# Appendix for Model 03130008

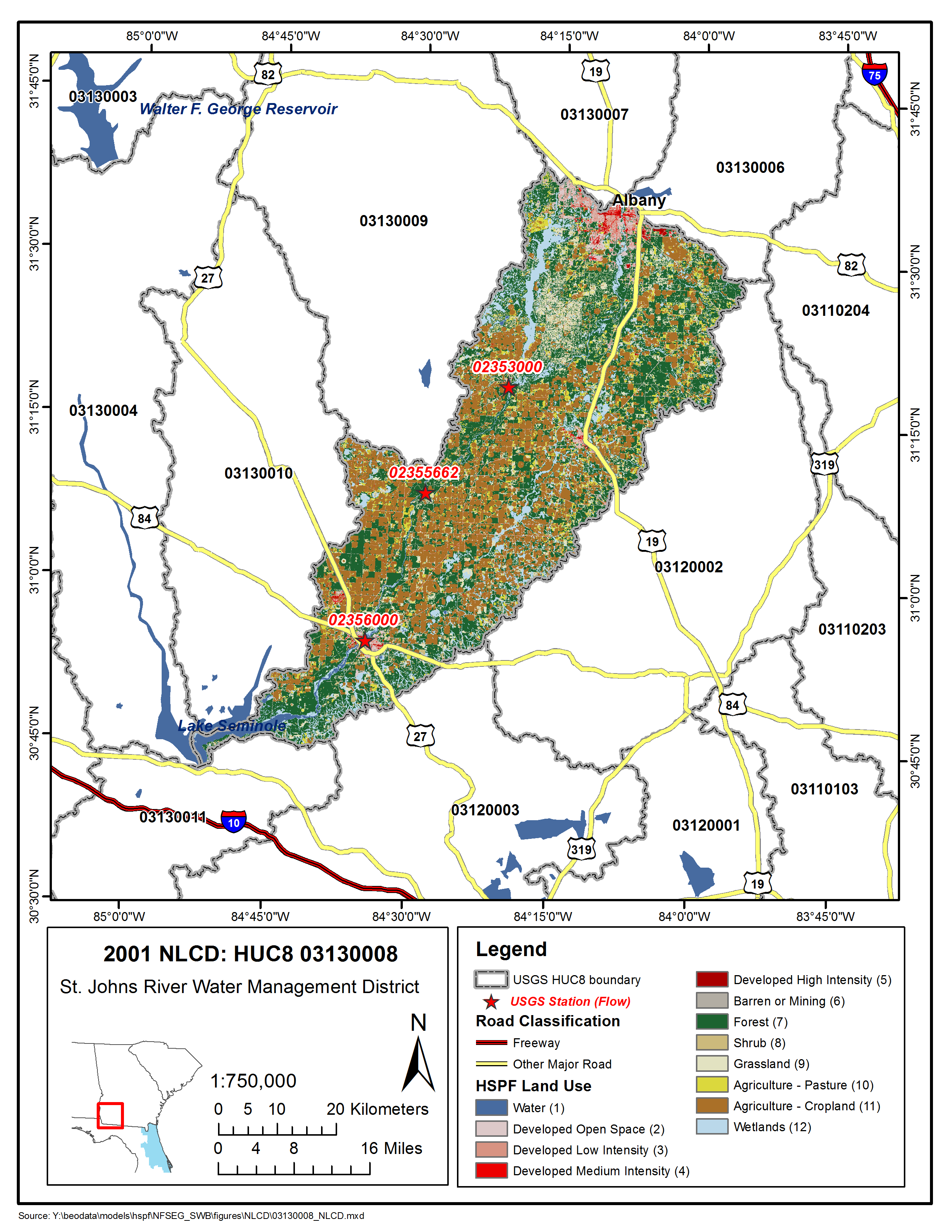


Figure 03130008-1: Land Cover from the National Land Cover Database.

