# Appendix for Model 03080103

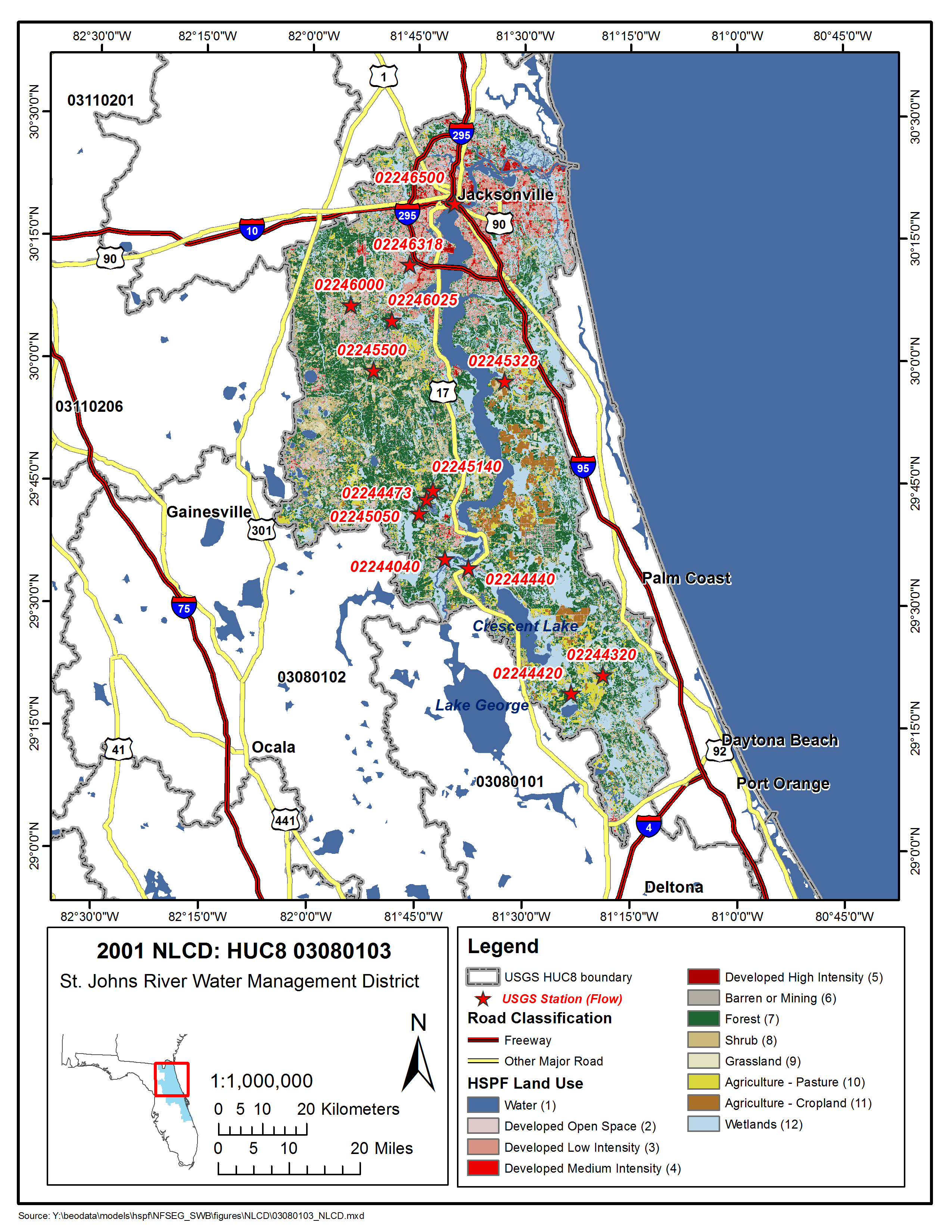


Figure 03080103-1: Land Cover from the National Land Cover Database.

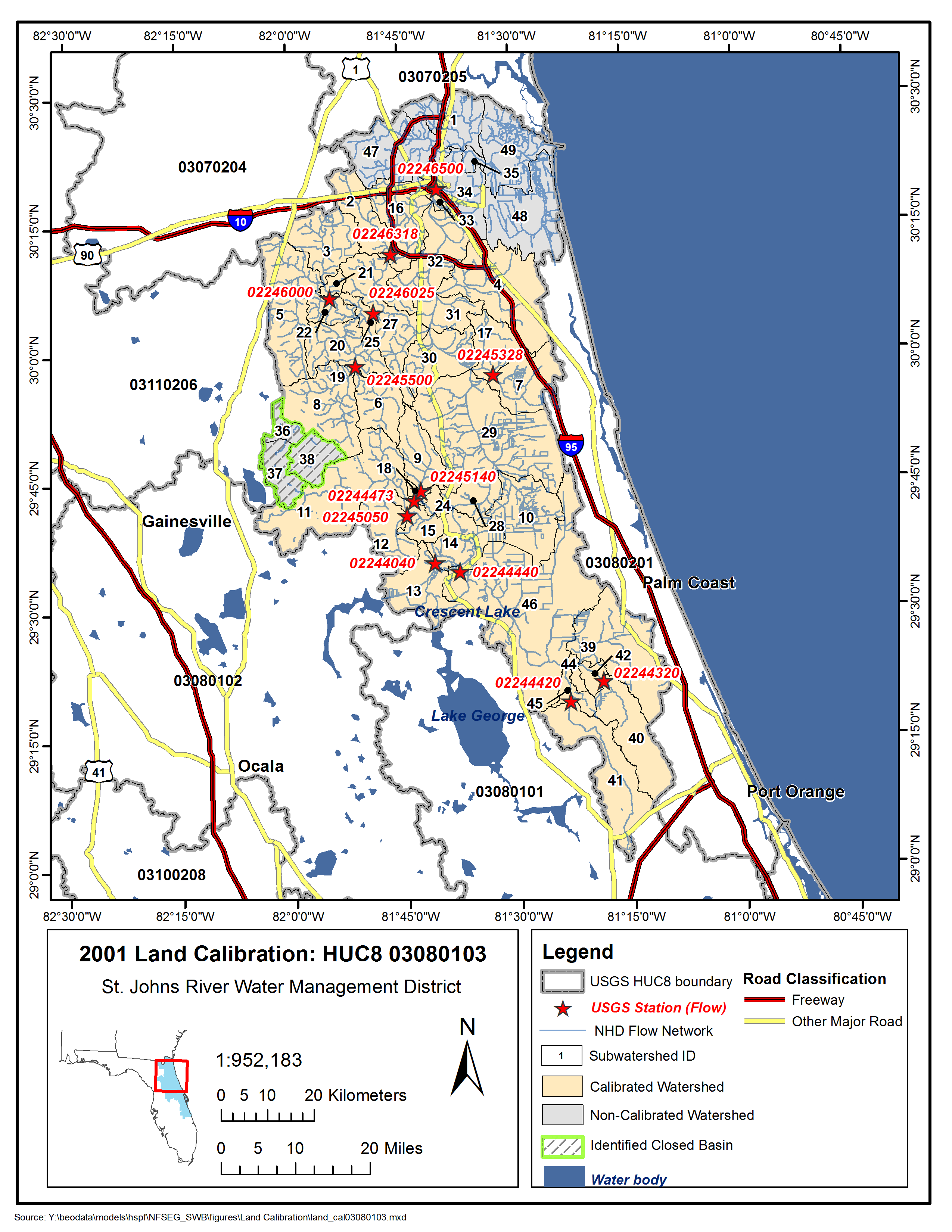


Figure 03080103-2: Calibrated sub-watersheds.

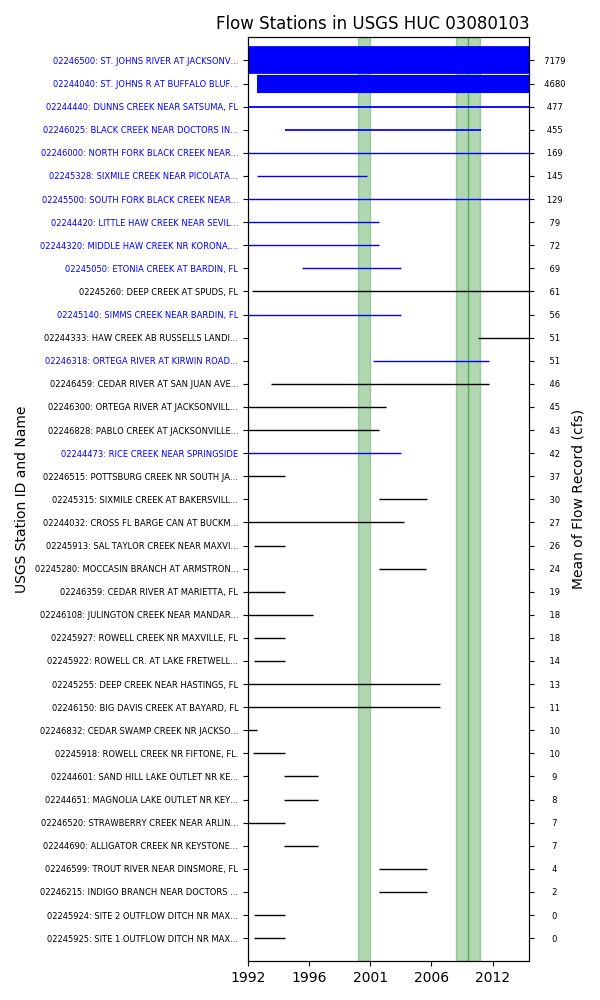


Figure 03080103-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 02, USGS Gauge 02246318

