User’s Guide for the New York Streamflow Estimation Tool (NYSET) version 1.0

By Christopher L. Gazoorian

Prepared in cooperation with The Nature Conservancy and the New York State Energy Research and Development Authority

Appendix 5 to accompany
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User’s Guide for the New York Streamflow Estimation Tool

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Introduction

The New York Streamflow Estimation Tool (NYSET) is a tool to simulate minimally altered streamflow at a daily time step for an ungaged site for the time period from October 1, 1960, to September 30, 2010. NYSET was developed by the U.S. Geological Survey in cooperation with The Nature Conservancy and the New York State Energy Research and Development Authority. The tool uses a modified QPPQ approach (Fennessey, 1994; Archfield and others, 2010), which relates probability exceedences at a gaged site, termed a reference streamgage, to an ungaged site. An appropriate reference streamgage is selected by the NYSET using streamflow correlation, or the user can manually select a different reference streamgage. A report file is generated documenting a summary of the reference streamgage and ungaged site information, any warnings, and basic statistics including the mean and median daily flows for WYs 1961 to 2010, and rank-based 7-day, 2-year (7Q2), 7-day, 10-year (7Q10), and select monthly exceedances. The estimated daily flows for the ungaged site can be easily exported to a comma separated values (.csv) file that can be used as input into a statistical software package to determine further streamflow statistics. More information related to the methodology used in the development of NYSET can be found in the body of this report.

Computer Requirements and Installation Instructions

Microsoft® Windows® 7 or 8, Microsoft® Excel 1997 or 2010 (or later), and Visual Basic .NET framework 4.5.1 are required on the machine running NYSET.[1] The tool and associated report can be downloaded from the U.S. Geological Survey (USGS) Publications Warehouse. To download the NYSET, go to *http://pubs.usgs.gov/sir/2014/5220/*, click on the “NYSET” link, and download NYSET_v.1.0.zip. Extract the files from the zip file and save them to your computer. Install NYSET by double clicking on the file “setup.exe” (administrative privileges are not typically required to install or uninstall this application). During this step, the program checks for prerequisites and will notify you of any problems or missing software. After successful installation, the program will be found in your start menu in a folder named “USGS NY WSC”; a shortcut will also be created on your desktop.

[1] Microsoft®, Windows® and Excel are either registered trademarks or trademarks of Microsoft® Corporation in the United States and/or other countries.

Data Input Requirements

NYSET requires basin characteristics for the ungaged site to be entered on the “Basin Characteristics” tab (fig. 5–1). The opening screen of NYSET is an interface with the USGS StreamStats for New York Web page for New York (fig. 5–2). From the opening screen, users can select an ungaged stream location, delineate a watershed boundary and obtain the required basin characteristics. This can also be done outside of the NYSET with StreamStats. An Esri file geodatabase (.gdb) that includes a shapefile of the watershed area and basin characteristics can be downloaded from StreamStats. Basin characteristics can also be entered manually in the “Basin Characteristics” tab. The following basin characteristics need to be entered: drainage area, mean annual runoff, percent hydrologic soils group A, percent hydrologic soils group B, mean monthly precipitation for the months of May, June and July, mean summer precipitation, maximum June temperature, X location of the basin centroid, Y location of the basin centroid, X location of the basin outlet, Y location of the basin outlet, slope of the lower one-half of the main channel and the percent of basin above 1,200 feet of elevation. More information about these basin characteristics, including data sources, can be found in the body of this report. It is important to use the same data source as was used to develop the regression equations for determination of the basin characteristics to maintain consistency in the accuracy of the regression estimates. This is not possible for some areas where SSURGO (U.S. Department of Agriculture, Natural Resources Conservation Service, 2011) data were unavailable; Digital General Soil Map of the United States (STATSGO2; U.S. Department of Agriculture, Natural Resources Conservation Service, 2013) data have been included in StreamStats to complete areas where SSURGO data are missing. Accuracy may vary from what was found in the regression analysis.

