WinSLAMM v 10.1
User's Guide

Stormwater Control Devices

Control Devices Summary

- Biofiltration
- Catch Basins
- Cisterns
- Filter Strips
- Grass Swales
- Hydrodynamic Devices
- Media Filters
- Other Control Device
- Porous Pavement
- Street Cleaning
- Wet Detention Pond

Control Devices

After the Parameter File and Source Area data are entered, Control Devices can be added to analyze their ability to reduce stormwater runoff volume and/or pollutants.

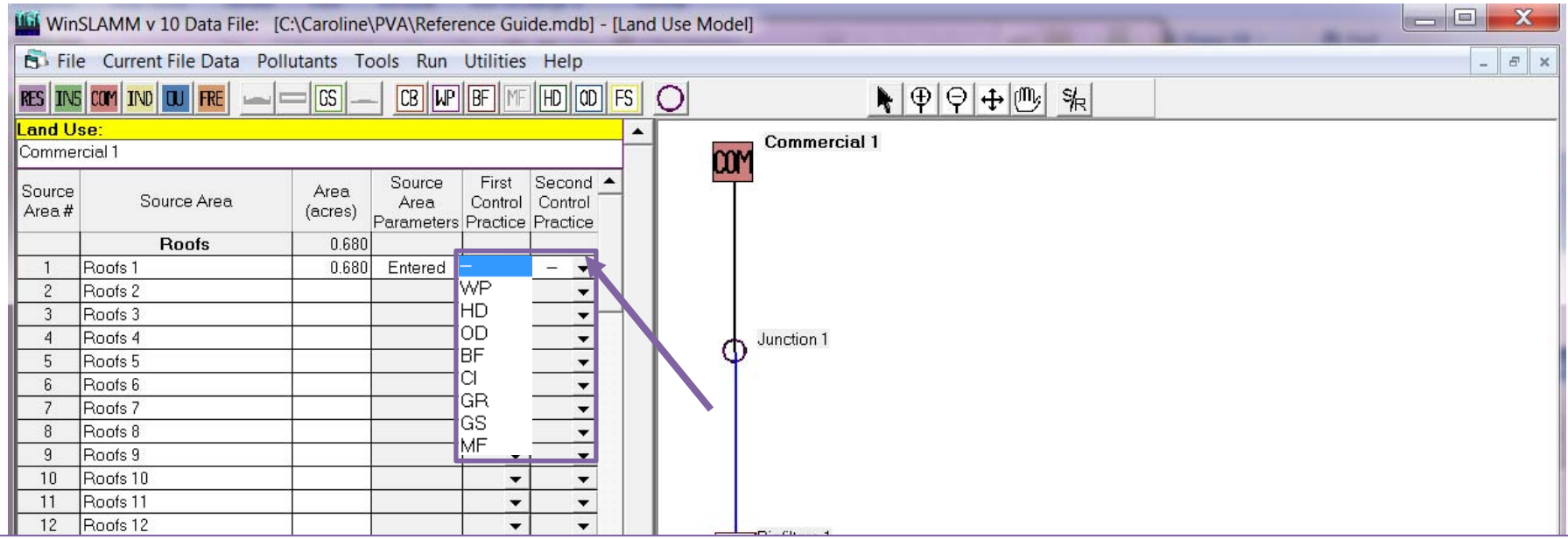
There are two types of control devices in the model:

1. Source Area Control Devices
2. Drainage System Control Devices

Depending upon the location in the program, not all Control Devices are available. For example, Street Cleaning is not available for the Roof Source Area.

All Control Devices have a “Copy/Paste” function. Data entered for one Control Device may be pasted into a new Control Device within the same model file.

Source Area Control Device

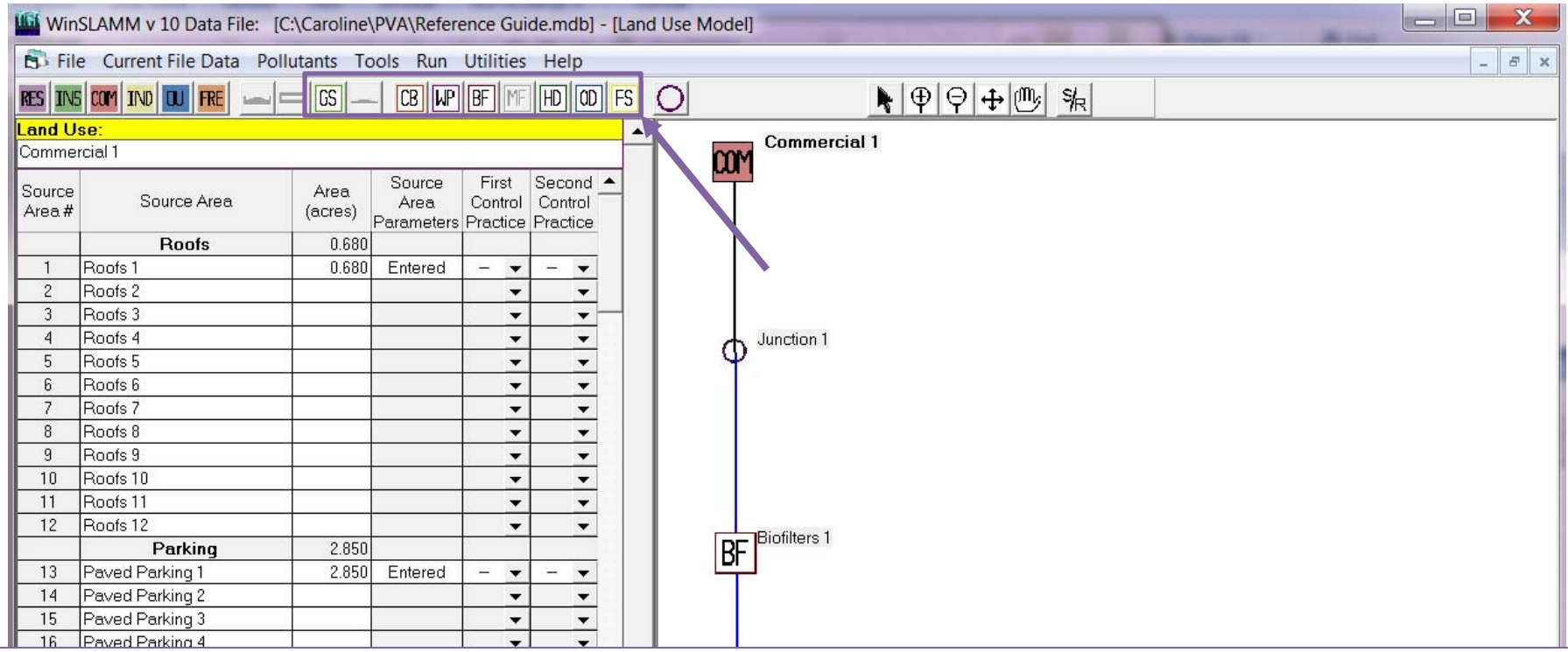


Source Area Control Devices are accessed from the Source Area Grid.
To access a Source Area Control Device, select the pull-down menu under “First Control Practice” or “Second Control Practice” and then select the desired Control Device. A Source Area Control Device will only treat one source area.

The letters represent the following Control Devices:

WP – Wet Detention Pond
HD – Hydrodynamic Device
OD - Other Device
BF – Biofiltration
CI - Cistern
PP – Porous Pavement
FS – Filter Strip
CB – Catch Basin
SC - Street Cleaning
GS – Grass Swale

Drainage System Control Device



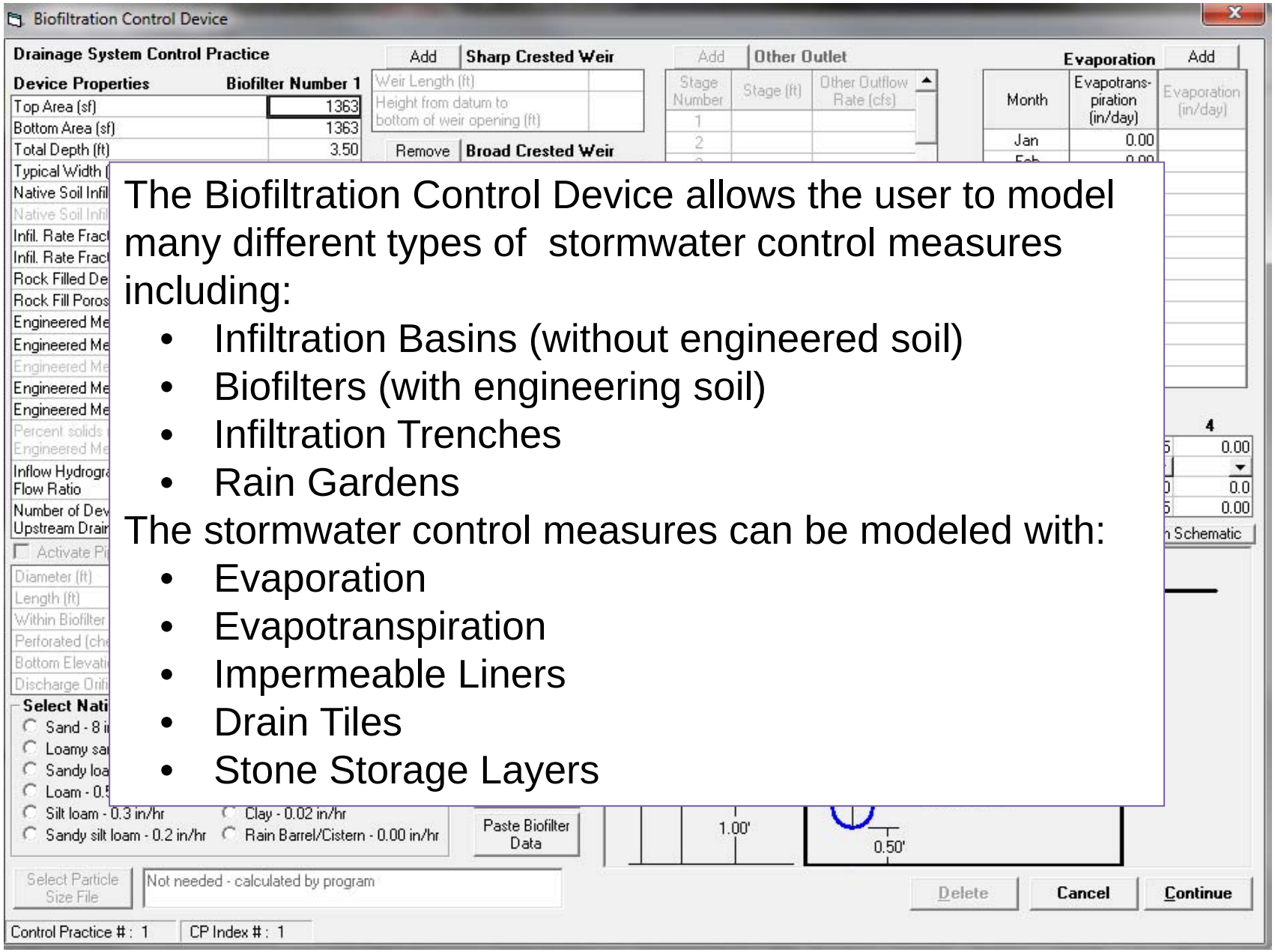
Drainage System Control Devices are accessed from the main toolbar.
To access a Drainage System Control Device, click on the desired Control Device, then click on the white map space. The Control Device Icon will appear.

The letters represent the following Control Devices:

GS – Grass Swale
CB – Catch Basin
WP – Wet Detention Pond
BF – Biofiltration
MF – Media Filter
HD – Hydrodynamic Device
OD – Other Device
FS – Filter Strip

Control Devices – Biofiltration

Biofiltration Control Device



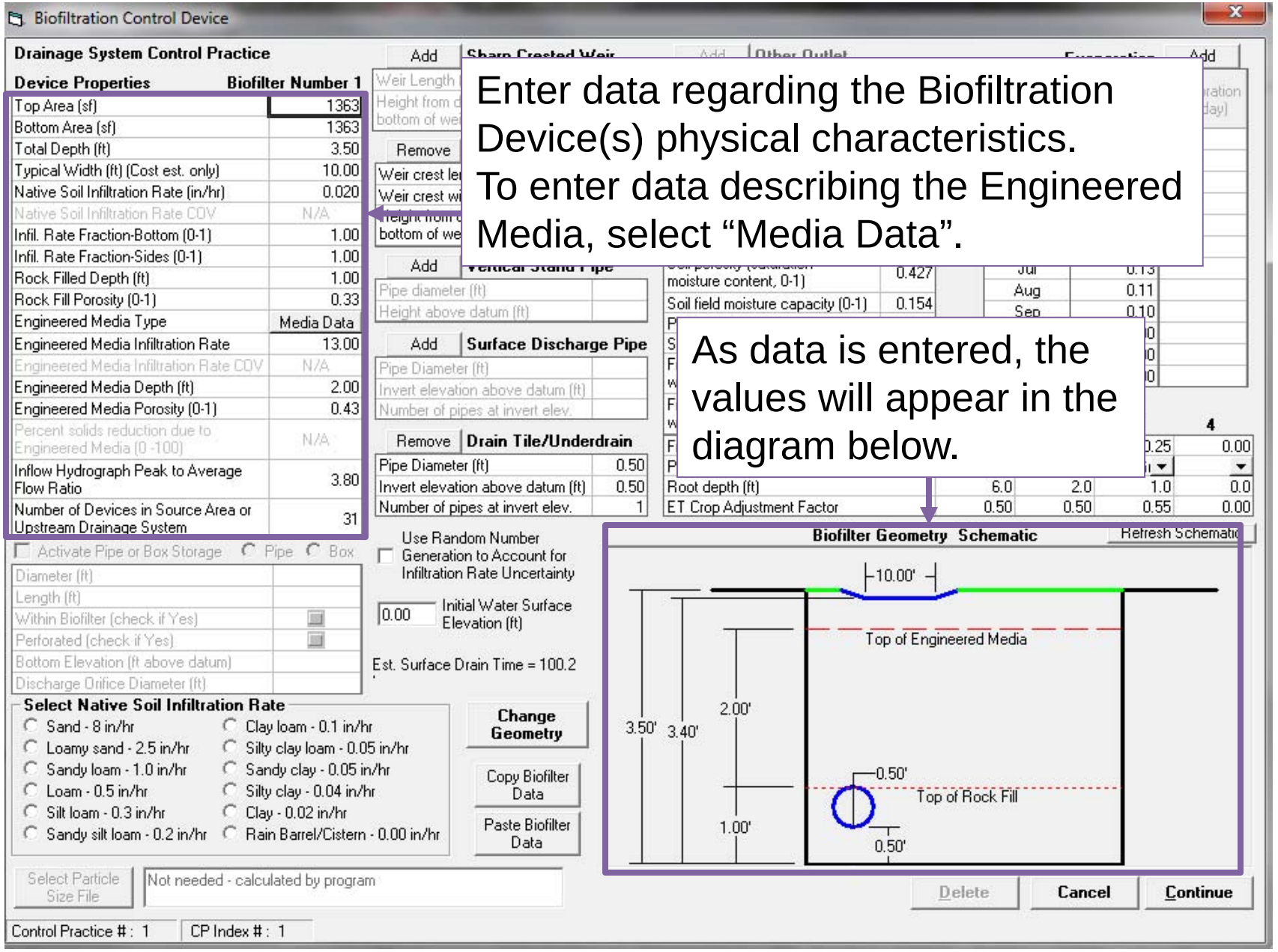
The Biofiltration Control Device allows the user to model many different types of stormwater control measures including:

- Infiltration Basins (without engineered soil)
- Biofilters (with engineering soil)
- Infiltration Trenches
- Rain Gardens

The stormwater control measures can be modeled with:

- Evaporation
- Evapotranspiration
- Impermeable Liners
- Drain Tiles
- Stone Storage Layers

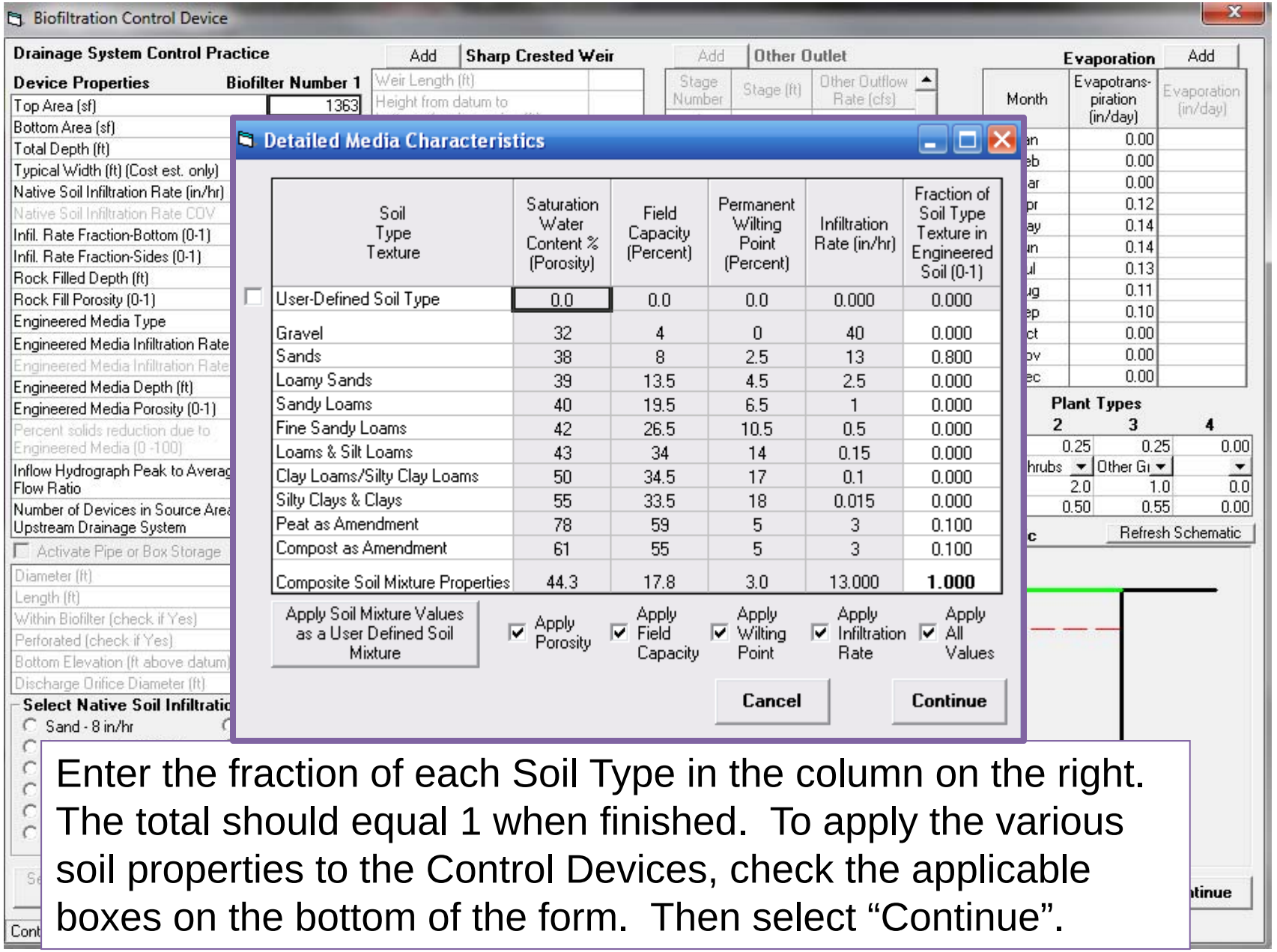
Biofiltration Control Device



Enter data regarding the Biofiltration Device(s) physical characteristics.
To enter data describing the Engineered Media, select “Media Data”.

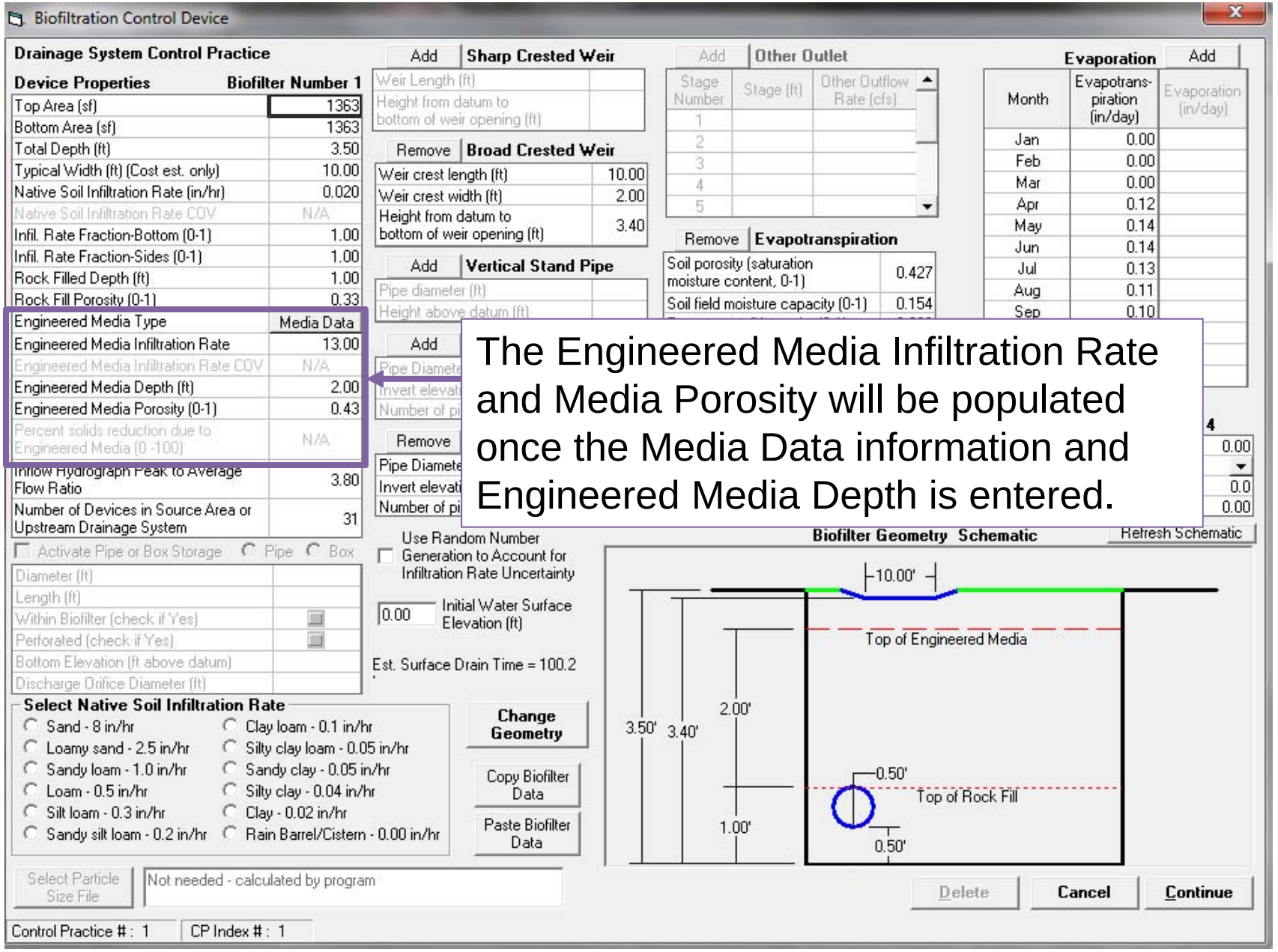
As data is entered, the values will appear in the diagram below.

Biofiltration Control Device



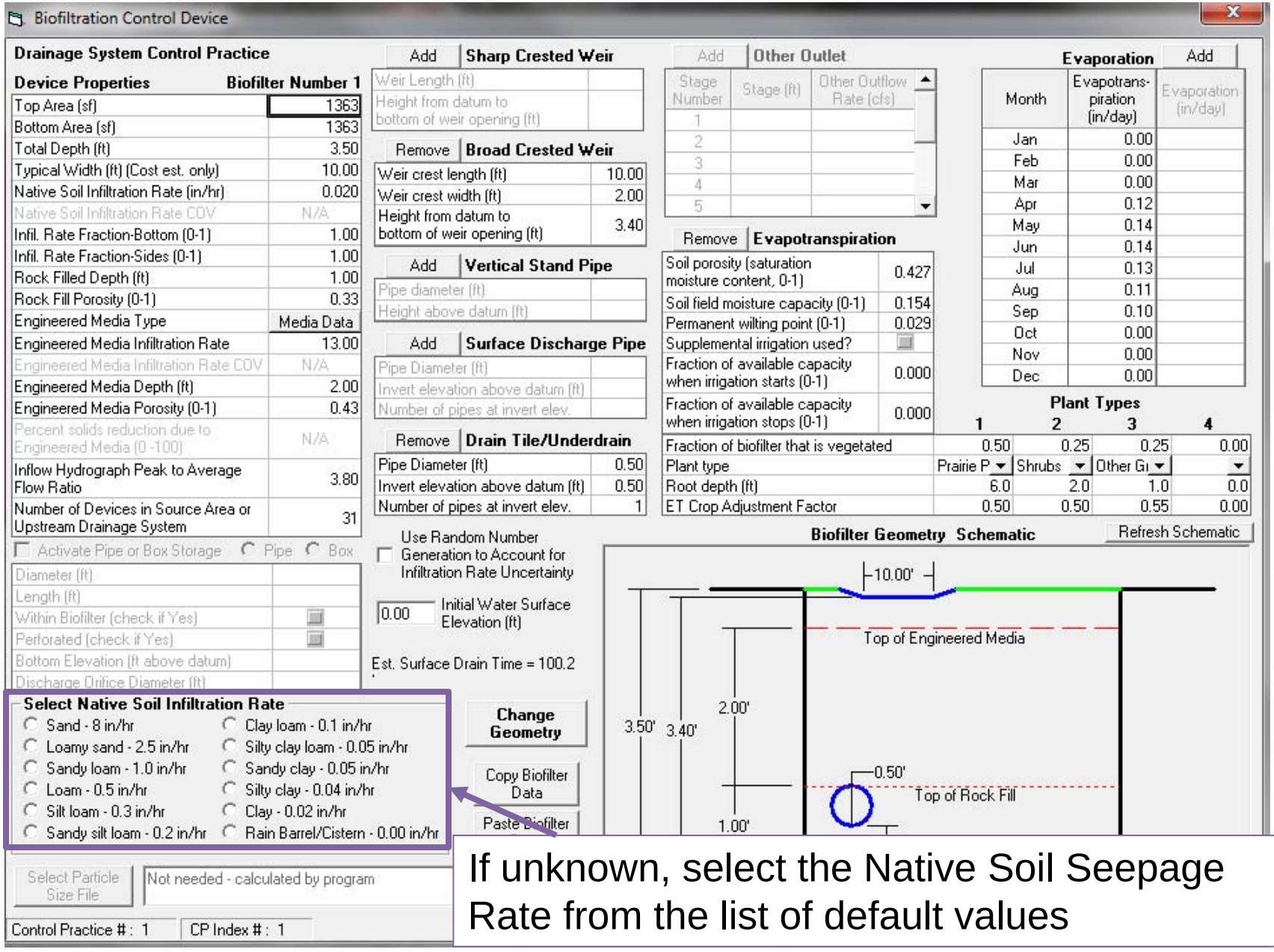
Enter the fraction of each Soil Type in the column on the right. The total should equal 1 when finished. To apply the various soil properties to the Control Devices, check the applicable boxes on the bottom of the form. Then select “Continue”.

Biofiltration Control Device



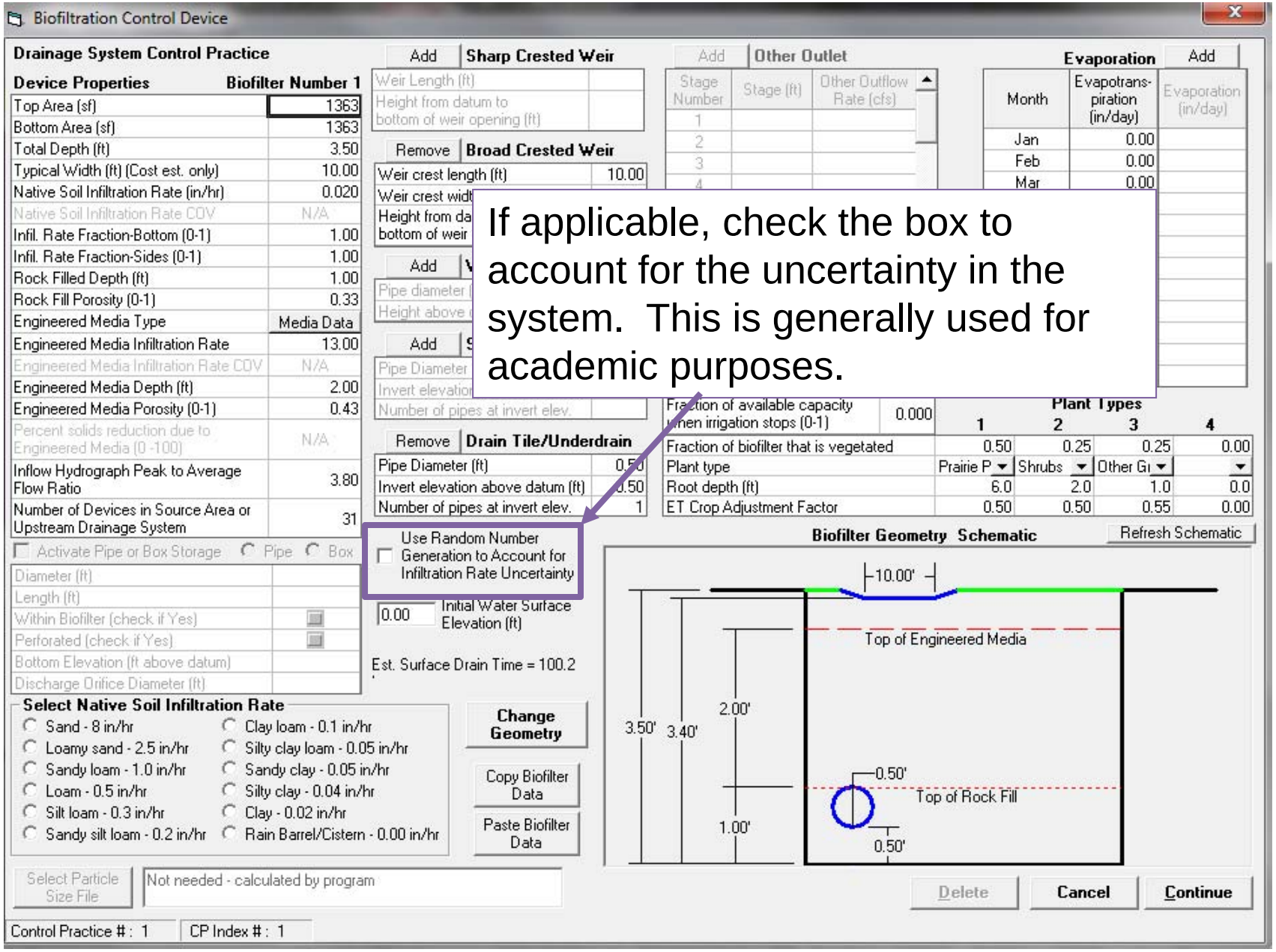
The Engineered Media Infiltration Rate and Media Porosity will be populated once the Media Data information and Engineered Media Depth is entered.

