# Appendix for Model 03080201

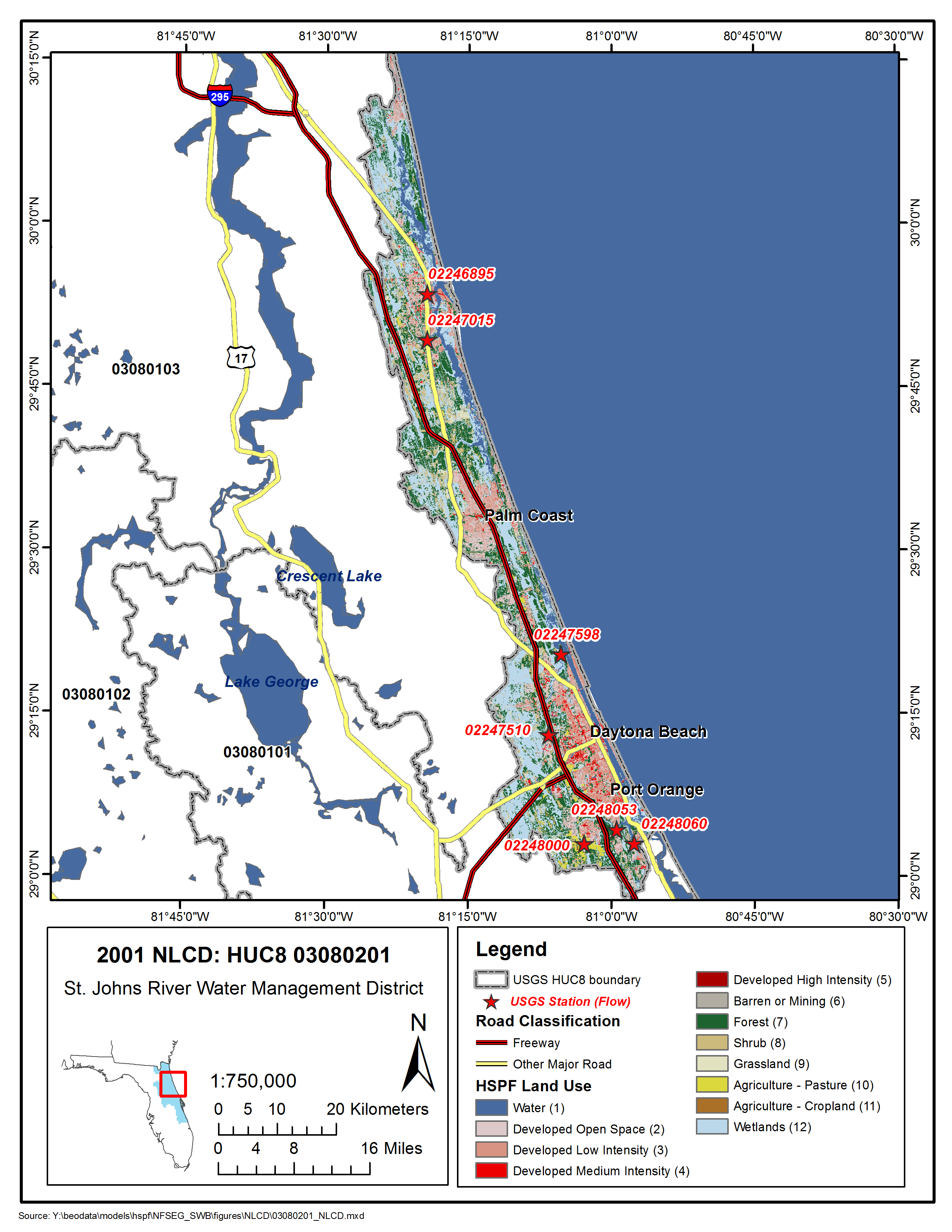


Figure 03080201-1: Land Cover from the National Land Cover Database.

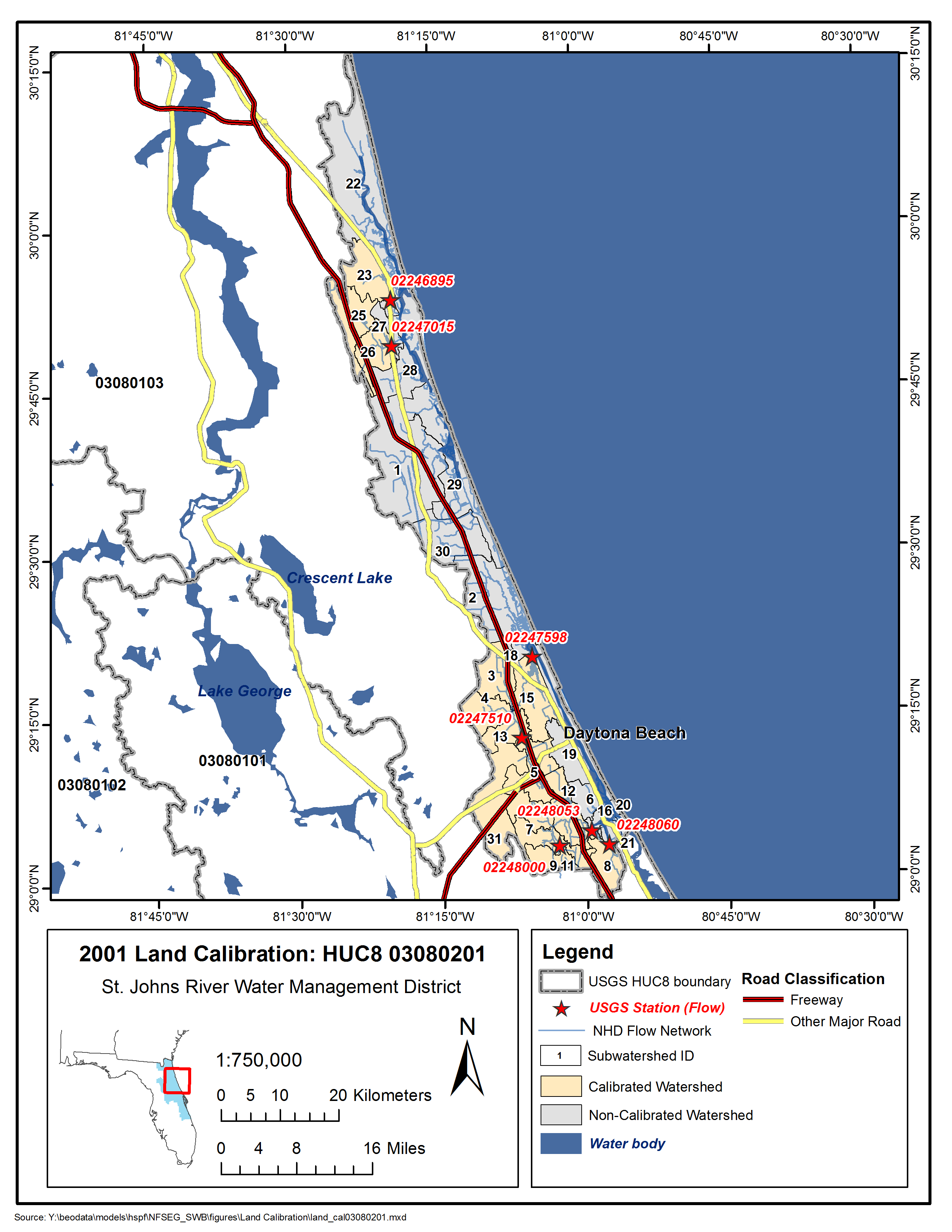


Figure 03080201-2: Calibrated sub-watersheds.

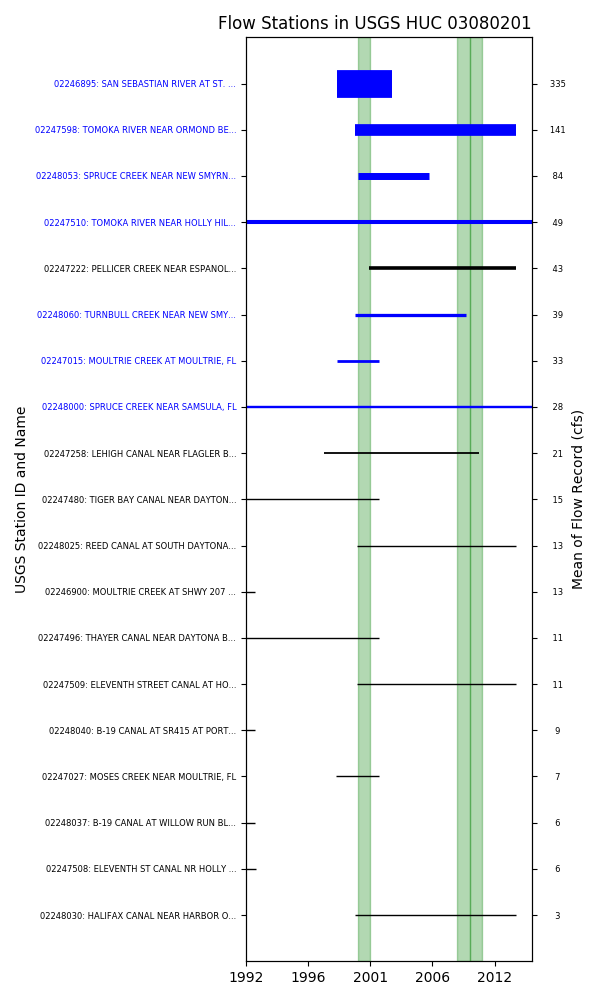


Figure 03080201-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 05, USGS Gauge 02247510

Table 03080201-1: Comparison Statistics Between HSPF Reach 05 and USGS Gauge 02247510.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 5.12 |
| Standard error | 50.29 |
| Relative bias | 0.10 |
| Relative standard error | 0.59 |
| Nash-Sutcliffe coefficient | 0.66 |
| Coefficient of efficiency | 0.46 |
| Index of agreement | 0.71 |

