

**“The Flowsheet  
Processor”**

# LIMN USER WIZARD

Compiled by: Richard Jermyn | The Flowsheet Guru | R&R Jermyn Pty Ltd

Date: 25 June 2004

<mailto:richardj@theflowsheetguru.com.au>



# CONTENTS


1.	INTRODUCTION .....	3
2.	CREATING THE USER DEFINED WIZARD .....	3
3.	CREATING AN ICON PICTURE FOR USER WIZARDS .....	6
4.	CONFIGURING THE WIZARD .....	8
5.	RUNNING THE USER WIZARD .....	10
6.	POPULATING THE WORKSHEETS .....	12
7.	CREATING A USER DEFINED UNIT MODEL .....	15
8.	CREATING ADVANCED UNIT MODELS .....	18
	APPENDIX A: USER WIZARD WORKED EXAMPLE .....	21

## 1. INTRODUCTION

When one is doing simulations with the same set of parameters it is easier to create a user-defined wizard. By editing the stream data sheets in the creation of the user wizard one does not have to edit the sheets once the wizard has run.

## 2. CREATING THE USER DEFINED WIZARD

2.1 Open a new Microsoft Excel workbook. Do not enter anything onto the sheets, make sure that they are all blank.

2.2 Click on the Limn: Wizards button. 

2.3 Select the 1D\_Vertical Wizard. The 1\_D Vertical Wizard will be used for this example however a user defined wizard can be created using any of the wizards.

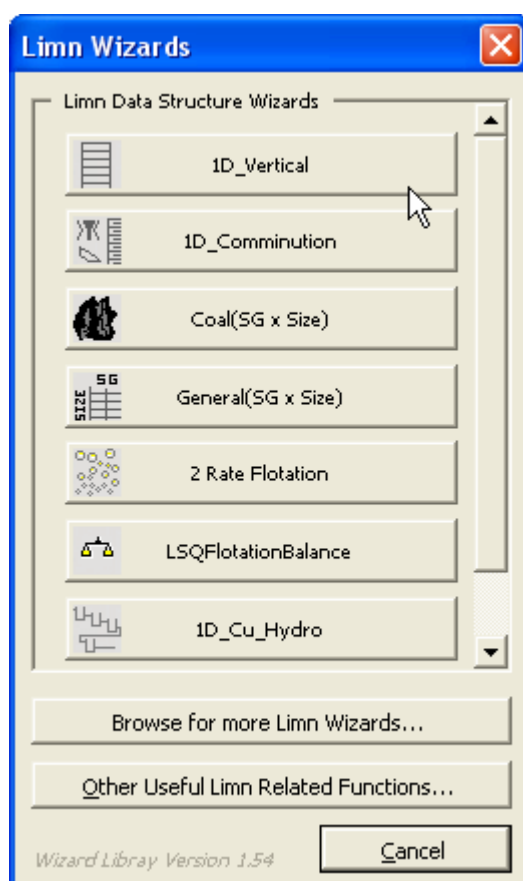


Figure 1: LIMN Wizards template

2.4 One will notice that the wizard only has 2 steps as opposed to the 6 steps when running the wizard with a complete flowsheet.