Biofiltration Control Device



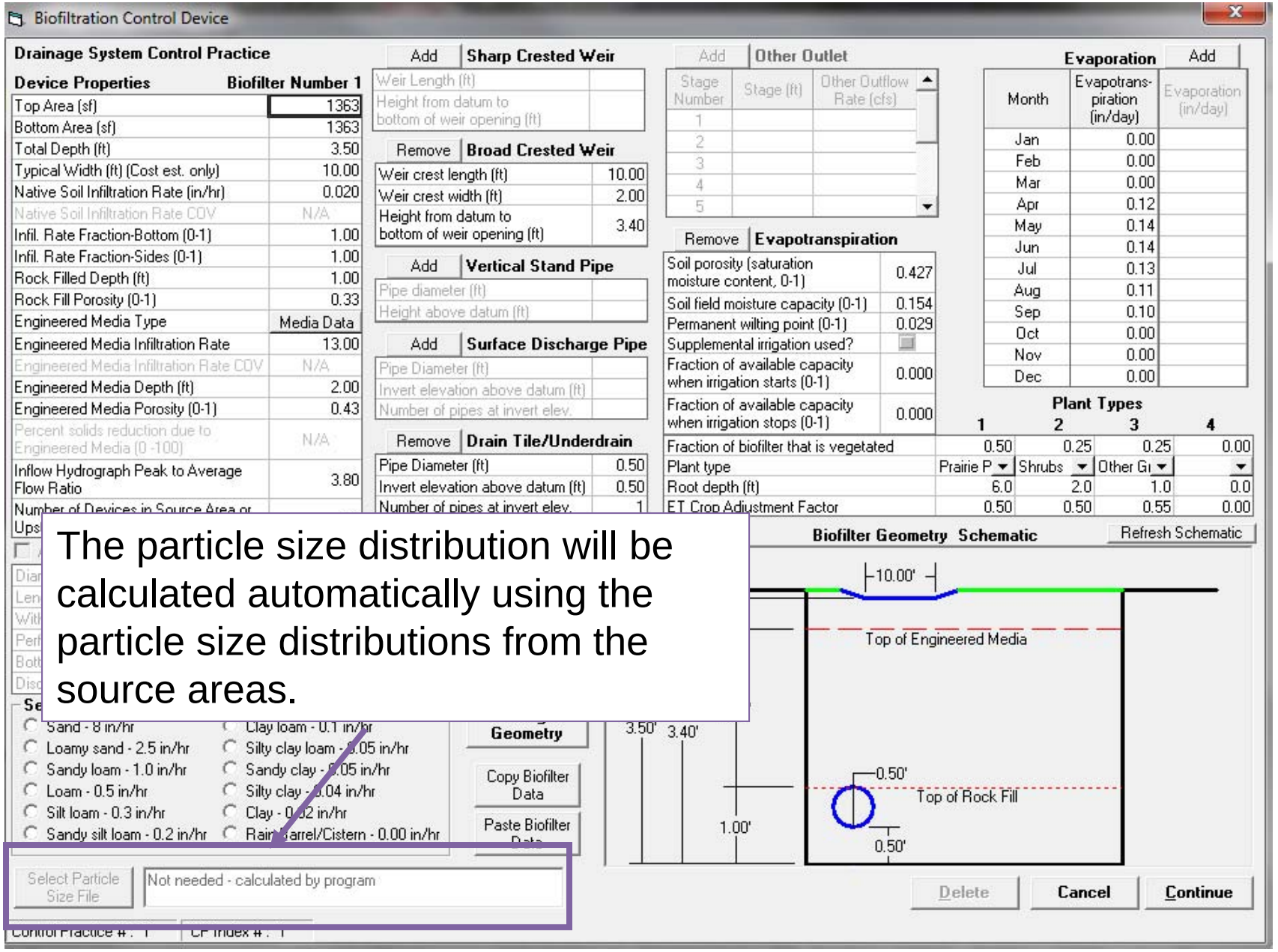
If unknown, select the Native Soil Seepage Rate from the list of default values

Biofiltration Control Device



If applicable, check the box to account for the uncertainty in the system. This is generally used for academic purposes.

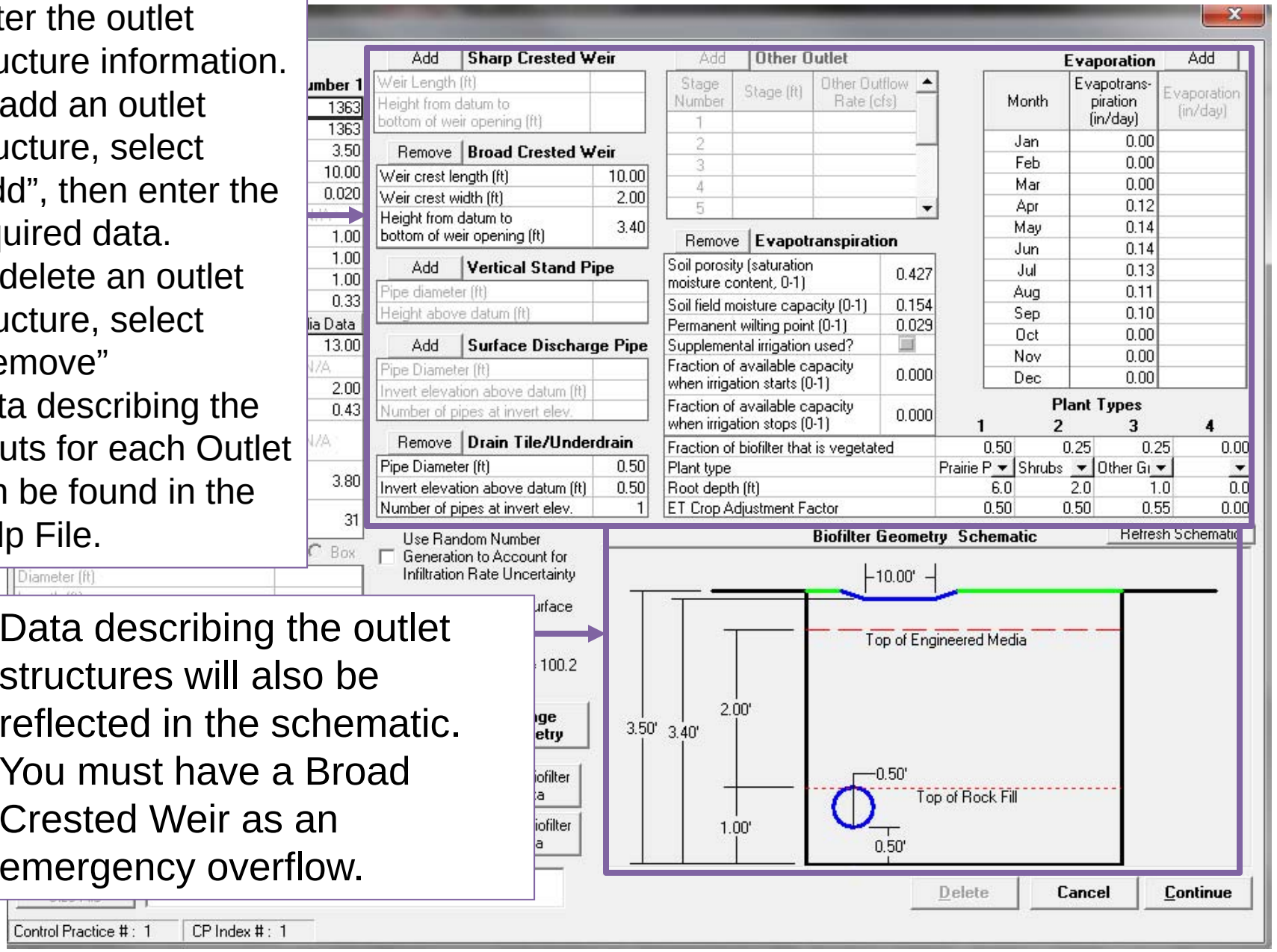
Biofiltration Control Device



The particle size distribution will be calculated automatically using the particle size distributions from the source areas.

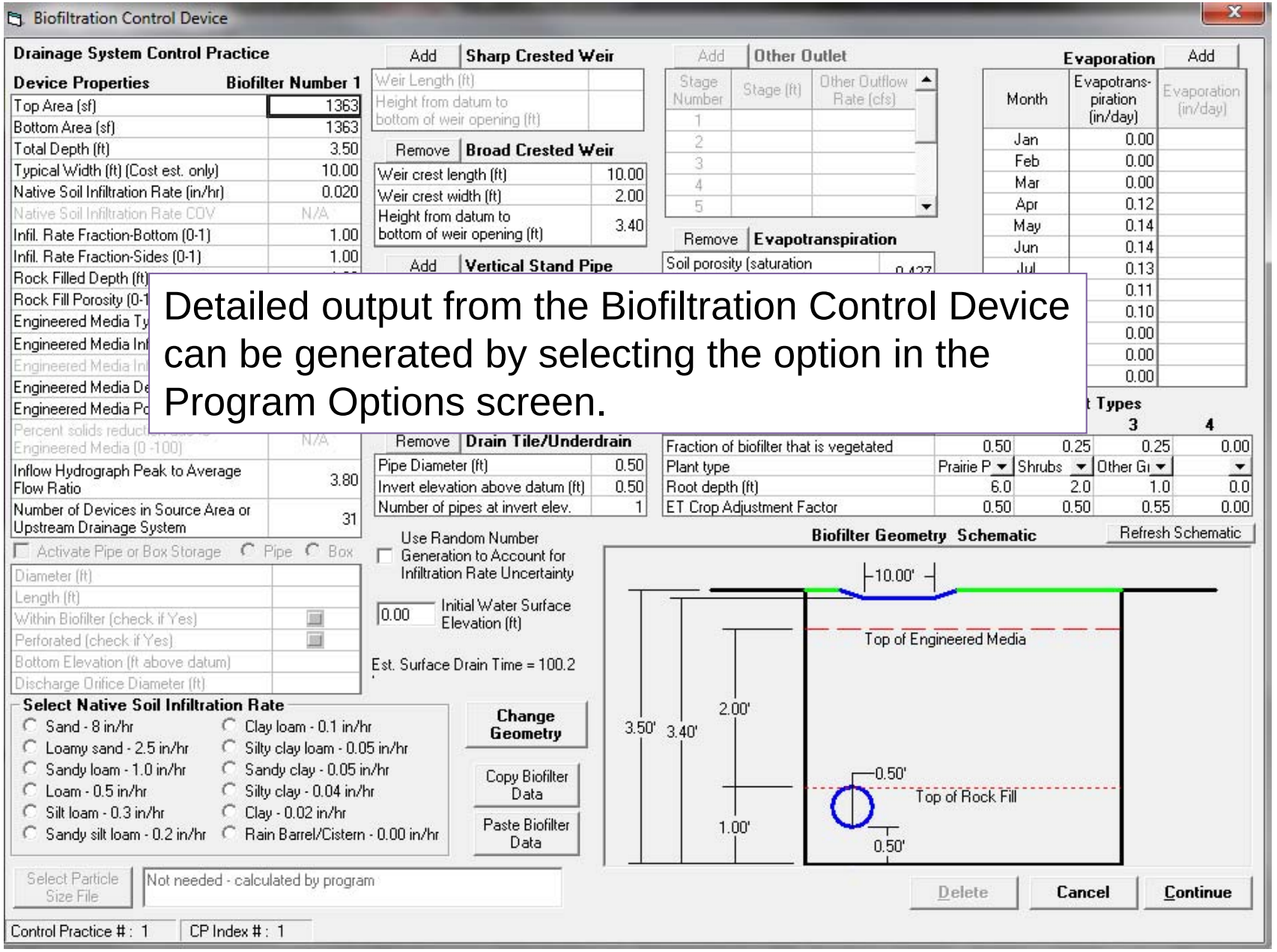
Biofiltration Control Device

Enter the outlet structure information.
To add an outlet structure, select "Add", then enter the required data.
To delete an outlet structure, select "Remove"
Data describing the inputs for each Outlet can be found in the Help File.



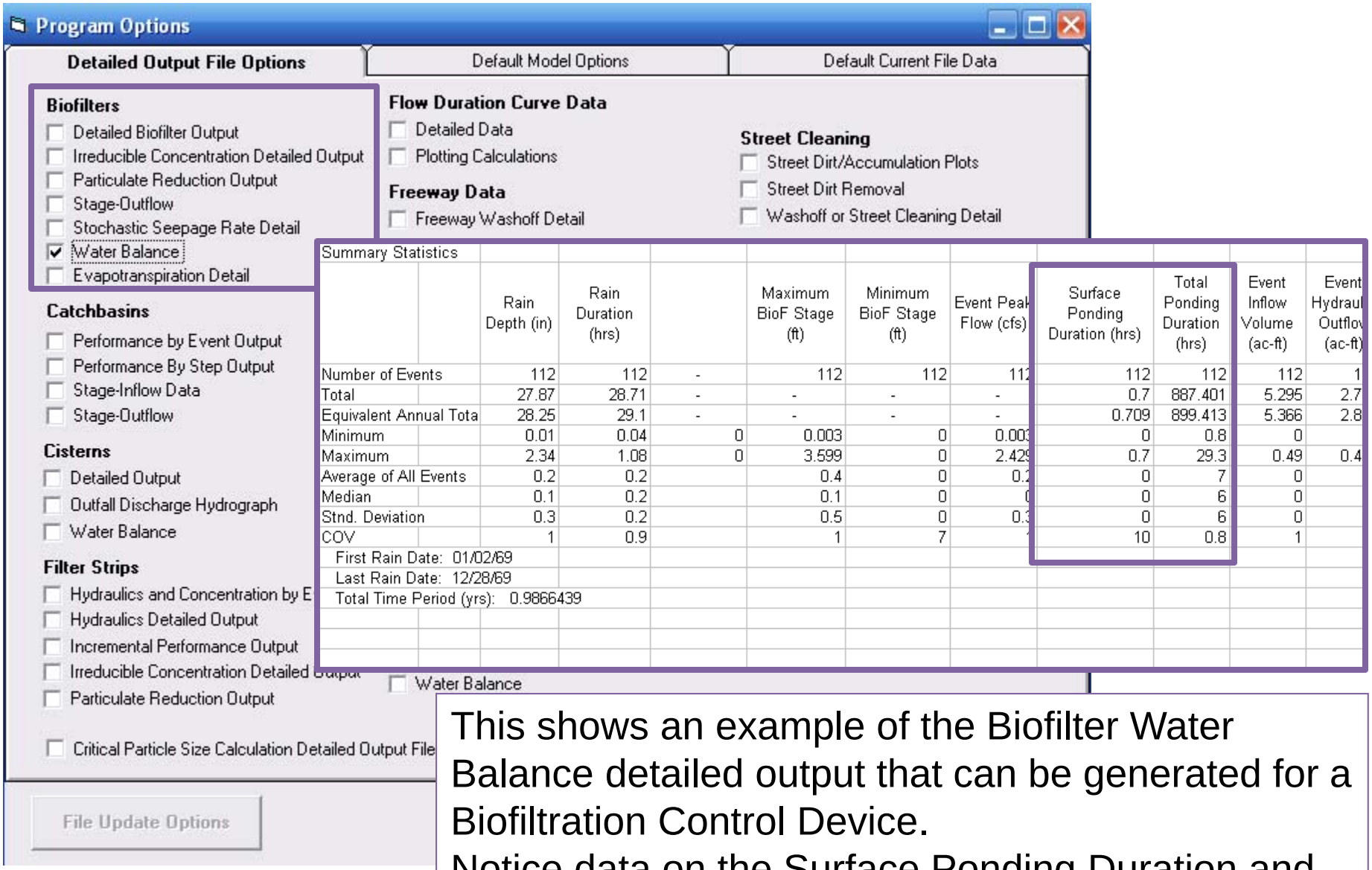
Data describing the outlet structures will also be reflected in the schematic.
You must have a Broad Crested Weir as an emergency overflow.

Biofiltration Control Device



Detailed output from the Biofiltration Control Device can be generated by selecting the option in the Program Options screen.

Biofiltration Control Device



Summary Statistics

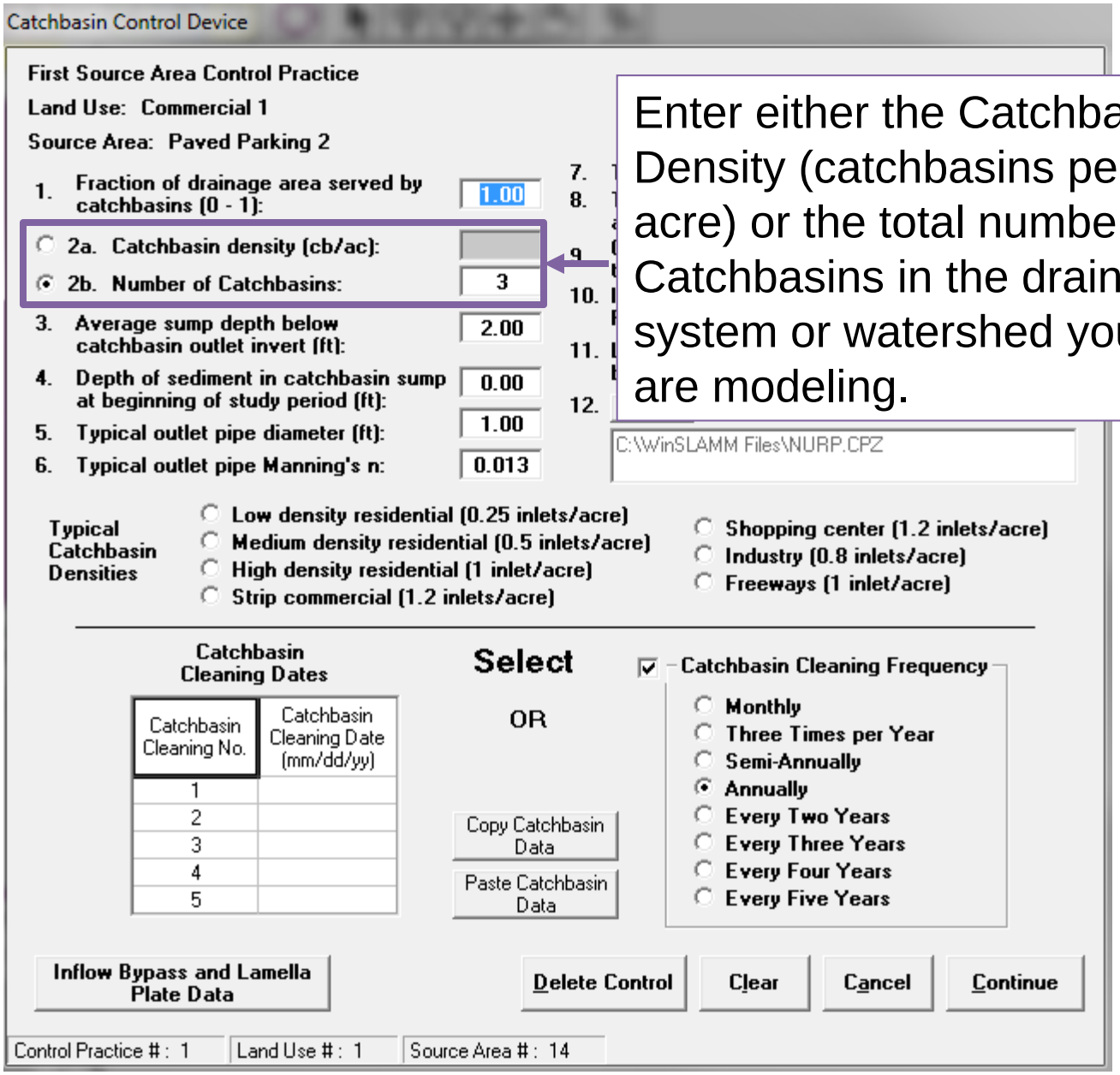
	Rain Depth (in)	Rain Duration (hrs)		Maximum BioF Stage (ft)	Minimum BioF Stage (ft)	Event Peak Flow (cfs)	Surface Ponding Duration (hrs)	Total Ponding Duration (hrs)	Event Inflow Volume (ac-ft)	Event Hydraul Outflo (ac-ft)
Number of Events	112	112	-	112	112	112	112	112	112	1
Total	27.87	28.71	-	-	-	-	0.7	887.401	5.295	2.7
Equivalent Annual Tota	28.25	29.1	-	-	-	-	0.709	899.413	5.366	2.8
Minimum	0.01	0.04	0	0.003	0	0.003	0	0.8	0	
Maximum	2.34	1.08	0	3.599	0	2.429	0.7	29.3	0.49	0.4
Average of All Events	0.2	0.2		0.4	0	0.2	0	7	0	
Median	0.1	0.2		0.1	0	0	0	6	0	
Stnd. Deviation	0.3	0.2		0.5	0	0.3	0	6	0	
COV	1	0.9		1	7	1	10	0.8	1	

First Rain Date: 01/02/69
Last Rain Date: 12/28/69
Total Time Period (yrs): 0.9866439

This shows an example of the Biofilter Water Balance detailed output that can be generated for a Biofiltration Control Device.
Notice data on the Surface Ponding Duration and the Total Ponding Duration.

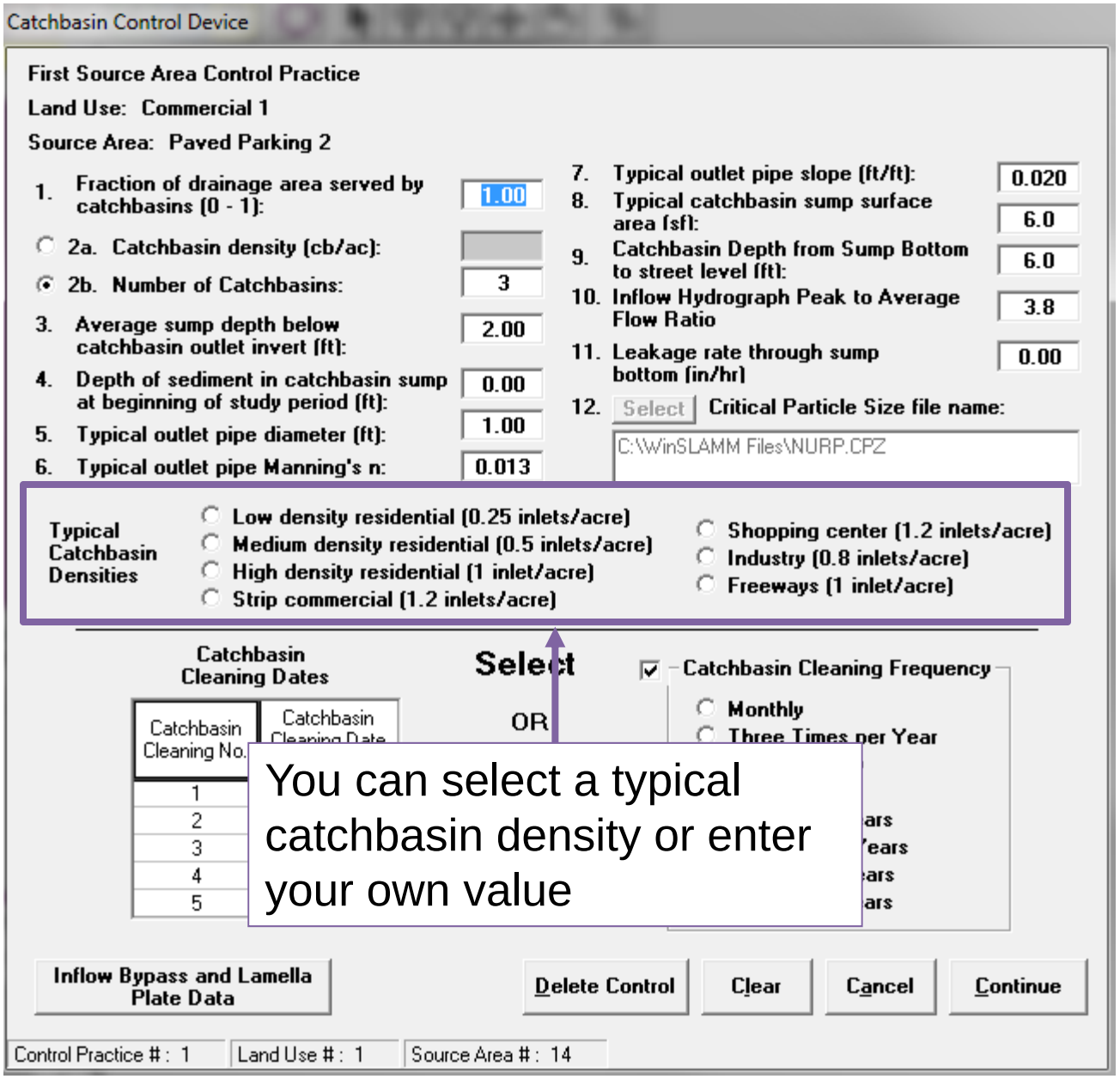
Control Devices – Catchbasins

Catchbasin Control Device

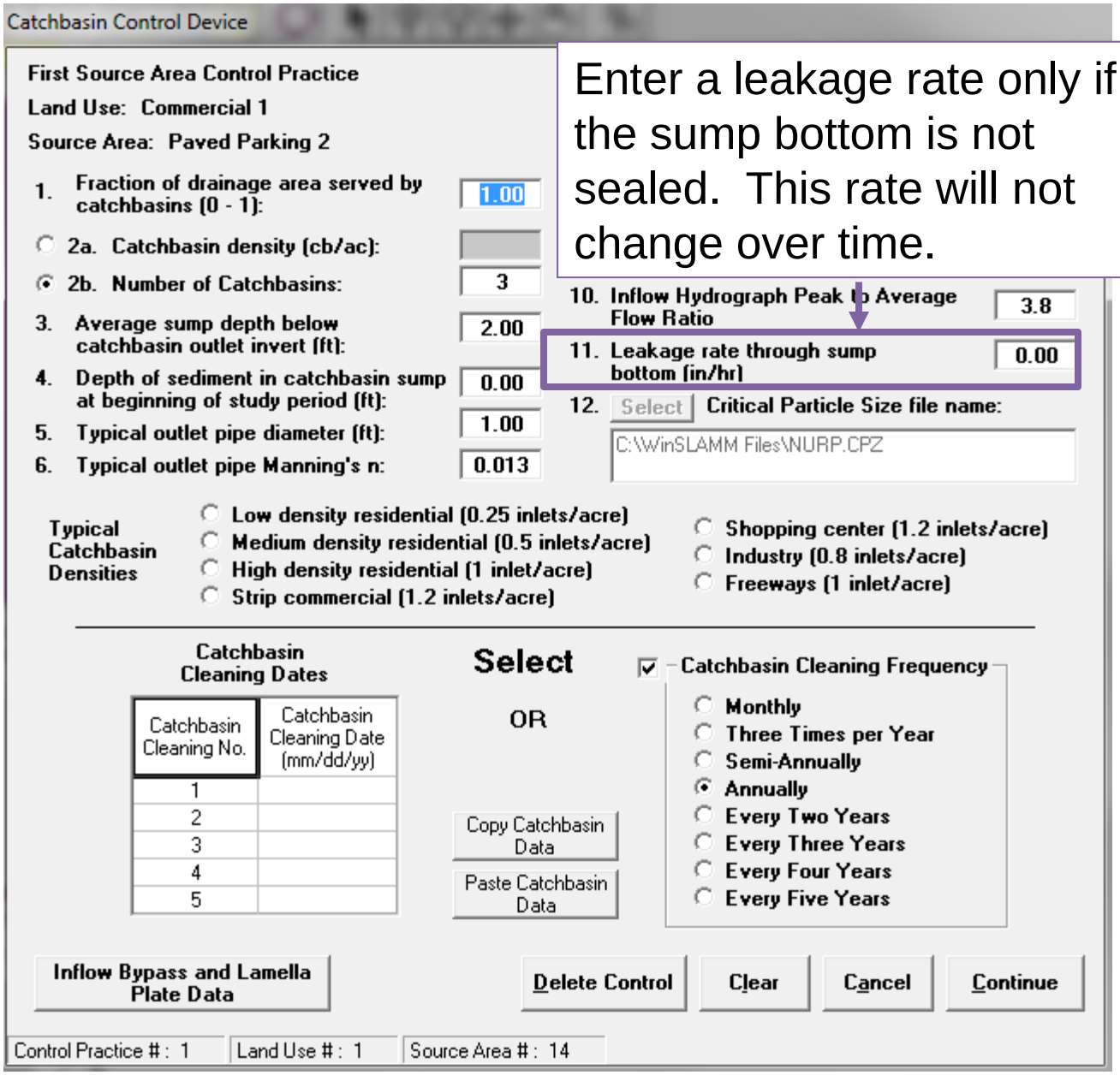


Enter either the Catchbasin Density (catchbasins per acre) or the total number of Catchbasins in the drainage system or watershed you are modeling.