Table 03080201-2: Hydrologic Indices Between USGS Gauge 02247510 and HSPF Reach 05.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02247510 | Simulated Reach 05 | Percent Difference |
| MA1: Mean, all daily flows | 49.89 | 54.98 | 10.22 |
| MA2: Median, all daily flows | 13.00 | 17.74 | 36.44 |
| MA3: CV, all daily flows | 183.73 | 186.26 | 1.38 |
| MA4: CV, log of all daily flows | 155.48 | 135.11 | -13.10 |
| MA5: Mean daily flow / median daily flow | 3.84 | 3.10 | -19.22 |
| MA9: (Q10 - Q90) / median daily flow | 9.82 | 7.59 | -22.69 |
| MA10: (Q20 - Q80) / median daily flow | 4.18 | 3.77 | -9.82 |
| MA11: (Q25 - Q75) / median daily flow | 3.03 | 2.76 | -9.06 |
| MA12: Mean monthly flow, January | 34.28 | 44.58 | 30.04 |
| MA13: Mean monthly flow, February | 27.16 | 40.73 | 49.98 |
| MA14: Mean monthly flow, March | 48.76 | 49.30 | 1.09 |
| MA15: Mean monthly flow, April | 20.11 | 18.91 | -5.95 |
| MA16: Mean monthly flow, May | 18.04 | 23.58 | 30.70 |
| MA17: Mean monthly flow, June | 42.37 | 61.89 | 46.07 |
| MA18: Mean monthly flow, July | 41.24 | 63.60 | 54.21 |
| MA19: Mean monthly flow, August | 68.70 | 75.25 | 9.53 |
| MA20: Mean monthly flow, September | 112.84 | 87.51 | -22.45 |
| MA21: Mean monthly flow, October | 88.94 | 82.74 | -6.97 |
| MA22: Mean monthly flow, November | 40.03 | 41.00 | 2.42 |
| MA23: Mean monthly flow, December | 30.72 | 43.17 | 40.56 |
| ML1: Mean minimum monthly flow, January | 13.19 | 8.89 | -32.56 |
| ML2: Mean minimum monthly flow, February | 11.65 | 7.59 | -34.90 |
| ML3: Mean minimum monthly flow, March | 14.28 | 9.94 | -30.41 |
| ML4: Mean minimum monthly flow, April | 4.72 | 3.88 | -17.75 |
| ML5: Mean minimum monthly flow, May | 2.58 | 2.76 | 7.03 |
| ML6: Mean minimum monthly flow, June | 9.08 | 6.69 | -26.31 |
| ML7: Mean minimum monthly flow, July | 11.86 | 8.12 | -31.54 |
| ML8: Mean minimum monthly flow, August | 15.47 | 7.22 | -53.29 |
| ML9: Mean minimum monthly flow, September | 31.86 | 8.30 | -73.96 |
| ML10: Mean minimum monthly flow, October | 23.34 | 7.99 | -65.76 |
| ML11: Mean minimum monthly flow, November | 12.67 | 6.28 | -50.47 |
| ML12: Mean minimum monthly flow, December | 10.87 | 7.33 | -32.57 |
| ML13: CV of minimum monthly flows | 175.74 | 141.41 | -19.54 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.12 | 0.08 | -30.70 |
| ML15: Mean minimum annual flow / mean annual flow | 0.05 | 0.04 | -21.27 |
| ML16: Median minimum annual flow / median annual flow | 0.08 | 0.06 | -18.68 |
| ML20: Ratio of baseflow volume to total flow volume | 0.42 | 0.24 | -42.75 |
| ML22: Mean annual minimum flow divided by catchment area | 0.02 | 0.02 | 0.34 |
| RA1: Mean of positive changes from one day to next (rise rate) | 25.05 | 38.48 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 434.62 | 294.00 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 9.57 | 15.87 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 413.84 | 308.40 |  |
| RA5: Ratio of days that are higher than previous day | 0.26 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.24 | 0.33 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.11 | 0.21 |  |
| RA8: Number of flow reversals from one day to the next | 87.00 | 88.88 |  |
| RA9: CV, number of flow reversals from one day to the next | 19.01 | 18.20 |  |

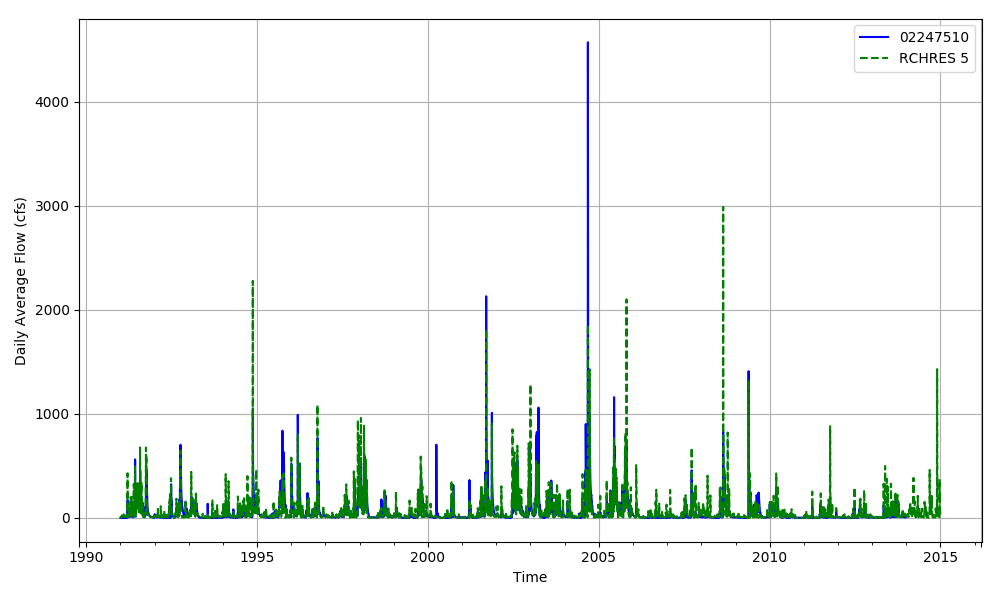


Figure 03080201-4: Daily flow for HSFP reach 05 and USGS station 02247510.

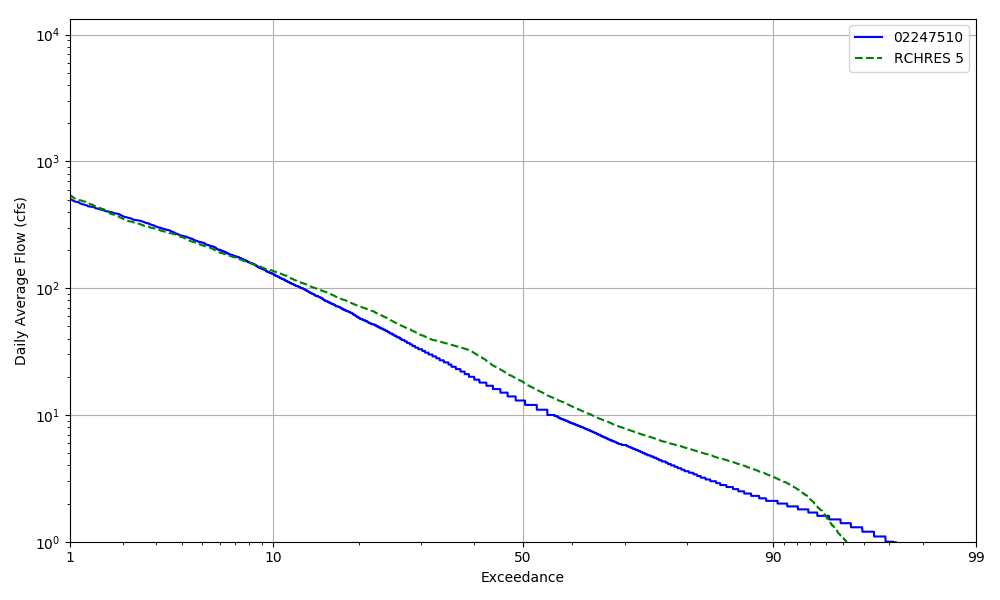


Figure 03080201-5: Daily exceedance for HSFP reach 05 and USGS station 02247510.

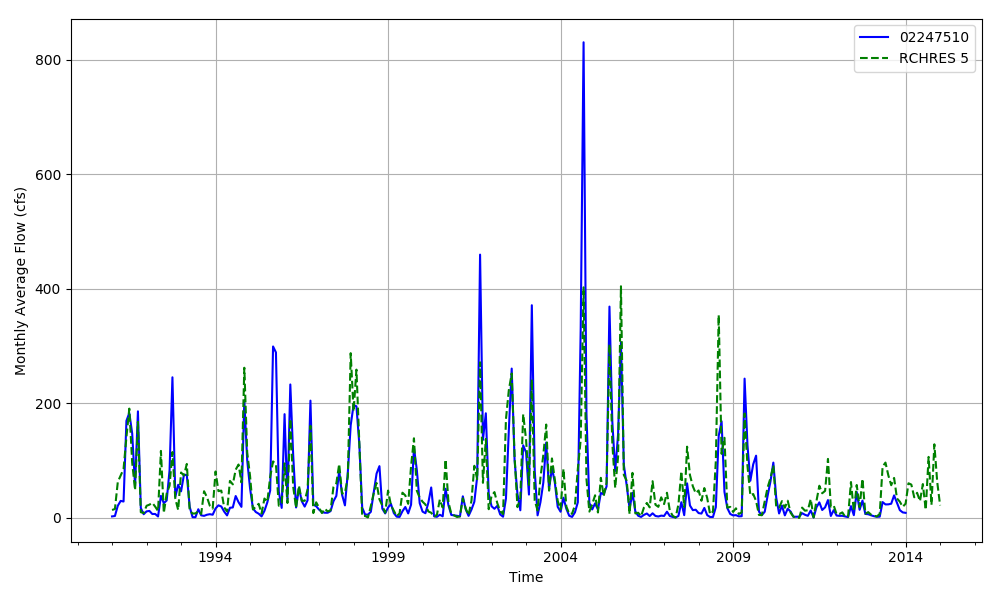


Figure 03080201-6: Monthly flow for HSFP reach 05 and USGS station 02247510.