Table 03080103-1: Comparison Statistics Between HSPF Reach 02 and USGS Gauge 02246318.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 3.39 |
| Standard error | 35.43 |
| Relative bias | 0.07 |
| Relative standard error | 0.54 |
| Nash-Sutcliffe coefficient | 0.71 |
| Coefficient of efficiency | 0.53 |
| Index of agreement | 0.76 |

Table 03080103-2: Hydrologic Indices Between USGS Gauge 02246318 and HSPF Reach 02.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02246318 | Simulated Reach 02 | Percent Difference |
| MA1: Mean, all daily flows | 51.23 | 54.56 | 6.49 |
| MA2: Median, all daily flows | 20.00 | 22.30 | 11.52 |
| MA3: CV, all daily flows | 188.08 | 186.71 | -0.73 |
| MA4: CV, log of all daily flows | 119.25 | 117.16 | -1.76 |
| MA5: Mean daily flow / median daily flow | 2.56 | 2.45 | -4.51 |
| MA9: (Q10 - Q90) / median daily flow | 5.12 | 5.27 | 2.90 |
| MA10: (Q20 - Q80) / median daily flow | 2.79 | 2.94 | 5.14 |
| MA11: (Q25 - Q75) / median daily flow | 2.12 | 2.19 | 3.07 |
| MA12: Mean monthly flow, January | 35.94 | 38.20 | 6.29 |
| MA13: Mean monthly flow, February | 48.28 | 62.74 | 29.95 |
| MA14: Mean monthly flow, March | 49.54 | 57.20 | 15.46 |
| MA15: Mean monthly flow, April | 33.64 | 35.63 | 5.93 |
| MA16: Mean monthly flow, May | 26.42 | 28.38 | 7.45 |
| MA17: Mean monthly flow, June | 38.31 | 36.60 | -4.45 |
| MA18: Mean monthly flow, July | 71.40 | 60.66 | -15.04 |
| MA19: Mean monthly flow, August | 97.89 | 92.64 | -5.36 |
| MA20: Mean monthly flow, September | 85.51 | 99.96 | 16.91 |
| MA21: Mean monthly flow, October | 46.09 | 52.48 | 13.86 |
| MA22: Mean monthly flow, November | 14.28 | 18.30 | 28.13 |
| MA23: Mean monthly flow, December | 39.83 | 43.26 | 8.61 |
| ML1: Mean minimum monthly flow, January | 16.63 | 7.94 | -52.29 |
| ML2: Mean minimum monthly flow, February | 19.53 | 15.80 | -19.11 |
| ML3: Mean minimum monthly flow, March | 17.24 | 12.79 | -25.79 |
| ML4: Mean minimum monthly flow, April | 7.67 | 3.89 | -49.32 |
| ML5: Mean minimum monthly flow, May | 3.23 | 1.66 | -48.44 |
| ML6: Mean minimum monthly flow, June | 3.96 | 3.60 | -9.08 |
| ML7: Mean minimum monthly flow, July | 15.64 | 15.14 | -3.19 |
| ML8: Mean minimum monthly flow, August | 17.35 | 19.70 | 13.52 |
| ML9: Mean minimum monthly flow, September | 11.33 | 10.02 | -11.56 |
| ML10: Mean minimum monthly flow, October | 13.54 | 11.34 | -16.26 |
| ML11: Mean minimum monthly flow, November | 8.08 | 5.26 | -34.85 |
| ML12: Mean minimum monthly flow, December | 12.31 | 8.27 | -32.85 |
| ML13: CV of minimum monthly flows | 89.59 | 101.02 | 12.75 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.16 | 0.05 | -71.30 |
| ML15: Mean minimum annual flow / mean annual flow | 0.08 | 0.02 | -71.84 |
| ML16: Median minimum annual flow / median annual flow | 0.13 | 0.03 | -72.69 |
| ML20: Ratio of baseflow volume to total flow volume | 0.34 | 0.32 | -3.96 |
| ML22: Mean annual minimum flow divided by catchment area | 0.03 | 0.01 | -66.70 |
| RA1: Mean of positive changes from one day to next (rise rate) | 30.04 | 32.39 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 354.50 | 398.25 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 11.75 | 10.80 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 408.59 | 406.45 |  |
| RA5: Ratio of days that are higher than previous day | 0.26 | 0.25 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.25 | 0.27 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.13 | 0.14 |  |
| RA8: Number of flow reversals from one day to the next | 85.10 | 82.10 |  |
| RA9: CV, number of flow reversals from one day to the next | 15.76 | 21.57 |  |

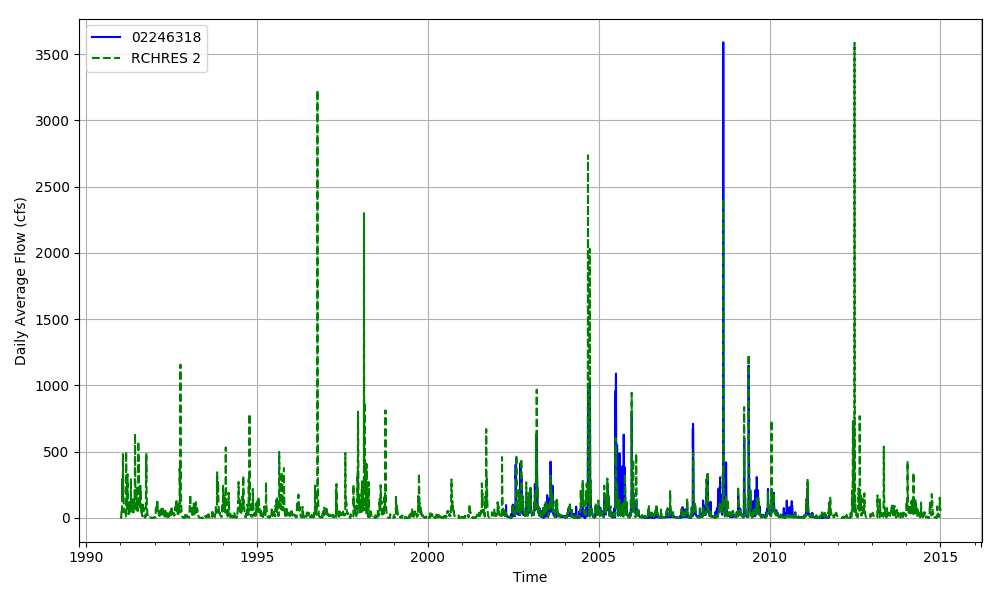


Figure 03080103-4: Daily flow for HSFP reach 02 and USGS station 02246318.

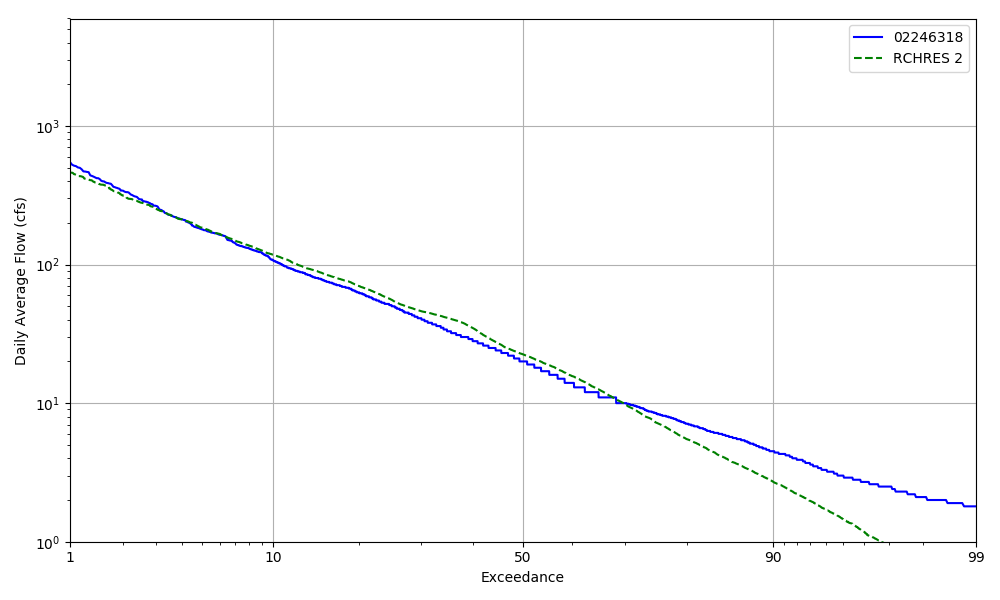


Figure 03080103-5: Daily exceedance for HSFP reach 02 and USGS station 02246318.

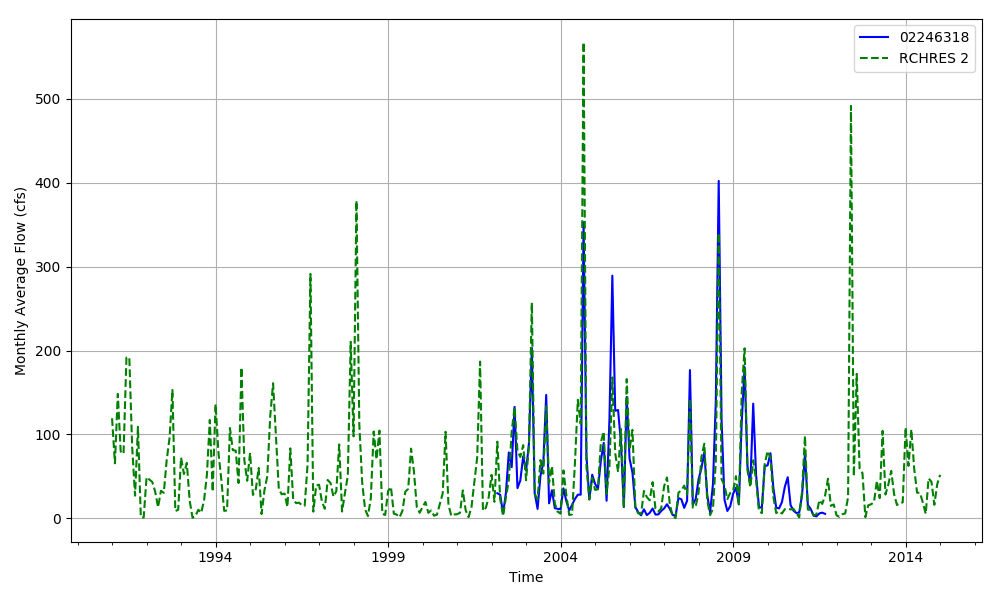


Figure 03080103-6: Monthly flow for HSFP reach 02 and USGS station 02246318.

