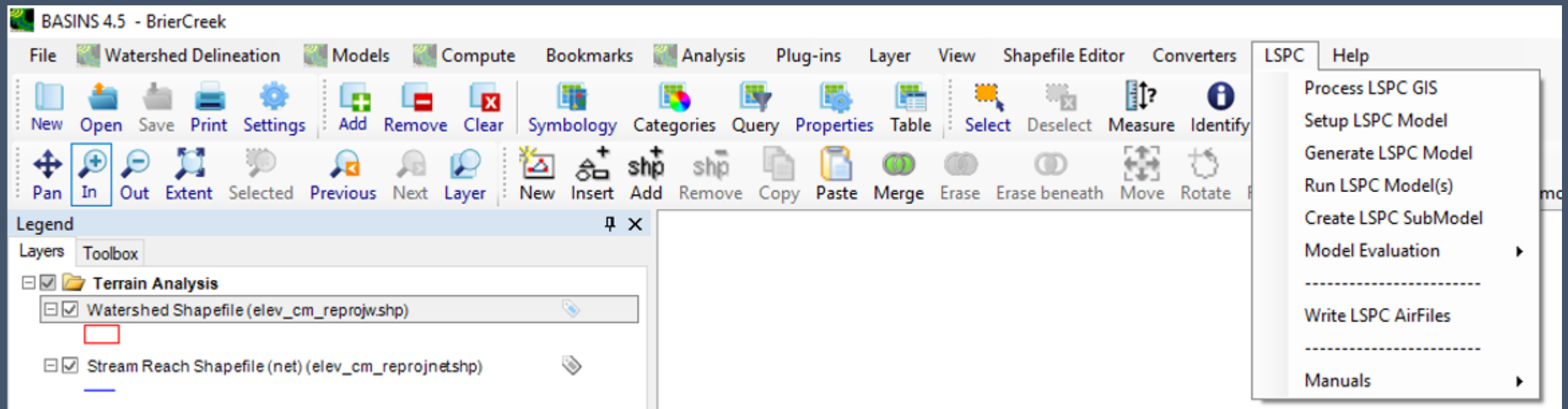


Harpeth LSPC Model

R4 Modeling Team

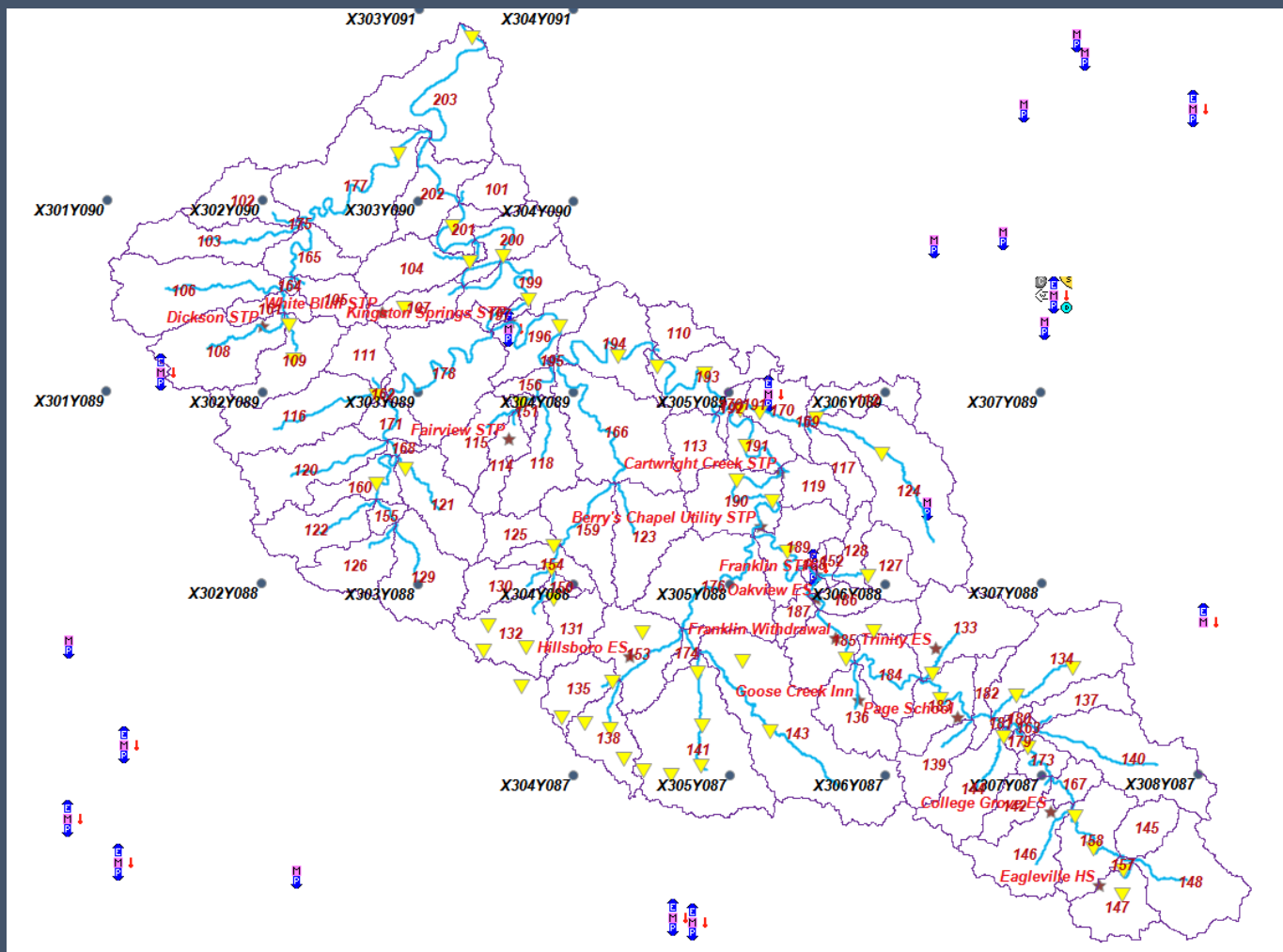
Loading Simulation Program in C++ (LSPC), the HSPF model written in C++ (BASINS 4.5 Plugin builds an initial LSPC model that a user can customize)