2.5 Click Next.

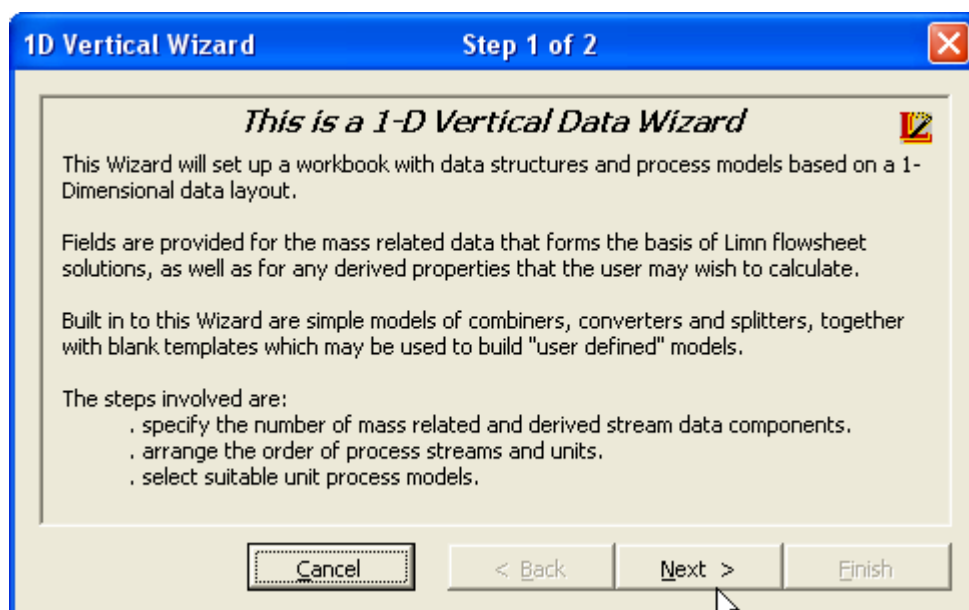


Figure 2: Step 1 of 2

2.6 Change the number of mass related components to 6 and the number of derived components to 3.

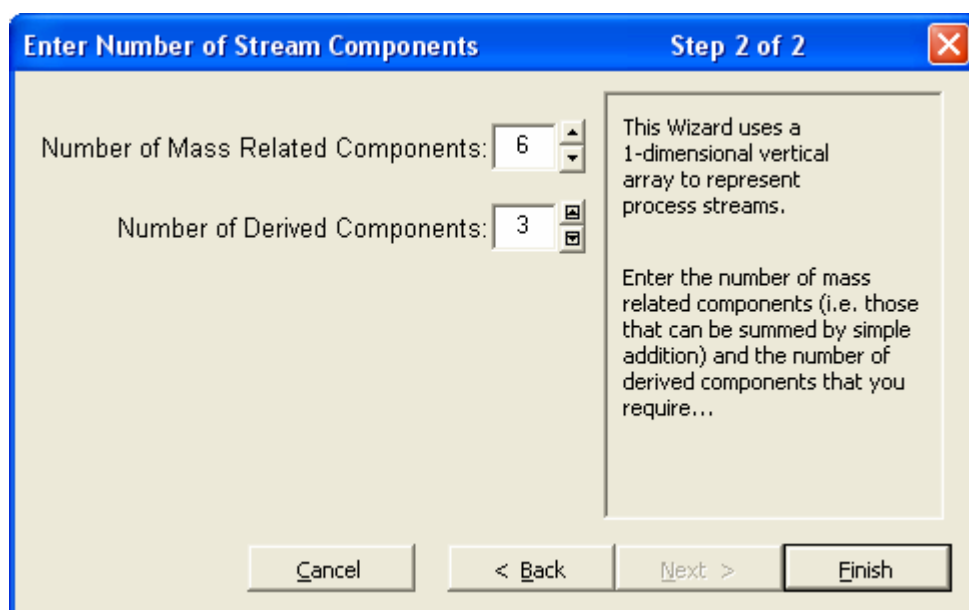


Figure 3: Step 2 of 2

2.7 Click on Finish.

2.8 The wizard will then prompt the user to save the wizard template. Click Yes.

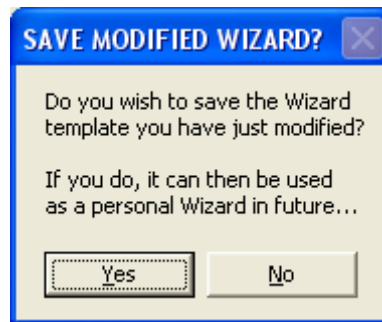


Figure 4: Save Wizard prompt

2.9 Save the wizard as Wizard\_1\_My\_1D\_Wizard.xls. Make sure that the name is correct.

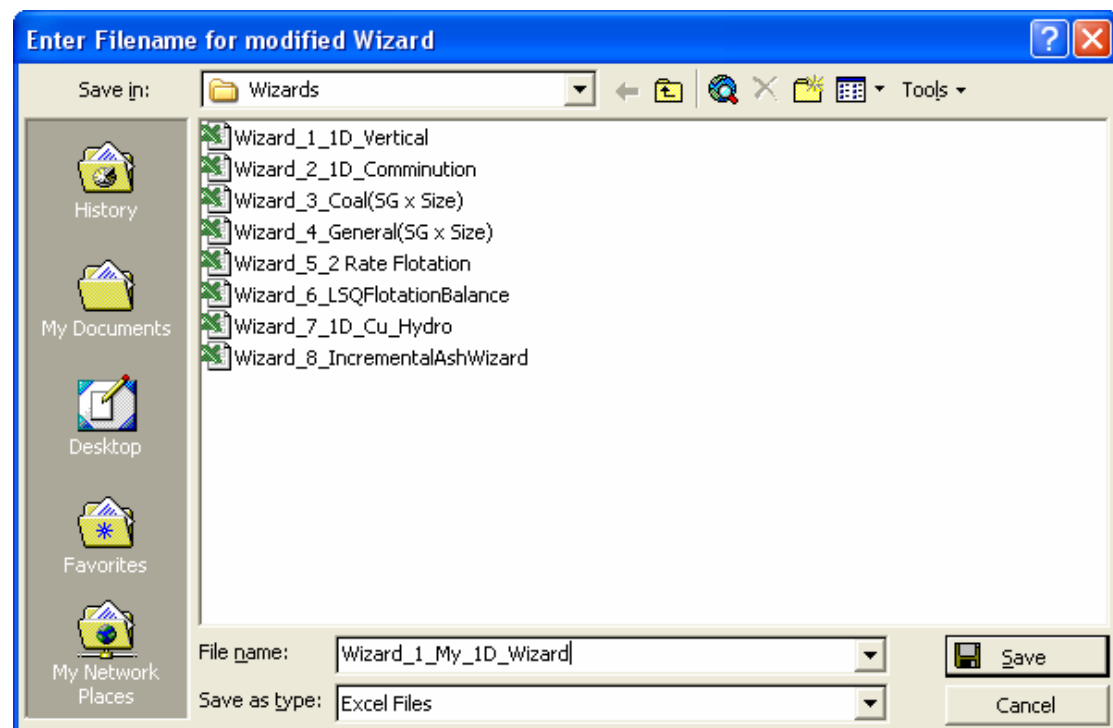


Figure 5: Save wizard

2.10 Close the Excel workbook.

### 3. CREATING AN ICON PICTURE FOR USER WIZARDS

Once a new user defined wizard has been created one can create an icon picture for the wizard.



3.1 Open Microsoft Paint.

3.2 To ensure that the icon picture is the right size one must specify the pixels. Click on the Image menu in Paint, select Attributes. Set the Width to 24 and the Height to 24. Make sure that Pixels and Colors are selected.



3.3 Use the paint drawing toolbar to reproduce the image in figure 6. Use the Large Size option for Zoom in the View toolbar.

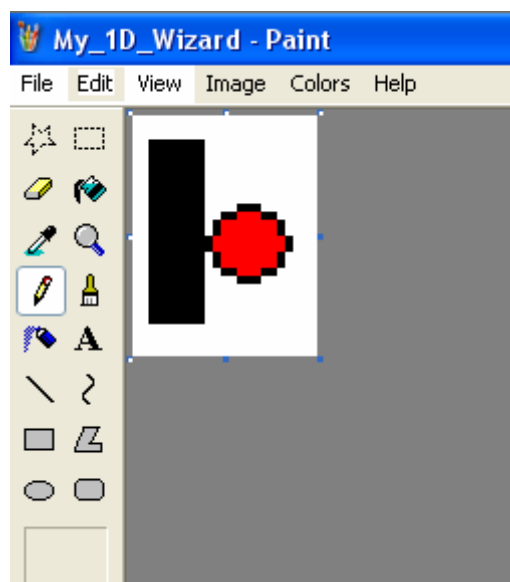



Figure 6: Wizard Icon Picture

- 3.4 Save the picture as a bitmap in the same folder as the LIMN user wizard, ie c:\ LIMN Wizards. The icon picture name must be the same as the associated wizard file without the "Wizard\_n\_" prefix.
- 3.5 Save the bitmap as My\_1D\_Wizard.bmp. The icon picture file must have the same format as the wizard file or else LIMN will not assign the picture to the wizard.
- 3.6 Check the icon picture by clicking the Limn: Wizards button in Excel. 