## HSPF Reach 08, USGS Gauge 02248060

Table 03080201-3: Comparison Statistics Between HSPF Reach 08 and USGS Gauge 02248060.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -19.54 |
| Standard error | 44.69 |
| Relative bias | -0.51 |
| Relative standard error | 0.87 |
| Nash-Sutcliffe coefficient | 0.24 |
| Coefficient of efficiency | 0.21 |
| Index of agreement | 0.56 |

Table 03080201-4: Hydrologic Indices Between USGS Gauge 02248060 and HSPF Reach 08.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02248060 | Simulated Reach 08 | Percent Difference |
| MA1: Mean, all daily flows | 53.03 | 19.21 | -63.79 |
| MA2: Median, all daily flows | 29.00 | 5.05 | -82.60 |
| MA3: CV, all daily flows | 150.99 | 232.77 | 54.16 |
| MA4: CV, log of all daily flows | 98.57 | 142.91 | 44.99 |
| MA5: Mean daily flow / median daily flow | 1.83 | 3.81 | 108.13 |
| MA9: (Q10 - Q90) / median daily flow | 3.75 | 9.62 | 156.36 |
| MA10: (Q20 - Q80) / median daily flow | 2.14 | 5.09 | 138.26 |
| MA11: (Q25 - Q75) / median daily flow | 1.61 | 3.48 | 115.74 |
| MA12: Mean monthly flow, January | 24.75 | 10.25 | -58.60 |
| MA13: Mean monthly flow, February | 25.16 | 11.52 | -54.19 |
| MA14: Mean monthly flow, March | 37.40 | 14.87 | -60.24 |
| MA15: Mean monthly flow, April | 25.08 | 5.65 | -77.49 |
| MA16: Mean monthly flow, May | 38.38 | 10.58 | -72.44 |
| MA17: Mean monthly flow, June | 31.27 | 24.93 | -20.30 |
| MA18: Mean monthly flow, July | 29.38 | 23.08 | -21.46 |
| MA19: Mean monthly flow, August | 47.51 | 29.01 | -38.94 |
| MA20: Mean monthly flow, September | 114.25 | 37.37 | -67.29 |
| MA21: Mean monthly flow, October | 97.96 | 30.64 | -68.72 |
| MA22: Mean monthly flow, November | 63.04 | 13.45 | -78.66 |
| MA23: Mean monthly flow, December | 30.93 | 13.89 | -55.11 |
| ML1: Mean minimum monthly flow, January | 2.31 | 1.22 | -47.04 |
| ML2: Mean minimum monthly flow, February | 3.87 | 1.11 | -71.38 |
| ML3: Mean minimum monthly flow, March | 1.10 | 3.57 | 223.90 |
| ML4: Mean minimum monthly flow, April | 3.33 | 0.53 | -83.99 |
| ML5: Mean minimum monthly flow, May | 2.13 | 0.36 | -83.17 |
| ML6: Mean minimum monthly flow, June | 4.85 | 2.59 | -46.51 |
| ML7: Mean minimum monthly flow, July | 2.76 | 1.38 | -49.92 |
| ML8: Mean minimum monthly flow, August | 4.17 | 1.63 | -60.87 |
| ML9: Mean minimum monthly flow, September | 5.37 | 2.82 | -47.52 |
| ML10: Mean minimum monthly flow, October | 22.67 | 2.15 | -90.53 |
| ML11: Mean minimum monthly flow, November | 6.53 | 1.12 | -82.82 |
| ML12: Mean minimum monthly flow, December | 2.83 | 1.08 | -61.73 |
| ML13: CV of minimum monthly flows | 178.62 | 178.76 | 0.08 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.01 | 0.05 | 395.95 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.01 | 146.16 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.06 | 1245.42 |
| ML20: Ratio of baseflow volume to total flow volume | 0.19 | 0.15 | -22.21 |
| ML22: Mean annual minimum flow divided by catchment area | 0.00 | 0.00 | 16.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 28.80 | 16.85 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 235.24 | 318.60 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 21.61 | 6.52 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 180.74 | 348.54 |  |
| RA5: Ratio of days that are higher than previous day | 0.42 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.54 | 0.46 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.43 | 0.27 |  |
| RA8: Number of flow reversals from one day to the next | 134.11 | 96.89 |  |
| RA9: CV, number of flow reversals from one day to the next | 16.71 | 13.02 |  |

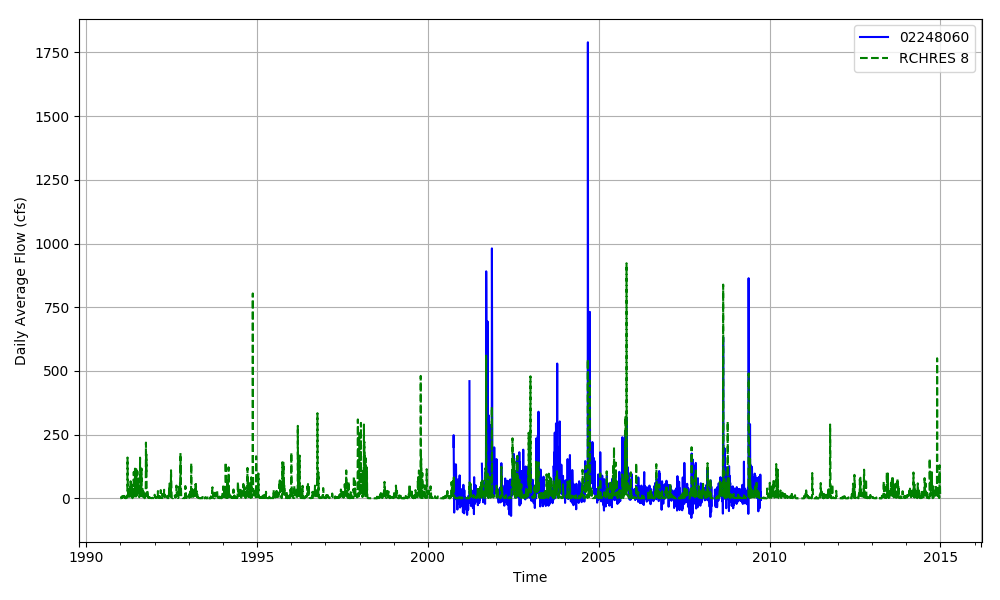


Figure 03080201-7: Daily flow for HSFP reach 08 and USGS station 02248060.

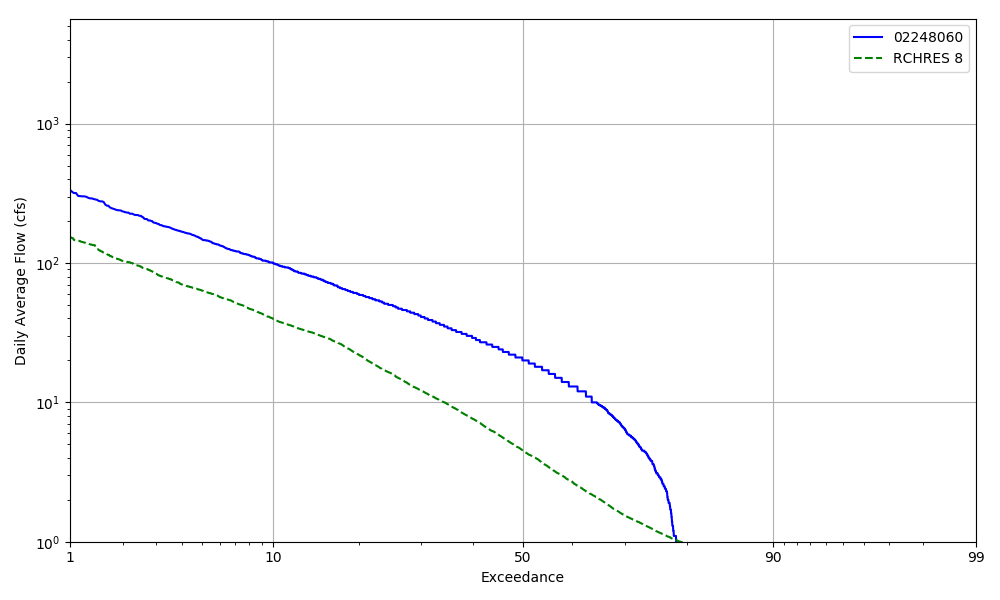


Figure 03080201-8: Daily exceedance for HSFP reach 08 and USGS station 02248060.

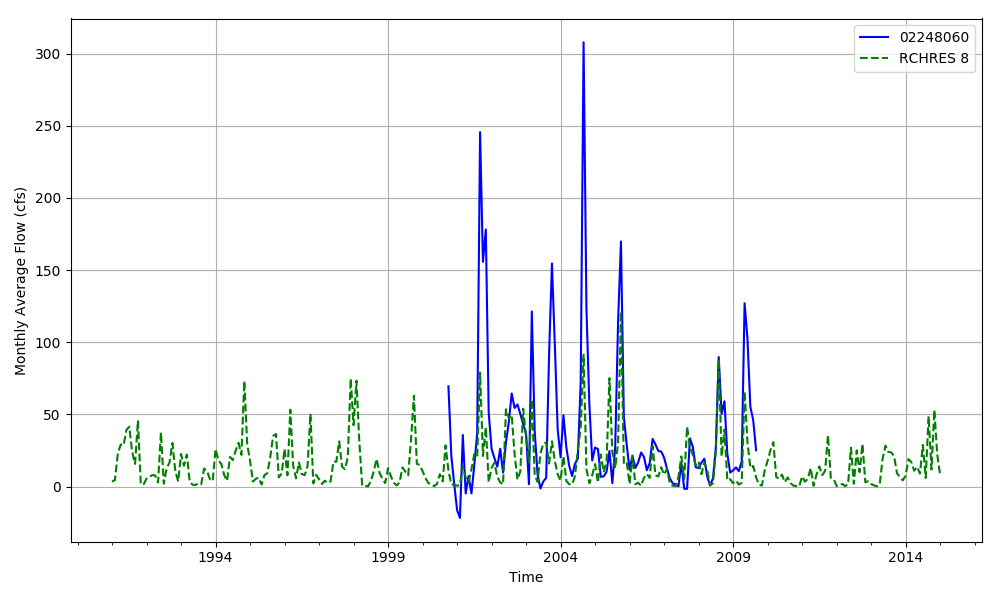


Figure 03080201-9: Monthly flow for HSFP reach 08 and USGS station 02248060.

