# Appendix for Model 03110205

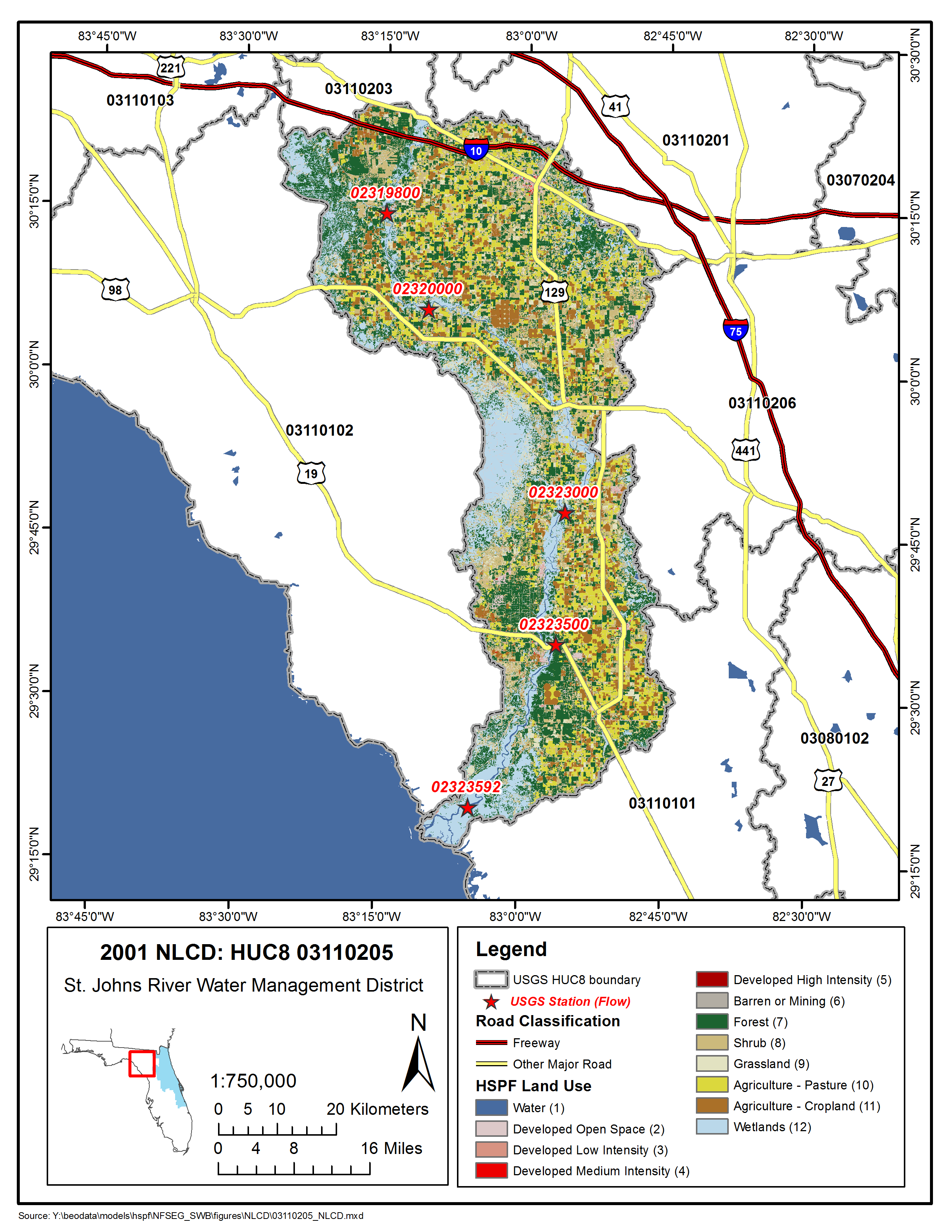


Figure 03110205-1: Land Cover from the National Land Cover Database.

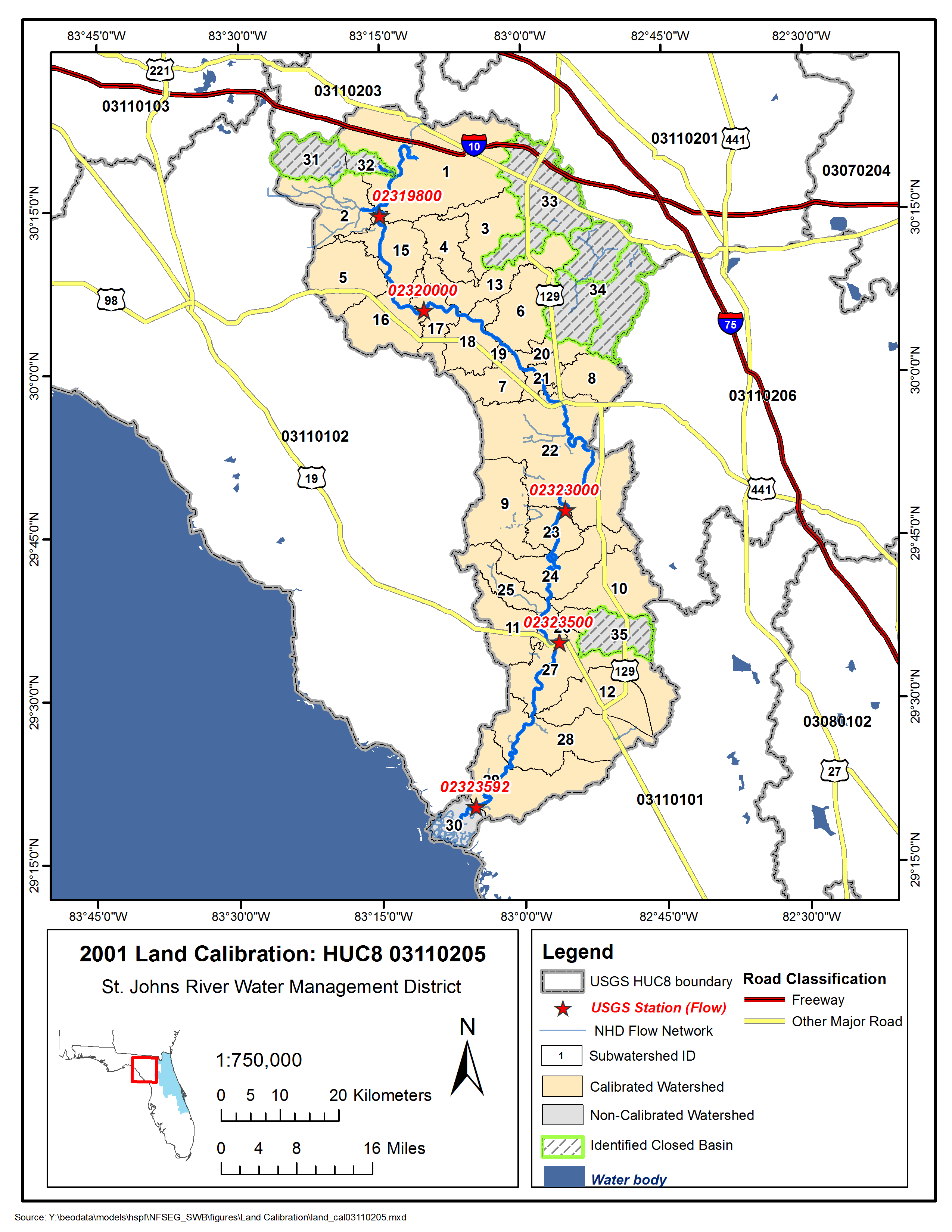


Figure 03110205-2: Calibrated sub-watersheds.

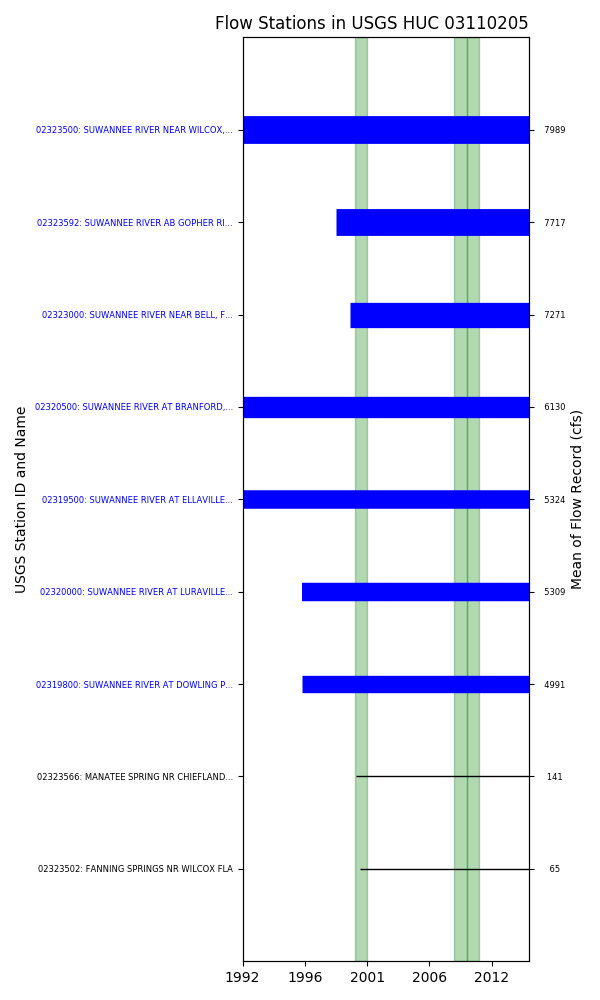


Figure 03110205-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 14, USGS Gauge 02319800