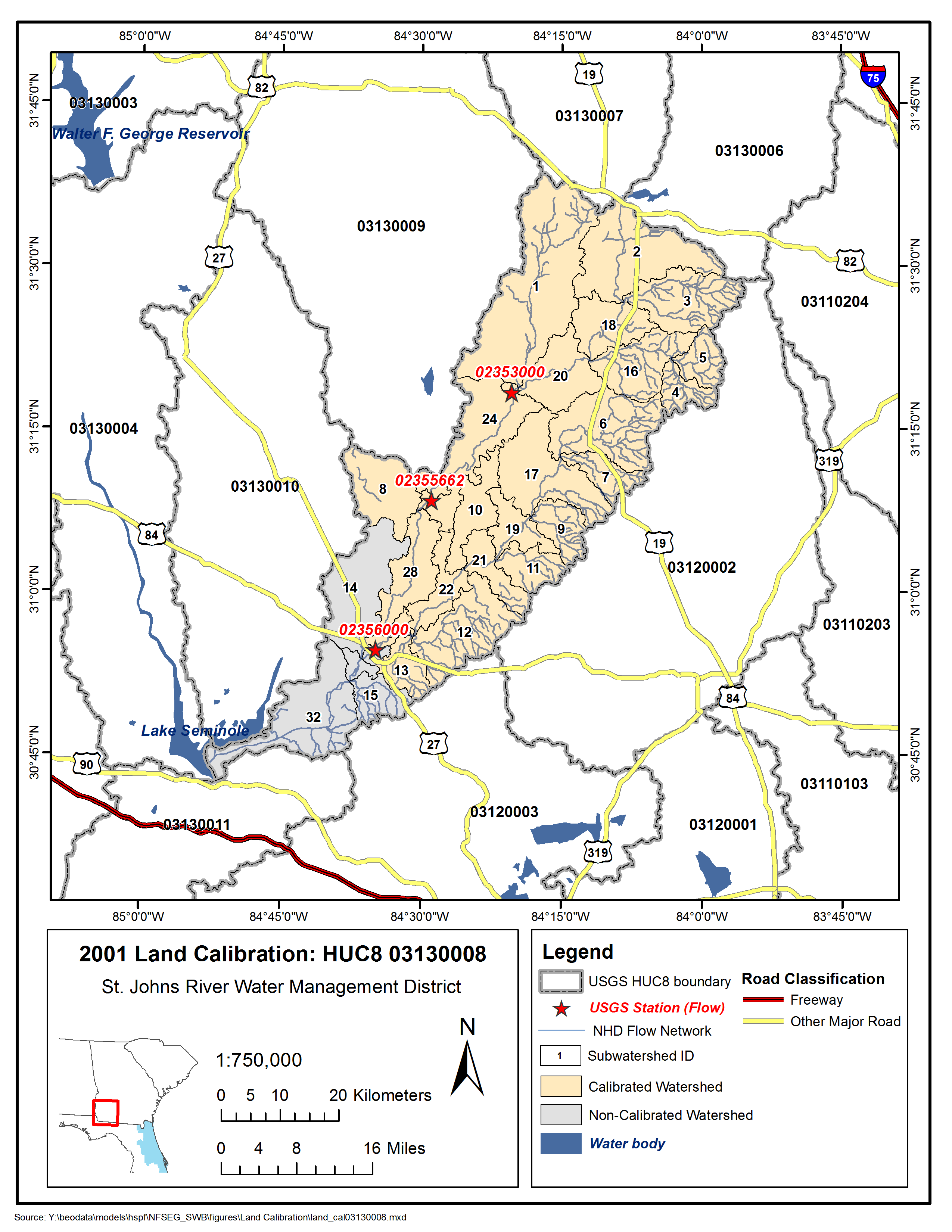


Figure 03130008-2: Calibrated sub-watersheds.

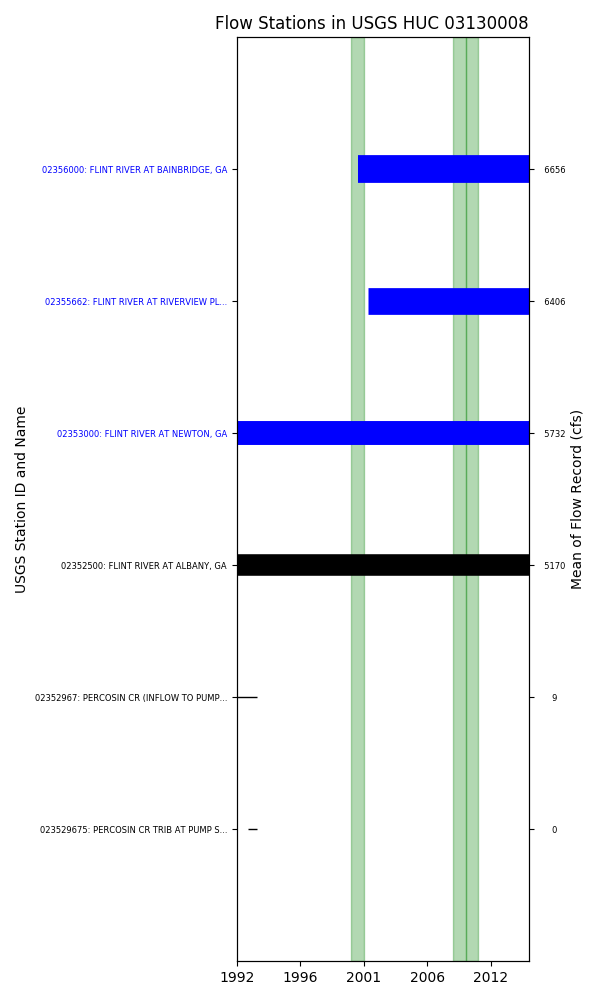


Figure 03130008-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 23, USGS Gauge 02353000

Table 03130008-1: Comparison Statistics Between HSPF Reach 23 and USGS Gauge 02353000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -110.11 |
| Standard error | 2197.93 |
| Relative bias | -0.02 |
| Relative standard error | 0.44 |
| Nash-Sutcliffe coefficient | 0.81 |
| Kling-Gupta coefficient | 0.90 |
| Coefficient of efficiency | 0.70 |
| Index of agreement | 0.86 |

