# Appendix for Model 03070102

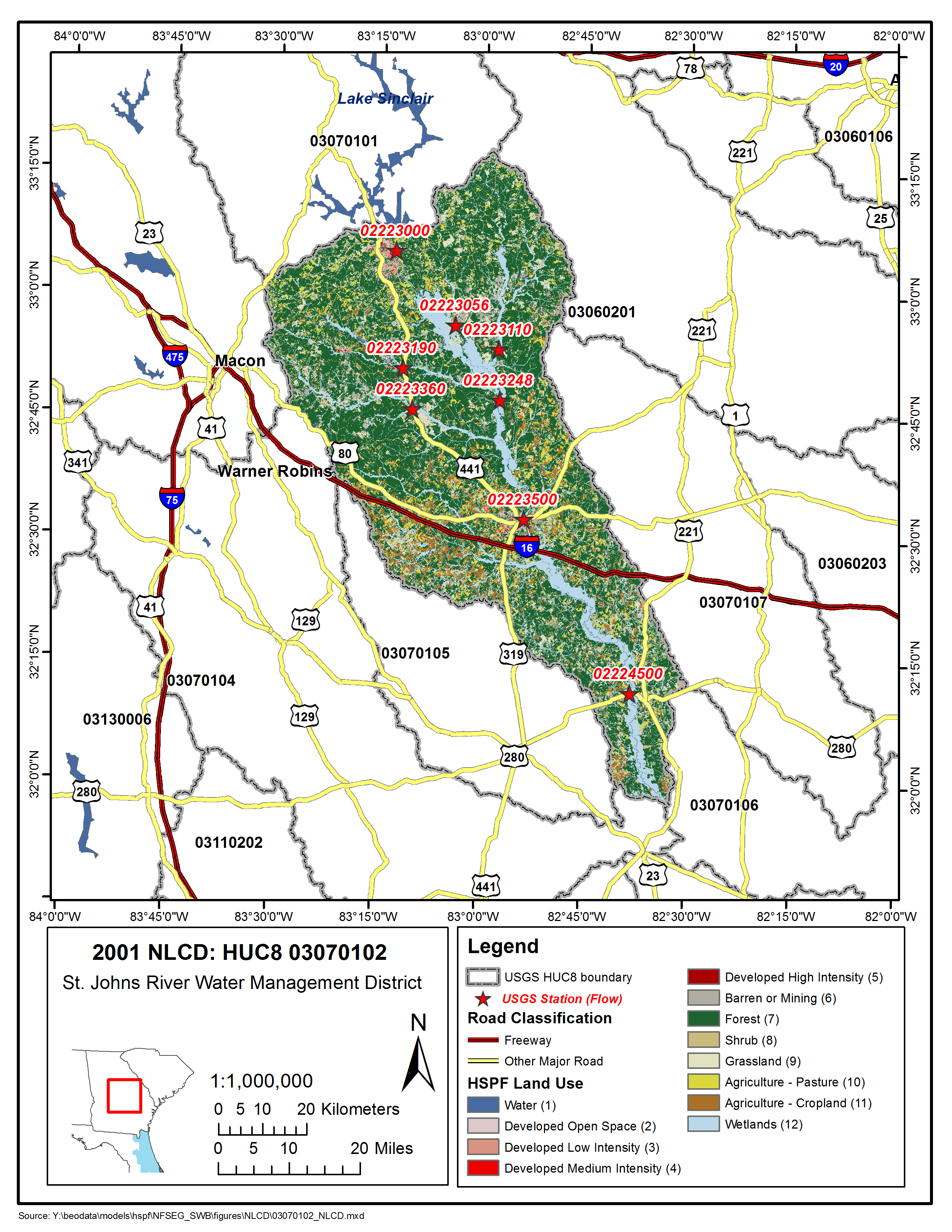


Figure 03070102-1: Land Cover from the National Land Cover Database.

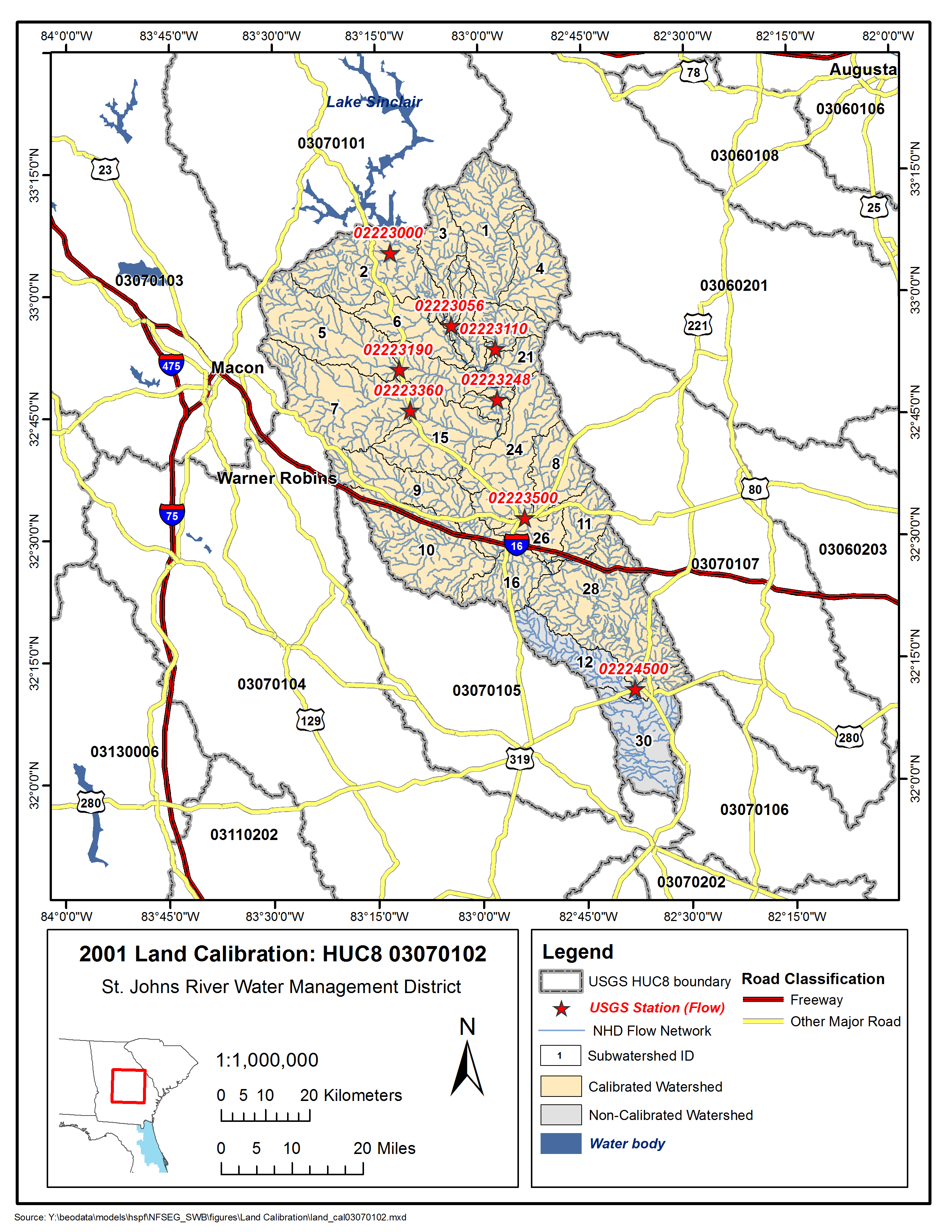


Figure 03070102-2: Calibrated sub-watersheds.

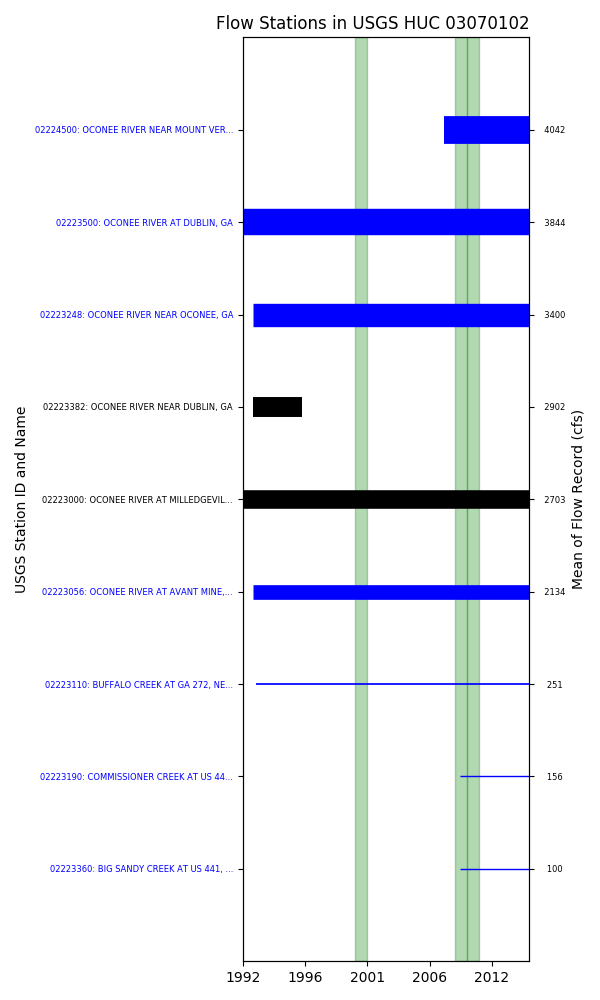


Figure 03070102-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 05, USGS Gauge 02223190

Table 03070102-1: Comparison Statistics Between HSPF Reach 05 and USGS Gauge 02223190.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -20.24 |
| Standard error | 73.08 |
| Relative bias | -0.13 |
| Relative standard error | 0.42 |
| Nash-Sutcliffe coefficient | 0.83 |
| Coefficient of efficiency | 0.65 |
| Index of agreement | 0.82 |