Table 03110205-1: Comparison Statistics Between HSPF Reach 14 and USGS Gauge 02319800.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 27.69 |
| Standard error | 1930.52 |
| Relative bias | 0.01 |
| Relative standard error | 0.36 |
| Nash-Sutcliffe coefficient | 0.87 |
| Kling-Gupta coefficient | 0.91 |
| Coefficient of efficiency | 0.65 |
| Index of agreement | 0.82 |

Table 03110205-2: Hydrologic Indices Between USGS Gauge 02319800 and HSPF Reach 14.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02319800 | Simulated Reach 14 | Percent Difference |
| MA1: Mean, all daily flows | 4798.15 | 4820.93 | 0.47 |
| MA2: Median, all daily flows | 2700.00 | 2736.19 | 1.34 |
| MA3: CV, all daily flows | 79.81 | 91.08 | 14.12 |
| MA4: CV, log of all daily flows | 96.36 | 93.75 | -2.71 |
| MA5: Mean daily flow / median daily flow | 1.78 | 1.76 | -0.85 |
| MA9: (Q10 - Q90) / median daily flow | 3.79 | 3.40 | -10.38 |
| MA10: (Q20 - Q80) / median daily flow | 2.15 | 1.76 | -18.07 |
| MA11: (Q25 - Q75) / median daily flow | 1.60 | 1.28 | -20.03 |
| MA12: Mean monthly flow, January | 4289.44 | 5144.26 | 19.93 |
| MA13: Mean monthly flow, February | 5725.48 | 7246.27 | 26.56 |
| MA14: Mean monthly flow, March | 9132.24 | 9405.24 | 2.99 |
| MA15: Mean monthly flow, April | 8012.35 | 6625.12 | -17.31 |
| MA16: Mean monthly flow, May | 3653.50 | 2853.05 | -21.91 |
| MA17: Mean monthly flow, June | 3161.76 | 2702.77 | -14.52 |
| MA18: Mean monthly flow, July | 4015.32 | 3620.30 | -9.84 |
| MA19: Mean monthly flow, August | 3657.12 | 3567.75 | -2.44 |
| MA20: Mean monthly flow, September | 3752.42 | 3766.11 | 0.36 |
| MA21: Mean monthly flow, October | 3998.95 | 3926.41 | -1.81 |
| MA22: Mean monthly flow, November | 2897.79 | 2894.00 | -0.13 |
| MA23: Mean monthly flow, December | 3204.96 | 4070.04 | 26.99 |
| ML1: Mean minimum monthly flow, January | 3286.06 | 3192.84 | -2.84 |
| ML2: Mean minimum monthly flow, February | 4560.53 | 4212.19 | -7.64 |
| ML3: Mean minimum monthly flow, March | 5866.47 | 5049.21 | -13.93 |
| ML4: Mean minimum monthly flow, April | 4571.77 | 3637.78 | -20.43 |
| ML5: Mean minimum monthly flow, May | 2572.00 | 2055.18 | -20.09 |
| ML6: Mean minimum monthly flow, June | 2244.41 | 1923.05 | -14.32 |
| ML7: Mean minimum monthly flow, July | 2935.24 | 2539.67 | -13.48 |
| ML8: Mean minimum monthly flow, August | 2866.00 | 2581.28 | -9.93 |
| ML9: Mean minimum monthly flow, September | 2295.88 | 2138.26 | -6.87 |
| ML10: Mean minimum monthly flow, October | 2591.61 | 2237.25 | -13.67 |
| ML11: Mean minimum monthly flow, November | 2205.17 | 2118.77 | -3.92 |
| ML12: Mean minimum monthly flow, December | 2410.00 | 2459.38 | 2.05 |
| ML13: CV of minimum monthly flows | 110.21 | 88.01 | -20.14 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.52 | 0.55 | 4.70 |
| ML15: Mean minimum annual flow / mean annual flow | 0.37 | 0.36 | -1.46 |
| ML16: Median minimum annual flow / median annual flow | 0.52 | 0.56 | 8.00 |
| ML20: Ratio of baseflow volume to total flow volume | 0.81 | 0.73 | -10.49 |
| ML22: Mean annual minimum flow divided by catchment area | 13.86 | 14.30 | 3.17 |
| RA1: Mean of positive changes from one day to next (rise rate) | 272.81 | 472.53 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 215.87 | 270.75 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 142.67 | 219.56 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 189.91 | 207.77 |  |
| RA5: Ratio of days that are higher than previous day | 0.32 | 0.32 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.03 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.02 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 43.61 | 43.44 |  |
| RA9: CV, number of flow reversals from one day to the next | 38.39 | 23.07 |  |

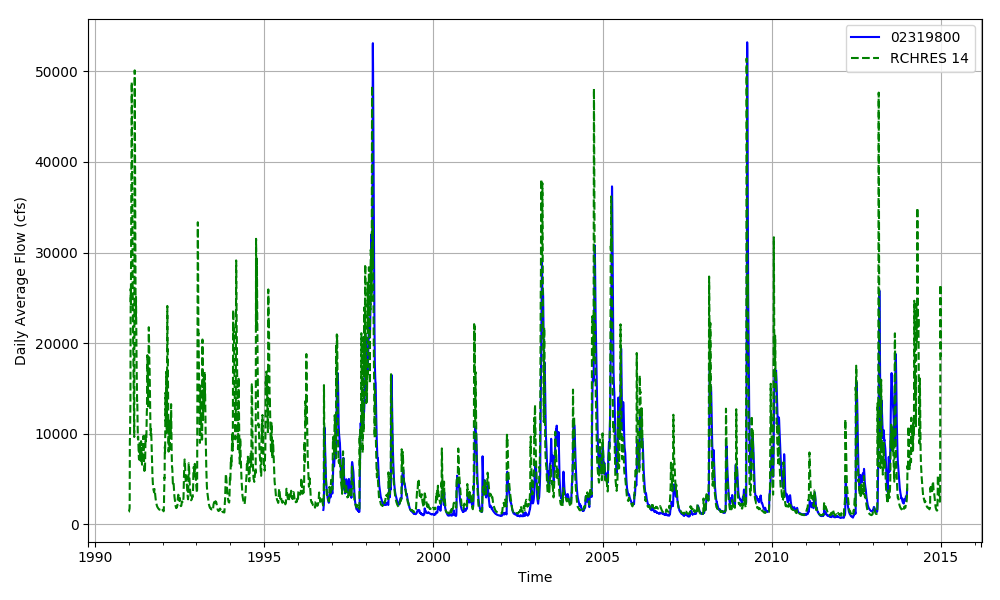


Figure 03110205-4: Daily flow for HSFP reach 14 and USGS station 02319800.

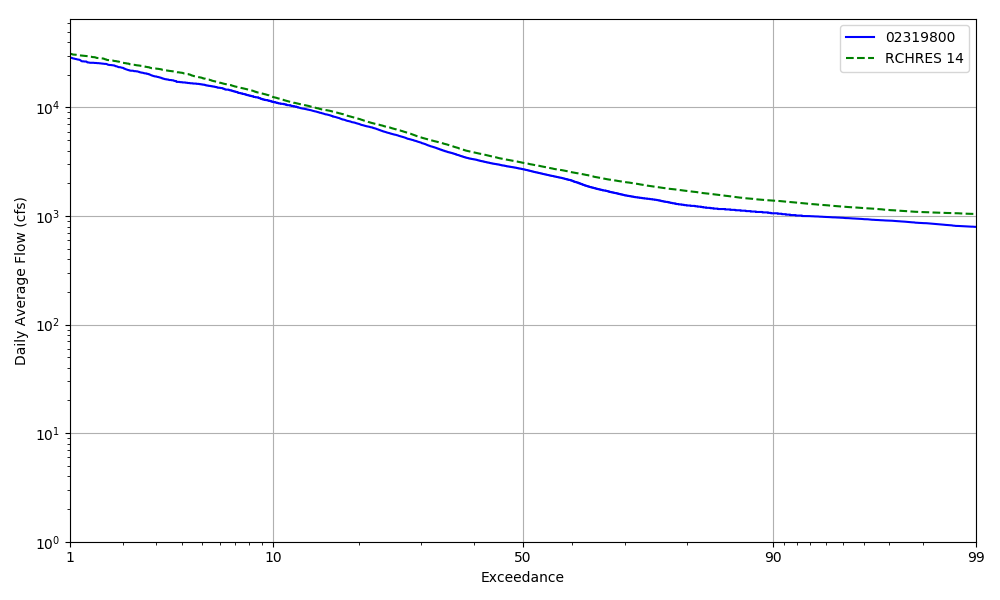


Figure 03110205-5: Daily exceedance for HSFP reach 14 and USGS station 02319800.