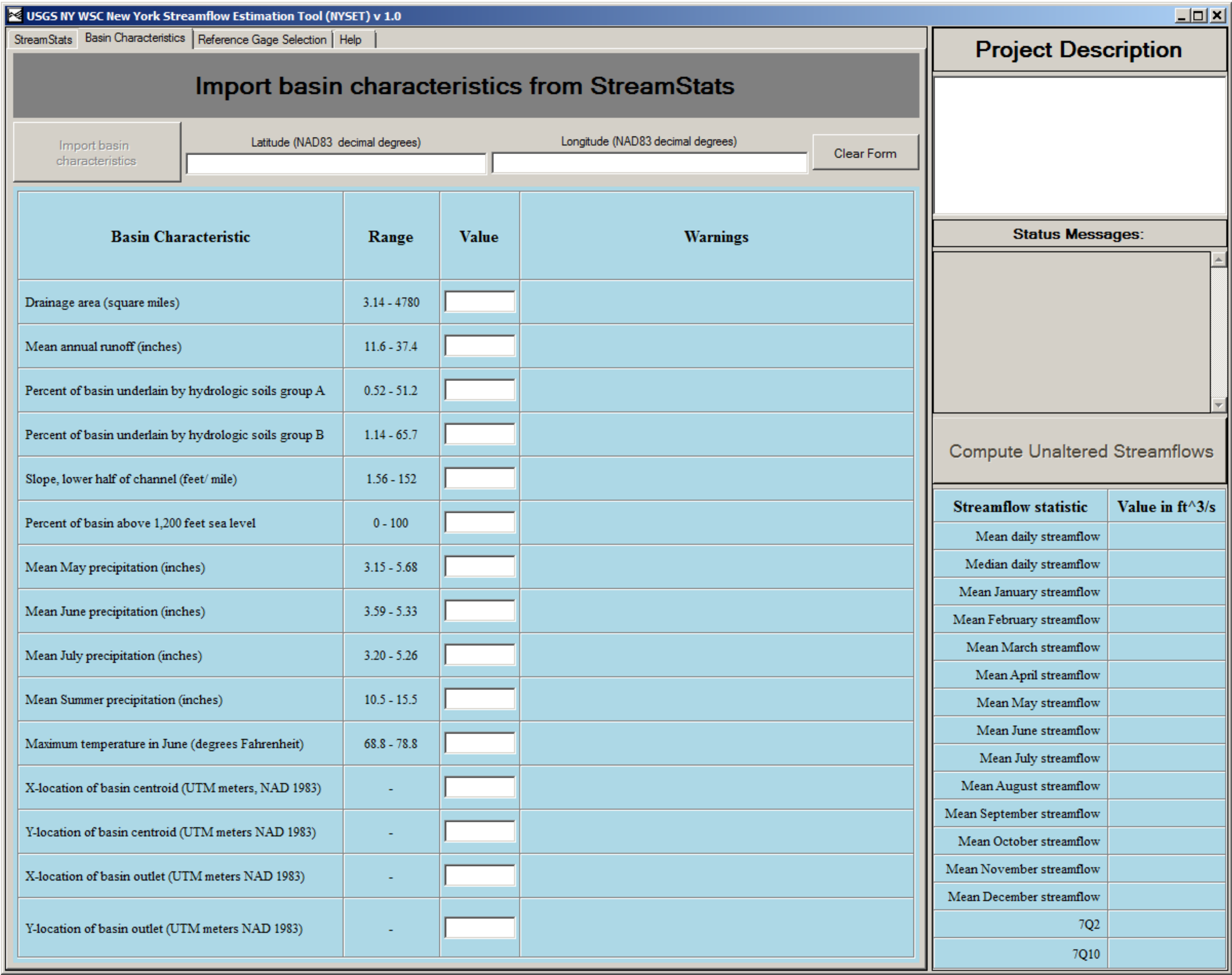

Figure 5–1. Screen capture of the Basin Characteristics screen of the New York Streamflow Estimation Tool