Table 03130008-2: Hydrologic Indices Between USGS Gauge 02353000 and HSPF Reach 23.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02353000 | Simulated Reach 23 | Percent Difference |
| MA1: Mean, all daily flows | 5753.82 | 5639.05 | -1.99 |
| MA2: Median, all daily flows | 3950.00 | 3486.96 | -11.72 |
| MA3: CV, all daily flows | 84.74 | 106.60 | 25.79 |
| MA4: CV, log of all daily flows | 75.72 | 84.09 | 11.05 |
| MA5: Mean daily flow / median daily flow | 1.46 | 1.62 | 11.02 |
| MA9: (Q10 - Q90) / median daily flow | 2.53 | 2.83 | 11.63 |
| MA10: (Q20 - Q80) / median daily flow | 1.55 | 1.66 | 6.98 |
| MA11: (Q25 - Q75) / median daily flow | 1.22 | 1.32 | 8.27 |
| MA12: Mean monthly flow, January | 7364.61 | 7449.88 | 1.16 |
| MA13: Mean monthly flow, February | 9103.31 | 9655.45 | 6.07 |
| MA14: Mean monthly flow, March | 10383.01 | 10695.82 | 3.01 |
| MA15: Mean monthly flow, April | 7957.18 | 7093.57 | -10.85 |
| MA16: Mean monthly flow, May | 4668.63 | 4450.80 | -4.67 |
| MA17: Mean monthly flow, June | 3702.51 | 3340.74 | -9.77 |
| MA18: Mean monthly flow, July | 5166.95 | 3869.72 | -25.11 |
| MA19: Mean monthly flow, August | 3328.98 | 3040.06 | -8.68 |
| MA20: Mean monthly flow, September | 2896.98 | 3214.01 | 10.94 |
| MA21: Mean monthly flow, October | 2981.61 | 2870.18 | -3.74 |
| MA22: Mean monthly flow, November | 3780.79 | 3816.54 | 0.95 |
| MA23: Mean monthly flow, December | 5784.60 | 6351.60 | 9.80 |
| ML1: Mean minimum monthly flow, January | 4703.33 | 4138.17 | -12.02 |
| ML2: Mean minimum monthly flow, February | 5080.00 | 4745.21 | -6.59 |
| ML3: Mean minimum monthly flow, March | 5654.78 | 5067.15 | -10.39 |
| ML4: Mean minimum monthly flow, April | 4207.83 | 3924.27 | -6.74 |
| ML5: Mean minimum monthly flow, May | 2611.35 | 2644.19 | 1.26 |
| ML6: Mean minimum monthly flow, June | 2089.13 | 2118.42 | 1.40 |
| ML7: Mean minimum monthly flow, July | 2191.48 | 2132.93 | -2.67 |
| ML8: Mean minimum monthly flow, August | 2080.30 | 2118.84 | 1.85 |
| ML9: Mean minimum monthly flow, September | 1715.39 | 1709.84 | -0.32 |
| ML10: Mean minimum monthly flow, October | 1914.17 | 1789.07 | -6.54 |
| ML11: Mean minimum monthly flow, November | 2244.43 | 2080.98 | -7.28 |
| ML12: Mean minimum monthly flow, December | 3202.61 | 2955.25 | -7.72 |
| ML13: CV of minimum monthly flows | 73.00 | 72.07 | -1.28 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.33 | 0.36 | 7.67 |
| ML15: Mean minimum annual flow / mean annual flow | 0.25 | 0.23 | -7.08 |
| ML16: Median minimum annual flow / median annual flow | 0.31 | 0.35 | 12.17 |
| ML20: Ratio of baseflow volume to total flow volume | 0.66 | 0.63 | -5.06 |
| ML22: Mean annual minimum flow divided by catchment area | 12.86 | 11.76 | -8.56 |
| RA1: Mean of positive changes from one day to next (rise rate) | 731.27 | 1656.66 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 177.72 | 328.35 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 608.78 | 645.87 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 170.06 | 315.14 |  |
| RA5: Ratio of days that are higher than previous day | 0.45 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.08 | 0.04 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 135.96 | 49.46 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.05 | 22.52 |  |

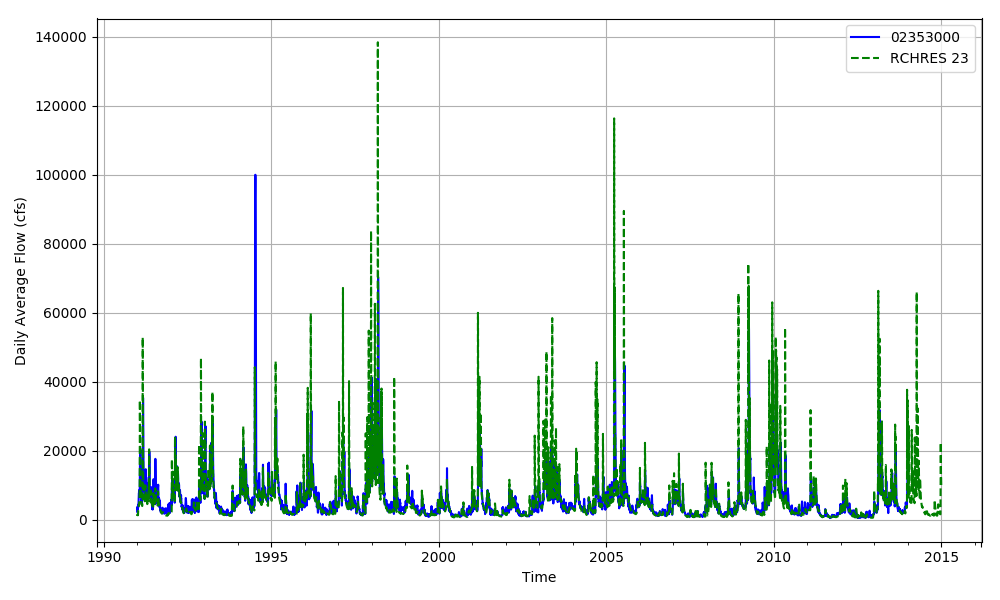


Figure 03130008-4: Daily flow for HSFP reach 23 and USGS station 02353000.