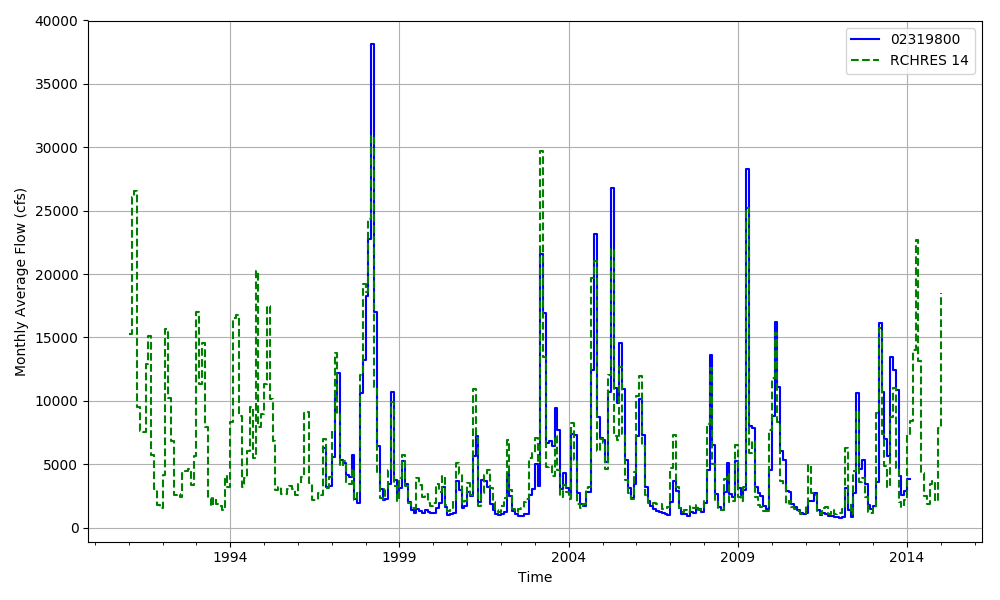


Figure 03110205-6: Monthly flow for HSFP reach 14 and USGS station 02319800.

## HSPF Reach 16, USGS Gauge 02320000

Table 03110205-3: Comparison Statistics Between HSPF Reach 16 and USGS Gauge 02320000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -155.02 |
| Standard error | 2112.09 |
| Relative bias | -0.03 |
| Relative standard error | 0.38 |
| Nash-Sutcliffe coefficient | 0.86 |
| Kling-Gupta coefficient | 0.88 |
| Coefficient of efficiency | 0.63 |
| Index of agreement | 0.81 |

Table 03110205-4: Hydrologic Indices Between USGS Gauge 02320000 and HSPF Reach 16.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02320000 | Simulated Reach 16 | Percent Difference |
| MA1: Mean, all daily flows | 5125.40 | 4961.41 | -3.20 |
| MA2: Median, all daily flows | 2940.00 | 2878.45 | -2.09 |
| MA3: CV, all daily flows | 73.08 | 84.24 | 15.28 |
| MA4: CV, log of all daily flows | 95.55 | 91.16 | -4.59 |
| MA5: Mean daily flow / median daily flow | 1.74 | 1.72 | -1.13 |
| MA9: (Q10 - Q90) / median daily flow | 3.71 | 3.25 | -12.44 |
| MA10: (Q20 - Q80) / median daily flow | 2.05 | 1.69 | -17.53 |
| MA11: (Q25 - Q75) / median daily flow | 1.49 | 1.23 | -17.91 |
| MA12: Mean monthly flow, January | 4210.38 | 5010.17 | 19.00 |
| MA13: Mean monthly flow, February | 5652.77 | 6989.19 | 23.64 |
| MA14: Mean monthly flow, March | 8879.98 | 9055.24 | 1.97 |
| MA15: Mean monthly flow, April | 8238.93 | 6416.55 | -22.12 |
| MA16: Mean monthly flow, May | 3833.36 | 2820.55 | -26.42 |
| MA17: Mean monthly flow, June | 3237.56 | 2681.82 | -17.17 |
| MA18: Mean monthly flow, July | 4101.18 | 3549.03 | -13.46 |
| MA19: Mean monthly flow, August | 3752.95 | 3505.49 | -6.59 |
| MA20: Mean monthly flow, September | 3955.17 | 3816.05 | -3.52 |
| MA21: Mean monthly flow, October | 4199.26 | 3864.43 | -7.97 |
| MA22: Mean monthly flow, November | 2980.24 | 2866.24 | -3.83 |
| MA23: Mean monthly flow, December | 3221.07 | 3982.86 | 23.65 |
| ML1: Mean minimum monthly flow, January | 3511.11 | 3326.77 | -5.25 |
| ML2: Mean minimum monthly flow, February | 4840.23 | 4359.19 | -9.94 |
| ML3: Mean minimum monthly flow, March | 6207.06 | 5190.35 | -16.38 |
| ML4: Mean minimum monthly flow, April | 5032.94 | 3779.77 | -24.90 |
| ML5: Mean minimum monthly flow, May | 2928.29 | 2179.59 | -25.57 |
| ML6: Mean minimum monthly flow, June | 2550.59 | 2044.40 | -19.85 |
| ML7: Mean minimum monthly flow, July | 3150.18 | 2668.96 | -15.28 |
| ML8: Mean minimum monthly flow, August | 3129.41 | 2716.10 | -13.21 |
| ML9: Mean minimum monthly flow, September | 2524.44 | 2271.94 | -10.00 |
| ML10: Mean minimum monthly flow, October | 2960.78 | 2372.92 | -19.85 |
| ML11: Mean minimum monthly flow, November | 2382.94 | 2245.16 | -5.78 |
| ML12: Mean minimum monthly flow, December | 2620.28 | 2583.55 | -1.40 |
| ML13: CV of minimum monthly flows | 107.40 | 84.88 | -20.97 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.57 | 0.59 | 2.12 |
| ML15: Mean minimum annual flow / mean annual flow | 0.42 | 0.41 | -2.74 |
| ML16: Median minimum annual flow / median annual flow | 0.58 | 0.59 | 2.03 |
| ML20: Ratio of baseflow volume to total flow volume | 0.82 | 0.74 | -9.95 |
| ML22: Mean annual minimum flow divided by catchment area | 16.05 | 15.84 | -1.31 |
| RA1: Mean of positive changes from one day to next (rise rate) | 270.63 | 473.58 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 184.21 | 274.50 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 141.32 | 222.76 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 167.59 | 209.85 |  |
| RA5: Ratio of days that are higher than previous day | 0.31 | 0.32 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.02 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.02 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 40.58 | 41.95 |  |
| RA9: CV, number of flow reversals from one day to the next | 48.99 | 33.88 |  |

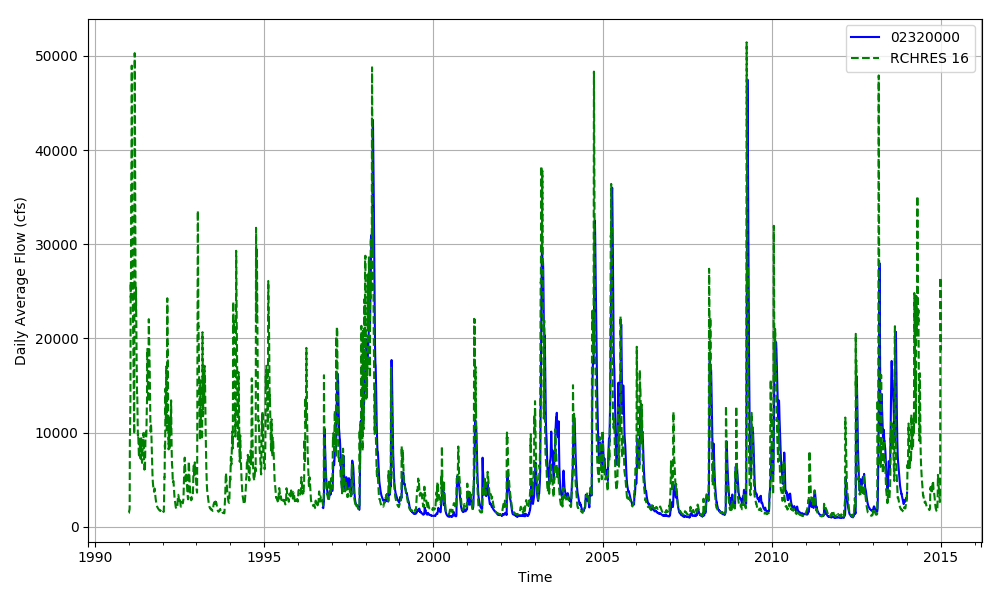


Figure 03110205-7: Daily flow for HSFP reach 16 and USGS station 02320000.