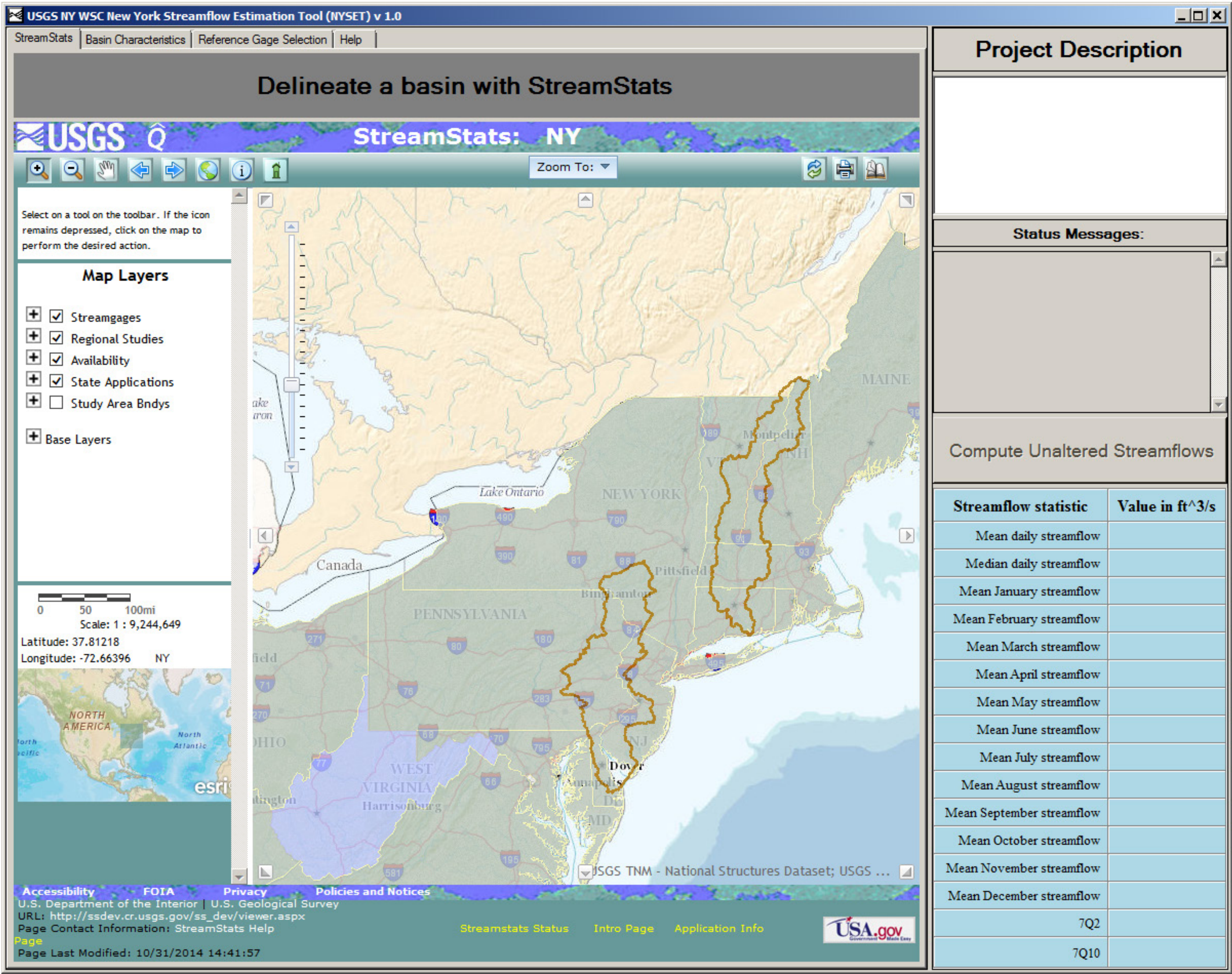

Figure 5–2. Screen capture of opening StreamStats screen of the New York Streamflow Estimation Tool.

To clear entered basin characteristics, click on the button "Clear Form." This will also clear any computed statistics and reference streamgage information summarized on the graphical user interface from an earlier analysis.

Running NYSET

The opening screen of NYSET is an interface with USGS StreamStats for New York. The user can navigate to and download the data for the desired stream basin using the StreamStats tools. When the user selects a basin in StreamStats, the latitude and longitude of the pour point are imported into the NYSET "Basin Characteristics" tab. After the ungaged basin delineation is complete, the user will be prompted to proceed with importing the basin characteristics into NYSET. If declined, the user can import the statistics later by clicking the "Import basin characteristics" button on the "Basin Characteristics" tab (fig. 5–3, black circle). If the location coordinates are not filled out, NYSET will not import any basin characteristics. The "Basin Characteristics" tab includes cells to enter basin characteristics manually if they are known. The range of values for each basin characteristic used to develop the regression equations is shown. A warning message will appear if the basin characteristic entered is outside this range (fig. 5–3, red circle), indicating the resulting flow-duration estimates determined from regression equations may not be valid.

After basin characteristics have been entered for the ungaged location, the user can choose whether to allow NYSET to select the reference streamgage to be used or select a different one. If the user would like to select the reference streamgage, uncheck the box "Let the NYSET choose" under the "Reference Gage Selection" tab. Next, click on the "Compute Unaltered Streamflows" button (fig. 5–3, arrow) to compute baseline daily flows. The user will have to agree to the disclaimer that appears before continuing. The computation of daily flows will take a few minutes, depending on the processing capacity of your computer. A status bar indicates progress. When computations are completed, a box will open asking you to save the resulting Microsoft® Excel output file. After saving the file, close or save the file under a new name before attempting to run NYSET again. NYSET may not function properly when the previous output file is open.

The Microsoft® Excel summary output files contain worksheets with reference gage information, daily flows for the reference site and ungaged location, probability exceedances for the reference site and ungaged location, a summary report with hydrographs and flow-duration curves (fig. 5–4), and a tool to manipulate additional monthly withdrawals and discharges (fig. 5–5). An additional spreadsheet displaying select monthly exceedance probability flows is also created and can be saved to a user defined directory (fig. 5–6). The worksheet named "Reference Gage Selection" lists information about the reference streamgage selected and five reference streamgages with the highest correlations to the ungaged location. The distances between the ungaged location and reference streamgages are listed in the table and can be used to evaluate the appropriateness of the selected streamgage. To save the estimated daily flows and dates for the ungaged location as a .csv, click on the "Export Daily Values" button on the report worksheet (fig. 5–4, black circle). Macros need to be enabled in Microsoft® Excel to use this feature. To enable macros, click directly on the "Enable Content" button on the yellow security message bar (if it appears) or from File, Options, Trust Center, Trust Center Settings and select the required options.. The exported .csv file can then be used as input into a number of statistical software packages to determine low-flow, flow-duration exceedance, base flow, or mean-flow statistics.

