Calculator for Low Flows (CaLF), Version 2.1

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DESCRIPTION

CaLF is a tool for: (1) downloading USGS daily streamflow data; (2) calculating the seven-day two-year low flow (7Q2); (3) calculating and plotting the flow duration curve; (4) calculating the harmonic mean; (5) calculating the Lyons' method monthly minimum streamflow and the modified Lyons' method streamflow and adjusting them via a Drainage Area Ratio (DAR) if desired; and (6) graphing these two minimum flows. The tool uses web services to download U.S. Geological Survey (USGS) mean daily streamflow data over an internet connection. This data is imported to the CaLF tool and manipulated through Visual Basic programming.

More information on the 7Q2 can be found here: http://info.sos.state.tx.us/fids/30_0307_0010-7.html. More on the Lyons' method here: https://repositories.lib.utexas.edu/handle/2152/6714.

REQUIREMENTS

The tool requires the installation of HydroObjects, which is included as part of this download. HydroObjects is also available online at http://his.cuahsi.org/hydroobjects.html.

The tool also requires that the "Analysis Toolpack" be activated within the Excel program. This is already done in the downloadable file.

USE

To use the CaLF tool, the user enters the desired USGS gauge station number into the "Station Definition" worksheet and the desired start and end dates.

The user then selects the "Calculate!" button. Depending on the speed of the internet connection, LDCurve takes a few minutes to access, retrieve, and import the data. The data is then manipulated to calculate and plot the results.

The imported flow data and flow duration curve calculations are contained in the "Flow Data" worksheet and the FDC is plotted on the "FDC" worksheet.

The 7Q2 is calculated and reported on the "7Q2" worksheet by calculating the seven-day minimum flow within each year of record (the 7Q1), then determining the value in this new series with a 2-year return interval (i.e., the median of the 7Q1 values).

The harmonic mean is calculated and reported on the "Harmonic Mean" worksheet according to the equation provided on that worksheet.

The Lyons' and Modified Lyons' flows are calculated and reported on the "Lyons" worksheet and plotted on the "Lyons Chart" worksheet. The Lyons' flows are calculated as 40% of the monthly median streamflow for October through February and 60% of the monthly median streamflow for March through September. The Modified Lyons' method simply replaces any monthly calculated Lyons' flows which fall below the 7Q2 with the calculated 7Q2 value (effectively using the 7Q2 minimum flow as an absolute floor).

If desired, the Lyons' and Modified Lyons' flows can be adjusted via a user-input Drainage Area Ratio (DAR) on the "Lyons" worksheet. The DAR can be entered directly, or the Diversion Point Area and the Stream Gage Area can be entered and the DAR will be calculated accordingly.

TROUBLESHOOTING

If CaLF is not functioning properly, ensure the following:

1. Macros are enabled in your Excel workbook
2. HydroObjects is correctly installed on your computer
3. The Excel "Analysis Toolpack" is activated
4. You have a live internet connection and appropriate permissions to download information from the internet
5. The USGS gaging station requested has mean daily flow data for the time frame entered

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CONTACT

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VERSION UPDATES

The following updates are included in version 2.1:

1. On the 'Station Definition' tab, two user input boxes for "7Q2 Missing Value Filtering Options" were added – "Applying Filtering? (Y/N)" and "Allowable Percent of Missing Days, 7/1-9/30." Per TCEQ guidance, a year of flow data may only be included in the 7Q2 calculation if two conditions are met: there are 6 months or more of data within the year, and those 6 months include the critical period July 1 through September 30, inclusive. Opting to "Apply Filtering" sets these two conditions as mandatory. The second option allows the user to set the allowable portion of daily flow values to be missing from the record and still be included in the calculation. A value of 0% means that every single day from 7/1 through 9/30 must be present, whereas a value of 100% means that every single day in that period may be missing.
   If the filter is not applied, two default filtering criteria are applied. These include: any 7-day period which includes a missing daily flow value will be excluded from the calculation, and any year missing all of its 7-day averages will be excluded from the calculation.
2. On the '7Q2' tab, an error message of "filter conditions not met" will be written into years where applicable per the above-specified criteria.
3. On the 'Harmonic Mean' tab, a bug was fixed such that the period of record included in the calculation is now updating properly.
4. Also on the 'Harmonic Mean' tab, intermediary calculation output is not explicitly printed, including the Unadjusted Harmonic Mean (left hand term in the provided equation), the Number of Flow Days (N_T), and the Number of Zero Flow Days (N_0).

PERTINENT REGULATIONS

CHAPTER 307 : TEXAS SURFACE WATER QUALITY STANDARDS
Effective August 17, 2000
§307.3. Definitions and Abbreviations.
https://repositories.lib.utexas.edu/bitstream/handle/2152/6719/Texas%20Surface%20WQ%20Standards_2000.pdf?sequence=2

(48) **Seven-day, two-year low-flow (7Q2)** - The lowest average stream flow for seven consecutive days with a recurrence interval of two years, as statistically determined from historical data. As specified in §307.8 of this title, some water quality standards do not apply at stream flows which are less than the 7Q2 flow.

Figure 30 TAC §307.10(2)
Appendix B - Low-Flow Criteria
http://info.sos.state.tx.us/fids/30_0307_0010-7.html

The table contains seven-day, two-year low flow (7Q2) and harmonic mean flow values, as defined in §307.3 of this title, for U.S. Geological Survey (USGS) gages (International Boundary and Water Commission (IBWC) for Rio Grande segments) listed in Commission stream segment order. Where multiple gages are listed for a segment, the gages are sequenced from a downstream to upstream order. The listed county names provide the general location of the gaging stations. Specific gage locations may be obtained from the report, Water Resource Data - Texas, which is published on an annual basis by the USGS or from the IBWC for Rio Grande segments. The flow values are calculated for each gaging station for the listed period of record from USGS or IBWC data that is currently in the Commission computerized data base. The flow values presented in Appendix B are intended as guidelines and may be recalculated as additional data become available. Low flow values utilized in conjunction with Commission regulatory actions (such as discharge permits) may be derived from data obtained at other USGS or IBWC gaging stations not presented in the table, Commission monitoring stations, drainage basin comparisons, interpolations or best available information.