## HSPF Reach 07, USGS Gauge 02245328

Table 03080103-3: Comparison Statistics Between HSPF Reach 07 and USGS Gauge 02245328.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -83.21 |
| Standard error | 185.17 |
| Relative bias | -0.53 |
| Relative standard error | 0.78 |
| Nash-Sutcliffe coefficient | 0.39 |
| Coefficient of efficiency | 0.22 |
| Index of agreement | 0.57 |

Table 03080103-4: Hydrologic Indices Between USGS Gauge 02245328 and HSPF Reach 07.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02245328 | Simulated Reach 07 | Percent Difference |
| MA1: Mean, all daily flows | 216.45 | 66.52 | -69.27 |
| MA2: Median, all daily flows | 120.00 | 10.50 | -91.25 |
| MA3: CV, all daily flows | 146.63 | 229.80 | 56.72 |
| MA4: CV, log of all daily flows | 96.04 | 166.23 | 73.09 |
| MA5: Mean daily flow / median daily flow | 1.80 | 6.33 | 251.06 |
| MA9: (Q10 - Q90) / median daily flow | 3.40 | 16.83 | 395.63 |
| MA10: (Q20 - Q80) / median daily flow | 2.10 | 8.36 | 299.05 |
| MA11: (Q25 - Q75) / median daily flow | 1.50 | 5.23 | 248.99 |
| MA12: Mean monthly flow, January | 191.96 | 75.87 | -60.48 |
| MA13: Mean monthly flow, February | 155.89 | 62.77 | -59.74 |
| MA14: Mean monthly flow, March | 131.81 | 47.59 | -63.90 |
| MA15: Mean monthly flow, April | 227.05 | 33.71 | -85.15 |
| MA16: Mean monthly flow, May | 126.28 | 11.46 | -90.92 |
| MA17: Mean monthly flow, June | 160.13 | 31.12 | -80.57 |
| MA18: Mean monthly flow, July | 113.45 | 42.00 | -62.98 |
| MA19: Mean monthly flow, August | 158.82 | 88.65 | -44.18 |
| MA20: Mean monthly flow, September | 438.34 | 144.26 | -67.09 |
| MA21: Mean monthly flow, October | 494.91 | 176.25 | -64.39 |
| MA22: Mean monthly flow, November | 125.30 | 31.87 | -74.56 |
| MA23: Mean monthly flow, December | 237.36 | 62.59 | -73.63 |
| ML1: Mean minimum monthly flow, January | 68.56 | 17.75 | -74.11 |
| ML2: Mean minimum monthly flow, February | 18.69 | 3.89 | -79.18 |
| ML3: Mean minimum monthly flow, March | 28.35 | 3.52 | -87.59 |
| ML4: Mean minimum monthly flow, April | 25.45 | 0.98 | -96.16 |
| ML5: Mean minimum monthly flow, May | 25.81 | 1.33 | -94.86 |
| ML6: Mean minimum monthly flow, June | 7.69 | 2.90 | -62.35 |
| ML7: Mean minimum monthly flow, July | 9.05 | 7.06 | -22.05 |
| ML8: Mean minimum monthly flow, August | 5.66 | 4.26 | -24.71 |
| ML9: Mean minimum monthly flow, September | 213.39 | 19.35 | -90.93 |
| ML10: Mean minimum monthly flow, October | 33.33 | 4.39 | -86.82 |
| ML11: Mean minimum monthly flow, November | 33.27 | 2.15 | -93.54 |
| ML12: Mean minimum monthly flow, December | 43.48 | 5.51 | -87.32 |
| ML13: CV of minimum monthly flows | 296.14 | 208.30 | -29.66 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.04 | 0.03 | -12.26 |
| ML15: Mean minimum annual flow / mean annual flow | 0.03 | 0.01 | -75.06 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.02 | 414.91 |
| ML20: Ratio of baseflow volume to total flow volume | 0.22 | 0.16 | -27.73 |
| ML22: Mean annual minimum flow divided by catchment area | 0.12 | 0.01 | -95.05 |
| RA1: Mean of positive changes from one day to next (rise rate) | 99.31 | 53.26 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 254.39 | 263.18 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 89.86 | 19.04 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 184.33 | 297.77 |  |
| RA5: Ratio of days that are higher than previous day | 0.47 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.44 | 0.45 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.41 | 0.25 |  |
| RA8: Number of flow reversals from one day to the next | 125.44 | 68.00 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.58 | 19.17 |  |

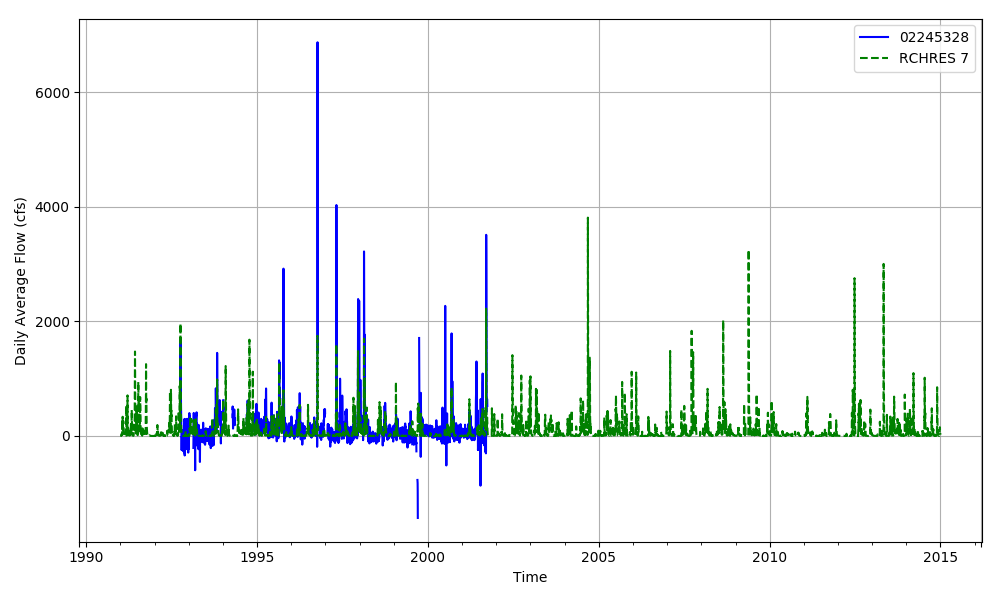


Figure 03080103-7: Daily flow for HSFP reach 07 and USGS station 02245328.

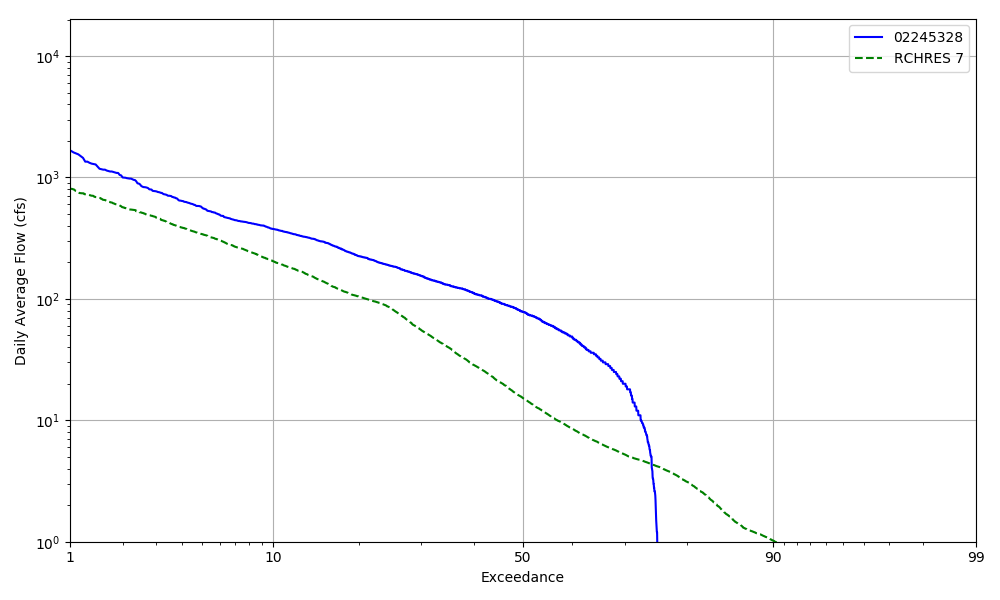


Figure 03080103-8: Daily exceedance for HSFP reach 07 and USGS station 02245328.