The reference streamgage can be chosen by the user, overriding the spatial map correlation process. After the basin characteristics have been entered for the ungaged location in NYSET, go to the "Reference Gage Selection" tab (fig. 5–7, black circle), and choose the reference streamgage you want to use. Click on "Compute Unaltered Streamflows" to proceed with calculations. Review the results and follow the data export procedures to save the data to a file for further use.

Evaluating Monthly Flows

Using the "MonthlyFlows" tab on the output summary file, the user can manipulate additional monthly withdrawals and discharges, designate monthly instream-flow targets and determine the remaining instream-flow after the user defined alterations (fig. 5–7). The "Unaltered streamflow" column is automatically filled in with the mean monthly flows for each month. This can be changed to any of the exceedence flows provided on the right side of the table or from the "MonthlyStats" tab in the monthly exceedance worksheet (fig. 5–7), depending on the user's preference. The "Instream-flow target" column can be filled in by the user to represent the minimum desirable flows. By entering the instream-flow target, the user will see the "Difference from target" values change. The "Difference from target" column represents the surplus or deficit from the instream-flow target designated by the user for the exceedance or mean flows used in the "Unaltered streamflow" column. For example, if the Q50 (50-percent exceedance flow) flow in January is 100 cubic feet per second (ft^3/s; "Unaltered streamflow") and the instream-flow target was 80 ft^3/s, then there would be a surplus ("Difference from target") of 20 ft^3/s, 50 percent of the time.

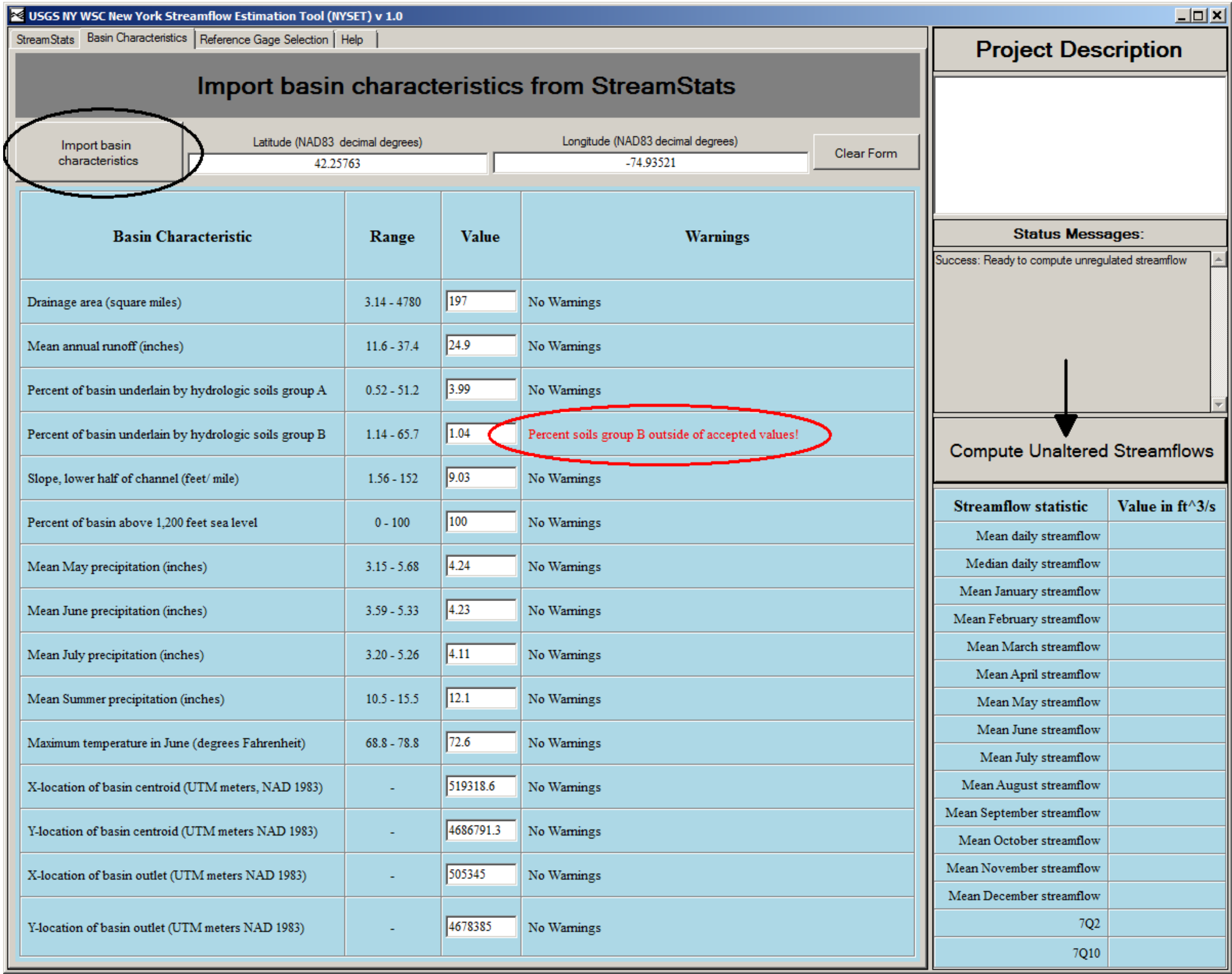

Figure 5–3. Screen capture showing an example entry of basin characteristics into the New York Streamflow Estimation Tool. Black oval shows button to import data from StreamStats; red oval shows basin characteristic warning; black arrow points to the button to compute unaltered daily mean streamflows.

