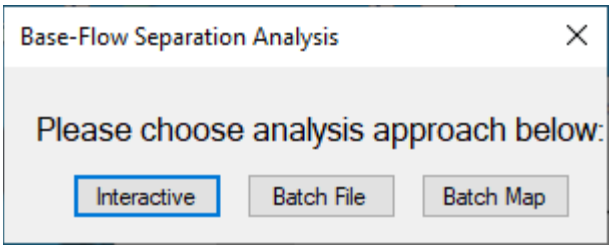
# Hydrograph Separation with the Hydrologic Toolbox

## Version 1.0 Release

This tutorial describes functionality developed for hydrograph (base-flow) separation with the Hydrologic Toolbox. The functionality allows users to evaluate (1) multiple streamflow records simultaneously, (2) streamflow records having intermittent (noncontinuous) periods of record, and (3) streamflow records that are less than a full calendar year in length or extend over periods that are not full calendar years. Each of these new capabilities is described below. Readers of this document should be familiar with the basic hydrograph-separation capabilities of the Hydrologic Toolbox described in USGS Techniques and Methods 3-B10, which is distributed with the software.

### Modes of Hydrograph Separation

The base-flow and runoff components of streamflow are determined from a streamflow record by use of the "**Base-Flow Separation**" option in the "**GW Tools**" menu. Selecting this option will result in the following dialog box:




The three options provide three modes of analysis:

"Interactive" is used to analyze a single streamflow record, including those with intermittent record.

"Batch File" opens an existing batch-run configuration file to run the hydrograph-separation methods on one or more streamflow records with pre-defined user options.

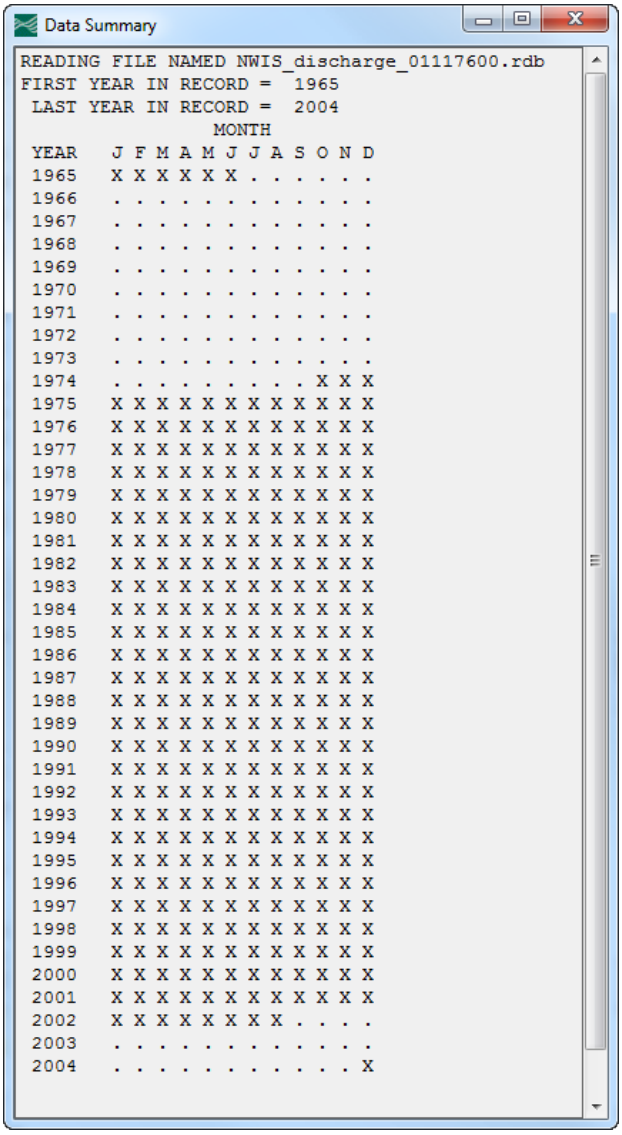
"Batch Map" is used to create a configuration file and, optionally, to run the hydrograph-separation methods on one or more streamflow records.

Each mode is described below, in order of "Interactive," "Batch Map," and "Batch File."

**“Interactive” Mode: Example Analysis of a Record with Intermittent Data**

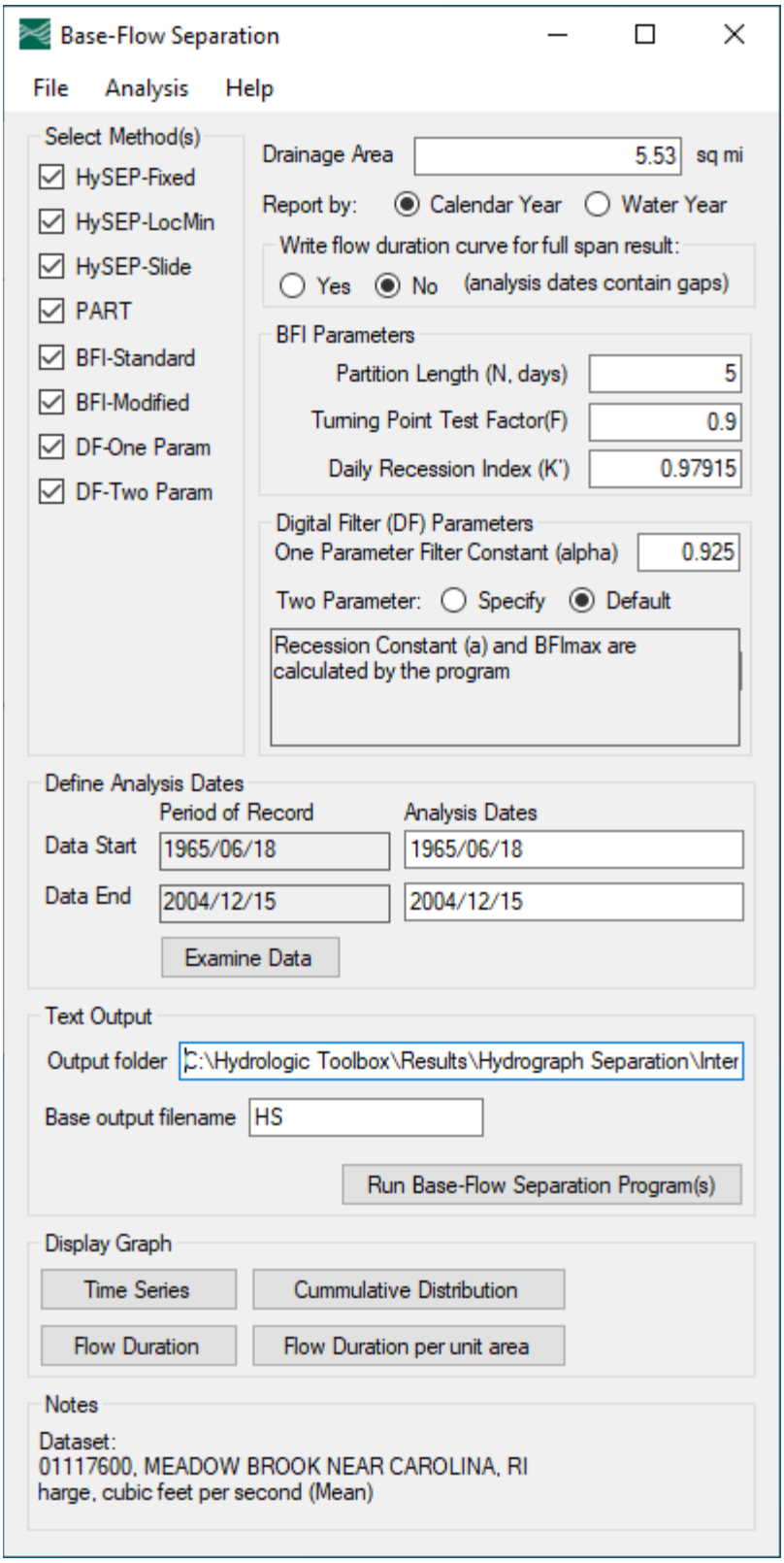
Selecting “Interactive” mode brings up the dialog box “Select Daily Streamflow for Analysis,” which is used to select a streamflow record for analysis (see USGS TM 3-B10 for details on how to select a streamflow record). In this example, streamflow data for USGS gaging station Meadow Brook near Carolina, Rhode Island (station 01117600) will be analyzed. The gaging station was operated intermittently between June 18, 1965, and December 15, 2004.

The user can view the months of complete and incomplete record with the “Examine Data” option in the “Base-Flow Separation” dialog box:

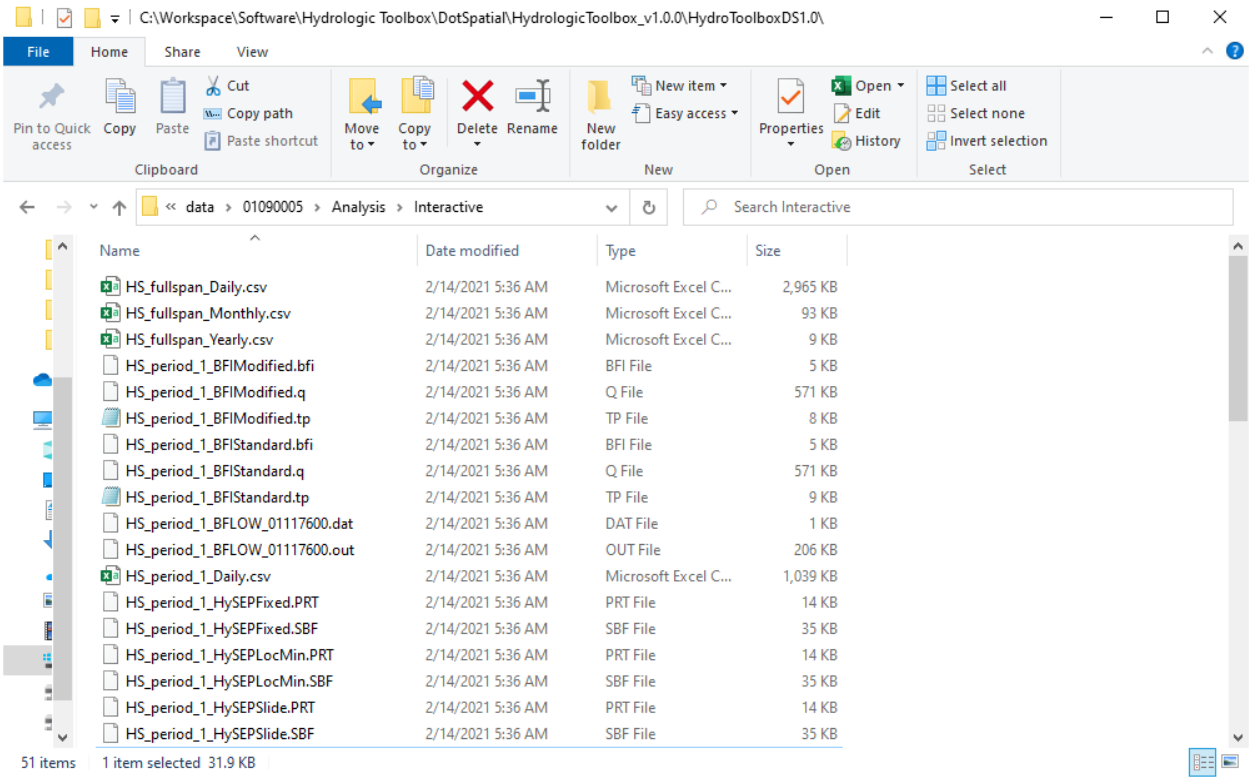



Two periods of record are identified: the first during 1965-1974 and the second during 2002-2004.