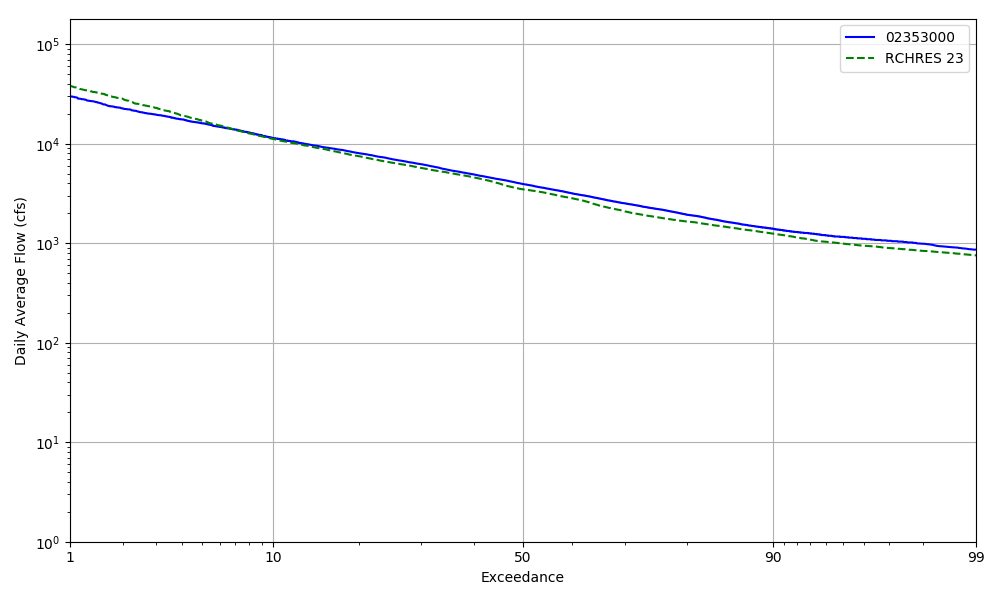


Figure 03130008-5: Daily exceedance for HSFP reach 23 and USGS station 02353000.

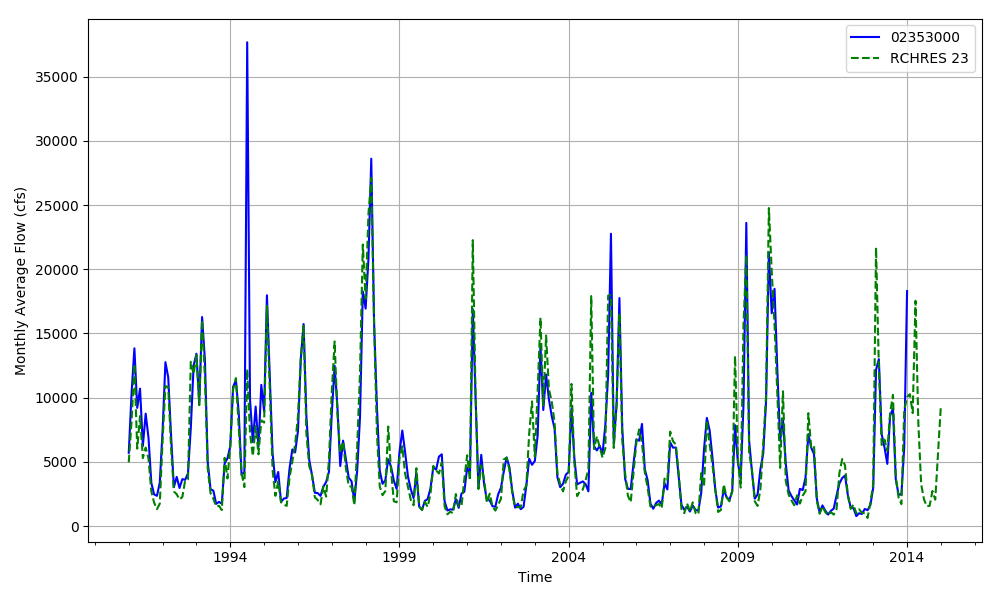


Figure 03130008-6: Monthly flow for HSFP reach 23 and USGS station 02353000.

