APPENDIX C: Calculating Observed Flow Volumes for Calibration

APPENDIX C: Calculating Observed Flow Volumes for Calibration

In order to calibrate hydrology manually, you need to compare observed flow volumes to simulated flow volumes. Annual and seasonal flow volumes can be calculated in a spreadsheet from the observed flow time series. The following steps explain this process.

A. Annual Flow Volumes

1.   From the **Start** menu under **Programs**, select **BASINS**, and then **WDMUtil**.

2.   From the **File** menu, select **Open**.

3.   Navigate to *c:\BASINS\modelout* and select "*hyd_out.wdm*." Click OPEN.

4.   Select the time series for Upper Marlboro's "OBSERVED" flow (DSN 261).
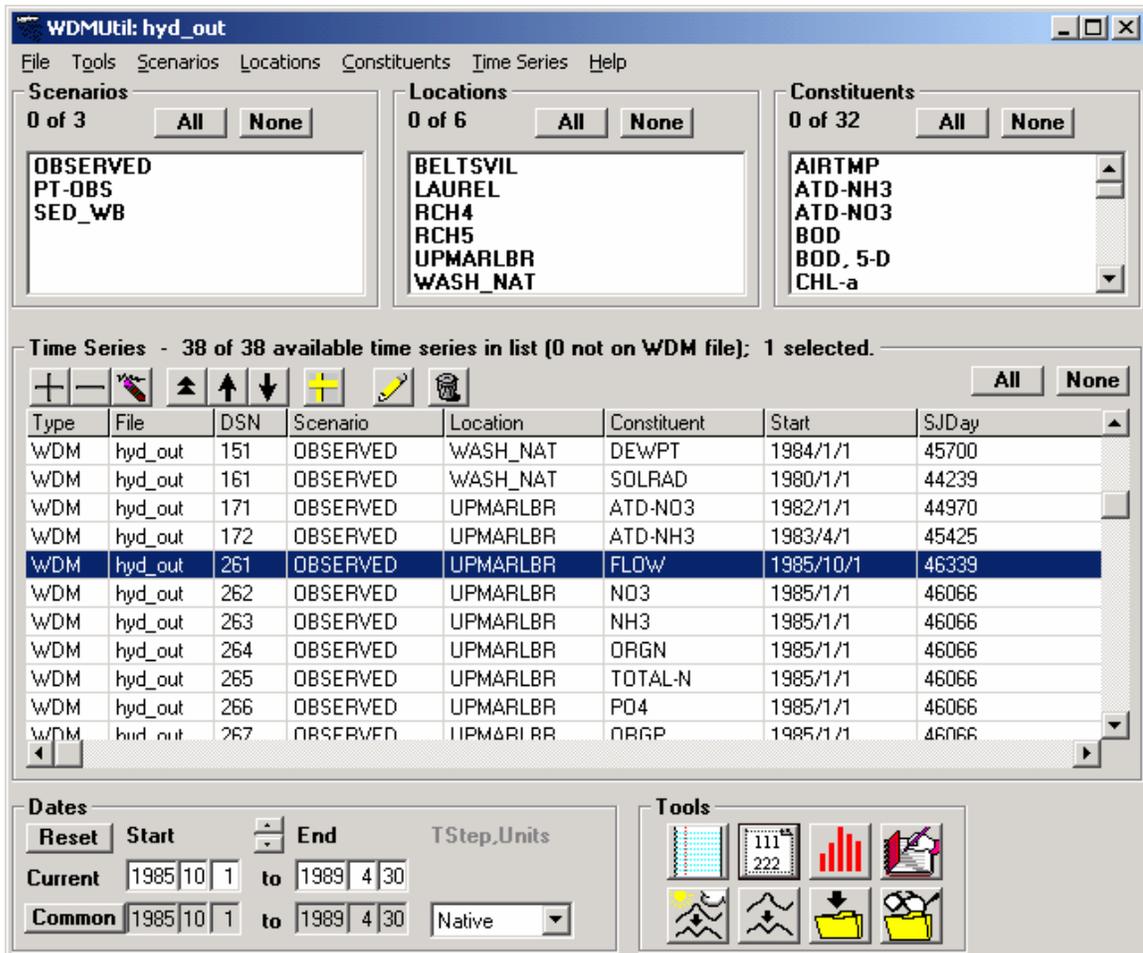
5.   In the current "Start" field, enter "1/1/1986."