For this example, all eight hydrograph-separation methods were selected and default values were used for all input parameters:


Base-Flow Separation
File
Analysis
Help
Select Method(s)
HySEP-Fixed
HySEP-LocMin
HySEP-Slide
PART
BFI-Standard
BFI-Modified
DF-One Param
DF-Two Param
Drainage Area
5.53
sq mi
Report by:
Calendar Year
Water Year
Write flow duration curve for full span result:
Yes
No
(analysis dates contain gaps)
BFI Parameters
Partition Length (N, days)
5
Turning Point Test Factor(F)
0.9
Daily Recession Index (K')
0.97915
Digital Filter (DF) Parameters
One Parameter Filter Constant (alpha)
0.925
Two Parameter:
Specify
Default
Recession Constant (a) and BFImax are calculated by the program
Define Analysis Dates
Period of Record
Analysis Dates
Data Start
1965/06/18
1965/06/18
Data End
2004/12/15
2004/12/15
Examine Data
Text Output
Output folder
C:\Hydrologic Toolbox\Results\Hydrograph Separation\Inter
Base output filename
HS
Run Base-Flow Separation Program(s)
Display Graph
Time Series
Cummulative Distribution
Flow Duration
Flow Duration per unit area
Notes
Dataset:
01117600, MEADOW BROOK NEAR CAROLINA, RI
harge, cubic feet per second (Mean)

After running the eight hydrograph-separation methods (by clicking “Run Base-Flow Separation Program(s)”), several output files are written to the “Output folder” specified above, many of which are shown in this screen capture:

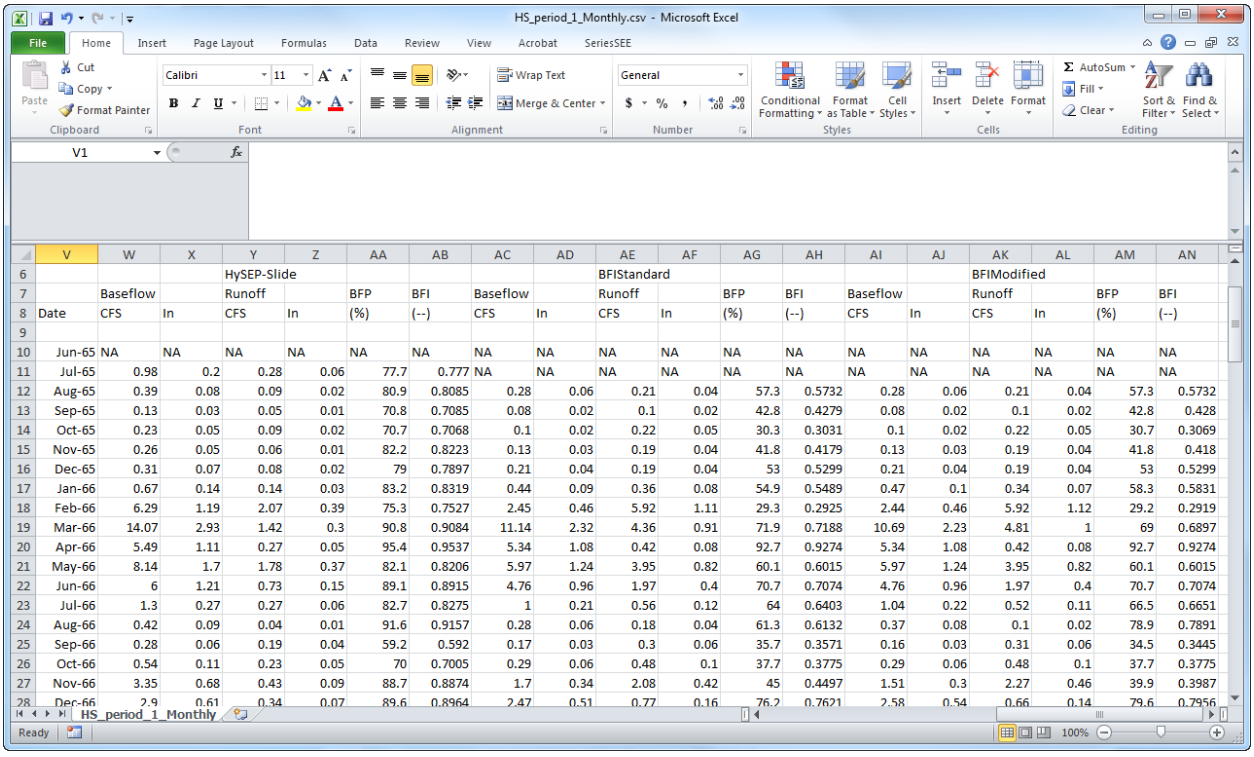



There are three sets of output files: the first set (identified with the text ‘period_1’ in the file name) is for the first period of record (June 18, 1965, through September 30, 1974), the second set (‘period_2)’ is for the second period of record (August 2, 2002, through December 15, 2004), and the third set (‘fullspan’) for the full span of record (June 18, 1965, through December 15, 2004). Output files for the two individual periods of record include the original output files generated by each of the individual hydrograph-separation programs as well as comma-delimited (.csv) output files for daily, monthly, and yearly time periods and for flow-duration analyses. Output files for the full period only include .csv files for the daily, monthly, and yearly results, and are generated so that the user can easily merge output from different stations. (Note: some laptops will identify files with the suffix ‘tp’ as having a digital-video format. This default file type can be changed to a text format with the laptop’s “Properties” command.)

There are two points to note about the output files:

1. 'Duration.csv' files include information on the 'Period of analysis' used to calculate the duration statistics (that is, the date range for each individual period of record). By default, the Hydrologic Toolbox will write duration files only for the individual periods of record and not for the full time span of record, which might include different periods of record. The user can calculate duration statistics for the full span of record by selecting "Yes" for that option on the "Base-Flow Separation" dialog box.

2. Output is only written to the 'Monthly.csv' and 'Yearly.csv' files for months and calendar years having complete record. So, for example, the 'period_1' output file for the station analyzed here has values of 'NA' (not applicable) for June 1965 in the 'period_1_Monthly.csv' file and no values shown for 1965 or 1974 for the 'period_1_Yearly.csv' file. Also note that in some cases the BFI methods will not find an initial turning point in the streamflow record for several days or weeks. This is demonstrated for the station analyzed here for July 1965 in the following screen capture of part of the 'period_1_Monthly.csv' file:




| | V | W | X | Y | Z | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL | AM | AN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | | | | HySEP-Slide | | | | | | BFIStandard | | | | | | BFIModified | | | |
| 7 | | Baseflow | | Runoff | | BFP | BFI | Baseflow | | Runoff | | BFP | BFI | Baseflow | | Runoff | | BFP | BFI |
| 8 | Date | CFS | In | CFS | In | (%) | (--) | CFS | In | CFS | In | (%) | (--) | CFS | In | CFS | In | (%) | (--) |
| 9 | | | | | | | | | | | | | | | | | | | |
| 10 | Jun-65 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 11 | Jul-65 | 0.98 | 0.2 | 0.28 | 0.06 | 77.7 | 0.777 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 12 | Aug-65 | 0.39 | 0.08 | 0.09 | 0.02 | 80.9 | 0.8085 | 0.28 | 0.06 | 0.21 | 0.04 | 57.3 | 0.5732 | 0.28 | 0.06 | 0.21 | 0.04 | 57.3 | 0.5732 |
| 13 | Sep-65 | 0.13 | 0.03 | 0.05 | 0.01 | 70.8 | 0.7085 | 0.08 | 0.02 | 0.1 | 0.02 | 42.8 | 0.4279 | 0.08 | 0.02 | 0.1 | 0.02 | 42.8 | 0.428 |
| 14 | Oct-65 | 0.23 | 0.05 | 0.09 | 0.02 | 70.7 | 0.7068 | 0.1 | 0.02 | 0.22 | 0.05 | 30.3 | 0.3031 | 0.1 | 0.02 | 0.22 | 0.05 | 30.7 | 0.3069 |
| 15 | Nov-65 | 0.26 | 0.05 | 0.06 | 0.01 | 82.2 | 0.8223 | 0.13 | 0.03 | 0.19 | 0.04 | 41.8 | 0.4179 | 0.13 | 0.03 | 0.19 | 0.04 | 41.8 | 0.418 |
| 16 | Dec-65 | 0.31 | 0.07 | 0.08 | 0.02 | 79 | 0.7897 | 0.21 | 0.04 | 0.19 | 0.04 | 53 | 0.5299 | 0.21 | 0.04 | 0.19 | 0.04 | 53 | 0.5299 |
| 17 | Jan-66 | 0.67 | 0.14 | 0.14 | 0.03 | 83.2 | 0.8319 | 0.44 | 0.09 | 0.36 | 0.08 | 54.9 | 0.5489 | 0.47 | 0.1 | 0.34 | 0.07 | 58.3 | 0.5831 |
| 18 | Feb-66 | 6.29 | 1.19 | 2.07 | 0.39 | 75.3 | 0.7527 | 2.45 | 0.46 | 5.92 | 1.11 | 29.3 | 0.2925 | 2.44 | 0.46 | 5.92 | 1.12 | 29.2 | 0.2919 |
| 19 | Mar-66 | 14.07 | 2.93 | 1.42 | 0.3 | 90.8 | 0.9084 | 11.14 | 2.32 | 4.36 | 0.91 | 71.9 | 0.7188 | 10.69 | 2.23 | 4.81 | 1 | 69 | 0.6897 |
| 20 | Apr-66 | 5.49 | 1.11 | 0.27 | 0.05 | 95.4 | 0.9537 | 5.34 | 1.08 | 0.42 | 0.08 | 92.7 | 0.9274 | 5.34 | 1.08 | 0.42 | 0.08 | 92.7 | 0.9274 |
| 21 | May-66 | 8.14 | 1.7 | 1.78 | 0.37 | 82.1 | 0.8206 | 5.97 | 1.24 | 3.95 | 0.82 | 60.1 | 0.6015 | 5.97 | 1.24 | 3.95 | 0.82 | 60.1 | 0.6015 |
| 22 | Jun-66 | 6 | 1.21 | 0.73 | 0.15 | 89.1 | 0.8915 | 4.76 | 0.96 | 1.97 | 0.4 | 70.7 | 0.7074 | 4.76 | 0.96 | 1.97 | 0.4 | 70.7 | 0.7074 |
| 23 | Jul-66 | 1.3 | 0.27 | 0.27 | 0.06 | 82.7 | 0.8275 | 1 | 0.21 | 0.56 | 0.12 | 64 | 0.6403 | 1.04 | 0.22 | 0.52 | 0.11 | 66.5 | 0.6651 |
| 24 | Aug-66 | 0.42 | 0.09 | 0.04 | 0.01 | 91.6 | 0.9157 | 0.28 | 0.06 | 0.18 | 0.04 | 61.3 | 0.6132 | 0.37 | 0.08 | 0.1 | 0.02 | 78.9 | 0.7891 |
| 25 | Sep-66 | 0.28 | 0.06 | 0.19 | 0.04 | 59.2 | 0.592 | 0.17 | 0.03 | 0.3 | 0.06 | 35.7 | 0.3571 | 0.16 | 0.03 | 0.31 | 0.06 | 34.5 | 0.3445 |
| 26 | Oct-66 | 0.54 | 0.11 | 0.23 | 0.05 | 70 | 0.7005 | 0.29 | 0.06 | 0.48 | 0.1 | 37.7 | 0.3775 | 0.29 | 0.06 | 0.48 | 0.1 | 37.7 | 0.3775 |
| 27 | Nov-66 | 3.35 | 0.68 | 0.43 | 0.09 | 88.7 | 0.8874 | 1.7 | 0.34 | 2.08 | 0.42 | 45 | 0.4497 | 1.51 | 0.3 | 2.27 | 0.46 | 39.9 | 0.3987 |
| 28 | Dec-66 | 2.9 | 0.61 | 0.34 | 0.07 | 89.6 | 0.8964 | 2.47 | 0.51 | 0.77 | 0.16 | 76.2 | 0.7621 | 2.58 | 0.54 | 0.66 | 0.14 | 79.6 | 0.7956 |