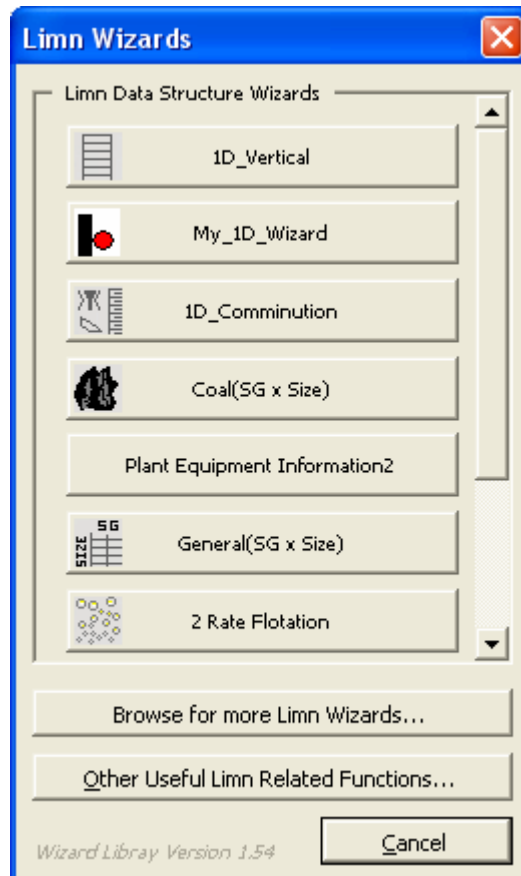


Figure 7: My\_1D\_Wizard button

## 4. CONFIGURING THE WIZARD

4.1 Open the wizard Wizard\_1\_My\_1D\_Wizard.xls in the folder C: \LIMN \ Wizards.

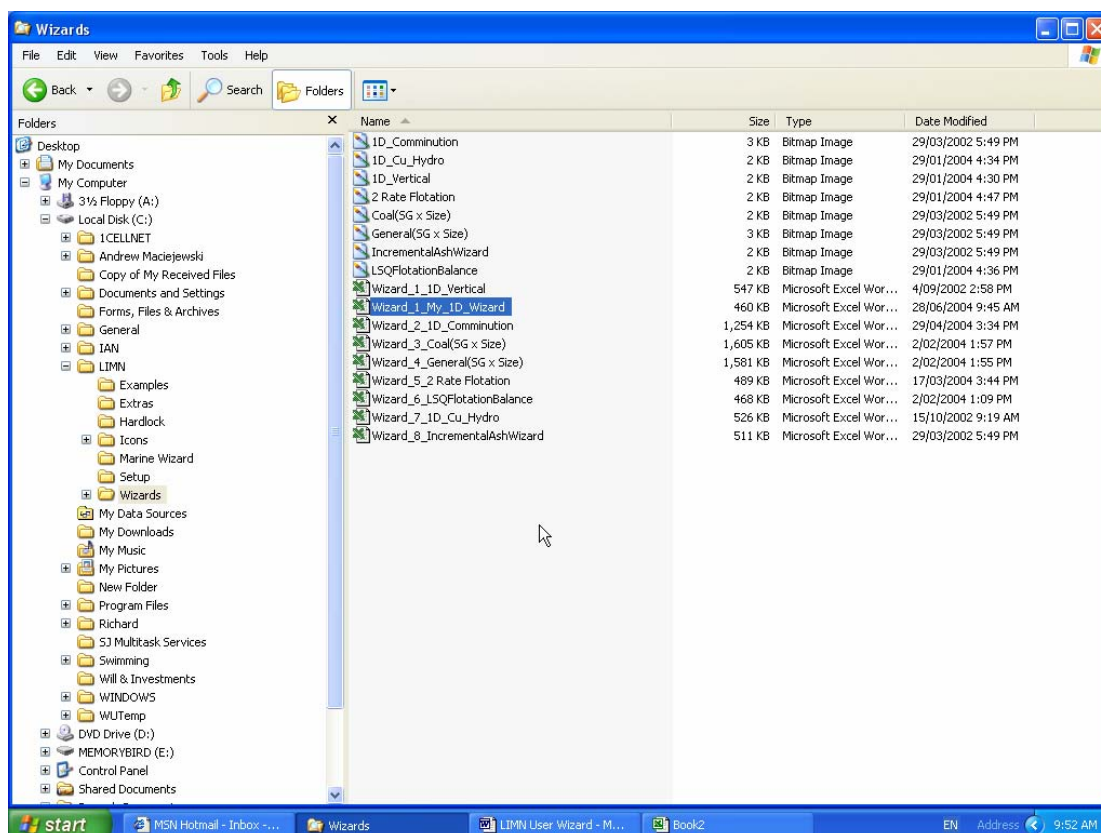


Figure 8: LIMN folder

4.2 Click on the Configuration Sheet. Enter the size fractions and Water in the Simulated Components column. Enter Total Solids, Total Flow and % solids in the Derived Components column, refer to figure 7 below.