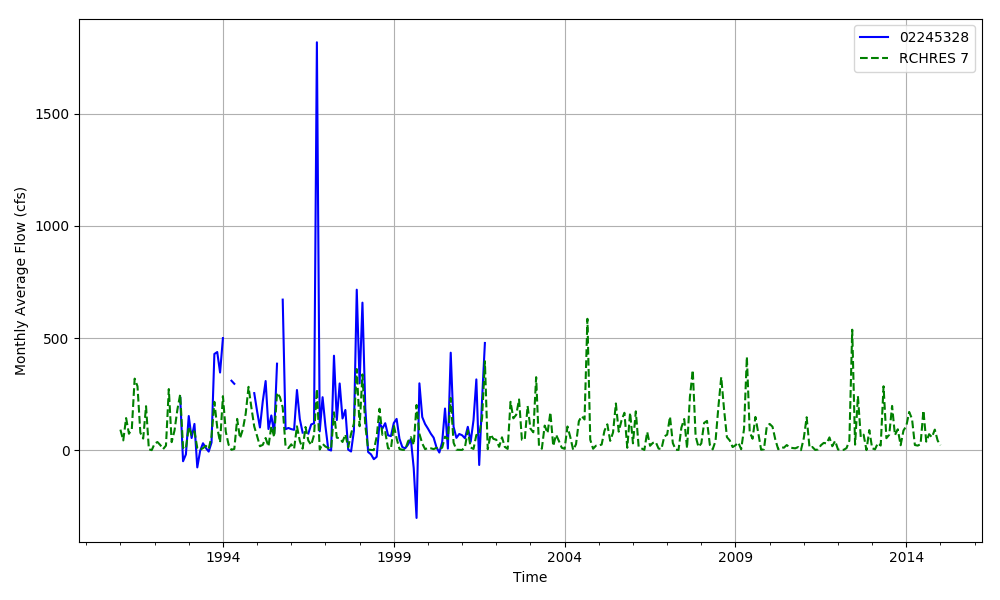


Figure 03080103-9: Monthly flow for HSFP reach 07 and USGS station 02245328.

## HSPF Reach 09, USGS Gauge 02245140

Table 03080103-5: Comparison Statistics Between HSPF Reach 09 and USGS Gauge 02245140.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -12.52 |
| Standard error | 33.42 |
| Relative bias | -0.22 |
| Relative standard error | 0.57 |
| Nash-Sutcliffe coefficient | 0.67 |
| Coefficient of efficiency | 0.51 |
| Index of agreement | 0.74 |

Table 03080103-6: Hydrologic Indices Between USGS Gauge 02245140 and HSPF Reach 09.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02245140 | Simulated Reach 09 | Percent Difference |
| MA1: Mean, all daily flows | 56.14 | 43.57 | -22.38 |
| MA2: Median, all daily flows | 22.00 | 17.52 | -20.38 |
| MA3: CV, all daily flows | 165.20 | 166.83 | 0.99 |
| MA4: CV, log of all daily flows | 120.17 | 121.94 | 1.48 |
| MA5: Mean daily flow / median daily flow | 2.55 | 2.49 | -2.51 |
| MA9: (Q10 - Q90) / median daily flow | 5.95 | 5.92 | -0.42 |
| MA10: (Q20 - Q80) / median daily flow | 2.55 | 3.28 | 28.76 |
| MA11: (Q25 - Q75) / median daily flow | 1.68 | 2.46 | 46.08 |
| MA12: Mean monthly flow, January | 51.12 | 37.87 | -25.92 |
| MA13: Mean monthly flow, February | 63.75 | 46.43 | -27.16 |
| MA14: Mean monthly flow, March | 63.40 | 48.98 | -22.74 |
| MA15: Mean monthly flow, April | 35.04 | 21.61 | -38.33 |
| MA16: Mean monthly flow, May | 15.54 | 11.20 | -27.95 |
| MA17: Mean monthly flow, June | 44.50 | 38.38 | -13.76 |
| MA18: Mean monthly flow, July | 56.77 | 38.79 | -31.68 |
| MA19: Mean monthly flow, August | 72.51 | 48.01 | -33.79 |
| MA20: Mean monthly flow, September | 77.30 | 67.71 | -12.40 |
| MA21: Mean monthly flow, October | 82.54 | 81.41 | -1.37 |
| MA22: Mean monthly flow, November | 38.70 | 29.91 | -22.69 |
| MA23: Mean monthly flow, December | 49.95 | 35.12 | -29.69 |
| ML1: Mean minimum monthly flow, January | 20.52 | 8.92 | -56.55 |
| ML2: Mean minimum monthly flow, February | 19.74 | 8.80 | -55.42 |
| ML3: Mean minimum monthly flow, March | 18.50 | 8.66 | -53.20 |
| ML4: Mean minimum monthly flow, April | 11.51 | 4.03 | -64.99 |
| ML5: Mean minimum monthly flow, May | 8.89 | 2.73 | -69.33 |
| ML6: Mean minimum monthly flow, June | 9.23 | 6.37 | -30.95 |
| ML7: Mean minimum monthly flow, July | 13.25 | 10.93 | -17.48 |
| ML8: Mean minimum monthly flow, August | 18.05 | 13.07 | -27.58 |
| ML9: Mean minimum monthly flow, September | 16.58 | 13.63 | -17.82 |
| ML10: Mean minimum monthly flow, October | 18.51 | 7.20 | -61.12 |
| ML11: Mean minimum monthly flow, November | 19.31 | 7.39 | -61.70 |
| ML12: Mean minimum monthly flow, December | 18.92 | 7.31 | -61.35 |
| ML13: CV of minimum monthly flows | 57.04 | 113.13 | 98.33 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.32 | 0.05 | -85.93 |
| ML15: Mean minimum annual flow / mean annual flow | 0.15 | 0.02 | -86.73 |
| ML16: Median minimum annual flow / median annual flow | 0.31 | 0.04 | -86.53 |
| ML20: Ratio of baseflow volume to total flow volume | 0.39 | 0.37 | -5.43 |
| ML22: Mean annual minimum flow divided by catchment area | 0.08 | 0.01 | -88.42 |
| RA1: Mean of positive changes from one day to next (rise rate) | 38.20 | 19.62 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 315.71 | 324.64 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 16.30 | 7.54 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 331.07 | 304.53 |  |
| RA5: Ratio of days that are higher than previous day | 0.25 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.22 | 0.21 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.12 |  |
| RA8: Number of flow reversals from one day to the next | 74.86 | 70.57 |  |
| RA9: CV, number of flow reversals from one day to the next | 12.94 | 14.89 |  |

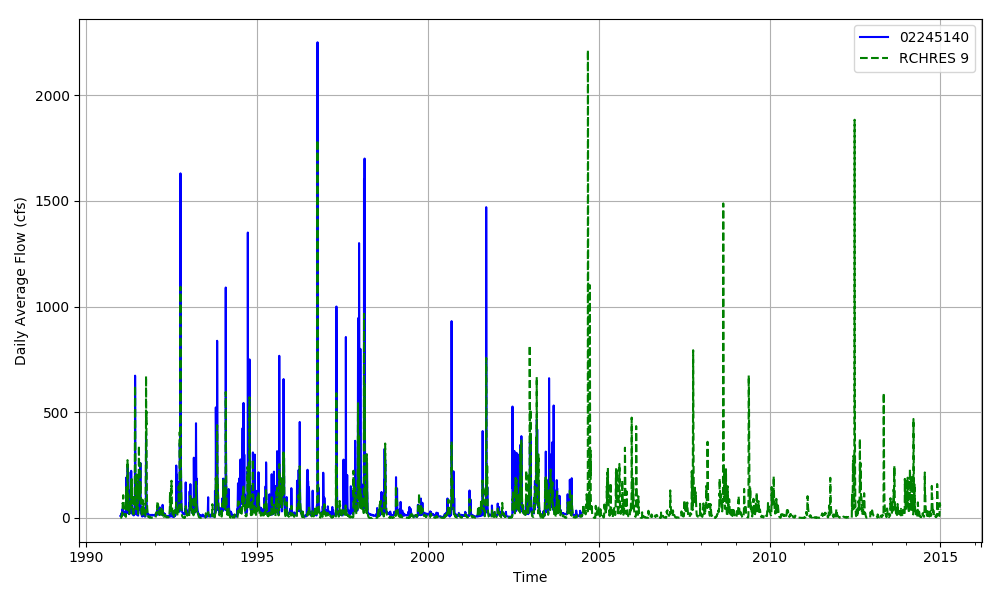


Figure 03080103-10: Daily flow for HSFP reach 09 and USGS station 02245140.

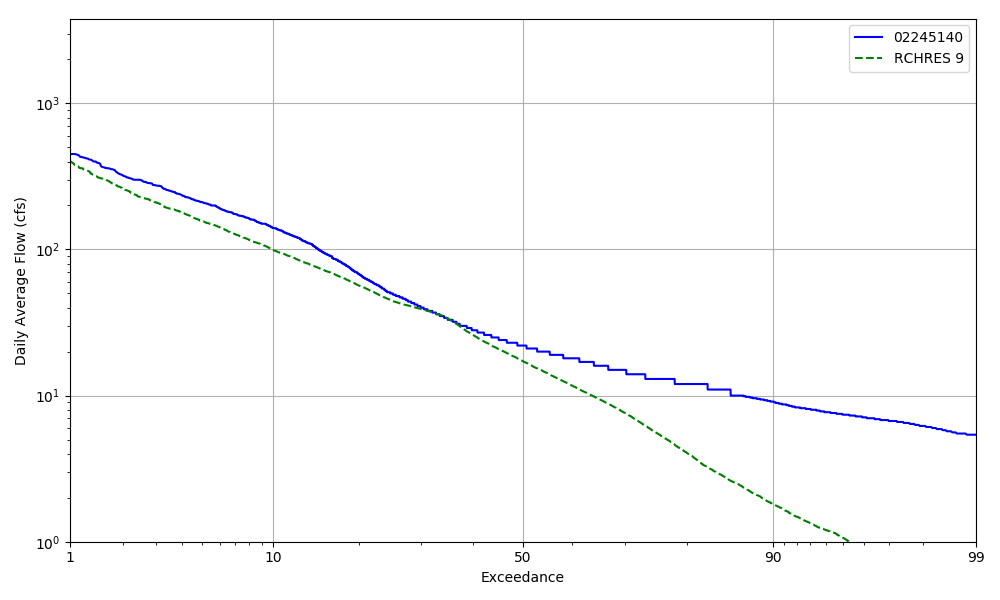


Figure 03080103-11: Daily exceedance for HSFP reach 09 and USGS station 02245140.