## HSPF Reach 24, USGS Gauge 02355662

Table 03130008-3: Comparison Statistics Between HSPF Reach 24 and USGS Gauge 02355662.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 323.89 |
| Standard error | 2194.40 |
| Relative bias | 0.05 |
| Relative standard error | 0.39 |
| Nash-Sutcliffe coefficient | 0.84 |
| Kling-Gupta coefficient | 0.89 |
| Coefficient of efficiency | 0.69 |
| Index of agreement | 0.85 |

Table 03130008-4: Hydrologic Indices Between USGS Gauge 02355662 and HSPF Reach 24.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02355662 | Simulated Reach 24 | Percent Difference |
| MA1: Mean, all daily flows | 6253.03 | 6571.01 | 5.09 |
| MA2: Median, all daily flows | 4250.00 | 4094.98 | -3.65 |
| MA3: CV, all daily flows | 76.42 | 105.35 | 37.86 |
| MA4: CV, log of all daily flows | 76.90 | 82.98 | 7.90 |
| MA5: Mean daily flow / median daily flow | 1.47 | 1.60 | 9.06 |
| MA9: (Q10 - Q90) / median daily flow | 2.61 | 2.79 | 6.98 |
| MA10: (Q20 - Q80) / median daily flow | 1.61 | 1.60 | -0.35 |
| MA11: (Q25 - Q75) / median daily flow | 1.27 | 1.27 | -0.01 |
| MA12: Mean monthly flow, January | 7737.44 | 8009.41 | 3.51 |
| MA13: Mean monthly flow, February | 8334.22 | 9822.42 | 17.86 |
| MA14: Mean monthly flow, March | 9160.22 | 9806.59 | 7.06 |
| MA15: Mean monthly flow, April | 9035.87 | 7928.65 | -12.25 |
| MA16: Mean monthly flow, May | 5283.32 | 5320.14 | 0.70 |
| MA17: Mean monthly flow, June | 4297.69 | 4035.43 | -6.10 |
| MA18: Mean monthly flow, July | 4808.78 | 4698.51 | -2.29 |
| MA19: Mean monthly flow, August | 3994.80 | 4230.27 | 5.89 |
| MA20: Mean monthly flow, September | 3562.14 | 4252.18 | 19.37 |
| MA21: Mean monthly flow, October | 3059.73 | 3039.34 | -0.67 |
| MA22: Mean monthly flow, November | 3730.10 | 3797.84 | 1.82 |
| MA23: Mean monthly flow, December | 6136.87 | 7713.44 | 25.69 |
| ML1: Mean minimum monthly flow, January | 6175.00 | 5462.24 | -11.54 |
| ML2: Mean minimum monthly flow, February | 5718.18 | 5072.73 | -11.29 |
| ML3: Mean minimum monthly flow, March | 6518.18 | 5815.62 | -10.78 |
| ML4: Mean minimum monthly flow, April | 5242.73 | 4590.14 | -12.45 |
| ML5: Mean minimum monthly flow, May | 3363.33 | 3127.31 | -7.02 |
| ML6: Mean minimum monthly flow, June | 2589.17 | 2522.09 | -2.59 |
| ML7: Mean minimum monthly flow, July | 2726.83 | 2609.86 | -4.29 |
| ML8: Mean minimum monthly flow, August | 2550.00 | 2737.17 | 7.34 |
| ML9: Mean minimum monthly flow, September | 2130.08 | 2165.05 | 1.64 |
| ML10: Mean minimum monthly flow, October | 2303.33 | 2221.35 | -3.56 |
| ML11: Mean minimum monthly flow, November | 2608.33 | 2467.21 | -5.41 |
| ML12: Mean minimum monthly flow, December | 3428.33 | 3102.45 | -9.51 |
| ML13: CV of minimum monthly flows | 77.90 | 76.85 | -1.35 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.43 | 0.41 | -2.81 |
| ML15: Mean minimum annual flow / mean annual flow | 0.32 | 0.27 | -15.46 |
| ML16: Median minimum annual flow / median annual flow | 0.40 | 0.42 | 4.86 |
| ML20: Ratio of baseflow volume to total flow volume | 0.68 | 0.61 | -10.92 |
| ML22: Mean annual minimum flow divided by catchment area | 16.39 | 15.29 | -6.72 |
| RA1: Mean of positive changes from one day to next (rise rate) | 671.35 | 1915.31 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 185.98 | 321.12 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 524.97 | 756.20 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 170.58 | 305.26 |  |
| RA5: Ratio of days that are higher than previous day | 0.43 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.06 | 0.05 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.05 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 108.23 | 46.77 |  |
| RA9: CV, number of flow reversals from one day to the next | 29.45 | 28.69 |  |

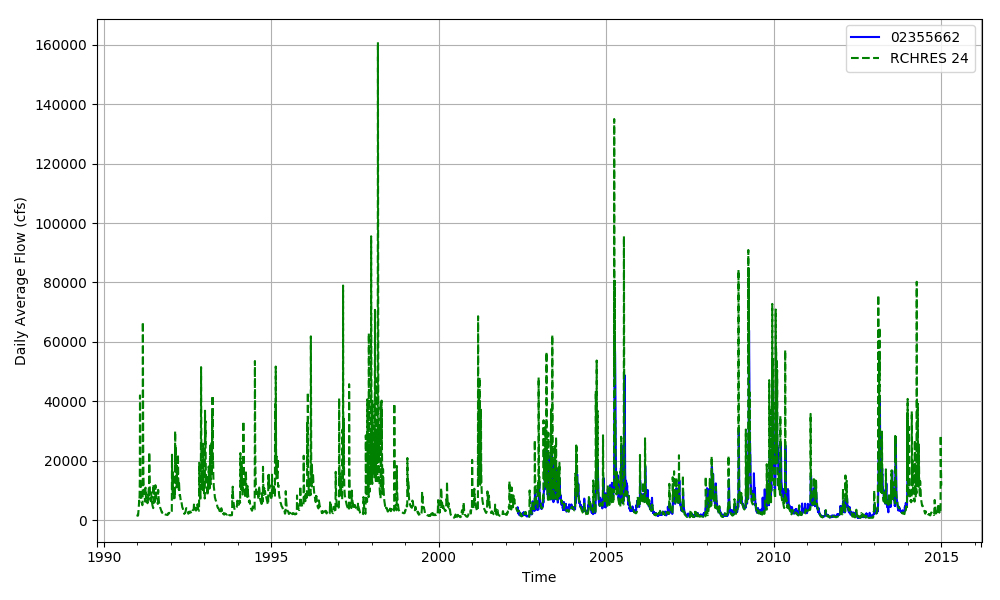


Figure 03130008-7: Daily flow for HSFP reach 24 and USGS station 02355662.