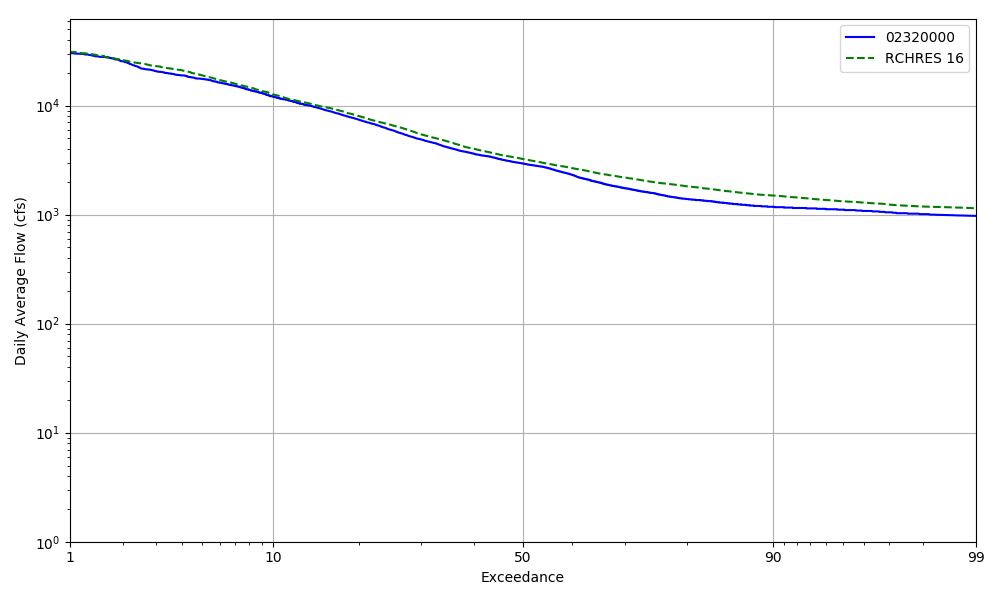


Figure 03110205-8: Daily exceedance for HSFP reach 16 and USGS station 02320000.

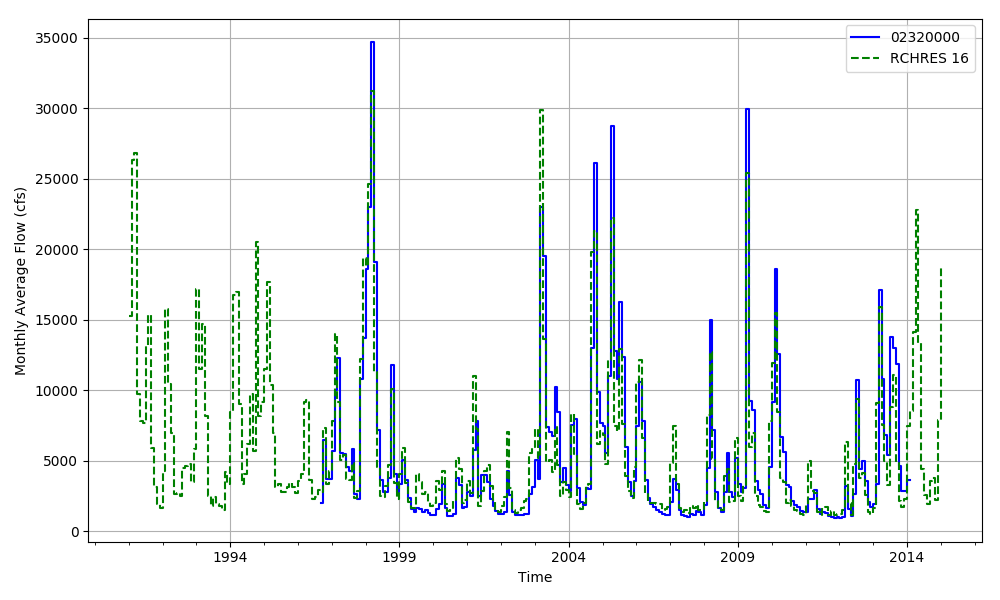


Figure 03110205-9: Monthly flow for HSFP reach 16 and USGS station 02320000.

## HSPF Reach 21, USGS Gauge 02320500

Table 03110205-5: Comparison Statistics Between HSPF Reach 21 and USGS Gauge 02320500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -146.56 |
| Standard error | 2493.81 |
| Relative bias | -0.02 |
| Relative standard error | 0.43 |
| Nash-Sutcliffe coefficient | 0.82 |
| Kling-Gupta coefficient | 0.88 |
| Coefficient of efficiency | 0.60 |
| Index of agreement | 0.79 |

Table 03110205-6: Hydrologic Indices Between USGS Gauge 02320500 and HSPF Reach 21.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02320500 | Simulated Reach 21 | Percent Difference |
| MA1: Mean, all daily flows | 6310.07 | 6156.97 | -2.43 |
| MA2: Median, all daily flows | 3860.00 | 3797.47 | -1.62 |
| MA3: CV, all daily flows | 66.03 | 78.78 | 19.30 |
| MA4: CV, log of all daily flows | 82.54 | 81.15 | -1.68 |
| MA5: Mean daily flow / median daily flow | 1.63 | 1.62 | -0.82 |
| MA9: (Q10 - Q90) / median daily flow | 3.31 | 2.93 | -11.55 |
| MA10: (Q20 - Q80) / median daily flow | 2.00 | 1.62 | -18.92 |
| MA11: (Q25 - Q75) / median daily flow | 1.48 | 1.21 | -18.36 |
| MA12: Mean monthly flow, January | 5234.72 | 7071.87 | 35.10 |
| MA13: Mean monthly flow, February | 8257.80 | 9966.73 | 20.69 |
| MA14: Mean monthly flow, March | 11415.81 | 11469.25 | 0.47 |
| MA15: Mean monthly flow, April | 10070.82 | 7781.87 | -22.73 |
| MA16: Mean monthly flow, May | 5311.47 | 3760.64 | -29.20 |
| MA17: Mean monthly flow, June | 4257.39 | 3620.57 | -14.96 |
| MA18: Mean monthly flow, July | 5076.71 | 4621.25 | -8.97 |
| MA19: Mean monthly flow, August | 5256.73 | 4945.26 | -5.93 |
| MA20: Mean monthly flow, September | 5023.10 | 4548.07 | -9.46 |
| MA21: Mean monthly flow, October | 5178.68 | 5067.54 | -2.15 |
| MA22: Mean monthly flow, November | 3916.33 | 3720.53 | -5.00 |
| MA23: Mean monthly flow, December | 3935.62 | 4669.98 | 18.66 |
| ML1: Mean minimum monthly flow, January | 3923.33 | 3919.72 | -0.09 |
| ML2: Mean minimum monthly flow, February | 6605.65 | 6142.85 | -7.01 |
| ML3: Mean minimum monthly flow, March | 8260.43 | 6482.12 | -21.53 |
| ML4: Mean minimum monthly flow, April | 6728.70 | 4683.43 | -30.40 |
| ML5: Mean minimum monthly flow, May | 4030.00 | 2970.07 | -26.30 |
| ML6: Mean minimum monthly flow, June | 3503.04 | 2802.55 | -20.00 |
| ML7: Mean minimum monthly flow, July | 4092.17 | 3569.69 | -12.77 |
| ML8: Mean minimum monthly flow, August | 4302.17 | 3729.85 | -13.30 |
| ML9: Mean minimum monthly flow, September | 3568.70 | 3082.40 | -13.63 |
| ML10: Mean minimum monthly flow, October | 3804.78 | 3130.96 | -17.71 |
| ML11: Mean minimum monthly flow, November | 3220.43 | 2991.89 | -7.10 |
| ML12: Mean minimum monthly flow, December | 3419.13 | 3322.93 | -2.81 |
| ML13: CV of minimum monthly flows | 88.74 | 69.57 | -21.60 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.54 | 0.58 | 6.19 |
| ML15: Mean minimum annual flow / mean annual flow | 0.41 | 0.41 | -1.10 |
| ML16: Median minimum annual flow / median annual flow | 0.57 | 0.57 | -0.09 |
| ML20: Ratio of baseflow volume to total flow volume | 0.86 | 0.76 | -10.75 |
| ML22: Mean annual minimum flow divided by catchment area | 21.45 | 21.30 | -0.68 |
| RA1: Mean of positive changes from one day to next (rise rate) | 251.26 | 528.50 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 165.35 | 273.57 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 141.43 | 252.87 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 149.91 | 224.07 |  |
| RA5: Ratio of days that are higher than previous day | 0.33 | 0.32 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.02 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.01 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 44.54 | 47.08 |  |
| RA9: CV, number of flow reversals from one day to the next | 39.89 | 22.53 |  |

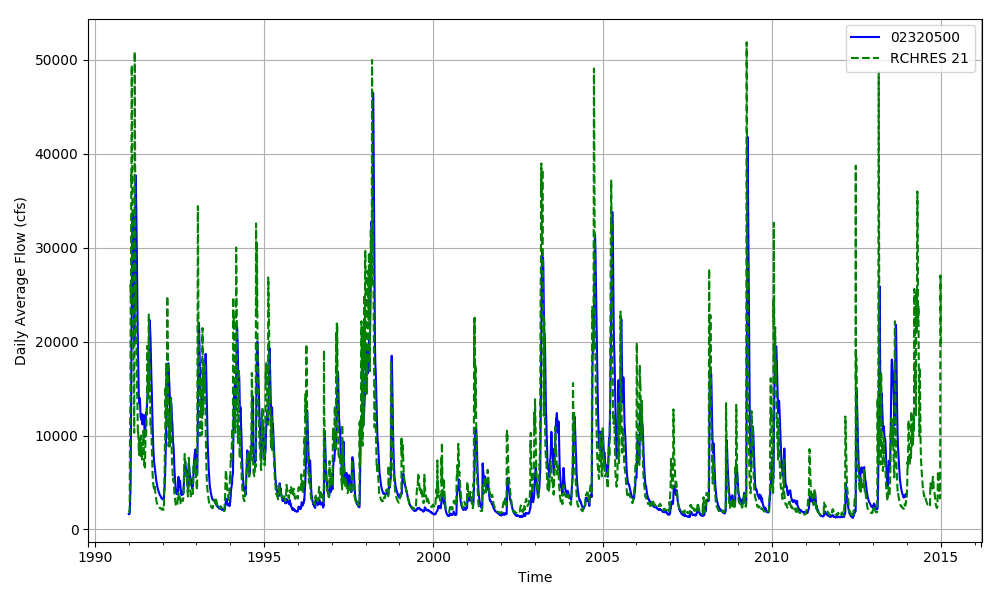


Figure 03110205-10: Daily flow for HSFP reach 21 and USGS station 02320500.