Catchbasin Control Device

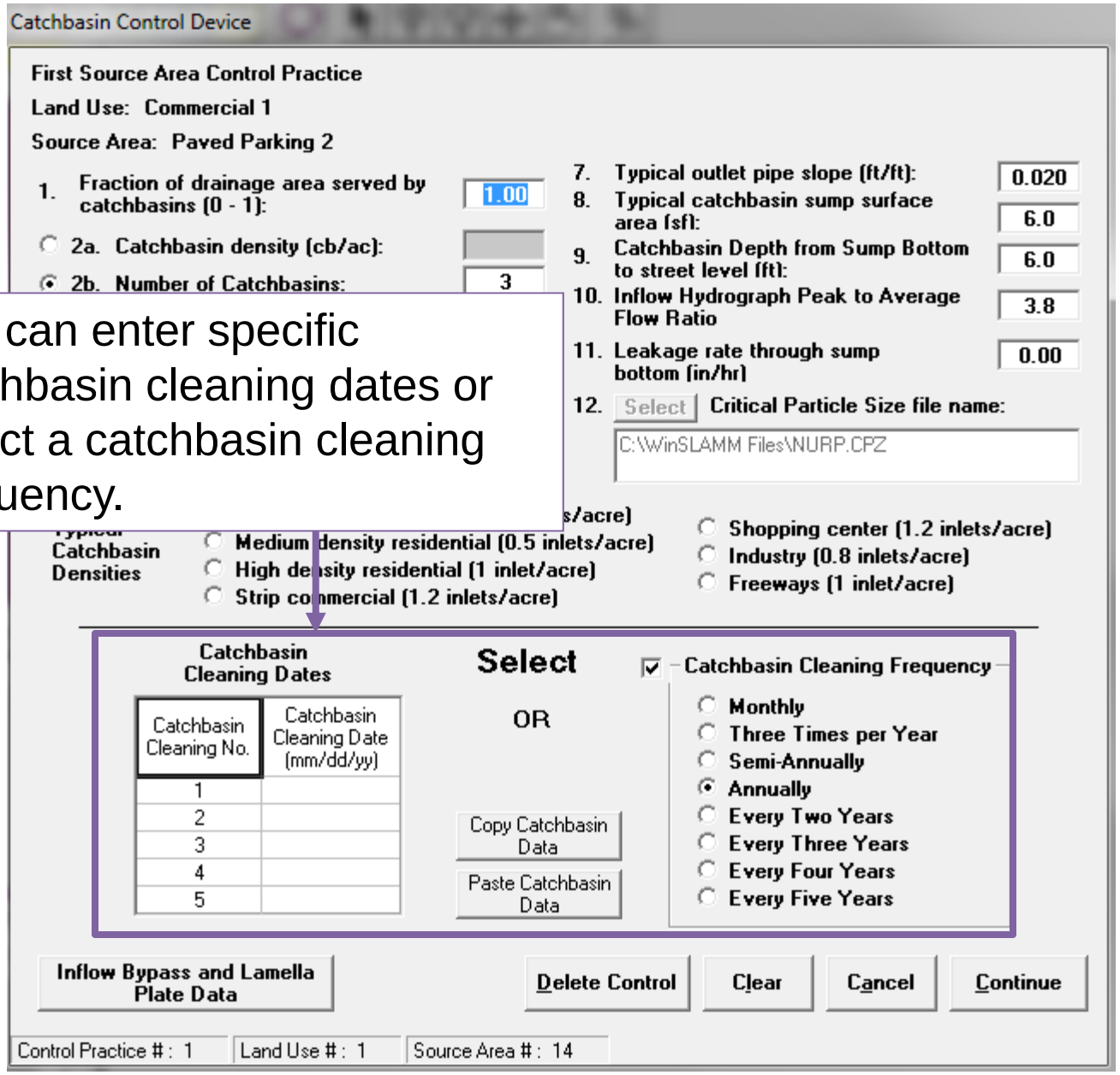


Catchbasin Control Device



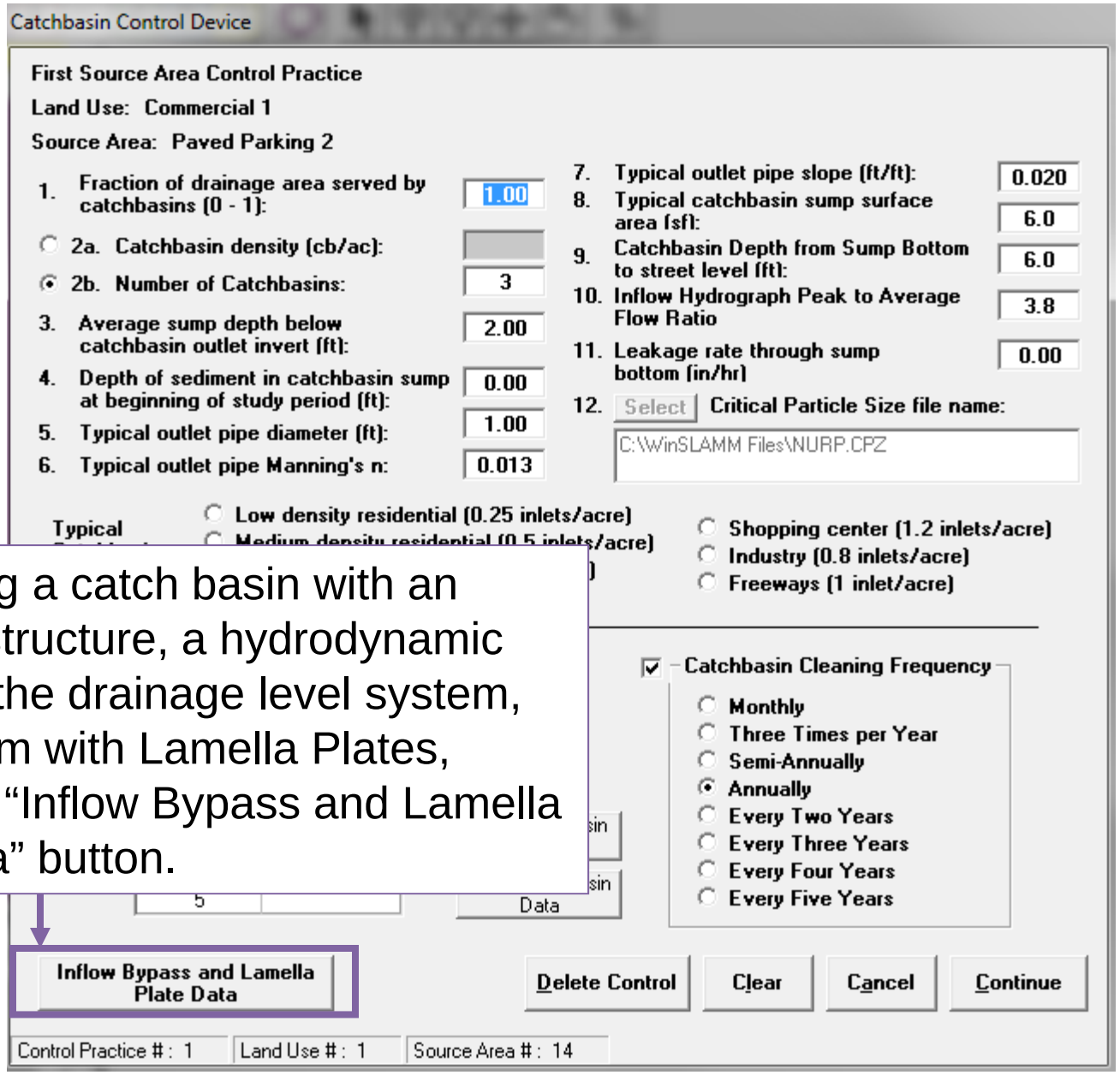
Enter a leakage rate only if the sump bottom is not sealed. This rate will not change over time.

Catchbasin Control Device



You can enter specific catchbasin cleaning dates or select a catchbasin cleaning frequency.

Catchbasin Control Device

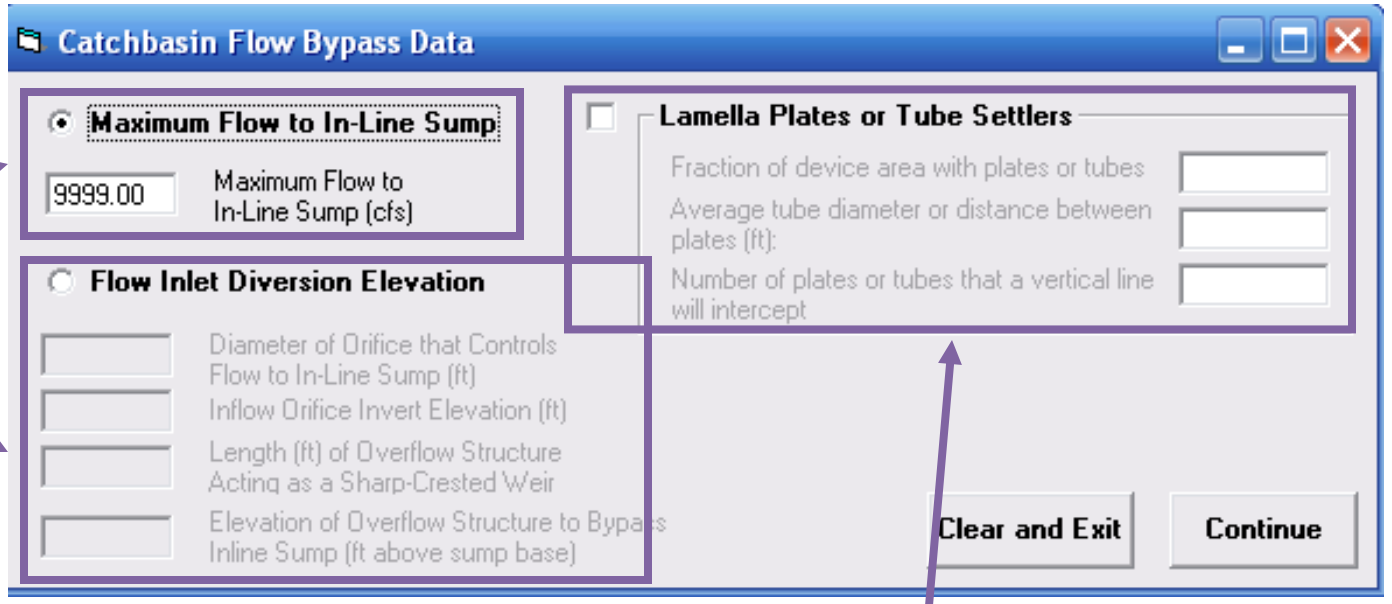


If modeling a catch basin with an overflow structure, a hydrodynamic device at the drainage level system, or a system with Lamella Plates, select the “Inflow Bypass and Lamella Plate Data” button.

Catchbasin Control Device

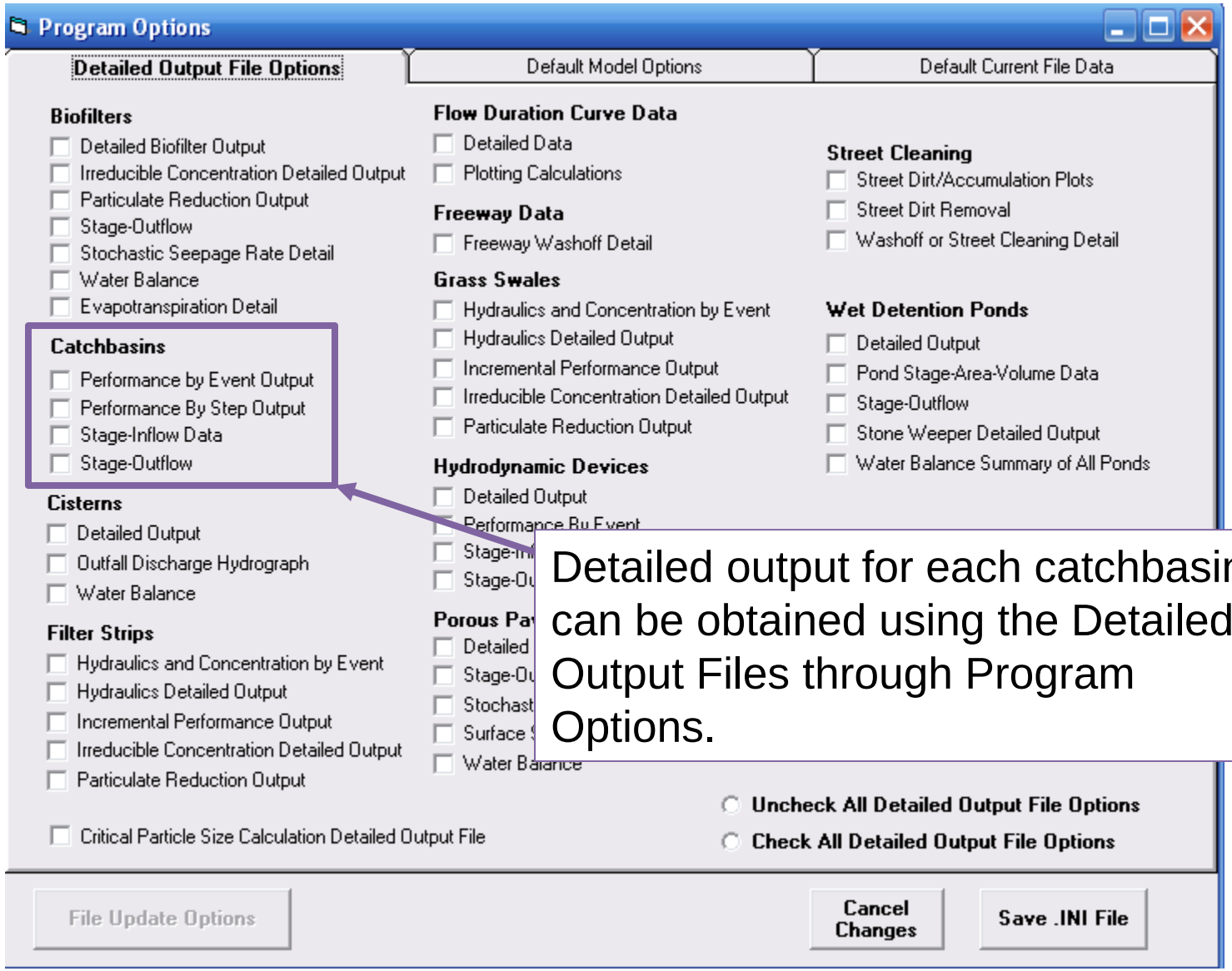
The data required for this control device when using the bypass is the same data required for the hydrodynamic device.

Enter the Maximum Flow to the In-Line Sump if known.
Or enter the characteristics of the diversion and the program will calculate the maximum flow.



Enter the data for the Lamella Plates if relevant.

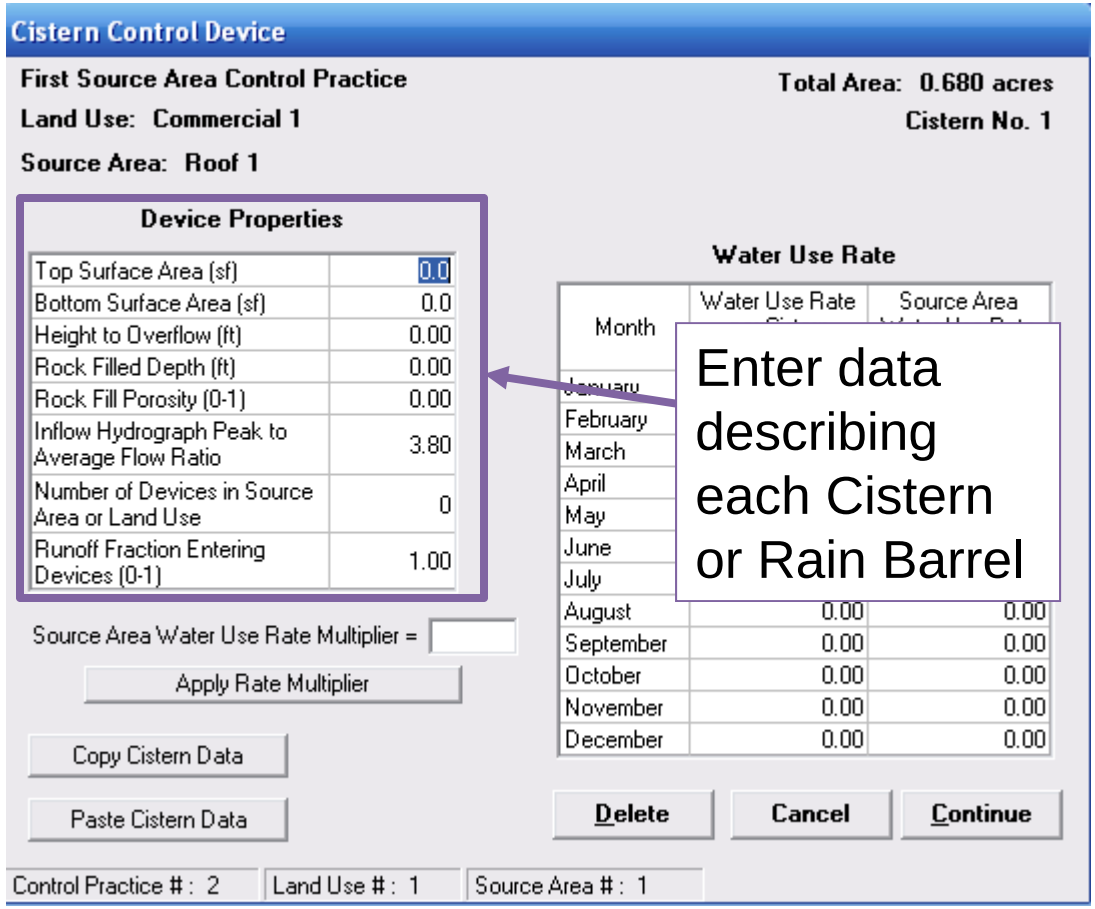
Catchbasin Control Device



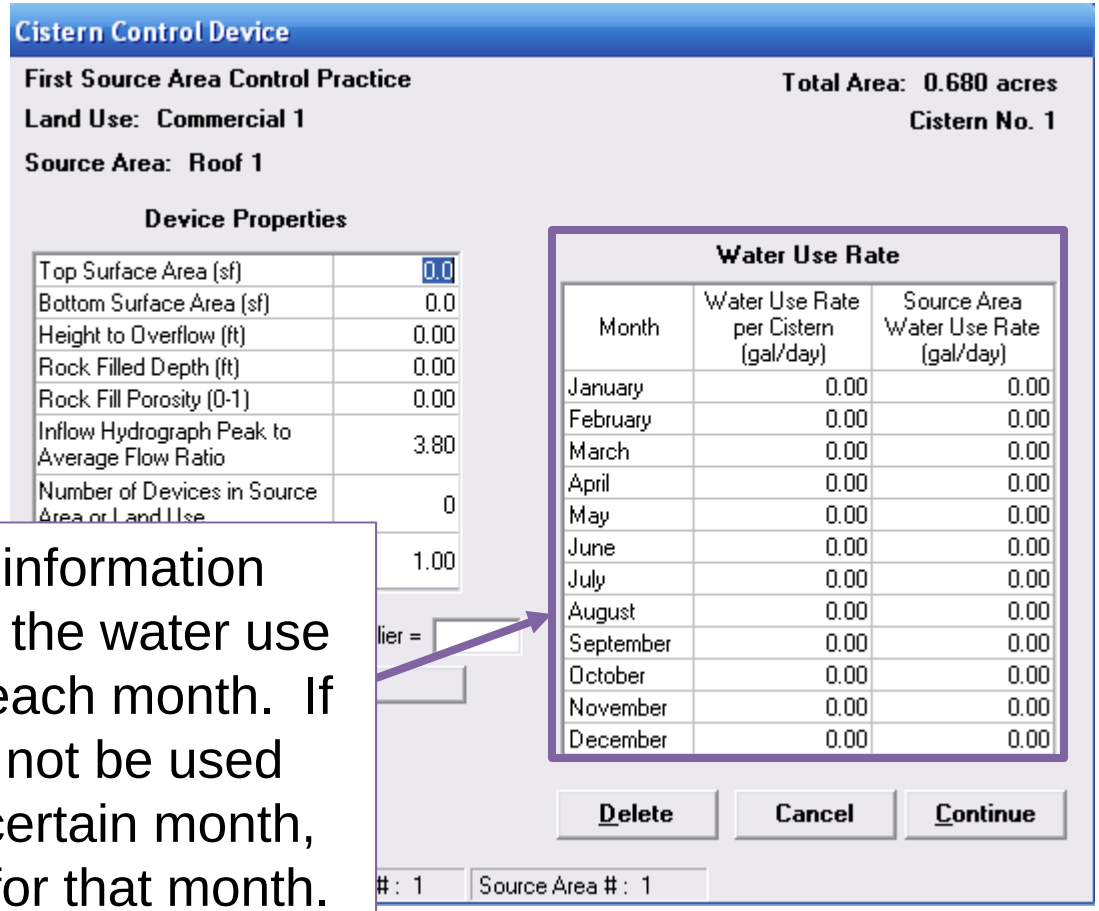
Detailed output for each catchbasin can be obtained using the Detailed Output Files through Program Options.

Control Devices – Cisterns

Cistern Control Device

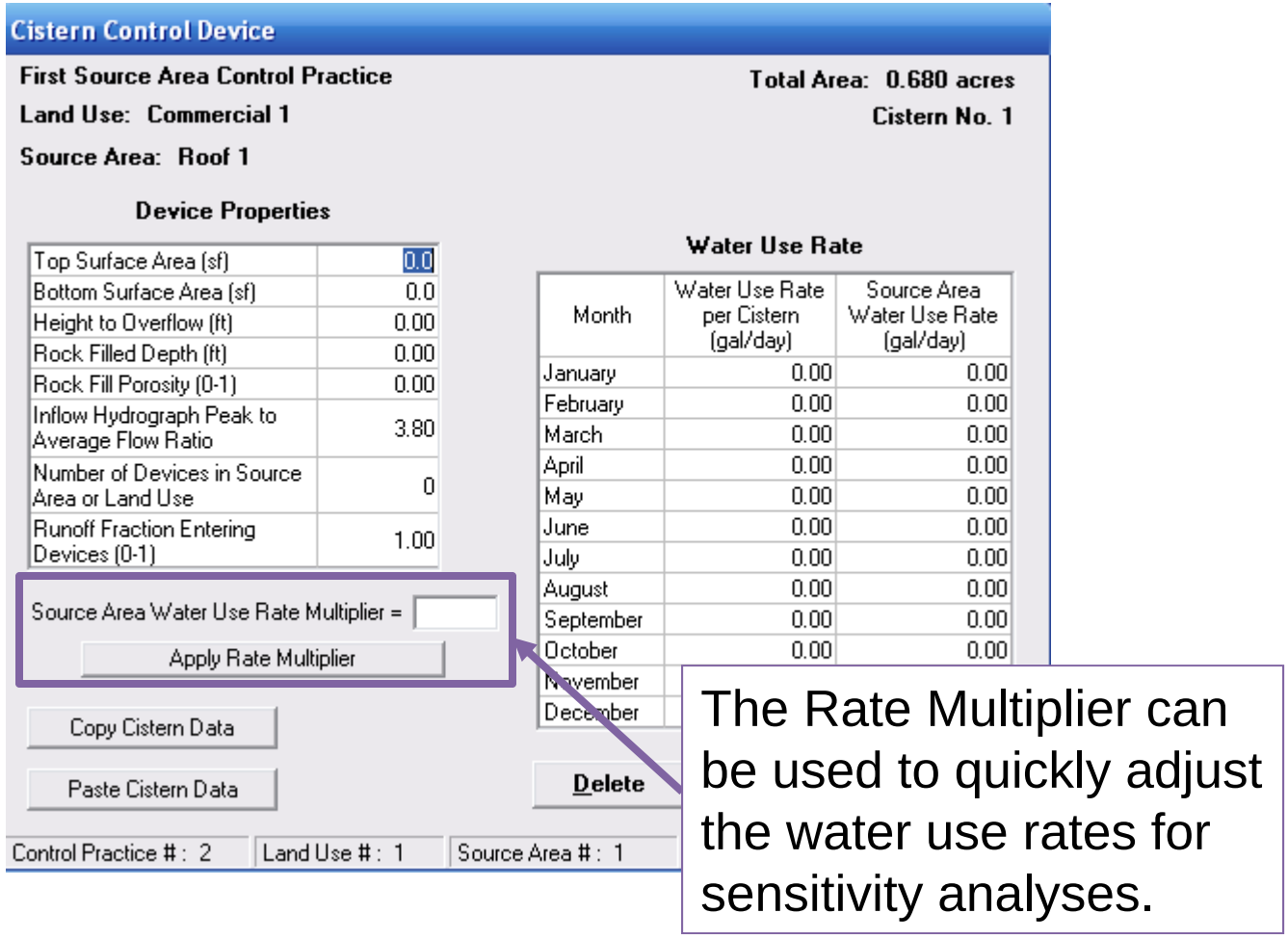


Cistern Control Device



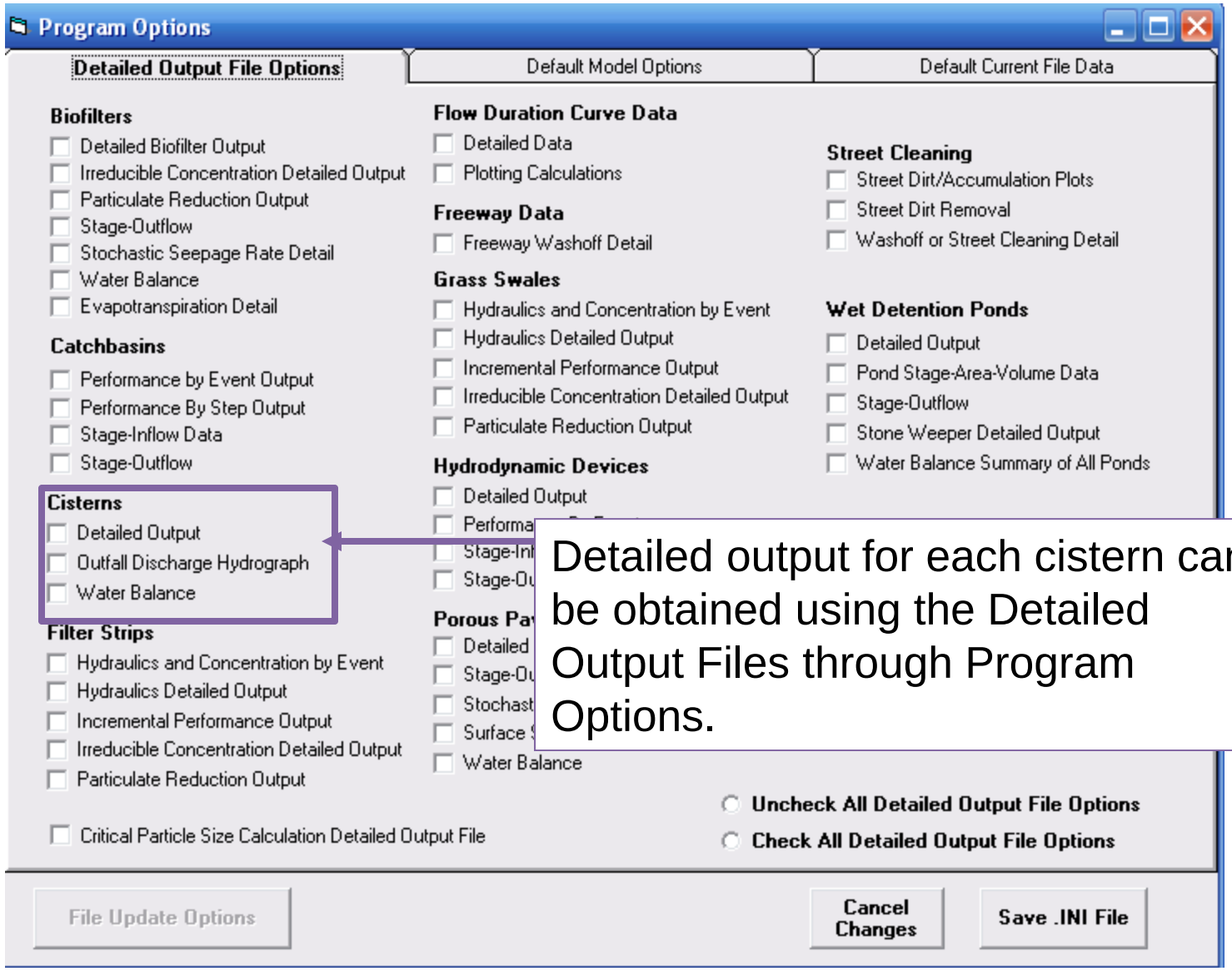
Enter the information regarding the water use rates for each month. If water will not be used during a certain month, enter “0” for that month.

Cistern Control Device



The Rate Multiplier can be used to quickly adjust the water use rates for sensitivity analyses.