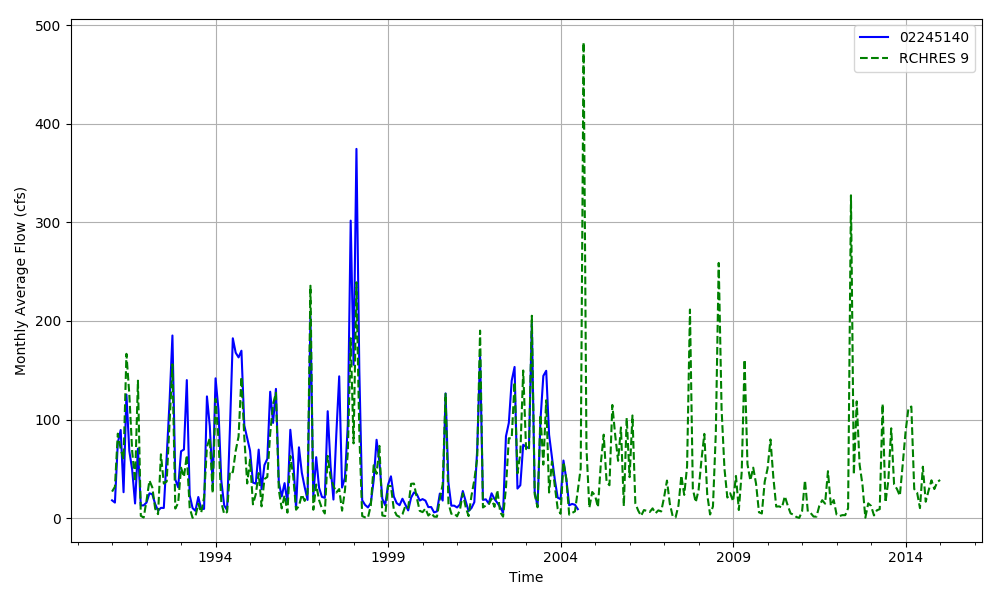


Figure 03080103-12: Monthly flow for HSFP reach 09 and USGS station 02245140.

## HSPF Reach 11, USGS Gauge 02245050

Table 03080103-7: Comparison Statistics Between HSPF Reach 11 and USGS Gauge 02245050.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 79.20 |
| Standard error | 153.23 |
| Relative bias | 1.14 |
| Relative standard error | 2.29 |
| Nash-Sutcliffe coefficient | -4.23 |
| Coefficient of efficiency | -1.16 |
| Index of agreement | 0.40 |

Table 03080103-8: Hydrologic Indices Between USGS Gauge 02245050 and HSPF Reach 11.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02245050 | Simulated Reach 11 | Percent Difference |
| MA1: Mean, all daily flows | 69.76 | 149.46 | 114.24 |
| MA2: Median, all daily flows | 47.00 | 63.01 | 34.05 |
| MA3: CV, all daily flows | 110.01 | 139.90 | 27.17 |
| MA4: CV, log of all daily flows | 79.09 | 117.45 | 48.50 |
| MA5: Mean daily flow / median daily flow | 1.48 | 2.37 | 59.82 |
| MA9: (Q10 - Q90) / median daily flow | 2.06 | 5.51 | 166.97 |
| MA10: (Q20 - Q80) / median daily flow | 1.02 | 3.05 | 199.03 |
| MA11: (Q25 - Q75) / median daily flow | 0.83 | 2.53 | 204.94 |
| MA12: Mean monthly flow, January | 63.07 | 108.08 | 71.37 |
| MA13: Mean monthly flow, February | 77.29 | 211.76 | 173.98 |
| MA14: Mean monthly flow, March | 69.77 | 165.46 | 137.13 |
| MA15: Mean monthly flow, April | 52.90 | 55.13 | 4.22 |
| MA16: Mean monthly flow, May | 40.14 | 33.04 | -17.68 |
| MA17: Mean monthly flow, June | 53.23 | 103.16 | 93.81 |
| MA18: Mean monthly flow, July | 66.65 | 153.22 | 129.89 |
| MA19: Mean monthly flow, August | 73.89 | 179.72 | 143.25 |
| MA20: Mean monthly flow, September | 71.52 | 217.80 | 204.53 |
| MA21: Mean monthly flow, October | 66.70 | 131.63 | 97.35 |
| MA22: Mean monthly flow, November | 44.30 | 82.92 | 87.20 |
| MA23: Mean monthly flow, December | 78.19 | 178.09 | 127.76 |
| ML1: Mean minimum monthly flow, January | 42.50 | 41.02 | -3.49 |
| ML2: Mean minimum monthly flow, February | 37.38 | 45.77 | 22.47 |
| ML3: Mean minimum monthly flow, March | 38.75 | 32.69 | -15.63 |
| ML4: Mean minimum monthly flow, April | 32.25 | 12.44 | -61.42 |
| ML5: Mean minimum monthly flow, May | 33.38 | 10.53 | -68.45 |
| ML6: Mean minimum monthly flow, June | 37.44 | 23.82 | -36.39 |
| ML7: Mean minimum monthly flow, July | 32.89 | 49.57 | 50.73 |
| ML8: Mean minimum monthly flow, August | 41.00 | 65.33 | 59.35 |
| ML9: Mean minimum monthly flow, September | 37.88 | 58.17 | 53.60 |
| ML10: Mean minimum monthly flow, October | 32.75 | 31.79 | -2.94 |
| ML11: Mean minimum monthly flow, November | 31.25 | 33.41 | 6.92 |
| ML12: Mean minimum monthly flow, December | 35.38 | 38.99 | 10.22 |
| ML13: CV of minimum monthly flows | 48.13 | 95.64 | 98.71 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.60 | 0.14 | -76.34 |
| ML15: Mean minimum annual flow / mean annual flow | 0.42 | 0.07 | -83.22 |
| ML16: Median minimum annual flow / median annual flow | 0.61 | 0.17 | -72.65 |
| ML20: Ratio of baseflow volume to total flow volume | 0.59 | 0.40 | -33.00 |
| ML22: Mean annual minimum flow divided by catchment area | 0.28 | 0.09 | -67.87 |
| RA1: Mean of positive changes from one day to next (rise rate) | 29.83 | 59.98 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 330.22 | 353.54 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 14.63 | 24.61 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 299.17 | 296.22 |  |
| 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 | 0.13 | 0.15 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.10 |  |
| RA8: Number of flow reversals from one day to the next | 88.44 | 75.44 |  |
| RA9: CV, number of flow reversals from one day to the next | 41.11 | 31.84 |  |

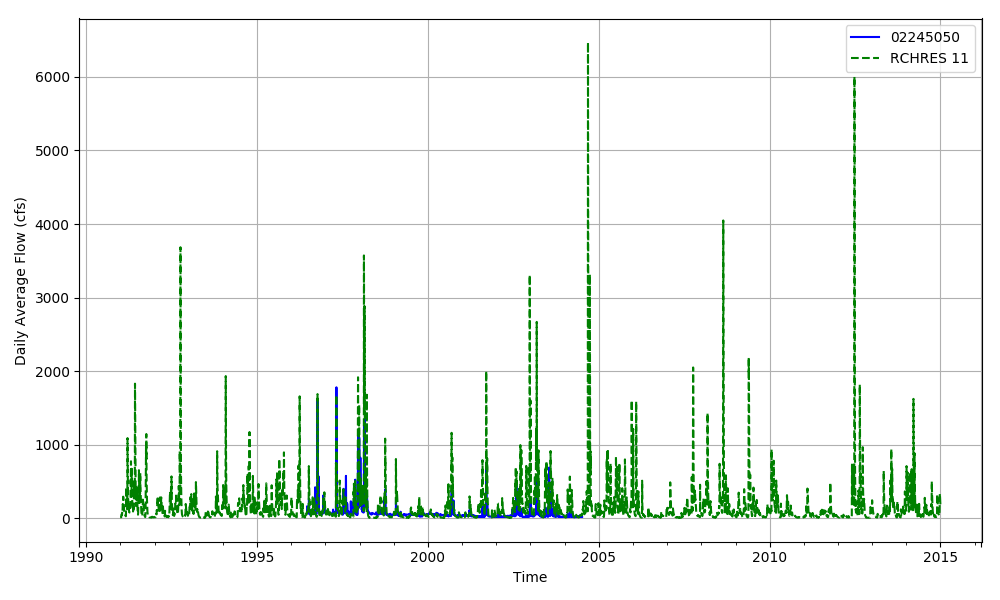


Figure 03080103-13: Daily flow for HSFP reach 11 and USGS station 02245050.