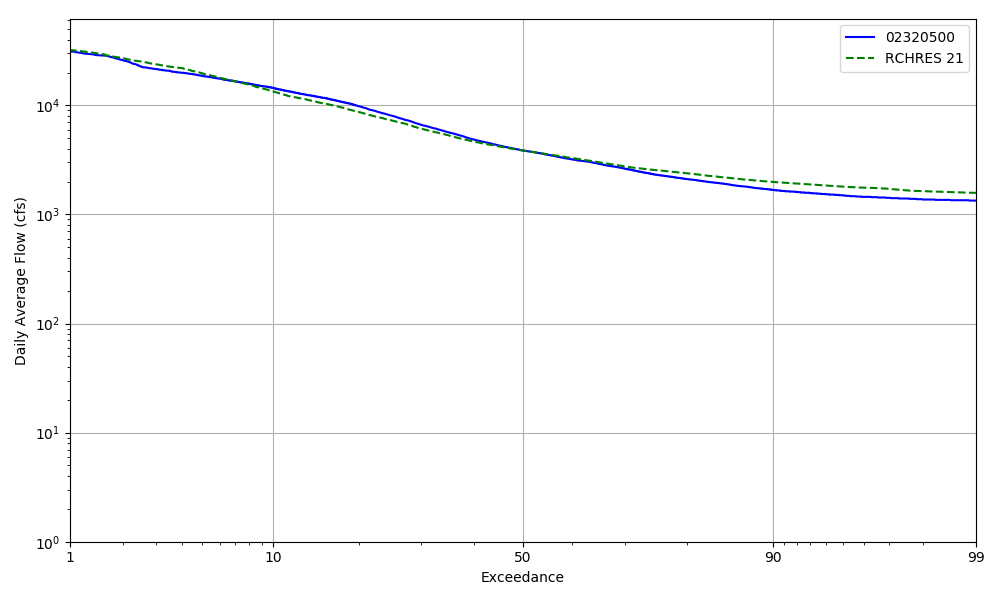


Figure 03110205-11: Daily exceedance for HSFP reach 21 and USGS station 02320500.

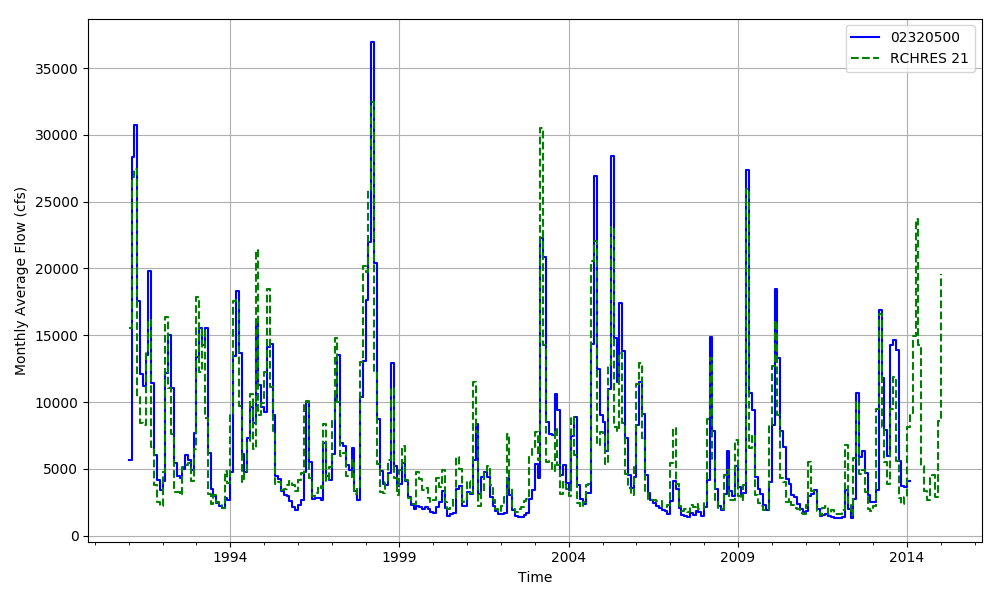


Figure 03110205-12: Monthly flow for HSFP reach 21 and USGS station 02320500.

## HSPF Reach 22, USGS Gauge 02323000

Table 03110205-7: Comparison Statistics Between HSPF Reach 22 and USGS Gauge 02323000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 152.42 |
| Standard error | 2618.52 |
| Relative bias | 0.02 |
| Relative standard error | 0.49 |
| Nash-Sutcliffe coefficient | 0.76 |
| Kling-Gupta coefficient | 0.88 |
| Coefficient of efficiency | 0.57 |
| Index of agreement | 0.78 |

Table 03110205-8: Hydrologic Indices Between USGS Gauge 02323000 and HSPF Reach 22.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02323000 | Simulated Reach 22 | Percent Difference |
| MA1: Mean, all daily flows | 6954.04 | 7131.14 | 2.55 |
| MA2: Median, all daily flows | 4690.00 | 4799.95 | 2.34 |
| MA3: CV, all daily flows | 48.93 | 67.23 | 37.41 |
| MA4: CV, log of all daily flows | 70.73 | 66.18 | -6.43 |
| MA5: Mean daily flow / median daily flow | 1.48 | 1.49 | 0.20 |
| MA9: (Q10 - Q90) / median daily flow | 2.60 | 2.16 | -17.06 |
| MA10: (Q20 - Q80) / median daily flow | 1.63 | 1.22 | -25.32 |
| MA11: (Q25 - Q75) / median daily flow | 1.24 | 0.95 | -23.31 |
| MA12: Mean monthly flow, January | 4394.70 | 5287.73 | 20.32 |
| MA13: Mean monthly flow, February | 5422.39 | 6982.27 | 28.77 |
| MA14: Mean monthly flow, March | 8682.21 | 10638.19 | 22.53 |
| MA15: Mean monthly flow, April | 9788.41 | 8914.08 | -8.93 |
| MA16: Mean monthly flow, May | 5932.07 | 4445.91 | -25.05 |
| MA17: Mean monthly flow, June | 5175.31 | 4748.55 | -8.25 |
| MA18: Mean monthly flow, July | 6526.31 | 6114.62 | -6.31 |
| MA19: Mean monthly flow, August | 6272.55 | 6422.09 | 2.38 |
| MA20: Mean monthly flow, September | 6917.12 | 6948.22 | 0.45 |
| MA21: Mean monthly flow, October | 5366.75 | 5405.71 | 0.73 |
| MA22: Mean monthly flow, November | 4057.33 | 3835.74 | -5.46 |
| MA23: Mean monthly flow, December | 3968.36 | 4667.18 | 17.61 |
| ML1: Mean minimum monthly flow, January | 4299.17 | 4291.89 | -0.17 |
| ML2: Mean minimum monthly flow, February | 5173.33 | 5125.39 | -0.93 |
| ML3: Mean minimum monthly flow, March | 6747.50 | 6443.30 | -4.51 |
| ML4: Mean minimum monthly flow, April | 7421.67 | 6001.80 | -19.13 |
| ML5: Mean minimum monthly flow, May | 5233.33 | 3941.12 | -24.69 |
| ML6: Mean minimum monthly flow, June | 4772.50 | 3928.00 | -17.70 |
| ML7: Mean minimum monthly flow, July | 5877.50 | 5073.50 | -13.68 |
| ML8: Mean minimum monthly flow, August | 5643.08 | 5111.28 | -9.42 |
| ML9: Mean minimum monthly flow, September | 5129.23 | 4707.84 | -8.22 |
| ML10: Mean minimum monthly flow, October | 5199.17 | 4381.53 | -15.73 |
| ML11: Mean minimum monthly flow, November | 3961.67 | 3851.77 | -2.77 |
| ML12: Mean minimum monthly flow, December | 3840.00 | 3937.79 | 2.55 |
| ML13: CV of minimum monthly flows | 71.24 | 50.75 | -28.76 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.59 | 0.62 | 5.31 |
| ML15: Mean minimum annual flow / mean annual flow | 0.46 | 0.46 | -0.81 |
| ML16: Median minimum annual flow / median annual flow | 0.67 | 0.65 | -2.75 |
| ML20: Ratio of baseflow volume to total flow volume | 0.90 | 0.81 | -10.28 |
| ML22: Mean annual minimum flow divided by catchment area | 7171.89 | 7173.37 | 0.02 |
| RA1: Mean of positive changes from one day to next (rise rate) | 222.88 | 533.13 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 157.84 | 292.33 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 151.82 | 256.87 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 125.40 | 227.73 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.33 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.02 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.02 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 69.36 | 38.36 |  |
| RA9: CV, number of flow reversals from one day to the next | 55.74 | 42.23 |  |

