



## Incorporating CULTEC Chambers into ICPR4

Modeling an underground chamber system is a relatively simple matter in ICPR4. It is modeled the same as any other pond. However, the key to modeling these systems correctly is in developing the stage-volume table for the node used to represent the chamber system. CULTEC has an easy-to-use Excel spreadsheet calculator that can build a relationship between elevation in the chamber and corresponding storage.

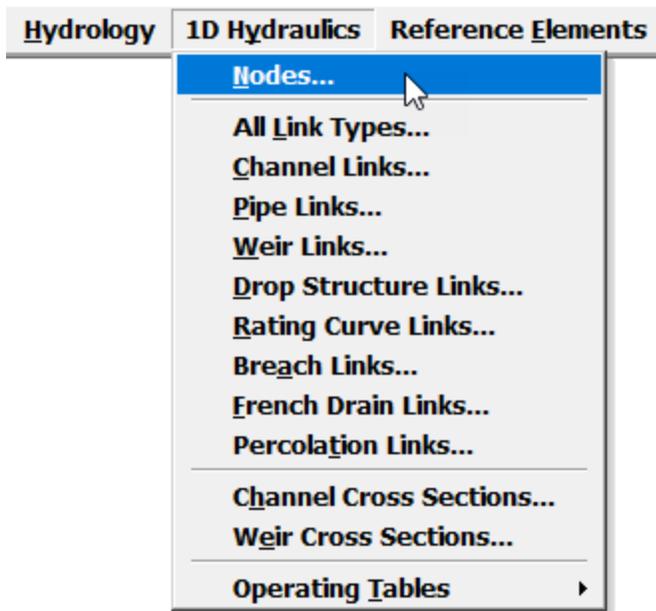
In the example shown below, the “Chamber Model” (a dropdown menu is available with the various model types) is set to “Recharger 902HD” and 21 chambers are used (3 rows of 7 units in each row). The base of the stone or gravel is at elevation 97 feet and 9 inches of stone is used below the chambers and 12 inches is used above the chambers. The porosity of the stone is 40%. Notice that the minimum area required is 659 square feet.

	A	B	C	D	E	F	G
9	<b>Project Information:</b>			Date: xx/xx/xxx			
10	SAMPLE DESIGN _____						
11	ABC Company _____						
12	123 West Street _____						
13	Anywhere, CT USA _____						
14							
15							
16	Chamber Model-		<b>Recharger 902HD</b>				
17	Number of Rows-		3	units			
18	Total number of chambers -		21	units			
19	HVLV FC-48 Feed Connectors-		4	units			
20	Stone Void -		40	%			
21	Stone Base -		9	inches			
22	Stone Above Units -		12	inches			
23	Area -		659.38	ft <sup>2</sup>		659.38 Min. Area Required	
24	Base of Stone Elevation-		97.00	ft		Note: Min. Area required is based on 12" around the system and typ. spacing	
25							
26							

The worksheet is interactive and the cumulative storage updates automatically as you change a parameter. A partial excerpt from the worksheet is shown below. Notice that the cumulative storage is presented from top to bottom in 1-inch increments. ICPR4 needs a relationship between elevation in feet and cumulative storage in acre-feet, from bottom to top. However, ICPR4 has sorting tools to make this easy.

Recharger 902HD Incremental Storage Volumes								
	Height of System	Chamber Volume	HVLV Feed Connector Volume	Stone Volume	Cumulative Storage Volume	Total Cumulative Storage Volume		Elevation
	in	ft <sup>3</sup>	ft <sup>3</sup>	ft <sup>3</sup>	ft <sup>3</sup>	ft <sup>3</sup>	Acre-ft	ft
31	69	0.00	0.00	21.98	21.98	2343.74	0.05380	102.75
32	68	0.00	0.00	21.98	21.98	2321.76	0.05330	102.67
33	67	0.00	0.00	21.98	21.98	2299.78	0.05280	102.58
34	66	0.00	0.00	21.98	21.98	2277.80	0.05229	102.50
35	65	0.00	0.00	21.98	21.98	2255.82	0.05179	102.42
36	64	0.00	0.00	21.98	21.98	2233.84	0.05128	102.33
37	63	0.00	0.00	21.98	21.98	2211.86	0.05078	102.25
38	62	0.00	0.00	21.98	21.98	2189.88	0.05027	102.17
39	61	0.00	0.00	21.98	21.98	2167.90	0.04977	102.08
40	60	0.00	0.00	21.98	21.98	2145.92	0.04926	102.00
41	59	0.00	0.00	21.98	21.98	2123.95	0.04876	101.92
42	58	0.00	0.00	21.98	21.98	2101.97	0.04825	101.83

