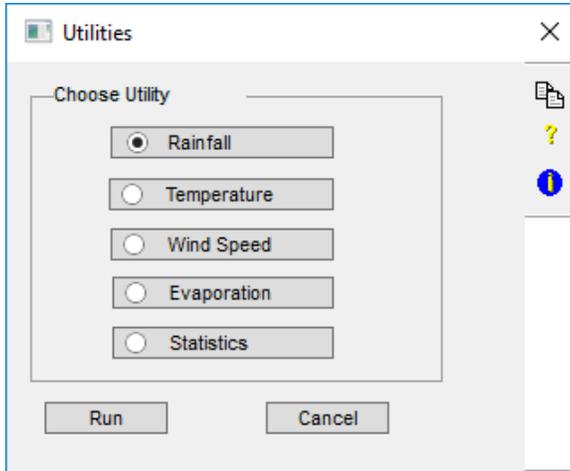


# Utilities

The **Utilities** command allows the conversion of various data files to Runoff input files and allows statistical analyses to be performed on XPSWMM and XPstorm interface files. In order to run a utility enter the required data from this dialog and hit the 'Run' button while the desired utility is selected.

On this page:

To open the utilities dialog, click **Tools -> Utilities** from the main menu bar.

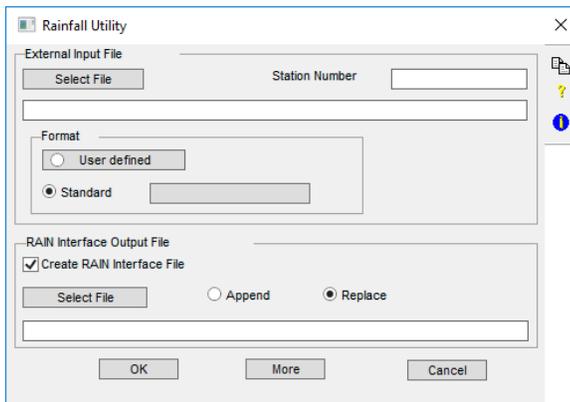


The following utility functions are available:

## Rainfall

The Rain utility is used to read long time series of precipitation records, perform an optional storm event analysis, and generate a precipitation interface file for input into Runoff. The purpose of the rain utility is to read long time series of precipitation records, to perform a storm event analysis, and/or generate a precipitation interface file for input into Runoff.

This dialog allows the entry of all Rainfall utility parameters. In order to run the utility, once the parameters have been entered, click OK, and hit the Run button from the main Utilities dialog.



## External Input File

**Select File.** Filename of external input time series file. Use the select button to display a directory listing and allow the required file to be selected. The filename can also be entered directly.

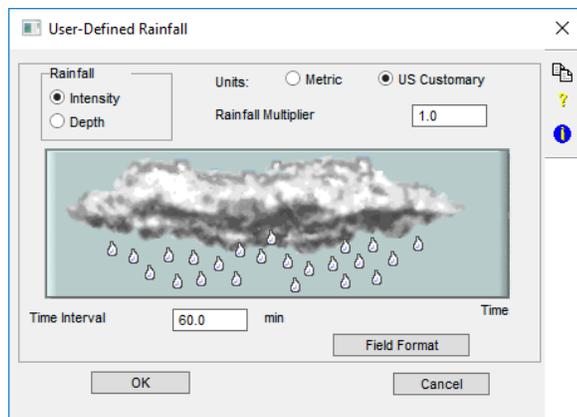
**Station Number.** Integer station number, up to six digits long. This parameter is the National Weather Service station number for NWS format files. Alternatively, for a user-defined format time series, this is the number used to identify the rainfall time series when the Runoff mode reads the RAIN interface file.

## Input File Format

The format of the external input file must be either selected from a list of [Standard](#) file formats, or defined using the [User Defined](#) format option.

## User Defined

This option should be selected if the input file does not match any of the [Standard](#) formats. If this option is selected, the definition and width of each input field must be entered in the underlying 'Field Format' dialog.



### Rainfall Unit

Specify the unit, depth or intensity, used to define rainfall values in the input time series file.

**Intensity.** Select 'Intensity' if the input data is specified as an intensity, in standard units of in./hr [mm/hr]. Note: other units (eg. mm/min) may be used by setting the 'Rainfall Multiplier' appropriately.

**Depth.** Select 'Depth' if the input data is specified as a depth of rainfall over the interval, in standard units of in. [mm]. Note: other units (eg. hundredths of an inch) may be used by setting the 'Rainfall Multiplier' appropriately.

### Units

Specify the units, metric or U.S. customary, of the data in the input time series file. If the units are metric, then the standard rainfall intensity unit is mm/hr, or depth in mm. If the units are U.S. customary, the standard rainfall intensity unit is in./hr, or depth in inches.

### Rainfall Multiplier

Value to multiply each input rainfall value by. This item can be used to convert non-standard units to standard units or to enter a dimensionless temporal pattern as a design storm.

### Time Interval

Time interval, in minutes, between rainfall values. Each rainfall value is assumed to be constant over this time interval.

### Field Format

This dialog allows a user-defined file format to be specified. The file format includes header definitions and descriptions of the sequence and widths of fields within data records in the input file.

The 'Field Format' dialog box contains the following elements:

- A checkbox labeled 'Free Format'.
- A text box labeled 'Number of header lines' with the value '0'.
- A grid for defining 10 fields. The first row is labeled 'Position' with values 1 through 5. The second row is labeled 'Information' and contains five empty text boxes. The third row is labeled 'Field Width' and contains five text boxes, each with the value '5'.
- A second row of the grid, labeled 'Position' with values 6 through 10, 'Information' (empty boxes), and 'Field Width' (boxes with '5').
- 'OK' and 'Cancel' buttons at the bottom.

**Free Format.** This flag specifies an input file format of either free or fixed format. When this flag is selected, the input file must be a FORTRAN free format file. In this format, numbers are separated by commas and/or spaces, and the actual column position within the line is not important; only the ordering of fields within the line matters. When this flag is OFF the input file format is fixed, where each relevant field must be within the column range specified.

**Number of header lines.** Number of lines of the input file to skip before reading field data. Set this item to a non-zero value if the input file contains header lines which should be ignored.

**Field Position.** The field position is the sequence number of the field within an input line. Note that dummy fields can be defined to allow for skipping of spaces and/or unused information.

**Field Information (Rainfall Variables).** Name of field to be read in from this position in the input file. Up to 10 field definitions can be entered. Each definition represents a column of character positions in the input file. The left most column is defined as column number 1 and so on. If the input file contains blank spaces or data that is not required, the DUMMY field type can be used to skip these positions. The DUMMY field type can be used multiple times if required. The field types supported are the station number, year, month, day, hour, minute, and precipitation.

The 'Rainfall Variables' dialog box features a list box with the following items:

- STN Station
- YR Year
- MTH Month
- DAY Day
- HR Hour
- MIN Minute

At the bottom, there are 'OK', 'Clear', and 'Cancel' buttons.

**Field Width.** Number of characters defining the data for this field. In Fixed format, all fields are concatenated on the input line. In Free format, the field width is irrelevant; as many characters as define each number are processed.

## Standard Format

As an alternative to the user-defined format a number of pre-defined formats including many of the National Weather Service hourly precipitation data formats are available. These are shown in the dialog below.

The 'Rainfall Formats' dialog box contains a list box with the following pre-defined formats:

- NWS80F NWS Post 1980 Fixed
- NWS80V NWS Post 1980 Variable
- NWS488 NWS Card Deck 488
- NWSDSK NWS Diskette
- CANAES Canadian AES
- NWSBRB NWS Diskette RBFIXed

At the bottom, there are 'OK', 'Clear', and 'Cancel' buttons.