Table 03070102-2: Hydrologic Indices Between USGS Gauge 02223190 and HSPF Reach 05.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02223190 | Simulated Reach 05 | Percent Difference |
| MA1: Mean, all daily flows | 152.96 | 131.78 | -13.84 |
| MA2: Median, all daily flows | 60.00 | 51.88 | -13.53 |
| MA3: CV, all daily flows | 126.04 | 120.39 | -4.48 |
| MA4: CV, log of all daily flows | 127.94 | 120.01 | -6.20 |
| MA5: Mean daily flow / median daily flow | 2.55 | 2.54 | -0.36 |
| MA9: (Q10 - Q90) / median daily flow | 7.04 | 6.19 | -12.05 |
| MA10: (Q20 - Q80) / median daily flow | 3.33 | 3.58 | 7.50 |
| MA11: (Q25 - Q75) / median daily flow | 2.09 | 2.43 | 16.40 |
| MA12: Mean monthly flow, January | 217.59 | 179.97 | -17.29 |
| MA13: Mean monthly flow, February | 241.36 | 178.07 | -26.22 |
| MA14: Mean monthly flow, March | 180.93 | 129.18 | -28.60 |
| MA15: Mean monthly flow, April | 96.36 | 78.01 | -19.03 |
| MA16: Mean monthly flow, May | 78.25 | 71.17 | -9.04 |
| MA17: Mean monthly flow, June | 56.36 | 69.63 | 23.56 |
| MA18: Mean monthly flow, July | 71.52 | 79.64 | 11.34 |
| MA19: Mean monthly flow, August | 66.07 | 103.47 | 56.59 |
| MA20: Mean monthly flow, September | 63.89 | 78.19 | 22.38 |
| MA21: Mean monthly flow, October | 58.35 | 61.34 | 5.13 |
| MA22: Mean monthly flow, November | 90.75 | 70.46 | -22.35 |
| MA23: Mean monthly flow, December | 211.27 | 151.34 | -28.37 |
| ML1: Mean minimum monthly flow, January | 173.40 | 151.73 | -12.50 |
| ML2: Mean minimum monthly flow, February | 126.50 | 77.94 | -38.39 |
| ML3: Mean minimum monthly flow, March | 112.25 | 108.55 | -3.30 |
| ML4: Mean minimum monthly flow, April | 53.00 | 73.04 | 37.81 |
| ML5: Mean minimum monthly flow, May | 36.50 | 64.48 | 76.67 |
| ML6: Mean minimum monthly flow, June | 30.25 | 62.93 | 108.04 |
| ML7: Mean minimum monthly flow, July | 28.25 | 58.87 | 108.40 |
| ML8: Mean minimum monthly flow, August | 26.20 | 42.57 | 62.48 |
| ML9: Mean minimum monthly flow, September | 21.34 | 34.49 | 61.62 |
| ML10: Mean minimum monthly flow, October | 29.60 | 42.68 | 44.18 |
| ML11: Mean minimum monthly flow, November | 41.40 | 42.85 | 3.51 |
| ML12: Mean minimum monthly flow, December | 64.80 | 48.44 | -25.25 |
| ML13: CV of minimum monthly flows | 133.01 | 121.55 | -8.61 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.32 | 0.45 | 37.35 |
| ML15: Mean minimum annual flow / mean annual flow | 0.15 | 0.22 | 48.30 |
| ML16: Median minimum annual flow / median annual flow | 0.28 | 0.45 | 62.15 |
| ML20: Ratio of baseflow volume to total flow volume | 0.47 | 0.58 | 24.37 |
| ML22: Mean annual minimum flow divided by catchment area | 0.17 | 0.20 | 17.65 |
| RA1: Mean of positive changes from one day to next (rise rate) | 68.04 | 58.99 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 220.75 | 254.43 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 36.25 | 15.73 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 238.20 | 290.16 |  |
| RA5: Ratio of days that are higher than previous day | 0.31 | 0.21 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.14 | 0.09 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.09 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 68.83 | 53.67 |  |
| RA9: CV, number of flow reversals from one day to the next | 58.32 | 54.60 |  |

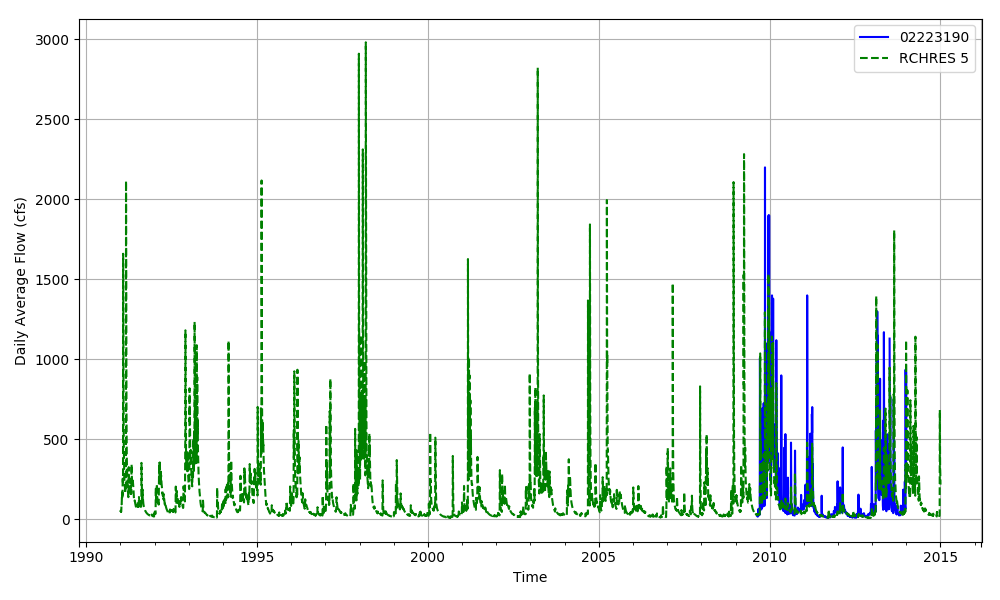


Figure 03070102-4: Daily flow for HSFP reach 05 and USGS station 02223190.

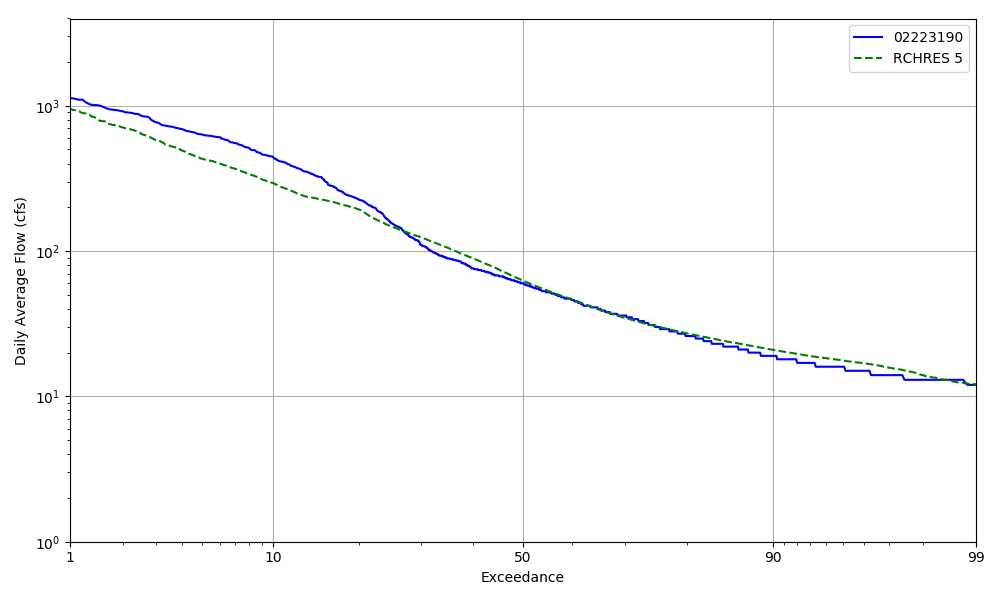


Figure 03070102-5: Daily exceedance for HSFP reach 05 and USGS station 02223190.

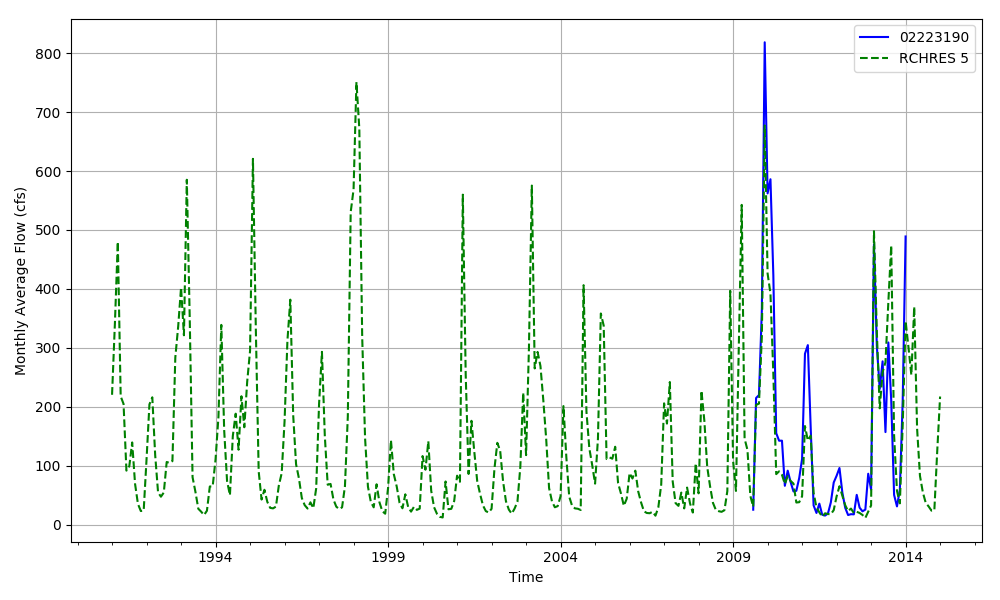


Figure 03070102-6: Monthly flow for HSFP reach 05 and USGS station 02223190.