LSPC Plugin accessible from main menu. Users can enable the plugin from the *Plug-ins* menu.

<https://www.epa.gov/ceam/basins-download-and-installation>

Harpeth LSPC Model Setup



- 100 Subbasins
- 14 Point Sources and 1 permitted withdrawal
- 2016 LULC and Impervious layers (13 modeled categories)
- SSURGO Soils (4 hydrologic soil groups)
- 23 NLDAS gridded and 5 NCEI weather stations
- 4 Flow and WQ monitoring stations

Evaluate goodness-of-fit of model for existing condition (2011-2016) using a set of criteria; Considered the quality and uncertainty of observed flow and WQ measurements

- ***Qualitative***

- Time series plots; Period-of-Record and Annualized Flow Durations; scatter and quantile plots

- ***Quantitative***

- Evaluation for bias (e.g. mean difference, mean absolute difference) and error variance/uncertainty (e.g. MSE, Nash-Sutcliffe, Index of Agreement) using various measures and acceptability criteria found in the literature (e.g. Moriasi et. al; Duda et al)

Calibration

Example Calibration for Gage 03433500
LSPC Subbasin 170-191

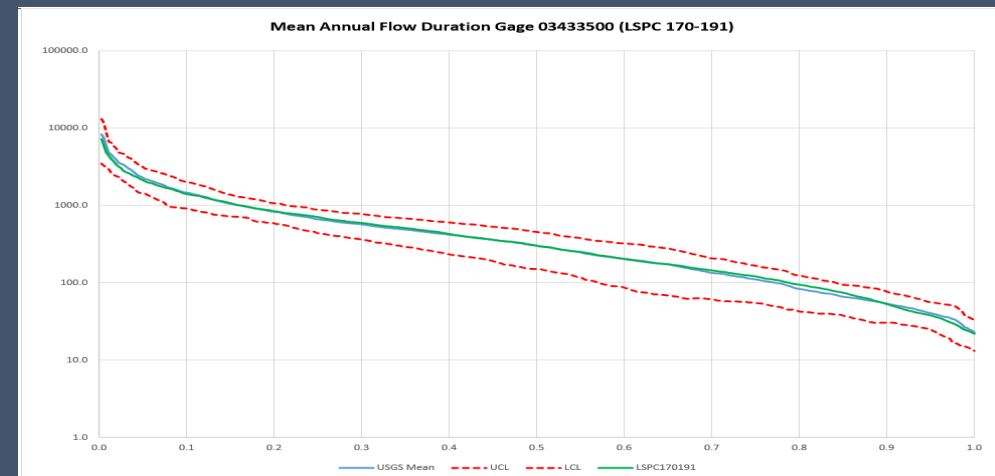
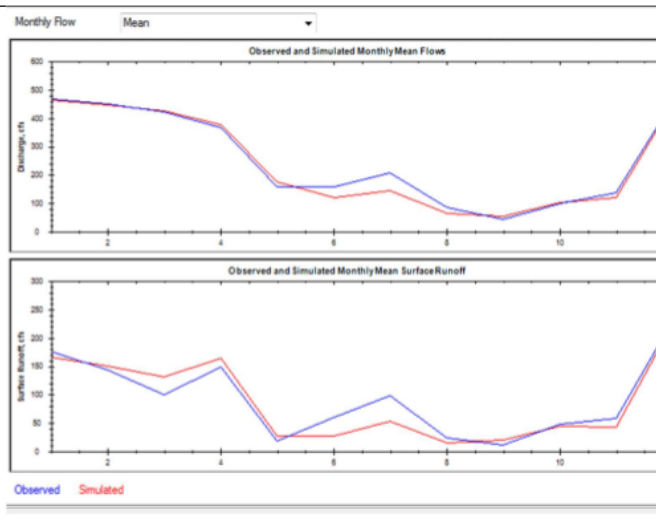
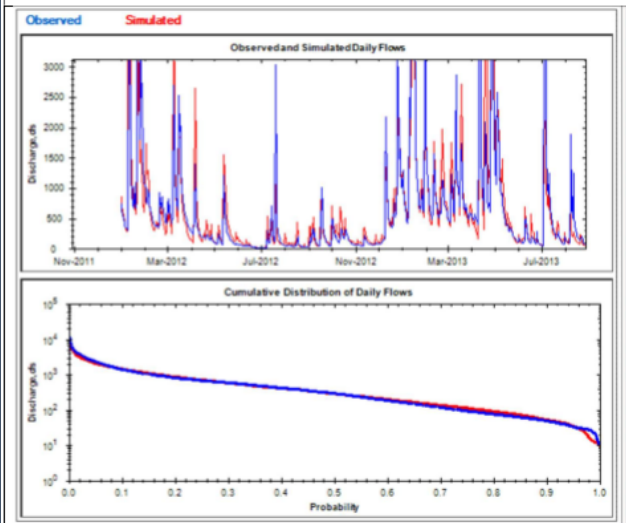
Performance Rating	Nash-Sutcliffe (Monthly)	Percent Bias of the Mean (Monthly)
Very good	0.75 < NSE < 1.00	< ±10
Good	0.65 < NSE < 0.75	±10 < PBM < ±15
Satisfactory	0.50 < NSE < 0.65	±15 < PBM < ±25