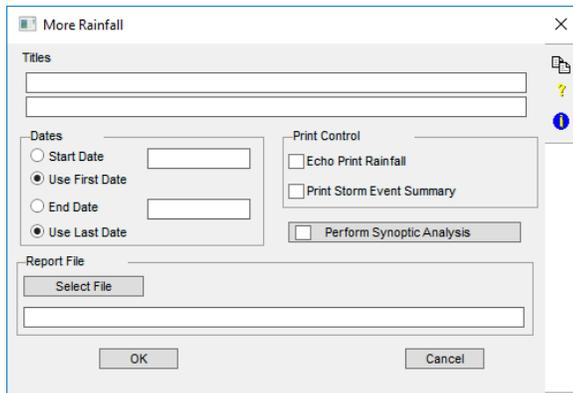
## RAIN Interface Output File

Filename of Rainfall output interface file. This is the name of the file which will be used later as input to the Runoff mode (if 'Create RAIN Interface File' has been selected). **Append** will cause the RAIN output file to be appended to if a file of the given name already exists. **Replace** will cause the RAIN output file to overwrite any existing file of the same name.

**Create RAIN Interface File.** This flag indicates a RAIN interface file is to be created. If this flag is ON the name of the file to create must be entered below. If this flag is OFF the 'Perform Synoptic Analysis' flag (under the [More Rainfall](#) button) must be turned ON, as at least one output option is required.

**Select File.** Filename of RAIN interface file to be created. Use the select button to display a directory listing and allow the required file to be selected. The filename can also be entered directly.

## More (Rainfall)



### Titles

Two descriptive title lines of up to 80 characters. Either or both titles may be left blank. These descriptive titles will be printed at the top of each page of output.

### Print Control

These parameters control the amount of output generated in the report file. This file contains the printable output, which can be voluminous depending on the options selected in this dialog. The output options include an echo of precipitation data, an annual storm event summary, a statistical summary (always generated), and synoptic analysis return period tables.

**Echo Print Rainfall.** This flag controls the echo of rainfall input in the output report file. The month/day/year and hour/rainfall are printed, five across a line, for each non-zero rainfall. This may generate one to three pages of output per year.

**Print Storm Event Summary.** This flag controls the printing of a storm event summary in the output report file.

The output table has the storm volume, average intensity, storm duration, beginning storm date, previous seven days rainfall, missing data, and number of meter malfunctions. One to two pages of output per year is generated depending on the actual number of storms per year.

### Dates

These options are used to define the period of the selected time series file that will be used on output. The simulation period can be entered manually; otherwise the start and end dates can be taken from the first and last data records belonging to the requested station number in the input file.

**Start Date.** Start of analysis date. The program starts processing data from this date. The date format is defined by the DATE\_FORMAT variable in the XPSWMM/XPSstorm .CFG configuration file. This item is ignored if the 'Use First Date' option is selected. All dates must be entered in one of the following formats, depending on your country configuration.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use First Date.** This option sets the analysis starting date to that of the first data record belonging to the requested station number in the selected time series input file.

**Ending Date.** End of analysis date. The program will stop reading data beyond this date. All dates must be entered in one of the following formats, depending on your country configuration. This item is ignored if the 'Use Last Date' option is selected.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

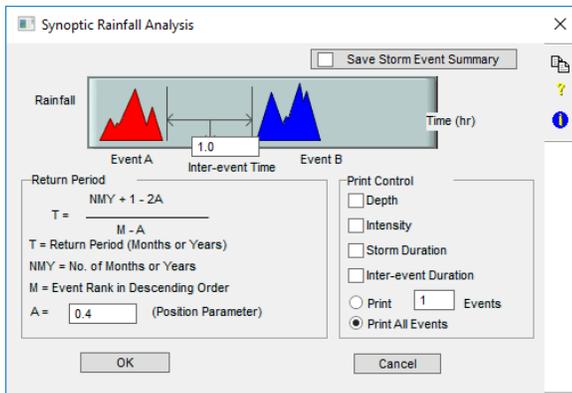
**Use Last Date.** This option sets the analysis ending date to that of the last data record belonging to the requested station number in the selected time series input file.

**Report File**

Name of the report file to be created. This file contains the printable output, which can be voluminous depending on the options selected in this dialog. The output options include an echo of precipitation data, an annual storm event summary, a statistical summary (always generated), and synoptic analysis return period tables.

**Perform Synoptic Analysis**

This flag controls synoptic analysis output to the report file. If this flag is ON then another screen of mandatory data will be displayed. If this flag is OFF the 'Create RAIN interface file' flag in the previous dialog must be ON, as at least one output option is required.



The synoptic analysis consists of generation of return period tables for storm volume, average intensity, duration, and inter-event time. Output is extensive, each return period table may be 10 to 20 pages long for a 30-year rainfall record.

Return periods are calculated on the basis of the equation given in this dialog. Calculations are made of estimates for the mean, variance, standard deviation, coefficient of variation, and coefficient of skewness for each requested parameter.

**Inter-event Time**

Minimum number of zero-rainfall hours to constitute separate rainfall events, ie. this number of hours with zero rainfall is required between two rainfall values for the values to be treated as separate storms. Dry periods of duration less than this value may exist within an event, preceded and followed by wet periods. If a value of 1 is chosen, every contiguous rainfall sequence will be viewed as a separate event.

Values of 3 to 30 hours are often used to separate rainfall events. Another approach uses the coefficient of variation (CV) of inter-event time (defined as the ratio of the standard deviation to the mean). The inter-event time giving a CV around 1.0 is usually chosen. This method assumes inter-event times have an exponential distribution, so that two trial values are used and corresponding CV values determined through two runs of the RAIN utility; a plot will give a good estimate of the minimum inter-event time for which CV is around 1.0.

**Return Period**

Empirical return period (plotting position) is calculated by the following equation:

$$T = (NYRS + 1 - 2*A) / (M - A)$$

where

T = return period, years

NYRS = simulation duration, years

M = rank of event (in descending order)

A = position parameter

**Position Parameter.** Parameter for return period calculation, it is dimensionless. Empirical return period (plotting position) is calculated by the above equation. A value of A = 0 gives the familiar Weibull plotting position, often used in hydrology, but criticised by Cunnane (1978) who suggested a value of A = 0.4 as a good compromise for the customary situation in which the underlying frequency distribution of the parameter is unknown.

#### **Print Control (Storm Event Tables)**

The sorted events from largest to smallest may be printed for storm volume, average intensity, storm duration, and inter-event duration. These parameters govern which tables are printed, and how much of each table is printed to the report file.

**Depth.** This flag controls the output of the table of rainfall depths/volumes by return period.

**Intensity.** This flag controls the output of the table of rainfall intensity by return period.

**Storm Duration.** This flag controls the output of the table of storm duration by return period.

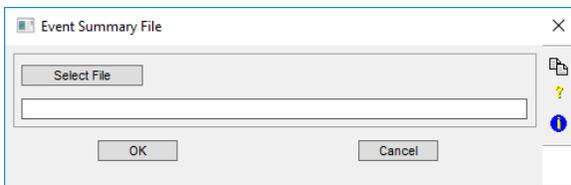
**Inter-event Duration.** This flag controls the output of the table of inter-event duration by return period.

**Print 'x' Events.** This option causes the specified number of storm events, ranked in order from highest return period to lowest, to be printed out in the report file.

**Print All Events.** This option causes all storm events, ranked in order from highest return period to lowest, to be printed out in the report file.