	A	B	C	D	E	F
1						
2		<b>Configuration Data</b>				<b>Created with Wizard : 1D_Generic</b>
3						
4		<u>Property Definition</u>				
5						
6			<b>Simulation Components</b>			
7			20 mm			
8			15 mm			
9			10 mm			
10			5 mm			
11			0 mm			
12			Water			
13						
14			<b>Derived Components</b>			
15			Total Solids			
16			Total Flow			
17			% solids			
18						

Figure 9: Configuration Sheet



4.3 Click on the Stream\_Data(Input) sheet. Enter the formula into the derived cells as per figure 8 below.

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							

Feed Stream Data Input	
	Stream Name
20 mm	
15 mm	
10 mm	
5 mm	
0 mm	
Water	
Total Solids	0.00
Total Flow	0.00
% solids	#DIV/0!

=sum(D4:D8)
=D9+D11
=D11/D12

Figure 10: Stream\_Data(Input) Sheet

4.4 Click on the Stream\_Data sheet. Enter the formula into the derived cells as per figure 9 below.

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							

Stream Summary	
	Stream Name
20 mm	
15 mm	
10 mm	
5 mm	
0 mm	
Water	
Total Solids	0.00
Total Flow	0.00
% solids	#DIV/0!

=sum(D4:D8)
=D9+D11
=D11/D12

Figure 11: Stream\_Data sheet

4.5 Save the wizard workbook.

4.6 Close the workbook.

## 5. RUNNING THE USER WIZARD

5.1 Open the workbook with the example from the LIMN Data Wizard manual.

5.2 Clone the flowsheet as detailed in the 1\_D Vertical manual.

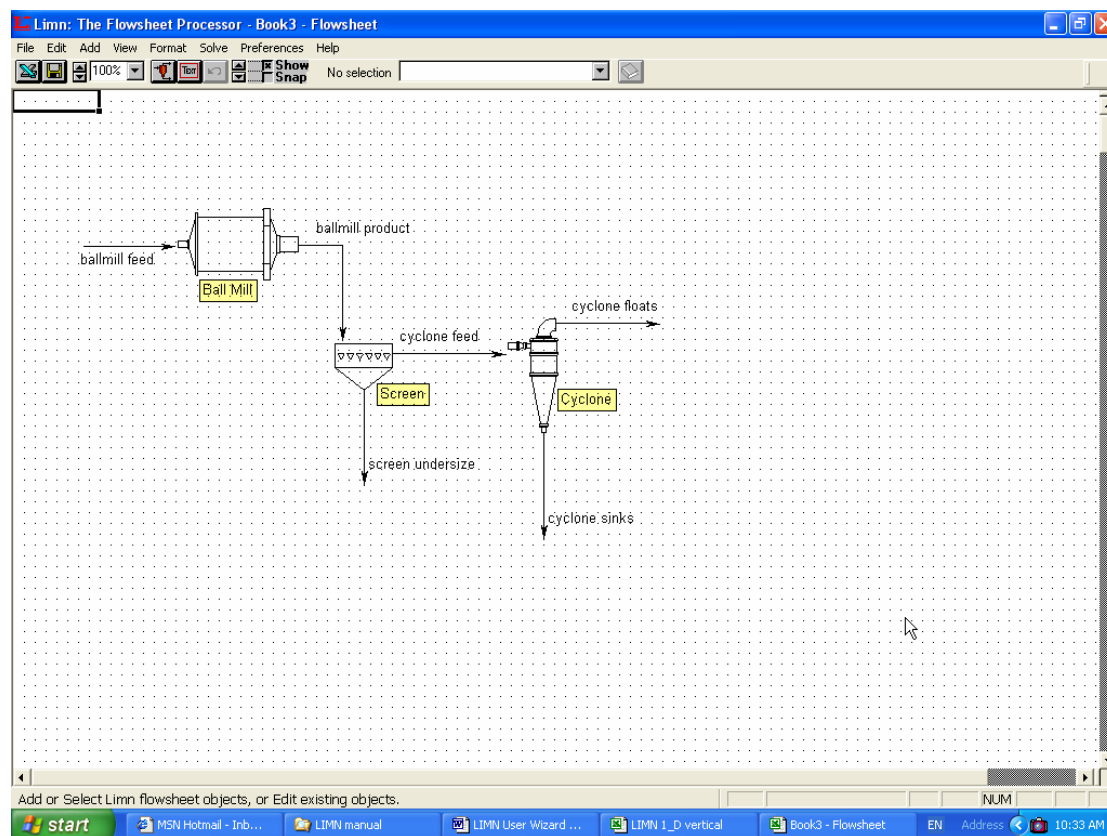


Figure 12: Limn Data wizard flowsheet

5.3 Save the workbook as LIMN User Wizard example.xls.

5.4 Click on the Limn: Wizards icon. 

5.5 Select the wizard that we have just created, i.e. My\_1D\_Wizard.



Figure 13: User Defined Wizard

- 5.6 One will notice that Step 2 of 6 has the mass related components and derived components as per the user defined wizard. We do not need to enter anything so click Next.

Figure 14: Step 2 of 6

- 5.7 Complete Step 3 of 6 and Step 4 of 6.

- 5.8 Select the models for the different unit operations as per figure 13 below.

Figure 15: Step 5 of 6

- 5.9 Click Next.

- 5.10 For step 6 of 6 click Finish to complete the running of the wizard.

- 5.11 Save the workbook.

## 6. POPULATING THE WORKSHEETS

6.1 If one clicks on the Configuration sheet one will notice that the sheet has already been completed.

6.2 Click on the Stream\_Data(Input) sheet. Input the % PSD of the ballmill feed stream, the total mass of ballmill feed and the total amount of water in the ballmill feed.

	A	B	C	E	F	G	H	I
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Feed Stream Data Input			
		ballmill feed	%PSD
20 mm		200.00	40.00
15 mm		125.00	25.00
10 mm		100.00	20.00
5 mm		50.00	10.00
0 mm		25.00	5.00
Water		2,000.00	
Total Solids		500.00	500.00
Total Flow		2,500.00	
% solids		20%	

Figure 16: Stream\_Data(Input) sheet

6.3 If one clicks on the Stream\_Data sheet one will notice that the formula for the Total Solids, Total Flow and % solids have been entered for the different streams.