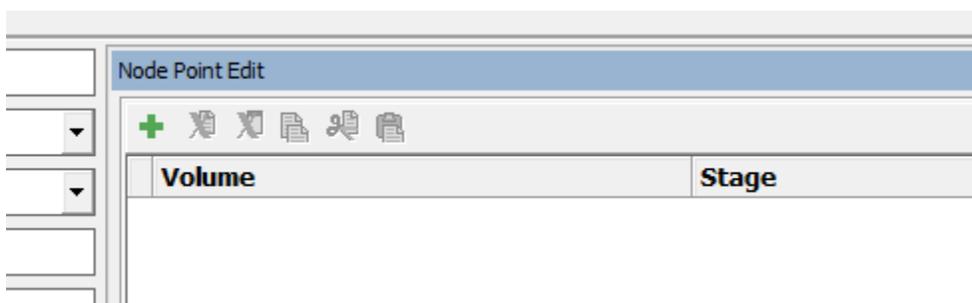
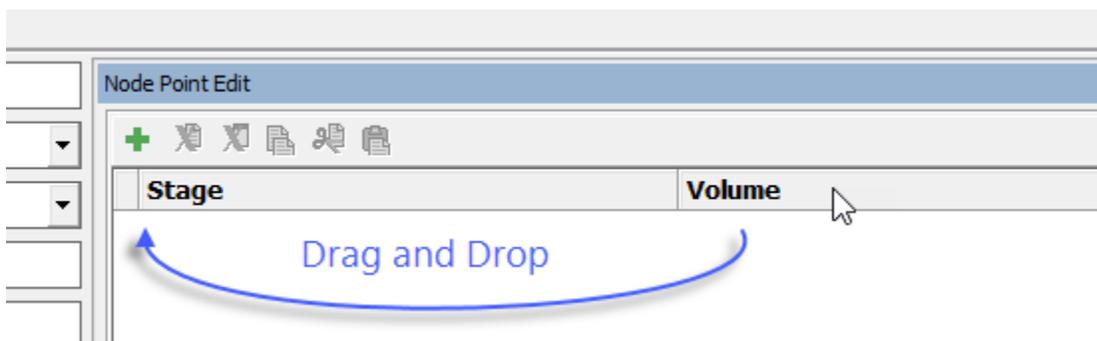
1. Open the node data form in ICPR4.



2. Set the "Type" to "Stage/Volume" and the initial stage to the bottom of the stone at elevation 97 feet, assuming the chamber is to start out dry. The warning stage is for informational purposes only and is set to the top of the stone in this example.

<b>Name</b>	CHAMBER
<b>Scenario</b>	Scenario1
<b>Type</b>	Stage/Volume
<b>Base Flow</b>	0
<b>Initial Stage</b>	97
<b>Warning Stage</b>	102.75

3. In the “Node Point Edit” area of the node data form, drag and drop the “Volume” column to the left of the “Stage” column to make it compatible with the CULTEC spreadsheet.



4. Select the data in the “Storage Volume (Acre-ft)” and “Elevation” columns of the CULTEC spreadsheet and press “Ctrl C” to copy the data into the clipboard.

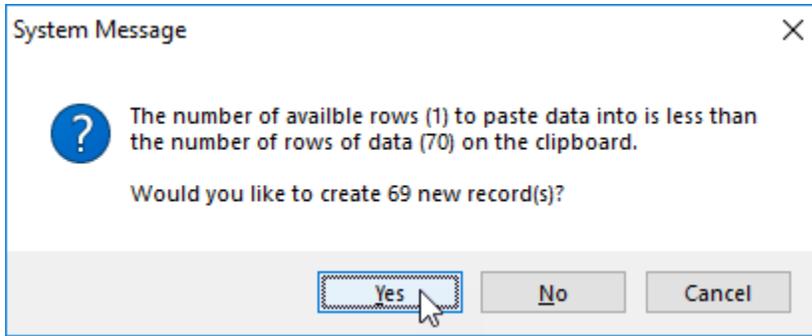
Select These Two Columns

	Total Cumulative Storage Volume	Elevation
	ft <sup>3</sup>	ft
	0.05380	102.75
	0.05330	102.67
	0.05280	102.58
	0.05229	102.50
	0.05179	102.42
	0.05128	102.33
	0.05078	102.25
	0.05027	102.17
	0.04977	102.08
	0.04926	102.00
	0.04876	101.92
	0.04825	101.83
	0.04775	101.75
	0.04723	101.67