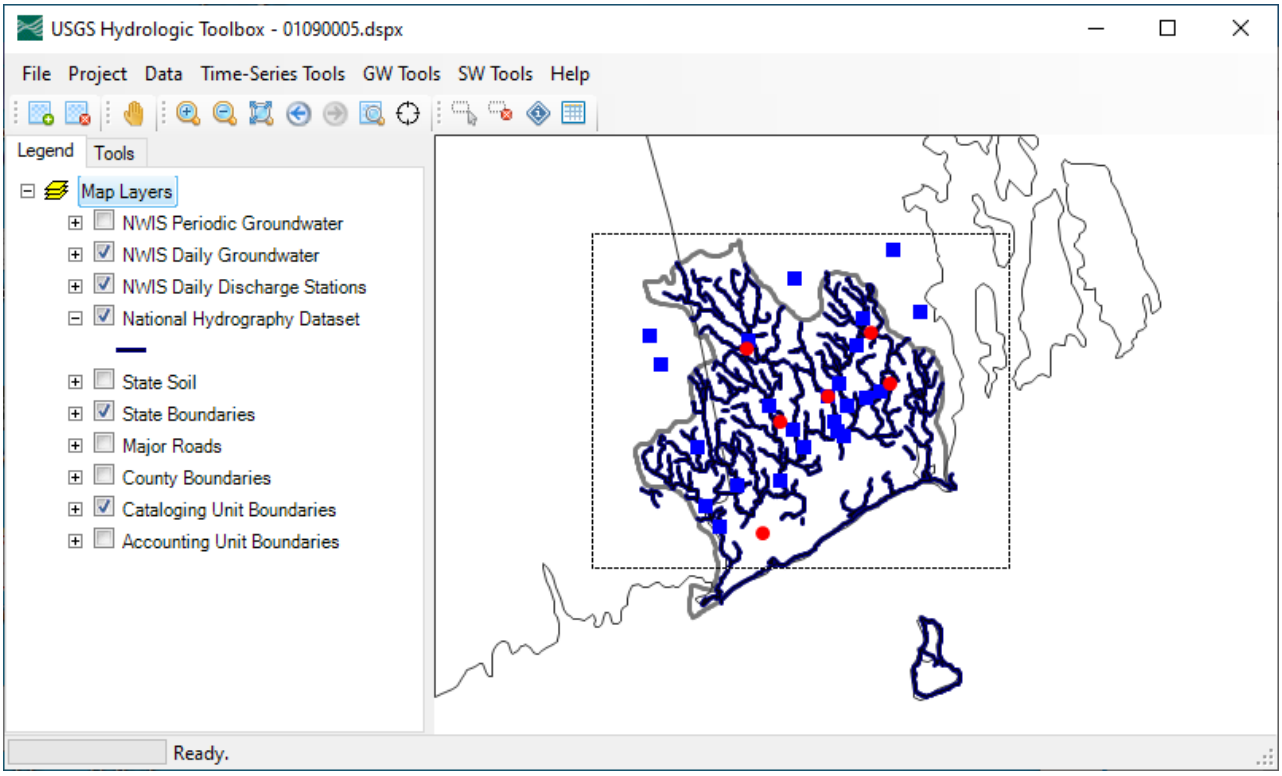
The base-flow and runoff time series calculated by the hydrograph-separation methods are now directly available for analysis with other Toolbox functionalities, such as graphing, statistics, and trends analysis. Also, the Toolbox will automatically re-open the "fullspan_Daily.csv" file that has been created for the project in future working sessions and reload the base-flow, base-flow percentage, and runoff time series that have been saved in that file.

**“Batch Map” Mode: To generate and execute a batch-run configuration file**

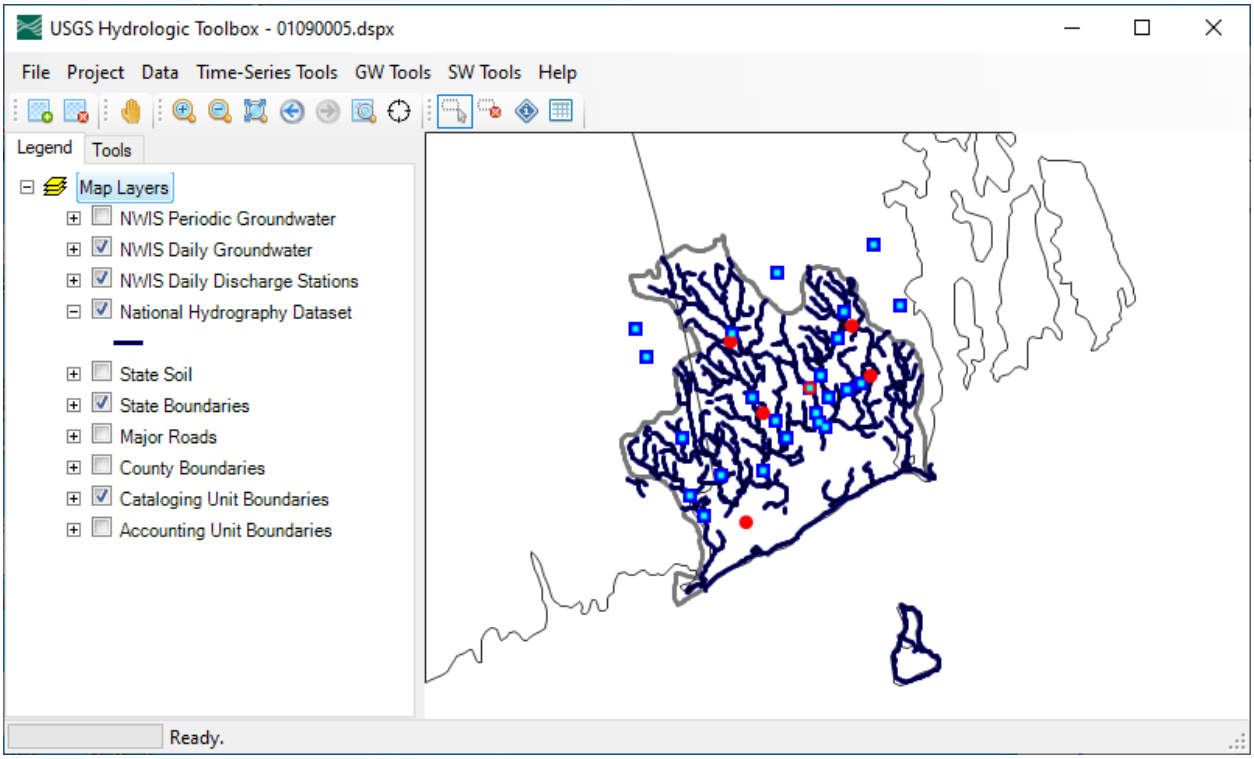
Two examples are provided to describe the process for generating a batch-run configuration file and, optionally, running the file within the “Batch Map” option. The first example assumes that the user has downloaded streamflow records for one or more stations in the working Hydrologic Toolbox project. The second example assumes that no data have been downloaded in the working project, but are either available on the user’s computer or will be downloaded on the basis of a list of station identifiers provided in an existing text file.

**a. Streamflow records have been downloaded in the working project**

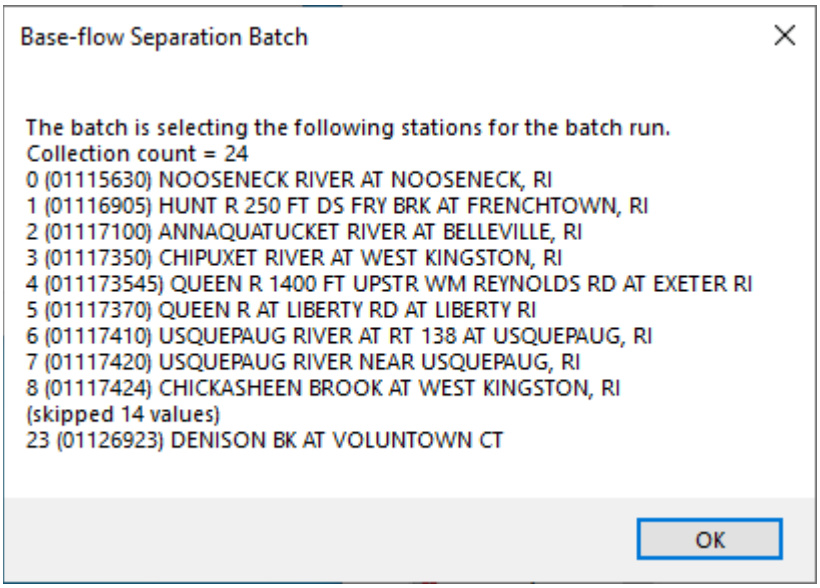
In this example, data have been downloaded for several streamgaging stations within a project and are available for analysis. The user first selects gages that will be analyzed from the project map. In this example, the “Select” tool is used to select all gages within the bounding box:



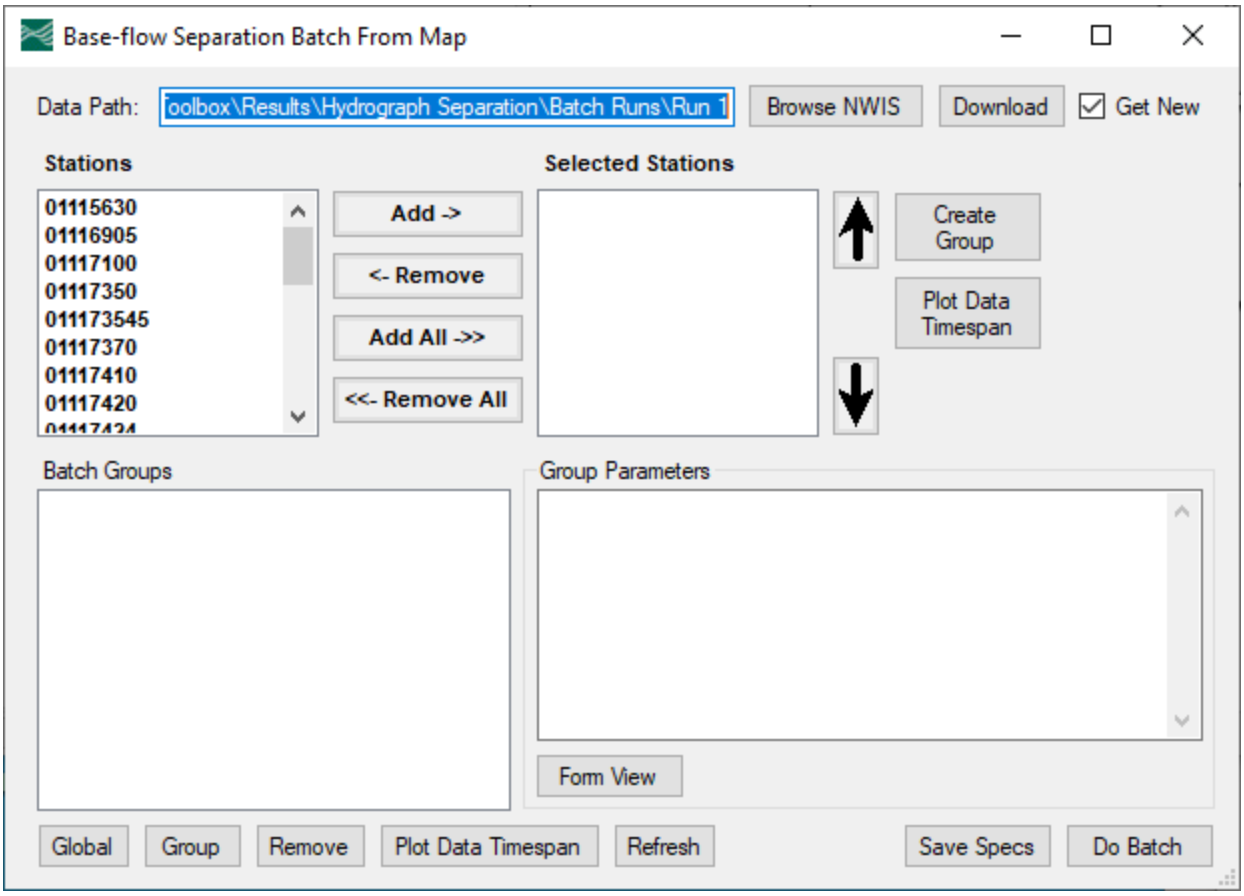

The selected gages appear with a light-blue circle in the middle of the blue boxes:




Now, selecting "Batch Map" from the "**Base-Flow Separation**" dialog box brings up the following screen, which indicates that a total of 24 stations have been selected for analysis:

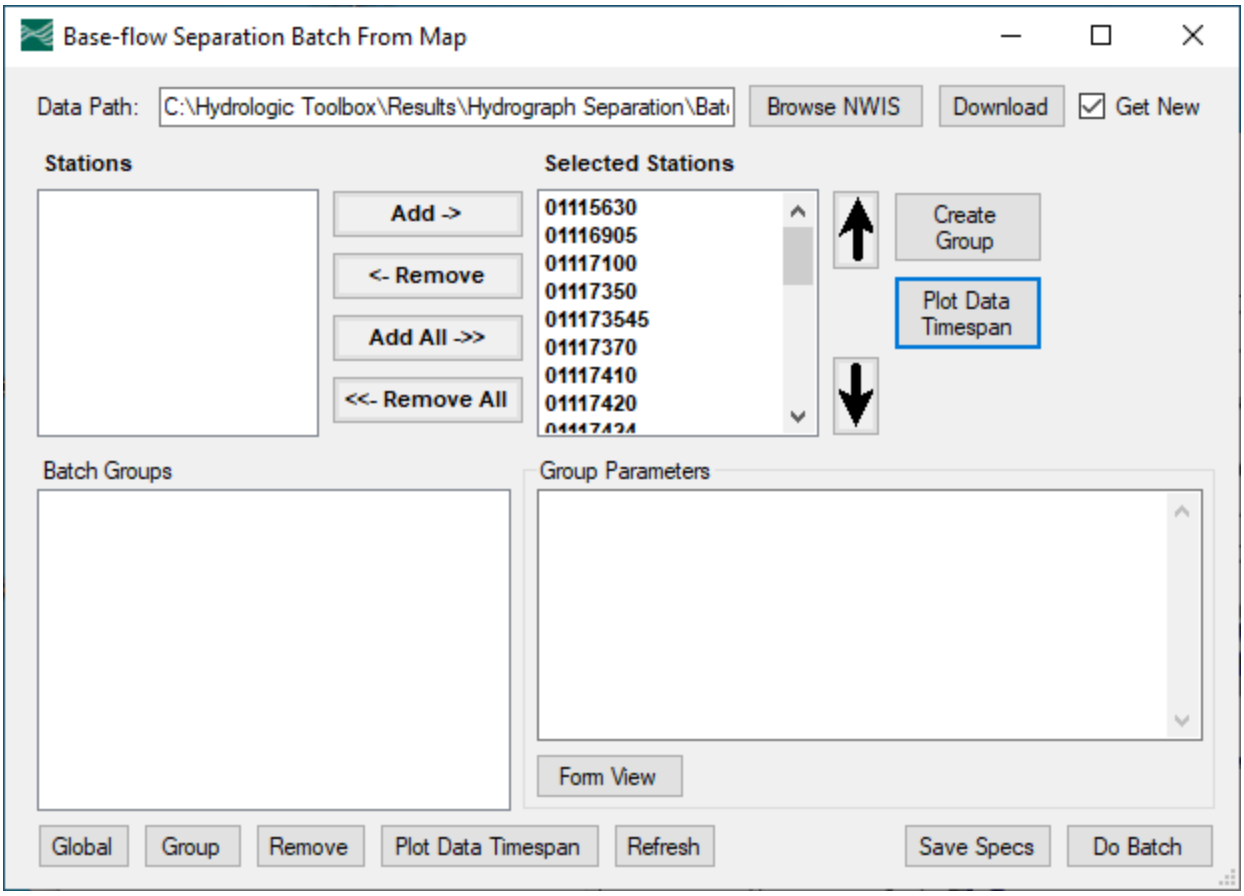



Click on "OK," which bring up the "Batch Map" dialog box:

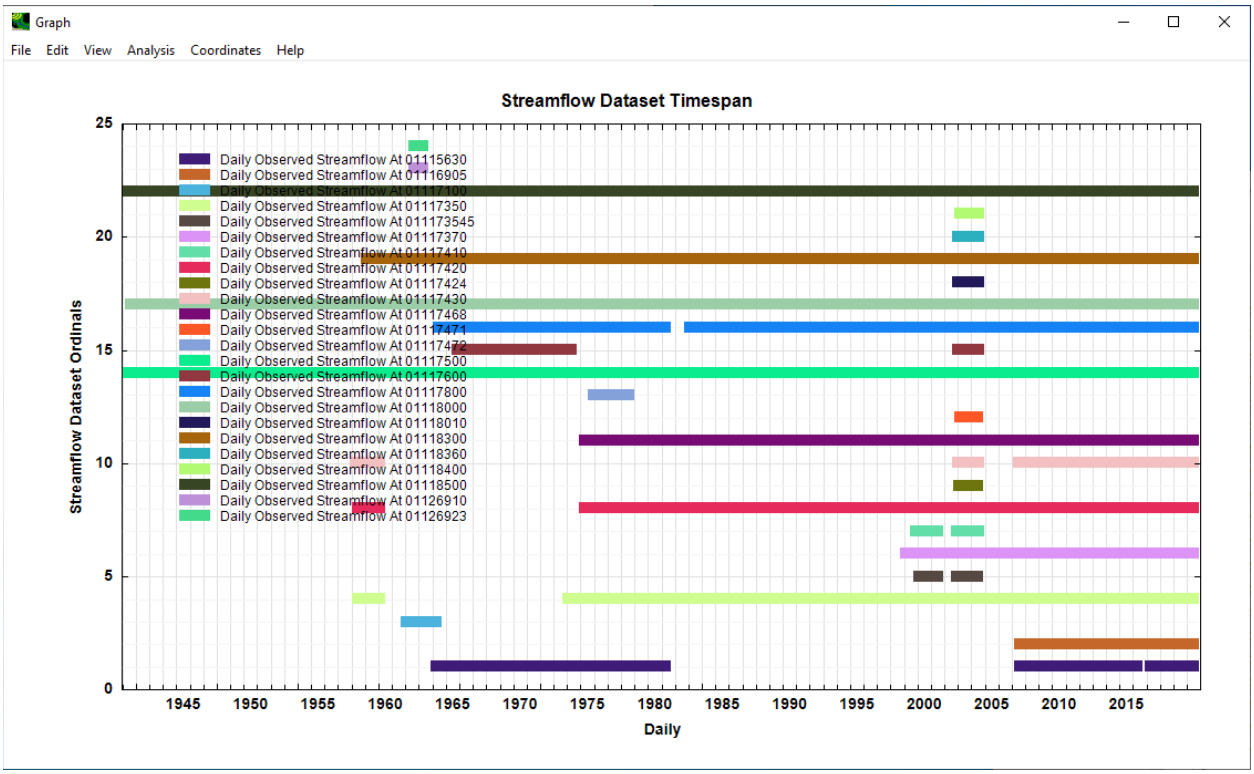



The user must first specify a “Data Path” into which the output files will be placed. The Hydrologic Toolbox will search your computer for existing, cached NWIS streamflow data, so it may be useful to check the ‘Get New’ button to ensure that the most up-to-date data will be downloaded for the analysis. Also, in this example an empty folder was created outside of the Toolbox with the name ‘Run 1’ under the data path partially shown above. The user can now “Download” data for the 24 stations into a subdirectory named ‘NWIS’ in the Run 1 folder.

A useful first step for the analysis is to plot a graph of the timespans of the 24 records. This is done by adding all of the stations to the “Selected Stations” box using the “Add All->>” button, which gives:

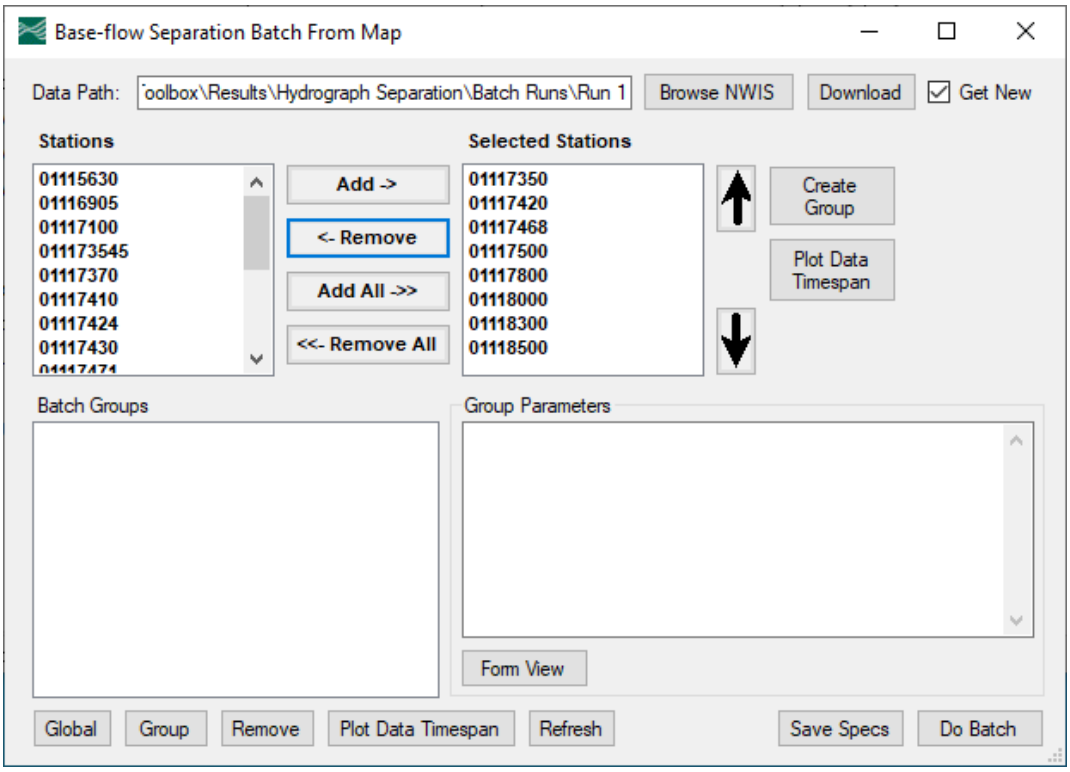



The user now clicks “Plot Data Timespan,” which gives the following graph:

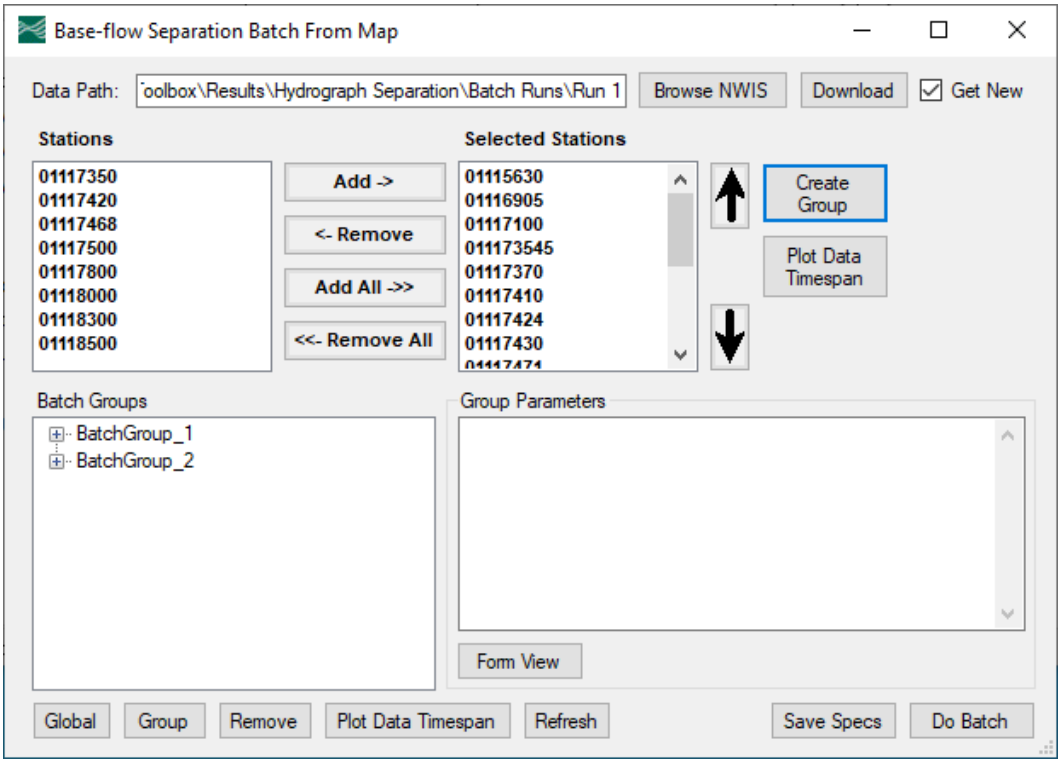



The graph provides a simple way to visualize the periods of record for the several gages within the study area.