6.4 Click on the Unit\_Ball Mill sheet. Enter the required % PSD of the ballmill product as per figure 15 below. Make sure that the water passes straight through the ballmill by changing the formula in the ballmill product column.

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

Model Parameters	
	Required % Product Component
20 mm	5.00
15 mm	10.00
10 mm	15.00
5 mm	20.00
0 mm	50.00
Water	

	Feed	ballmill product
20 mm	200.00	25.00
15 mm	125.00	50.00
10 mm	100.00	75.00
5 mm	50.00	100.00
0 mm	25.00	250.00
Water	2,000.00	2,000.00

Figure 17: Unit\_Ball Mill sheet

6.5 Click on the Unit\_Cyclone sheet. Enter the partition fractions for the split to the cyclone floats as per figure 16 below.

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

Model for Unit: Cyclone																																				
	<table> <tr> <th colspan="2">Partition Fractions</th> </tr> <tr> <th></th> <th>Split to cyclone floats</th> </tr> <tr><td>20 mm</td><td>0.95</td></tr> <tr><td>15 mm</td><td>0.95</td></tr> <tr><td>10 mm</td><td>0.95</td></tr> <tr><td>5 mm</td><td>0.95</td></tr> <tr><td>0 mm</td><td>0.95</td></tr> <tr><td>Water</td><td>0.70</td></tr> </table>	Partition Fractions			Split to cyclone floats	20 mm	0.95	15 mm	0.95	10 mm	0.95	5 mm	0.95	0 mm	0.95	Water	0.70																			
Partition Fractions																																				
	Split to cyclone floats																																			
20 mm	0.95																																			
15 mm	0.95																																			
10 mm	0.95																																			
5 mm	0.95																																			
0 mm	0.95																																			
Water	0.70																																			
	<table> <tr> <th></th> <th>Feed</th> <th></th> <th>cyclone floats</th> <th>cyclone sinks</th> </tr> <tr><td>20 mm</td><td>25.00</td><td></td><td>23.75</td><td>1.25</td></tr> <tr><td>15 mm</td><td>50.00</td><td></td><td>47.50</td><td>2.50</td></tr> <tr><td>10 mm</td><td>75.00</td><td></td><td>71.25</td><td>3.75</td></tr> <tr><td>5 mm</td><td>100.00</td><td></td><td>95.00</td><td>5.00</td></tr> <tr><td>0 mm</td><td>50.00</td><td></td><td>47.50</td><td>2.50</td></tr> <tr><td>Water</td><td>200.00</td><td></td><td>140.00</td><td>60.00</td></tr> </table>		Feed		cyclone floats	cyclone sinks	20 mm	25.00		23.75	1.25	15 mm	50.00		47.50	2.50	10 mm	75.00		71.25	3.75	5 mm	100.00		95.00	5.00	0 mm	50.00		47.50	2.50	Water	200.00		140.00	60.00
	Feed		cyclone floats	cyclone sinks																																
20 mm	25.00		23.75	1.25																																
15 mm	50.00		47.50	2.50																																
10 mm	75.00		71.25	3.75																																
5 mm	100.00		95.00	5.00																																
0 mm	50.00		47.50	2.50																																
Water	200.00		140.00	60.00																																

Figure 18: Unit\_Cyclone sheet

6.6 Click on the Unit\_Screen sheet. Enter the partition fractions for the split to cyclone feed as per figure 17 below.

A	B	C	D	E	F	G
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						

Model for Unit: Screen

Partition Fractions	
	Split to cyclone feed
20 mm	1.00
15 mm	1.00
10 mm	1.00
5 mm	1.00
0 mm	0.20
Water	0.10

	Feed		cyclone feed	screen undersize
20 mm	25.00		25.00	0.00
15 mm	50.00		50.00	0.00
10 mm	75.00		75.00	0.00
5 mm	100.00		100.00	0.00
0 mm	250.00		50.00	200.00
Water	2,000.00		200.00	1,800.00

Figure 19: Unit\_Screen sheet

6.7 Click on the Datablocks sheet. Click on the add datablocks adjacent to stream segment button.

6.8 Click on the flowsheet sheet.

6.9 Click on the Limn: Solve button. 

6.10 Click on Limn: Draw and position the datablocks as required. Go back to Excel mode and save the workbook.

6.11 Use the drop down dialogue boxes to show the Total Solids, Water, Total Flow and % solids as per figure 19 below.

Total Solids	Water
20 mm	% solids
15 mm	
10 mm	
5 mm	
0 mm	
Water	
Total Solids	
Total Flow	
% solids	