## HSPF Reach 07, USGS Gauge 02223360

Table 03070102-3: Comparison Statistics Between HSPF Reach 07 and USGS Gauge 02223360.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 54.79 |
| Standard error | 98.96 |
| Relative bias | 0.53 |
| Relative standard error | 0.68 |
| Nash-Sutcliffe coefficient | 0.54 |
| Coefficient of efficiency | 0.42 |
| Index of agreement | 0.75 |

Table 03070102-4: Hydrologic Indices Between USGS Gauge 02223360 and HSPF Reach 07.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02223360 | Simulated Reach 07 | Percent Difference |
| MA1: Mean, all daily flows | 98.11 | 150.74 | 53.64 |
| MA2: Median, all daily flows | 35.00 | 54.61 | 56.01 |
| MA3: CV, all daily flows | 152.34 | 122.65 | -19.49 |
| MA4: CV, log of all daily flows | 162.38 | 125.10 | -22.96 |
| MA5: Mean daily flow / median daily flow | 2.80 | 2.76 | -1.52 |
| MA9: (Q10 - Q90) / median daily flow | 5.57 | 6.25 | 12.24 |
| MA10: (Q20 - Q80) / median daily flow | 2.20 | 3.78 | 71.77 |
| MA11: (Q25 - Q75) / median daily flow | 1.54 | 2.76 | 79.11 |
| MA12: Mean monthly flow, January | 157.31 | 203.06 | 29.08 |
| MA13: Mean monthly flow, February | 187.76 | 214.69 | 14.34 |
| MA14: Mean monthly flow, March | 121.55 | 147.23 | 21.13 |
| MA15: Mean monthly flow, April | 55.06 | 90.38 | 64.16 |
| MA16: Mean monthly flow, May | 32.02 | 64.33 | 100.94 |
| MA17: Mean monthly flow, June | 26.27 | 66.16 | 151.88 |
| MA18: Mean monthly flow, July | 43.39 | 102.75 | 136.83 |
| MA19: Mean monthly flow, August | 45.29 | 121.66 | 168.62 |
| MA20: Mean monthly flow, September | 22.16 | 84.24 | 280.15 |
| MA21: Mean monthly flow, October | 26.26 | 64.46 | 145.50 |
| MA22: Mean monthly flow, November | 41.29 | 76.00 | 84.04 |
| MA23: Mean monthly flow, December | 168.70 | 185.20 | 9.78 |
| ML1: Mean minimum monthly flow, January | 112.40 | 172.53 | 53.50 |
| ML2: Mean minimum monthly flow, February | 63.75 | 89.06 | 39.70 |
| ML3: Mean minimum monthly flow, March | 58.25 | 128.07 | 119.86 |
| ML4: Mean minimum monthly flow, April | 31.48 | 85.58 | 171.91 |
| ML5: Mean minimum monthly flow, May | 17.88 | 68.04 | 280.64 |
| ML6: Mean minimum monthly flow, June | 14.93 | 61.55 | 312.37 |
| ML7: Mean minimum monthly flow, July | 17.57 | 76.98 | 338.01 |
| ML8: Mean minimum monthly flow, August | 13.42 | 51.48 | 283.60 |
| ML9: Mean minimum monthly flow, September | 7.86 | 40.86 | 419.91 |
| ML10: Mean minimum monthly flow, October | 13.78 | 47.41 | 244.04 |
| ML11: Mean minimum monthly flow, November | 24.80 | 48.56 | 95.81 |
| ML12: Mean minimum monthly flow, December | 40.20 | 55.65 | 38.44 |
| ML13: CV of minimum monthly flows | 159.76 | 121.66 | -23.84 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.26 | 0.44 | 71.94 |
| ML15: Mean minimum annual flow / mean annual flow | 0.10 | 0.22 | 109.99 |
| ML16: Median minimum annual flow / median annual flow | 0.19 | 0.46 | 145.19 |
| ML20: Ratio of baseflow volume to total flow volume | 0.41 | 0.57 | 38.68 |
| ML22: Mean annual minimum flow divided by catchment area | 0.08 | 0.22 | 179.74 |
| RA1: Mean of positive changes from one day to next (rise rate) | 50.23 | 63.20 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 275.77 | 264.82 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 24.32 | 17.14 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 285.70 | 293.50 |  |
| RA5: Ratio of days that are higher than previous day | 0.29 | 0.22 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.17 | 0.07 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.03 |  |
| RA8: Number of flow reversals from one day to the next | 67.67 | 52.33 |  |
| RA9: CV, number of flow reversals from one day to the next | 56.16 | 55.28 |  |

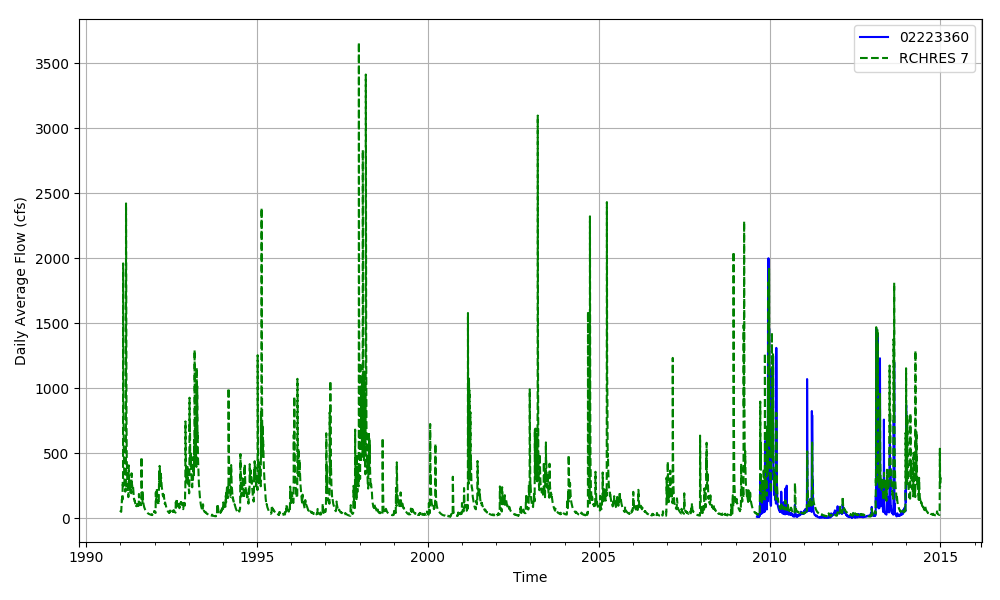


Figure 03070102-7: Daily flow for HSFP reach 07 and USGS station 02223360.

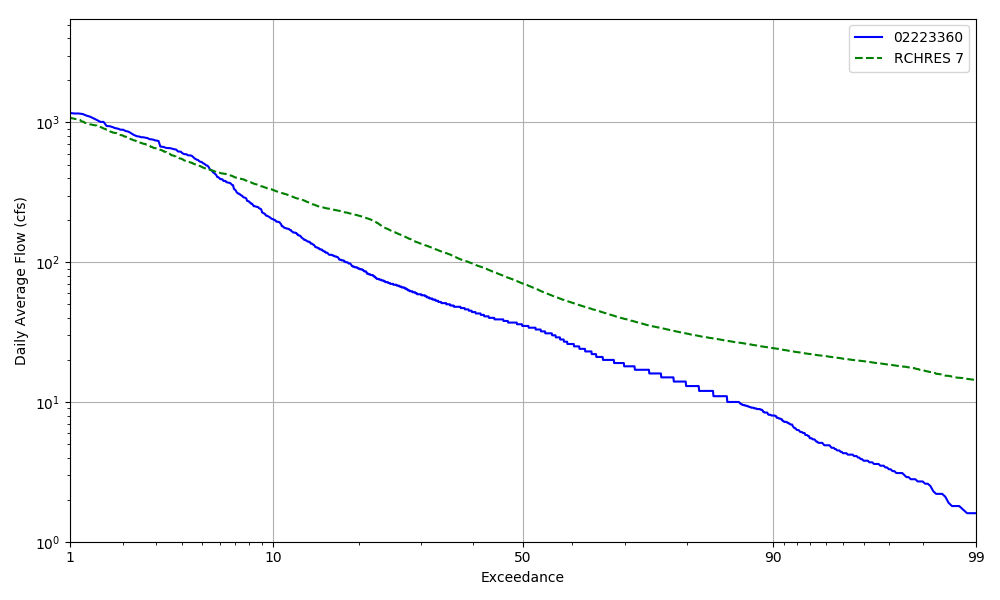


Figure 03070102-8: Daily exceedance for HSFP reach 07 and USGS station 02223360.

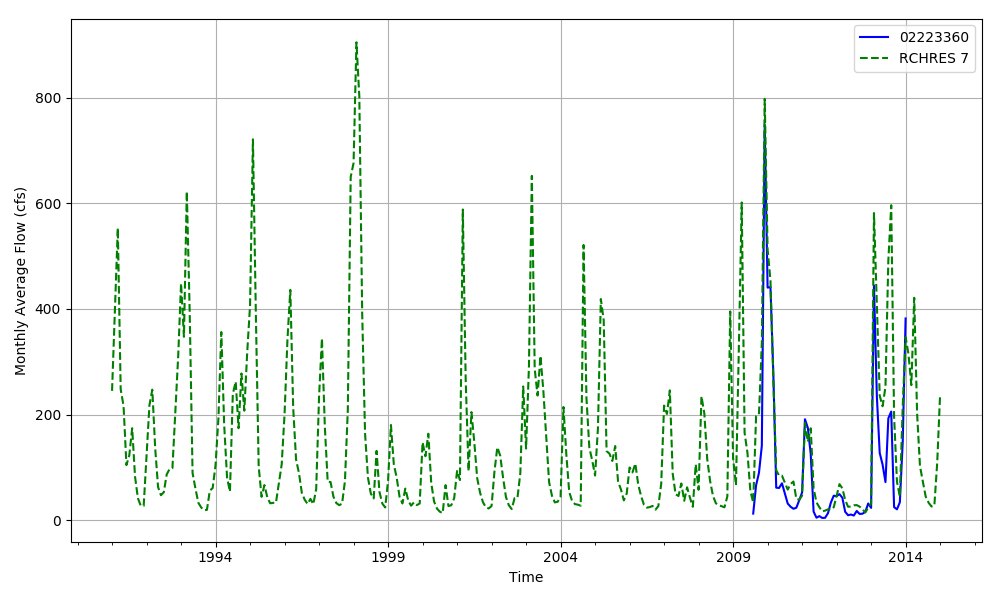


Figure 03070102-9: Monthly flow for HSFP reach 07 and USGS station 02223360.