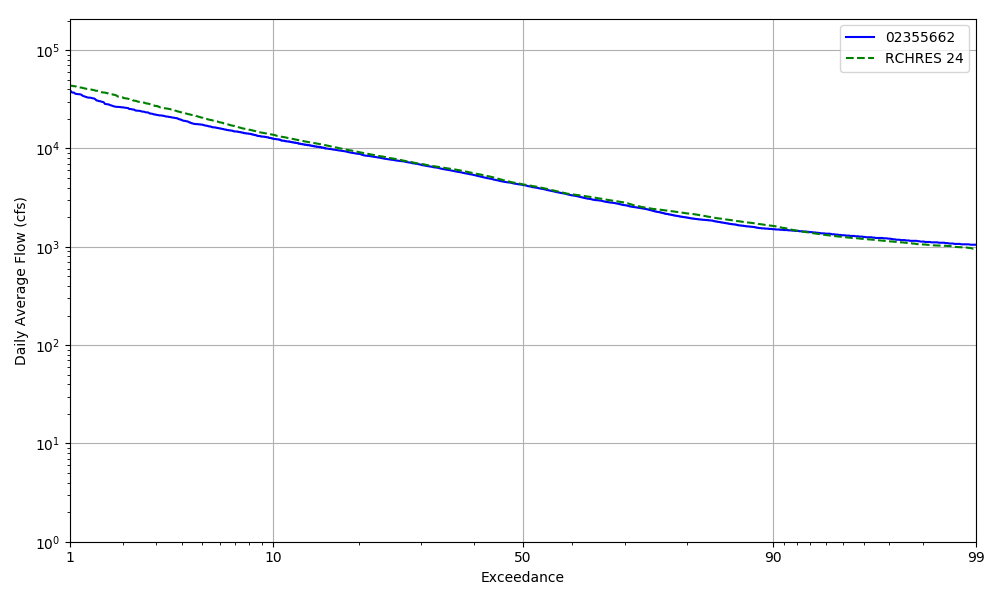


Figure 03130008-8: Daily exceedance for HSFP reach 24 and USGS station 02355662.

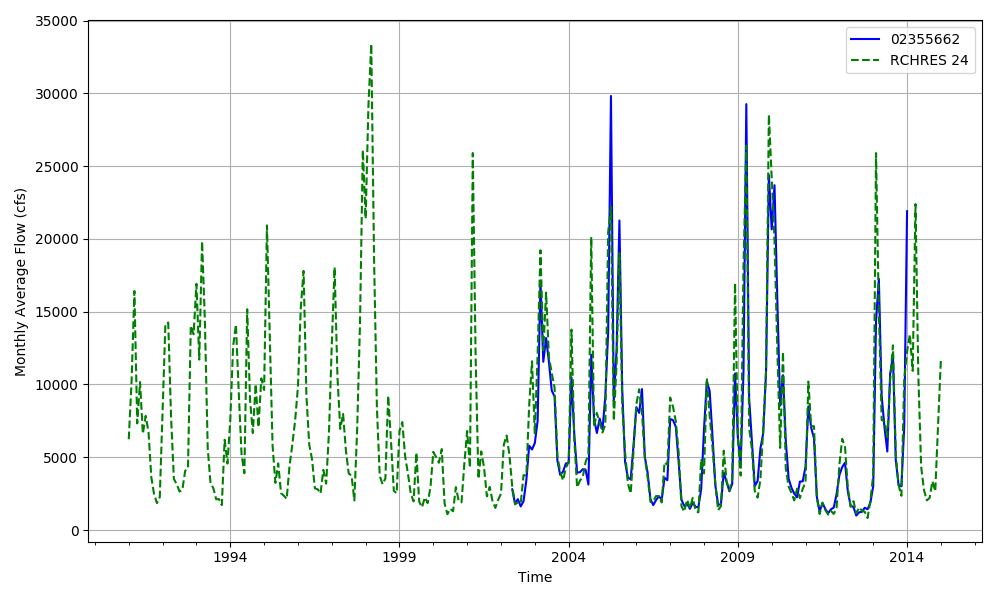


Figure 03130008-9: Monthly flow for HSFP reach 24 and USGS station 02355662.