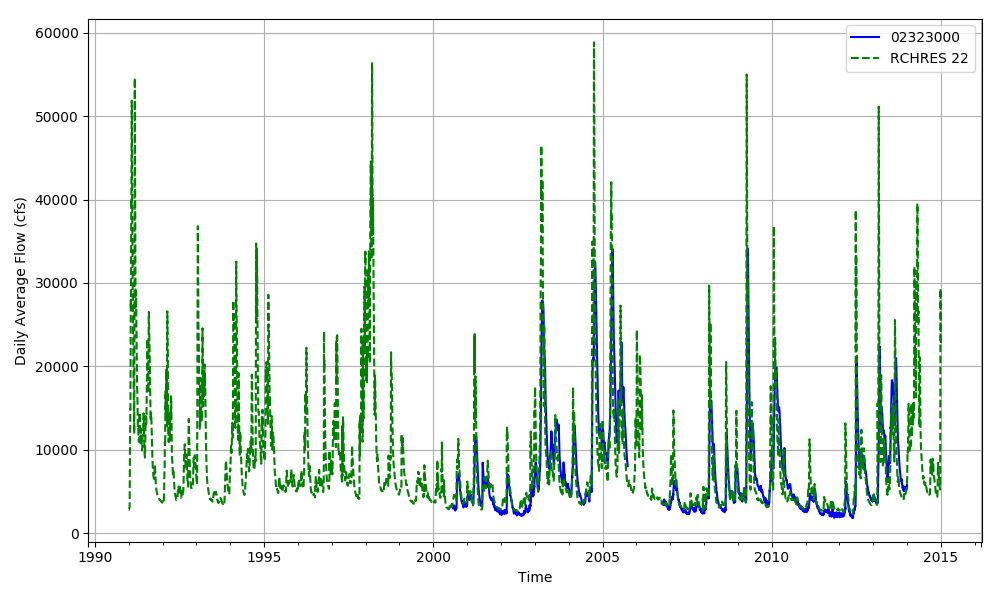


Figure 03110205-13: Daily flow for HSFP reach 22 and USGS station 02323000.

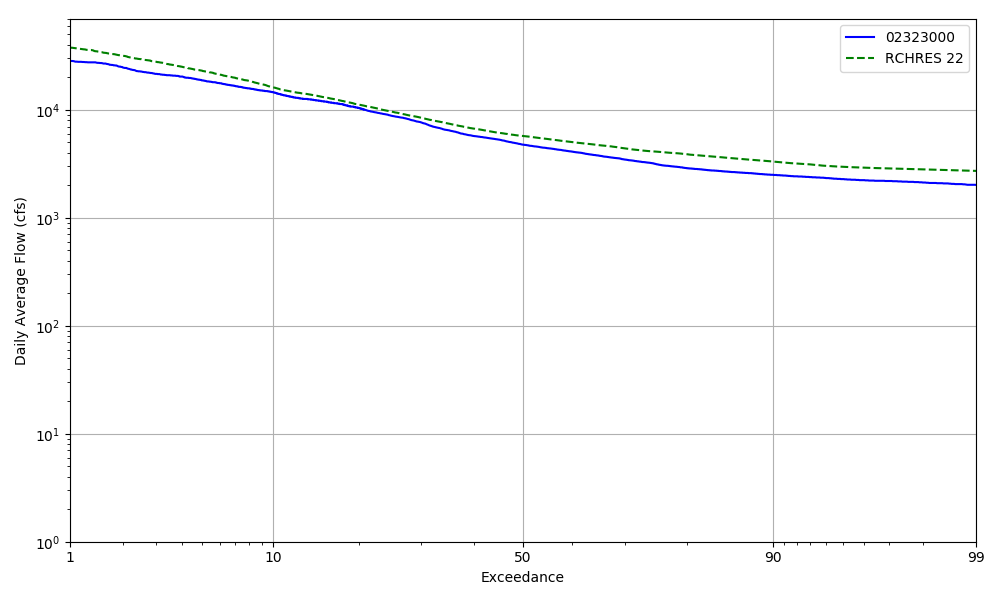


Figure 03110205-14: Daily exceedance for HSFP reach 22 and USGS station 02323000.

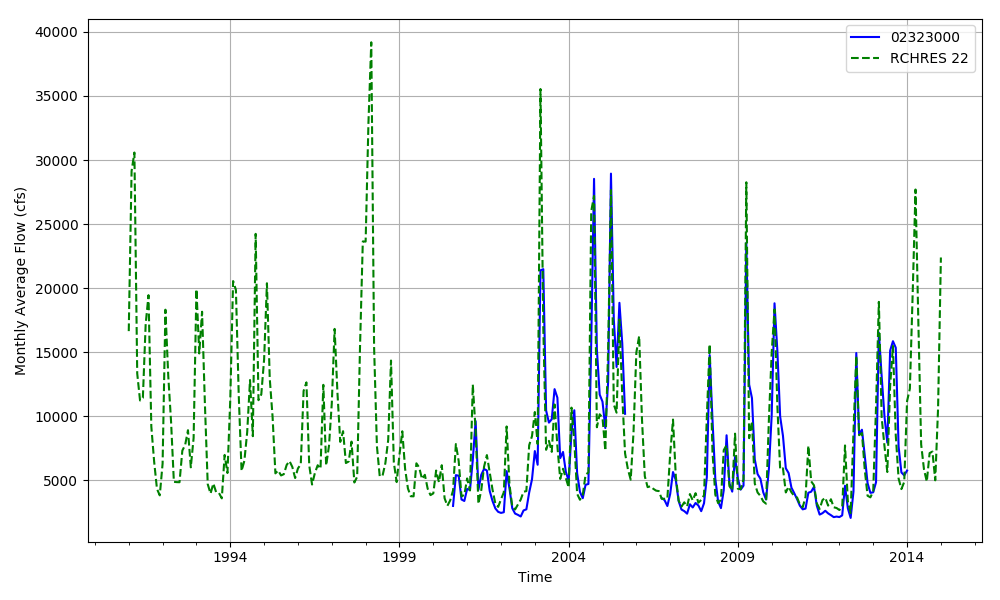


Figure 03110205-15: Monthly flow for HSFP reach 22 and USGS station 02323000.

## HSPF Reach 26, USGS Gauge 02323500

Table 03110205-9: Comparison Statistics Between HSPF Reach 26 and USGS Gauge 02323500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 367.94 |
| Standard error | 2908.52 |
| Relative bias | 0.05 |
| Relative standard error | 0.49 |
| Nash-Sutcliffe coefficient | 0.76 |
| Kling-Gupta coefficient | 0.87 |
| Coefficient of efficiency | 0.56 |
| Index of agreement | 0.77 |

Table 03110205-10: Hydrologic Indices Between USGS Gauge 02323500 and HSPF Reach 26.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02323500 | Simulated Reach 26 | Percent Difference |
| MA1: Mean, all daily flows | 8145.96 | 8508.33 | 4.45 |
| MA2: Median, all daily flows | 5810.00 | 5986.04 | 3.03 |
| MA3: CV, all daily flows | 50.33 | 63.15 | 25.47 |
| MA4: CV, log of all daily flows | 65.30 | 64.76 | -0.82 |
| MA5: Mean daily flow / median daily flow | 1.40 | 1.42 | 1.38 |
| MA9: (Q10 - Q90) / median daily flow | 2.38 | 2.12 | -11.09 |
| MA10: (Q20 - Q80) / median daily flow | 1.45 | 1.21 | -16.37 |
| MA11: (Q25 - Q75) / median daily flow | 1.11 | 0.91 | -18.22 |
| MA12: Mean monthly flow, January | 7223.93 | 9288.12 | 28.57 |
| MA13: Mean monthly flow, February | 9999.57 | 12325.60 | 23.26 |
| MA14: Mean monthly flow, March | 12541.36 | 13988.03 | 11.54 |
| MA15: Mean monthly flow, April | 11634.18 | 10047.75 | -13.64 |
| MA16: Mean monthly flow, May | 7382.76 | 5680.81 | -23.05 |
| MA17: Mean monthly flow, June | 5901.75 | 5562.24 | -5.75 |
| MA18: Mean monthly flow, July | 6766.32 | 6911.26 | 2.14 |
| MA19: Mean monthly flow, August | 6882.50 | 7435.87 | 8.04 |
| MA20: Mean monthly flow, September | 6838.36 | 7074.54 | 3.45 |
| MA21: Mean monthly flow, October | 7236.72 | 7618.02 | 5.27 |
| MA22: Mean monthly flow, November | 5897.01 | 5739.92 | -2.66 |
| MA23: Mean monthly flow, December | 5836.51 | 6715.46 | 15.06 |
| ML1: Mean minimum monthly flow, January | 5593.33 | 5906.99 | 5.61 |
| ML2: Mean minimum monthly flow, February | 8190.44 | 8286.84 | 1.18 |
| ML3: Mean minimum monthly flow, March | 9743.91 | 8623.50 | -11.50 |
| ML4: Mean minimum monthly flow, April | 8495.65 | 6688.89 | -21.27 |
| ML5: Mean minimum monthly flow, May | 5796.96 | 4759.80 | -17.89 |
| ML6: Mean minimum monthly flow, June | 5001.30 | 4592.85 | -8.17 |
| ML7: Mean minimum monthly flow, July | 5725.22 | 5644.93 | -1.40 |
| ML8: Mean minimum monthly flow, August | 5979.56 | 5945.51 | -0.57 |
| ML9: Mean minimum monthly flow, September | 5250.00 | 5298.47 | 0.92 |
| ML10: Mean minimum monthly flow, October | 5460.00 | 5245.41 | -3.93 |
| ML11: Mean minimum monthly flow, November | 4780.44 | 4968.73 | 3.94 |
| ML12: Mean minimum monthly flow, December | 4911.74 | 5226.75 | 6.41 |
| ML13: CV of minimum monthly flows | 72.98 | 53.78 | -26.32 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.49 | 0.63 | 28.29 |
| ML15: Mean minimum annual flow / mean annual flow | 0.42 | 0.50 | 17.33 |
| ML16: Median minimum annual flow / median annual flow | 0.47 | 0.65 | 36.45 |
| ML20: Ratio of baseflow volume to total flow volume | 0.89 | 0.81 | -8.00 |
| ML22: Mean annual minimum flow divided by catchment area | 32.74 | 38.04 | 16.17 |
| RA1: Mean of positive changes from one day to next (rise rate) | 339.84 | 577.12 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 118.79 | 251.74 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 288.63 | 281.73 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 101.83 | 183.28 |  |
| RA5: Ratio of days that are higher than previous day | 0.44 | 0.33 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.03 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 134.42 | 47.79 |  |
| RA9: CV, number of flow reversals from one day to the next | 34.56 | 27.63 |  |