## HSPF Reach 14, USGS Gauge 02223110

Table 03070102-5: Comparison Statistics Between HSPF Reach 14 and USGS Gauge 02223110.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -0.28 |
| Standard error | 82.91 |
| Relative bias | -0.00 |
| Relative standard error | 0.29 |
| Nash-Sutcliffe coefficient | 0.92 |
| Coefficient of efficiency | 0.78 |
| Index of agreement | 0.89 |

Table 03070102-6: Hydrologic Indices Between USGS Gauge 02223110 and HSPF Reach 14.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02223110 | Simulated Reach 14 | Percent Difference |
| MA1: Mean, all daily flows | 348.72 | 348.22 | -0.14 |
| MA2: Median, all daily flows | 181.50 | 197.46 | 8.79 |
| MA3: CV, all daily flows | 56.58 | 53.02 | -6.29 |
| MA4: CV, log of all daily flows | 103.12 | 98.96 | -4.03 |
| MA5: Mean daily flow / median daily flow | 1.92 | 1.76 | -8.21 |
| MA9: (Q10 - Q90) / median daily flow | 4.46 | 3.89 | -12.73 |
| MA10: (Q20 - Q80) / median daily flow | 2.32 | 2.27 | -2.23 |
| MA11: (Q25 - Q75) / median daily flow | 1.70 | 1.81 | 6.24 |
| MA12: Mean monthly flow, January | 194.47 | 206.73 | 6.31 |
| MA13: Mean monthly flow, February | 309.27 | 307.67 | -0.52 |
| MA14: Mean monthly flow, March | 360.05 | 363.82 | 1.05 |
| MA15: Mean monthly flow, April | 157.84 | 143.30 | -9.22 |
| MA16: Mean monthly flow, May | 64.82 | 66.55 | 2.66 |
| MA17: Mean monthly flow, June | 50.97 | 56.33 | 10.52 |
| MA18: Mean monthly flow, July | 88.95 | 72.30 | -18.72 |
| MA19: Mean monthly flow, August | 78.71 | 74.47 | -5.39 |
| MA20: Mean monthly flow, September | 37.14 | 35.99 | -3.09 |
| MA21: Mean monthly flow, October | 133.23 | 101.78 | -23.61 |
| MA22: Mean monthly flow, November | 70.59 | 88.32 | 25.11 |
| MA23: Mean monthly flow, December | 105.76 | 94.51 | -10.64 |
| ML1: Mean minimum monthly flow, January | 263.25 | 269.10 | 2.22 |
| ML2: Mean minimum monthly flow, February | 296.00 | 295.60 | -0.13 |
| ML3: Mean minimum monthly flow, March | 334.75 | 340.28 | 1.65 |
| ML4: Mean minimum monthly flow, April | 184.25 | 166.87 | -9.43 |
| ML5: Mean minimum monthly flow, May | 68.00 | 79.05 | 16.25 |
| ML6: Mean minimum monthly flow, June | 61.50 | 61.91 | 0.66 |
| ML7: Mean minimum monthly flow, July | 66.00 | 78.07 | 18.29 |
| ML8: Mean minimum monthly flow, August | 54.50 | 78.25 | 43.57 |
| ML9: Mean minimum monthly flow, September | 61.25 | 56.44 | -7.85 |
| ML10: Mean minimum monthly flow, October | 197.75 | 106.28 | -46.26 |
| ML11: Mean minimum monthly flow, November | 140.67 | 131.11 | -6.79 |
| ML12: Mean minimum monthly flow, December | 190.00 | 177.71 | -6.47 |
| ML13: CV of minimum monthly flows | 85.14 | 80.41 | -5.56 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.18 | 0.17 | -2.12 |
| ML15: Mean minimum annual flow / mean annual flow | 0.13 | 0.14 | 4.58 |
| ML16: Median minimum annual flow / median annual flow | 0.08 | 0.07 | -9.74 |
| ML20: Ratio of baseflow volume to total flow volume | 0.50 | 0.51 | 0.94 |
| ML22: Mean annual minimum flow divided by catchment area | 50000.72 | 50000.36 | -0.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 139.26 | 162.10 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 244.32 | 264.76 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 79.17 | 57.00 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 281.52 | 273.71 |  |
| RA5: Ratio of days that are higher than previous day | 0.35 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.13 | 0.08 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 31.30 | 30.30 |  |
| RA9: CV, number of flow reversals from one day to the next | 130.61 | 129.90 |  |

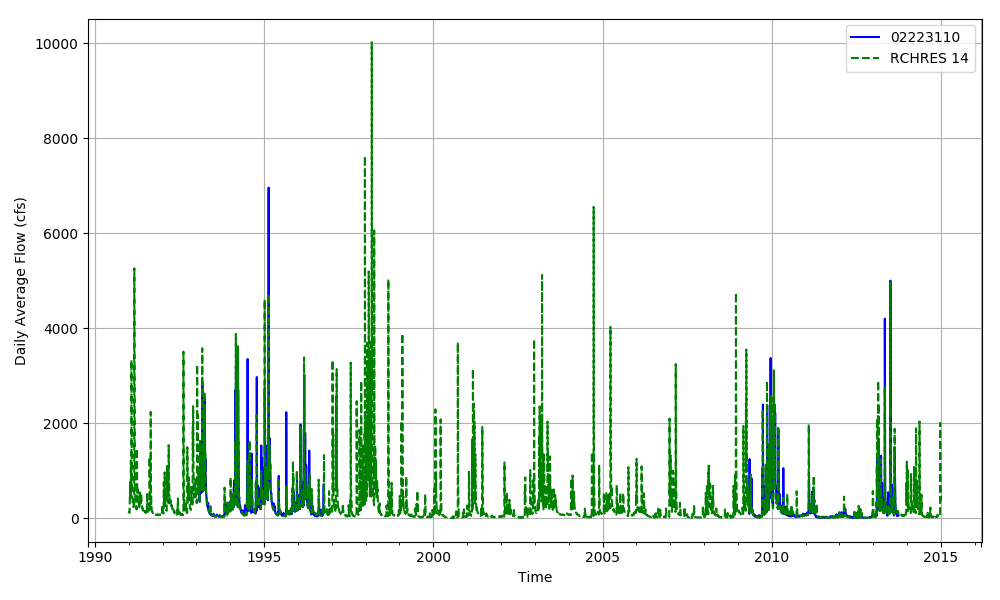


Figure 03070102-10: Daily flow for HSFP reach 14 and USGS station 02223110.

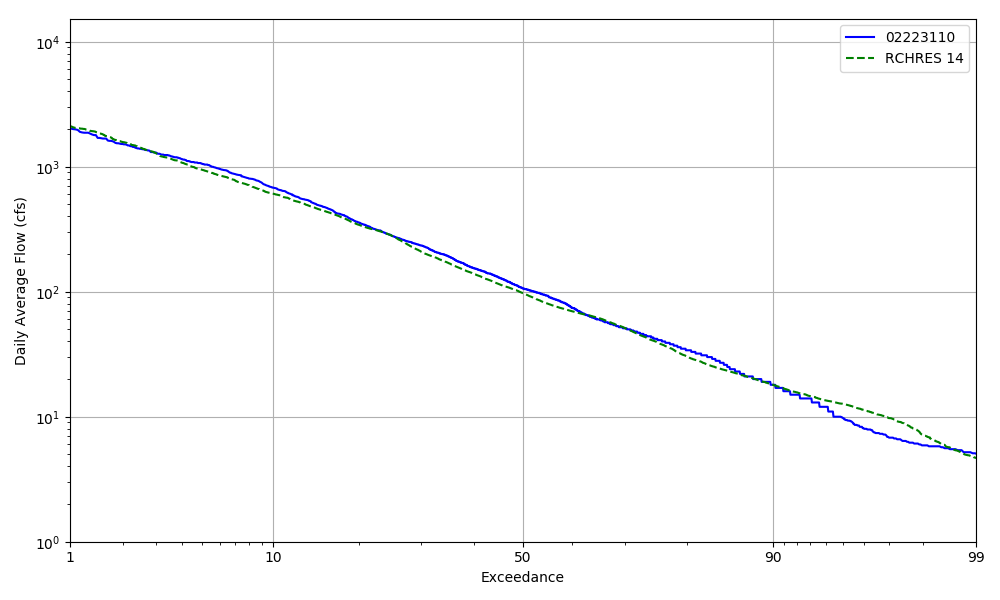


Figure 03070102-11: Daily exceedance for HSFP reach 14 and USGS station 02223110.

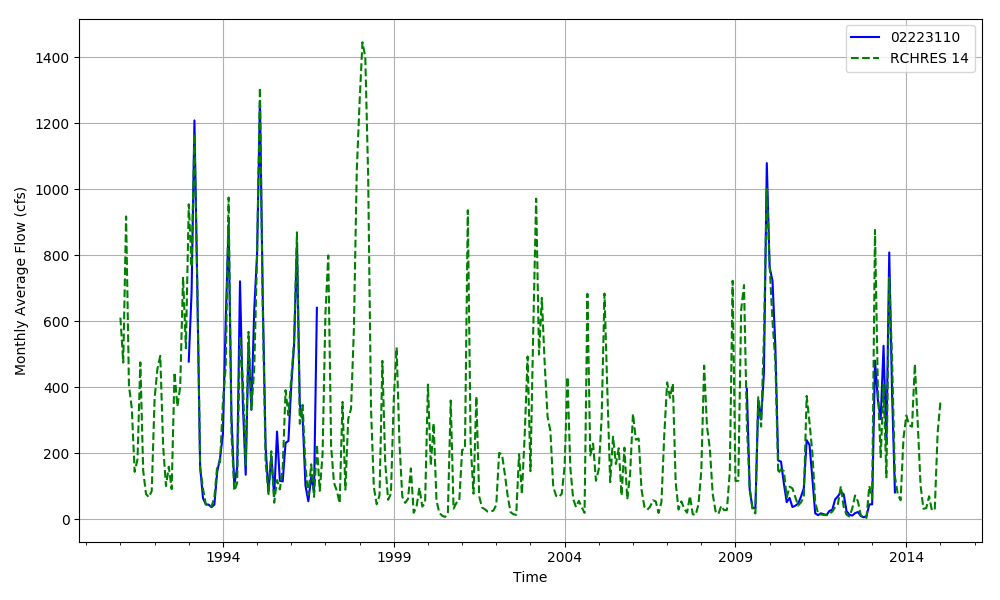


Figure 03070102-12: Monthly flow for HSFP reach 14 and USGS station 02223110.