## HSPF Reach 29, USGS Gauge 02356000

Table 03130008-5: Comparison Statistics Between HSPF Reach 29 and USGS Gauge 02356000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 594.13 |
| Standard error | 2243.13 |
| Relative bias | 0.09 |
| Relative standard error | 0.42 |
| Nash-Sutcliffe coefficient | 0.82 |
| Kling-Gupta coefficient | 0.83 |
| Coefficient of efficiency | 0.68 |
| Index of agreement | 0.85 |

Table 03130008-6: Hydrologic Indices Between USGS Gauge 02356000 and HSPF Reach 29.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02356000 | Simulated Reach 29 | Percent Difference |
| MA1: Mean, all daily flows | 6478.12 | 7051.28 | 8.85 |
| MA2: Median, all daily flows | 4600.00 | 4541.90 | -1.26 |
| MA3: CV, all daily flows | 68.11 | 94.88 | 39.30 |
| MA4: CV, log of all daily flows | 70.76 | 75.47 | 6.66 |
| MA5: Mean daily flow / median daily flow | 1.41 | 1.55 | 10.24 |
| MA9: (Q10 - Q90) / median daily flow | 2.38 | 2.48 | 4.27 |
| MA10: (Q20 - Q80) / median daily flow | 1.50 | 1.42 | -5.26 |
| MA11: (Q25 - Q75) / median daily flow | 1.21 | 1.12 | -7.58 |
| MA12: Mean monthly flow, January | 7700.62 | 8305.74 | 7.86 |
| MA13: Mean monthly flow, February | 8406.11 | 10168.90 | 20.97 |
| MA14: Mean monthly flow, March | 9212.53 | 10314.28 | 11.96 |
| MA15: Mean monthly flow, April | 9206.21 | 8482.20 | -7.86 |
| MA16: Mean monthly flow, May | 5384.35 | 5541.29 | 2.91 |
| MA17: Mean monthly flow, June | 4392.05 | 4275.57 | -2.65 |
| MA18: Mean monthly flow, July | 4962.96 | 5190.00 | 4.57 |
| MA19: Mean monthly flow, August | 4306.59 | 4752.31 | 10.35 |
| MA20: Mean monthly flow, September | 3901.67 | 4739.31 | 21.47 |
| MA21: Mean monthly flow, October | 3328.21 | 3535.21 | 6.22 |
| MA22: Mean monthly flow, November | 3945.41 | 4189.24 | 6.18 |
| MA23: Mean monthly flow, December | 6193.66 | 7854.40 | 26.81 |
| ML1: Mean minimum monthly flow, January | 6140.00 | 5880.98 | -4.22 |
| ML2: Mean minimum monthly flow, February | 5898.33 | 5606.75 | -4.94 |
| ML3: Mean minimum monthly flow, March | 6890.83 | 6337.02 | -8.04 |
| ML4: Mean minimum monthly flow, April | 5704.17 | 5192.38 | -8.97 |
| ML5: Mean minimum monthly flow, May | 3959.17 | 3807.83 | -3.82 |
| ML6: Mean minimum monthly flow, June | 3074.17 | 3137.88 | 2.07 |
| ML7: Mean minimum monthly flow, July | 3095.39 | 3225.33 | 4.20 |
| ML8: Mean minimum monthly flow, August | 2990.77 | 3278.38 | 9.62 |
| ML9: Mean minimum monthly flow, September | 2493.08 | 2761.83 | 10.78 |
| ML10: Mean minimum monthly flow, October | 2532.31 | 2770.19 | 9.39 |
| ML11: Mean minimum monthly flow, November | 2800.00 | 2981.32 | 6.48 |
| ML12: Mean minimum monthly flow, December | 3587.69 | 3553.59 | -0.95 |
| ML13: CV of minimum monthly flows | 72.23 | 67.04 | -7.19 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.45 | 0.49 | 9.56 |
| ML15: Mean minimum annual flow / mean annual flow | 0.35 | 0.35 | -0.88 |
| ML16: Median minimum annual flow / median annual flow | 0.45 | 0.49 | 11.12 |
| ML20: Ratio of baseflow volume to total flow volume | 0.72 | 0.65 | -9.47 |
| ML22: Mean annual minimum flow divided by catchment area | 19.45 | 21.17 | 8.86 |
| RA1: Mean of positive changes from one day to next (rise rate) | 629.31 | 1825.80 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 177.76 | 329.39 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 502.22 | 733.49 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 161.85 | 312.42 |  |
| RA5: Ratio of days that are higher than previous day | 0.44 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.06 | 0.03 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.03 |  |
| RA8: Number of flow reversals from one day to the next | 125.07 | 42.57 |  |
| RA9: CV, number of flow reversals from one day to the next | 35.73 | 35.12 |  |