#### **Save Storm Event Summary**

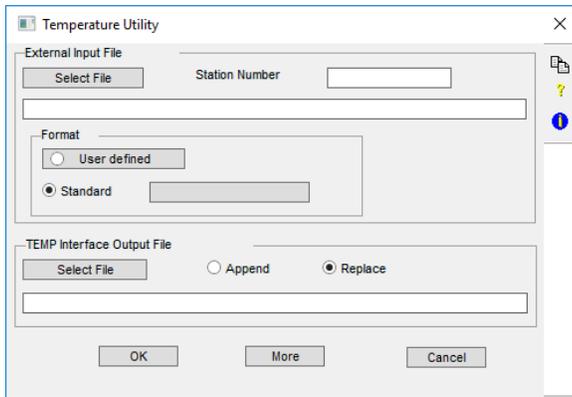
This flag indicates a storm event summary is to be output to an additional file. This file can then be read by a spreadsheet, database, or statistical program for further analysis. The output file has the same appearance as the normal printed storm event summary. Additionally, at the head of each column of numbers on the first line a short description of the variable is included.



**Select Event Summary File.** This button allows the naming of the output file for the additional Storm Event Summary. The file name can also be entered directly and should be different to the report output file name. If the select button is clicked the default filename is the XP filename with a .out extension, or alternatively the filename may be entered manually.

## Temperature Utility

The purpose of the Temperature utility is to convert temperature data of various formats to a format accessible to the Runoff mode. This dialog allows the entry of all Temperature utility parameters. In order to run the utility, once the parameters have been entered, OK this dialog and hit the Run button from the main Utilities dialog.



This utility manipulates a TEMP interface file. TEMP interface files are used for temperature, evaporation, and wind speed data in the Runoff module. Thus, the 'Evaporation' and 'Wind Speed' utilities also manipulate TEMP interface files.

## External Input File

**Select File.** Filename of external input time series file. Use the select button to display a directory listing and allow the required file to be selected. The filename can also be entered directly.

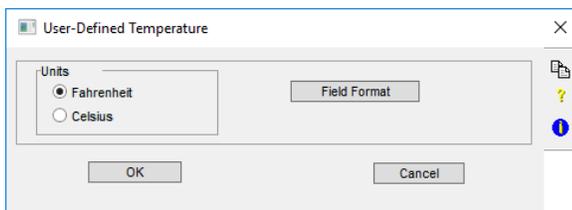
**Station Number.** Integer station number, up to six digits long. This parameter is the National Weather Service station number for NWS format files. Alternatively, for a user-defined format time series, this is the number used to identify the rainfall time series when the Runoff mode reads the TEMP interface file.

## Input File Format

The format of the external input file must be either selected from a list of [Standard](#) file formats, or defined using the [User Defined](#) format option.

## User Defined Temperature

This option should be selected if the input file does not match any of the standard formats. If this option is selected, the definition and width of each input field must be entered in the underlying 'Field Format' dialog.



Use this dialog to enter parameters specific to a user-defined format for temperature data. These parameters include the temperature unit and file format. The temperature unit used is entered on this dialog. The positioning of data in the input file is specified via the 'Field Format' button.

## Temperature Units

This parameter defines the unit of temperature to interpret values in the input time series file. It may be either degrees Fahrenheit, F or degrees Celsius, C.

### Fahrenheit

This option indicates data in the input file is specified in degrees Fahrenheit, F.

### Celsius

This option indicates data in the input file is specified in degrees Celsius, C.

## Field Format

This dialog allows a user-defined file format to be specified. The file format includes header definitions and descriptions of the sequence and widths of fields within data records in the input file.

**Free Format.** This flag specifies an input file format of either free or fixed format. When this flag is selected, the input file must be a FORTRAN free format file. In this format, numbers are separated by commas and/or spaces, and the actual column position within the line is not important; only the ordering of fields within the line matters. When this flag is OFF the input file format is fixed, where each relevant field must be within the column range specified.

**Number of header lines.** Number of lines of the input file to skip before reading field data. Set this item to a non-zero value if the input file contains header lines which should be ignored.

**Field Position.** The field position is the sequence number of the field within an input line. Note that dummy fields can be defined to allow for skipping of spaces and/or unused information.

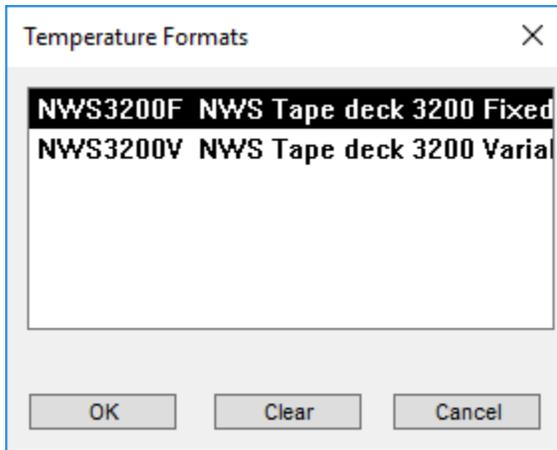
**Field Information (Temperature Variables).** Name of field to be read in from this position in the input file. Up to 10 field definitions can be entered. Each definition represents a column of character positions in the input file. The left most column is defined as column number 1 and so on. If the input file contains blank spaces or data that is not required, the DUMMY field type can be used to skip these positions. The DUMMY field type can be used multiple times if required. The field types supported are the station number, year, month, day, hour, minute, and precipitation.

**Field Width.** Number of characters defining the data for this field. In Fixed format, all fields are concatenated on the input line. In Free format, the field width is irrelevant; as many characters as define each number are processed.

## Standard Format

This option allows one of the standard file formats, recognised by the XPSWMM/XPS storm model, to be selected. The formats supported include many of the National Weather Service hourly precipitation data.

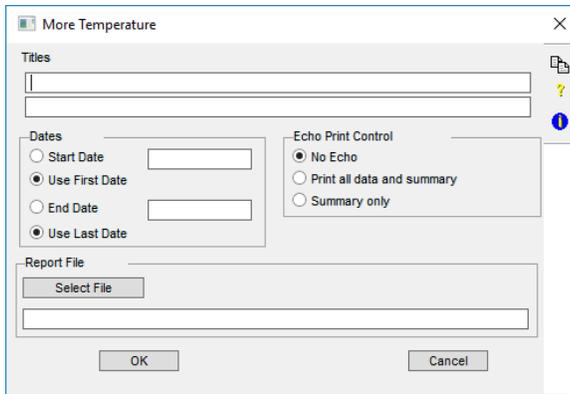
Only two National Weather Service standard formats are currently supported; NSW3200F and NWS3200V.



## TEMP Interface Output File

Sets the filename of the Temperature output interface file. This is the file which will be used later as input to the Runoff mode (if 'Create TEMP Interface File' has been selected). Append will cause the TEMP output file to be appended to if a file of the given name already exists. Replace will cause the TEMP output file to overwrite any other file of the same name which already exists.

## More Temperature



Additional mandatory temperature utility parameters are entered here. These parameters control the simulation period, options for output, and the output file selection.

### Titles

Two descriptive title lines of up to 80 characters. Either or both titles may be left blank. These descriptive titles will be printed at the top of each page of output.

### Dates

These options are used to define the period of the selected time series file that will be used on output. The simulation period can be entered manually; otherwise the start and end dates can be taken from the first and last data records belonging to the requested station number in the input file.

**Start Date.** Start of analysis date. The program starts processing data from this date. The date format is defined by the DATE\_FORMAT variable in the XPSWMM/XPSstorm .CFG configuration file. This item is ignored if the 'Use First Date' option is selected. All dates must be entered in one of the following formats, depending on your country configuration.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use First Date.** This option sets the analysis starting date to that of the first data record belonging to the requested station number in the selected time series input file.