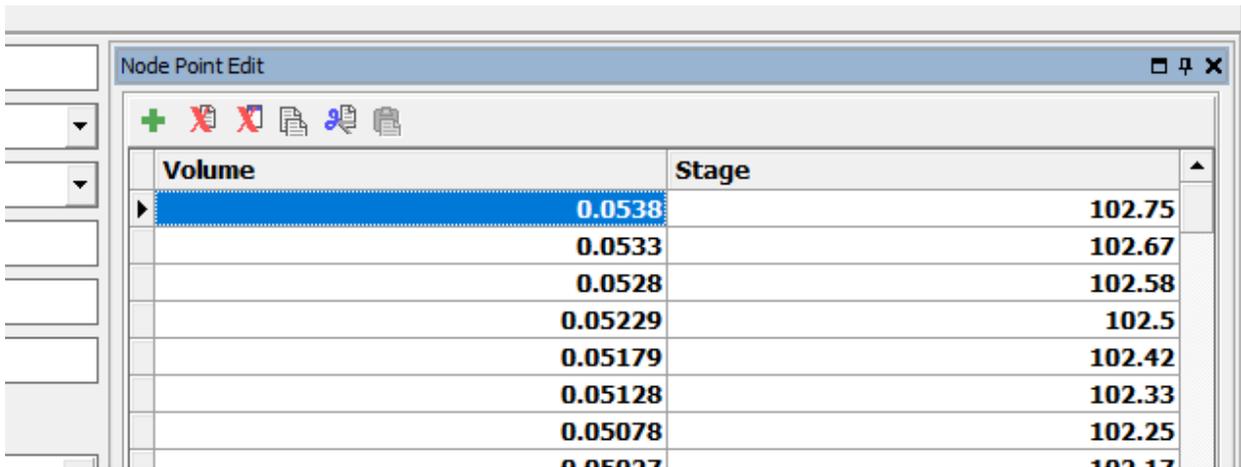
5. Add a record in the ICPR4 table as shown below, click in the "Volume" data field and press "Ctrl V" to paste the clipboard data into the ICPR4 data form.



A message will appear letting you know that new records will be created. Click "Yes" to continue.



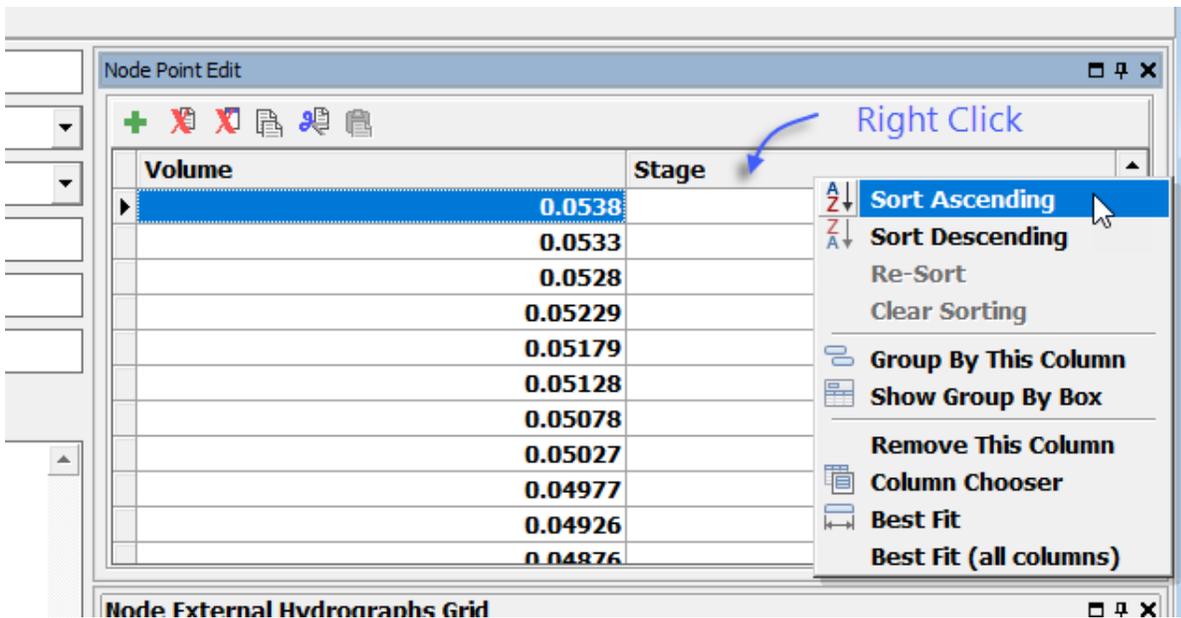
The stage/volume data should now appear in the node data form. Notice that the stage values are in descending order, like the CULTEC spreadsheet.