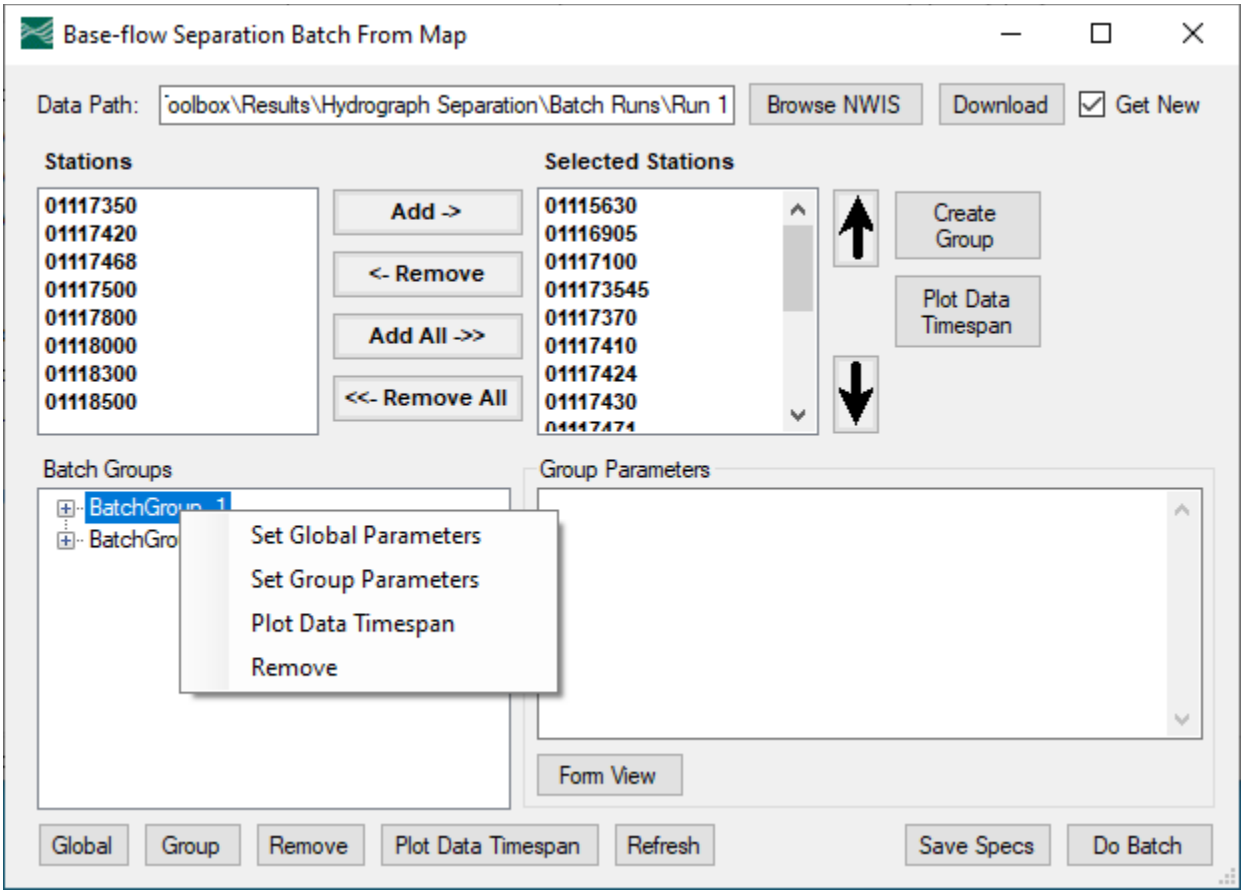
The user may want to organize different groups of stations for analysis, such as by subbasin, record length, or analysis technique. For this example, the dataset will be divided into two groups, the first with the eight longest periods of record and the second with the remaining 16 records. The first group is created by removing these 16 stations from the “Selected Stations” window, resulting in the following dialog box:



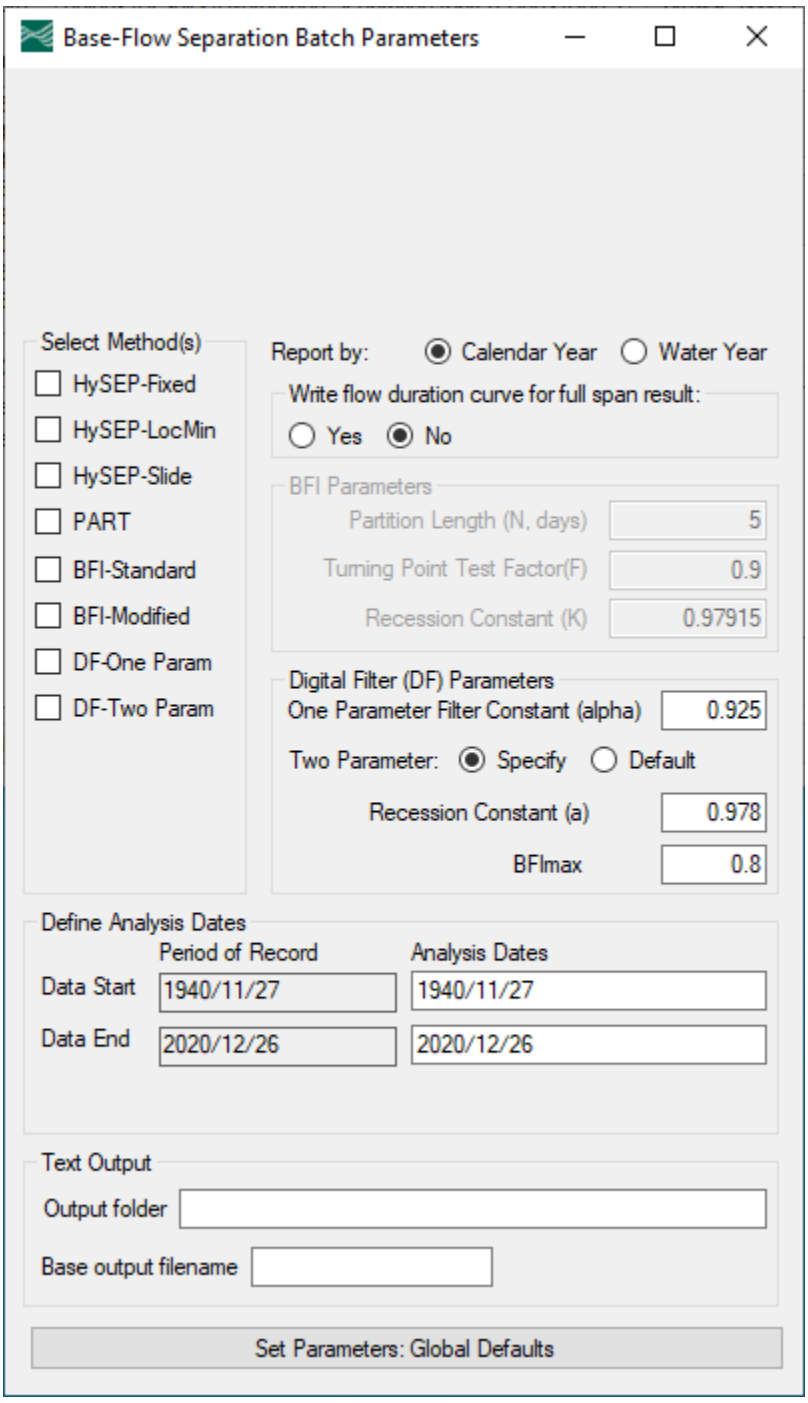

The user now selects the “Create Group” button, which creates a first Batch Group under the “Batch Groups” window. A second group is then created by removing the first eight stations from the “Selected Stations” window and adding back the remaining 16 stations. After creating the second group, the following dialog box results:



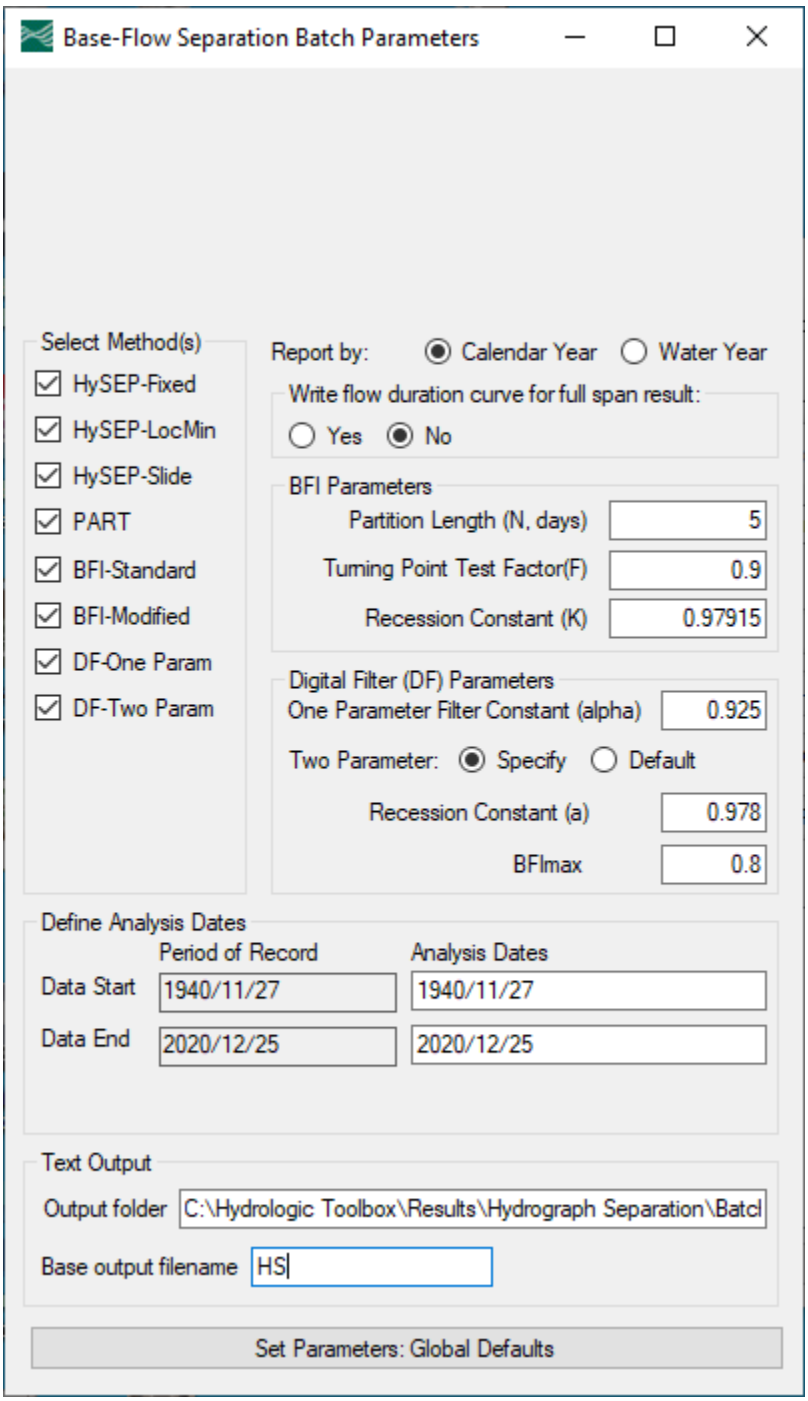
The user now needs to create a configuration file to run the batch process. There are two steps for creating this file: setting global parameters that apply to all stations that are analyzed and then setting group parameters for each group of stations. These steps are shown by right-clicking on either of the two Batch Groups:



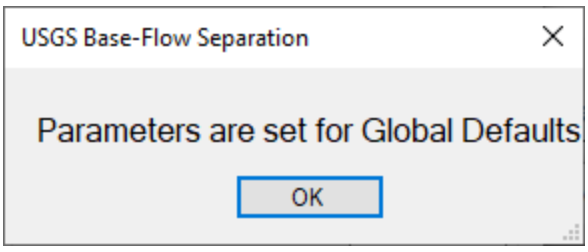

The first step is to select the “Set Global Parameters” option, which results in the following screen:




Note that the Toolbox has identified the full time span of record for the 24 stations, November 27, 1940 through December 26, 2020. For this example, all hydrograph-separation methods will be selected, and the output folder identified:

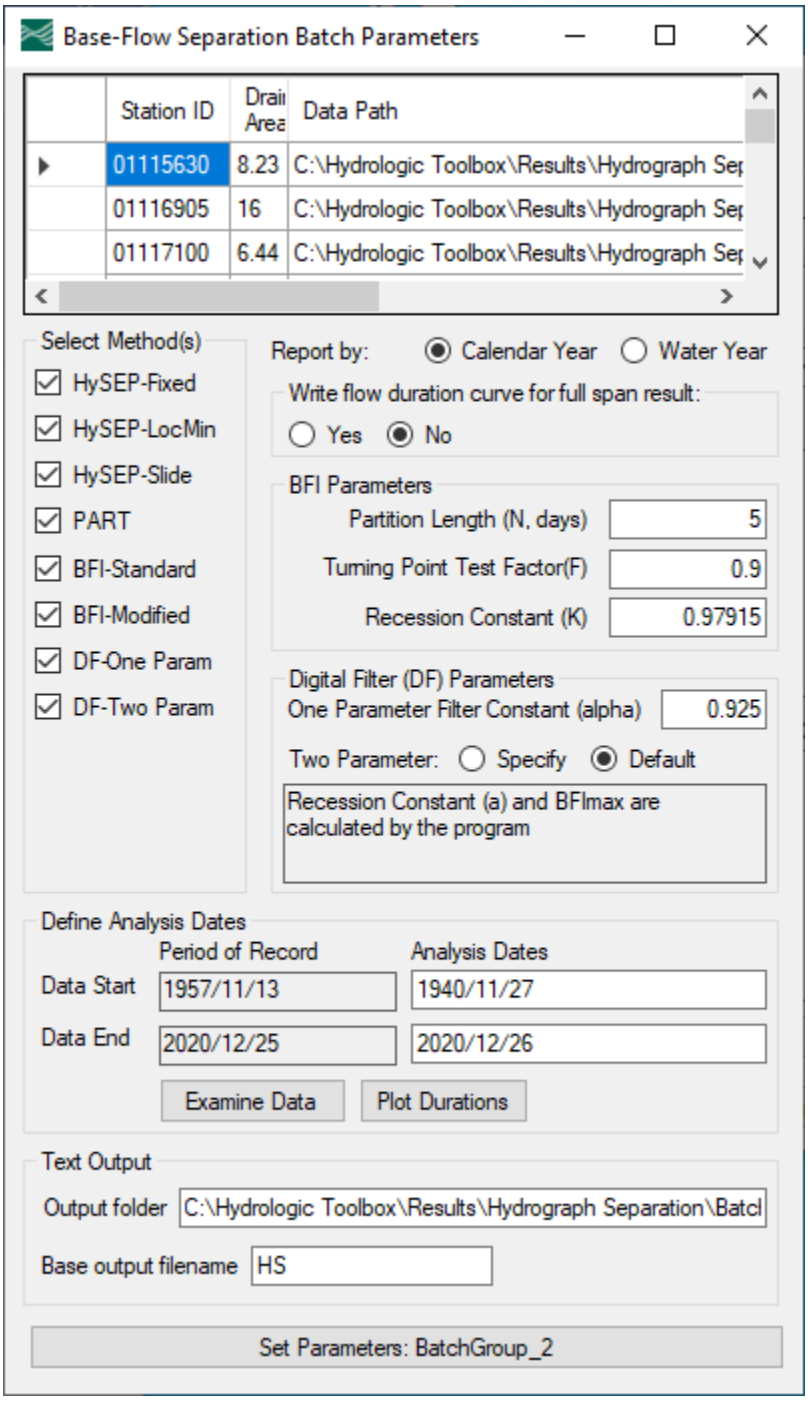



The user now clicks “Set Parameters: Global Defaults,” which results in

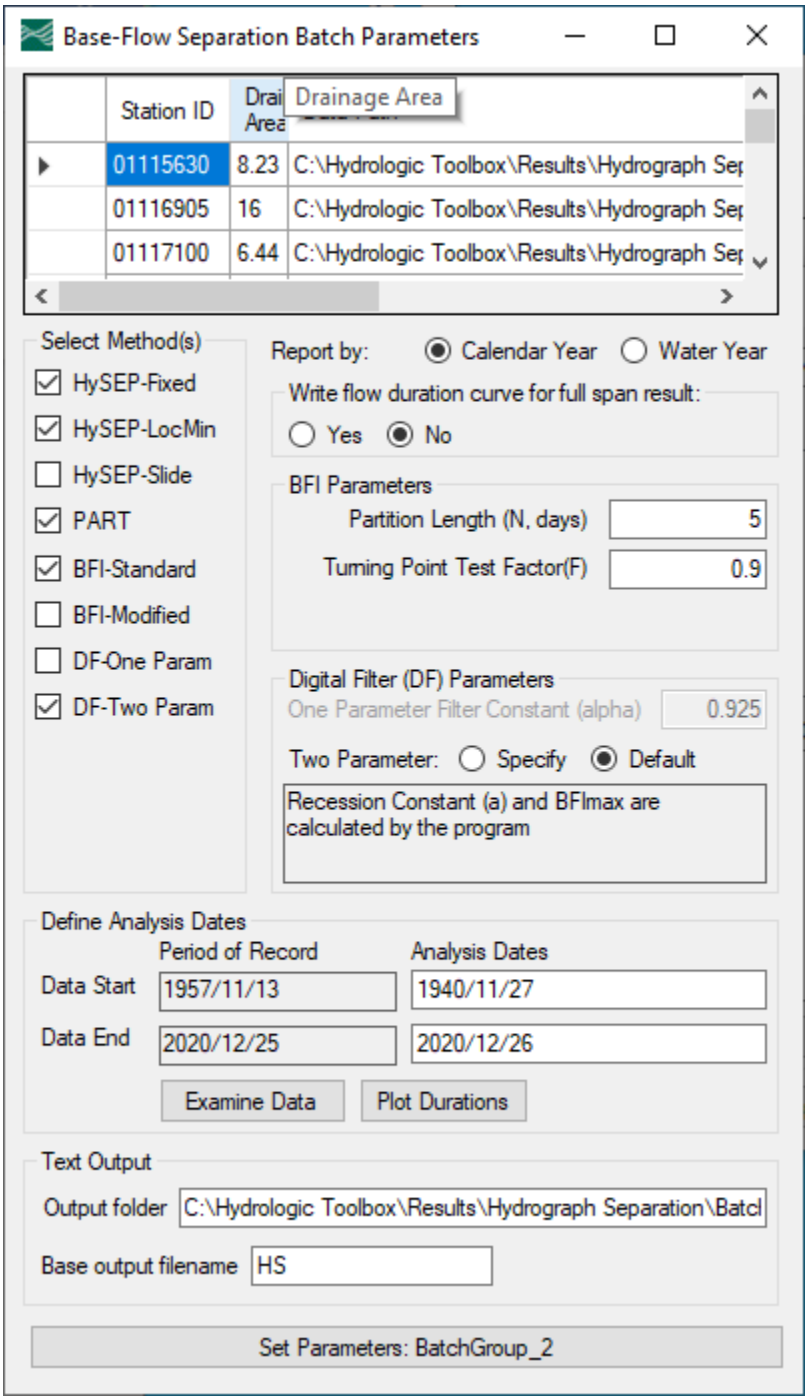


By hitting “OK,” the user is returned to the main Batch-Map dialog box. If the user now selects “Save Specs,” a configuration file is saved in the specified folder. In this example, the name of the file is ‘BatchConfigBase-flowSep_12_26_2020 6_48_47 AM.txt.’ At this point, default Group Parameters have been defined for each of the two groups that are equivalent to those specified for the Global Parameters, and the user could procede to the “Do Batch” analysis.

However, for this example, the Group Parameters will be updated for each of the two groups. The “Group Parameters” dialog box is:



For this example, we will eliminate the HySEP-Slide, BFI-Modified, and DF-One Param options for each group (only the change to the second group is shown here):




Now select “Set Parameters: BatchGroup_1” and then “OK” in the resulting screen, which returns the user to the main Batch-Map dialog box. After saving the specifications for each group modification, the resulting configuration file (now named ‘BatchConfigBase-flowSep_12_26_2020 6_54_44 AM.txt’) is as follows:

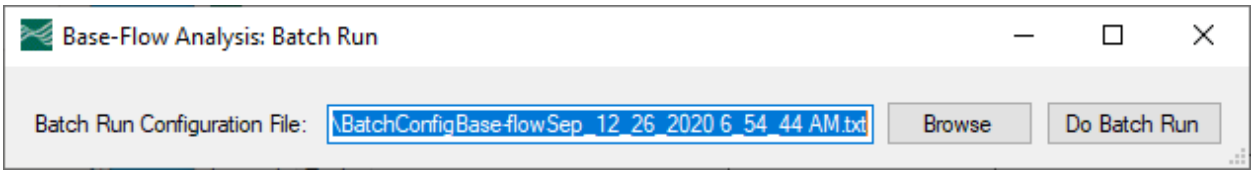
```
GLOBAL
STARTDATE     1940/11/27
ENDDATE       2020/12/26
BFMethod      PART
BFMethod      HYFX
BFMethod      HYLM
BFMethod      HYSL
BFMethod      BFIS
BFMethod      BFIM
BFMethod      DF1P
BFMethod      DF2P
BFI_TurnPtFrac        0.9
BFI_NDayScreen        5
BFI_RecessConst       0.97915
BFI_Reportby  CY
Reportby      Calendar
FullSpanDuration      NO
BFLOWFilter   0.925
TwoPRDF_RC    Default
TwoPRDF_BFImax        Default
TwoParamEstimationMethodECKHARDT
DataDir       C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1
OUTPUTDIR     C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1
OUTPUTPrefix HS
END GLOBAL

BASE-FLOW
Station 01117350,9.59,NWIS\NWIS_discharge_01117350.rdb
Station 01117420,36.1,NWIS\NWIS_discharge_01117420.rdb
Station 01117468,8.87,NWIS\NWIS_discharge_01117468.rdb
Station 01117500,100,NWIS\NWIS_discharge_01117500.rdb
Station 01117800,35.2,NWIS\NWIS_discharge_01117800.rdb
Station 01118000,72.4,NWIS\NWIS_discharge_01118000.rdb
Station 01118300,4.02,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run
1\NWIS\NWIS_discharge_01118300.rdb
Station 01118500,295,NWIS\NWIS_discharge_01118500.rdb
STARTDATE     1940/11/27
ENDDATE       2020/12/26
BFMethod      PART
BFMethod      HYFX
BFMethod      HYLM
BFMethod      BFIS
BFMethod      DF2P
BFI_TurnPtFrac        0.9
```

BFI_NDayScreen 5
BFI_RecessConst 0.97915
BFI_Reportby CY
Reportby Calendar
FullSpanDuration NO
BFLOWFilter 0.925
TwoPRDF_RC Default
TwoPRDF_BFImax Default
TwoParamEstimationMethod ECKHARDT
OUTPUTDIR C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1
OUTPUTPrefix HS
END BASE-FLOW

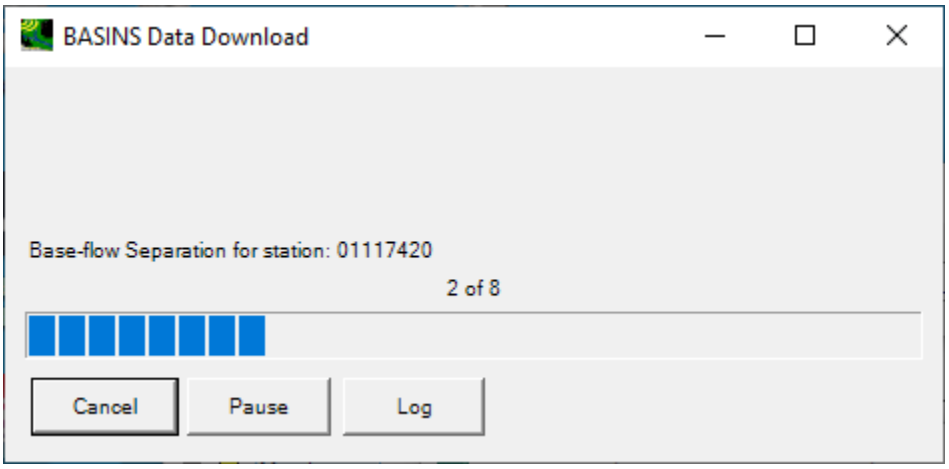
BASE-FLOW
Station 01115630,8.23,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1\NWIS\NWIS_discharge_01115630.rdb
Station 01116905,16,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1\NWIS\NWIS_discharge_01116905.rdb
Station 01117100,6.44,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1\NWIS\NWIS_discharge_01117100.rdb
Station 011173545,3.78,NWIS\NWIS_discharge_011173545.rdb
Station 01117370,19.6,NWIS\NWIS_discharge_01117370.rdb
Station 01117410,32.75,NWIS\NWIS_discharge_01117410.rdb
Station 01117424,4.82,NWIS\NWIS_discharge_01117424.rdb
Station 01117430,72.7,NWIS\NWIS_discharge_01117430.rdb
Station 01117471,11.20,NWIS\NWIS_discharge_01117471.rdb
Station 01117472,11.70,NWIS\NWIS_discharge_01117472.rdb
Station 01117600,5.53,NWIS\NWIS_discharge_01117600.rdb
Station 01118010,205.00,NWIS\NWIS_discharge_01118010.rdb
Station 01118360,28.6,NWIS\NWIS_discharge_01118360.rdb
Station 01118400,17.20,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1\NWIS\NWIS_discharge_01118400.rdb
Station 01126910,2.31,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1\NWIS\NWIS_discharge_01126910.rdb
Station 01126923,4.07,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1\NWIS\NWIS_discharge_01126923.rdb
STARTDATE 1940/11/27
ENDDATE 2020/12/26
BFMethod PART
BFMethod HYFX
BFMethod HYLM
BFMethod BFIS
BFMethod DF2P
BFI_TurnPtFrac 0.9

```
BFI_NDayScreen      5
BFI_RecessConst     0.97915
BFI_Reportby  CY
Reportby      Calendar
FullSpanDuration    NO
BFLOWFilter   0.925
TwoPRDF_RC  Default
TwoPRDF_BFImax      Default
TwoParamEstimationMethodECKHARDT
OUTPUTDIR     C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 1
OUTPUTPrefix HS
END BASE-FLOW
```