Unsatisfactory	< 0.50	> ±25

USGS 03433500-BASIN 170-191

Number of series terms	1827	1827	1827
Bias	-23.402	-18.412	-4.989
Standard error	444.019	401.833	128.531
Relative bias	-3.80%	-8.30%	-1.30%
Relative standard error	0.432	0.488	0.332
Nash-Sutcliffe coefficient	0.813	0.762	0.89
Coefficient of efficiency	0.675	0.672	0.727
Index of agreement	0.833	0.828	0.861

Metrics	USGS Q	LSPC Q	% DIFF
Mean, all daily flows	608.43	584.78	-3.9
Median, all daily flows	288.00	288.46	0.2
CV, all daily flows	149.09	139.42	-6.5

Year	USGS 03433500 LSPC 170191
2012	Records good except for estimated daily discharges which are poor
2013-2016	Records good except for estimated daily discharges which are fair



- Within the BASINS 4.5 Plugin or standalone
 - as single or batch run
- Need to make sure have right file paths (edit input file or set in GUI)
 - weather timeseries files (hourly)
 - LSPC model database (*.mdb)
 - output folder

```
C-----  
c30 output file path      input (weather) file path (each must be a continuous string)  
    D:\EPAWORK\PROJECTS\TN\HP2021\Harpeth_WQ_Model\LSPC\PS\  D:\EPAWORK\PROJECTS\TN\HP2021\Harpeth_WQ_Model\LSPC\Weather\  
C-----  
c31 point source file path  point source file name (each must be a continuous string)  
    D:\EPAWORK\PROJECTS\TN\HP2021\Harpeth_WQ_Model\LSPC\  HP_V5_06.23.20.ps  
C-----
```


Demo