USGS NY WSC Streamflow Estimation Tool (NYSET)

Summary Report by: userID Date: 12/4/14

Project Description:

Reference streamgage: 01350000 Schoharie Creek at Prattsville, NY
Correlation coefficient: 0.98
Distance from ungaged site: 12.45

Export Daily Values

Basin characteristics	Ungaged site	Reference streamgage	Range*	Units	different from reference
Drainage area	4.80	237.00	3.14–4,780	miles squared	-97.97
Mean annual runoff, 1951 - 1980	30.20	27.60	11.6–37.4	inches	9.42
Percent of basin underlain by hydrologic soils group A	1.24	2.54	0.52–51.9	percent	-1.30
Percent of basin underlain by hydrologic soils group B	1.46	3.25	1.16–69.6	percent	-1.79
Slope of lower half of channel	53.20	21.50	1.56–152	feet/ mile	147.44
Percent of basin above 1200 ft sea level	100.00	99.70	0.00–100	percent	0.30
Mean May precipitation, 1971 - 2000	5.27	4.42	3.15–5.68	inches	19.23
Mean June precipitation, 1971 - 2000	5.07	4.23	3.59–5.33	inches	19.86
Mean July precipitation, 1971 - 2000	5.13	4.00	3.20–5.26	inches	28.25
Mean Summer precipitation, 1971 - 2000	15.10	12.10	10.48–15.51	inches	24.79
Maximun June temperature, 1971 - 2000	68.90	71.80	68.8–78.8	degrees Fahrenhe	-4.04
X location of basin centroid	561544.00	560452.76	–	UTM meters	-
Y location of basin centroid	4670100.00	4678527.28	–	UTM meters	-
X location of basin outlet	559845.00	546444.42	–	UTM meters	-
Y location of basin outlet	4670505.00	4685407.78	–	UTM meters	-

*Streamflow estimates may not be valid if value for ungaged site is outside of this range

Streamflow statistics for ungaged site, 1961 - 2010, in cubic feet per second	
Mean daily streamflow	10.40
Median daily streamflow	5.60
7Q2	0.99
7Q10	0.36

Monthly streamflow statistics for ungaged site, 1961 - 2010 in cubic feet per second	Mean	Q10	Q50	Q75	Q95	Q99
January	11.13	21.55	5.83	4.32	3.25	2.91
February	10.31	20.76	6.34	4.22	2.78	2.21
March	18.31	37.20	11.40	6.59	3.72	2.53
April	21.88	40.36	15.65	9.56	6.12	5.12
May	12.25	23.90	8.42	5.68	3.98	3.40
June	7.83	14.23	4.37	3.40	1.70	1.09
July	4.28	6.84	3.09	1.83	0.77	0.63
August	3.26	5.32	2.04	1.20	0.65	0.22
September	4.74	8.78	1.84	1.12	0.48	0.12
October	7.81	16.43	3.80	1.81	0.75	0.33
November	10.94	21.07	6.89	4.14	1.66	0.20
December	12.16	24.03	7.21	4.96	3.54	2.56