The user now selects “Do Batch,” which brings up the following ‘Batch Run’ dialog box:




Notice that the most recent configuration file is listed in the file path. Alternatively, the user can search for another file to process. In this example, we’ll use the file that was just created, by selecting “Do Batch Run.” The Toolbox will then complete the hydrograph-separation analyses, which might take a few minutes depending on the number of stations to process. As the analyses are being made, progress will be shown by a dialog box, such as the following:

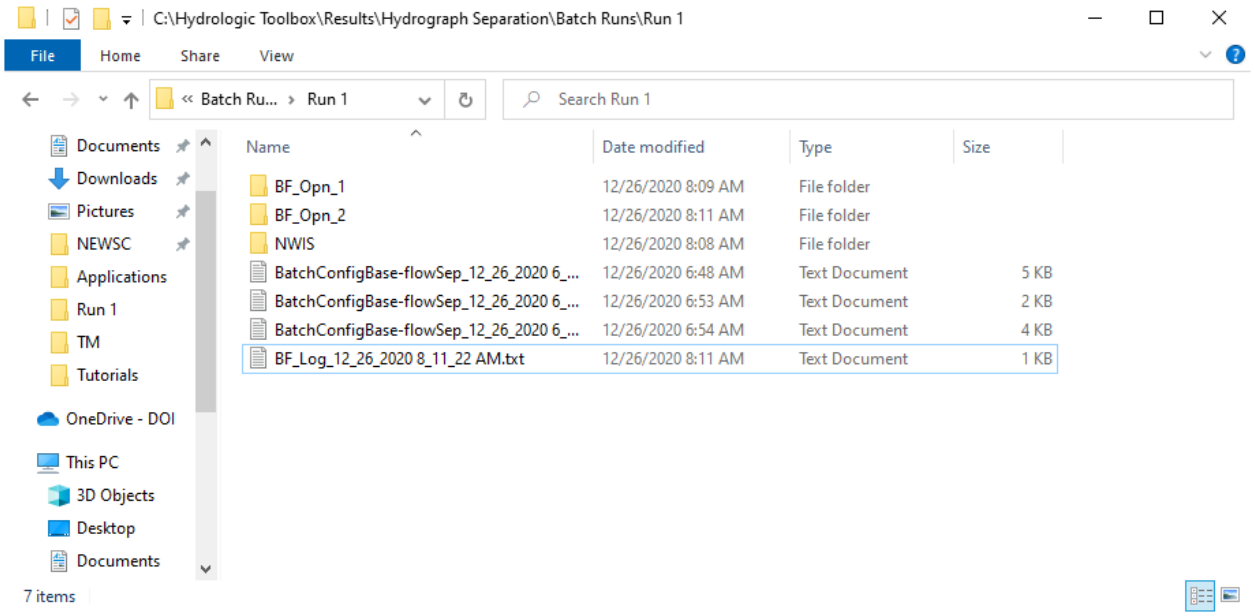



Also, many output files will be written to the specified directory as the analyses are being done.

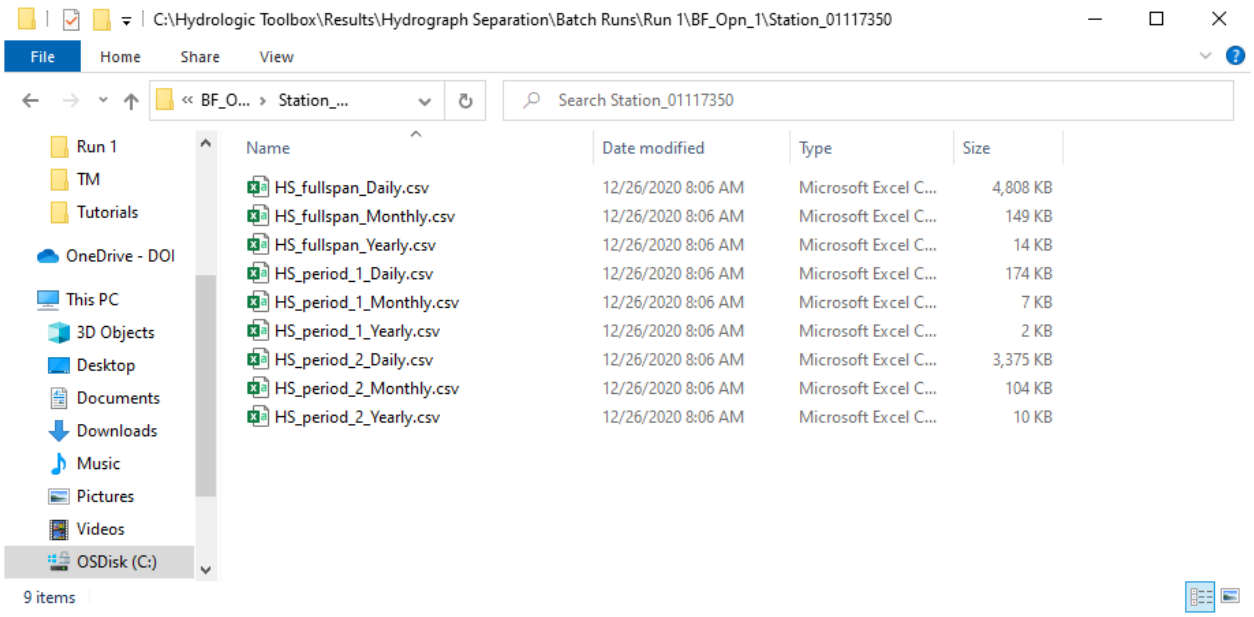
At completion, a log file will be created in the output directory. The contents of the log file for this example run (‘BF_Log_12_26_2020 8_11_22 AM.txt’) indicates that both groups ran successfully:

Batch Run Group *** 1 ***
End Batch Run Group 1, Successful
Batch Run Group *** 2 ***
End Batch Run Group 2, Successful

The output for each station is arranged by group, as shown by the directory structure for this example:



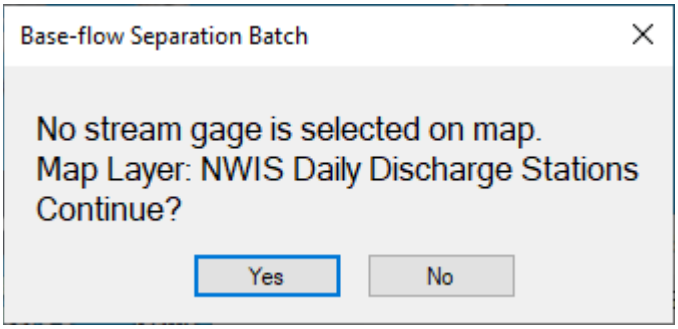

When running in 'Batch Mode,' the Toolbox only creates .csv files; the original files created by each of the hydrograph-separation methods are not written. This is shown for one of the stations analyzed for this example, which consists of two intermittent periods:



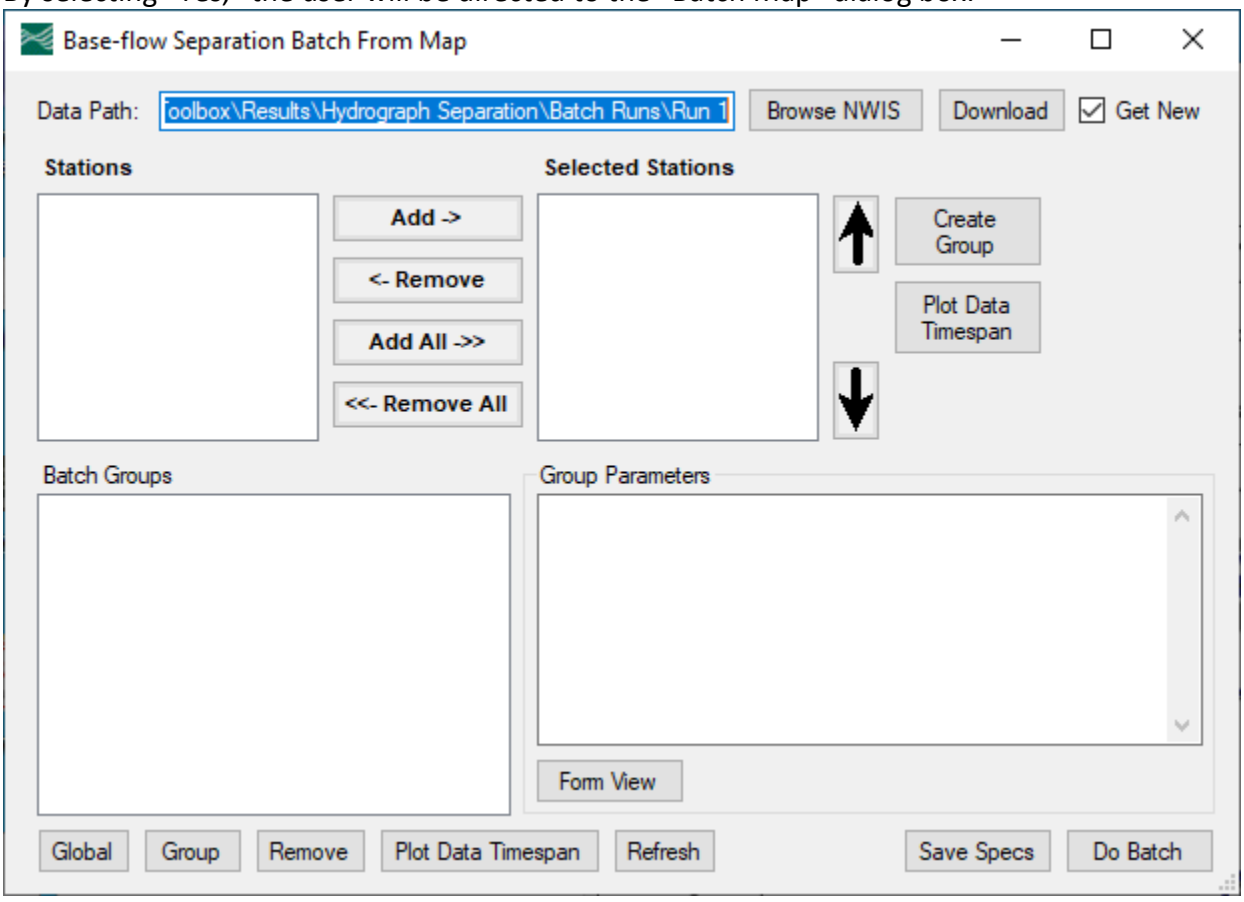
The 'fullspan' output files can be used to copy-and-paste columns for consistent time periods (that is, the full span of record for all stations analyzed) from multiple stations into one or more files.