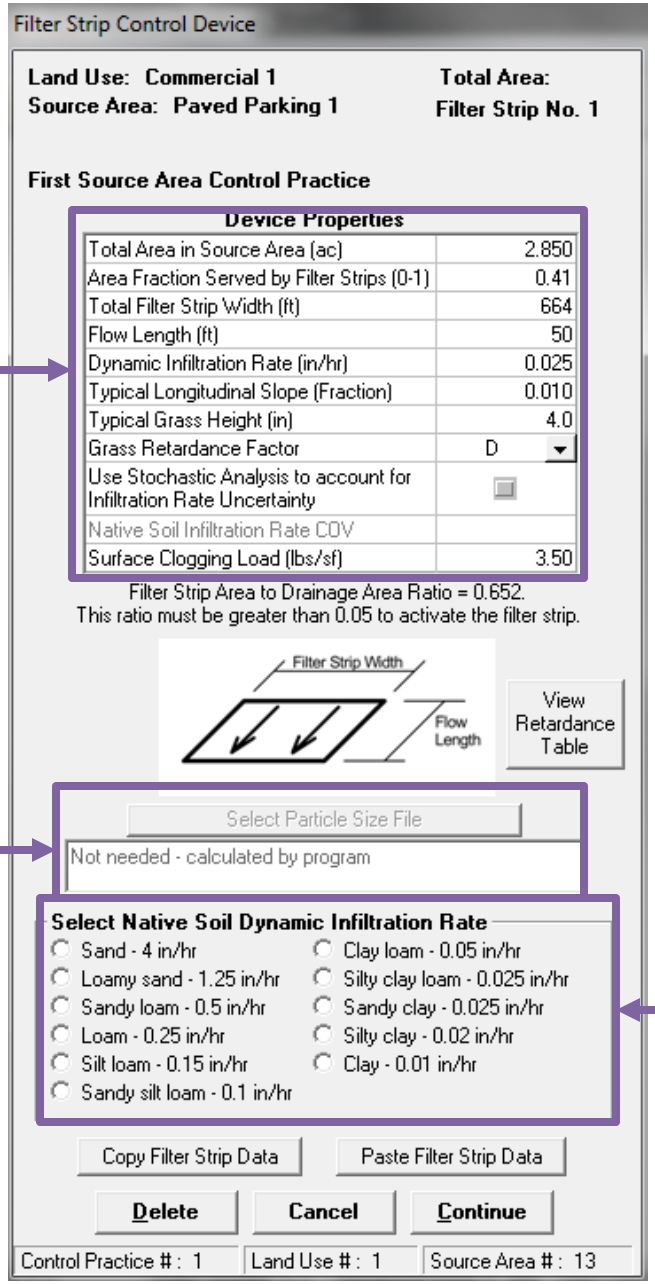
Cistern Control Device



Detailed output for each cistern can be obtained using the Detailed Output Files through Program Options.

Control Devices – Filter Strips

Filter Strip Control Device

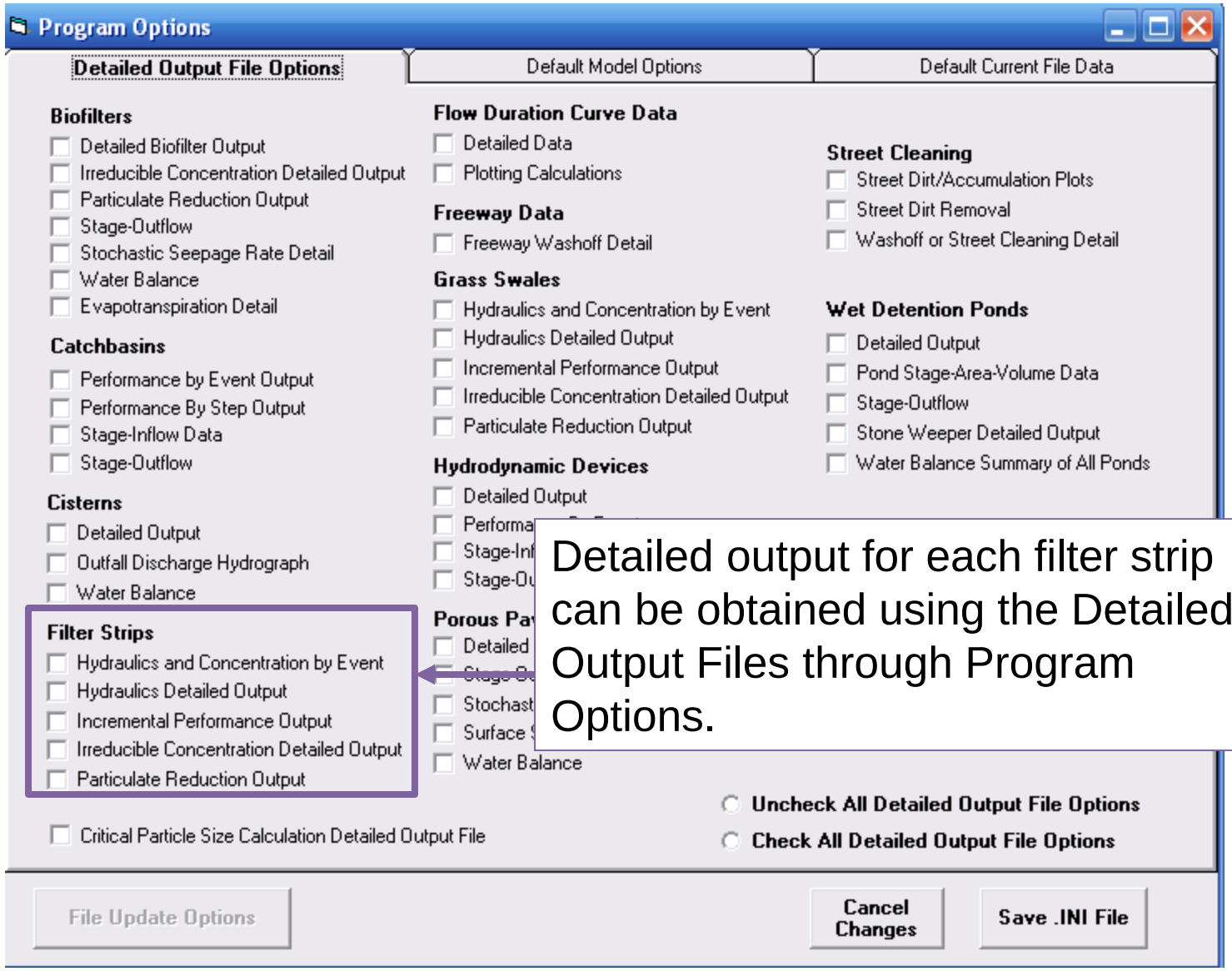


Enter data describing each Filter Strip

The particle size distribution will be calculated automatically using the particle size distributions from the source areas.

If unknown, select a default Dynamic Infiltration Rate based on the project site's soil data description.

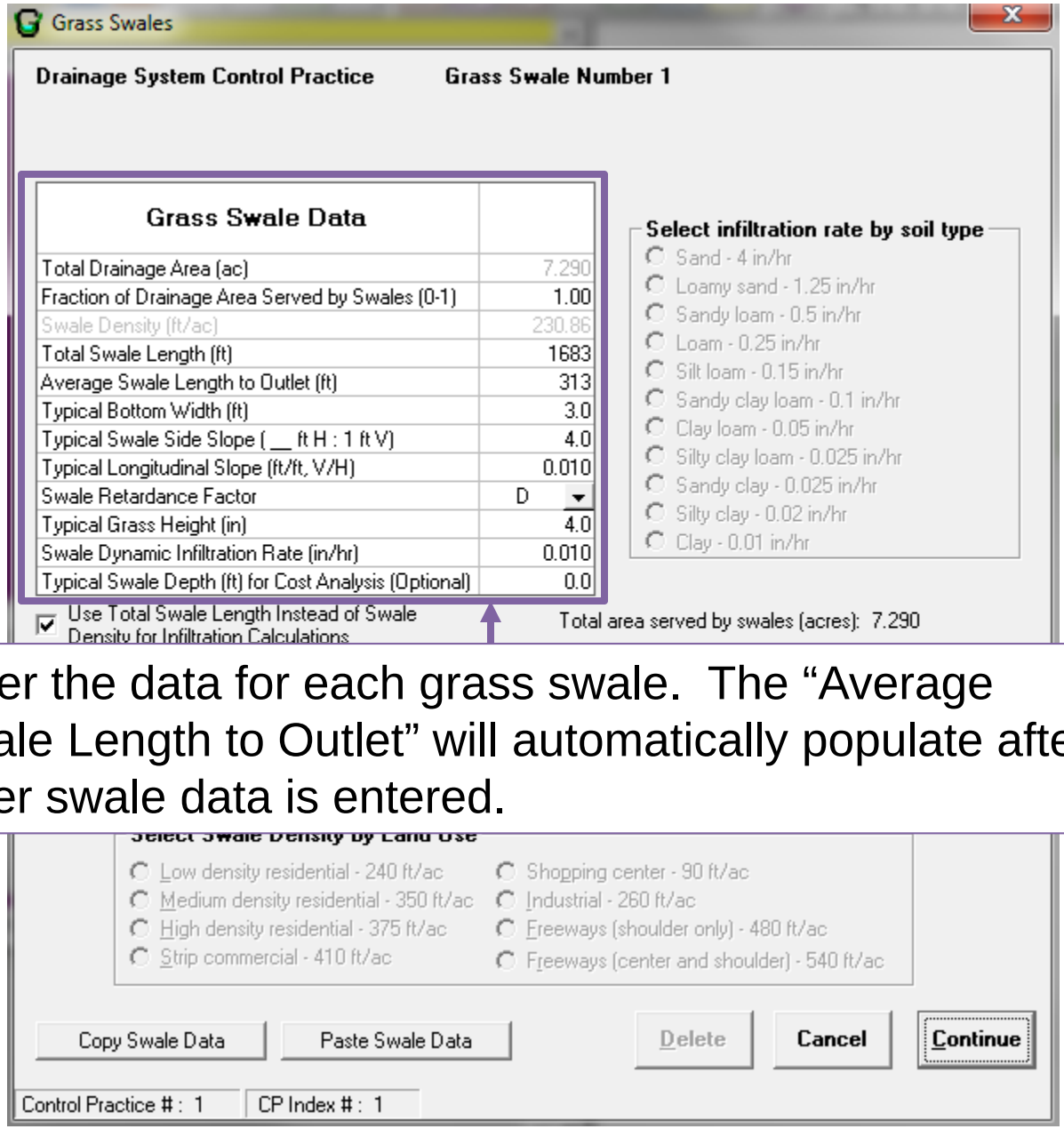
Filter Strip Control Device



Detailed output for each filter strip can be obtained using the Detailed Output Files through Program Options.

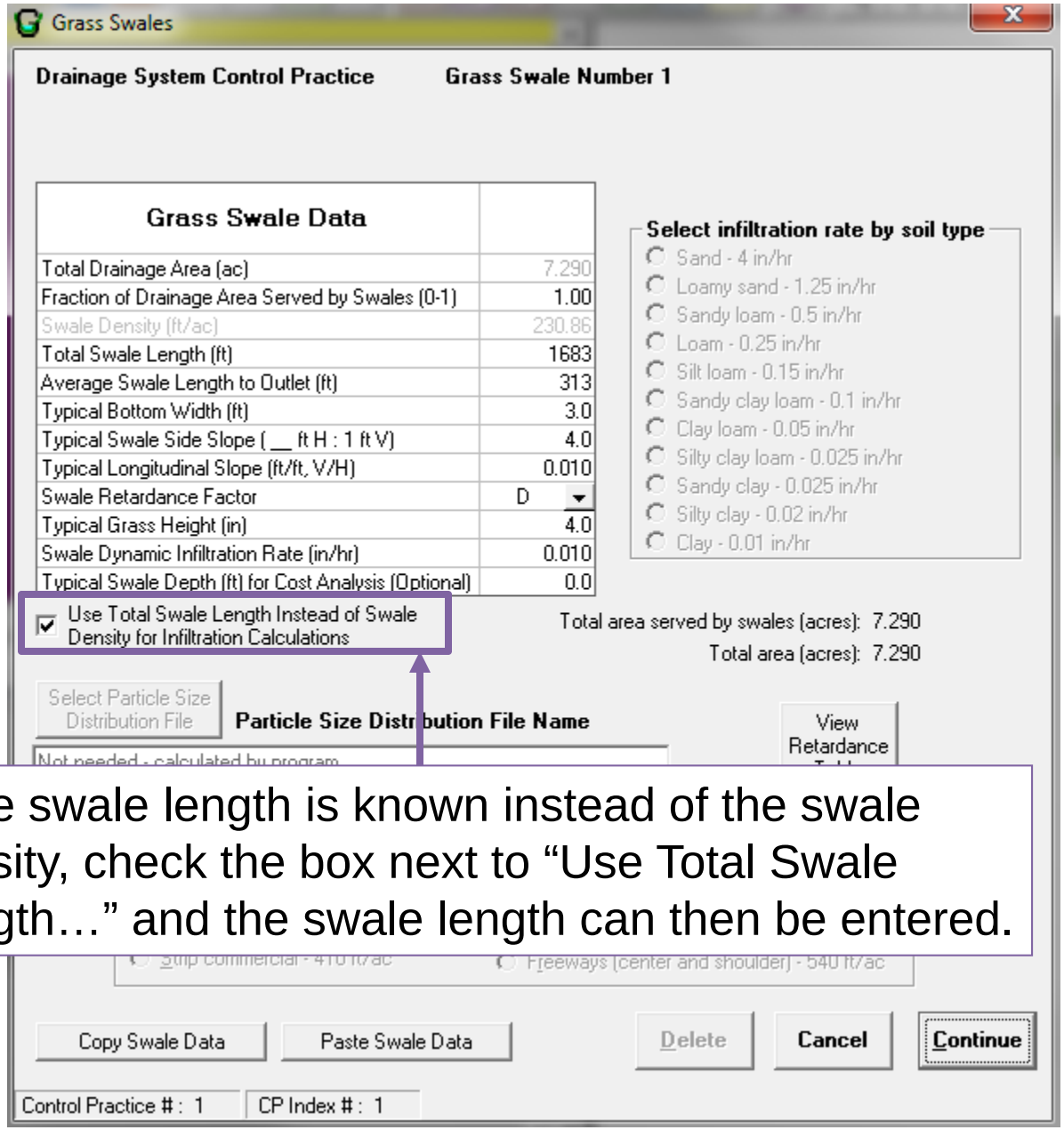
Control Devices – Grass Swales

Grass Swales



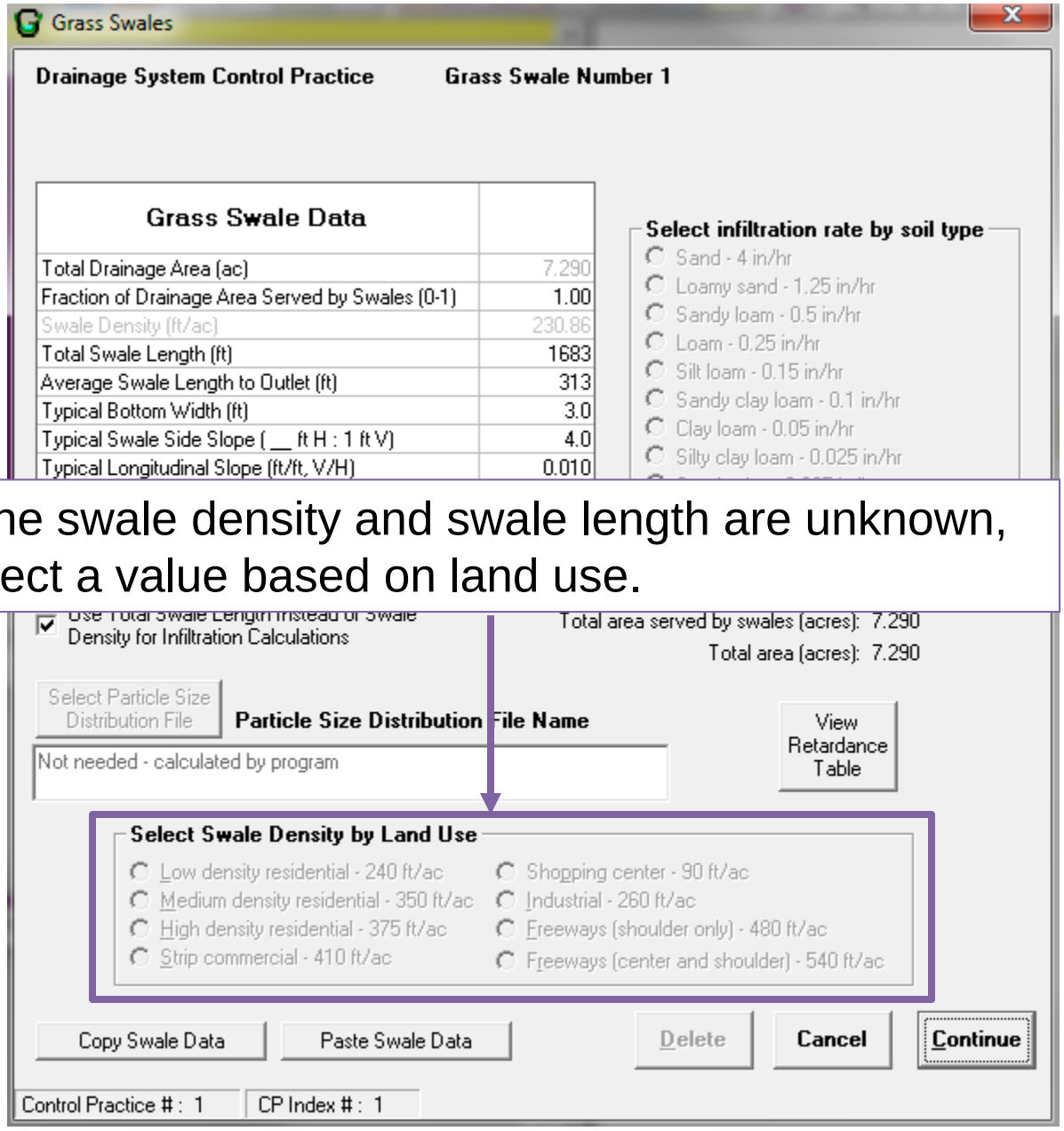
Enter the data for each grass swale. The “Average Swale Length to Outlet” will automatically populate after other swale data is entered.

Grass Swales

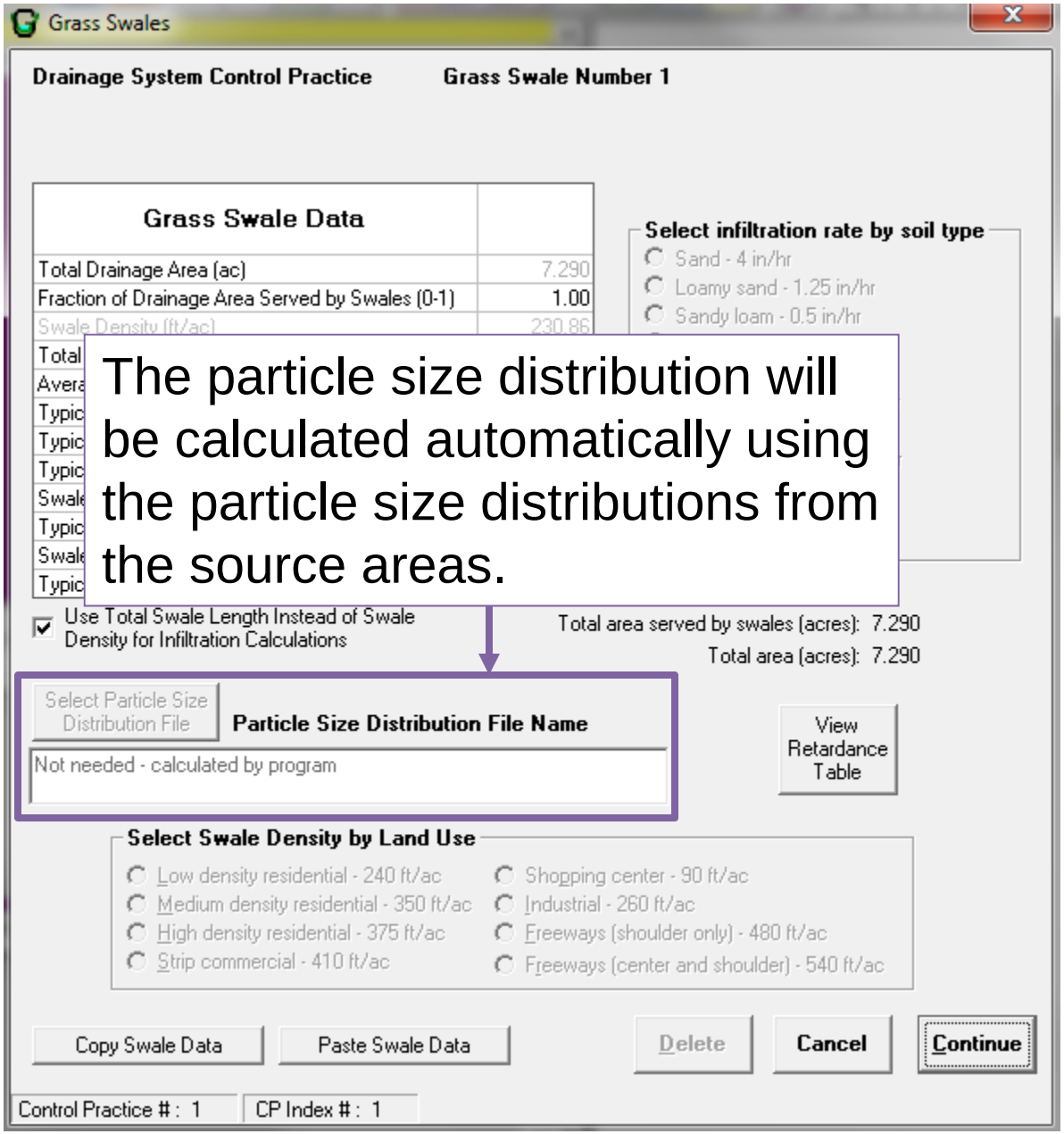


If the swale length is known instead of the swale density, check the box next to “Use Total Swale Length…” and the swale length can then be entered.

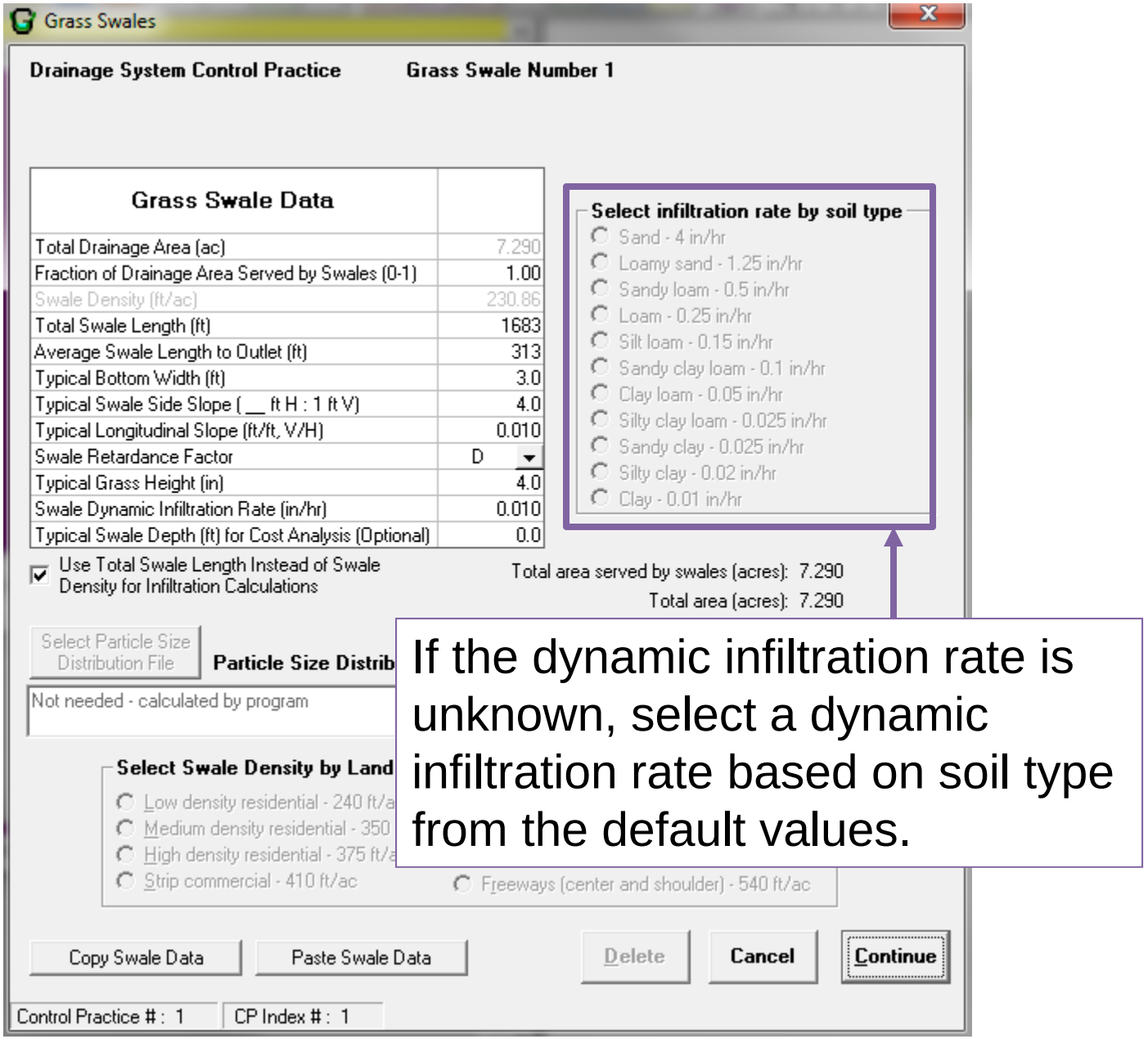
Grass Swales



Grass Swales

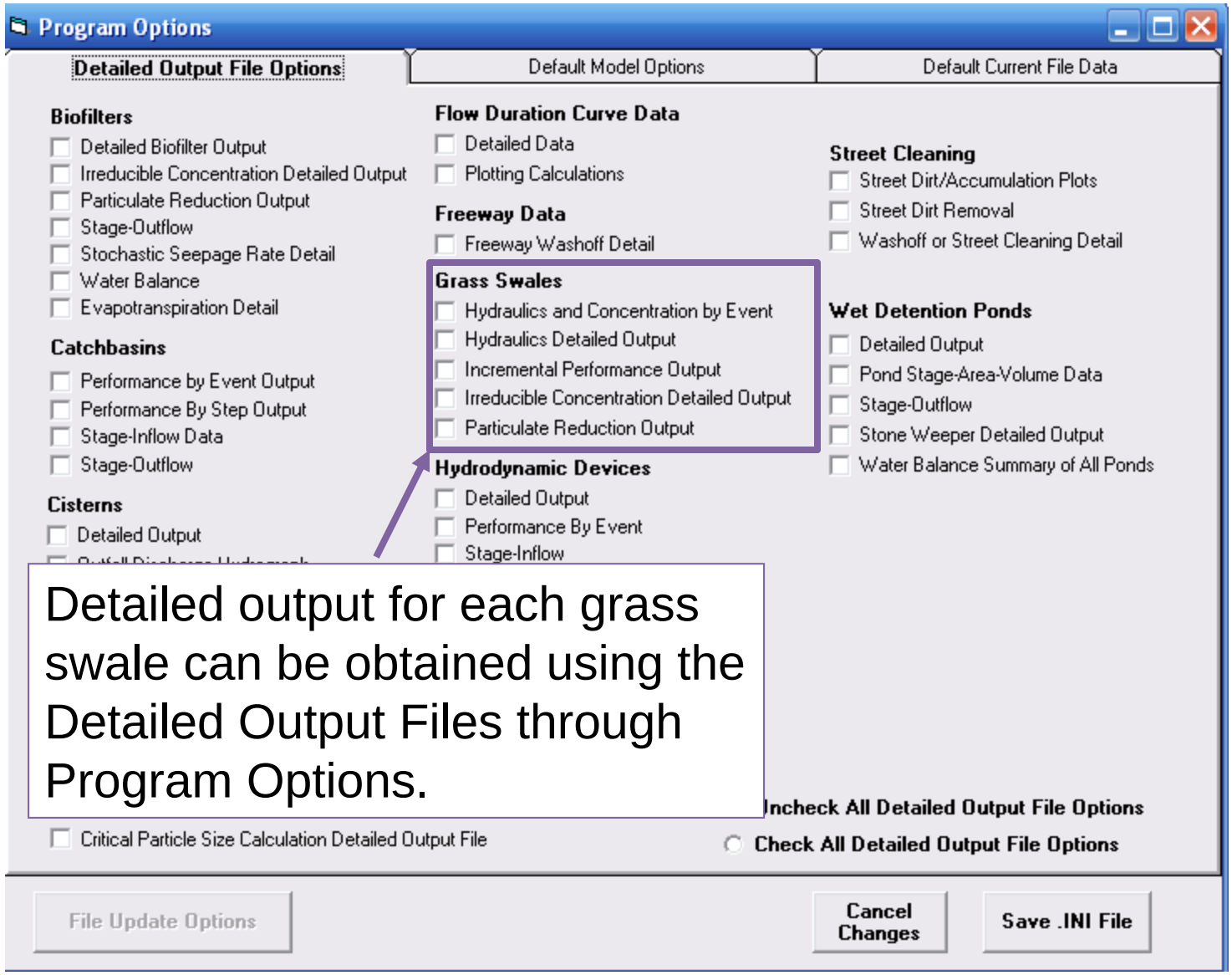


Grass Swales



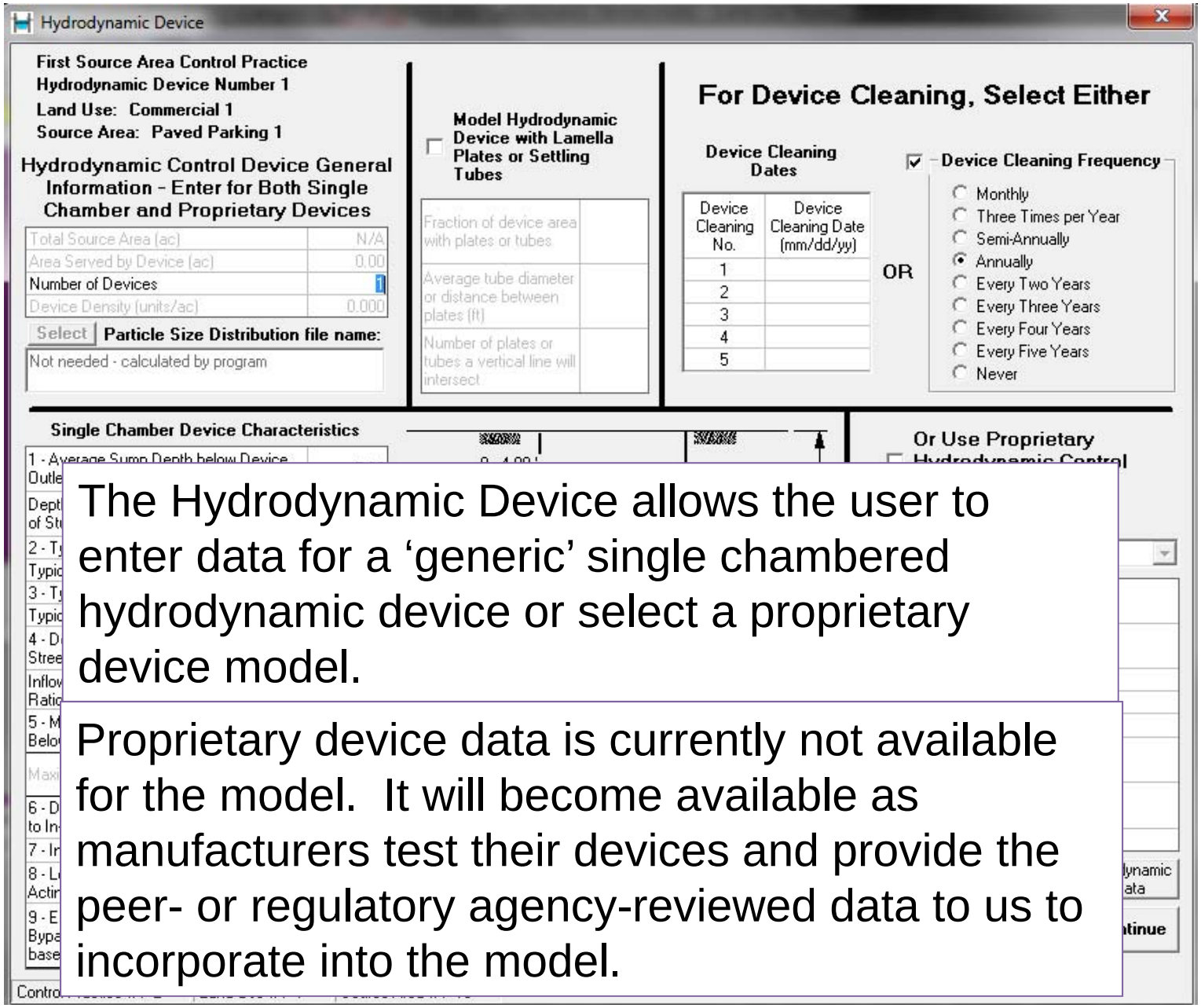
If the dynamic infiltration rate is unknown, select a dynamic infiltration rate based on soil type from the default values.