**Ending Date.** End of analysis date. The program will stop reading data beyond this date. All dates must be entered in one of the following formats, depending on your country configuration. This item is ignored if the 'Use Last Date' option is selected.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use Last Date.** This option sets the analysis ending date to that of the last data record belonging to the requested station number in the selected time series input file.

### Print Control

These parameters determine the extent to which input data will be echoed to the output file. Three options exist for echoing input data in the output file, no echo, summary only or all data and summary. The summary tables contain the minimum, mean, and maximum values read in by month and/or year.

**No Echo.** This option does not echo input data in the output file. This eliminates the echo of the raw data input and the summary tables.

**Print all data and summary.** This option will result in voluminous output containing all the input data and the summary tables.

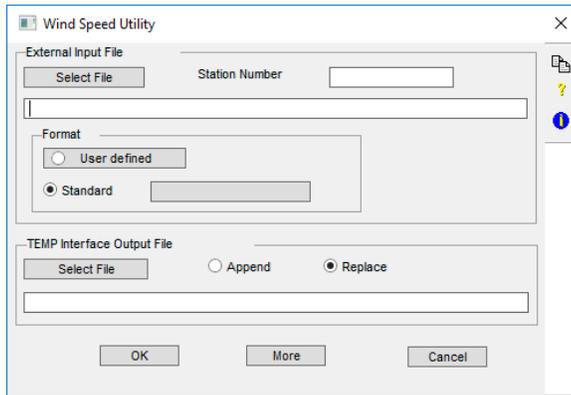
**Print Summary only.** This option prints only the monthly/yearly summary tables. This option is recommended.

### Report File

Name of the report output file to be created. The 'Select' button can also be used to enter a file name. If the select button is clicked the default filename will be the XP filename with a .out extension. The filename, however, can also be entered directly and should be different to the report output file name. This file contains the printable output, which can be voluminous depending on the Print Control options selected in this dialog.

## Wind Speed Utility

The **Wind Speed** utility converts wind speed data of various formats to a format accessible to the Runoff mode.



This dialog allows the entry of all Wind Speed utility parameters. In order to run the utility, once the parameters have been entered, OK this dialog and hit the Run button from the main Utilities dialog.

This utility manipulates a TEMP interface file. TEMP interface files are used for temperature, evaporation, and wind speed data in the Runoff module. Thus, the 'Temperature' and 'Evaporation' utilities also manipulate TEMP interface files.

## External Input File

**Select File.** Filename of external input time series file. Use the select button to display a directory listing and allow the required file to be selected. The filename can also be entered directly.

**Station Number.** Integer station number, up to six digits long. This parameter is the National Weather Service station number for NWS format files. Alternatively, for a user-defined format time series, this is the number used to identify the rainfall time series when the Runoff mode reads the TEMP interface file.

## Input File Format

The format of the external input file must be either selected from a list of [Standard](#) file formats, or defined using the [User Defined](#) format option.

### User Defined Wind Speed

This option should be selected if the input file does not match any of the standard formats. If this option is selected, the definition and width of each input field must be entered in the underlying 'Field Format' dialog.

### Units

Specify the units, metric (km/hr) or U.S. Customary (miles/hr), of the data in the input file.

### Wind Speed Multiplier

Floating point value to multiply each input wind speed value by. This item can be used as a conversion factor (eg m/s => km/hr).

### Field Format

This dialog allows a user-defined file format to be specified. The file format includes header definitions and descriptions of the sequence and widths of fields within data records in the input file.

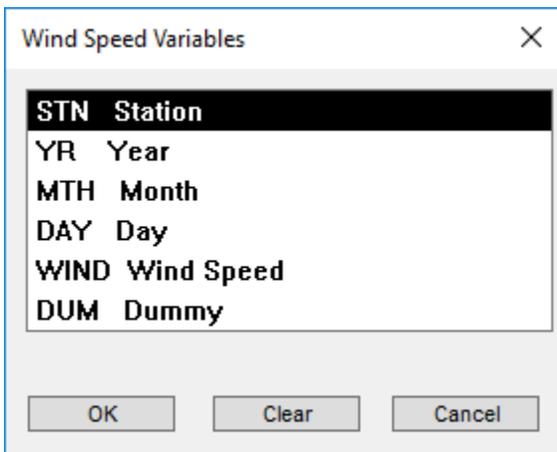
	1	2	3	4	5	6	7	8	9	10
Free Format	<input type="checkbox"/>									
Number of header lines	0									
Position	1	2	3	4	5	6	7	8	9	10
Information										
Field Width	5	5	5	5	5	5	5	5	5	5
Field Width	5	5	5	5	5	5	5	5	5	5

**Free Format.** This flag specifies an input file format of either free or fixed format. When this flag is ON the input file must be a FORTRAN free format file. In this format, numbers are separated by commas and/or spaces, and the actual column position within the line is not important; only the ordering of fields within the line is important. When this flag is OFF the input file format is fixed, and each field must be within the column range specified.

**Number of header lines.** Number of lines of the input file to skip before reading field data. Set this item to a non-zero value if the input file contains header lines which should be ignored.

**Field Position.** The field position is the sequence number of the field within an input line. Note that dummy fields can be defined to allow for skipping of spaces and/or unused information in fixed format files.

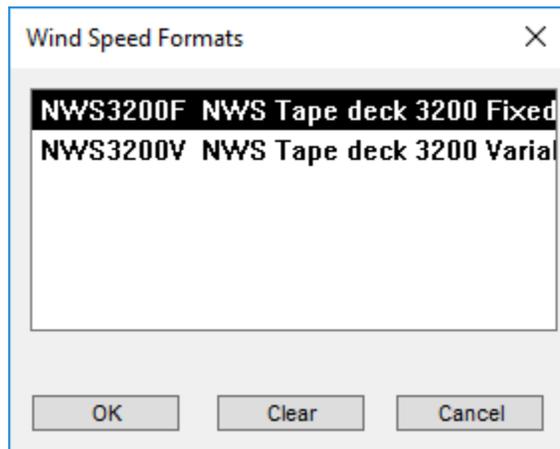
**Field Information.** Name of field to be read in from this position in the input file. Click this item to display a list of fields to select from. The field types supported are the station number, year, month, day, hour, minute, precipitation and dummy. Up to 10 field definitions can be entered. Each definition represents a column of character positions in the input file. The left most column is defined by column number 1 and so on. If the input file contains blank spaces or data that is not required, the DUMMY field type can be used to skip these positions. The DUMMY field type can be used multiple times if required.



### Standard Format

This option allows one of the standard file formats, recognised by the XPSWMM/XPStorm model, to be selected. The formats supported include many of the National Weather Service hourly precipitation data.

Only two National Weather Service standard formats are currently support; NSW3200F and NWS3200V.

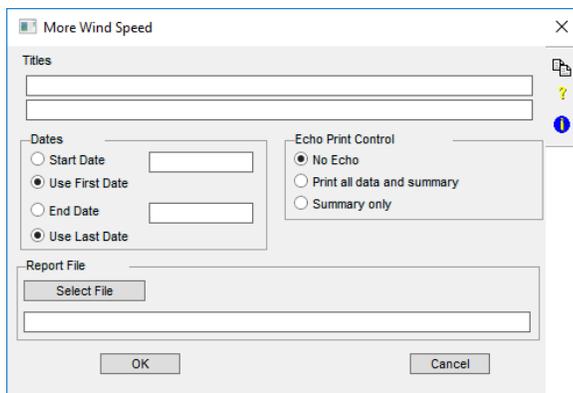


### TEMP Interface Output File

Filename of Temperature output interface file. This is the name of the file which will be used later as input to the Runoff mode (if 'Create TEMP Interface File' has been selected). Append will cause the TEMP output file to be appended to if a file of the given name already exists. Replace will cause the TEMP output file to overwrite any other file of the same name which already exists.