## HSPF Reach 09, USGS Gauge 02248000

Table 03080201-5: Comparison Statistics Between HSPF Reach 09 and USGS Gauge 02248000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -18.21 |
| Standard error | 41.85 |
| Relative bias | -0.62 |
| Relative standard error | 0.89 |
| Nash-Sutcliffe coefficient | 0.21 |
| Coefficient of efficiency | 0.37 |
| Index of agreement | 0.62 |

Table 03080201-6: Hydrologic Indices Between USGS Gauge 02248000 and HSPF Reach 09.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02248000 | Simulated Reach 09 | Percent Difference |
| MA1: Mean, all daily flows | 29.63 | 11.29 | -61.89 |
| MA2: Median, all daily flows | 5.70 | 3.23 | -43.37 |
| MA3: CV, all daily flows | 209.40 | 203.31 | -2.91 |
| MA4: CV, log of all daily flows | 172.03 | 137.25 | -20.22 |
| MA5: Mean daily flow / median daily flow | 5.20 | 3.50 | -32.71 |
| MA9: (Q10 - Q90) / median daily flow | 12.64 | 8.59 | -32.03 |
| MA10: (Q20 - Q80) / median daily flow | 5.16 | 4.70 | -8.83 |
| MA11: (Q25 - Q75) / median daily flow | 3.68 | 3.34 | -9.32 |
| MA12: Mean monthly flow, January | 16.00 | 8.87 | -44.53 |
| MA13: Mean monthly flow, February | 14.15 | 8.37 | -40.87 |
| MA14: Mean monthly flow, March | 28.57 | 10.23 | -64.18 |
| MA15: Mean monthly flow, April | 9.44 | 4.32 | -54.22 |
| MA16: Mean monthly flow, May | 8.36 | 5.49 | -34.40 |
| MA17: Mean monthly flow, June | 26.08 | 13.30 | -48.98 |
| MA18: Mean monthly flow, July | 24.42 | 11.94 | -51.11 |
| MA19: Mean monthly flow, August | 50.71 | 14.95 | -70.51 |
| MA20: Mean monthly flow, September | 65.82 | 17.89 | -72.82 |
| MA21: Mean monthly flow, October | 62.19 | 17.82 | -71.35 |
| MA22: Mean monthly flow, November | 22.16 | 8.13 | -63.29 |
| MA23: Mean monthly flow, December | 12.16 | 8.55 | -29.71 |
| ML1: Mean minimum monthly flow, January | 4.17 | 1.01 | -75.79 |
| ML2: Mean minimum monthly flow, February | 4.13 | 0.63 | -84.67 |
| ML3: Mean minimum monthly flow, March | 6.34 | 1.29 | -79.60 |
| ML4: Mean minimum monthly flow, April | 2.08 | 0.50 | -75.79 |
| ML5: Mean minimum monthly flow, May | 1.08 | 0.35 | -67.27 |
| ML6: Mean minimum monthly flow, June | 3.82 | 1.17 | -69.31 |
| ML7: Mean minimum monthly flow, July | 4.69 | 0.74 | -84.18 |
| ML8: Mean minimum monthly flow, August | 5.58 | 0.91 | -83.66 |
| ML9: Mean minimum monthly flow, September | 7.90 | 1.19 | -84.96 |
| ML10: Mean minimum monthly flow, October | 10.96 | 0.82 | -92.49 |
| ML11: Mean minimum monthly flow, November | 5.51 | 0.61 | -88.91 |
| ML12: Mean minimum monthly flow, December | 3.46 | 0.72 | -79.35 |
| ML13: CV of minimum monthly flows | 150.91 | 170.33 | 12.87 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.13 | 0.06 | -52.63 |
| ML15: Mean minimum annual flow / mean annual flow | 0.03 | 0.02 | -39.50 |
| ML16: Median minimum annual flow / median annual flow | 0.08 | 0.06 | -29.29 |
| ML20: Ratio of baseflow volume to total flow volume | 0.28 | 0.16 | -45.35 |
| ML22: Mean annual minimum flow divided by catchment area | 0.01 | 0.00 | -73.42 |
| RA1: Mean of positive changes from one day to next (rise rate) | 19.47 | 8.06 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 277.58 | 312.28 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 6.73 | 3.81 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 240.55 | 321.90 |  |
| RA5: Ratio of days that are higher than previous day | 0.23 | 0.32 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.24 | 0.54 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.13 | 0.29 |  |
| RA8: Number of flow reversals from one day to the next | 80.29 | 108.33 |  |
| RA9: CV, number of flow reversals from one day to the next | 18.94 | 19.99 |  |

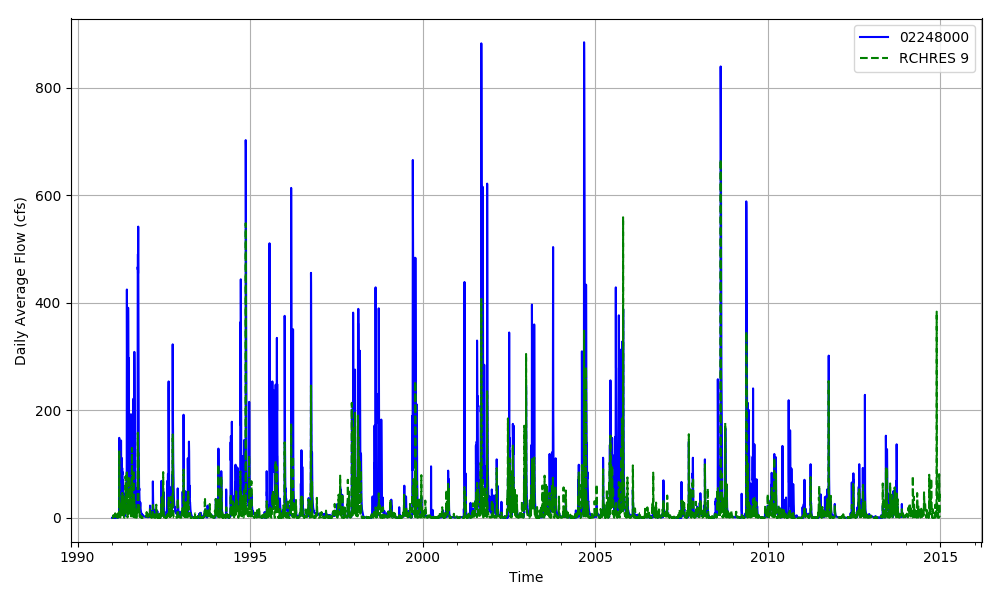


Figure 03080201-10: Daily flow for HSFP reach 09 and USGS station 02248000.

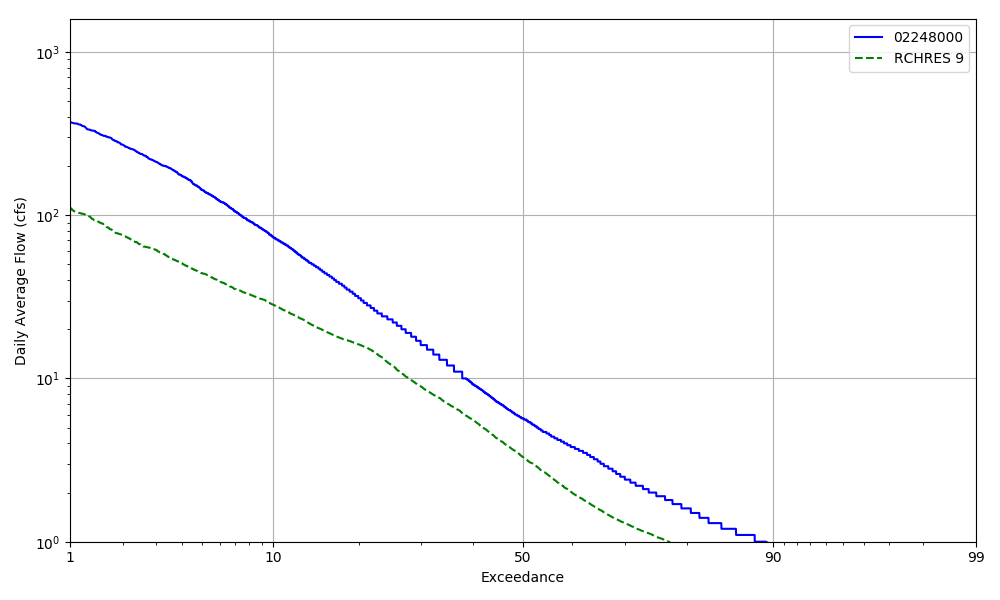


Figure 03080201-11: Daily exceedance for HSFP reach 09 and USGS station 02248000.

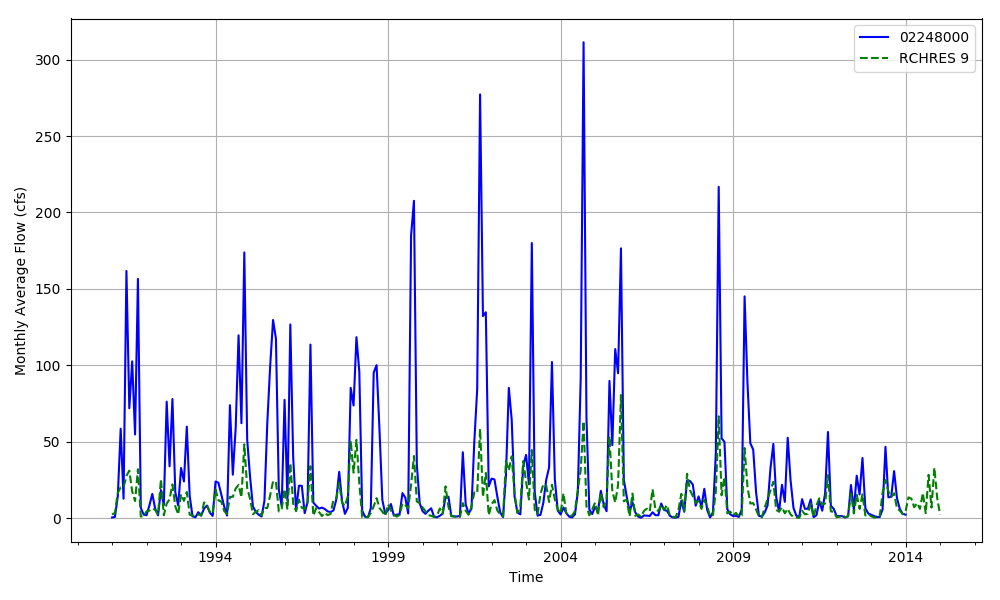


Figure 03080201-12: Monthly flow for HSFP reach 09 and USGS station 02248000.