**b. Streamflow records are available on the user's computer or will be downloaded based on a "Stations.txt" file**

In this example, a project has been created but either data have not been selected from the project map or streamflow data have not been downloaded for the project. Selecting "Batch Map" from the "**Base-Flow Separation Analysis**" dialog box brings up the following screen:

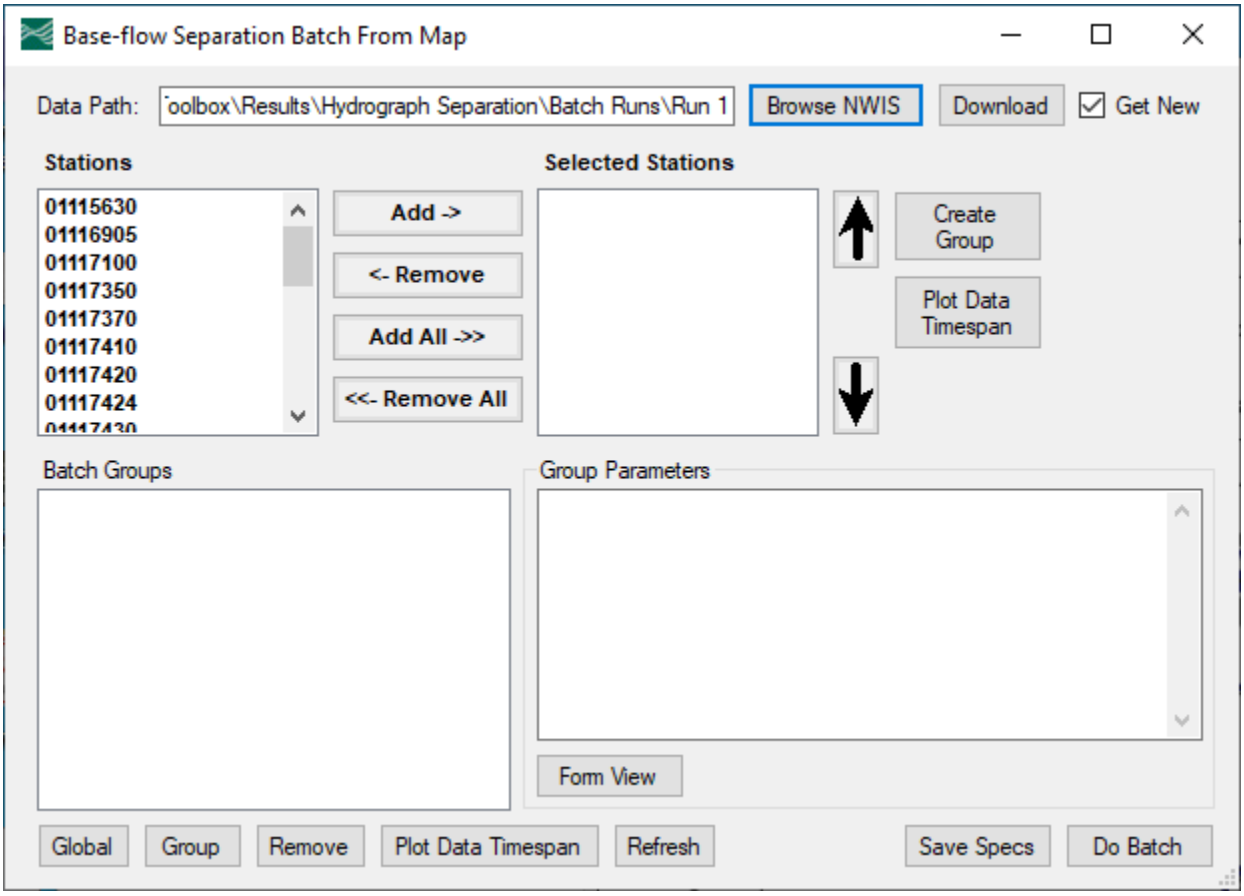



By selecting "Yes," the user will be directed to the "Batch Map" dialog box:



At this point, the user has two options:

Option 1: if the user selects “Browse NWIS,” they can navigate to a folder on their computer in which there is an existing “NWIS” subdirectory in which there are text relational database files (‘.rdb’) files of streamflow data. The program will then look at the file names in the folder and extract the 8-digit station identifiers for the stations found in the folder. For example, the user browses to subdirectory Run 1 created in the previous example and the program finds .rdb files for the 24 stations in the “NWIS” subdirectory. The 24 station identifiers that are now shown in the “Batch Map” dialog box:



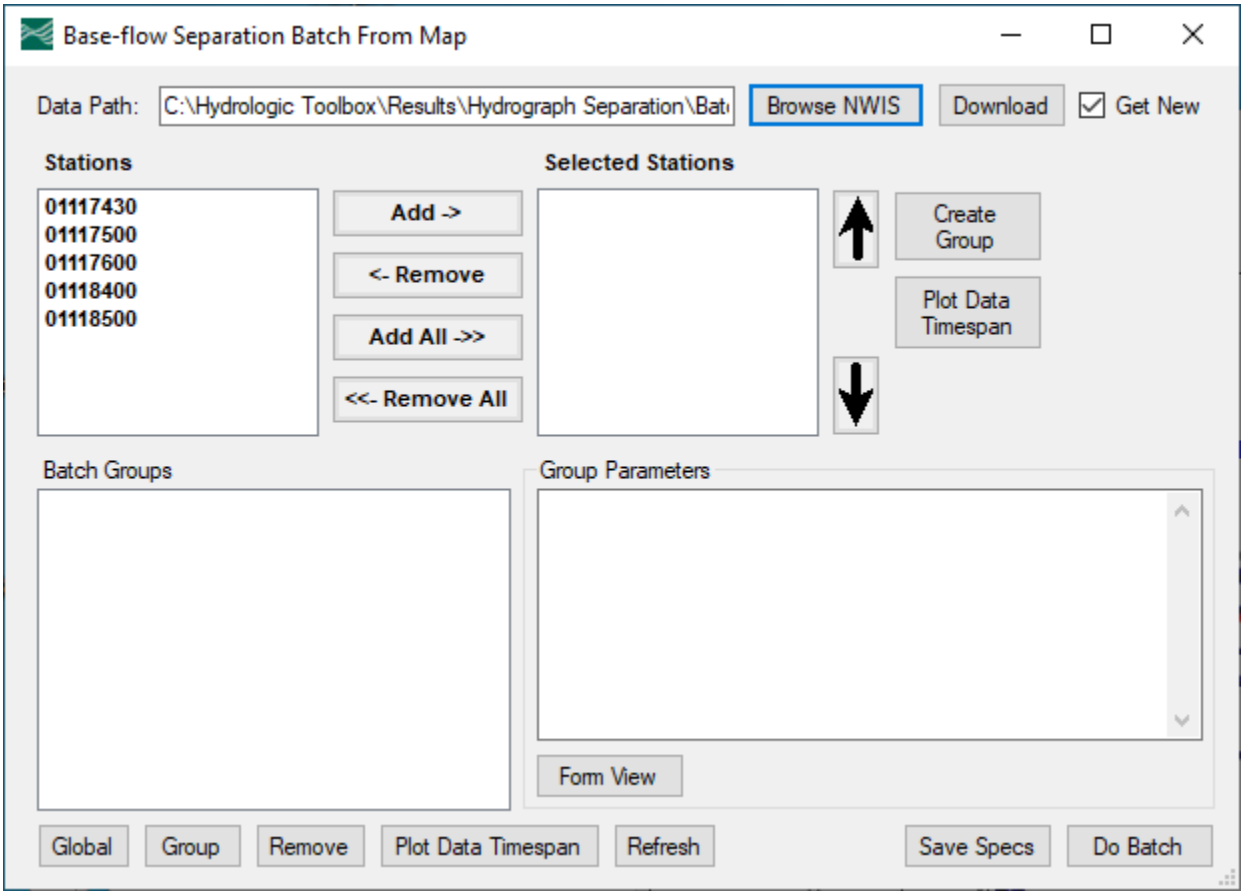

The data are now available for a batch-run analysis using the approach described previously.

Option 2: in the second approach, the user can create a list of USGS streamflow-gaging station identifiers in file ‘Stations.txt,’ which the program will use to download data. Each station identifier consists of numbers (typically, an 8-digit number), and only one station identifier can be listed per line. In this example, the text file ‘Stations.txt’ has been created in folder ‘Run 3,’ and includes 8-digit identifiers for the following five stations:

01117430
01117500
01117600
01118400

01118500

Now, by selecting “Browse NWIS,” the user can direct the program to the ‘Run 3’ folder and the program will open and read the station identifiers into the “Base-flow Separation Batch From Map” dialog box:




The user now checks the “Get New” option and then “Download” option to download new streamflow data for the gages of interest; these data will be stored in the ‘NWIS’ directory under the ‘Run 3’ folder.

The data are now available for a batch-run analysis using the approach described previously.

**“Batch File” Mode: Running an existing configuration file**

Once a user has created configuration files, they can be modified using a text editor and then rerun within the Hydrologic Toolbox.

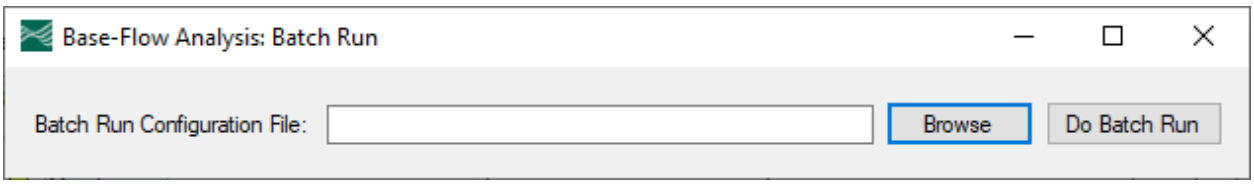
For example, we may want to adjust the start and end dates of analysis for the stations analyzed in Run 3 to include only 1971-2000, and then save the output to a different directory (‘Run 4’). This can be done by modifying the existing configuration file (‘BatchConfigBase-flowSep_12_26_2020 8_39_52 AM.txt’). (Note: the file must be saved as a plain-text document,

such as in WordPad). Note that the data directory points to the Run 3 example and output is specified for example Run 4. The revised configuration file is:

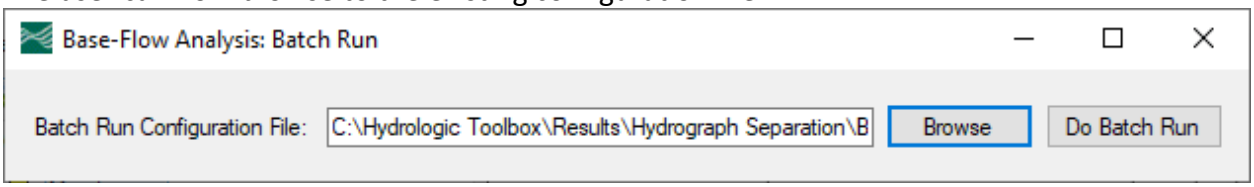
```
GLOBAL
STARTDATE    1971/01/01
ENDDATE      2000/12/31
BFMethod     PART
BFMethod     HYFX
BFMethod     HYLM
BFMethod     HYSL
BFMethod     BFIS
BFMethod     BFIM
BFMethod     DF1P
BFMethod     DF2P
BFI_TurnPtFrac        0.9
BFI_NDayScreen        5
BFI_RecessConst       0.97915
BFI_Reportby CY
Reportby     Calendar
FullSpanDuration      NO
BFLOWFilter  0.925
TwoPRDF_RC   Default
TwoPRDF_BFImax     Default
TwoParamEstimationMethodECKHARDT
DataDir      C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 3
OUTPUTDIR    C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 4
OUTPUTPrefix HS
END GLOBAL

BASE-FLOW
Station 01117430,72.7,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run
3\NWIS\NWIS_discharge_01117430.rdb
Station 01117500,100,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run
3\NWIS\NWIS_discharge_01117500.rdb
Station 01117600,5.53,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run
3\NWIS\NWIS_discharge_01117600.rdb
Station 01118400,17.2,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run
3\NWIS\NWIS_discharge_01118400.rdb
Station 01118500,295,C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run
3\NWIS\NWIS_discharge_01118500.rdb
STARTDATE    1971/01/01
ENDDATE      2000/12/31
BFMethod     PART
BFMethod     HYFX
```

```
BFMethod	HYLM
BFMethod	HYSL
BFMethod	BFIS
BFMethod	BFIM
BFMethod	DF1P
BFMethod	DF2P
BFI_TurnPtFrac	0.9
BFI_NDayScreen	5
BFI_RecessConst	0.97915
BFI_Reportby	CY
FullSpanDuration	NO
BFLOWFilter	0.925
TwoPRDF_RC	Default
TwoPRDF_BFImax	Default
TwoParamEstimationMethodECKHARDT
OUTPUTDIR	C:\Hydrologic Toolbox\Results\Hydrograph Separation\Batch Runs\Run 4
OUTPUTPrefix HS
END BASE-FLOW
```

Now, within the Hydrologic Toolbox, select the 'Batch File' option from the 'Base-Flow Separation Analysis' dialog box, which results in the following dialog box:




The user can now browse to the existing configuration file:




and then select 'Do Batch Run.' Output files for the time span (1971-2000) are then written to the 'Run 4' folder specified in the configuration file. Note that two of the stations analyzed here (01117430 and 01118400) did not have any data within the 1971-2000 time period and the output directories for these stations are empty.

In some cases the drainage area of a streamgage site that is reported on the USGS NWISWeb is inconsistent with other information that is available for the site, or two drainage areas are listed that reflect the contributing drainage area to the gage for different hydrologic conditions. In such cases, the user may want to modify the drainage area to the gage that is read from NWISWeb and stored in the RDB (relational data base) for the gage. This is done by modifying the configuration file. In a batch-file run, the Hydrologic Toolbox will use the drainage area

specified in the configuration file by default. For example, in the configuration file shown above, the drainage area for station 01117500 is shown as 100 square miles, which is the value stored in NWISWeb. The user can change that value if needed and rerun the configuration file with the new specified value. The value specified for the drainage area will have two effects on the calculations: the duration of surface runoff (see equation 1 in TM 3-B10) and the flow rates over the drainage area. Of these two, the effects on the duration of surface runoff may be relatively small, depending on the differences between the value of drainage area for the basin stored in NWISWeb and that specified by the user in the configuration file.