### More Wind Speed

Additional mandatory Wind Speed utility parameters. These parameters control the simulation period, options for output and the output file selection.



## Titles

Two descriptive title lines of up to 80 characters. Either or both titles may be left blank. These descriptive titles will be printed at the top of each page of output.

## Dates

These options are used to define the period of the selected time series file that will be used on output. The simulation period can be entered manually; otherwise the start and end dates can be taken from the first and last data records belonging to the requested station number in the input file.

**Start Date.** Start of analysis date. The program starts processing data from this date. The date format is defined by the DATE\_FORMAT variable in the .CFG configuration file. This item is ignored if the 'Use First Date' option is selected. All dates must be entered in one of the following formats, depending on your country configuration.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use First Date.** This option sets the analysis starting date to that of the first data record belonging to the requested station number in the selected time series input file.

**Ending Date.** End of analysis date. The program will stop reading data beyond this date. All dates must be entered in one of the following formats, depending on your country configuration. This item is ignored if the 'Use Last Date' option is selected.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use Last Date.** This option sets the analysis ending date to that of the last data record belonging to the requested station number in the selected time series input file.

## Print Control

These parameters determine the extent to which input data will be echoed to the output file. Three options exist for echoing input data in the output file, no echo, summary only or all data and summary. The summary tables contain the minimum, mean, and maximum values read in by month and/or year.

**No Echo.** This option does not echo input data in the output file. This eliminates the echo of the raw data input and the summary tables.

**Print all data and summary.** This option will result in voluminous output containing all the input data and the summary tables.

**Print Summary only.** This option prints only the monthly/yearly summary tables. This option is recommended.

## Report File

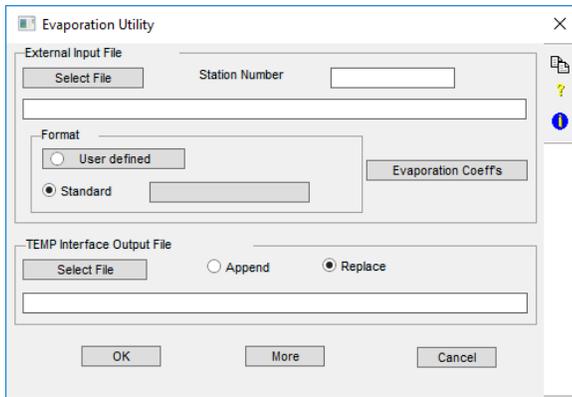
Name of the report output file to be created. The 'Select' button can also be used to enter a file name. If the select button is clicked the default filename will be the XP filename with a .out extension. The filename, however, can also be entered directly and should be different to the report output file name. This file contains the printable output, which can be voluminous depending on the Print Control options selected in this dialog.

## Evaporation Utility

The purpose of the Evaporation utility is to convert evaporation data of various formats to a format accessible to the Runoff mode.

This dialog allows the entry of all required evaporation parameters. In order to run the utility, once the parameters have been entered, OK this dialog and hit the Run button from the main Utilities dialog.

This utility manipulates a TEMP interface file. TEMP interface files are used for temperature, evaporation, and wind speed data in the Runoff mode. Thus, the 'Temperature' and 'Evaporation' utilities also manipulate TEMP files.



## External Input File

**Select File.** Filename of external input time series file. Use the select button to display a directory listing and allow the required file to be selected. The filename can also be entered directly.

**Station Number.** Integer station number, up to six digits long. This parameter is the National Weather Service station number for NWS format files. Alternatively, for a user-defined format time series, this is an arbitrary integer station identifier.

## Input File Format

The format of the external input file must be either selected from a list of [Standard](#) file formats, or defined using the [User Defined](#) format option.

### User Defined Evaporation

This option should be selected if the input file does not match any of the standard formats. If this option is selected, the definition and width of each input field must be entered in the underlying 'Field Format' dialog.

### Units

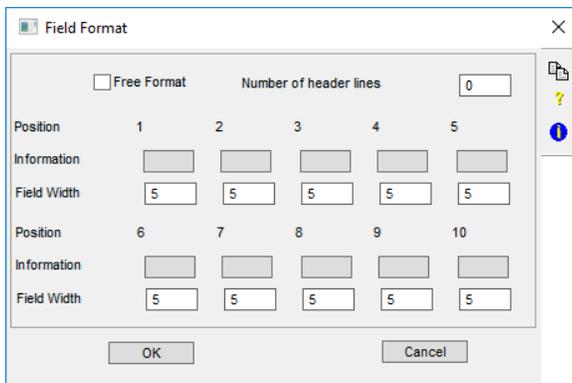
Specify the units, metric (mm/day) or U.S. Customary (in/day), of the data in the input file.

### Evaporation Multiplier

Floating point value to multiply each input evaporation value by. This item can be used as a conversion factor (eg mm/month => mm/day).

### Field Format

This dialog allows a user-defined file format to be specified. The file format includes header definitions and descriptions of the sequence and widths of fields within data records in the input file.

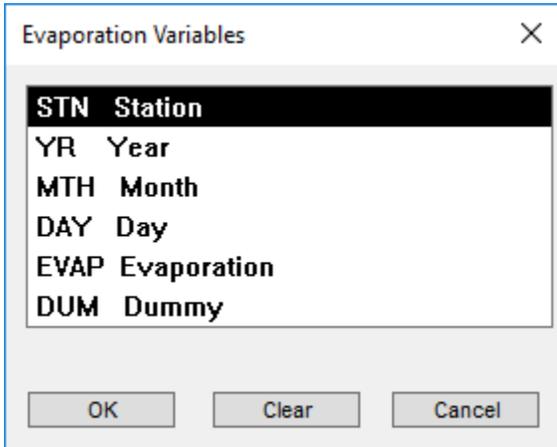


**Free Format.** This flag specifies an input file format of either free or fixed format. When this flag is ON the input file must be a FORTRAN free format file. In this format, numbers are separated by commas and/or spaces, and the actual column position within the line is not important; only the ordering of fields within the line is important. When this flag is OFF the input file format is fixed, and each field must be within the column range specified.

**Number of header lines.** Number of lines of the input file to skip before reading field data. Set this item to a non-zero value if the input file contains header lines which should be ignored.

**Field Position.** The field position is the sequence number of the field within an input line. Note that dummy fields can be defined to allow for skipping of spaces and/or unused information in fixed format files.

**Field Information.** Name of field to be read in from this position in the input file. Click this item to display a list of fields to select from. The field types supported are the station number, year, month, day, hour, minute, precipitation and dummy. Up to 10 field definitions can be entered. Each definition represents a column of character positions in the input file. The left most column is defined by column number 1 and so on. If the input file contains blank spaces or data that is not required, the DUMMY field type can be used to skip these positions. The DUMMY field type can be used multiple times if required.