## HSPF Reach 12, USGS Gauge 02248053

Table 03080201-7: Comparison Statistics Between HSPF Reach 12 and USGS Gauge 02248053.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 0.29 |
| Standard error | 84.88 |
| Relative bias | 0.00 |
| Relative standard error | 0.62 |
| Nash-Sutcliffe coefficient | 0.61 |
| Coefficient of efficiency | 0.33 |
| Index of agreement | 0.61 |

Table 03080201-8: Hydrologic Indices Between USGS Gauge 02248053 and HSPF Reach 12.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02248053 | Simulated Reach 12 | Percent Difference |
| MA1: Mean, all daily flows | 155.96 | 86.02 | -44.84 |
| MA2: Median, all daily flows | 82.00 | 27.33 | -66.67 |
| MA3: CV, all daily flows | 150.50 | 207.21 | 37.68 |
| MA4: CV, log of all daily flows | 108.00 | 136.46 | 26.35 |
| MA5: Mean daily flow / median daily flow | 1.90 | 3.15 | 65.48 |
| MA9: (Q10 - Q90) / median daily flow | 3.98 | 8.11 | 103.80 |
| MA10: (Q20 - Q80) / median daily flow | 2.18 | 4.33 | 98.72 |
| MA11: (Q25 - Q75) / median daily flow | 1.72 | 3.13 | 81.89 |
| MA12: Mean monthly flow, January | 85.53 | 45.47 | -46.84 |
| MA13: Mean monthly flow, February | 81.64 | 54.91 | -32.74 |
| MA14: Mean monthly flow, March | 146.31 | 77.01 | -47.37 |
| MA15: Mean monthly flow, April | 74.00 | 22.27 | -69.90 |
| MA16: Mean monthly flow, May | 75.80 | 19.14 | -74.76 |
| MA17: Mean monthly flow, June | 142.75 | 120.62 | -15.50 |
| MA18: Mean monthly flow, July | 145.26 | 110.92 | -23.64 |
| MA19: Mean monthly flow, August | 148.70 | 118.39 | -20.38 |
| MA20: Mean monthly flow, September | 281.31 | 181.74 | -35.40 |
| MA21: Mean monthly flow, October | 173.71 | 120.88 | -30.41 |
| MA22: Mean monthly flow, November | 127.36 | 58.57 | -54.01 |
| MA23: Mean monthly flow, December | 88.43 | 61.27 | -30.71 |
| ML1: Mean minimum monthly flow, January | 8.20 | 3.84 | -53.15 |
| ML2: Mean minimum monthly flow, February | 6.43 | 3.74 | -41.85 |
| ML3: Mean minimum monthly flow, March | 8.60 | 20.15 | 134.17 |
| ML4: Mean minimum monthly flow, April | 6.17 | 2.23 | -63.89 |
| ML5: Mean minimum monthly flow, May | 15.47 | 2.32 | -85.02 |
| ML6: Mean minimum monthly flow, June | 13.02 | 12.04 | -7.54 |
| ML7: Mean minimum monthly flow, July | 12.83 | 5.41 | -57.86 |
| ML8: Mean minimum monthly flow, August | 10.10 | 6.39 | -36.77 |
| ML9: Mean minimum monthly flow, September | 22.89 | 14.57 | -36.34 |
| ML10: Mean minimum monthly flow, October | 7.17 | 11.50 | 60.32 |
| ML11: Mean minimum monthly flow, November | 11.52 | 5.07 | -55.98 |
| ML12: Mean minimum monthly flow, December | 19.38 | 4.00 | -79.34 |
| ML13: CV of minimum monthly flows | 126.57 | 191.93 | 51.63 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.00 | 0.06 | 2420.84 |
| ML15: Mean minimum annual flow / mean annual flow | 0.00 | 0.02 | 1326.28 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.06 | 2586.23 |
| ML20: Ratio of baseflow volume to total flow volume | 0.13 | 0.20 | 54.84 |
| ML22: Mean annual minimum flow divided by catchment area | 0.00 | 0.02 | 679.36 |
| RA1: Mean of positive changes from one day to next (rise rate) | 82.74 | 67.37 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 203.25 | 310.99 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 68.19 | 28.93 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 128.40 | 313.27 |  |
| RA5: Ratio of days that are higher than previous day | 0.45 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.58 | 0.38 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.44 | 0.25 |  |
| RA8: Number of flow reversals from one day to the next | 118.00 | 96.83 |  |
| RA9: CV, number of flow reversals from one day to the next | 18.58 | 8.92 |  |

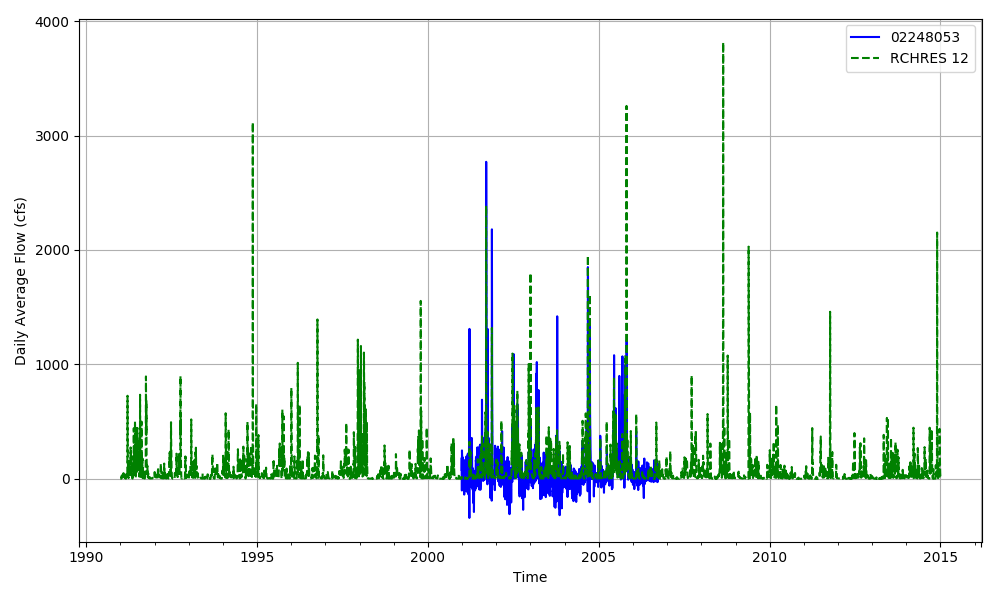


Figure 03080201-13: Daily flow for HSFP reach 12 and USGS station 02248053.

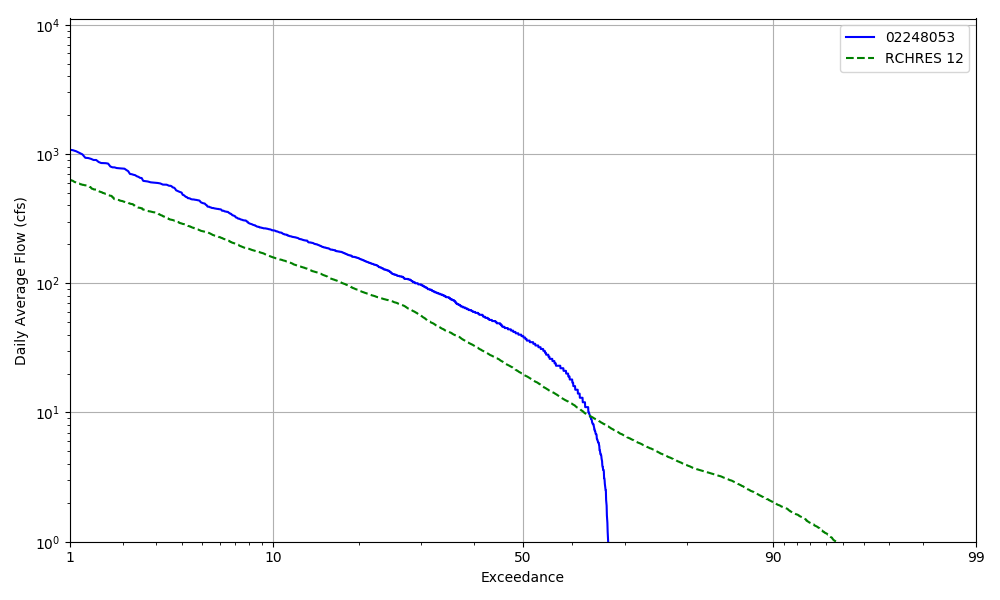


Figure 03080201-14: Daily exceedance for HSFP reach 12 and USGS station 02248053.

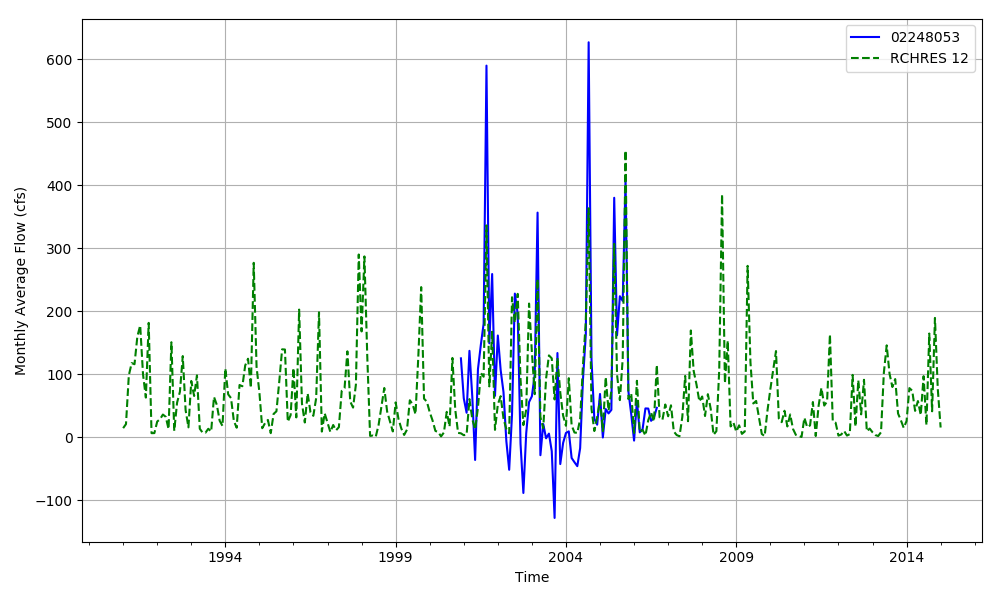


Figure 03080201-15: Monthly flow for HSFP reach 12 and USGS station 02248053.