## HSPF Reach 18, USGS Gauge 02223056

Table 03070102-7: Comparison Statistics Between HSPF Reach 18 and USGS Gauge 02223056.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 370.21 |
| Standard error | 710.92 |
| Relative bias | 0.17 |
| Relative standard error | 0.40 |
| Nash-Sutcliffe coefficient | 0.84 |
| Coefficient of efficiency | 0.64 |
| Index of agreement | 0.83 |

Table 03070102-8: Hydrologic Indices Between USGS Gauge 02223056 and HSPF Reach 18.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02223056 | Simulated Reach 18 | Percent Difference |
| MA1: Mean, all daily flows | 2080.52 | 2431.91 | 16.89 |
| MA2: Median, all daily flows | 1260.00 | 1864.53 | 47.98 |
| MA3: CV, all daily flows | 83.56 | 76.11 | -8.92 |
| MA4: CV, log of all daily flows | 99.58 | 76.37 | -23.31 |
| MA5: Mean daily flow / median daily flow | 1.65 | 1.30 | -21.01 |
| MA9: (Q10 - Q90) / median daily flow | 4.08 | 2.44 | -40.37 |
| MA10: (Q20 - Q80) / median daily flow | 2.31 | 1.62 | -29.83 |
| MA11: (Q25 - Q75) / median daily flow | 1.77 | 1.28 | -27.92 |
| MA12: Mean monthly flow, January | 2723.22 | 3148.91 | 15.63 |
| MA13: Mean monthly flow, February | 3465.55 | 3918.02 | 13.06 |
| MA14: Mean monthly flow, March | 3502.20 | 3689.26 | 5.34 |
| MA15: Mean monthly flow, April | 2858.41 | 3101.30 | 8.50 |
| MA16: Mean monthly flow, May | 1848.54 | 2303.72 | 24.62 |
| MA17: Mean monthly flow, June | 1549.52 | 1813.99 | 17.07 |
| MA18: Mean monthly flow, July | 1493.16 | 1769.86 | 18.53 |
| MA19: Mean monthly flow, August | 1097.98 | 1277.13 | 16.32 |
| MA20: Mean monthly flow, September | 1026.40 | 1506.74 | 46.80 |
| MA21: Mean monthly flow, October | 897.98 | 1357.95 | 51.22 |
| MA22: Mean monthly flow, November | 1630.33 | 1976.37 | 21.22 |
| MA23: Mean monthly flow, December | 2179.51 | 2527.79 | 15.98 |
| ML1: Mean minimum monthly flow, January | 1154.47 | 2031.93 | 76.01 |
| ML2: Mean minimum monthly flow, February | 1749.53 | 2608.68 | 49.11 |
| ML3: Mean minimum monthly flow, March | 1883.56 | 2607.77 | 38.45 |
| ML4: Mean minimum monthly flow, April | 1313.37 | 2173.21 | 65.47 |
| ML5: Mean minimum monthly flow, May | 730.74 | 1570.15 | 114.87 |
| ML6: Mean minimum monthly flow, June | 606.25 | 1235.46 | 103.79 |
| ML7: Mean minimum monthly flow, July | 682.45 | 1054.34 | 54.49 |
| ML8: Mean minimum monthly flow, August | 586.50 | 885.99 | 51.06 |
| ML9: Mean minimum monthly flow, September | 496.35 | 772.56 | 55.65 |
| ML10: Mean minimum monthly flow, October | 563.72 | 933.60 | 65.61 |
| ML11: Mean minimum monthly flow, November | 594.79 | 1300.00 | 118.57 |
| ML12: Mean minimum monthly flow, December | 1119.84 | 1739.08 | 55.30 |
| ML13: CV of minimum monthly flows | 100.70 | 73.84 | -26.67 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.37 | 0.29 | -21.57 |
| ML15: Mean minimum annual flow / mean annual flow | 0.22 | 0.23 | 5.55 |
| ML16: Median minimum annual flow / median annual flow | 0.31 | 0.31 | 1.22 |
| ML20: Ratio of baseflow volume to total flow volume | 0.51 | 0.69 | 34.90 |
| ML22: Mean annual minimum flow divided by catchment area | 4765.64 | 4767.18 | 0.03 |
| RA1: Mean of positive changes from one day to next (rise rate) | 580.85 | 647.53 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 166.82 | 350.41 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 396.49 | 269.61 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 169.97 | 432.12 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.10 | 0.05 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 124.00 | 46.81 |  |
| RA9: CV, number of flow reversals from one day to the next | 31.54 | 30.81 |  |

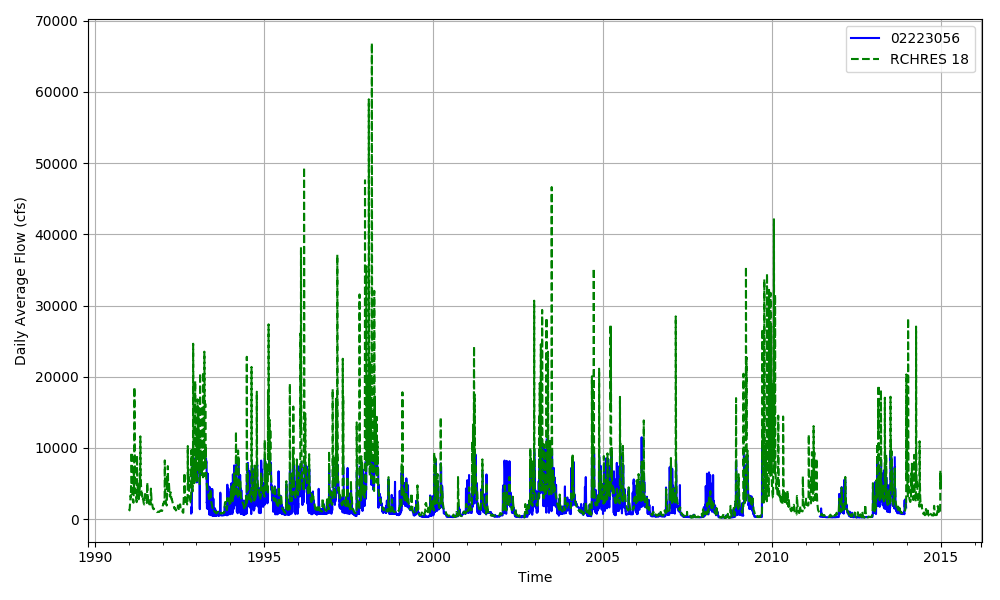


Figure 03070102-13: Daily flow for HSFP reach 18 and USGS station 02223056.

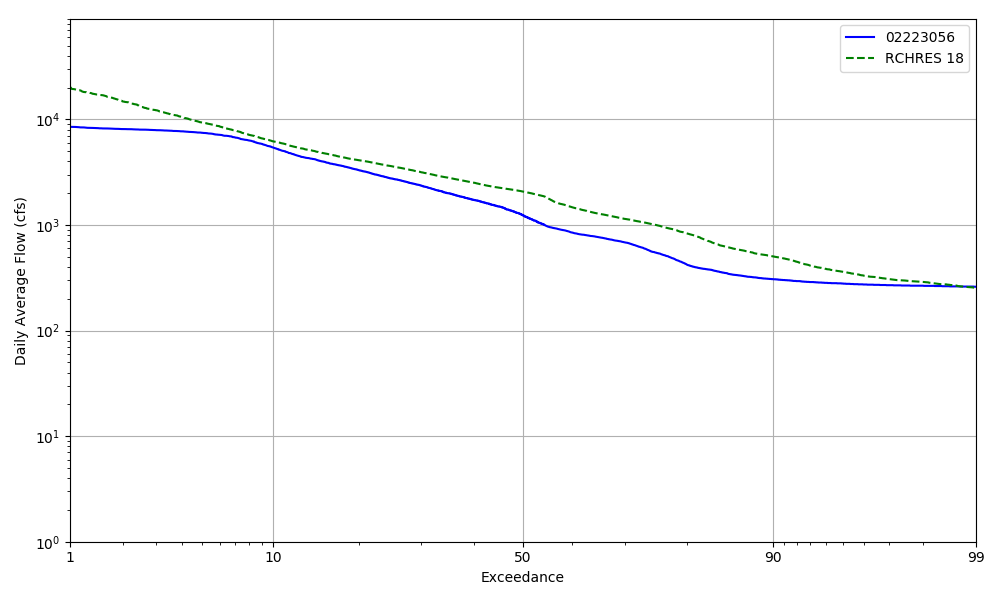


Figure 03070102-14: Daily exceedance for HSFP reach 18 and USGS station 02223056.

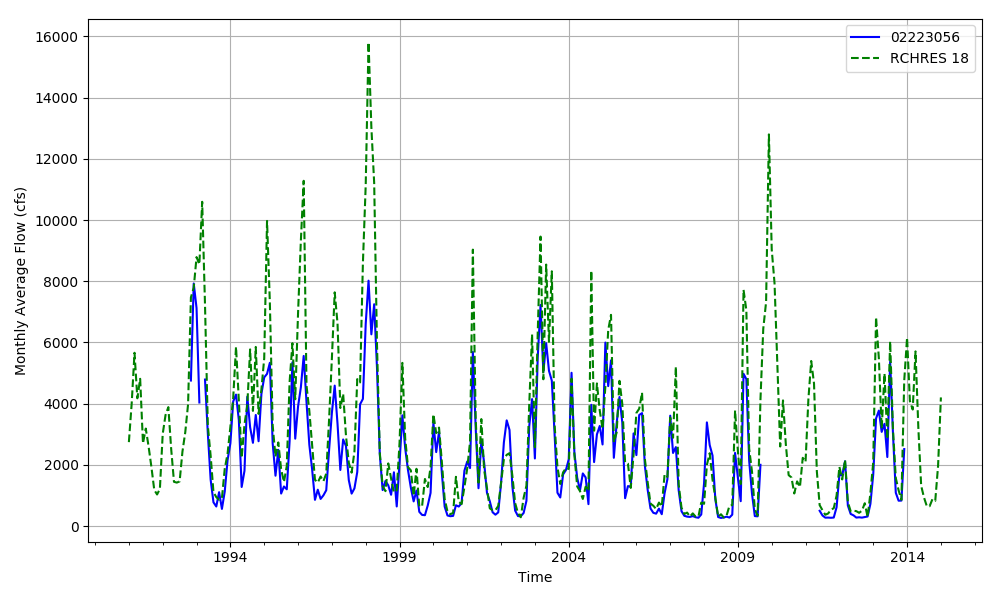


Figure 03070102-15: Monthly flow for HSFP reach 18 and USGS station 02223056.