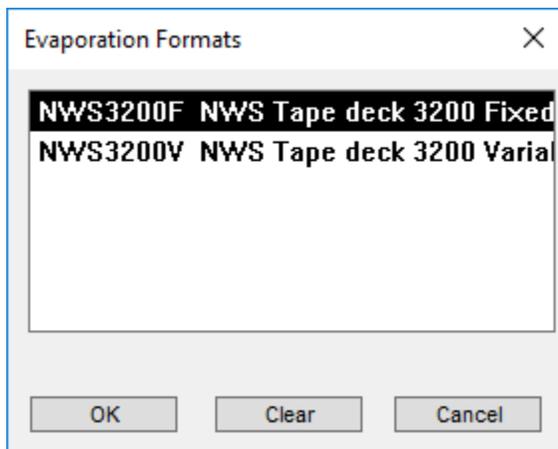


**Field Width.** Number of characters defining the data for this field. In Fixed format, all fields are concatenated on the input line. In Free format, the field width is irrelevant; as many characters as define each number are processed.

### Standard Format

This option allows one of the standard file formats, recognised by the XPSWMM/XPStorm model, to be selected. The formats supported include many of the National Weather Service hourly precipitation data.

Only two National Weather Service standard formats are currently supported: NSW3200F and NSW3200V.



### TEMP Interface Output File

Filename of TEMP output interface file. This is the name of the file which will be used later as input to the Runoff mode (if 'Create TEMP Interface File' has been selected). Append will cause the TEMP output file to be appended to if a file of the given name already exists. Replace will cause the TEMP output file to overwrite any other file of the same name which already exists.

### More Evaporation

Additional mandatory Evaporation utility parameters. These parameters control the simulation period, options for output selection and the output file selection.

### Titles

Two descriptive title lines of up to 80 characters. Either or both titles may be left blank. These descriptive titles will be printed at the top of each page of output.

### Dates

These options are used to define the period of the selected time series file that will be used on output. The simulation period can be entered manually; otherwise the start and end dates can be taken from the first and last data records belonging to the requested station number in the input file.

**Start Date.** Start of analysis date. The program starts processing data from this date. The date format is defined by the DATE\_FORMAT variable in the .CFG configuration file. This item is ignored if the 'Use First Date' option is selected. All dates must be entered in one of the following formats, depending on your country configuration.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use First Date.** This option sets the analysis starting date to that of the first data record belonging to the requested station number in the selected time series input file.

**Ending Date.** End of analysis date. The program will stop reading data beyond this date. All dates must be entered in one of the following formats, depending on your country configuration. This item is ignored if the 'Use Last Date' option is selected.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

**Use Last Date.** This option sets the analysis ending date to that of the last data record belonging to the requested station number in the selected time series input file.

### Print Control

These parameters determine the extent to which input data will be echoed to the output file. Three options exist for echoing input data in the output file, no echo, summary only or all data and summary. The summary tables contain the minimum, mean, and maximum values read in by month and/or year.

**No Echo.** This option does not echo input data in the output file. This eliminates the echo of the raw data input and the summary tables.

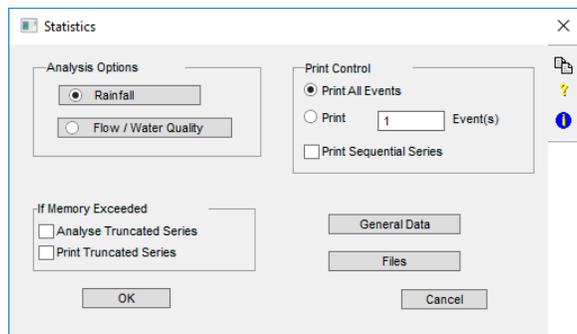
**Print all data and summary.** This option will result in voluminous output containing all the input data and the summary tables.

**Print Summary only.** This option prints only the monthly/yearly summary tables. This option is recommended.

### Report File

Name of the report output file to be created. The 'Select' button can also be used to enter a file name. If the select button is clicked the default filename will be the XP filename with a .out extension. The filename, however, can also be entered directly and should be different from the report output file name. This file contains the printable output, which can be voluminous depending on the Print Control options selected in this dialog.

## Statistics Utility



This utility is used to perform statistical analyses on continuous or single event data. Both water quantity and quality parameters may be analysed. The options available include separation of events with a table depicting the sequential series of events, a table of magnitude, return period and frequency of events, a graph of magnitude versus frequency, and the first three moments of the event data.

The Statistics utility operates on any XPSWMM/XPStorm interface files and any RAIN interface files. The analysis will be performed for all selected nodes in the network that have results generated for them in the interface file.

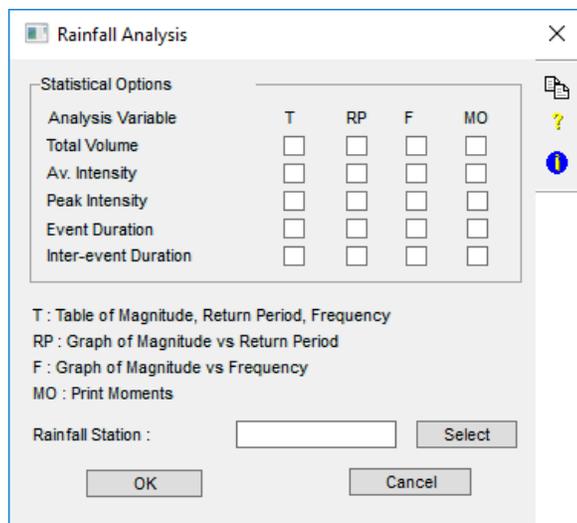
This dialog allows the entry of all Statistics utility parameters. In order to run the utility, once the parameters have been entered, OK this dialog and hit the Run button from the main Utilities dialog.

The utility operates by reading data from the interface file, printing descriptive information from the file header, and then printing a summary of the input file. The data is then separated into events. There is an internal limit to the number of events that can be analysed per location. After the entire simulation period has been examined, a table of the sequential series of events is printed, if requested. Tables of magnitude, return period, and frequency are then printed followed by graphs of magnitude versus return period or frequency. Finally, the mean, variance, standard deviation, coefficient of variation and coefficient of skewness of the event data are calculated and printed.

## Analysis Options

### Rainfall Analysis Options

This option allows statistics to be performed on rain gauge data. If this option is selected the input file must be a rain interface file generated from either the Runoff mode or the Rainfall utility.



## Statistical Options

These flags determine which variables will be reported on various output tables and graphs.

**Total Volume.** Select options in this row to perform statistical analysis on total rainfall volumes. Event volumes are reported as inches [mm].

**Average Intensity.** Select options in this row to perform statistical analysis on average rainfall intensities, reported as in./hr [mm/hr].

**Peak Intensity.** Select options in this row to perform statistical analysis on peak rainfall intensities, reported as in./hr [mm/hr].

**Event Duration.** Select options in this row to perform statistical analysis on event durations, reported in hours.

**Inter-event Duration.** Select options in this row to perform statistical analysis on inter-event durations, reported in hours.

## Table of Magnitude, Return Period and Frequency

Select options in this column to print tables of magnitude, return period and frequency for different variables.

## Graph of Magnitude vs. Return Period

Select options in this column to graph on a line printer magnitude against period for different variables.

## Graph of Magnitude vs. Frequency

Select options in this column to graph on a line printer magnitude against frequency for different variables.

## Print Moments

Select options in this column to calculate and print unbiased estimates for the mean, variance, standard deviation, coefficient of variation and coefficient of skewness for different variables.