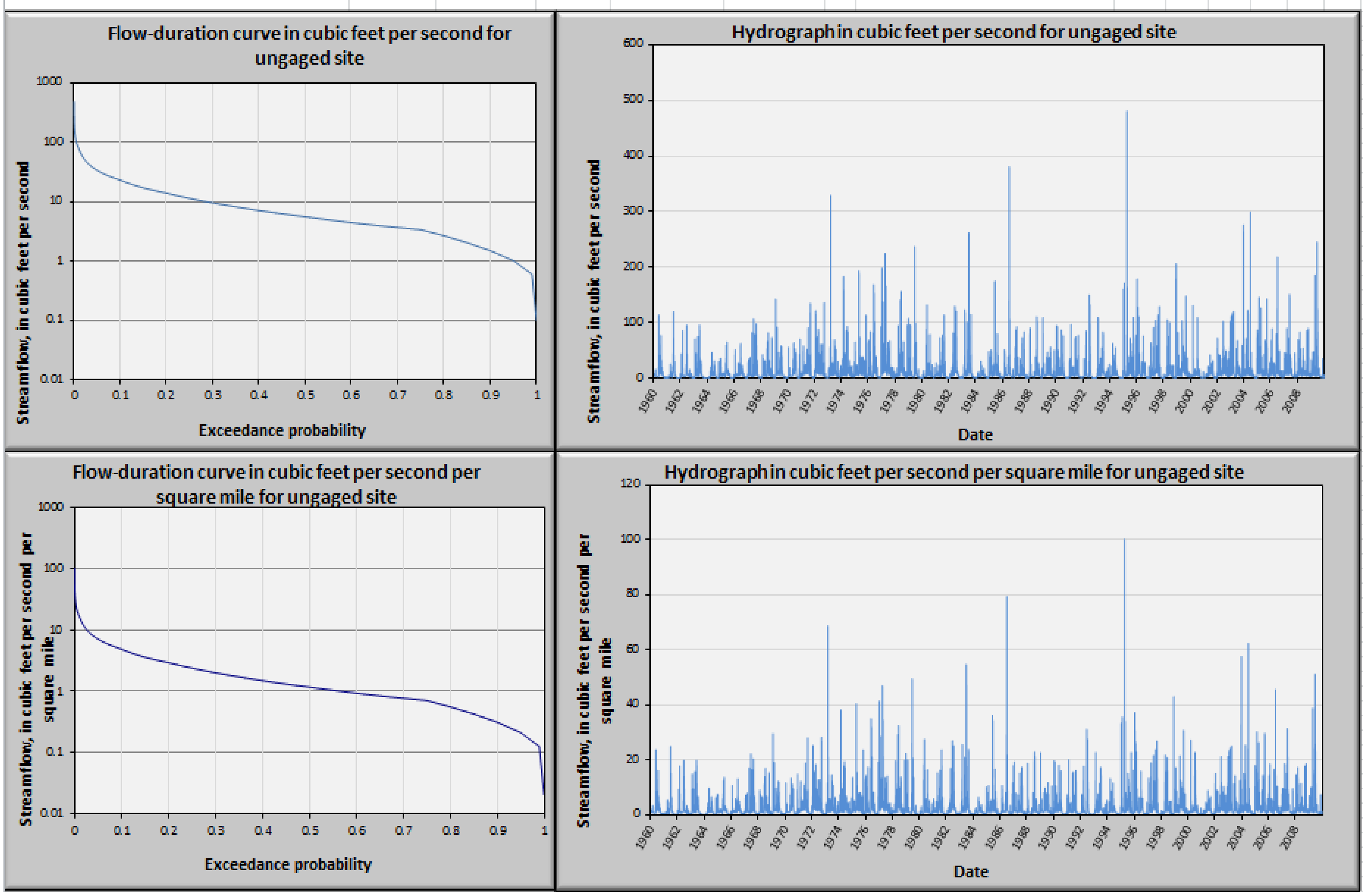

Figure 5–4. Screen capture of the summary report generated from the New York Streamflow Estimation Tool. Black oval shows the button to export daily streamflow for the ungaged location as a comma separated values (.csv) file.

USGS NY WSC Streamflow Estimation Tool (NYSET)

Summary Report by: Date:

Project Description:

	Unaltered streamflow for ungaged site, in cubic feet per second					Monthly unaltered streamflow statistics for ungaged site, in cubic feet per second					
Monthly flows:	Unaltered streamflow	Instream-flow target	Additional withdrawals	Altered streamflow	Difference from target	mean	Q10	Q50	Q75	Q95	Q99
January	468.04			468.04	468.04	468.04	970.58	259.29	164.12	92.19	59.59
February	416.18			416.18	416.18	416.18	891.43	256.81	161.15	87.78	55.83
March	765.45			765.45	765.45	765.45	1638.57	509.98	266.84	135.68	84.98
April	981.76			981.76	981.76	981.76	1837.17	728.43	479.76	291.09	225.21
May	560.21			560.21	560.21	560.21	1002.32	415.85	273.94	169.97	129.26
June	338.64			338.64	338.64	338.64	658.51	198.38	125.78	79.22	60.38
July	178.57			178.57	178.57	178.57	316.02	110.59	70.61	36.82	26.36
August	128.83			128.83	128.83	128.83	249.08	75.37	47.26	27.19	21.67
September	170.42			170.42	170.42	170.42	342.38	67.70	41.93	24.15	16.47
October	303.18			303.18	303.18	303.18	721.55	129.36	57.73	27.53	18.44
November	455.77			455.77	455.77	455.77	957.37	304.40	158.16	49.53	18.77
December	519.01			519.01	519.01	519.01	1073.06	346.63	216.40	120.25	76.95