Figure 20: Datablock Drop Down List

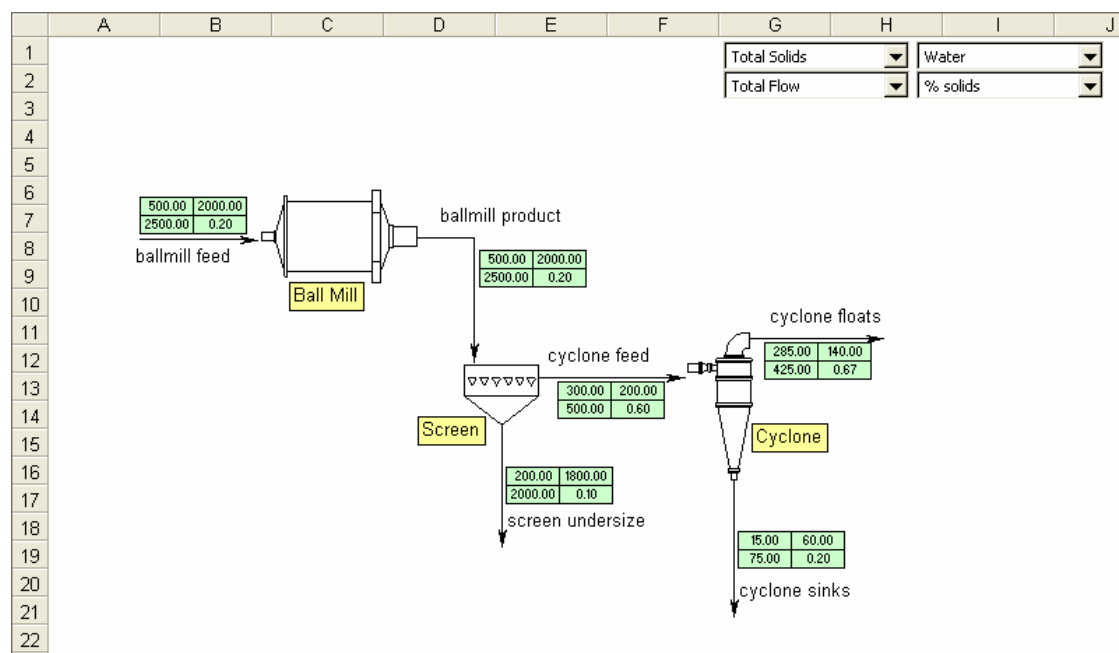


Figure 21: Flowsheet with dialogue boxes

6.12 Save the workbook.

## 7. CREATING A USER DEFINED UNIT MODEL

One can create a user defined model in LIMN for a unit operation which can be selected when running the wizard, thus saving time and hassle. We will create a cyclone model in this example.

7.1 Open the user-defined wizard that we have just created: Wizard\_1\_My\_1D\_Wizard.xls.

7.2 As we used the 2Product\_ComponentSplitter model for the cyclone select the Unit\_2\_ComponentSplitter sheet in the wizard workbook.

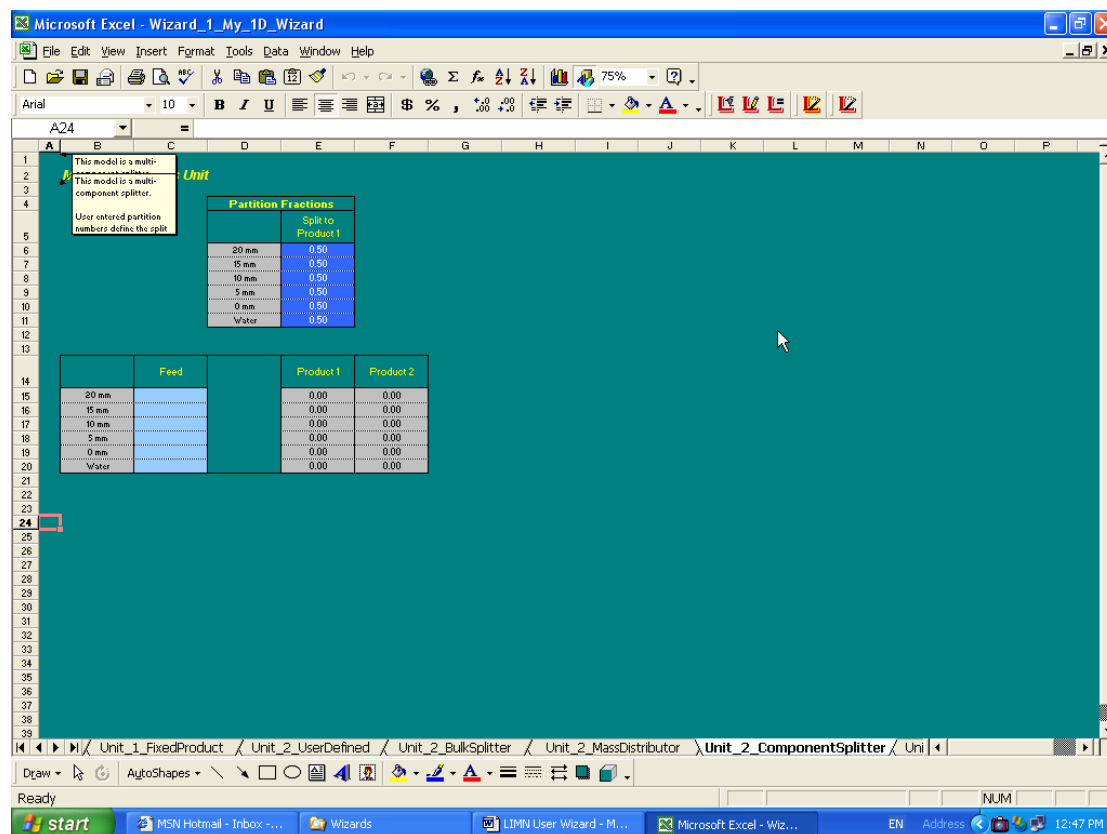


Figure 22: Component Splitter sheet

7.3 Click on the Limn: Wizards icon. 

7.4 Click the other useful functions button.

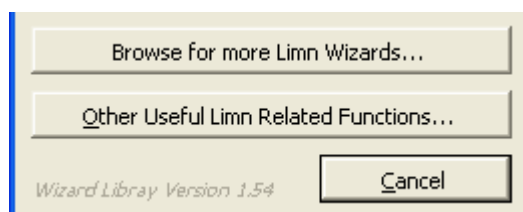


Figure 23: Limn wizards menu





7.9 If one reruns the user defined wizard (My\_1D\_Wizard) then the new model 2\_Product Cyclone appears as a model option in Step 5 of 6.