Grass Swale Control Device



Control Devices – Hydrodynamic Device

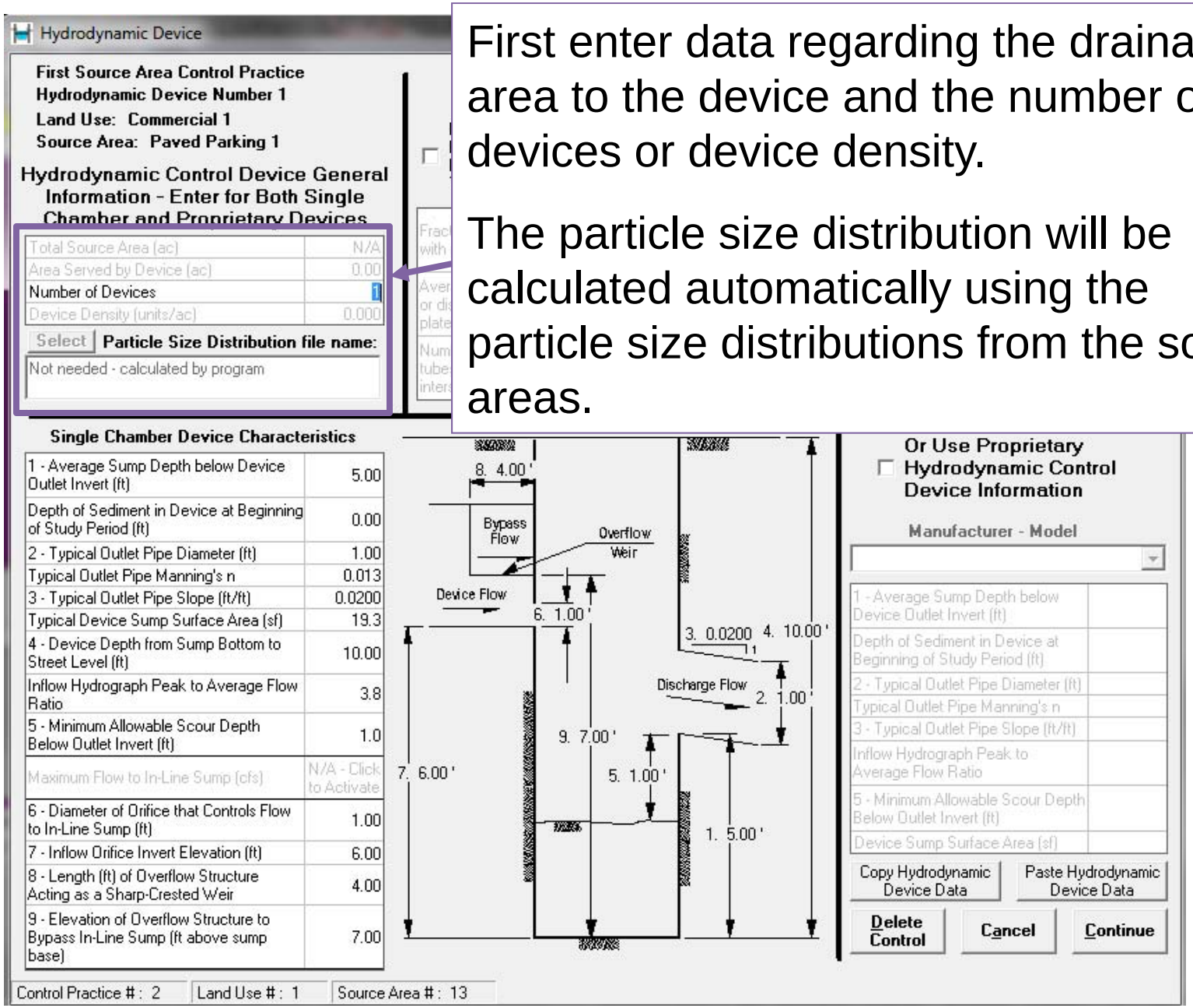
Hydrodynamic Device



The Hydrodynamic Device allows the user to enter data for a ‘generic’ single chambered hydrodynamic device or select a proprietary device model.

Proprietary device data is currently not available for the model. It will become available as manufacturers test their devices and provide the peer- or regulatory agency-reviewed data to us to incorporate into the model.

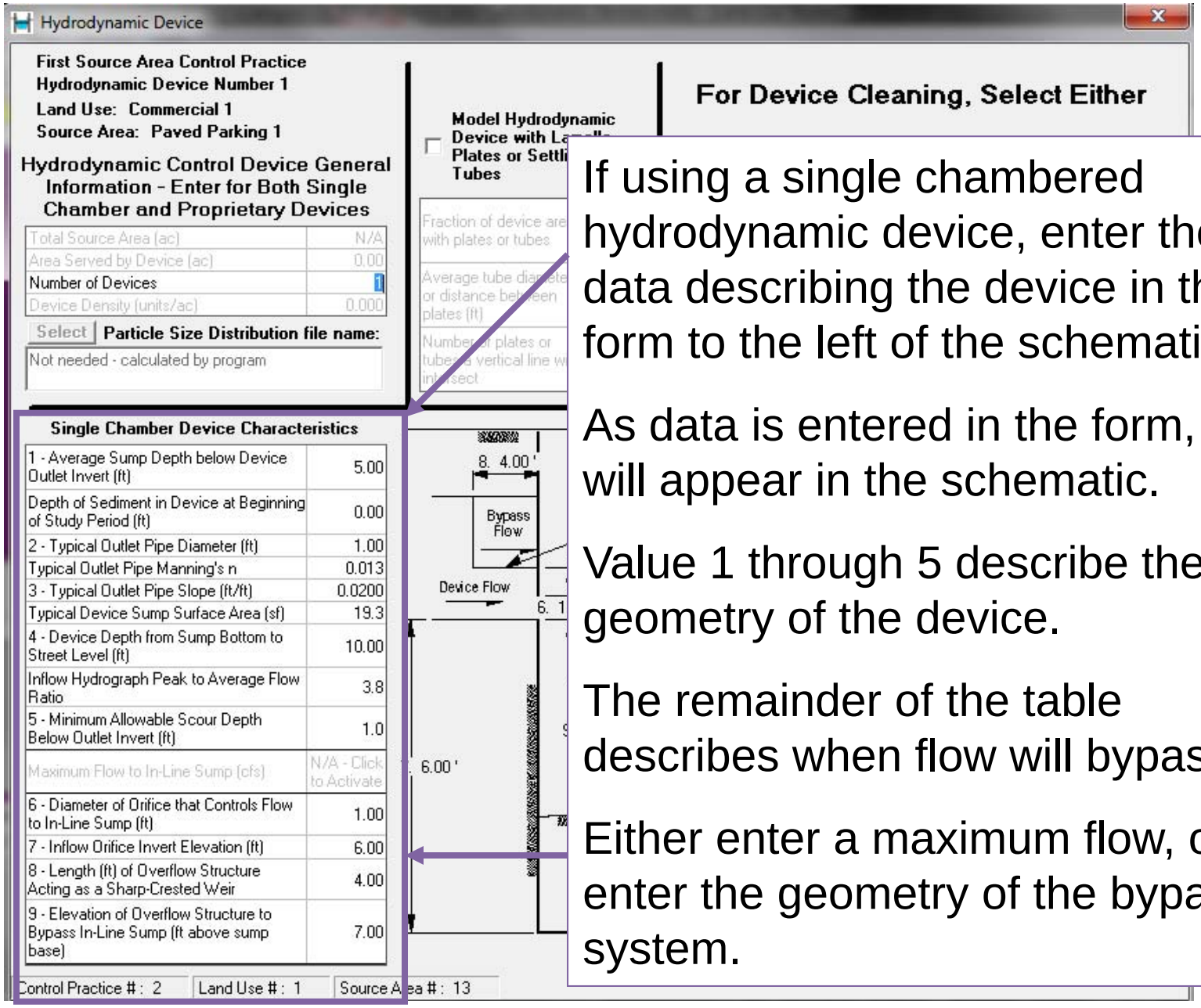
Hydrodynamic Device



First enter data regarding the drainage area to the device and the number of devices or device density.

The particle size distribution will be calculated automatically using the particle size distributions from the source areas.

Hydrodynamic Device



If using a single chambered hydrodynamic device, enter the data describing the device in the form to the left of the schematic.

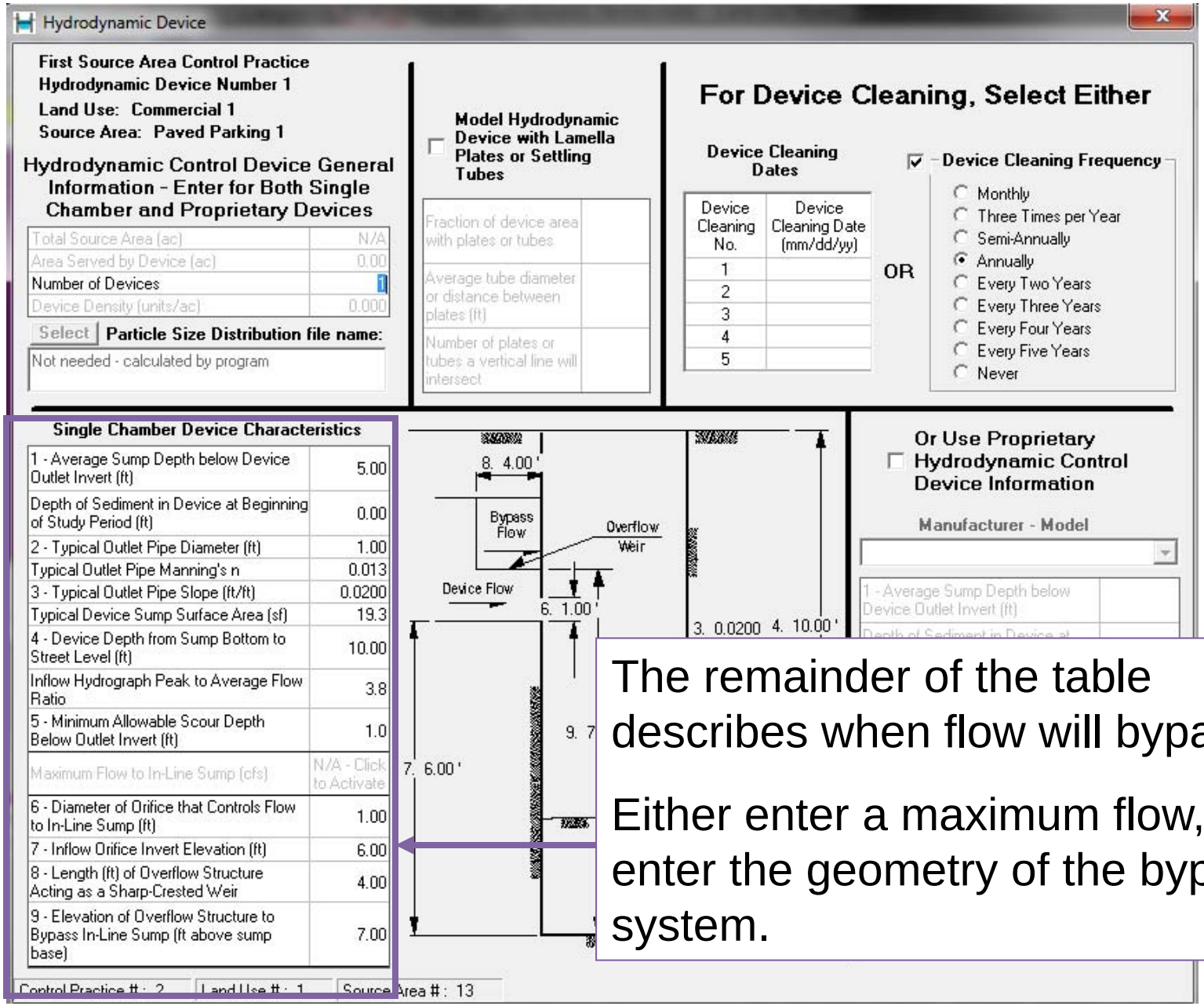
As data is entered in the form, it will appear in the schematic.

Value 1 through 5 describe the geometry of the device.

The remainder of the table describes when flow will bypass.

Either enter a maximum flow, or enter the geometry of the bypass system.

Hydrodynamic Device



The remainder of the table describes when flow will bypass.

Either enter a maximum flow, or enter the geometry of the bypass system.

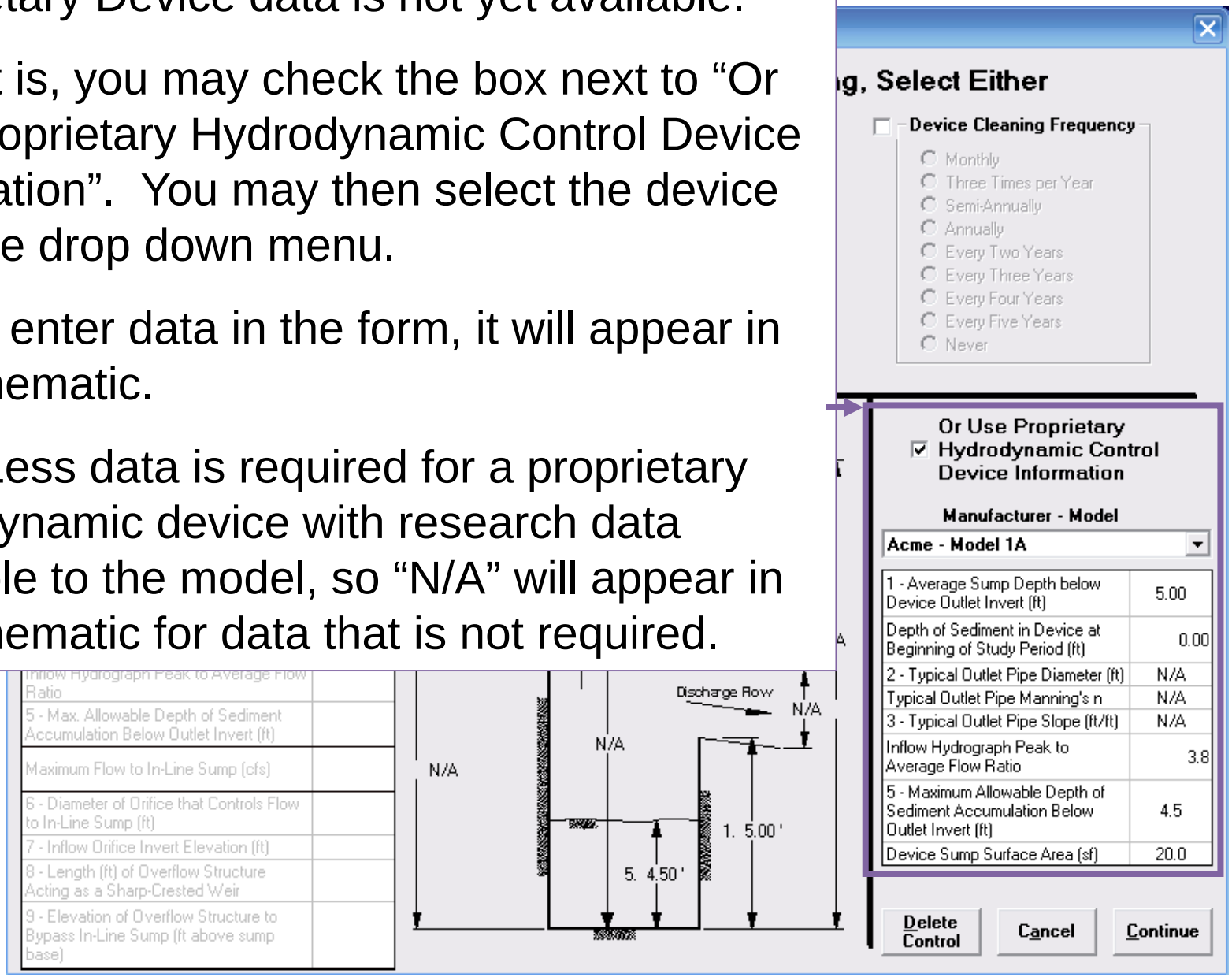
Hydrodynamic Device

Proprietary Device data is not yet available.

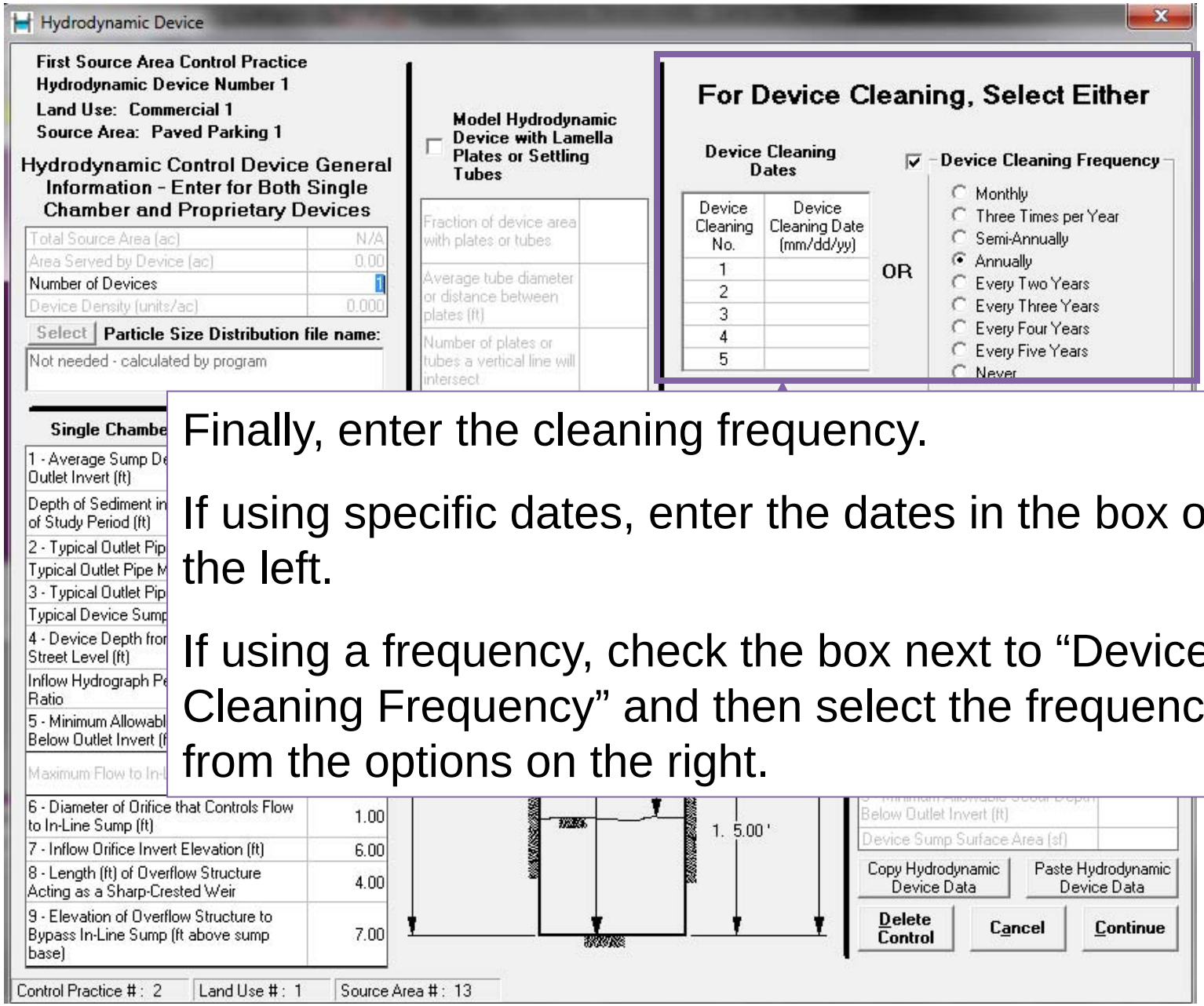
Once it is, you may check the box next to “Or Use Proprietary Hydrodynamic Control Device Information”. You may then select the device from the drop down menu.

As you enter data in the form, it will appear in the schematic.

Note: Less data is required for a proprietary hydrodynamic device with research data available to the model, so “N/A” will appear in the schematic for data that is not required.



Hydrodynamic Device

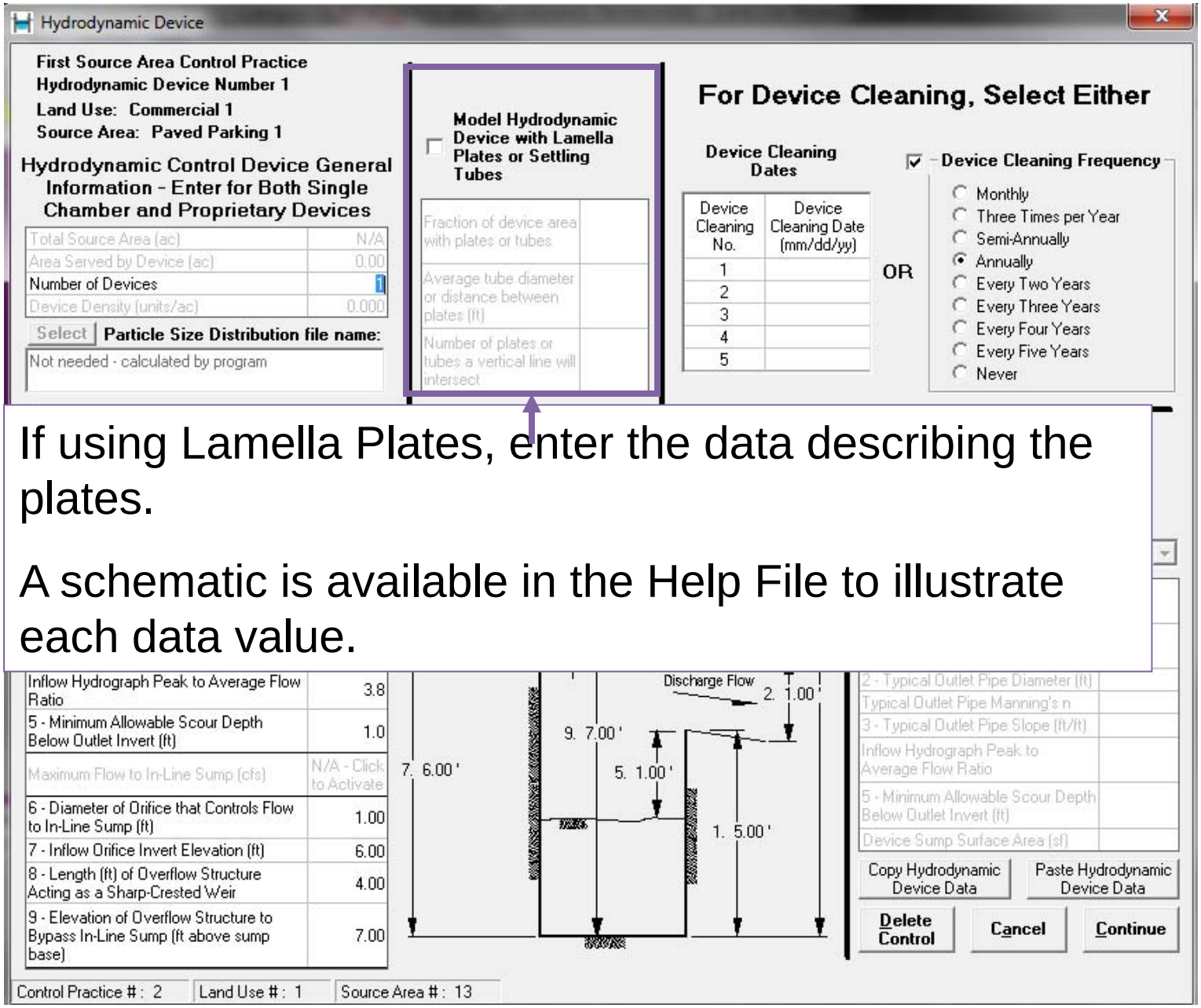


Finally, enter the cleaning frequency.

If using specific dates, enter the dates in the box on the left.

If using a frequency, check the box next to “Device Cleaning Frequency” and then select the frequency from the options on the right.

Hydrodynamic Device



If using Lamella Plates, enter the data describing the plates.

A schematic is available in the Help File to illustrate each data value.

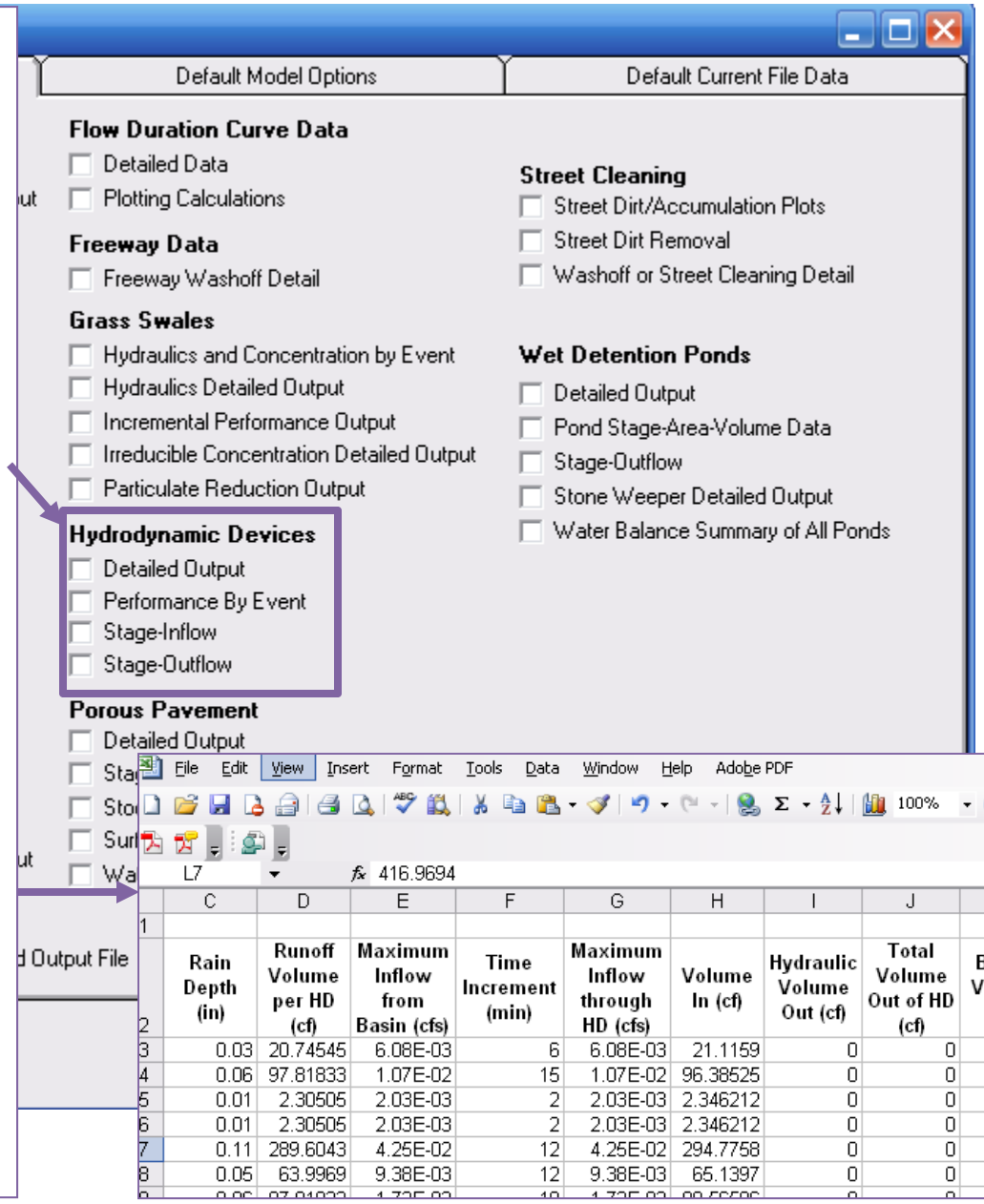
Hydrodynamic Device

Several detailed output files are available for the Hydrodynamic Device through the Program Options form.