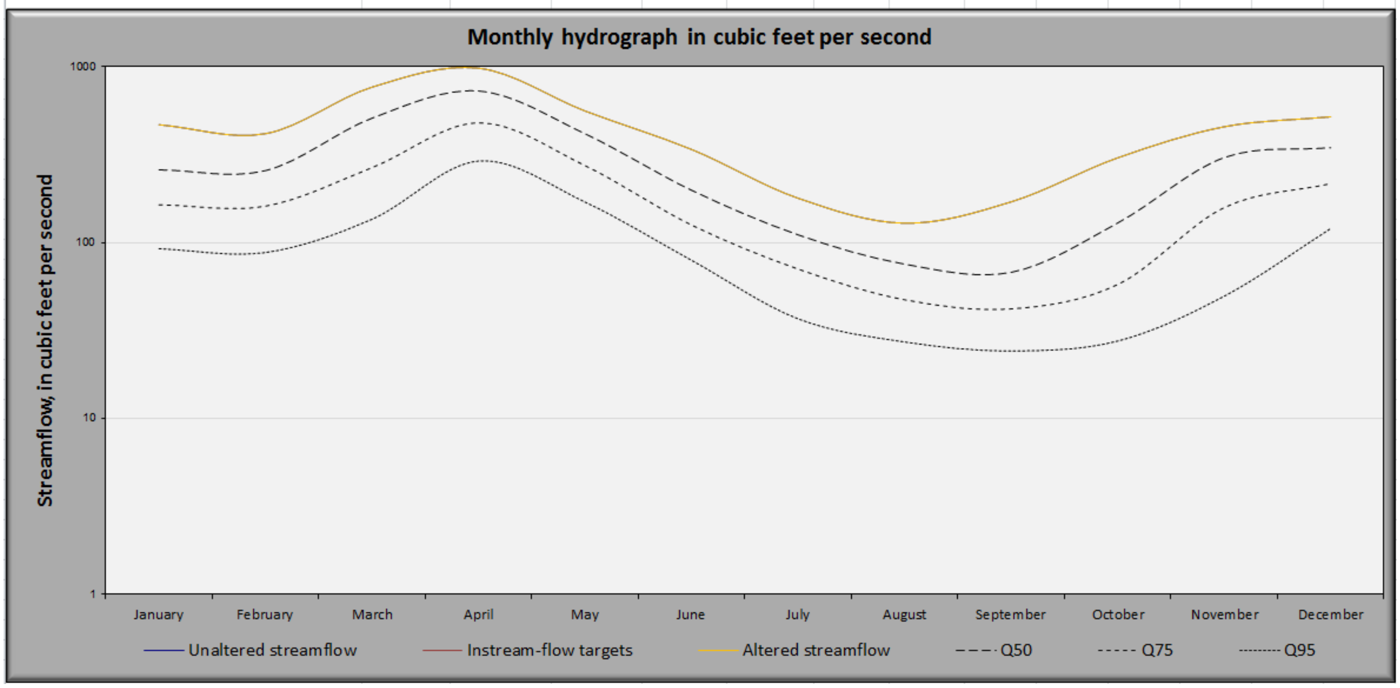

Figure 5–5. Screen capture showing MonthlyFlows evaluation tool.

USGS NY WSC Streamflow Estimation Tool (NYSET)

Summary Report by: | Date:

Project Description:

Flow statistic	Unaltered streamflow in cubic feet per second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q1	2983.25	2928.99	3814.57	3132.13	1954.00	1432.76	1232.46	731.08	1607.42	2164.38	2077.16	2843.28
Q2	2333.08	2224.08	3035.86	2665.22	1594.77	1102.51	773.41	551.07	1034.99	1465.79	1626.22	2043.34
Q5	1278.63	1447.96	2239.89	1994.38	1111.57	742.52	442.10	329.72	494.37	816.72	1100.73	1279.32
Q10	822.03	906.33	1557.31	1431.78	796.54	513.58	267.11	200.05	220.04	529.37	780.59	852.58
Q15	605.93	672.21	1216.70	1228.48	637.20	375.11	202.34	145.68	143.30	375.04	662.66	674.43
Q20	491.96	540.19	990.66	1018.19	547.59	311.47	156.98	116.12	109.50	290.02	571.69	580.02
Q25	403.05	422.56	861.47	895.14	475.75	256.46	133.42	92.49	86.71	231.20	490.00	503.03
Q30	331.39	362.93	755.36	796.01	428.63	217.47	119.49	79.58	72.40	199.34	424.02	446.48
Q35	289.59	317.86	670.34	708.90	383.83	185.29	101.32	70.16	62.07	170.62	374.97	400.50
Q40	253.90	277.50	598.02	642.30	348.34	157.34	87.84	61.81	55.48	138.97	327.86	358.63
Q45	219.74	237.32	536.64	573.41	314.86	139.12	77.60	56.24	50.25	114.41	294.87	330.00
Q50	195.47	209.22	481.40	526.96	283.64	123.59	70.37	51.40	45.67	91.83	243.63	300.71
Q55	180.63	185.32	421.92	483.50	249.62	112.39	64.05	47.07	41.83	74.17	210.95	266.52
Q60	164.63	163.08	368.16	447.45	221.12	98.83	58.87	41.91	38.52	63.85	184.53	237.36
Q65	150.12	146.19	323.55	410.54	200.08	90.63	53.81	37.78	35.18	54.97	154.54	217.10
Q70	138.48	132.15	281.88	373.76	180.33	82.53	49.25	34.34	31.99	45.23	129.19	195.82
Q75	129.30	119.30	247.74	345.10	160.64	75.11	44.68	30.83	29.14	37.65	115.75	177.56
Q80	116.71	105.81	214.22	313.36	142.91	66.51	40.67	27.41	26.18	32.66	96.07	153.65
Q85	101.60	95.11	177.95	275.19	125.74	59.75	36.82	23.87	22.41	28.91	73.43	134.93
Q90	87.73	84.65	145.26	239.42	110.39	52.30	31.64	20.35	18.95	25.30	49.97	112.45
Q95	68.22	76.40	107.52	203.87	87.15	44.82	26.89	17.54	16.42	18.59	29.31	75.36
Q98	55.35	66.67	74.84	176.11	75.61	38.74	21.61	12.73	6.47	10.93	17.45	43.90
Q99	50.81	53.32	67.21	157.87	69.31	34.39	19.96	9.94	5.67	8.33	7.77	38.77