## HSPF Reach 15, USGS Gauge 02247598

Table 03080201-9: Comparison Statistics Between HSPF Reach 15 and USGS Gauge 02247598.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -3.60 |
| Standard error | 138.96 |
| Relative bias | -0.03 |
| Relative standard error | 0.85 |
| Nash-Sutcliffe coefficient | 0.27 |
| Coefficient of efficiency | 0.18 |
| Index of agreement | 0.57 |

Table 03080201-10: Hydrologic Indices Between USGS Gauge 02247598 and HSPF Reach 15.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02247598 | Simulated Reach 15 | Percent Difference |
| MA1: Mean, all daily flows | 214.56 | 123.34 | -42.52 |
| MA2: Median, all daily flows | 134.00 | 41.67 | -68.91 |
| MA3: CV, all daily flows | 120.15 | 194.86 | 62.18 |
| MA4: CV, log of all daily flows | 90.50 | 137.00 | 51.38 |
| MA5: Mean daily flow / median daily flow | 1.60 | 2.96 | 84.87 |
| MA9: (Q10 - Q90) / median daily flow | 3.18 | 7.04 | 121.53 |
| MA10: (Q20 - Q80) / median daily flow | 1.82 | 3.49 | 91.44 |
| MA11: (Q25 - Q75) / median daily flow | 1.43 | 2.58 | 80.27 |
| MA12: Mean monthly flow, January | 106.81 | 69.69 | -34.75 |
| MA13: Mean monthly flow, February | 118.26 | 80.05 | -32.31 |
| MA14: Mean monthly flow, March | 169.13 | 113.40 | -32.95 |
| MA15: Mean monthly flow, April | 121.39 | 41.89 | -65.49 |
| MA16: Mean monthly flow, May | 224.87 | 59.26 | -73.65 |
| MA17: Mean monthly flow, June | 210.39 | 149.46 | -28.96 |
| MA18: Mean monthly flow, July | 150.15 | 169.09 | 12.62 |
| MA19: Mean monthly flow, August | 226.18 | 188.21 | -16.79 |
| MA20: Mean monthly flow, September | 260.34 | 177.59 | -31.78 |
| MA21: Mean monthly flow, October | 249.39 | 156.08 | -37.42 |
| MA22: Mean monthly flow, November | 193.20 | 85.22 | -55.89 |
| MA23: Mean monthly flow, December | 141.03 | 87.51 | -37.95 |
| ML1: Mean minimum monthly flow, January | 11.58 | 13.47 | 16.32 |
| ML2: Mean minimum monthly flow, February | 17.45 | 12.93 | -25.87 |
| ML3: Mean minimum monthly flow, March | 15.92 | 27.71 | 74.06 |
| ML4: Mean minimum monthly flow, April | 13.58 | 6.72 | -50.51 |
| ML5: Mean minimum monthly flow, May | 15.27 | 5.33 | -65.08 |
| ML6: Mean minimum monthly flow, June | 16.81 | 17.08 | 1.57 |
| ML7: Mean minimum monthly flow, July | 12.26 | 34.95 | 184.95 |
| ML8: Mean minimum monthly flow, August | 32.58 | 28.14 | -13.65 |
| ML9: Mean minimum monthly flow, September | 24.77 | 24.34 | -1.72 |
| ML10: Mean minimum monthly flow, October | 18.57 | 22.24 | 19.77 |
| ML11: Mean minimum monthly flow, November | 16.81 | 14.61 | -13.09 |
| ML12: Mean minimum monthly flow, December | 21.04 | 15.28 | -27.37 |
| ML13: CV of minimum monthly flows | 116.37 | 149.80 | 28.73 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.01 | 0.07 | 380.98 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.03 | 204.81 |
| ML16: Median minimum annual flow / median annual flow | 0.01 | 0.06 | 502.30 |
| ML20: Ratio of baseflow volume to total flow volume | 0.20 | 0.25 | 29.33 |
| ML22: Mean annual minimum flow divided by catchment area | 0.02 | 0.05 | 141.68 |
| RA1: Mean of positive changes from one day to next (rise rate) | 113.41 | 82.64 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 179.02 | 305.44 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 99.98 | 34.17 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 122.65 | 319.34 |  |
| RA5: Ratio of days that are higher than previous day | 0.47 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.57 | 0.30 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.47 | 0.20 |  |
| RA8: Number of flow reversals from one day to the next | 124.75 | 75.67 |  |
| RA9: CV, number of flow reversals from one day to the next | 29.37 | 26.20 |  |

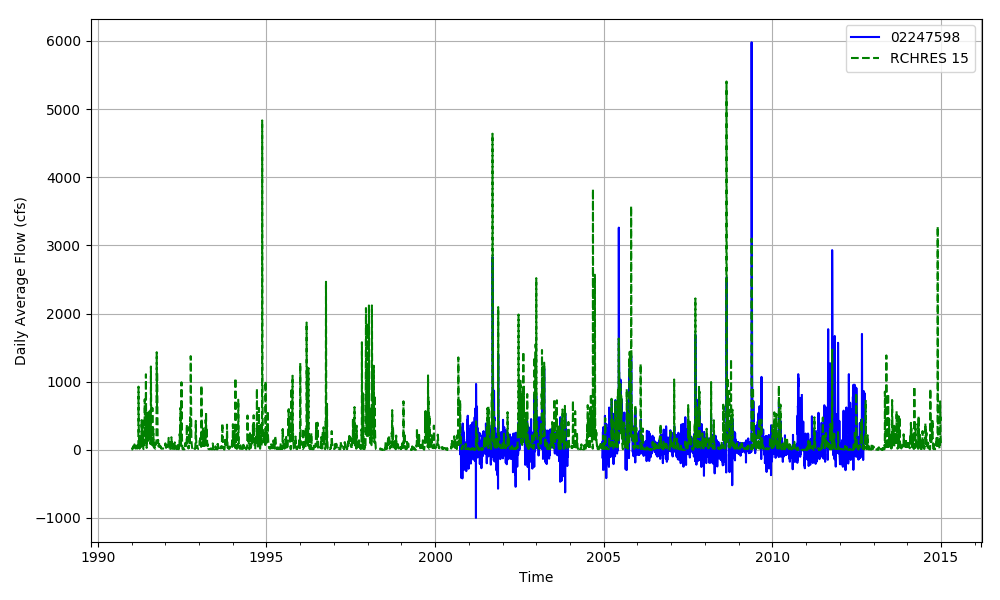


Figure 03080201-16: Daily flow for HSFP reach 15 and USGS station 02247598.

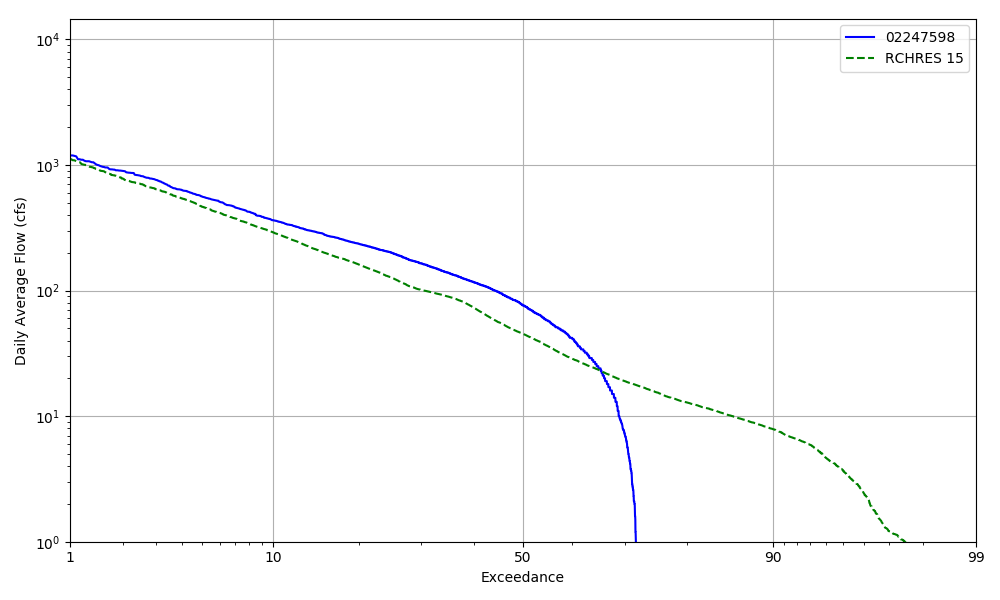


Figure 03080201-17: Daily exceedance for HSFP reach 15 and USGS station 02247598.

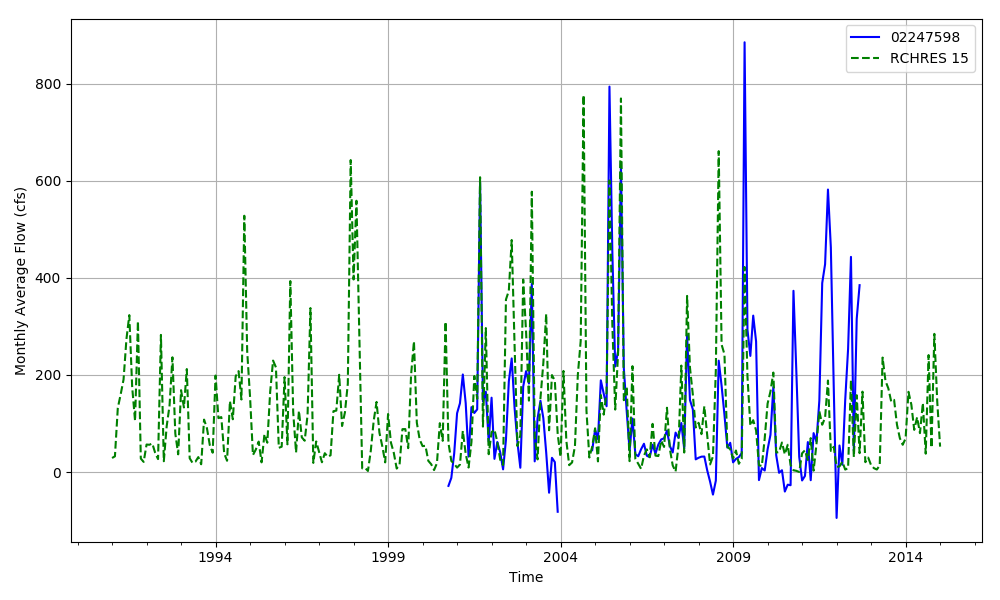


Figure 03080201-18: Monthly flow for HSFP reach 15 and USGS station 02247598.