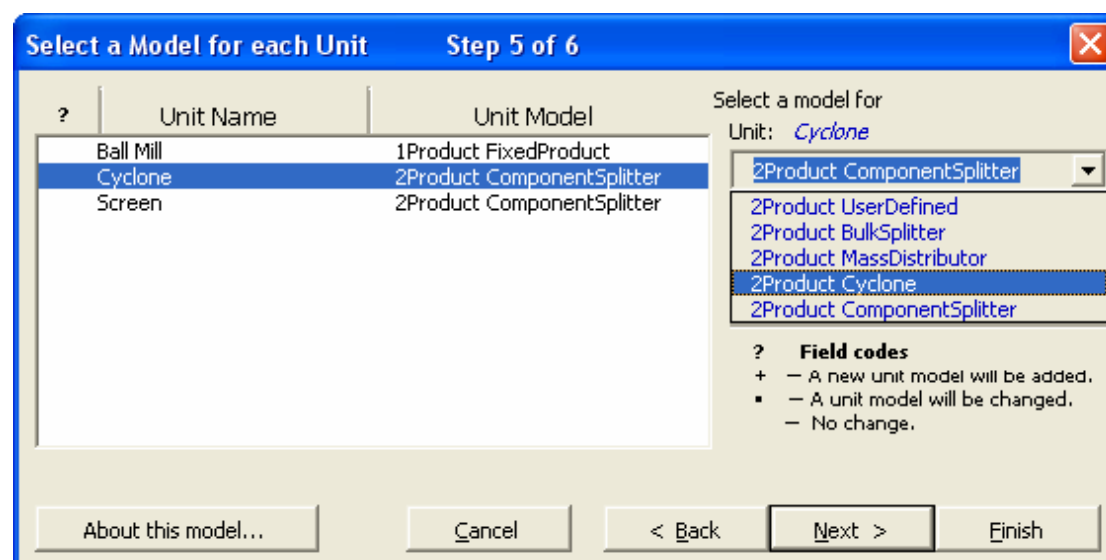


Figure 27: Step 5 of 6

## 8. CREATING ADVANCED UNIT MODELS

The separation within a cyclone is normally best modelled using a separation curve such as the Whiten efficiency curve equation. Cyclones are normally used to separate material according to size or according to density, therefore separation model curves can be used for either application. We will use the Whiten equation to separate the material according to size.

8.1 Open the wizard workbook that we created called Wizard\_1\_My\_1D\_Wizard.xls in the C:\LIMN\Wizards folder.

8.2 Click on the Unit\_2\_UserDefined sheet.

8.3 Click on the Limn: Wizards icon. 

8.4 Click on the Other Useful Limn Related Functions button.

8.5 Click on the Create a copy of a Limn Wizard Worksheet button.

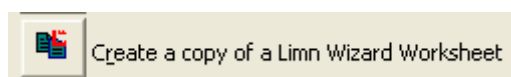


Figure 28: Copy of Wizard Worksheet button

8.6 Label the model Unit\_2\_Cyclone(Whiten).

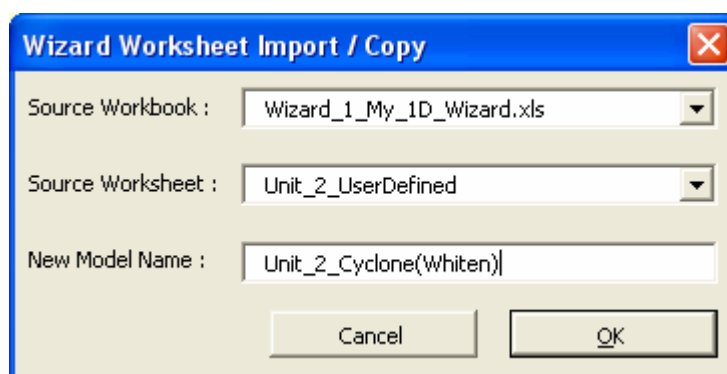


Figure 29: Naming Wizard

8.7 The basic format of the Whiten efficiency curve equation is:

$$pf = 1 - (1 - R_f) \times \left[ \frac{\exp(\alpha - 1)}{\exp\left(\alpha \cdot \frac{D_i}{D_{50}}\right) + \exp(\alpha) - 2} \right]$$

Where pf is the partition fraction,  $R_f$  is the bypass fraction to coarse,  $\alpha$  is the sharpness of cut,  $D_i$  is the current mean size and  $D_{50}$  is the cut point size.

8.8 Select the model worksheet that we have just created, Unit\_2\_Cyclone(Whiten).

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						

Model for Unit: this Unit		
Model Parameters		
Sharpness of cut - Alpha		5.00
Nominal cut size - d50c		5.00
Bypass fraction to coarse - Rf		0.10

Size	Mean	Split Fraction to Coarse
20 mm	28.00	1.000
10 mm	14.00	1.000
5 mm	7.00	0.893
2.5 mm	3.50	0.261
0 mm	1.25	0.115

	Water	
		0.30

	Feed		Product 1	Product 2
20 mm			-	-
15 mm			-	-
10 mm			-	-
5 mm			-	-
0 mm			-	-
Water			-	-

Figure 30: Unit\_2\_Cylone(Whiten) sheet

8.9 Reproduce the model in figure 30 by doing the following:

- Insert the required number of rows above the stream table (15 rows).
- Create the model parameter table as per figure 30, shade the input cells blue.
- Create the model table with the Size, Mean and Split Fraction to Coarse columns.
- Enter the Whiten efficiency curve equation into the Split Fraction to Coarse column.
- Enter the required split of water to the coarse (sinks) product.

8.10 In the Product 2 column, multiply the Feed column by the Split Fraction to Coarse column. Make sure to multiply the water in the feed by the required split to coarse.

8.11 In the Product 1 column, subtract the Product 2 column from the Feed column.

8.12 Save the Wizard workbook and close the workbook.

8.13 Open the Excel workbook with the User Wizard example.

8.14 Click on the flowsheet sheet.

8.15 Click on the Limn: Wizards icon. 

8.16 Click on the Other Useful Limn Related Functions button.

8.17 Click on the Change a Limn: Wizard generated unit model button.

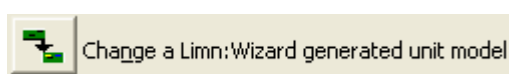


Figure 31: Change a model button

- 8.18 Click on the Cyclone unit and select the 2Product Cyclone(Whiten) model from the drop down list.