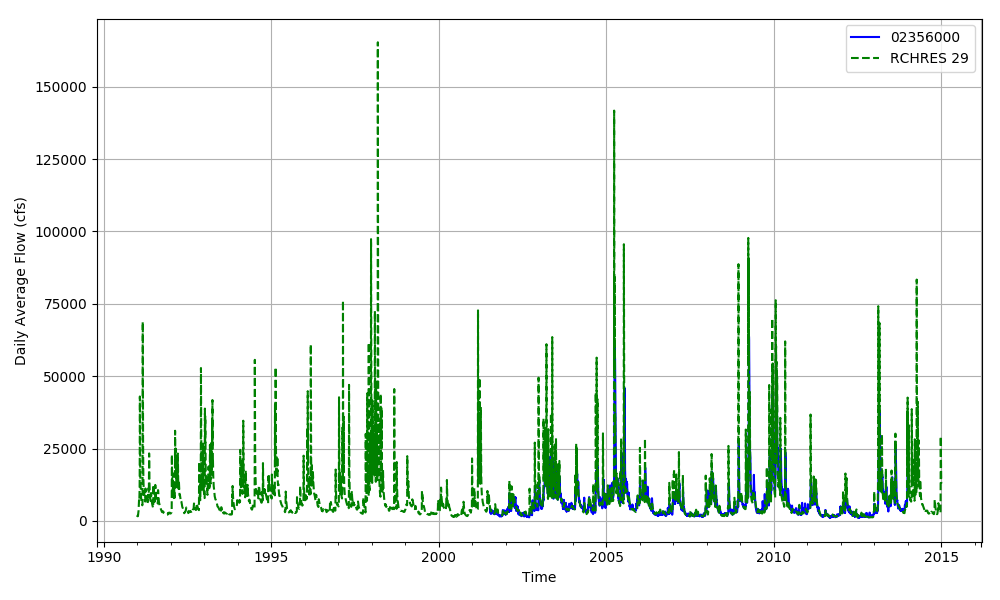


Figure 03130008-10: Daily flow for HSFP reach 29 and USGS station 02356000.

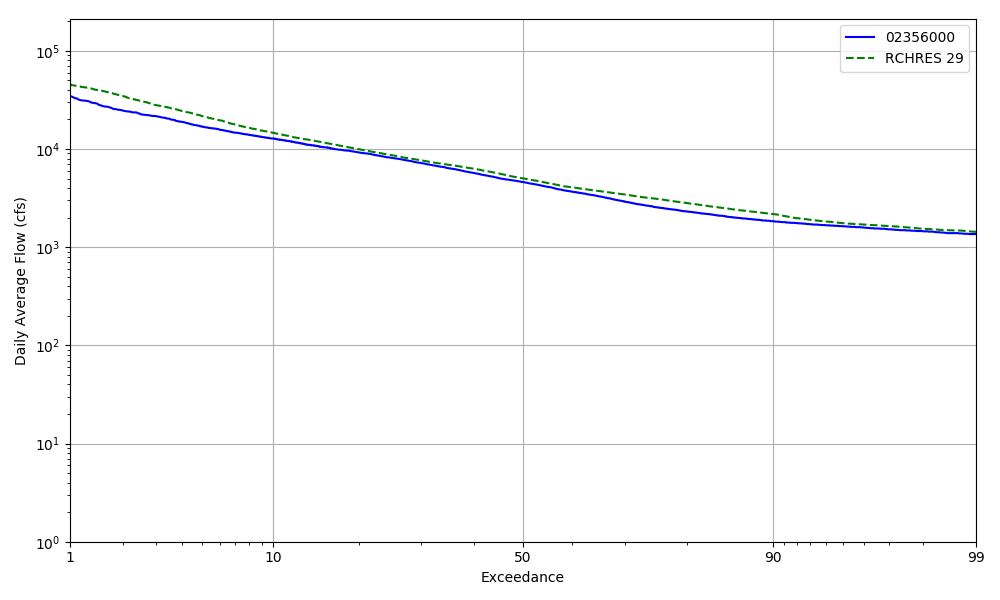


Figure 03130008-11: Daily exceedance for HSFP reach 29 and USGS station 02356000.

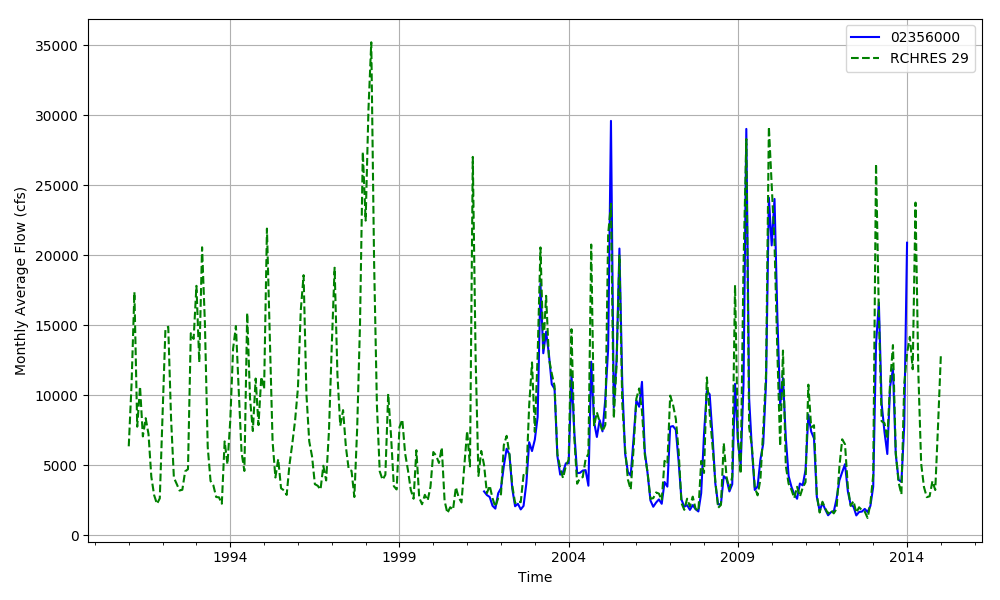


Figure 03130008-12: Monthly flow for HSFP reach 29 and USGS station 02356000.