Access the form through the Main Menu of the program. Select the desired file(s). Then select “Save .INI File”.

*.csv file(s) will be created in the same directory that your .MDB file is stored in for the detailed output options selected.

For example, this *.csv output file illustrates the Hydrodynamic Device Performance By Event. The file was opened in Microsoft Excel.



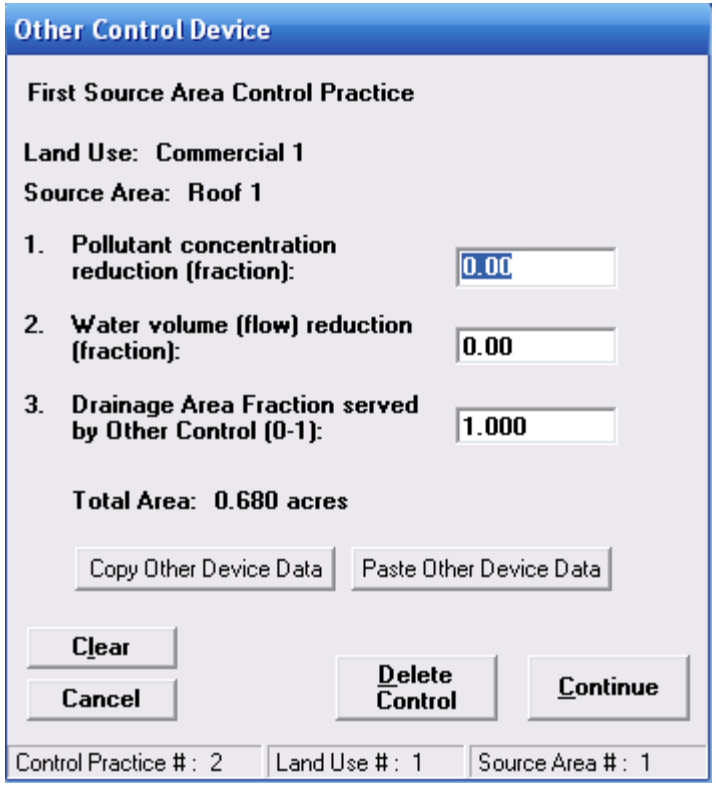
	C	D	E	F	G	H	I	J	K	L
1										
2	Rain Depth (in)	Runoff Volume per HD (cf)	Maximum Inflow from Basin (cfs)	Time Increment (min)	Maximum Inflow through HD (cfs)	Volume In (cf)	Hydraulic Volume Out (cf)	Total Volume Out of HD (cf)	Bypass Volume (cf)	Cumulative Volume Out of HD (cf)
3	0.03	20.74545	6.08E-03	6	6.08E-03	21.1159	0	0	0	21.1159
4	0.06	97.81833	1.07E-02	15	1.07E-02	96.38525	0	0	0	117.5011
5	0.01	2.30505	2.03E-03	2	2.03E-03	2.346212	0	0	0	119.8474
6	0.01	2.30505	2.03E-03	2	2.03E-03	2.346212	0	0	0	122.1936
7	0.11	289.6043	4.25E-02	12	4.25E-02	294.7758	0	0	0	416.9694
8	0.05	63.9969	9.38E-03	12	9.38E-03	65.1397	0	0	0	482.1091

Control Devices – Media Filters

Media Filters will be available in version 10.2

Control Devices - Other

Other Control Device



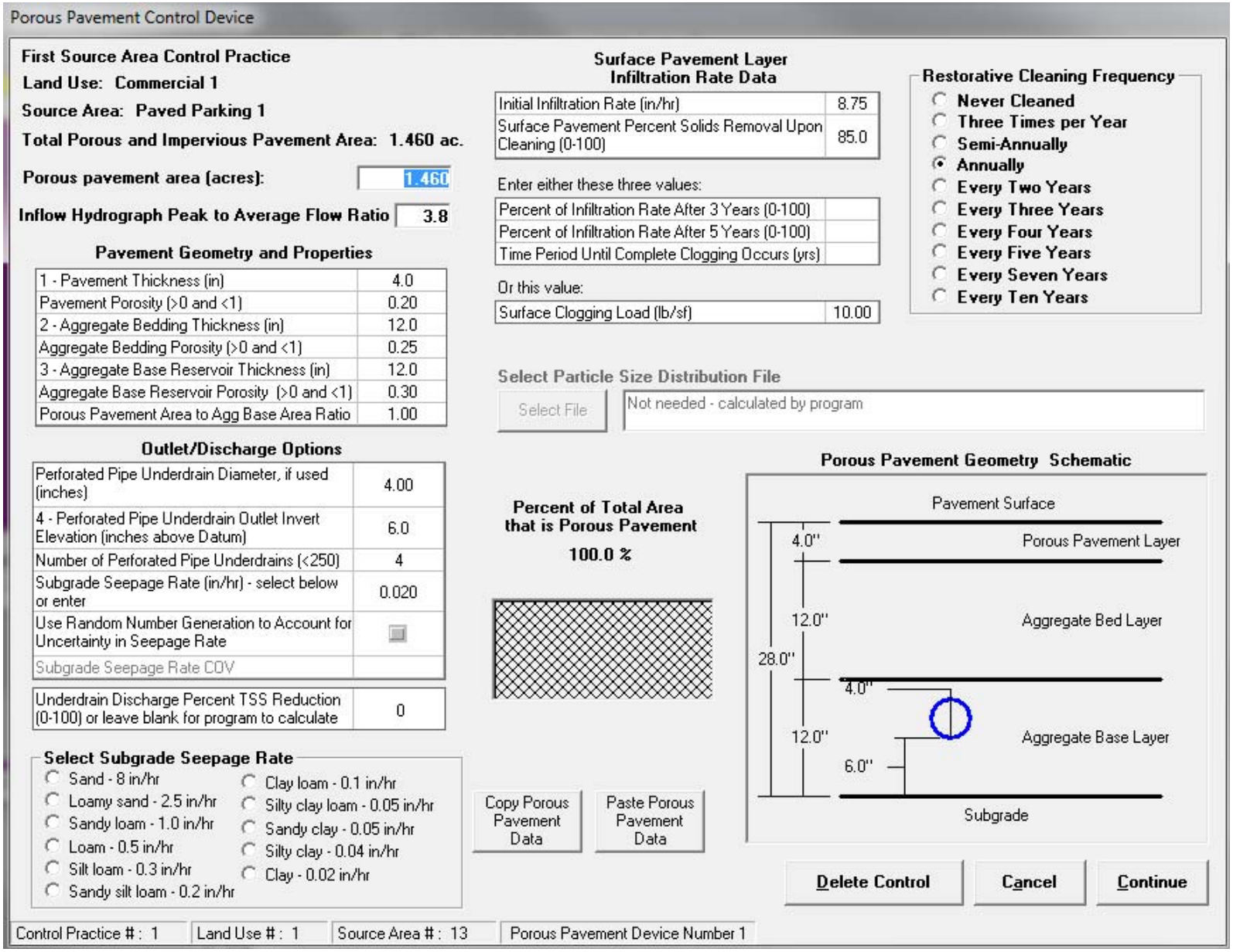
Enter the Percent Reduction in Pollutant Concentration and Runoff, and the Fraction of the Area served by the Control Device. The percent reduction will be applied uniformly to the Pollutant Load and Runoff Volume generated.

Note: The Other Control Device should only be used for runoff and pollutant reduction if review agency approved monitored data is available and applicable.

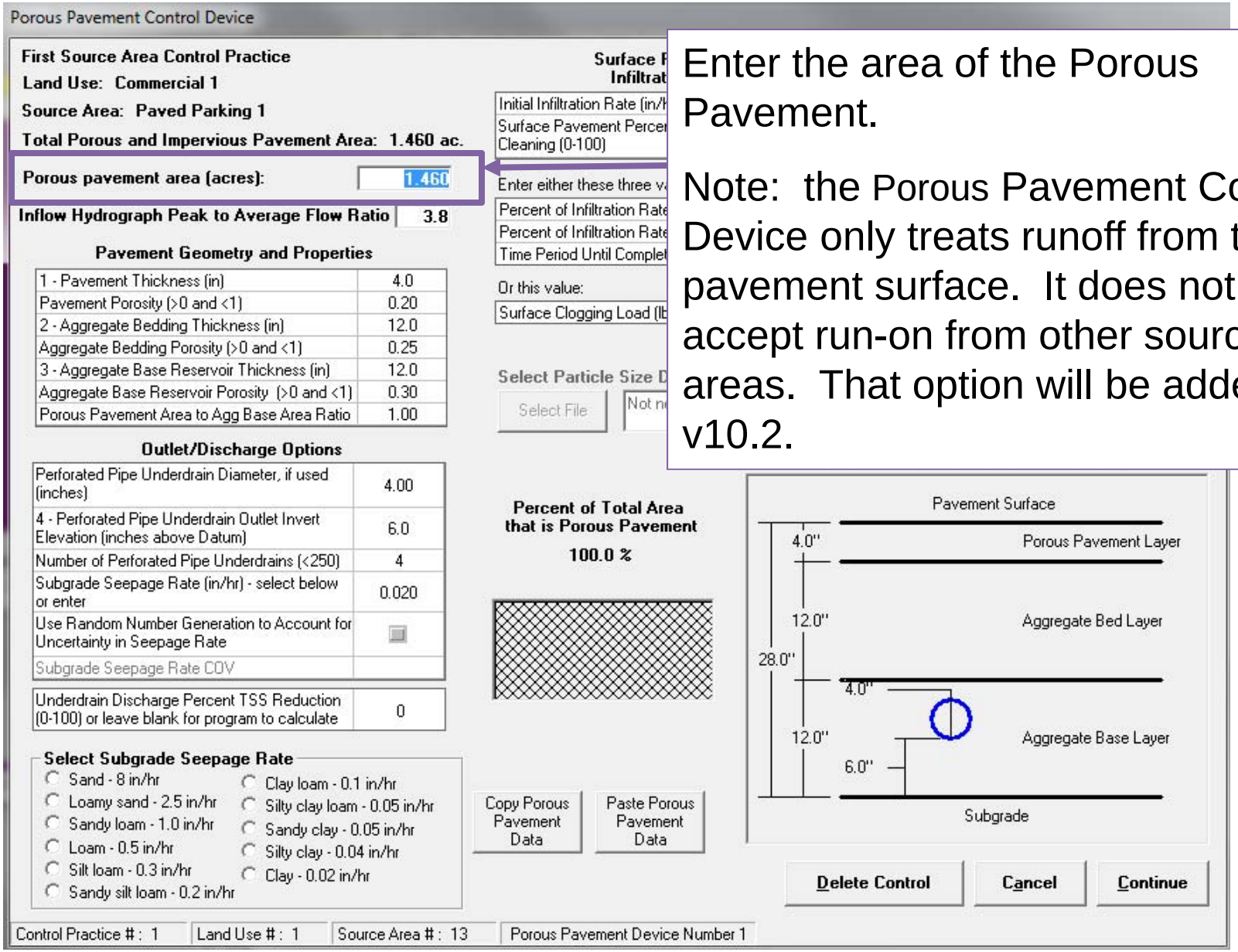
Until the storm sewer and overland flow options are available in the model, the Other Control Device can also be used as links to connect subbasins together in a larger watershed model. To use this, set the Pollutant Concentration reduction to 0.01, the Water Volume reduction to zero, and the Drainage Area Fraction served by Other Control to 0.001.

Control Devices – Porous Pavement

Porous Pavement Control Device



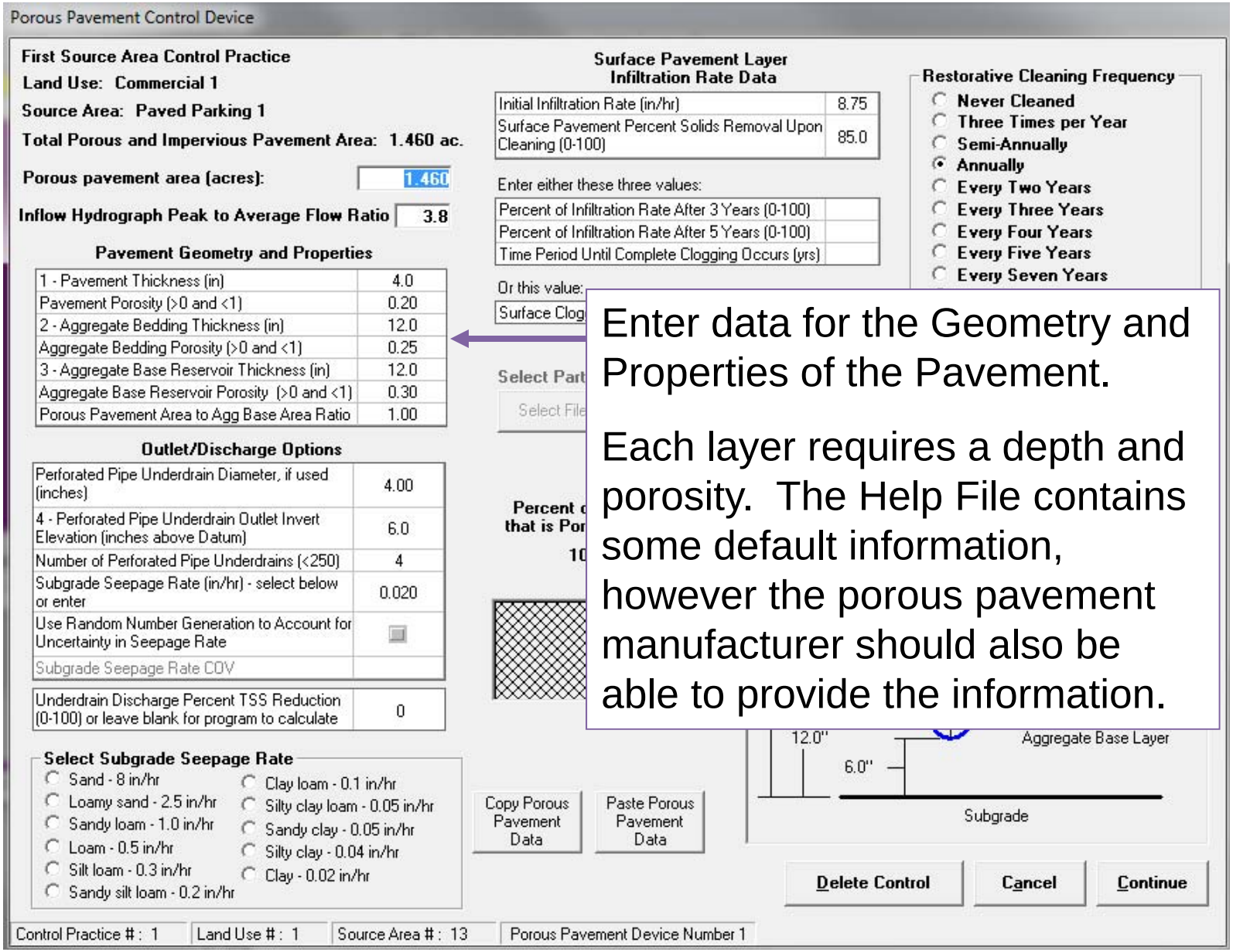
Porous Pavement Control Device



Enter the area of the Porous Pavement.

Note: the Porous Pavement Control Device only treats runoff from the pavement surface. It does not accept run-on from other source areas. That option will be added in v10.2.

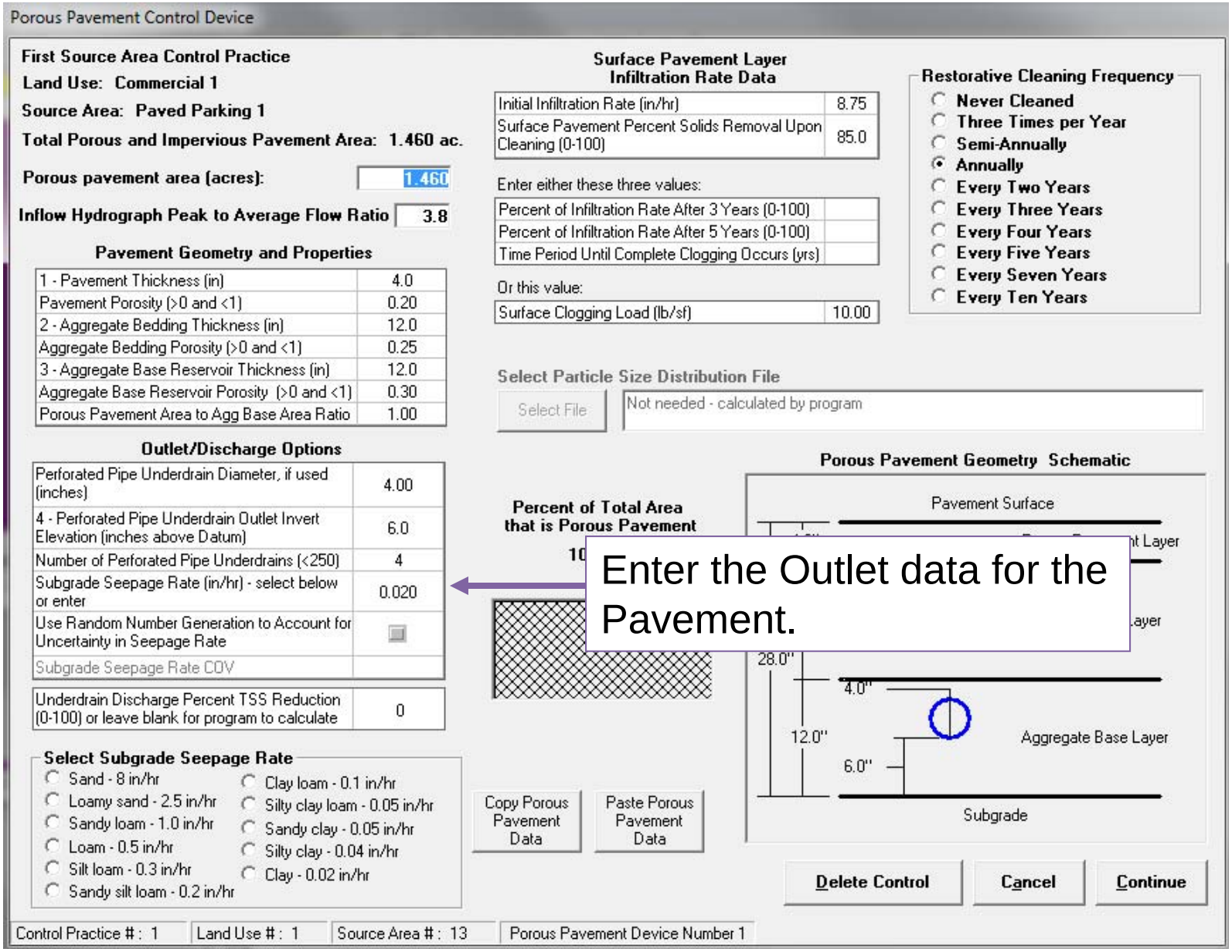
Porous Pavement Control Device



Enter data for the Geometry and Properties of the Pavement.

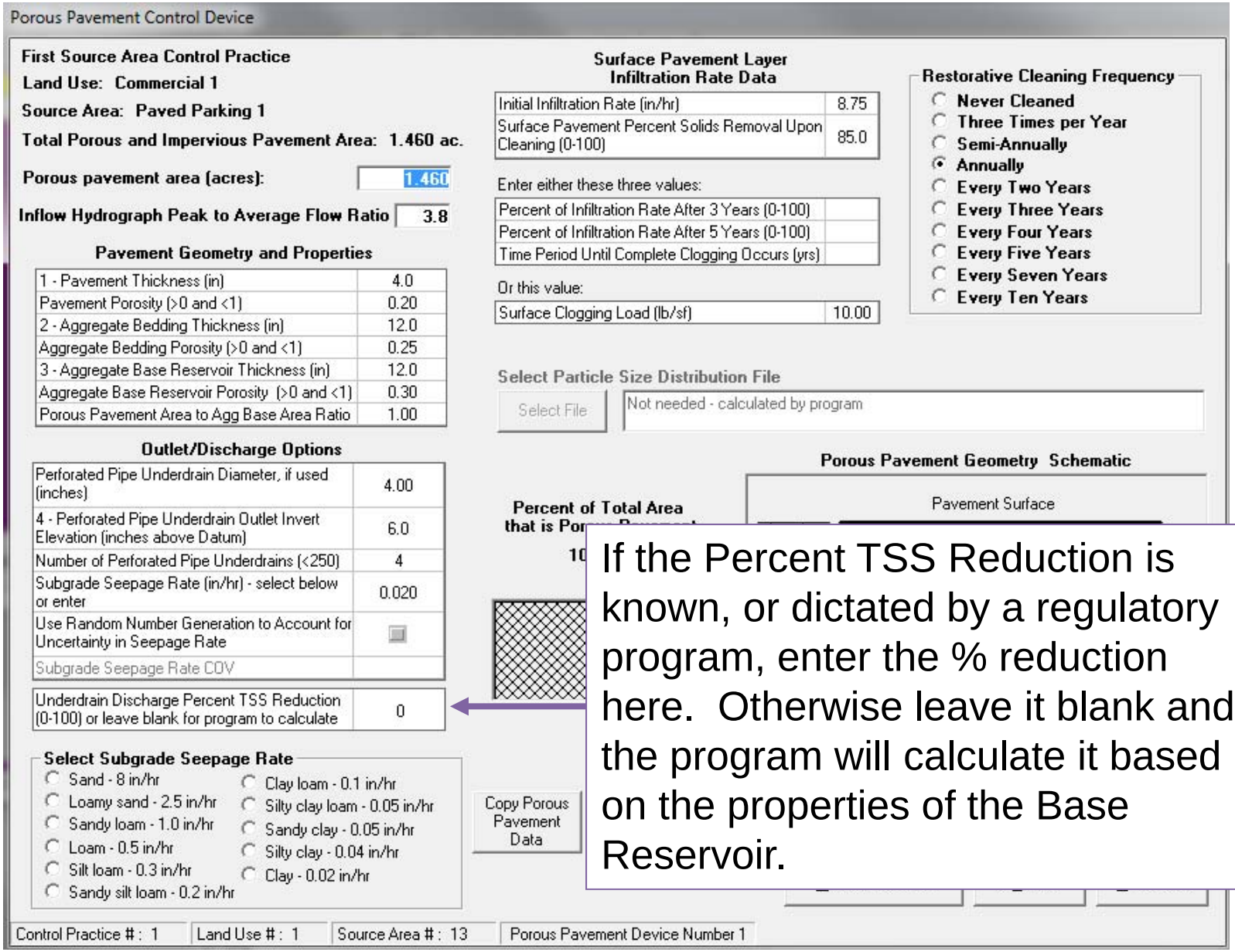
Each layer requires a depth and porosity. The Help File contains some default information, however the porous pavement manufacturer should also be able to provide the information.

Porous Pavement Control Device



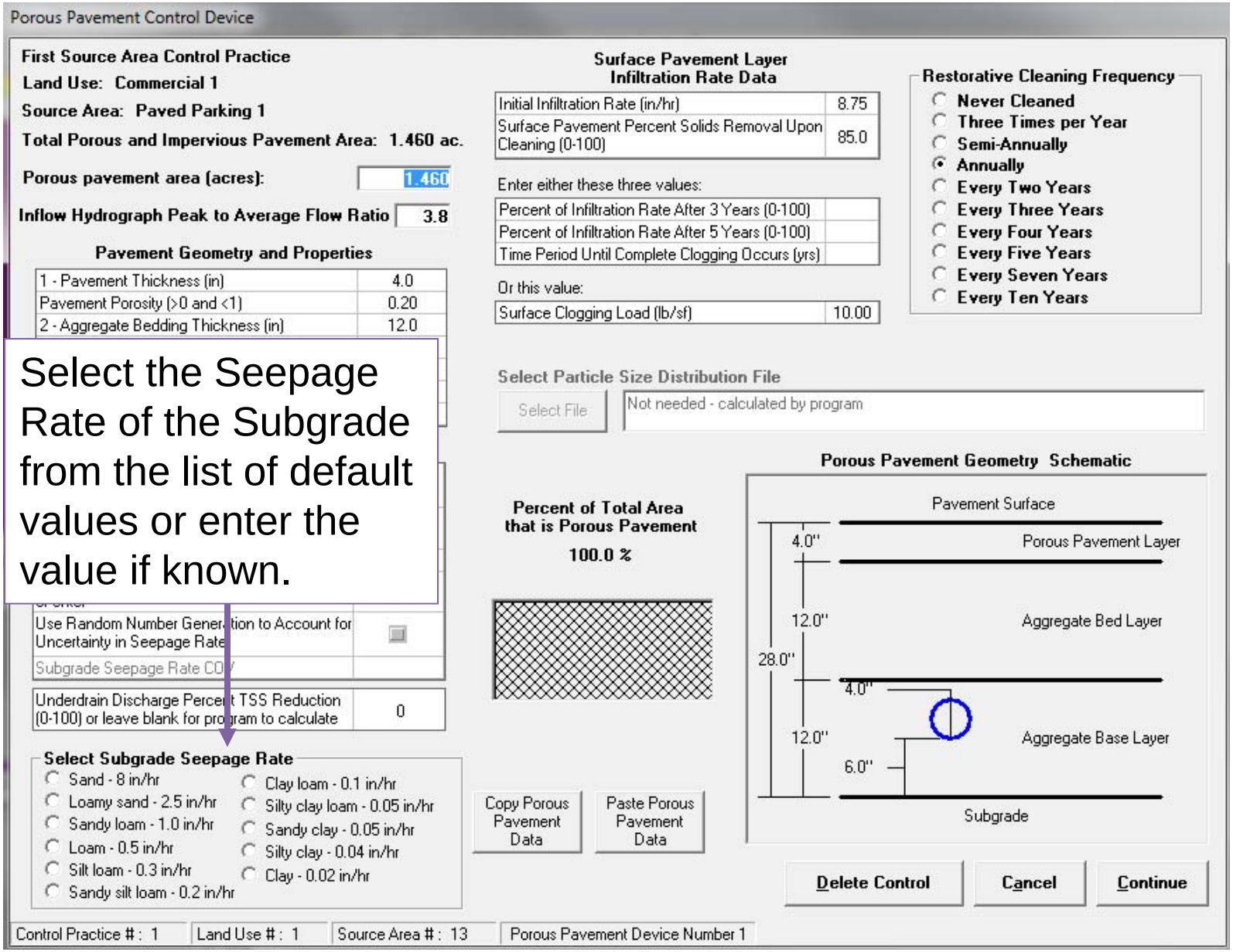
Enter the Outlet data for the Pavement.

Porous Pavement Control Device



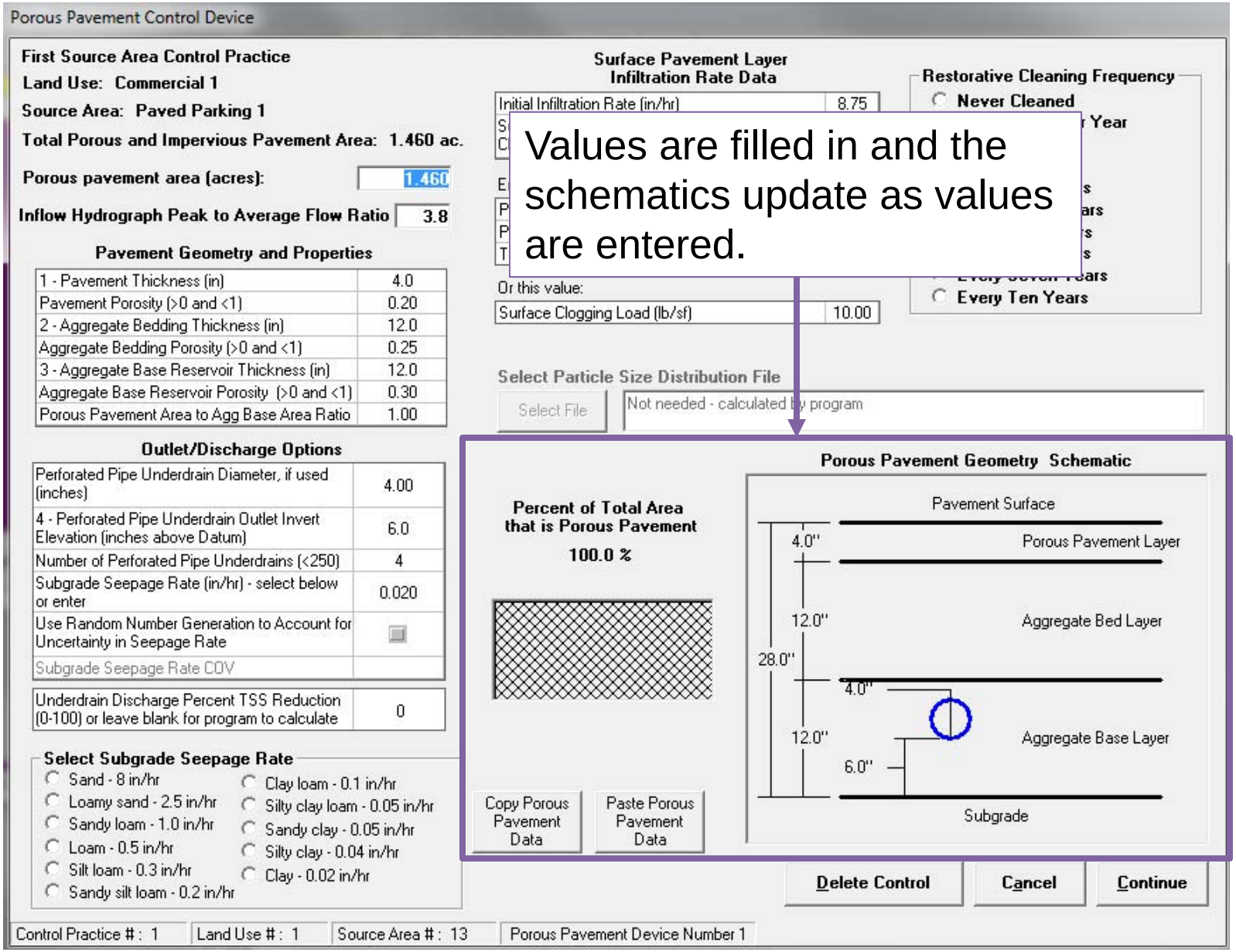
If the Percent TSS Reduction is known, or dictated by a regulatory program, enter the % reduction here. Otherwise leave it blank and the program will calculate it based on the properties of the Base Reservoir.