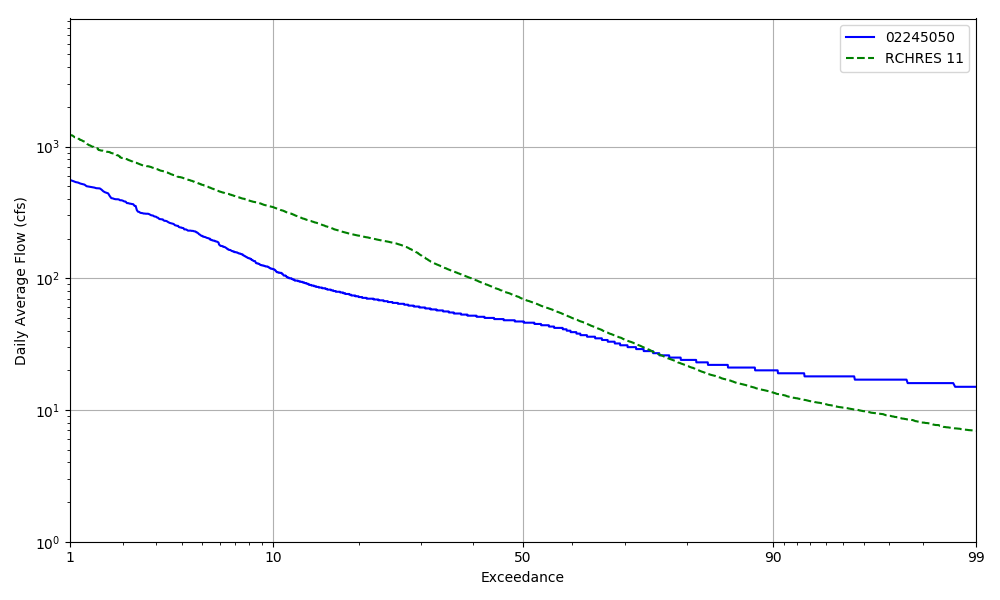


Figure 03080103-14: Daily exceedance for HSFP reach 11 and USGS station 02245050.

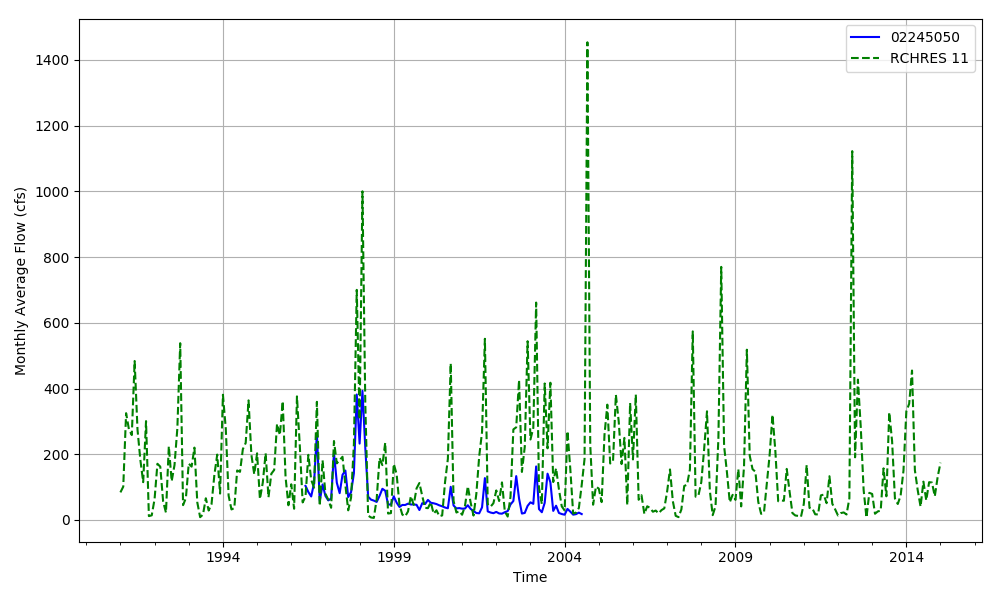


Figure 03080103-15: Monthly flow for HSFP reach 11 and USGS station 02245050.

## HSPF Reach 12, USGS Gauge 02244473

Table 03080103-9: Comparison Statistics Between HSPF Reach 12 and USGS Gauge 02244473.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 1.95 |
| Standard error | 30.36 |
| Relative bias | 0.05 |
| Relative standard error | 0.55 |
| Nash-Sutcliffe coefficient | 0.70 |
| Coefficient of efficiency | 0.50 |
| Index of agreement | 0.74 |

Table 03080103-10: Hydrologic Indices Between USGS Gauge 02244473 and HSPF Reach 12.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02244473 | Simulated Reach 12 | Percent Difference |
| MA1: Mean, all daily flows | 43.31 | 45.33 | 4.66 |
| MA2: Median, all daily flows | 12.00 | 19.18 | 59.85 |
| MA3: CV, all daily flows | 180.08 | 163.37 | -9.28 |
| MA4: CV, log of all daily flows | 145.50 | 124.58 | -14.38 |
| MA5: Mean daily flow / median daily flow | 3.61 | 2.36 | -34.52 |
| MA9: (Q10 - Q90) / median daily flow | 9.11 | 5.78 | -36.55 |
| MA10: (Q20 - Q80) / median daily flow | 3.96 | 2.92 | -26.35 |
| MA11: (Q25 - Q75) / median daily flow | 2.73 | 2.22 | -18.95 |
| MA12: Mean monthly flow, January | 46.21 | 39.16 | -15.25 |
| MA13: Mean monthly flow, February | 59.74 | 52.97 | -11.33 |
| MA14: Mean monthly flow, March | 64.69 | 52.14 | -19.40 |
| MA15: Mean monthly flow, April | 27.19 | 25.67 | -5.57 |
| MA16: Mean monthly flow, May | 7.78 | 13.48 | 73.14 |
| MA17: Mean monthly flow, June | 35.90 | 37.95 | 5.71 |
| MA18: Mean monthly flow, July | 31.52 | 40.33 | 27.95 |
| MA19: Mean monthly flow, August | 46.51 | 47.27 | 1.63 |
| MA20: Mean monthly flow, September | 53.70 | 66.95 | 24.67 |
| MA21: Mean monthly flow, October | 53.41 | 79.39 | 48.64 |
| MA22: Mean monthly flow, November | 29.99 | 30.98 | 3.29 |
| MA23: Mean monthly flow, December | 46.66 | 39.75 | -14.80 |
| ML1: Mean minimum monthly flow, January | 13.94 | 10.43 | -25.14 |
| ML2: Mean minimum monthly flow, February | 12.99 | 10.88 | -16.26 |
| ML3: Mean minimum monthly flow, March | 13.13 | 10.53 | -19.82 |
| ML4: Mean minimum monthly flow, April | 5.00 | 4.87 | -2.59 |
| ML5: Mean minimum monthly flow, May | 3.42 | 3.49 | 2.14 |
| ML6: Mean minimum monthly flow, June | 5.14 | 6.09 | 18.58 |
| ML7: Mean minimum monthly flow, July | 8.65 | 13.15 | 52.08 |
| ML8: Mean minimum monthly flow, August | 6.45 | 13.03 | 101.93 |
| ML9: Mean minimum monthly flow, September | 6.52 | 13.79 | 111.42 |
| ML10: Mean minimum monthly flow, October | 7.85 | 10.30 | 31.18 |
| ML11: Mean minimum monthly flow, November | 9.75 | 10.65 | 9.23 |
| ML12: Mean minimum monthly flow, December | 11.21 | 9.33 | -16.72 |
| ML13: CV of minimum monthly flows | 93.68 | 104.80 | 11.87 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.22 | 0.06 | -73.27 |
| ML15: Mean minimum annual flow / mean annual flow | 0.08 | 0.03 | -68.13 |
| ML16: Median minimum annual flow / median annual flow | 0.22 | 0.05 | -77.51 |
| ML20: Ratio of baseflow volume to total flow volume | 0.31 | 0.38 | 20.34 |
| ML22: Mean annual minimum flow divided by catchment area | 0.03 | 0.01 | -61.79 |
| RA1: Mean of positive changes from one day to next (rise rate) | 26.18 | 19.30 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 354.06 | 285.94 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 11.16 | 7.60 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 334.07 | 266.62 |  |
| RA5: Ratio of days that are higher than previous day | 0.28 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.22 | 0.17 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.13 | 0.10 |  |
| RA8: Number of flow reversals from one day to the next | 81.36 | 62.43 |  |
| RA9: CV, number of flow reversals from one day to the next | 10.30 | 14.10 |  |

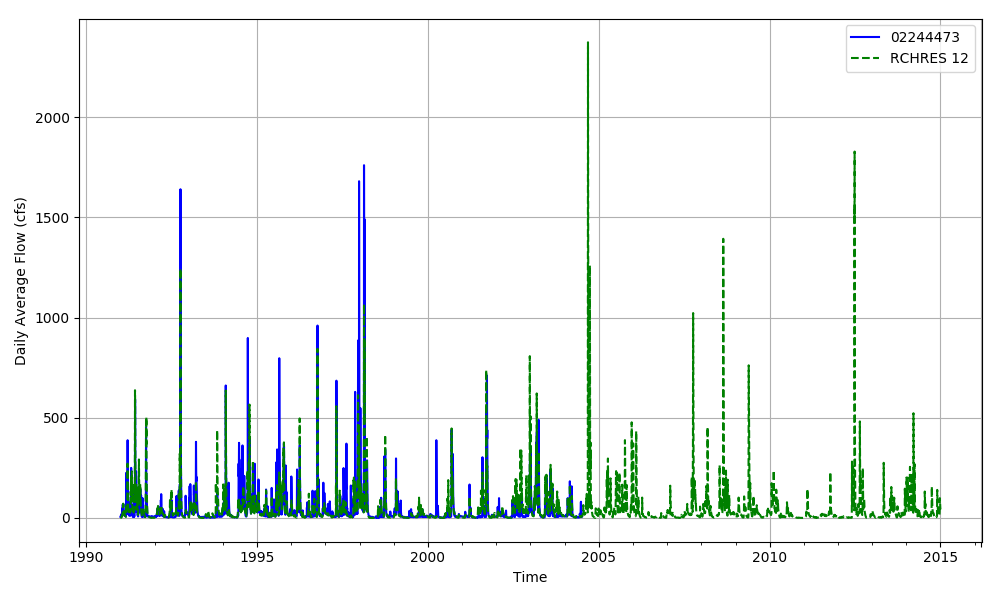


Figure 03080103-16: Daily flow for HSFP reach 12 and USGS station 02244473.