6.   In the current "End" field, enter "12/31/1988."

7.   In the "Dates" frame, under the "T Step, Units" heading, select "Sum/Div."

8.   Two new boxes will appear above the "Sum/Div" box. Leave the left box as "1" and make sure "Day" is selected in the in the right box. The "Dates" frame should look like the following:
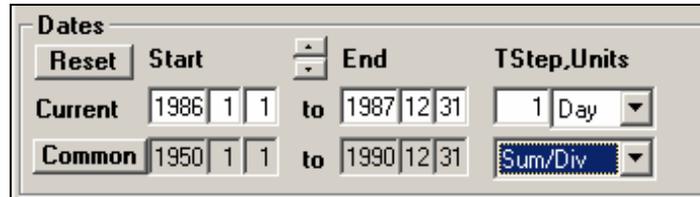
9.   From the "Tools" frame, click the "List Edit Time Series" button, . The following window will appear:

10.   From the **Edit** menu, select **Copy All**.

11.   Open Excel or another spreadsheet program.

12.   Click in the upper left cell. From the **Edit** menu, select **Paste**. You can now manipulate the WDM time series within the spreadsheet.

In order to compute total volumes from average daily flows, we need to: (1) convert the flow values from cubic feet per second to acre-feet per day, (2) sum the flow rates (for a desired time period), and (3) multiply the sum by the corresponding time interval for each desired increment (i.e., annual, seasonal, monthly, etc).

The conversion from ft^3/sec to acre-feet/day is:

$$\frac{ft^3}{1\,sec} * \frac{60\,sec}{1\,min} * \frac{60\,min}{1\,hour} * \frac{24\,hour}{1\,day} * \frac{1\,acre}{43560\,ft^2} = \frac{acre \cdot feet}{day}$$ or **1 cfs = 1.983 acre-feet/day**

13.   Enter this conversion factor as a formula in the next spreadsheet field. If you are using Excel, click in the C4 cell and enter =B4*1.983.

14.   **Double click** the small square on the bottom right corner of the cell containing the formula. This will fill down the formula to all of the time series.

Now we will sum the volumes in yearly increments in order to obtain yearly flow volumes.

15.   In cell D4, type "=C4" and in cell D5 type "=C5+D4".

16.   Fill the formula you just entered down to the end of 1986.

17.   Repeat the process for 1987 and 1988 in order to calculate values for total annual
       flow volumes. The totals should be approximately 40622.75 for 1986, 53251.09 for
       1987, and 49388.2 for 1988. These totals can now be compared to simulated annual
       volumes.

B. Seasonal Flow Volumes

Seasonal flow volumes can be calculated by repeating this summing process with seasonal
(instead of yearly) increments.

1.   Using the same spreadsheet, in cell E4, type "=C4" and in cell E5 type "=E4+C5".

For this model, we will look at the seasonal flow totals for winter (defined for our purposes as the months comprising December, January, and February) and for summer (June, July, and August). In your own models, the seasons you select and the time span for which you define a season may vary. For example, you may want to look at the total flows for spring, and define spring as the months of April, May, and June.

2.   Fill the formula down to the end of February 1986 to obtain the total volume for winter 1986. Use the same method for summer 1986, winter 1987 (including December of 1986), summer 1987, winter 1988 (including December of 1987), summer 1988, and December of 1988. Because we have only two months of data for the winter of 1986, the extra winter month will make our totals more accurate. The values you should get are as follows:

Season	Total Volume (acre-ft)
1986 winter total	10181.15702
1986 summer total	5187.570248
1986-7 winter total	25517.35537
1987 summer total	4273.38843
1987-8 winter total	22076.03306
1988 summer total	5427.570248
1988 winter total	2358.347107
Winter Total	60132.89256
Summer Total	14888.52893

3.   Once you have totaled the flows for each of the seasons, add their volumes together to achieve total winter and total summer volumes. These values can now be compared to simulated seasonal flow totals.