## HSPF Reach 23, USGS Gauge 02246895

Table 03080201-11: Comparison Statistics Between HSPF Reach 23 and USGS Gauge 02246895.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -299.08 |
| Standard error | 352.03 |
| Relative bias | -0.94 |
| Relative standard error | 1.90 |
| Nash-Sutcliffe coefficient | -2.62 |
| Coefficient of efficiency | -1.47 |
| Index of agreement | 0.25 |

Table 03080201-12: Hydrologic Indices Between USGS Gauge 02246895 and HSPF Reach 23.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02246895 | Simulated Reach 23 | Percent Difference |
| MA1: Mean, all daily flows | 373.39 | 20.29 | -94.57 |
| MA2: Median, all daily flows | 361.00 | 6.42 | -98.22 |
| MA3: CV, all daily flows | 50.83 | 163.42 | 221.47 |
| MA4: CV, log of all daily flows | 46.28 | 139.92 | 202.32 |
| MA5: Mean daily flow / median daily flow | 1.03 | 3.16 | 205.75 |
| MA9: (Q10 - Q90) / median daily flow | 1.37 | 8.69 | 533.20 |
| MA10: (Q20 - Q80) / median daily flow | 0.91 | 4.00 | 340.36 |
| MA11: (Q25 - Q75) / median daily flow | 0.73 | 2.94 | 303.40 |
| MA12: Mean monthly flow, January | 353.47 | 10.53 | -97.02 |
| MA13: Mean monthly flow, February | 311.98 | 8.16 | -97.38 |
| MA14: Mean monthly flow, March | 330.10 | 27.76 | -91.59 |
| MA15: Mean monthly flow, April | 298.33 | 8.93 | -97.01 |
| MA16: Mean monthly flow, May | 264.58 | 2.85 | -98.92 |
| MA17: Mean monthly flow, June | 230.41 | 16.75 | -92.73 |
| MA18: Mean monthly flow, July | 223.63 | 20.82 | -90.69 |
| MA19: Mean monthly flow, August | 312.42 | 32.40 | -89.63 |
| MA20: Mean monthly flow, September | 419.48 | 48.32 | -88.48 |
| MA21: Mean monthly flow, October | 316.99 | 11.62 | -96.33 |
| MA22: Mean monthly flow, November | 310.58 | 10.52 | -96.61 |
| MA23: Mean monthly flow, December | 352.35 | 14.82 | -95.79 |
| ML1: Mean minimum monthly flow, January | 194.00 | 1.67 | -99.14 |
| ML2: Mean minimum monthly flow, February | 98.45 | 1.56 | -98.41 |
| ML3: Mean minimum monthly flow, March | 145.50 | 7.48 | -94.86 |
| ML4: Mean minimum monthly flow, April | 100.30 | 3.47 | -96.54 |
| ML5: Mean minimum monthly flow, May | 59.08 | 0.79 | -98.66 |
| ML6: Mean minimum monthly flow, June | 42.60 | 1.27 | -97.01 |
| ML7: Mean minimum monthly flow, July | 44.02 | 2.82 | -93.59 |
| ML8: Mean minimum monthly flow, August | 83.80 | 4.98 | -94.05 |
| ML9: Mean minimum monthly flow, September | 111.80 | 4.69 | -95.80 |
| ML10: Mean minimum monthly flow, October | 116.75 | 2.29 | -98.04 |
| ML11: Mean minimum monthly flow, November | 144.50 | 1.90 | -98.69 |
| ML12: Mean minimum monthly flow, December | 153.25 | 1.72 | -98.88 |
| ML13: CV of minimum monthly flows | 100.22 | 144.35 | 44.03 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.04 | 0.08 | 115.08 |
| ML15: Mean minimum annual flow / mean annual flow | 0.04 | 0.03 | -13.53 |
| ML16: Median minimum annual flow / median annual flow | 0.03 | 0.06 | 149.39 |
| ML20: Ratio of baseflow volume to total flow volume | 0.43 | 0.27 | -36.27 |
| ML22: Mean annual minimum flow divided by catchment area | 0.13 | 0.01 | -94.27 |
| RA1: Mean of positive changes from one day to next (rise rate) | 108.05 | 12.23 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 104.74 | 258.08 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 91.89 | 5.98 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 95.36 | 267.40 |  |
| 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 | 0.21 | 0.28 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.21 | 0.22 |  |
| RA8: Number of flow reversals from one day to the next | 153.20 | 82.20 |  |
| RA9: CV, number of flow reversals from one day to the next | 45.49 | 27.89 |  |

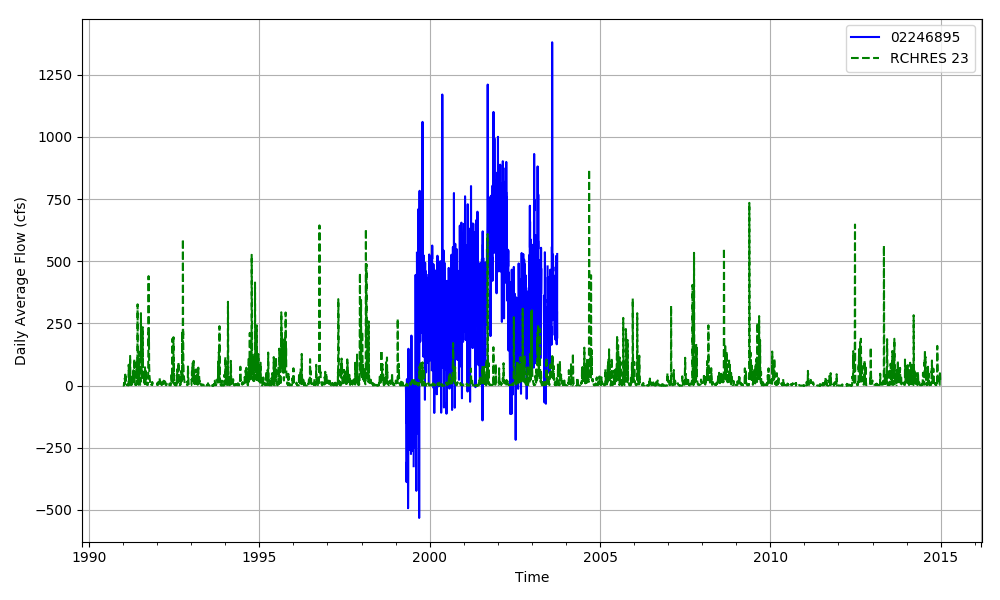


Figure 03080201-19: Daily flow for HSFP reach 23 and USGS station 02246895.

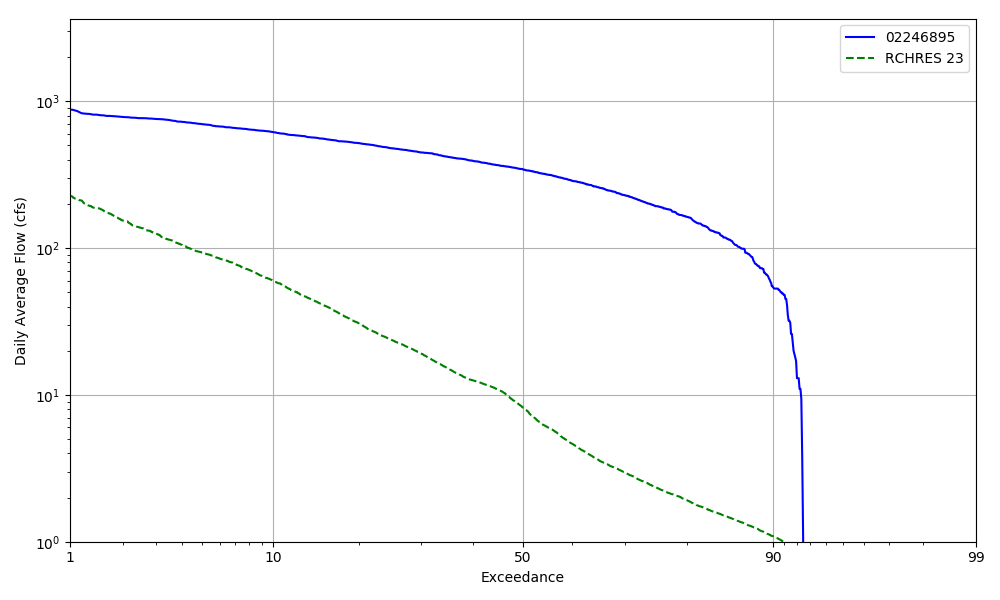


Figure 03080201-20: Daily exceedance for HSFP reach 23 and USGS station 02246895.

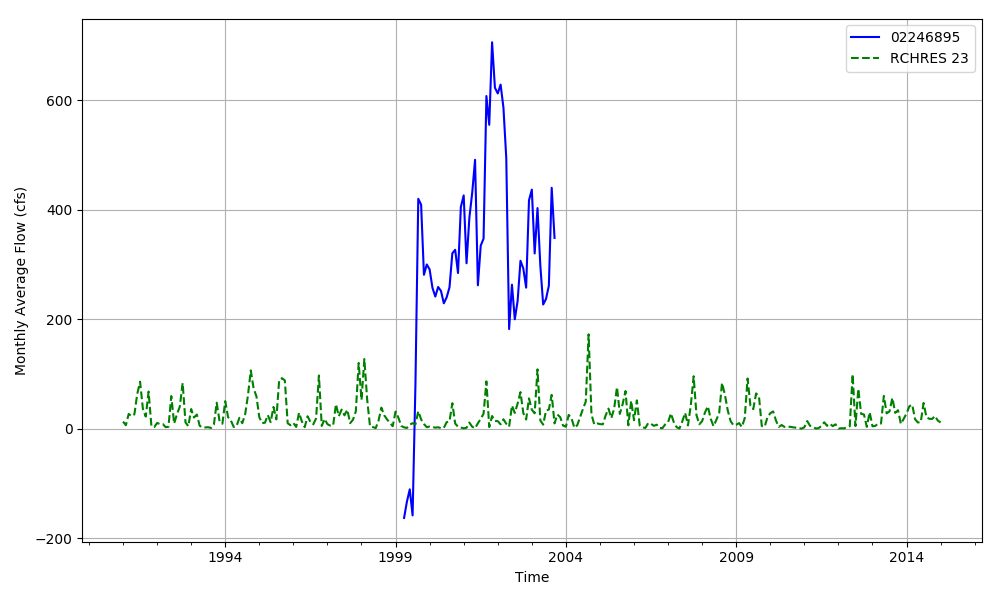


Figure 03080201-21: Monthly flow for HSFP reach 23 and USGS station 02246895.