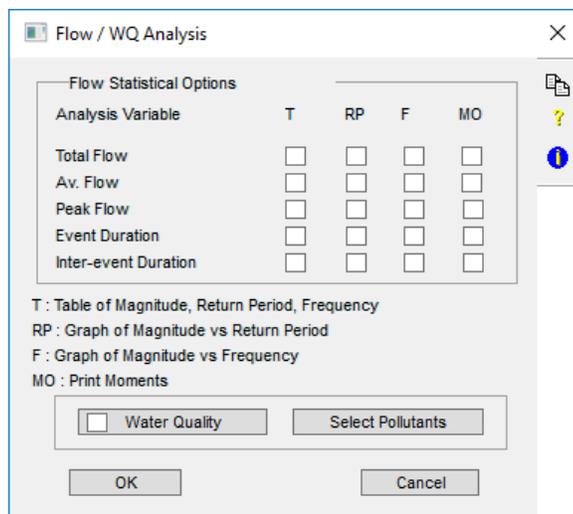
## Rainfall Station

An integer number representing the rain station. Use the select button to read the station numbers from the interface. Station numbers are read from the file specified as the input file in the Files dialog. If an error occurs reading the interface file it may be because the file is not in the expected format. If the interface file was not created by XPSWMM/XPStorm it may need to be converted.

## Flow/Water Quality Analysis Option

This dialog allows the entry of flow and water quality analysis options. The options selected will be performed on each of the highlighted nodes. It is assumed the input file is a XPSWMM/XPStorm interface file generated for the current network.

Only nodes which exist in the input file should be selected while running flow statistics. The nodes created in the file will depend on which XPSWMM/XPStorm mode created the file. For Runoff and Extran all end nodes (nodes with no outgoing conduits for that mode) will be created. For Transport the nodes created will be all those with the 'Save Outflows to XPSWMM/XPStorm Interface File' flag selected.



The dialog box titled "Flow / WQ Analysis" contains a table for selecting statistical options. The table has columns for Analysis Variable, T, RP, F, and MO. Below the table are legends for T, RP, F, and MO. At the bottom, there are buttons for "Water Quality", "Select Pollutants", "OK", and "Cancel".

Analysis Variable	T	RP	F	MO
Total Flow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Av. Flow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peak Flow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Event Duration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inter-event Duration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

T : Table of Magnitude, Return Period, Frequency  
RP : Graph of Magnitude vs Return Period  
F : Graph of Magnitude vs Frequency  
MO : Print Moments

Water Quality      Select Pollutants

OK      Cancel

## Flow Statistical Options

These flags determine which variables will be reported on various output tables and graphs.

**Total Flow.** Select options in this row to perform statistical analysis on total flow. Event flows are reported as cfs [cms].

**Average Flow.** Select options in this row to perform statistical analysis on average flow, reported as cfs [cms].

**Peak Flow.** Select options in this row to perform statistical analysis on peak flow, reported as cfs [cms].

**Event Duration.** Select options in this row to perform statistical analysis on event durations, reported in hours.

**Inter-event Duration.** Select options in this row to perform statistical analysis on inter-event durations, reported in hours.

## Table of Magnitude, Return Period and Frequency

Select options in this column to print tables of magnitude, return period and frequency for different variables.

## Graph of Magnitude vs. Frequency

Select options in this column to graph on a line printer magnitude against frequency for different variables.

## Print Moments

Select options in this column to calculate and print unbiased estimates for the mean, variance, standard deviation, coefficient of variation and coefficient of skewness for different variables.

## Water Quality

This flag and the underlying dialog allows the statistical analysis options to be selected for each pollutant being analysed. Enter the analysis you wish to perform for the highlighted pollutant and repeat for each pollutant in the list. Exit this dialog and enter the 'Select Pollutants' dialog to select the list of pollutants to analyse.

If the input interface file was generated by Extran the 'Water Quality Analysis' parameters will be ignored, since Extran currently does not route water quality.

Analysis Variable	T	RP	F	MO
Total Load	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Av. Load	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peak Load	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flow Weigh Av. Conc	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peak Conc.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

T : Table of Magnitude, Return Period,  
 RP : Graph of Magnitude vs Return Period  
 F : Graph of Magnitude vs Frequency  
 MO : Print Moments

## Flow Statistical Options

These flags determine which variables will be reported on various output tables and graphs.

### Total Load

Select options in this row to perform statistical analysis on the total pollutant loads. The unit that the results are reported in depends on the pollutant unit as follows:

Pollutant Unit	Unit for Total Load
mg/liter	lb [kg]
'other'/liter	Quantity [Quantity]
other ft <sup>3</sup> *PUNIT	[litre*PUNIT]

**where**

Quantity = quantity of the pollutant involved

PUNIT = label for given pollutant unit

**Average Load**

Select options in this row to perform statistical analysis on the average pollutant loads. The unit that the results are reported in depends on the pollutant unit as follows:

Pollutant Unit	Unit for Ave. Load
mg/liter	lb/hr [kg/hr]
'other'/liter	[Quantity/hr]
other cfs*PUNIT	[litre/sec*PUNIT]

**where**

Quantity = quantity of the pollutant involved

PUNIT = label for given pollutant unit

**Peak Load**

Select options in this row to perform statistical analysis on the peak pollutant loads. The unit that the results are reported in depends on the pollutant unit as follows:

Pollutant Unit	Unit for Peak Load
mg/liter	lb/hr [kg/hr]
'other'/liter	[Quantity/hr]
other cfs*PUNIT	[litre/sec*PUNIT]

**where**

Quantity = quantity of the pollutant involved

PUNIT = label for given pollutant unit

**Flow Weighted Average Concentration**

Select options in this row to perform statistical analysis on the Flow weighted average pollutant concentrations (event mean concentration). The unit that the results are reported in depends on the pollutant unit as follows:

Flow Weighted Pollutant Unit	Unit for Ave. Concentration
mg/liter	mg/l [mg/l]
'other'/liter	PUNIT [PUNIT]
other PUNIT	[PUNIT]

**where**

PUNIT = label for given pollutant unit

**Peak Concentration**

Select options in this row to perform statistical analysis on the peak pollutant concentrations. The unit that the results are reported in depends on the pollutant unit as follows:

Pollutant Unit	Unit for Peak Concentration
mg/liter	mg/l [mg/l]
'other'/liter	PUNIT [PUNIT]

other PUNIT	[PUNIT]
-------------	---------

*where*

PUNIT = label for given pollutant unit

### Table of Magnitude, Return Period and Frequency

Select options in this column to print tables of magnitude, return period and frequency for different variables.

### Graph of Magnitude vs. Period

Select options in this column to graph on a line printer magnitude against period for different variables.

### Graph of Magnitude vs. Frequency

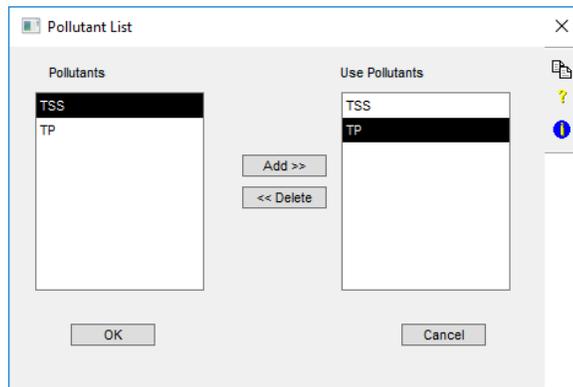
Select options in this column to graph on a line printer magnitude against frequency for different variables.

### Print Moments

Select options in this column to calculate and print unbiased estimates for the mean, variance, standard deviation, coefficient of variation and coefficient of skewness for different variables.

### Select Pollutants

Hit this button to select the list of pollutants to perform quality analysis on. This data is required only if water quality analysis is to be performed.



Any number of pollutants may be defined, but a maximum of 20 may be used in any particular simulation. (this is the typical configuration but if errors are encountered the SWMM.PAR file should be checked for the actual maximum number allowed). The pollutants to be used are chosen from those defined in the 'Pollutants' Global Database. To add a pollutant to the "Use Pollutants" list, highlight the pollutant required in the Pollutant list (left-hand list), then select the "Add" button. To remove a pollutant from the list select the pollutant you wish to delete from the "Use Pollutants" list (right-hand list), then select the "Delete" button.