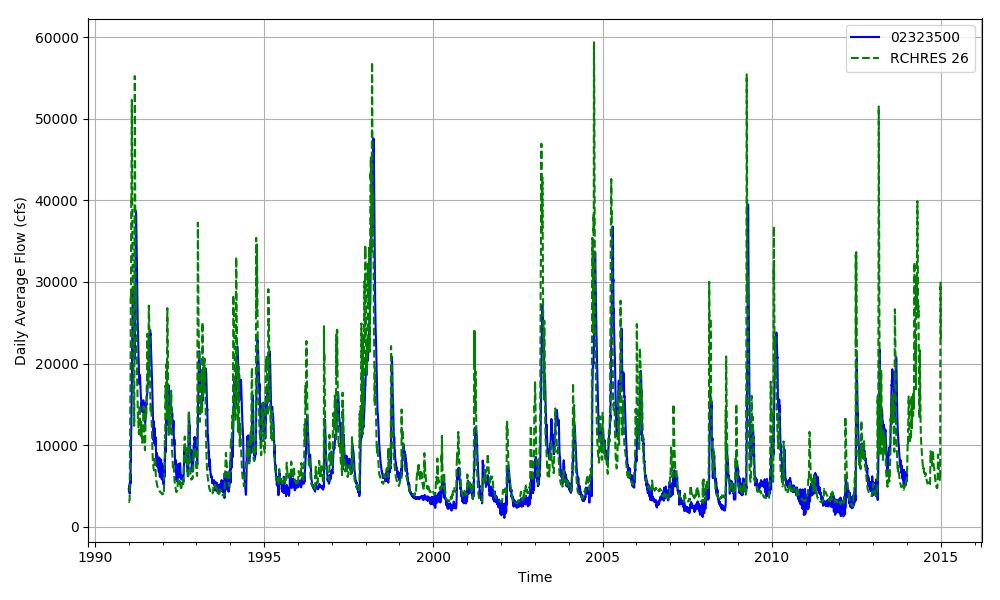


Figure 03110205-16: Daily flow for HSFP reach 26 and USGS station 02323500.

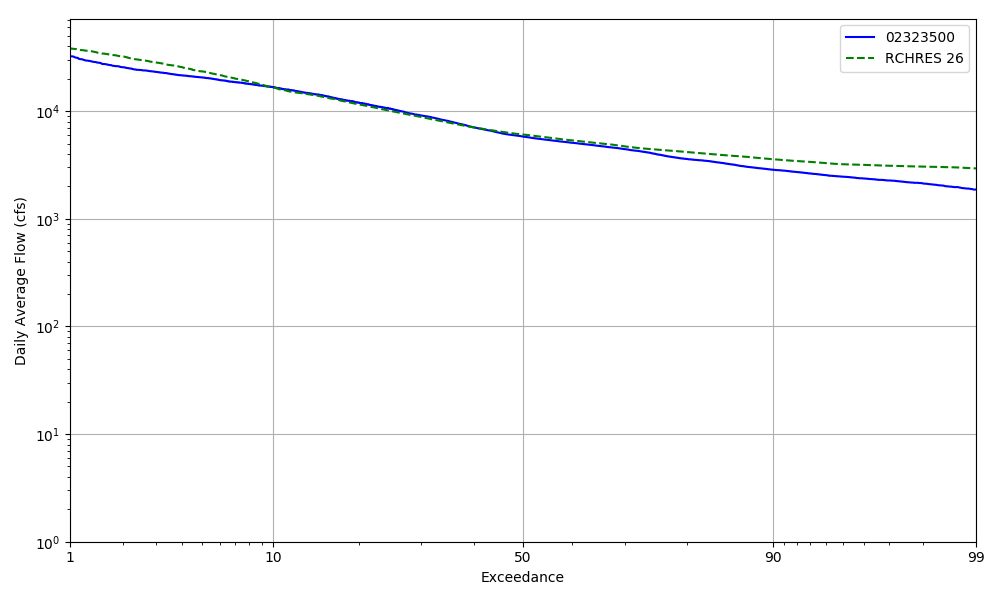


Figure 03110205-17: Daily exceedance for HSFP reach 26 and USGS station 02323500.

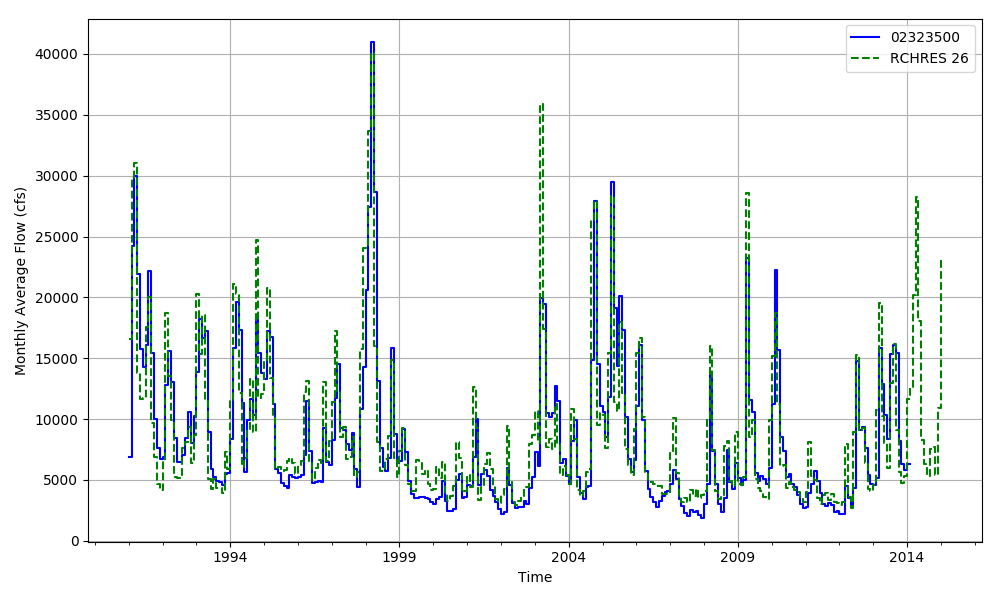


Figure 03110205-18: Monthly flow for HSFP reach 26 and USGS station 02323500.

## HSPF Reach 29, USGS Gauge 02323592

Table 03110205-11: Comparison Statistics Between HSPF Reach 29 and USGS Gauge 02323592.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 171.51 |
| Standard error | 2607.42 |
| Relative bias | 0.02 |
| Relative standard error | 0.51 |
| Nash-Sutcliffe coefficient | 0.74 |
| Kling-Gupta coefficient | 0.87 |
| Coefficient of efficiency | 0.54 |
| Index of agreement | 0.77 |