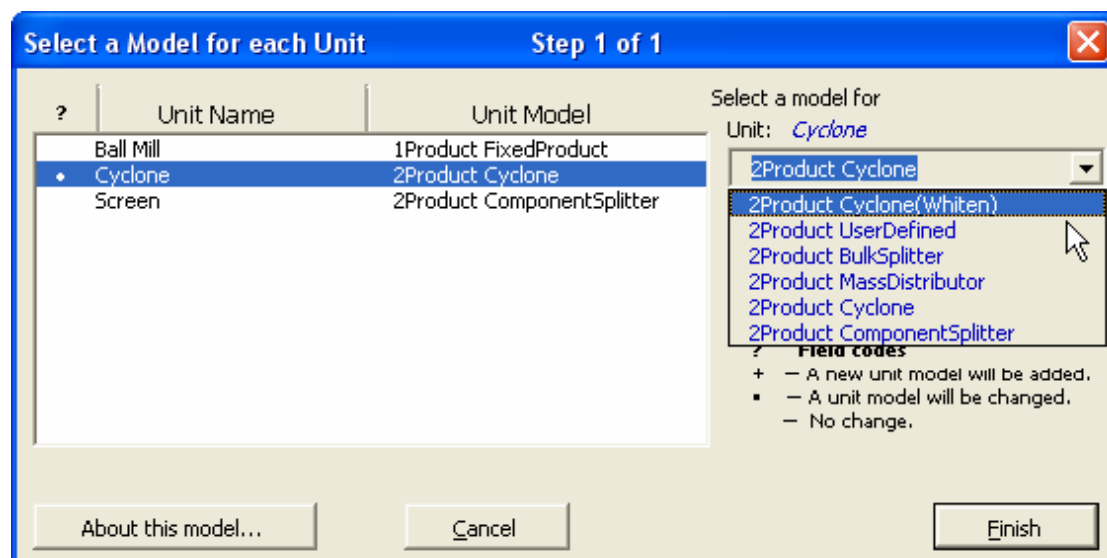



Figure 32: Select a model

- 8.19 Click on the Unit\_Cyclone Sheet.
- 8.20 Click on the Limn: Solver icon. 
- 8.21 Once the solver has run the Unit\_Cyclone sheet should be the same as figure 33.

	A	B	C	D	E	F
1	<b>Model for Unit: Cyclone</b>					
2						
3						
4	<b>Model Parameters</b>					
5	Sharpness of cut - Alpha				5.00	
6	Nominal cut size - d50c				5.00	
7	Bypass fraction to coarse - Rf				0.10	
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						

Figure 33: Unit\_Cyclone sheet

- 8.22 Save the workbook.

## APPENDIX A: USER WIZARD WORKED EXAMPLE

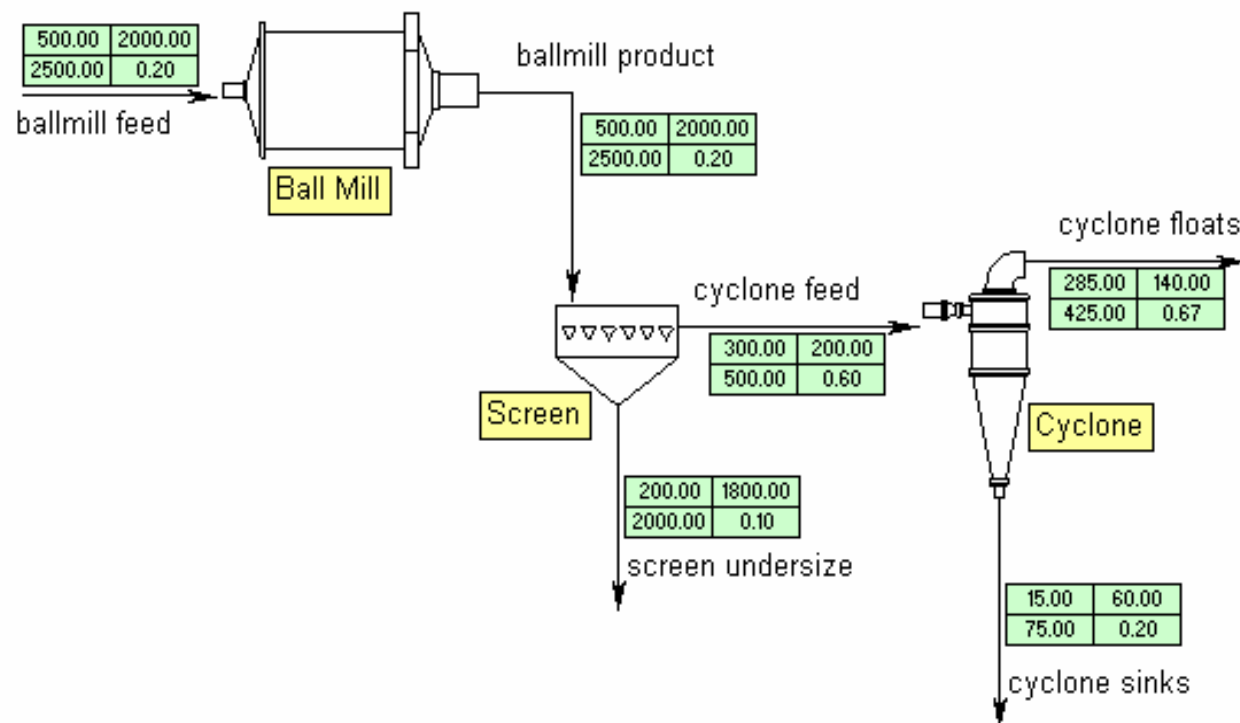


Figure 34: User Wizard worked example