## HSPF Reach 22, USGS Gauge 02223248

Table 03070102-9: Comparison Statistics Between HSPF Reach 22 and USGS Gauge 02223248.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 168.37 |
| Standard error | 712.24 |
| Relative bias | 0.05 |
| Relative standard error | 0.20 |
| Nash-Sutcliffe coefficient | 0.96 |
| Coefficient of efficiency | 0.81 |
| Index of agreement | 0.90 |

Table 03070102-10: Hydrologic Indices Between USGS Gauge 02223248 and HSPF Reach 22.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02223248 | Simulated Reach 22 | Percent Difference |
| MA1: Mean, all daily flows | 3423.51 | 3604.88 | 5.30 |
| MA2: Median, all daily flows | 1780.00 | 2275.42 | 27.83 |
| MA3: CV, all daily flows | 115.60 | 105.90 | -8.39 |
| MA4: CV, log of all daily flows | 111.02 | 92.63 | -16.56 |
| MA5: Mean daily flow / median daily flow | 1.92 | 1.58 | -17.63 |
| MA9: (Q10 - Q90) / median daily flow | 4.98 | 3.21 | -35.52 |
| MA10: (Q20 - Q80) / median daily flow | 2.31 | 1.74 | -25.01 |
| MA11: (Q25 - Q75) / median daily flow | 1.77 | 1.38 | -22.15 |
| MA12: Mean monthly flow, January | 4743.39 | 4985.38 | 5.10 |
| MA13: Mean monthly flow, February | 6260.39 | 6230.85 | -0.47 |
| MA14: Mean monthly flow, March | 7140.49 | 6955.09 | -2.60 |
| MA15: Mean monthly flow, April | 4426.93 | 4280.29 | -3.31 |
| MA16: Mean monthly flow, May | 2505.73 | 2898.13 | 15.66 |
| MA17: Mean monthly flow, June | 1983.55 | 2161.33 | 8.96 |
| MA18: Mean monthly flow, July | 2020.20 | 2148.79 | 6.36 |
| MA19: Mean monthly flow, August | 1491.08 | 1615.09 | 8.32 |
| MA20: Mean monthly flow, September | 1446.15 | 1974.22 | 36.52 |
| MA21: Mean monthly flow, October | 1844.04 | 2147.15 | 16.44 |
| MA22: Mean monthly flow, November | 2601.52 | 2751.57 | 5.77 |
| MA23: Mean monthly flow, December | 3847.55 | 4114.65 | 6.94 |
| ML1: Mean minimum monthly flow, January | 2154.73 | 2723.63 | 26.40 |
| ML2: Mean minimum monthly flow, February | 2362.67 | 3076.27 | 30.20 |
| ML3: Mean minimum monthly flow, March | 2744.33 | 3253.72 | 18.56 |
| ML4: Mean minimum monthly flow, April | 1706.29 | 2456.15 | 43.95 |
| ML5: Mean minimum monthly flow, May | 955.48 | 1771.66 | 85.42 |
| ML6: Mean minimum monthly flow, June | 774.24 | 1432.56 | 85.03 |
| ML7: Mean minimum monthly flow, July | 841.76 | 1197.23 | 42.23 |
| ML8: Mean minimum monthly flow, August | 740.29 | 1019.67 | 37.74 |
| ML9: Mean minimum monthly flow, September | 595.48 | 856.07 | 43.76 |
| ML10: Mean minimum monthly flow, October | 745.05 | 1112.18 | 49.28 |
| ML11: Mean minimum monthly flow, November | 933.18 | 1452.53 | 55.65 |
| ML12: Mean minimum monthly flow, December | 1506.86 | 2022.41 | 34.21 |
| ML13: CV of minimum monthly flows | 108.17 | 79.48 | -26.52 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.32 | 0.28 | -11.64 |
| ML15: Mean minimum annual flow / mean annual flow | 0.16 | 0.19 | 14.13 |
| ML16: Median minimum annual flow / median annual flow | 0.25 | 0.27 | 7.56 |
| ML20: Ratio of baseflow volume to total flow volume | 0.49 | 0.60 | 22.58 |
| ML22: Mean annual minimum flow divided by catchment area | 4.73 | 6.25 | 32.15 |
| RA1: Mean of positive changes from one day to next (rise rate) | 879.54 | 1179.01 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 234.23 | 311.65 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 585.83 | 473.50 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 214.27 | 293.68 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.11 | 0.06 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 111.27 | 54.00 |  |
| RA9: CV, number of flow reversals from one day to the next | 21.15 | 22.37 |  |

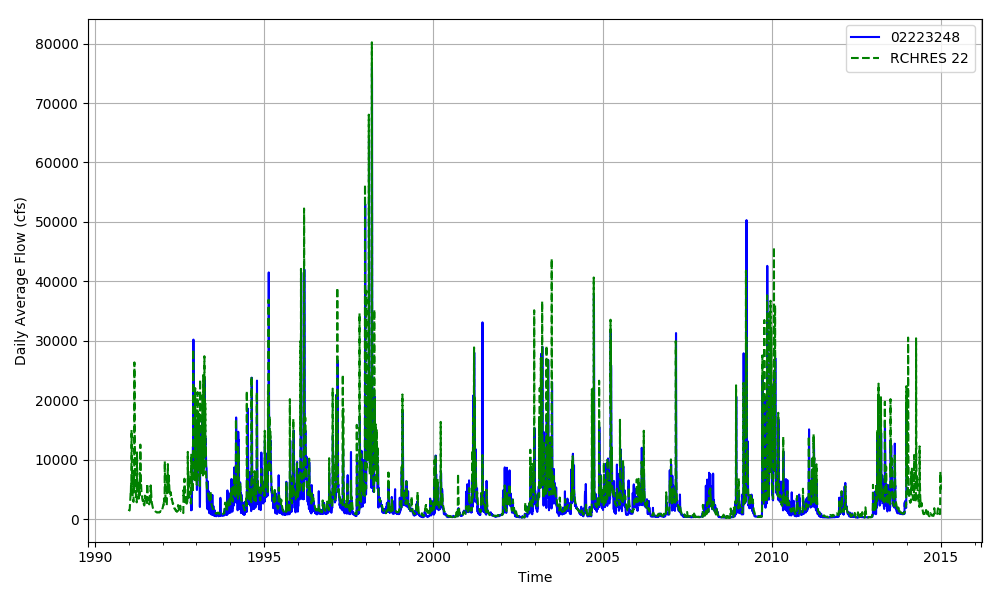


Figure 03070102-16: Daily flow for HSFP reach 22 and USGS station 02223248.

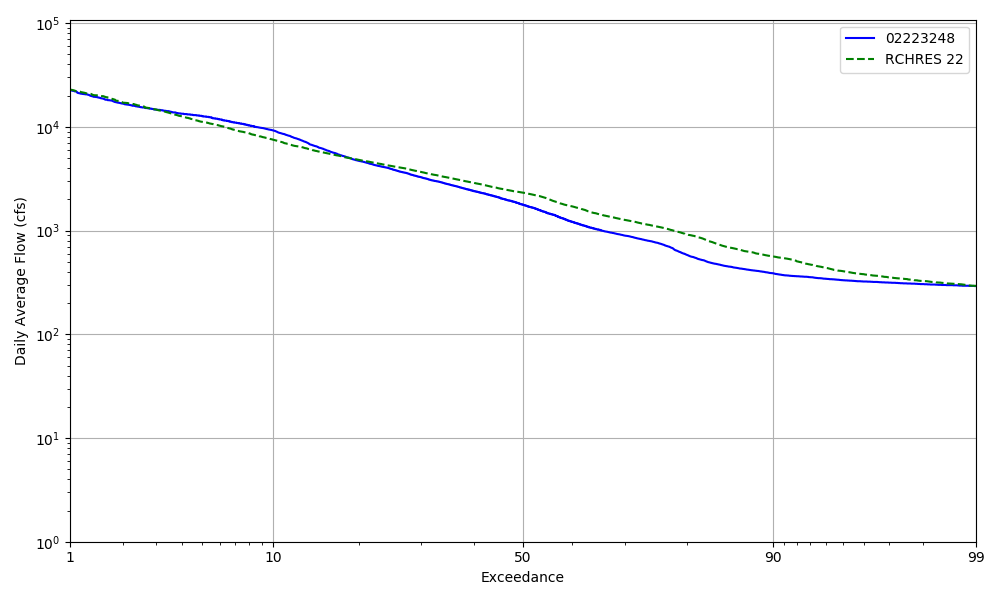


Figure 03070102-17: Daily exceedance for HSFP reach 22 and USGS station 02223248.

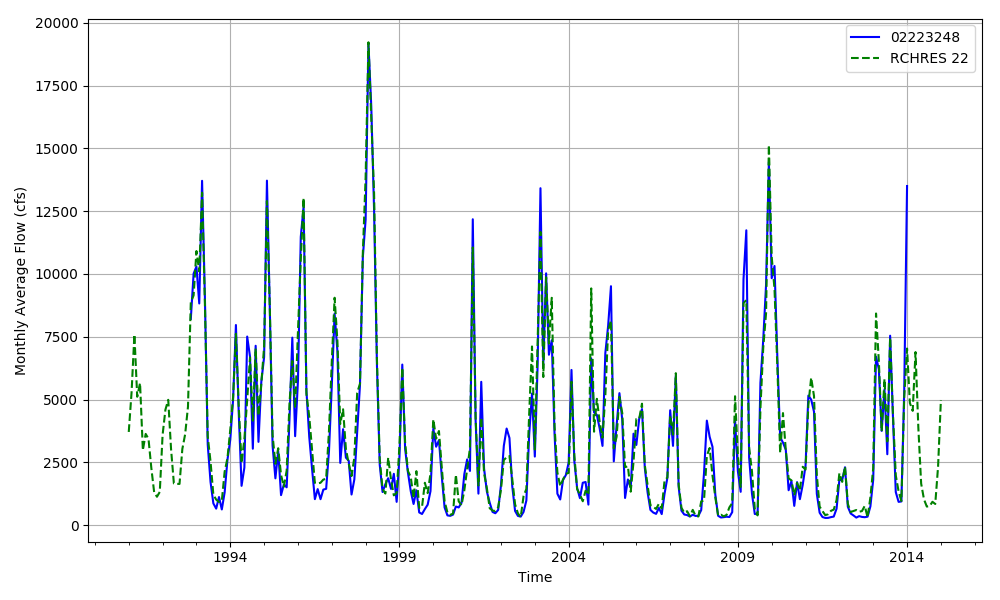


Figure 03070102-18: Monthly flow for HSFP reach 22 and USGS station 02223248.

