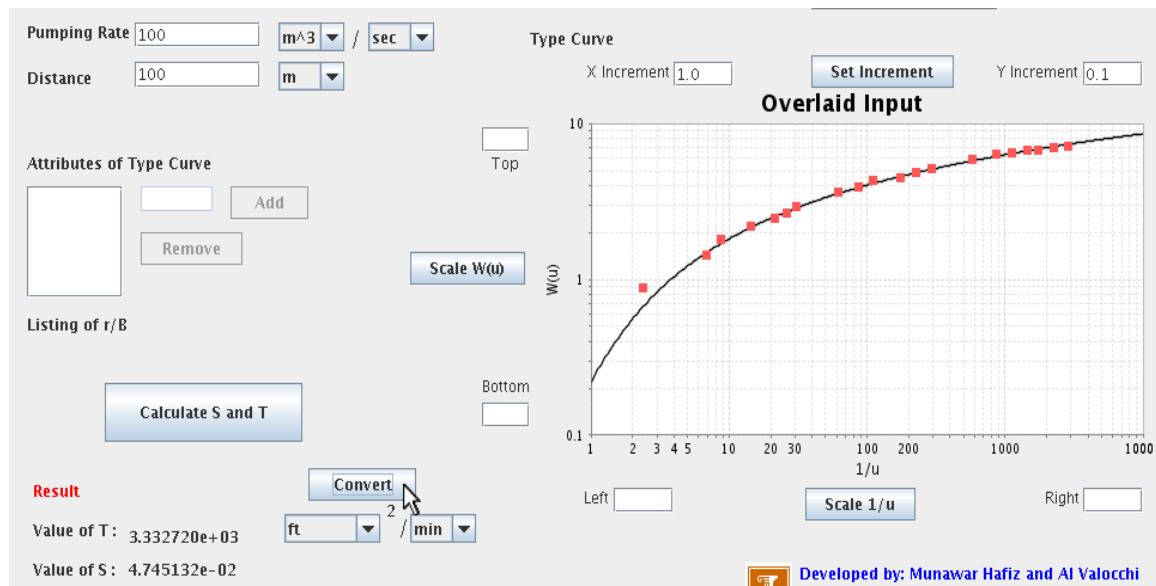


### Step 7: Calculating Transmissivity (T) and Storativity (S)

After getting a desirable match point, user calculates the transmissivity and storativity value by pressing the 'Calculate S and T' button.



The default unit for transmissivity is m<sup>2</sup>/sec and the storativity value is dimensionless. The values for T can be determined in other units. The user has to select the desired unit for T from the associated combo and press the 'Convert' button.