Table 03110205-12: Hydrologic Indices Between USGS Gauge 02323592 and HSPF Reach 29.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02323592 | Simulated Reach 29 | Percent Difference |
| MA1: Mean, all daily flows | 7405.60 | 7550.06 | 1.95 |
| MA2: Median, all daily flows | 5610.00 | 5396.03 | -3.81 |
| MA3: CV, all daily flows | 45.84 | 60.83 | 32.70 |
| MA4: CV, log of all daily flows | 60.08 | 57.99 | -3.48 |
| MA5: Mean daily flow / median daily flow | 1.32 | 1.40 | 5.99 |
| MA9: (Q10 - Q90) / median daily flow | 1.99 | 1.86 | -6.41 |
| MA10: (Q20 - Q80) / median daily flow | 1.16 | 1.01 | -12.99 |
| MA11: (Q25 - Q75) / median daily flow | 0.87 | 0.74 | -14.71 |
| MA12: Mean monthly flow, January | 5756.67 | 6777.97 | 17.74 |
| MA13: Mean monthly flow, February | 6399.46 | 7960.93 | 24.40 |
| MA14: Mean monthly flow, March | 9111.52 | 10781.69 | 18.33 |
| MA15: Mean monthly flow, April | 10030.02 | 9122.03 | -9.05 |
| MA16: Mean monthly flow, May | 6427.57 | 4905.17 | -23.69 |
| MA17: Mean monthly flow, June | 5691.97 | 5388.93 | -5.32 |
| MA18: Mean monthly flow, July | 7037.10 | 6850.77 | -2.65 |
| MA19: Mean monthly flow, August | 6880.81 | 7238.09 | 5.19 |
| MA20: Mean monthly flow, September | 7283.16 | 7328.26 | 0.62 |
| MA21: Mean monthly flow, October | 6513.14 | 6452.91 | -0.92 |
| MA22: Mean monthly flow, November | 5255.63 | 4808.10 | -8.52 |
| MA23: Mean monthly flow, December | 5141.68 | 5747.29 | 11.78 |
| ML1: Mean minimum monthly flow, January | 4194.00 | 5305.16 | 26.49 |
| ML2: Mean minimum monthly flow, February | 4512.14 | 6005.11 | 33.09 |
| ML3: Mean minimum monthly flow, March | 6253.93 | 6759.13 | 8.08 |
| ML4: Mean minimum monthly flow, April | 6736.43 | 6425.43 | -4.62 |
| ML5: Mean minimum monthly flow, May | 4977.14 | 4446.16 | -10.67 |
| ML6: Mean minimum monthly flow, June | 3827.20 | 4399.24 | 14.95 |
| ML7: Mean minimum monthly flow, July | 4854.00 | 5485.86 | 13.02 |
| ML8: Mean minimum monthly flow, August | 5469.13 | 6065.79 | 10.91 |
| ML9: Mean minimum monthly flow, September | 5008.67 | 5315.84 | 6.13 |
| ML10: Mean minimum monthly flow, October | 4830.00 | 5137.90 | 6.37 |
| ML11: Mean minimum monthly flow, November | 3465.33 | 4548.86 | 31.27 |
| ML12: Mean minimum monthly flow, December | 3355.33 | 4624.36 | 37.82 |
| ML13: CV of minimum monthly flows | 76.32 | 44.49 | -41.71 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.28 | 0.69 | 145.79 |
| ML15: Mean minimum annual flow / mean annual flow | 0.25 | 0.56 | 122.53 |
| ML16: Median minimum annual flow / median annual flow | 0.27 | 0.70 | 160.23 |
| ML20: Ratio of baseflow volume to total flow volume | 0.79 | 0.82 | 4.02 |
| ML22: Mean annual minimum flow divided by catchment area | 18.68 | 39.15 | 109.53 |
| RA1: Mean of positive changes from one day to next (rise rate) | 791.41 | 502.00 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 137.93 | 283.18 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 681.14 | 245.07 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 104.94 | 227.05 |  |
| RA5: Ratio of days that are higher than previous day | 0.46 | 0.33 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.08 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.01 |  |
| RA8: Number of flow reversals from one day to the next | 176.00 | 50.44 |  |
| RA9: CV, number of flow reversals from one day to the next | 28.00 | 32.99 |  |

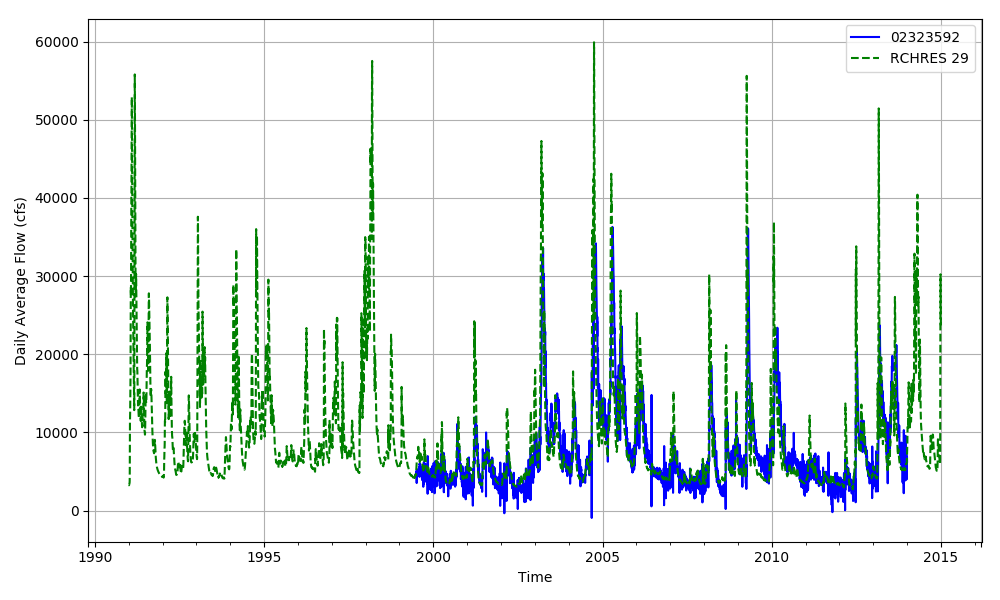


Figure 03110205-19: Daily flow for HSFP reach 29 and USGS station 02323592.

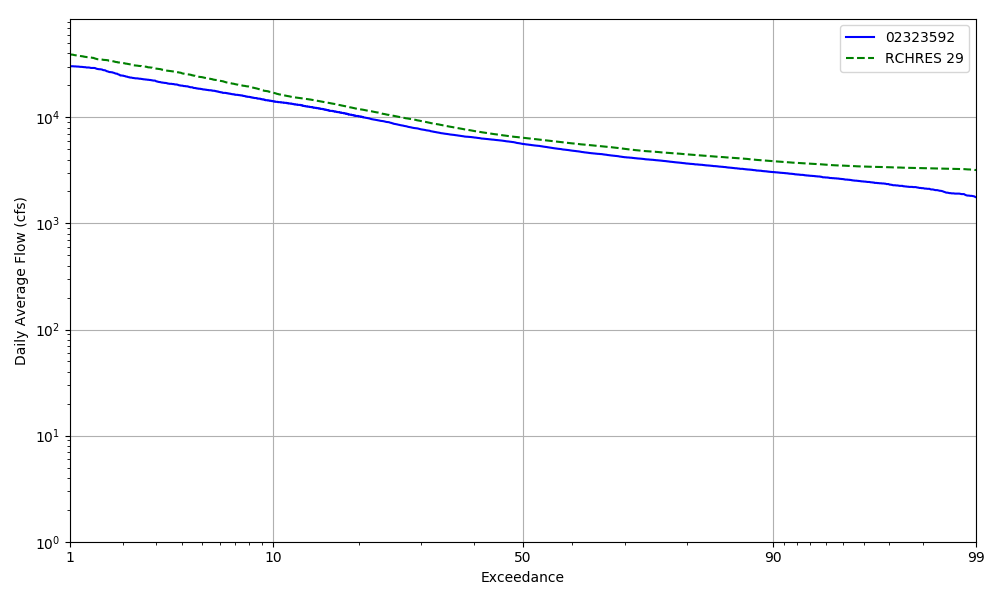


Figure 03110205-20: Daily exceedance for HSFP reach 29 and USGS station 02323592.

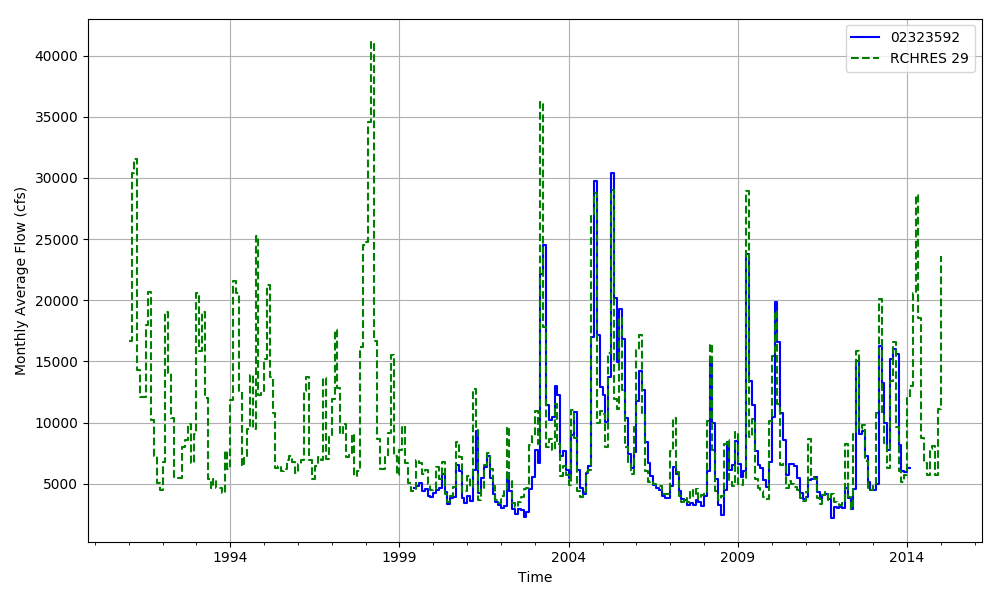


Figure 03110205-21: Monthly flow for HSFP reach 29 and USGS station 02323592.