## HSPF Reach 25, USGS Gauge 02223500

Table 03070102-11: Comparison Statistics Between HSPF Reach 25 and USGS Gauge 02223500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 63.96 |
| Standard error | 1028.96 |
| Relative bias | 0.02 |
| Relative standard error | 0.26 |
| Nash-Sutcliffe coefficient | 0.93 |
| Coefficient of efficiency | 0.79 |
| Index of agreement | 0.89 |

Table 03070102-12: Hydrologic Indices Between USGS Gauge 02223500 and HSPF Reach 25.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02223500 | Simulated Reach 25 | Percent Difference |
| MA1: Mean, all daily flows | 3896.23 | 3993.28 | 2.49 |
| MA2: Median, all daily flows | 2140.00 | 2482.52 | 16.01 |
| MA3: CV, all daily flows | 106.98 | 102.93 | -3.78 |
| MA4: CV, log of all daily flows | 104.04 | 91.77 | -11.80 |
| MA5: Mean daily flow / median daily flow | 1.82 | 1.61 | -11.65 |
| MA9: (Q10 - Q90) / median daily flow | 4.50 | 3.25 | -27.84 |
| MA10: (Q20 - Q80) / median daily flow | 2.29 | 1.75 | -23.31 |
| MA11: (Q25 - Q75) / median daily flow | 1.74 | 1.41 | -19.05 |
| MA12: Mean monthly flow, January | 5499.83 | 5449.86 | -0.91 |
| MA13: Mean monthly flow, February | 7169.57 | 6956.15 | -2.98 |
| MA14: Mean monthly flow, March | 7939.80 | 7840.44 | -1.25 |
| MA15: Mean monthly flow, April | 5311.49 | 4810.74 | -9.43 |
| MA16: Mean monthly flow, May | 2949.64 | 3201.96 | 8.55 |
| MA17: Mean monthly flow, June | 2302.53 | 2382.41 | 3.47 |
| MA18: Mean monthly flow, July | 2348.15 | 2396.29 | 2.05 |
| MA19: Mean monthly flow, August | 1926.11 | 1998.85 | 3.78 |
| MA20: Mean monthly flow, September | 1599.27 | 2196.65 | 37.35 |
| MA21: Mean monthly flow, October | 2176.79 | 2409.06 | 10.67 |
| MA22: Mean monthly flow, November | 2591.86 | 2742.75 | 5.82 |
| MA23: Mean monthly flow, December | 4045.44 | 4213.47 | 4.15 |
| ML1: Mean minimum monthly flow, January | 2781.17 | 2923.28 | 5.11 |
| ML2: Mean minimum monthly flow, February | 2877.74 | 3364.18 | 16.90 |
| ML3: Mean minimum monthly flow, March | 3361.30 | 3700.54 | 10.09 |
| ML4: Mean minimum monthly flow, April | 2173.39 | 2740.25 | 26.08 |
| ML5: Mean minimum monthly flow, May | 1229.78 | 1968.67 | 60.08 |
| ML6: Mean minimum monthly flow, June | 926.91 | 1580.34 | 70.50 |
| ML7: Mean minimum monthly flow, July | 988.17 | 1392.15 | 40.88 |
| ML8: Mean minimum monthly flow, August | 839.74 | 1205.94 | 43.61 |
| ML9: Mean minimum monthly flow, September | 697.35 | 1032.50 | 48.06 |
| ML10: Mean minimum monthly flow, October | 855.43 | 1279.30 | 49.55 |
| ML11: Mean minimum monthly flow, November | 1072.52 | 1536.33 | 43.24 |
| ML12: Mean minimum monthly flow, December | 1754.04 | 2150.21 | 22.59 |
| ML13: CV of minimum monthly flows | 114.95 | 79.04 | -31.24 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.29 | 0.30 | 0.76 |
| ML15: Mean minimum annual flow / mean annual flow | 0.16 | 0.20 | 21.48 |
| ML16: Median minimum annual flow / median annual flow | 0.25 | 0.28 | 9.13 |
| ML20: Ratio of baseflow volume to total flow volume | 0.51 | 0.62 | 19.69 |
| ML22: Mean annual minimum flow divided by catchment area | 5.35 | 7.20 | 34.59 |
| RA1: Mean of positive changes from one day to next (rise rate) | 775.20 | 1155.37 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 199.43 | 318.07 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 542.45 | 492.46 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 192.65 | 287.03 |  |
| RA5: Ratio of days that are higher than previous day | 0.41 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.10 | 0.05 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 101.33 | 51.04 |  |
| RA9: CV, number of flow reversals from one day to the next | 21.03 | 24.45 |  |

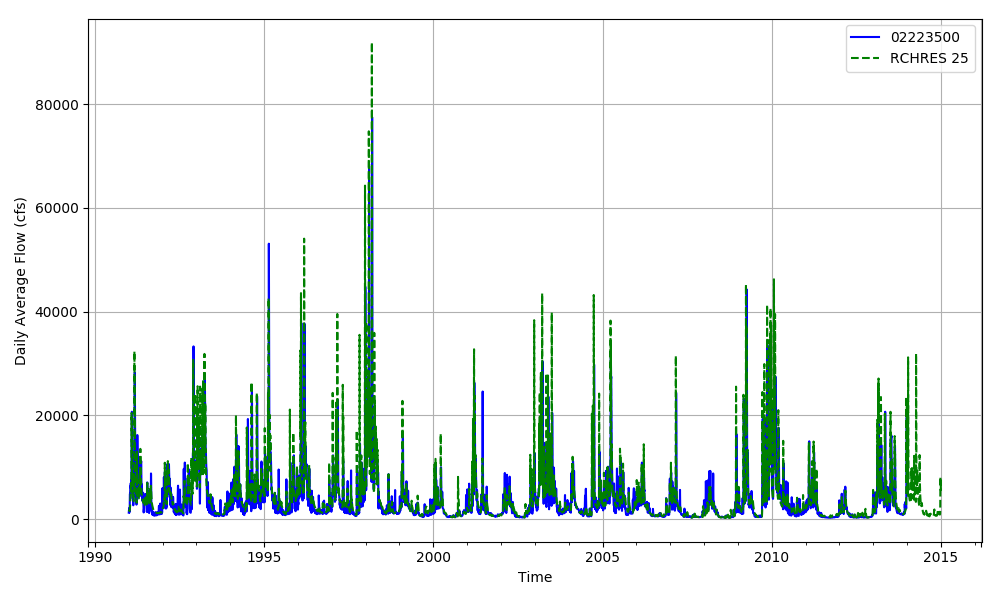


Figure 03070102-19: Daily flow for HSFP reach 25 and USGS station 02223500.

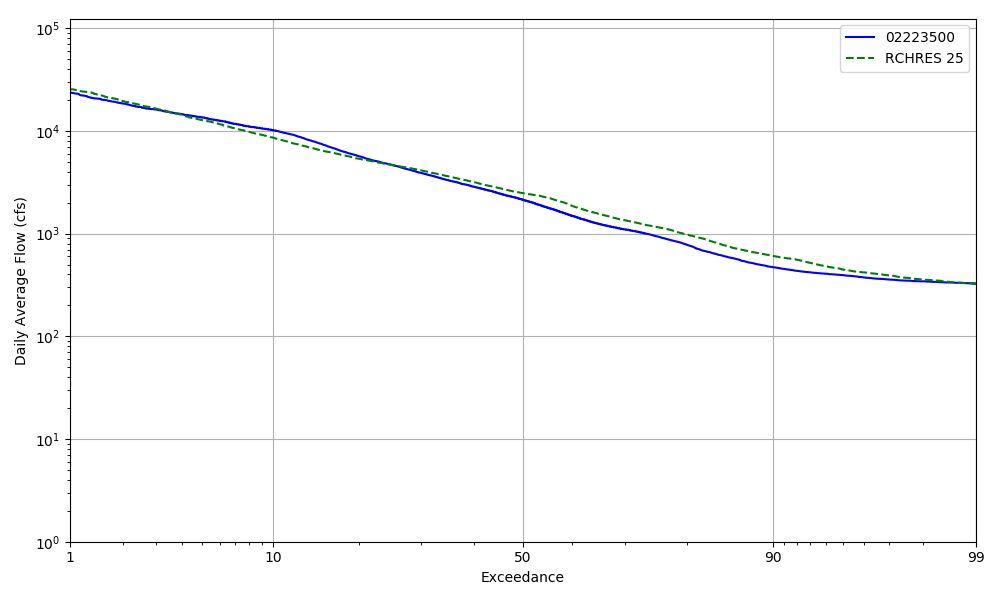


Figure 03070102-20: Daily exceedance for HSFP reach 25 and USGS station 02223500.

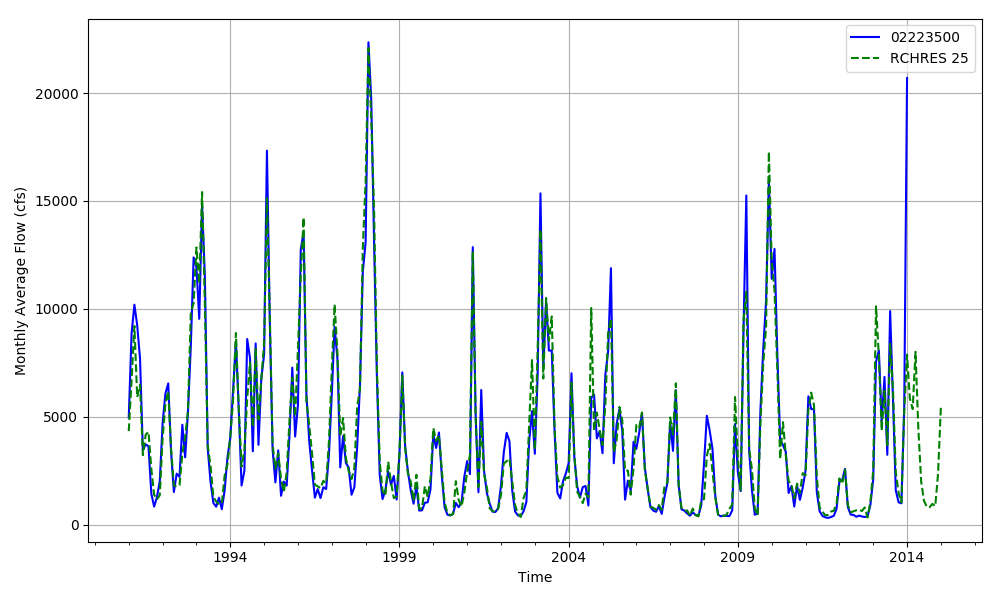


Figure 03070102-21: Monthly flow for HSFP reach 25 and USGS station 02223500.