Figure 5–6. Screen capture showing monthly exceedance probability flows as output from the New York Streamflow Estimation Tool.

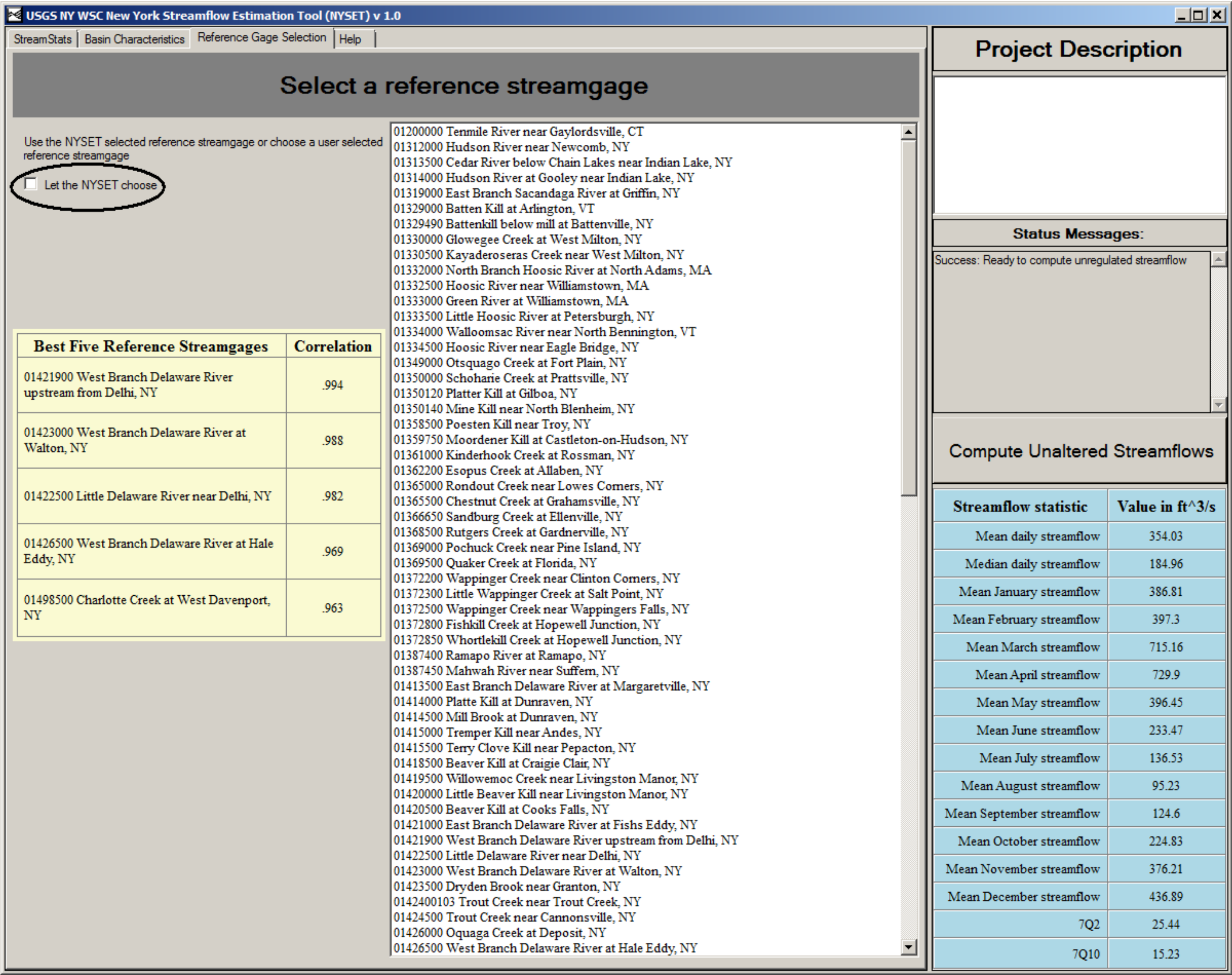

Figure 5–7. Screen capture showing manual reference streamgage selection checkbox (black oval) for use with the New York Streamflow Estimation Tool.

If additional withdrawals were specified, then the "Difference from target" value would be reduced by those withdrawals.

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