### Statistics Print Control

These options control the amount of results printed in the report file. The sequential series of events is controlled, as is the number of events, in the output tables of magnitude, return period and frequency.

#### Print All Events

Select this option to print all events in the table of magnitude, return period, and frequency. This table shows the date and time that each event began, the magnitude of the event being analysed, the return period (in years or months), and the percentage of occurrences that are less than or equal to the given magnitude. The table is sorted in descending order of magnitude.

#### Print 'x' events

Select this option to print the top 'x' events in the table of magnitude, return period, and frequency. This table shows the date and time that each event began, the magnitude of the event being analysed, the return period (in years or months), and the percentage of occurrences that are less than or equal to the given magnitude. The table is sorted in descending order of magnitude.

#### Print Sequential Series

This flag controls printing of a sequential time series. If this flag is selected a table of the original series of events before any sorting has taken place will be printed. The table depicts the original time series after the time steps have been grouped into events. The table includes the date and time of day that each event began, flow volume of each event, total rainfall during the flow event, duration of each event, and inter-event duration (time from the end of the previous event).

## If Memory Exceeded

The options in this box will only become relevant if the number of events exceeds the maximum number allowable. Since the maximum is normally set reasonably high, it is unlikely these options will be invoked.

If the number of events exceeds the internal limit, and the 'Analyze Truncated Series' flag is ON, the table will still be printed, ignoring the rest of the series. If the 'Analyze Truncated Series' flag is OFF and memory is exceeded, this flag will be ignored. In this case printing of the series will depend on the 'Print Truncated Series' flag.

### Analyze Truncated Series

If this flag is selected and memory is exceeded, analysis will still be performed on the truncated series. Selecting this option will cause the 'Print Truncated Series' flag to be ignored. Printing of the truncated series will then depend on the 'Print Sequential Series' flag.

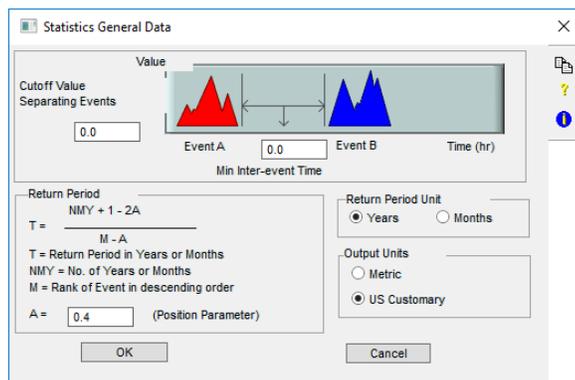
### Print Truncated Series

This flag controls printing of a sequential time series if memory is exceeded. If this flag is selected and memory is exceeded a table of the events read so far will be printed.

If the 'Analyze Truncated Series' flag is ON this flag will be ignored. In this case printing of the series will depend on the 'Print Sequential Series' flag.

## Statistics General Data

These mandatory parameters define the criteria for an event and units for data to be presented in tables.



### Cutoff Value Separating Events

Events are separated using a base or cutoff value. Values greater than this threshold are part of the event; conversely values less than or equal to this threshold are part of the inter-event period. The value may be interpreted as a flow, volume or intensity, depending on the type of analysis being done.

The units depend on what the interface file contains. The units for rainfall intensity are in./hr [mm/hr]. The units for rainfall volume are in. [mm]. The units of flow are cfs [cumec].

### Minimum Inter-event Time

Minimum number of dry hours between separate events. Minimum period of zero values (or values less than the base value) before any new values will be considered part of a separate event.

If a value of zero is chosen for this value, every wet time step will be viewed as a separate event. Values less than the base value will be considered as part of an inter-event period.

Values of 3 to 30 hours are often used to separate rainfall events. Another approach uses the coefficient of variation (CV) of inter-event time (defined as the ratio of the standard deviation to the mean). The inter-event time giving a CV around 1.0 is usually chosen. This method assumes inter-event times have an exponential distribution, so that two trial values are used and corresponding CV values determined through two runs of the Statistics utility; a plot will give a good estimate of the minimum inter-event time for which CV is around 1.0. Depending upon the site, this definition applied to the runoff time series can yield large values in the order of 100 hours.

## Return Period

Empirical return period (plotting position) is calculated by the following equation:

$$T = (NMY + 1 - 2 \cdot A) / (M - A)$$

### where

T = return period, months or years

NMY = simulation duration, months or years

M = rank of event (in descending order)

A = position parameter

The frequency computed for each event is the percent of total events less than or equal to the given magnitude:

$$FREQ = 100 \cdot (1 - (M - 1)/N)$$

### where

FREQ = percentage not greater than a given magnitude

M = rank of event (in descending order)

N = total number of events within the period of analysis

## Position Parameter

Parameter for return period calculation, dimensionless. Empirical return period (plotting position) is calculated from the above equation.

A value of  $A = 0$  gives the familiar Weibull plotting position, often used in hydrology, but criticised by Cunnane (1978) who suggested a value of  $A = 0.4$  as a good compromise for the customary situation in which the underlying frequency distribution of the parameter is unknown.

## Return Period Units

Return periods will be calculated using either months or years as the basic time unit.

## Output Units

This parameter indicates the system of units in which output is reported, metric or US Customary.

## Files (Statistics Files)

Input and output files for the statistics utility and the period of analysis to be extracted from the input file (if the entire period covered by the file is not required).

The screenshot shows a dialog box titled "Statistics Files". It has a standard Windows-style title bar with a close button (X). The dialog is divided into three main sections. The first section, "Input Interface File", contains a "Select File" button and an empty text input field. The second section, "Starting\_Ending Dates", contains four text input fields: "Start Date" (01/01/1990), "End Date" (01/01/1990), "Start Time" (h:m), and "End Time" (h:m). Below these fields are two checked checkboxes: "Use First Date and Time" and "Use Last Date and Time". The third section, "Output File", contains a "Select File" button and an empty text input field. At the bottom of the dialog are "OK" and "Cancel" buttons.

### Input Interface File

Filename of SWMM or RAIN interface input file. Use the select button to display a directory listing and allow the required file to be selected or alternatively enter the name manually.

### Start and Ending Dates

*Start Date*

Start of analysis date. All dates must be entered in one of the following formats, depending on your country configuration.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

The date format is defined by the DATE\_FORMAT variable in the SWMM.CFG configuration file.

This item is ignored if the 'Use First Date and Time' option is selected.

***Start Time***

Start of analysis time. The time can be entered in either 12 or 24 hour format, (HH:MM or HH:MMpm).

This item is ignored if the 'Use First Date and Time' option is selected.

***Use First Date and Time***

This option sets the analysis starting date and time to the first value found in the input interface file.

***End Date***

End of analysis date. All dates must be entered in one of the following formats, depending on your country configuration.

Day, Month, Year DD/MM/YY

Month, Day, Year MM/DD/YY

Year, Month, Day YY/MM/DD

The date format is defined by the DATE\_FORMAT variable in the SWMM.CFG configuration file.

This item is ignored if the 'Use Last Date and Time' option is selected.

***End Time***

End of analysis time. The time can be entered in either 12 or 24 hour format, (HH:MM or HH:MMpm).

This item is ignored if the 'Use Last Date and Time' option is selected.

***Use Last Date and Time***

This option indicates that analysis should continue to the end of the available record in the interface file.

## Run

This button runs the currently selected utility. The required data for the selected utility must be entered first.