## HSPF Reach 28, USGS Gauge 02224500

Table 03070102-13: Comparison Statistics Between HSPF Reach 28 and USGS Gauge 02224500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -272.71 |
| Standard error | 1450.76 |
| Relative bias | -0.06 |
| Relative standard error | 0.30 |
| Nash-Sutcliffe coefficient | 0.91 |
| Coefficient of efficiency | 0.78 |
| Index of agreement | 0.89 |

Table 03070102-14: Hydrologic Indices Between USGS Gauge 02224500 and HSPF Reach 28.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02224500 | Simulated Reach 28 | Percent Difference |
| MA1: Mean, all daily flows | 3937.76 | 3778.80 | -4.04 |
| MA2: Median, all daily flows | 1685.00 | 1985.93 | 17.86 |
| MA3: CV, all daily flows | 107.02 | 109.70 | 2.51 |
| MA4: CV, log of all daily flows | 124.90 | 111.21 | -10.96 |
| MA5: Mean daily flow / median daily flow | 2.34 | 1.90 | -18.58 |
| MA9: (Q10 - Q90) / median daily flow | 5.96 | 4.07 | -31.69 |
| MA10: (Q20 - Q80) / median daily flow | 3.05 | 2.21 | -27.66 |
| MA11: (Q25 - Q75) / median daily flow | 2.31 | 1.77 | -23.27 |
| MA12: Mean monthly flow, January | 6127.42 | 5467.92 | -10.76 |
| MA13: Mean monthly flow, February | 6646.08 | 5882.56 | -11.49 |
| MA14: Mean monthly flow, March | 6340.69 | 5899.30 | -6.96 |
| MA15: Mean monthly flow, April | 5854.89 | 4500.97 | -23.12 |
| MA16: Mean monthly flow, May | 2896.01 | 2926.99 | 1.07 |
| MA17: Mean monthly flow, June | 1687.01 | 1818.80 | 7.81 |
| MA18: Mean monthly flow, July | 2510.21 | 2025.38 | -19.31 |
| MA19: Mean monthly flow, August | 1803.52 | 1755.28 | -2.67 |
| MA20: Mean monthly flow, September | 1224.22 | 1452.98 | 18.69 |
| MA21: Mean monthly flow, October | 1991.90 | 1934.56 | -2.88 |
| MA22: Mean monthly flow, November | 2125.81 | 2030.17 | -4.50 |
| MA23: Mean monthly flow, December | 4383.67 | 5091.52 | 16.15 |
| ML1: Mean minimum monthly flow, January | 5006.67 | 4184.41 | -16.42 |
| ML2: Mean minimum monthly flow, February | 4271.67 | 3434.53 | -19.60 |
| ML3: Mean minimum monthly flow, March | 3081.67 | 3320.52 | 7.75 |
| ML4: Mean minimum monthly flow, April | 2380.83 | 2542.84 | 6.80 |
| ML5: Mean minimum monthly flow, May | 1612.33 | 2047.10 | 26.97 |
| ML6: Mean minimum monthly flow, June | 890.50 | 1380.64 | 55.04 |
| ML7: Mean minimum monthly flow, July | 1055.83 | 1032.89 | -2.17 |
| ML8: Mean minimum monthly flow, August | 906.00 | 967.45 | 6.78 |
| ML9: Mean minimum monthly flow, September | 644.00 | 693.90 | 7.75 |
| ML10: Mean minimum monthly flow, October | 984.00 | 1098.20 | 11.61 |
| ML11: Mean minimum monthly flow, November | 1009.67 | 1221.58 | 20.99 |
| ML12: Mean minimum monthly flow, December | 1542.17 | 1585.76 | 2.83 |
| ML13: CV of minimum monthly flows | 139.97 | 105.37 | -24.72 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.41 | 0.30 | -27.07 |
| ML15: Mean minimum annual flow / mean annual flow | 0.20 | 0.17 | -14.90 |
| ML16: Median minimum annual flow / median annual flow | 0.29 | 0.19 | -32.11 |
| ML20: Ratio of baseflow volume to total flow volume | 0.54 | 0.57 | 4.88 |
| ML22: Mean annual minimum flow divided by catchment area | 5.24 | 4.65 | -11.19 |
| RA1: Mean of positive changes from one day to next (rise rate) | 640.46 | 1046.06 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 166.35 | 333.97 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 428.75 | 492.24 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 212.17 | 276.11 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.32 |  |
| 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 | 0.05 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 68.29 | 35.86 |  |
| RA9: CV, number of flow reversals from one day to the next | 37.73 | 44.84 |  |

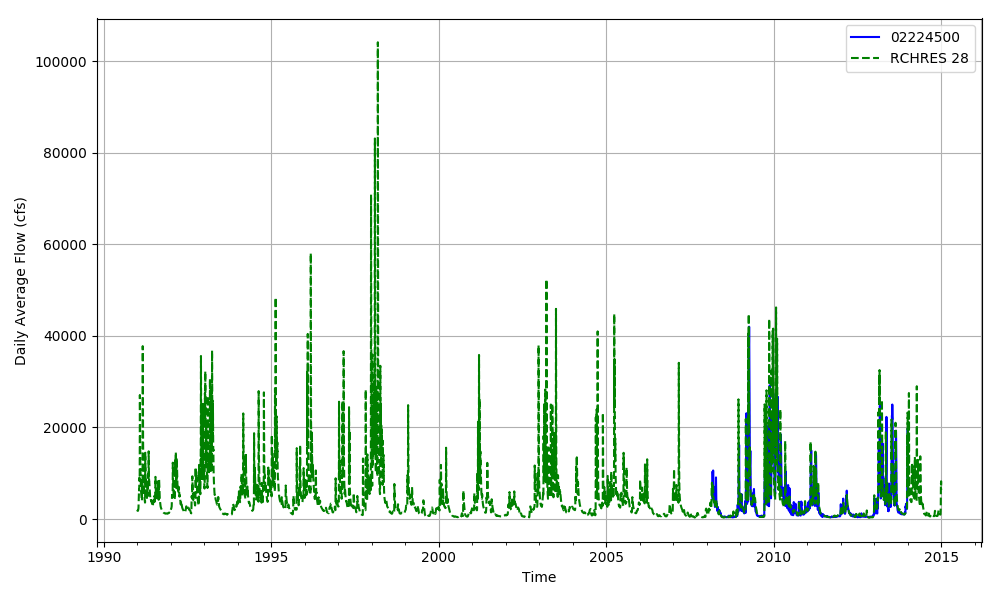


Figure 03070102-22: Daily flow for HSFP reach 28 and USGS station 02224500.

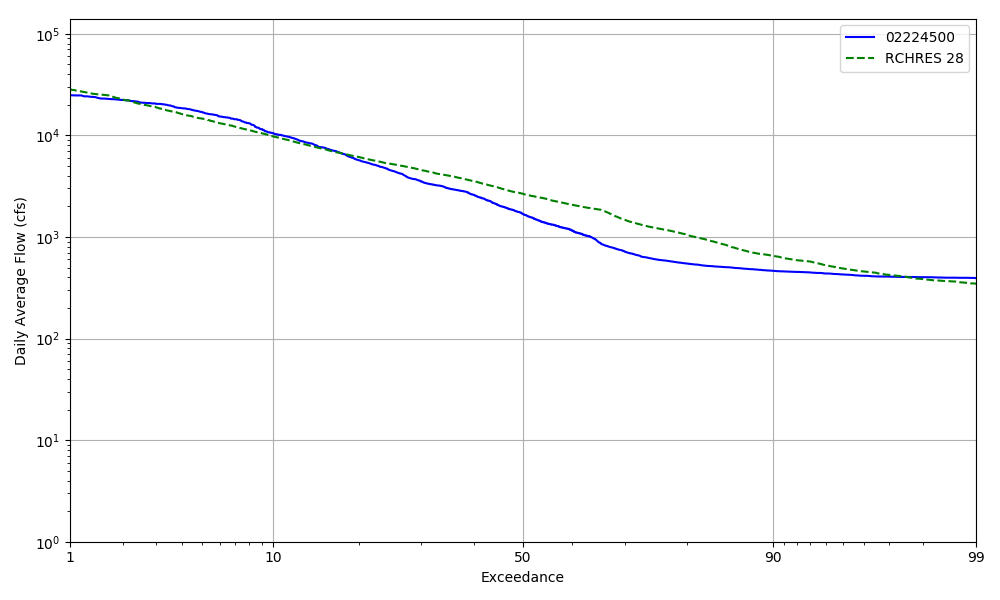


Figure 03070102-23: Daily exceedance for HSFP reach 28 and USGS station 02224500.

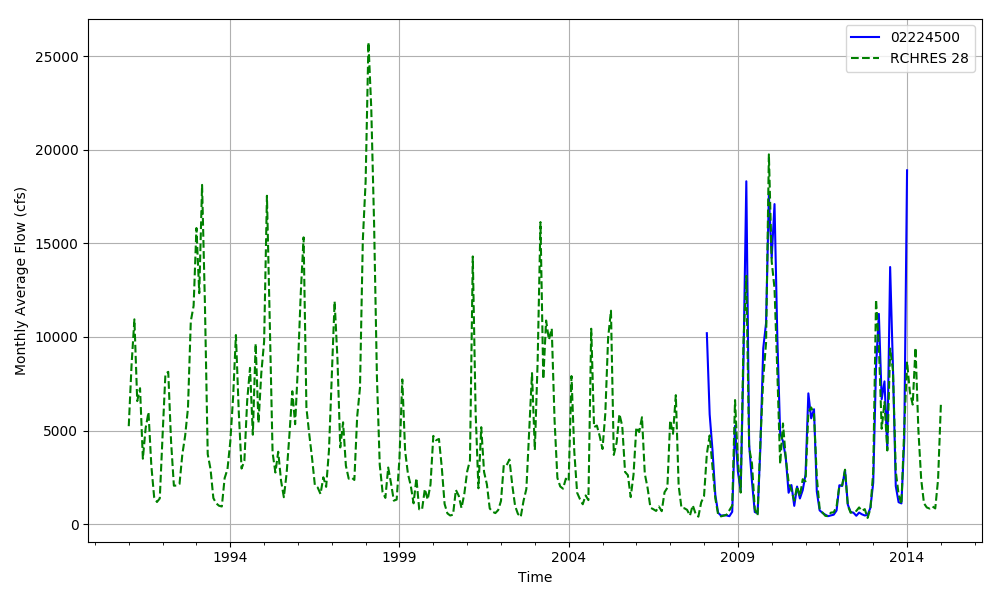


Figure 03070102-24: Monthly flow for HSFP reach 28 and USGS station 02224500.