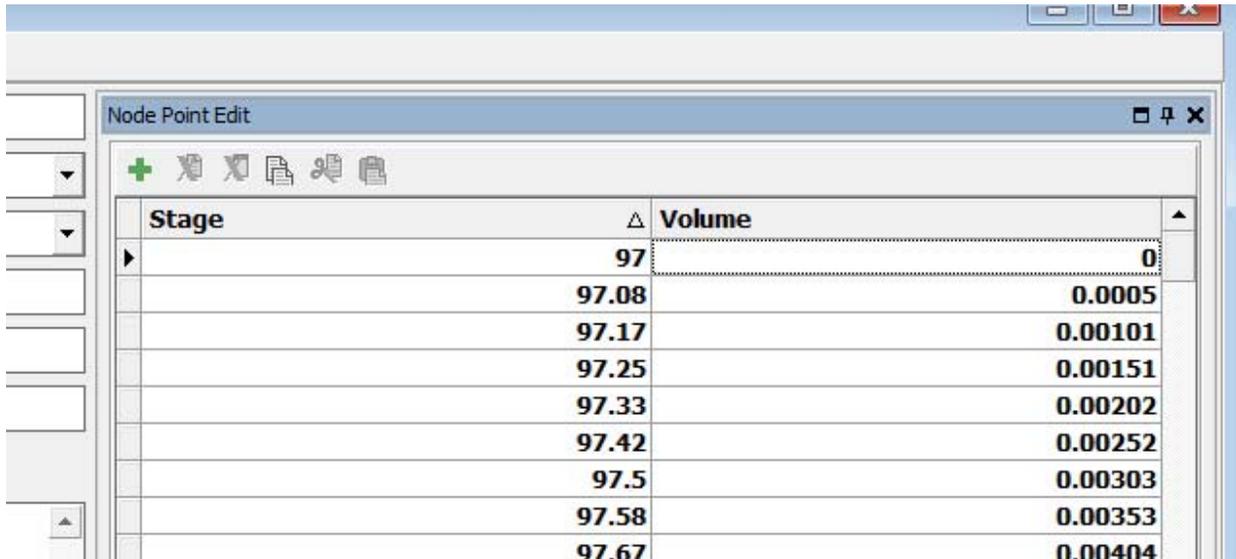
The "Node Point Edit" window displays a table with two columns: "Volume" and "Stage". The data is sorted in descending order of Stage values.

Volume	Stage
0.0538	102.75
0.0533	102.67
0.0528	102.58
0.05229	102.5
0.05179	102.42
0.05128	102.33
0.05078	102.25
0.05027	102.17

6. Right click on the "Stage" column in the node data form and select "Sort Ascending".



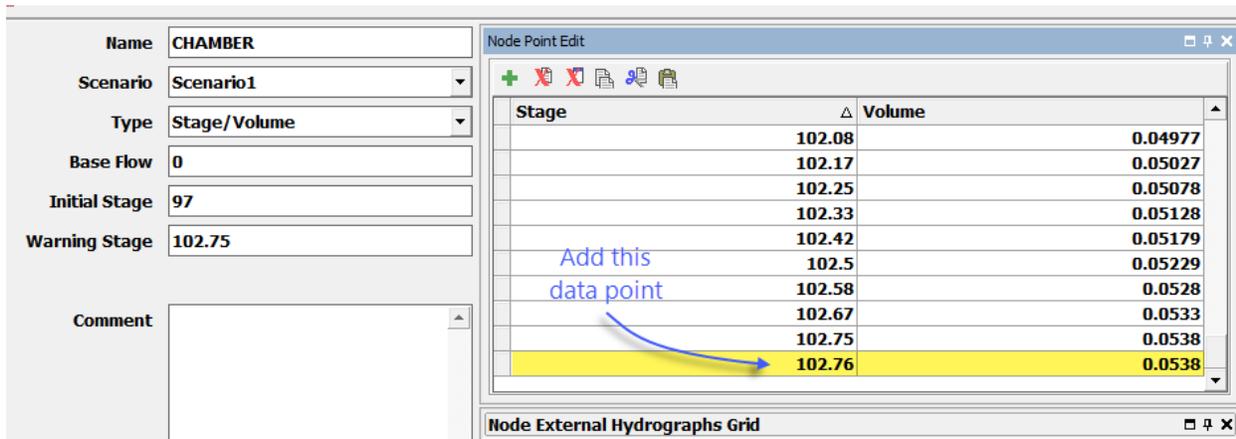
The data should now appear sorted. You can drag and drop the volume column back to its original position if you'd like.



The screenshot shows the 'Node Point Edit' window with a table containing the following data:

Stage	Volume
97	0
97.08	0.0005
97.17	0.00101
97.25	0.00151
97.33	0.00202
97.42	0.00252
97.5	0.00303
97.58	0.00353
97.67	0.00404

7. Add the following data point to “close off” the top of the chamber.



The screenshot shows the 'Node Point Edit' window with a table of Stage and Volume data. A new data point is added and highlighted in yellow. A blue arrow points to this data point with the text 'Add this data point'.

Stage	Volume
102.08	0.04977
102.17	0.05027
102.25	0.05078
102.33	0.05128
102.42	0.05179
102.5	0.05229
102.58	0.0528
102.67	0.0533
102.75	0.0538
102.76	0.0538

The node is now ready to incorporate into your full ICPR4 model.

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