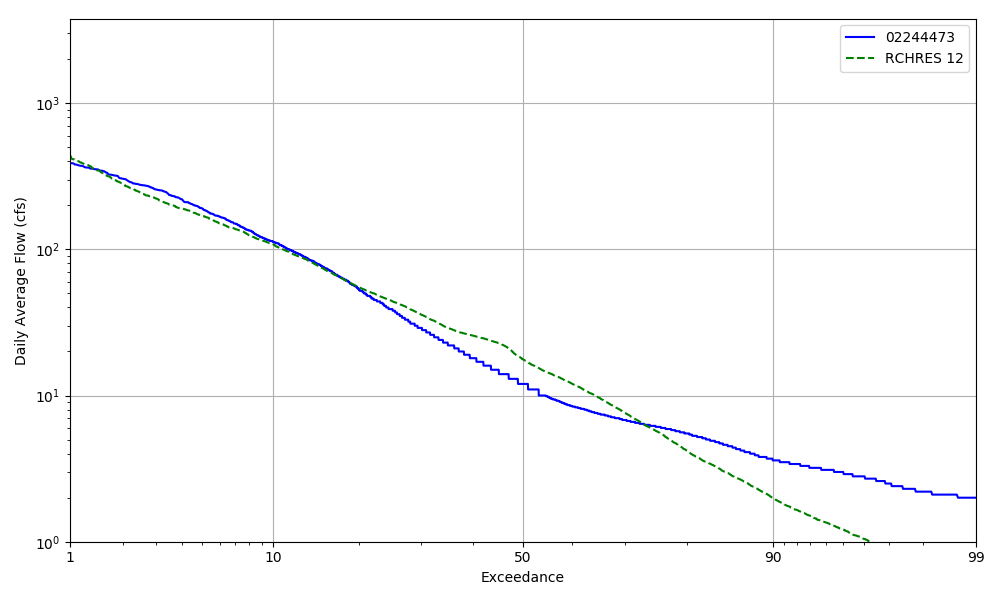


Figure 03080103-17: Daily exceedance for HSFP reach 12 and USGS station 02244473.

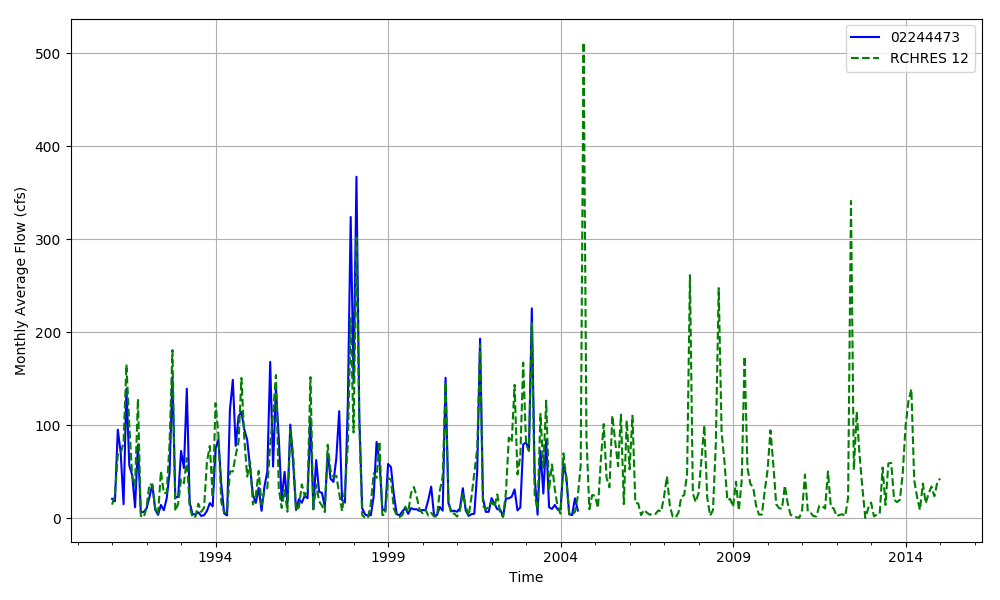


Figure 03080103-18: Monthly flow for HSFP reach 12 and USGS station 02244473.

## HSPF Reach 13, USGS Gauge 02244040

Table 03080103-11: Comparison Statistics Between HSPF Reach 13 and USGS Gauge 02244040.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -14.21 |
| Standard error | 2219.51 |
| Relative bias | -0.00 |
| Relative standard error | 0.64 |
| Nash-Sutcliffe coefficient | 0.59 |
| Coefficient of efficiency | 0.42 |
| Index of agreement | 0.70 |

Table 03080103-12: Hydrologic Indices Between USGS Gauge 02244040 and HSPF Reach 13.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02244040 | Simulated Reach 13 | Percent Difference |
| MA1: Mean, all daily flows | 6162.90 | 4641.29 | -24.69 |
| MA2: Median, all daily flows | 5300.00 | 3479.91 | -34.34 |
| MA3: CV, all daily flows | 60.01 | 68.31 | 13.83 |
| MA4: CV, log of all daily flows | 62.54 | 68.49 | 9.50 |
| MA5: Mean daily flow / median daily flow | 1.16 | 1.33 | 14.70 |
| MA9: (Q10 - Q90) / median daily flow | 2.01 | 2.27 | 12.53 |
| MA10: (Q20 - Q80) / median daily flow | 1.31 | 1.33 | 1.54 |
| MA11: (Q25 - Q75) / median daily flow | 1.04 | 0.99 | -4.19 |
| MA12: Mean monthly flow, January | 5800.31 | 4300.77 | -25.85 |
| MA13: Mean monthly flow, February | 4977.96 | 3840.72 | -22.85 |
| MA14: Mean monthly flow, March | 5326.78 | 3963.89 | -25.59 |
| MA15: Mean monthly flow, April | 4875.36 | 3047.64 | -37.49 |
| MA16: Mean monthly flow, May | 3610.13 | 2193.58 | -39.24 |
| MA17: Mean monthly flow, June | 4394.01 | 2941.97 | -33.05 |
| MA18: Mean monthly flow, July | 5193.74 | 4438.32 | -14.54 |
| MA19: Mean monthly flow, August | 5417.55 | 5723.36 | 5.64 |
| MA20: Mean monthly flow, September | 7006.79 | 6748.66 | -3.68 |
| MA21: Mean monthly flow, October | 7947.76 | 7355.23 | -7.46 |
| MA22: Mean monthly flow, November | 7444.15 | 4907.79 | -34.07 |
| MA23: Mean monthly flow, December | 6123.02 | 4081.14 | -33.35 |
| ML1: Mean minimum monthly flow, January | 1591.89 | 3221.15 | 102.35 |
| ML2: Mean minimum monthly flow, February | 864.78 | 3048.58 | 252.53 |
| ML3: Mean minimum monthly flow, March | 1278.19 | 2980.63 | 133.19 |
| ML4: Mean minimum monthly flow, April | 993.14 | 2307.72 | 132.37 |
| ML5: Mean minimum monthly flow, May | 340.54 | 1816.16 | 433.32 |
| ML6: Mean minimum monthly flow, June | 550.90 | 2053.91 | 272.82 |
| ML7: Mean minimum monthly flow, July | 1387.95 | 3335.91 | 140.35 |
| ML8: Mean minimum monthly flow, August | 837.33 | 4197.71 | 401.32 |
| ML9: Mean minimum monthly flow, September | 1560.71 | 4499.57 | 188.30 |
| ML10: Mean minimum monthly flow, October | 1369.98 | 4735.78 | 245.68 |
| ML11: Mean minimum monthly flow, November | 1655.48 | 3692.43 | 123.04 |
| ML12: Mean minimum monthly flow, December | 1294.49 | 3045.05 | 135.23 |
| ML13: CV of minimum monthly flows | 137.20 | 63.04 | -54.05 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.01 | 0.51 | 6252.83 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.38 | 5122.44 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.50 | 13111.60 |
| ML20: Ratio of baseflow volume to total flow volume | 0.32 | 0.84 | 163.06 |
| ML22: Mean annual minimum flow divided by catchment area | 0.48 | 16.47 | 3358.66 |
| RA1: Mean of positive changes from one day to next (rise rate) | 1816.39 | 358.37 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 90.53 | 407.78 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 1906.93 | 163.65 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 92.04 | 301.18 |  |
| RA5: Ratio of days that are higher than previous day | 0.51 | 0.31 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.28 | 0.02 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.29 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 132.45 | 48.82 |  |
| RA9: CV, number of flow reversals from one day to the next | 19.11 | 24.07 |  |

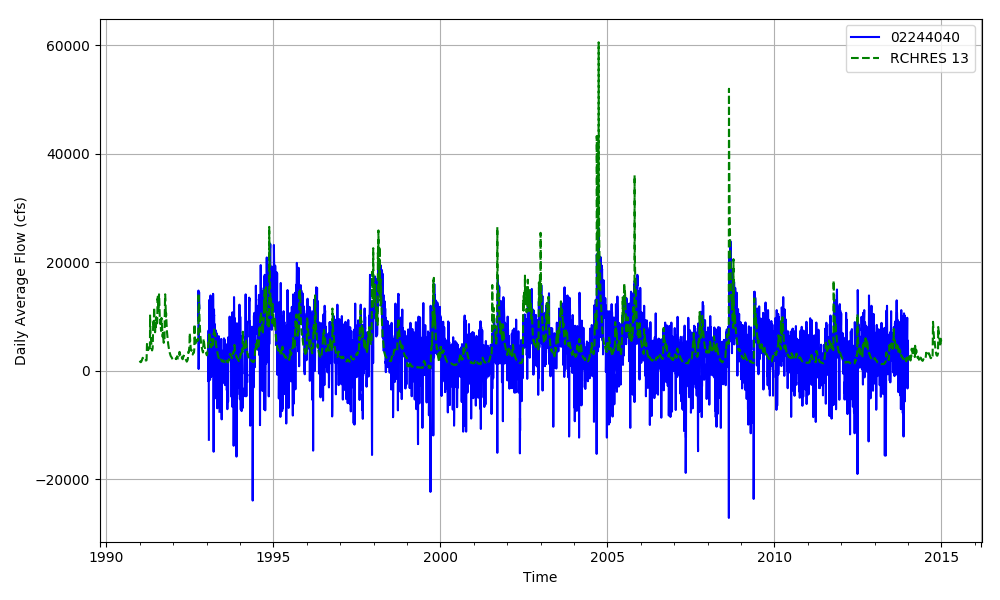


Figure 03080103-19: Daily flow for HSFP reach 13 and USGS station 02244040.