## Appendix A – Excel sheet

|    | A | B | C | D             | E                | F               | G                    | H | I | J | K | L | M | N |
|----|---|---|---|---------------|------------------|-----------------|----------------------|---|---|---|---|---|---|---|
| 1  |   |   |   | Use Same Unit |                  | Use Same Unit   |                      |   |   |   |   |   |   |   |
| 2  |   |   |   |               |                  |                 |                      |   |   |   |   |   |   |   |
| 3  |   |   |   |               |                  |                 |                      |   |   |   |   |   |   |   |
| 4  |   |   |   |               |                  |                 |                      |   |   |   |   |   |   |   |
| 5  |   |   |   | <b>Time</b>   | <b>Time Unit</b> | <b>Drawdown</b> | <b>Drawdown Unit</b> |   |   |   |   |   |   |   |
| 6  |   |   |   | 1,000         | sec              | 1,000           | mm                   |   |   |   |   |   |   |   |
| 7  |   |   |   | 2,000         | sec              | 2,000           | mm                   |   |   |   |   |   |   |   |
| 8  |   |   |   | 3,000         | sec              | 3,000           | mm                   |   |   |   |   |   |   |   |
| 9  |   |   |   | 4,000         | sec              | 4,000           | mm                   |   |   |   |   |   |   |   |
| 10 |   |   |   | 5,000         | sec              | 5,000           | mm                   |   |   |   |   |   |   |   |
| 11 |   |   |   | 6,000         | sec              | 6,000           | mm                   |   |   |   |   |   |   |   |
| 12 |   |   |   | 7,000         | sec              | 7,000           | mm                   |   |   |   |   |   |   |   |
| 13 |   |   |   | 8,000         | sec              | 8,000           | mm                   |   |   |   |   |   |   |   |
| 14 |   |   |   | 9,000         | sec              | 9,000           | mm                   |   |   |   |   |   |   |   |
| 15 |   |   |   | 10,000        | sec              | 10,000          | mm                   |   |   |   |   |   |   |   |
| 16 |   |   |   | 11,000        | sec              | 11,000          | mm                   |   |   |   |   |   |   |   |
| 17 |   |   |   | 12,000        | sec              | 12,000          | mm                   |   |   |   |   |   |   |   |
| 18 |   |   |   | 13,000        | sec              | 13,000          | mm                   |   |   |   |   |   |   |   |
| 19 |   |   |   | 14,000        | sec              | 14,000          | mm                   |   |   |   |   |   |   |   |
| 20 |   |   |   | 15,000        | sec              | 15,000          | mm                   |   |   |   |   |   |   |   |
| 21 |   |   |   | 16,000        | sec              | 16,000          | mm                   |   |   |   |   |   |   |   |
| 22 |   |   |   | 17,000        | sec              | 17,000          | mm                   |   |   |   |   |   |   |   |
| 23 |   |   |   | 18,000        | sec              | 18,000          | mm                   |   |   |   |   |   |   |   |
| 24 |   |   |   | 19,000        | sec              | 19,000          | mm                   |   |   |   |   |   |   |   |
| 25 |   |   |   | 20,000        | sec              | 20,000          | mm                   |   |   |   |   |   |   |   |
| 26 |   |   |   | 21,000        | sec              | 21,000          | mm                   |   |   |   |   |   |   |   |
| 27 |   |   |   | 22,000        | sec              | 22,000          | mm                   |   |   |   |   |   |   |   |
| 28 |   |   |   | 23,000        | sec              | 23,000          | mm                   |   |   |   |   |   |   |   |
| 29 |   |   |   | 24,000        | sec              | 24,000          | mm                   |   |   |   |   |   |   |   |
| 30 |   |   |   | 25,000        | sec              | 25,000          | mm                   |   |   |   |   |   |   |   |

The excel file can be used to input up to 25 data values for time and drawdown. The user inputs data in the excel sheet, and then presses the 'Save Input File' button. Then he selects the file path and saves the input file in the proper format. This input file can be read by the aquifer test application. The excel sheet has the 'Same time unit' and 'Same drawdown unit' button that can be used for fast data entry (See step 2).

## Appendix B – Input File Format

The time and drawdown data is stored in an ASCII text file. The first line of the file contains the data count, i.e. number of rows of data. The following lines contain the data each row containing a separate row of the table. Each row has five values each separated by a tab. The first column contains the index. It is an integer that increments by 1 for each row. The second column contains the time value. The third column contains the time unit. The valid units are *sec*, *min*, *hour* and *day*. The fourth column contains the drawdown value. The final column contains the drawdown unit. The valid units are *m*, *cm*, *ft* and *in*.

Here is a sample input file containing seven data rows. The contents of the file are in bold face. The italicized text (in blue) contains the illustration.

```
7 <----- Count of data values
1    55.0  sec   4.5   ft
2    157.0 sec   7.3   ft
3    200.0 sec   9.1   ft
4    333.0 sec  11.1  ft
5    490.0 sec  12.5  ft
6    600.0 sec  13.5  ft
7    700.0 sec  14.8  ft
^      ^    ^      ^      ^
Index  ^    Time  ^    Drawdown
      ^    unit  ^    unit
      ^          ^
      ^          ^
      Time value Drawdown
                   value
```

### Contact Information

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