## HSPF Reach 26, USGS Gauge 02247015

Table 03080201-13: Comparison Statistics Between HSPF Reach 26 and USGS Gauge 02247015.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -0.69 |
| Standard error | 40.59 |
| Relative bias | -0.02 |
| Relative standard error | 0.78 |
| Nash-Sutcliffe coefficient | 0.39 |
| Coefficient of efficiency | 0.15 |
| Index of agreement | 0.53 |

Table 03080201-14: Hydrologic Indices Between USGS Gauge 02247015 and HSPF Reach 26.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02247015 | Simulated Reach 26 | Percent Difference |
| MA1: Mean, all daily flows | 55.92 | 31.63 | -43.43 |
| MA2: Median, all daily flows | 43.00 | 9.70 | -77.45 |
| MA3: CV, all daily flows | 85.42 | 180.94 | 111.82 |
| MA4: CV, log of all daily flows | 72.02 | 137.12 | 90.38 |
| MA5: Mean daily flow / median daily flow | 1.30 | 3.26 | 150.89 |
| MA9: (Q10 - Q90) / median daily flow | 2.33 | 7.98 | 242.74 |
| MA10: (Q20 - Q80) / median daily flow | 1.49 | 4.25 | 185.57 |
| MA11: (Q25 - Q75) / median daily flow | 1.20 | 2.87 | 139.50 |
| MA12: Mean monthly flow, January | 33.15 | 10.78 | -67.48 |
| MA13: Mean monthly flow, February | 23.85 | 10.00 | -58.07 |
| MA14: Mean monthly flow, March | 27.75 | 17.26 | -37.78 |
| MA15: Mean monthly flow, April | 19.77 | 9.32 | -52.88 |
| MA16: Mean monthly flow, May | 42.99 | 3.25 | -92.44 |
| MA17: Mean monthly flow, June | 45.65 | 22.90 | -49.82 |
| MA18: Mean monthly flow, July | 57.62 | 40.76 | -29.26 |
| MA19: Mean monthly flow, August | 55.40 | 58.35 | 5.34 |
| MA20: Mean monthly flow, September | 103.80 | 122.02 | 17.55 |
| MA21: Mean monthly flow, October | 19.26 | 15.10 | -21.59 |
| MA22: Mean monthly flow, November | 23.14 | 11.68 | -49.56 |
| MA23: Mean monthly flow, December | 36.63 | 7.69 | -79.01 |
| ML1: Mean minimum monthly flow, January | 12.80 | 4.08 | -68.16 |
| ML2: Mean minimum monthly flow, February | 2.43 | 3.48 | 43.51 |
| ML3: Mean minimum monthly flow, March | 4.07 | 3.68 | -9.60 |
| ML4: Mean minimum monthly flow, April | 4.21 | 2.06 | -51.13 |
| ML5: Mean minimum monthly flow, May | 6.97 | 1.01 | -85.53 |
| ML6: Mean minimum monthly flow, June | 13.13 | 1.00 | -92.38 |
| ML7: Mean minimum monthly flow, July | 19.40 | 8.83 | -54.48 |
| ML8: Mean minimum monthly flow, August | 6.40 | 6.70 | 4.62 |
| ML9: Mean minimum monthly flow, September | 10.56 | 9.14 | -13.49 |
| ML10: Mean minimum monthly flow, October | 1.16 | 3.12 | 169.72 |
| ML11: Mean minimum monthly flow, November | 12.77 | 4.15 | -67.46 |
| ML12: Mean minimum monthly flow, December | 19.50 | 4.46 | -77.15 |
| ML13: CV of minimum monthly flows | 113.92 | 105.19 | -7.66 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.01 | 0.05 | 418.89 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.02 | 106.46 |
| ML16: Median minimum annual flow / median annual flow | 0.01 | 0.03 | 326.00 |
| ML20: Ratio of baseflow volume to total flow volume | 0.22 | 0.17 | -24.72 |
| ML22: Mean annual minimum flow divided by catchment area | 0.00 | 0.01 | 31.07 |
| RA1: Mean of positive changes from one day to next (rise rate) | 29.49 | 22.54 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 202.89 | 251.25 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 27.81 | 10.05 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 188.62 | 334.83 |  |
| RA5: Ratio of days that are higher than previous day | 0.48 | 0.31 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.51 | 0.37 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.43 | 0.22 |  |
| RA8: Number of flow reversals from one day to the next | 115.75 | 67.75 |  |
| RA9: CV, number of flow reversals from one day to the next | 72.43 | 54.24 |  |

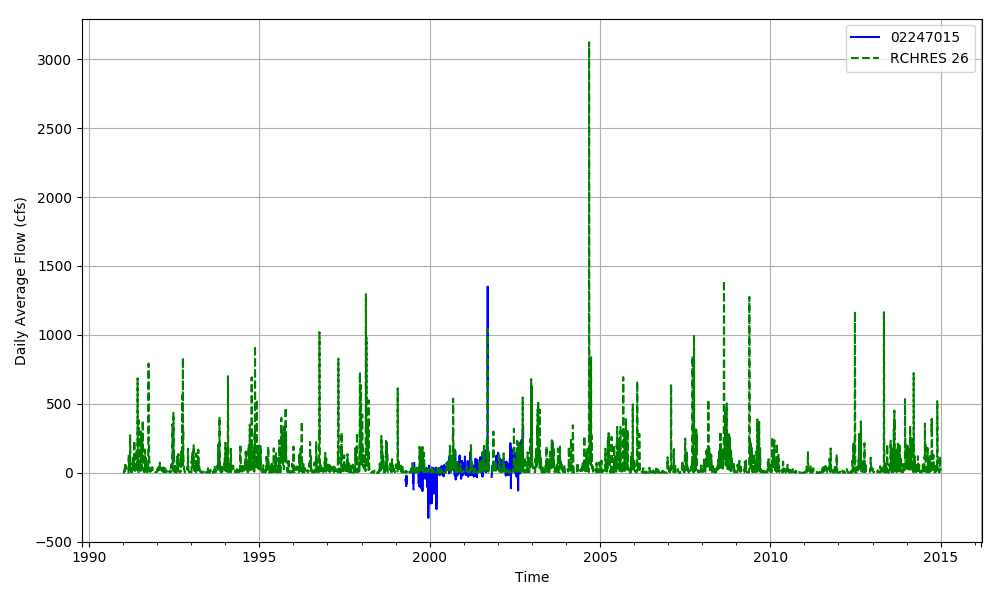


Figure 03080201-22: Daily flow for HSFP reach 26 and USGS station 02247015.

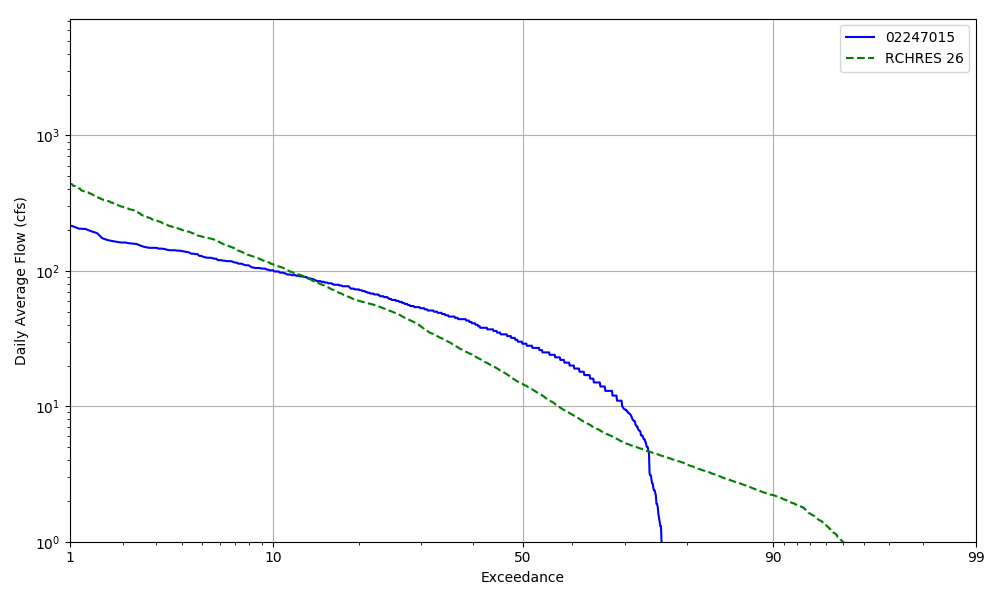


Figure 03080201-23: Daily exceedance for HSFP reach 26 and USGS station 02247015.

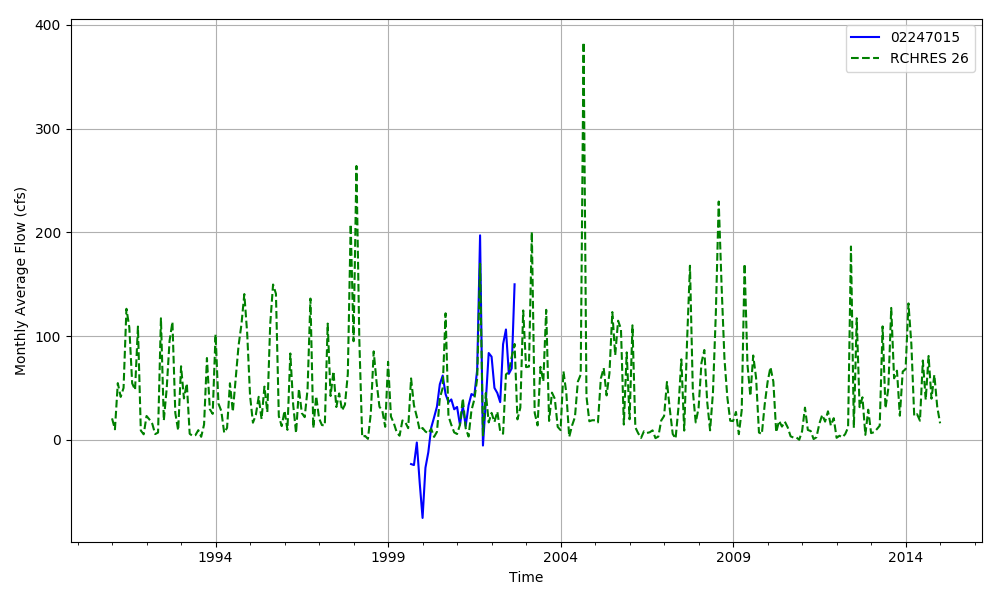


Figure 03080201-24: Monthly flow for HSFP reach 26 and USGS station 02247015.