Porous Pavement Control Device



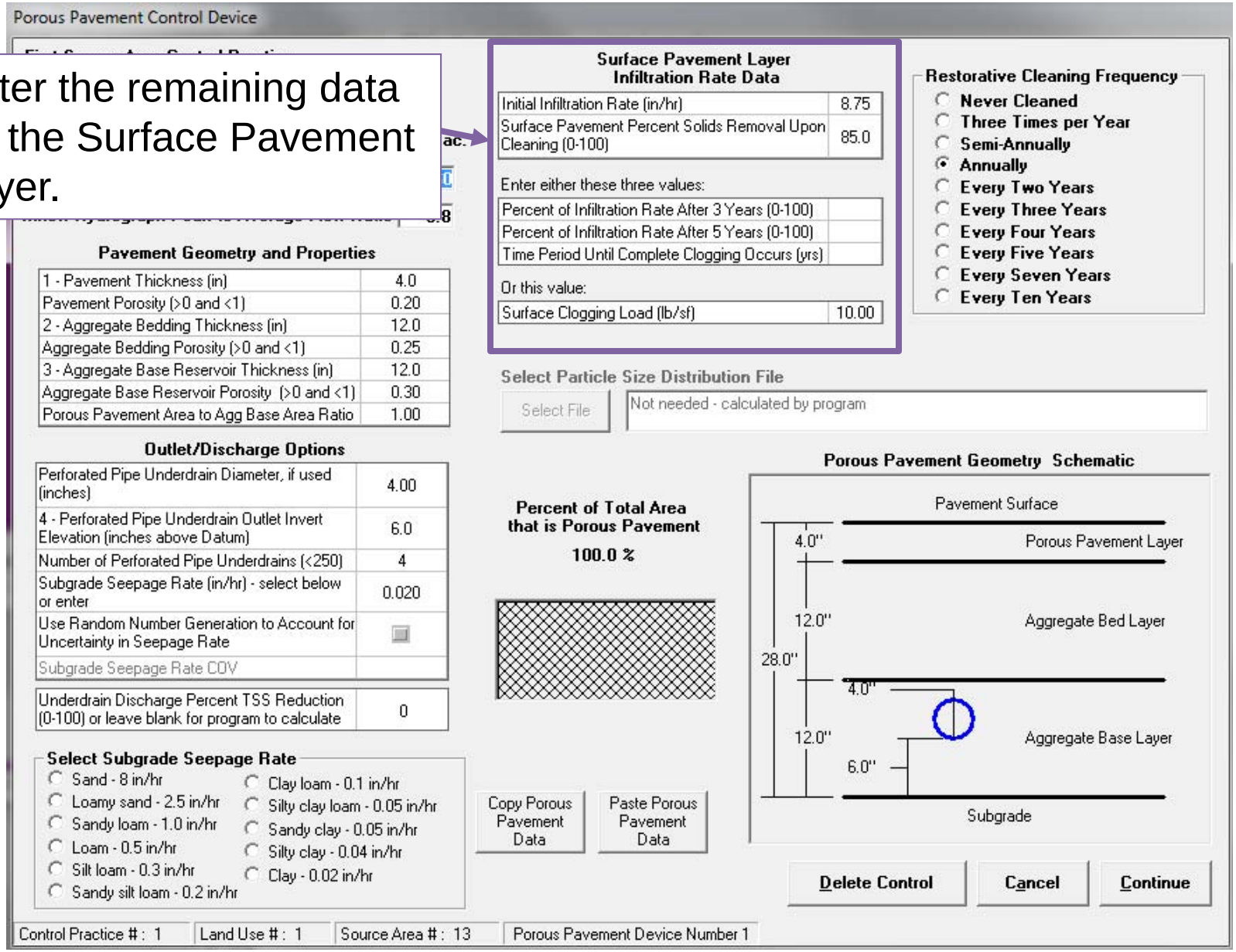
Select the Seepage Rate of the Subgrade from the list of default values or enter the value if known.

Porous Pavement Control Device

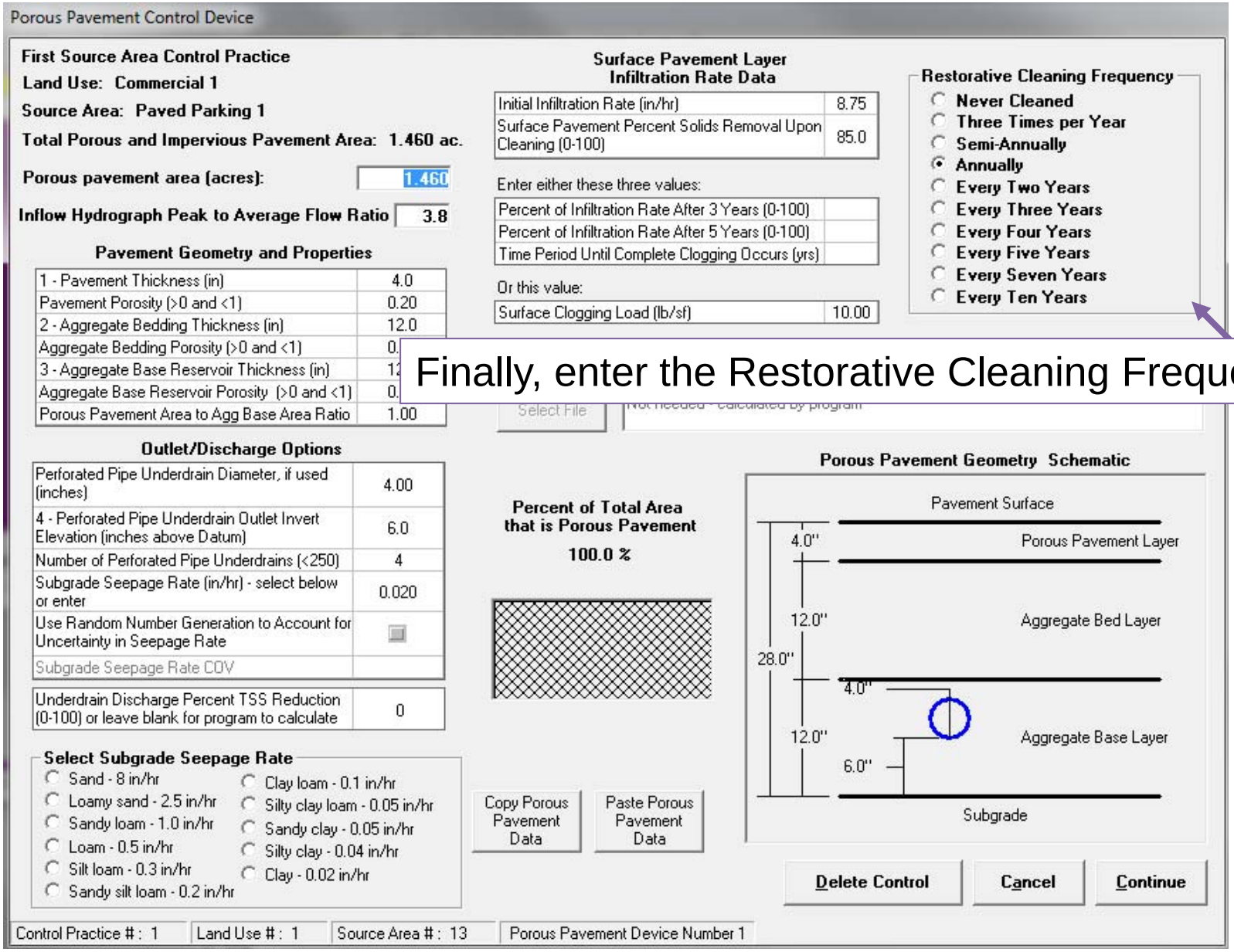


Porous Pavement Control Device

Enter the remaining data for the Surface Pavement Layer.

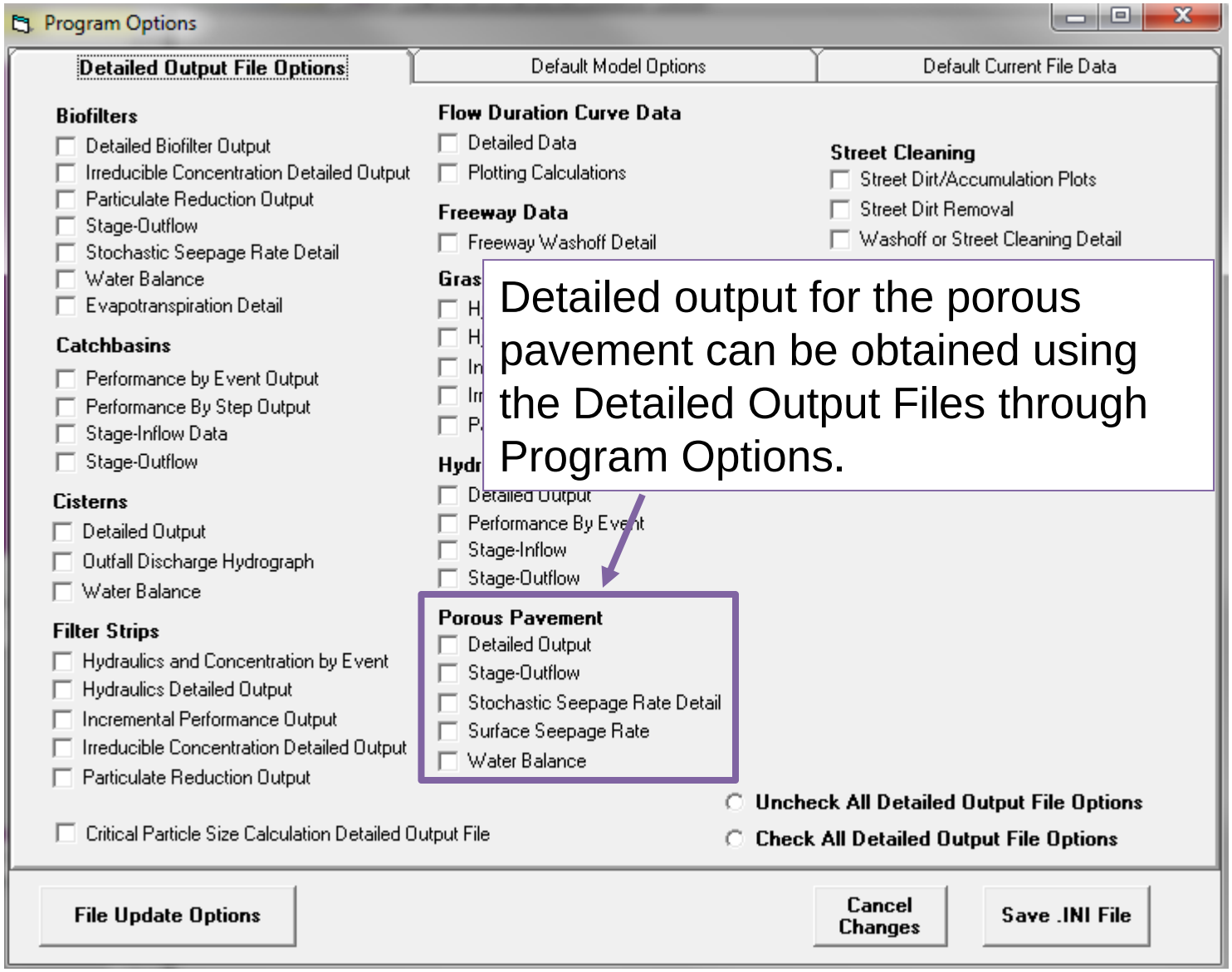


Porous Pavement Control Device



Finally, enter the Restorative Cleaning Frequency.

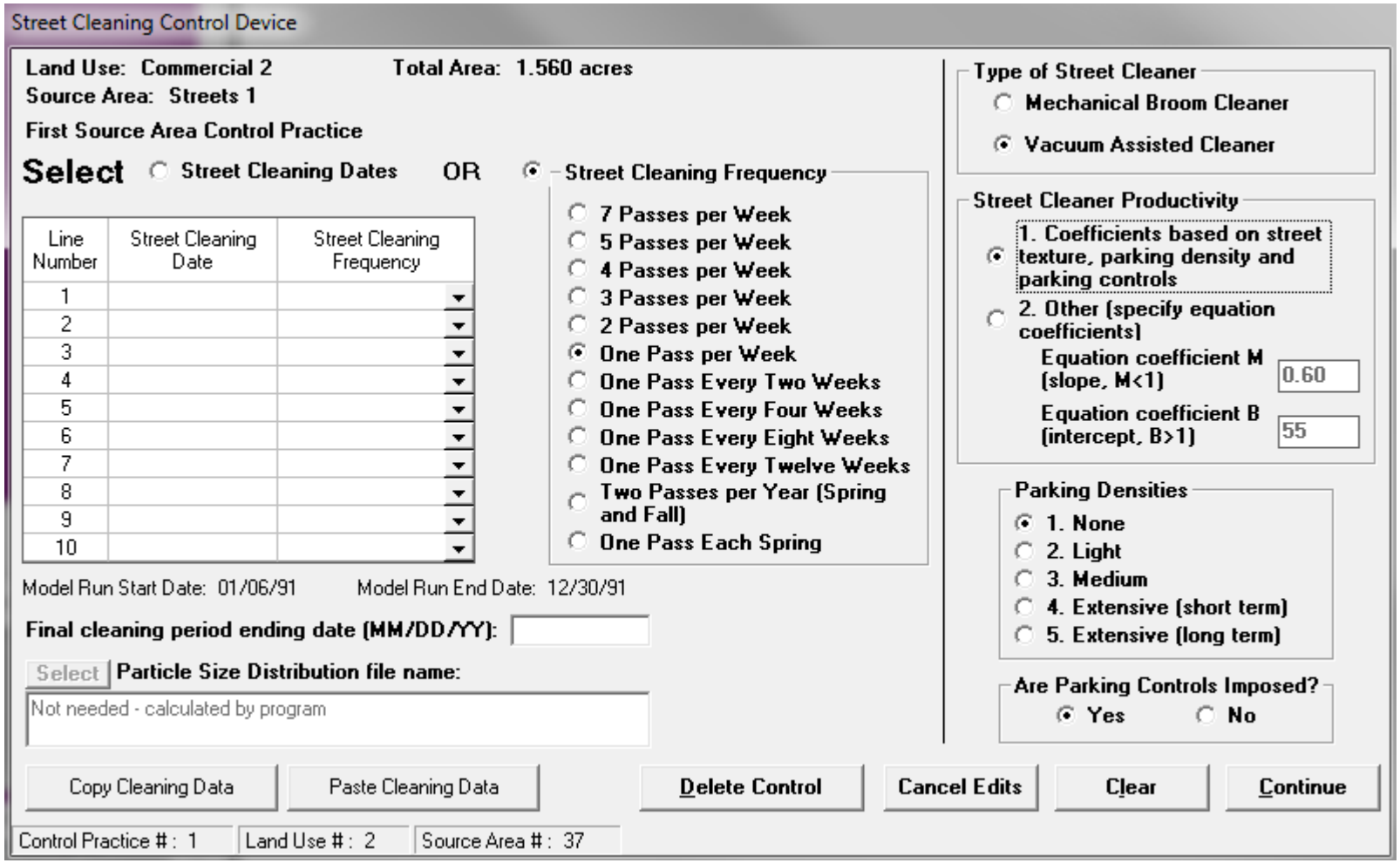
Porous Pavement Control Device



Detailed output for the porous pavement can be obtained using the Detailed Output Files through Program Options.

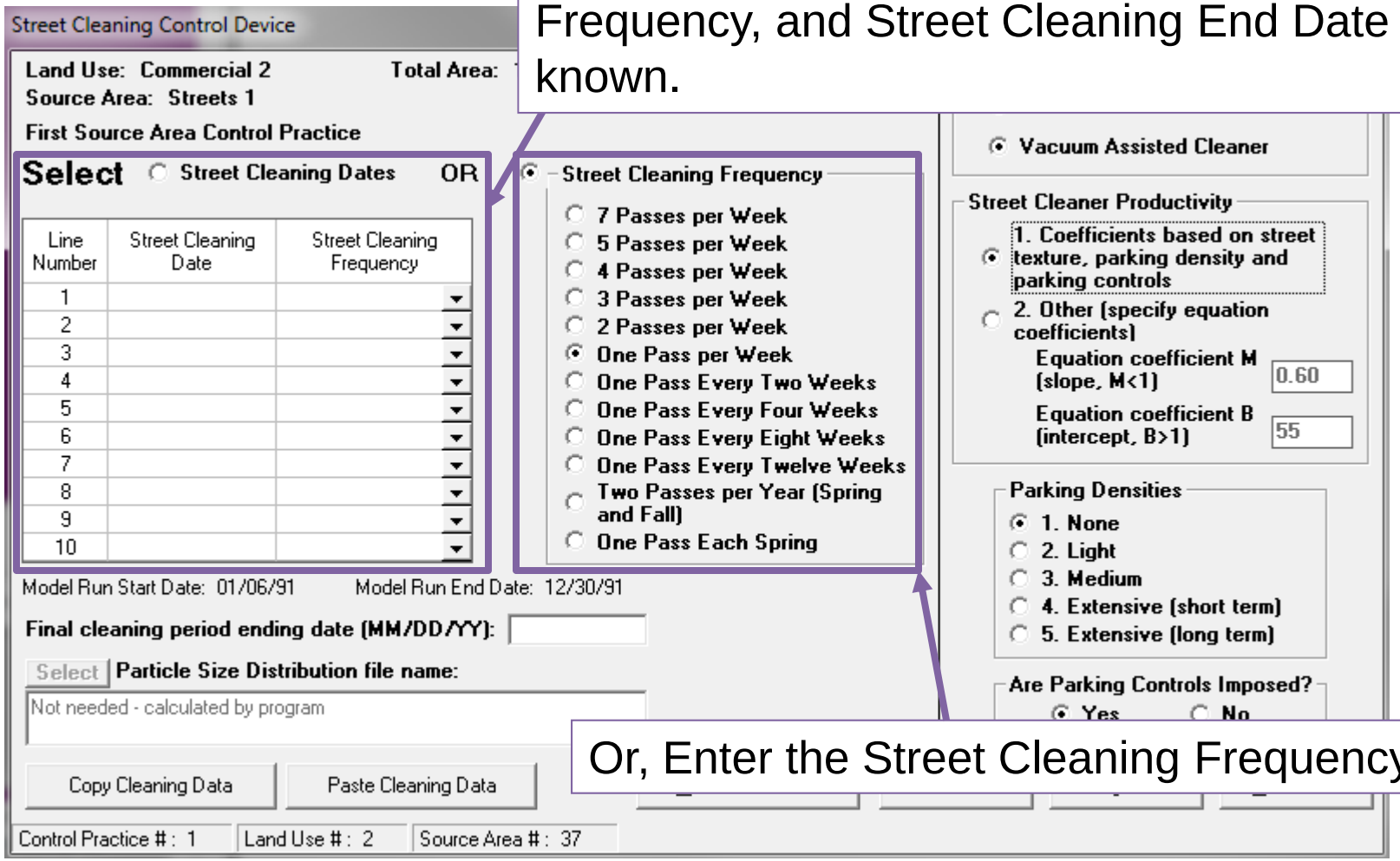
Control Devices – Street Cleaning

Street Cleaning Control Device



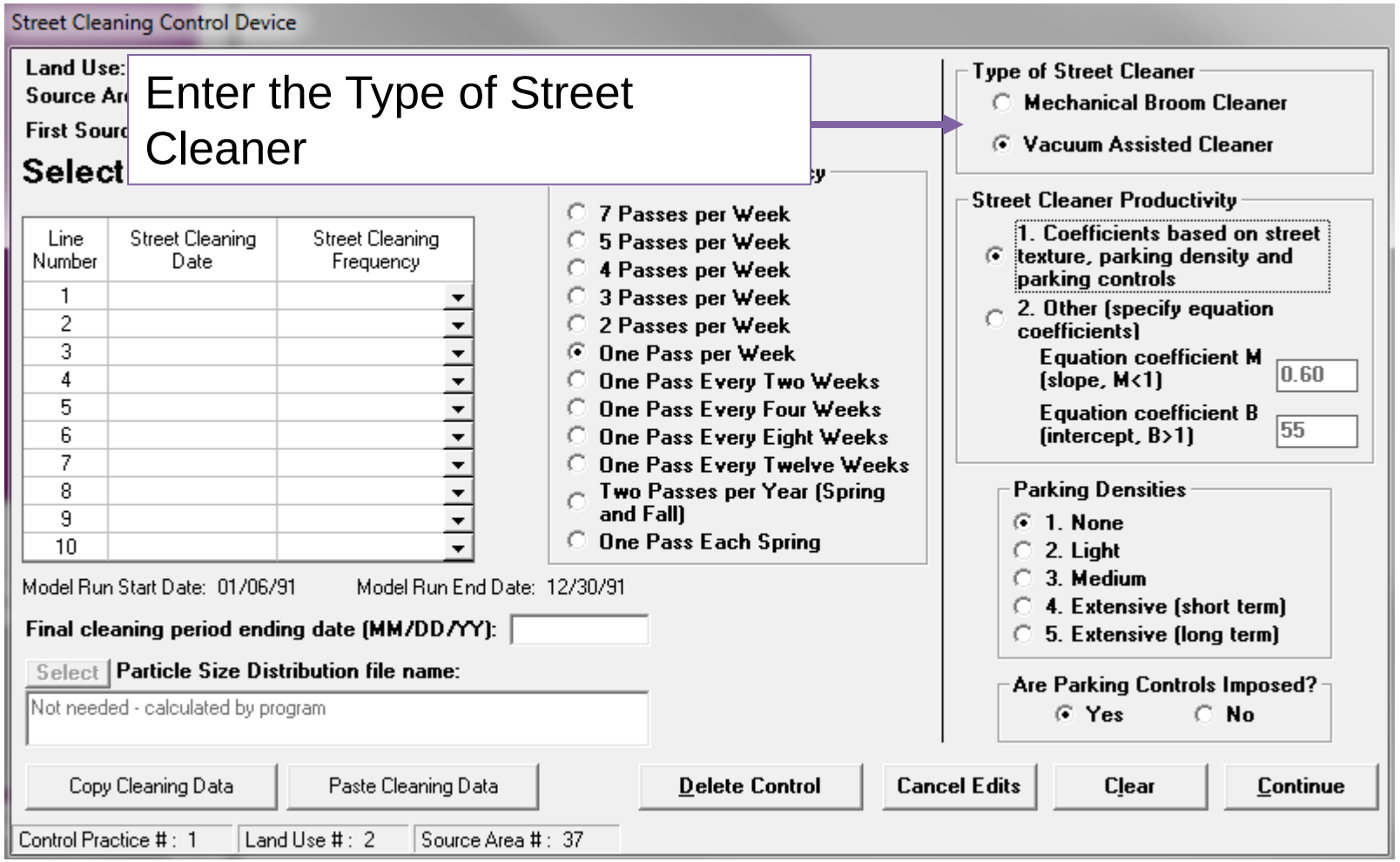
Street Cleaning Control Device

Enter the Street Cleaning Start Date, Frequency, and Street Cleaning End Date if known.

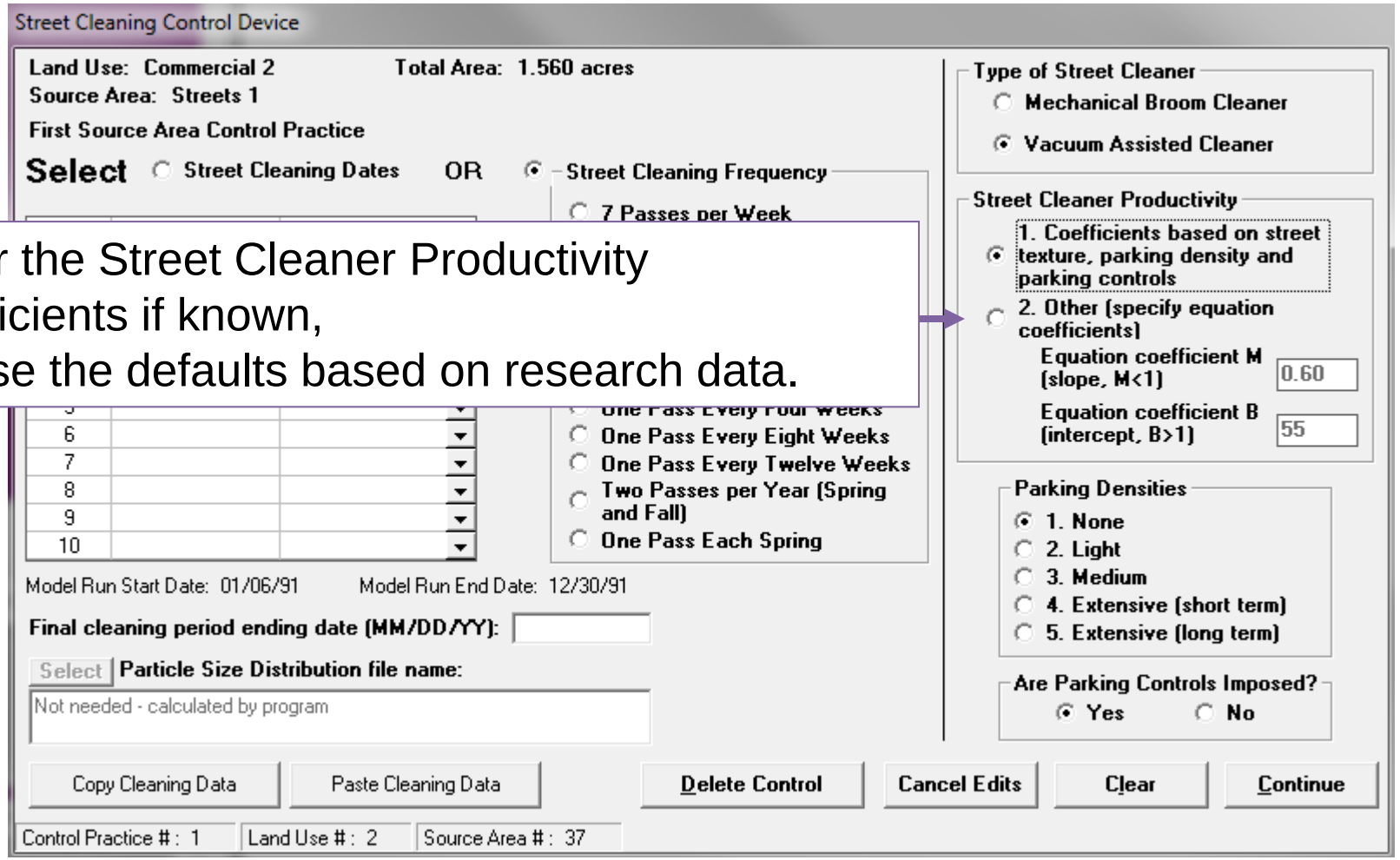


Or, Enter the Street Cleaning Frequency.

Street Cleaning Control Device

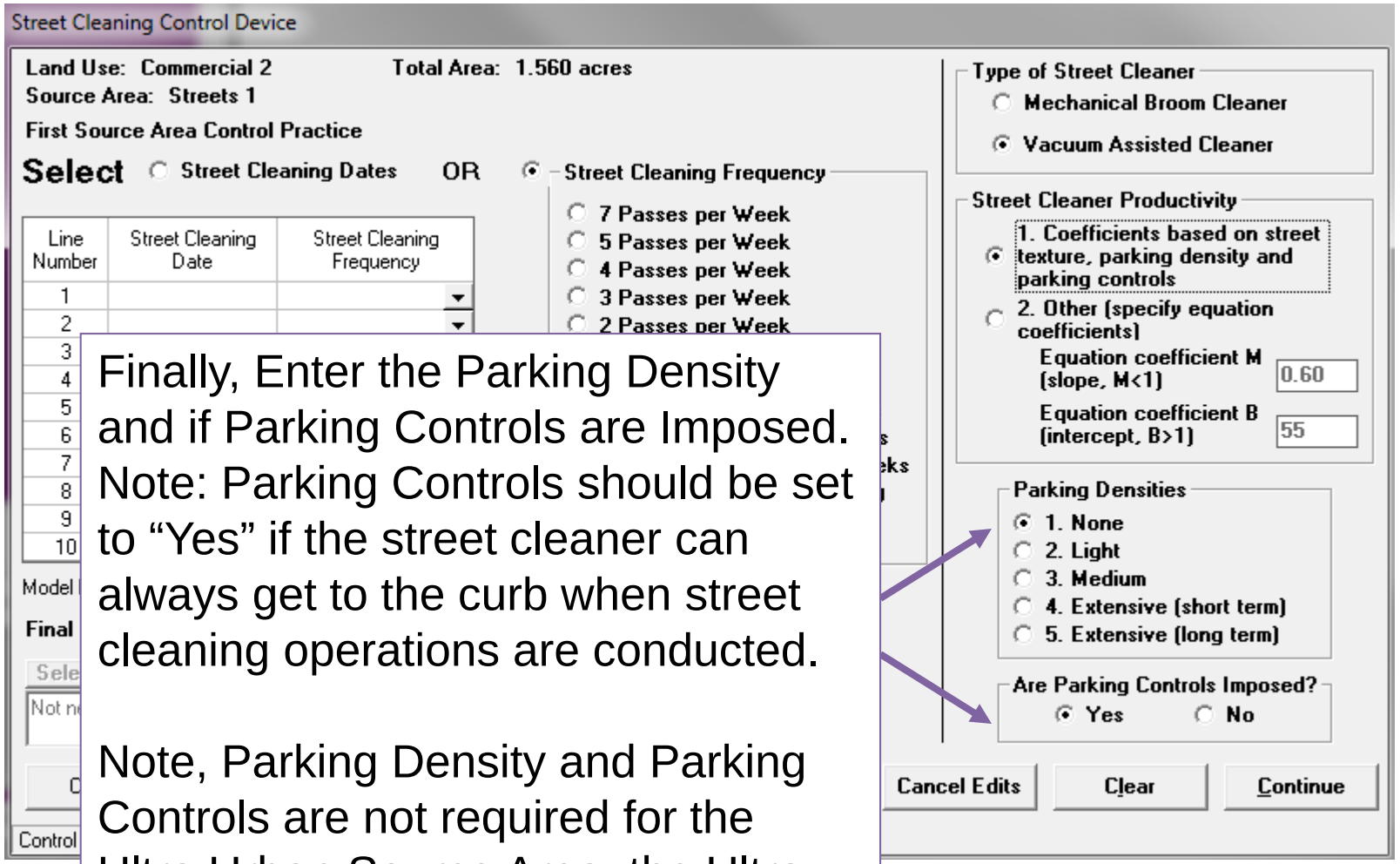


Street Cleaning Control Device



Enter the Street Cleaner Productivity coefficients if known,
Or use the defaults based on research data.

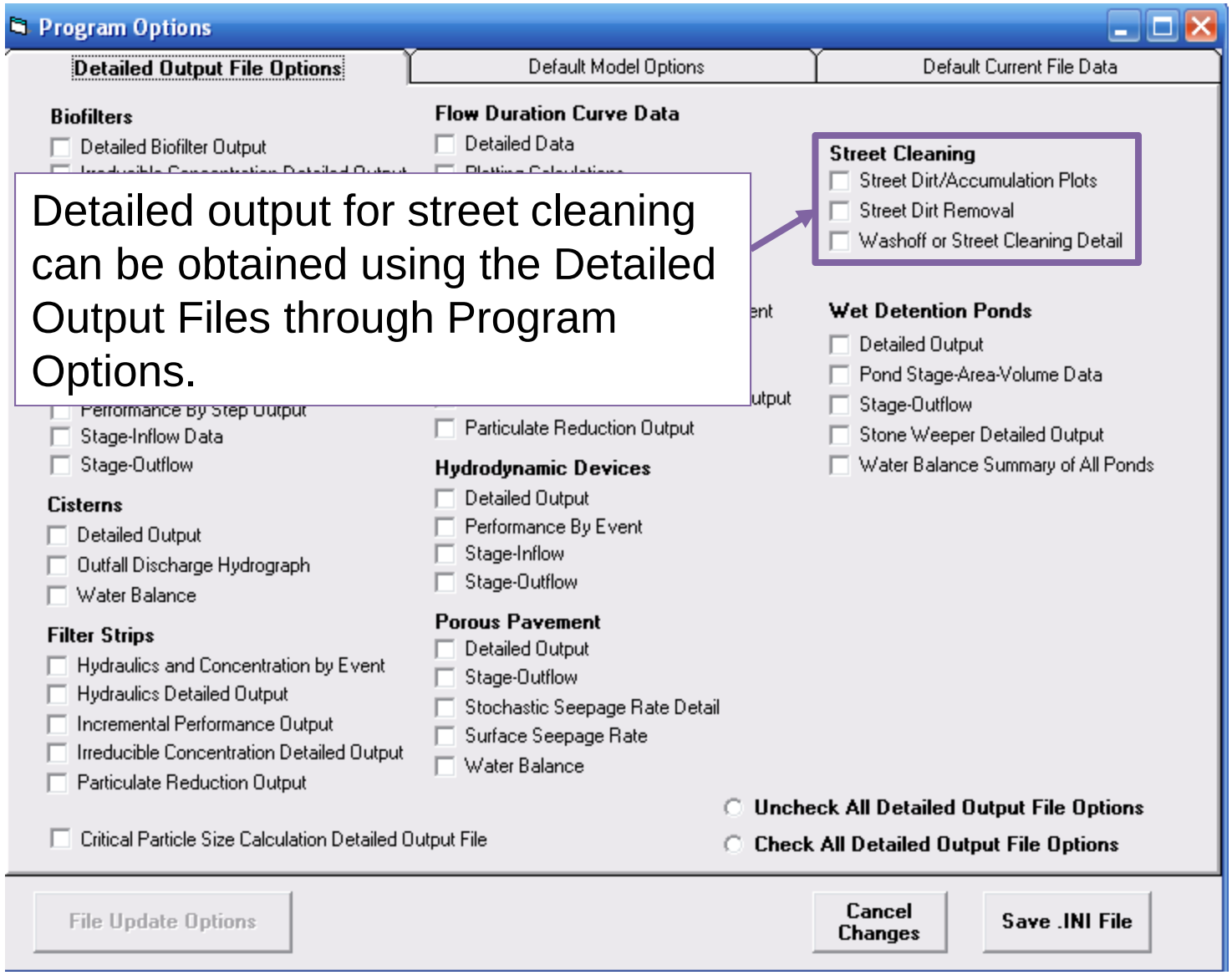
Street Cleaning Control Device



Finally, Enter the Parking Density and if Parking Controls are Imposed. Note: Parking Controls should be set to “Yes” if the street cleaner can always get to the curb when street cleaning operations are conducted.

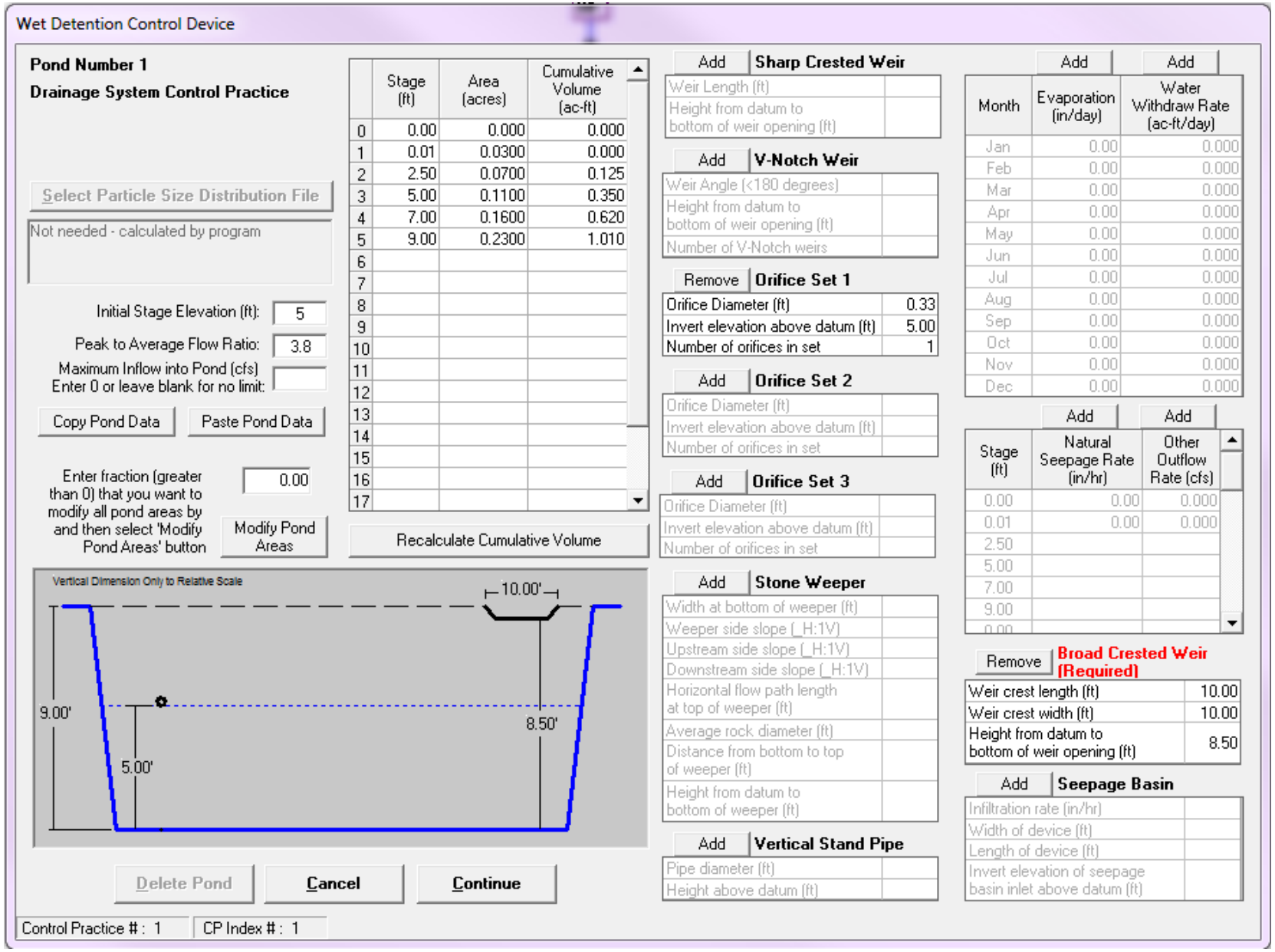
Note, Parking Density and Parking Controls are not required for the Ultra Urban Source Area; the Ultra Urban Source Area assumes there is never parking on the street.

Street Cleaning Control Device



Control Devices – Wet Detention

Wet Detention Control Device



	Stage (ft)	Area (acres)	Cumulative Volume (ac-ft)
0	0.00	0.000	0.000
1	0.01	0.0300	0.000
2	2.50	0.0700	0.125
3	5.00	0.1100	0.350
4	7.00	0.1600	0.620
5	9.00	0.2300	1.010
6			
7			
8			
9			
10			
11			
12			
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14			
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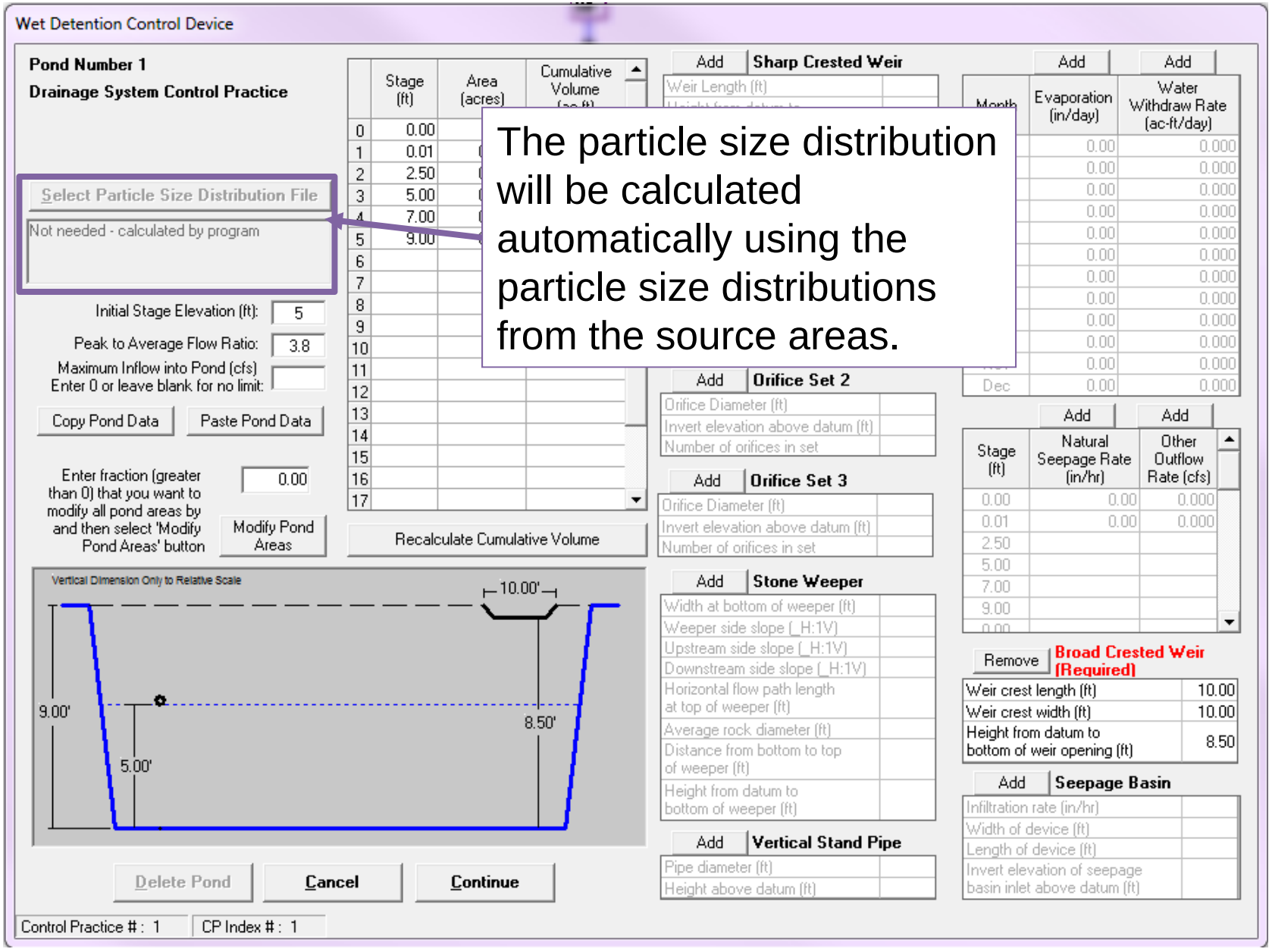
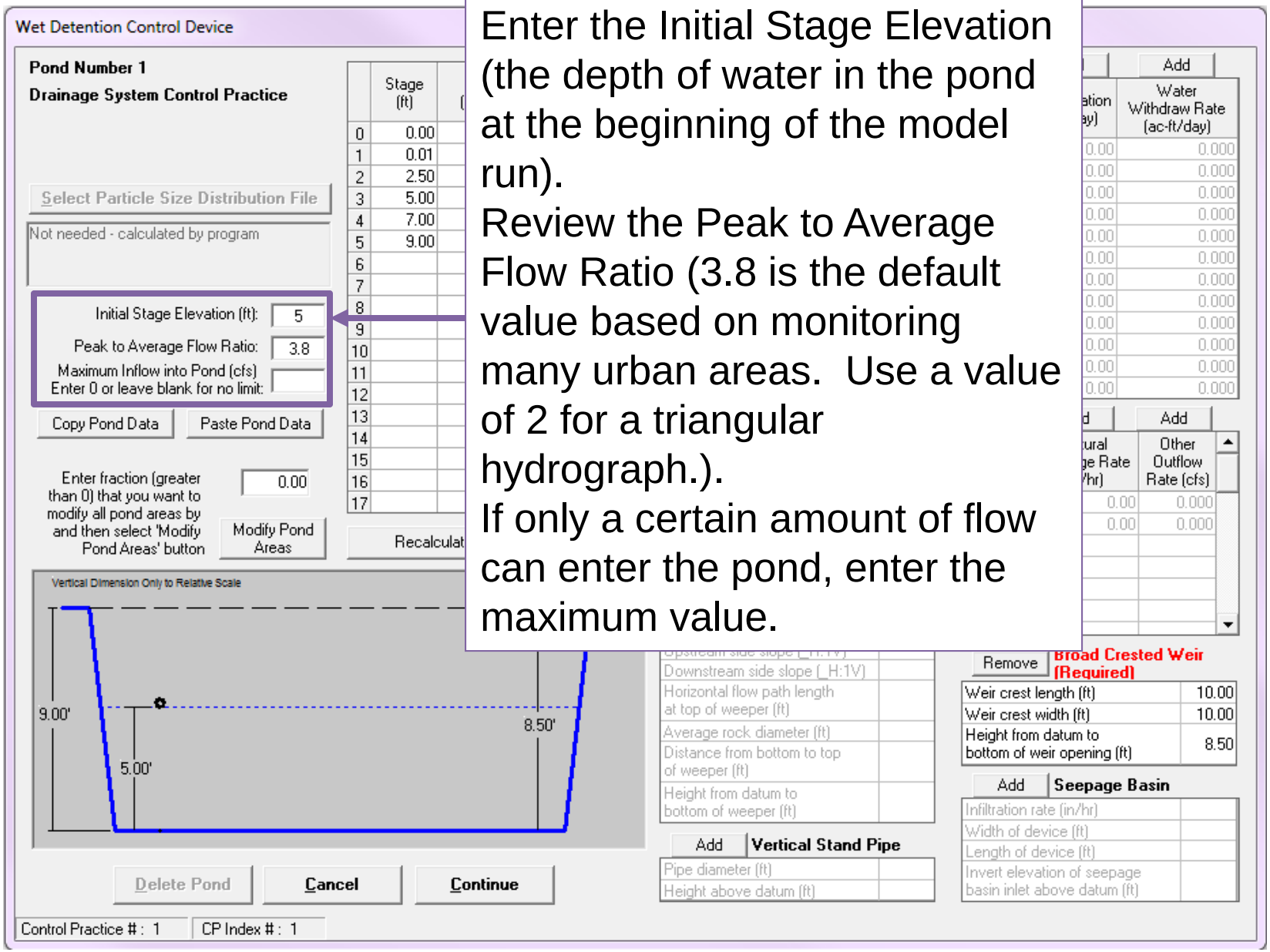
16			
17			

Wet Detention Control Device



Wet Detention Control Device

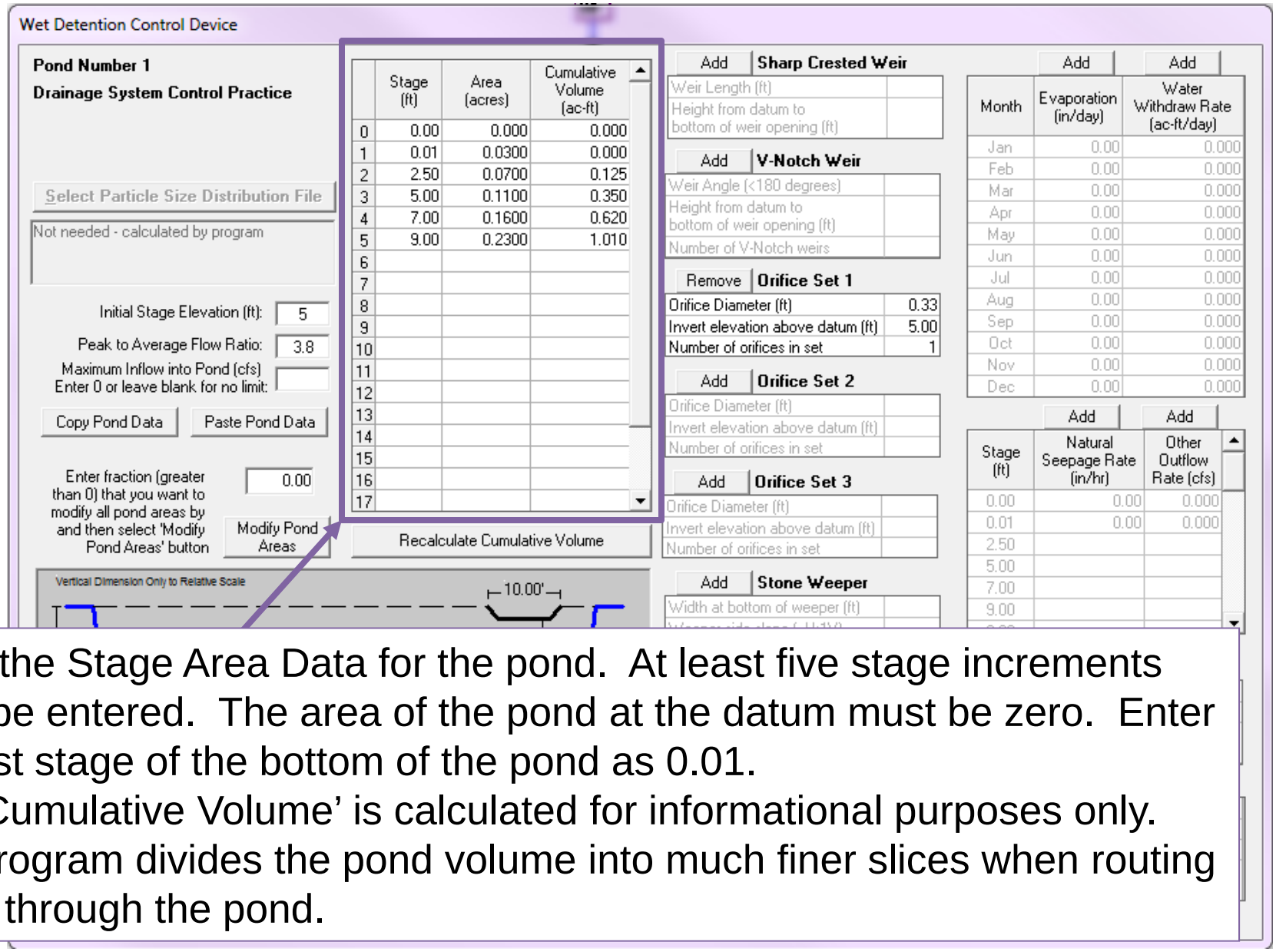


Enter the Initial Stage Elevation (the depth of water in the pond at the beginning of the model run).

Review the Peak to Average Flow Ratio (3.8 is the default value based on monitoring many urban areas. Use a value of 2 for a triangular hydrograph.).

If only a certain amount of flow can enter the pond, enter the maximum value.

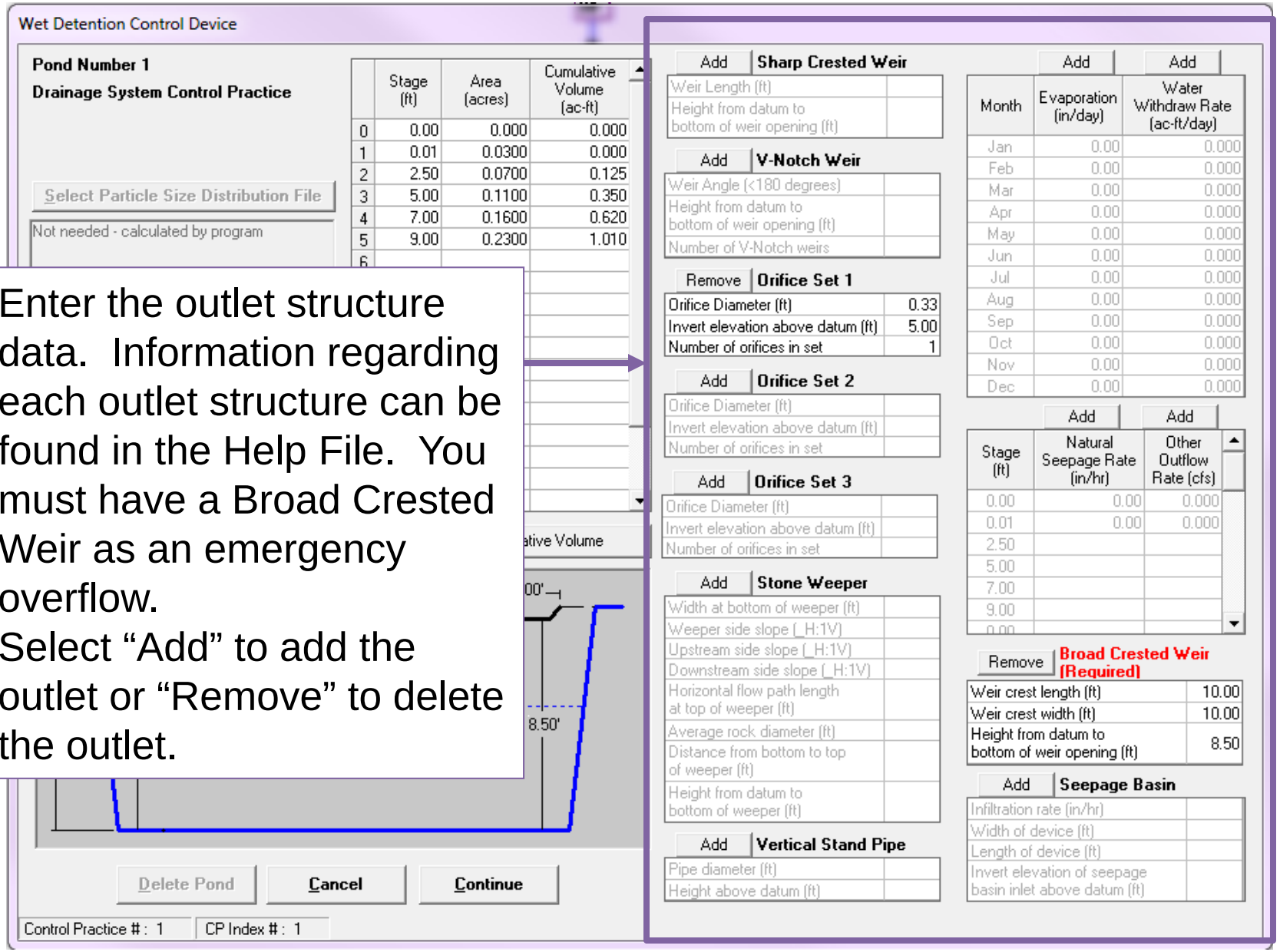
Wet Detention Control Device



Enter the Stage Area Data for the pond. At least five stage increments must be entered. The area of the pond at the datum must be zero. Enter the first stage of the bottom of the pond as 0.01.

The ‘Cumulative Volume’ is calculated for informational purposes only. The program divides the pond volume into much finer slices when routing runoff through the pond.

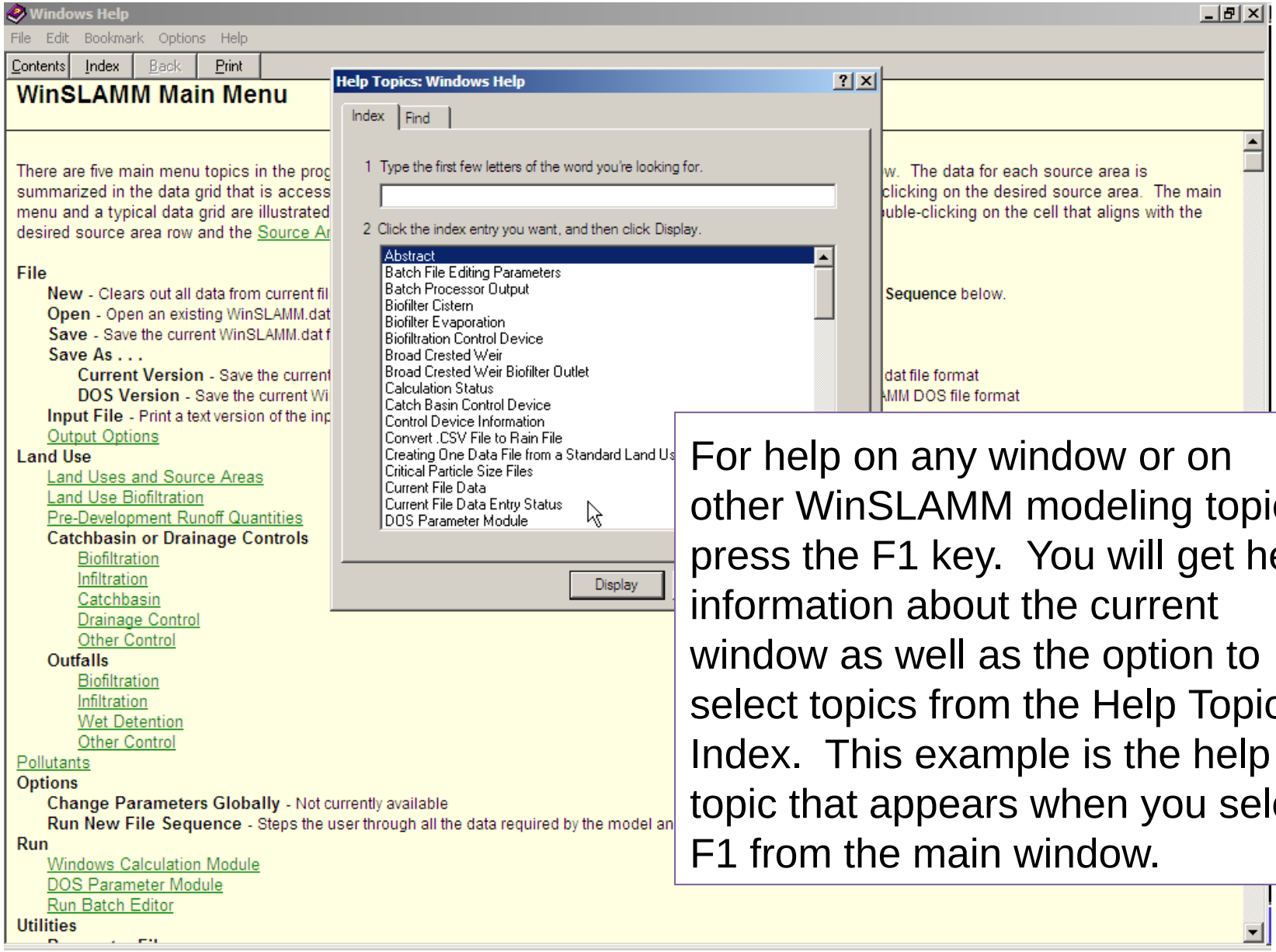
Wet Detention Control Device



Enter the outlet structure data. Information regarding each outlet structure can be found in the Help File. You must have a Broad Crested Weir as an emergency overflow.
Select “Add” to add the outlet or “Remove” to delete the outlet.

For Additional Information See . . .

The Context-Sensitive Help in the Program



For help on any window or on other WinSLAMM modeling topics, press the F1 key. You will get help information about the current window as well as the option to select topics from the Help Topics Index. This example is the help topic that appears when you select F1 from the main window.

Questions?

For model information, go to www.winslamm.com

Remember to Press the "F1" to access the Help File