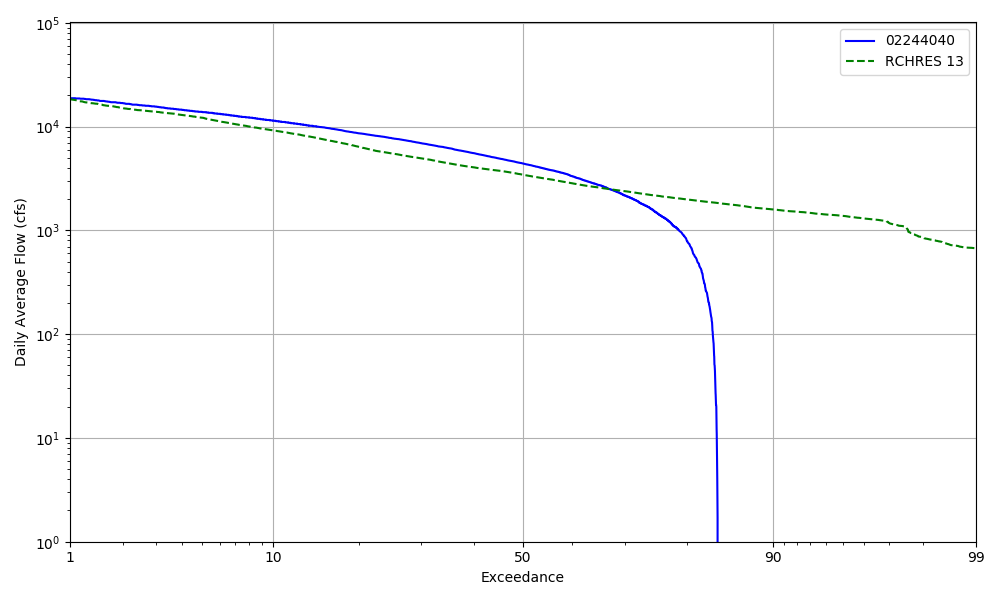


Figure 03080103-20: Daily exceedance for HSFP reach 13 and USGS station 02244040.

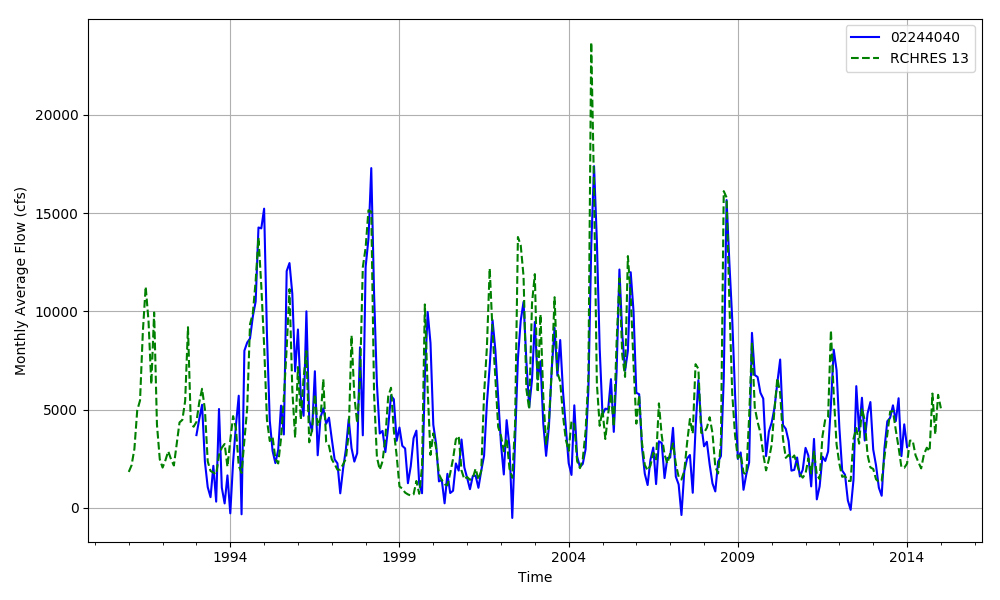


Figure 03080103-21: Monthly flow for HSFP reach 13 and USGS station 02244040.

## HSPF Reach 19, USGS Gauge 02245500

Table 03080103-13: Comparison Statistics Between HSPF Reach 19 and USGS Gauge 02245500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 1.65 |
| Standard error | 101.83 |
| Relative bias | 0.01 |
| Relative standard error | 0.68 |
| Nash-Sutcliffe coefficient | 0.54 |
| Coefficient of efficiency | 0.46 |
| Index of agreement | 0.74 |

Table 03080103-14: Hydrologic Indices Between USGS Gauge 02245500 and HSPF Reach 19.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02245500 | Simulated Reach 19 | Percent Difference |
| MA1: Mean, all daily flows | 128.10 | 129.64 | 1.20 |
| MA2: Median, all daily flows | 55.00 | 53.06 | -3.52 |
| MA3: CV, all daily flows | 194.28 | 179.00 | -7.87 |
| MA4: CV, log of all daily flows | 114.81 | 119.27 | 3.89 |
| MA5: Mean daily flow / median daily flow | 2.33 | 2.44 | 4.90 |
| MA9: (Q10 - Q90) / median daily flow | 4.49 | 5.30 | 18.19 |
| MA10: (Q20 - Q80) / median daily flow | 2.20 | 2.98 | 35.37 |
| MA11: (Q25 - Q75) / median daily flow | 1.60 | 2.29 | 43.15 |
| MA12: Mean monthly flow, January | 106.55 | 107.80 | 1.17 |
| MA13: Mean monthly flow, February | 132.24 | 144.39 | 9.19 |
| MA14: Mean monthly flow, March | 121.57 | 133.69 | 9.97 |
| MA15: Mean monthly flow, April | 93.99 | 73.85 | -21.43 |
| MA16: Mean monthly flow, May | 84.97 | 69.27 | -18.48 |
| MA17: Mean monthly flow, June | 121.98 | 157.60 | 29.20 |
| MA18: Mean monthly flow, July | 136.62 | 143.41 | 4.97 |
| MA19: Mean monthly flow, August | 191.34 | 187.09 | -2.22 |
| MA20: Mean monthly flow, September | 181.88 | 182.49 | 0.33 |
| MA21: Mean monthly flow, October | 144.60 | 145.30 | 0.48 |
| MA22: Mean monthly flow, November | 61.07 | 48.97 | -19.81 |
| MA23: Mean monthly flow, December | 101.32 | 103.32 | 1.97 |
| ML1: Mean minimum monthly flow, January | 48.17 | 28.20 | -41.45 |
| ML2: Mean minimum monthly flow, February | 50.35 | 34.40 | -31.67 |
| ML3: Mean minimum monthly flow, March | 46.22 | 29.00 | -37.25 |
| ML4: Mean minimum monthly flow, April | 26.63 | 12.92 | -51.47 |
| ML5: Mean minimum monthly flow, May | 19.86 | 9.45 | -52.43 |
| ML6: Mean minimum monthly flow, June | 23.41 | 22.59 | -3.51 |
| ML7: Mean minimum monthly flow, July | 34.84 | 38.80 | 11.36 |
| ML8: Mean minimum monthly flow, August | 40.02 | 51.17 | 27.87 |
| ML9: Mean minimum monthly flow, September | 39.04 | 37.71 | -3.41 |
| ML10: Mean minimum monthly flow, October | 38.48 | 19.13 | -50.29 |
| ML11: Mean minimum monthly flow, November | 35.13 | 12.90 | -63.29 |
| ML12: Mean minimum monthly flow, December | 39.26 | 20.86 | -46.87 |
| ML13: CV of minimum monthly flows | 67.34 | 115.45 | 71.45 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.29 | 0.04 | -85.02 |
| ML15: Mean minimum annual flow / mean annual flow | 0.15 | 0.02 | -85.12 |
| ML16: Median minimum annual flow / median annual flow | 0.29 | 0.04 | -87.59 |
| ML20: Ratio of baseflow volume to total flow volume | 0.37 | 0.34 | -7.65 |
| ML22: Mean annual minimum flow divided by catchment area | 0.16 | 0.02 | -85.06 |
| RA1: Mean of positive changes from one day to next (rise rate) | 98.83 | 59.14 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 331.65 | 424.25 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 37.88 | 22.62 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 395.10 | 436.91 |  |
| RA5: Ratio of days that are higher than previous day | 0.25 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.25 | 0.19 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.12 |  |
| RA8: Number of flow reversals from one day to the next | 83.54 | 70.12 |  |
| RA9: CV, number of flow reversals from one day to the next | 18.09 | 21.50 |  |

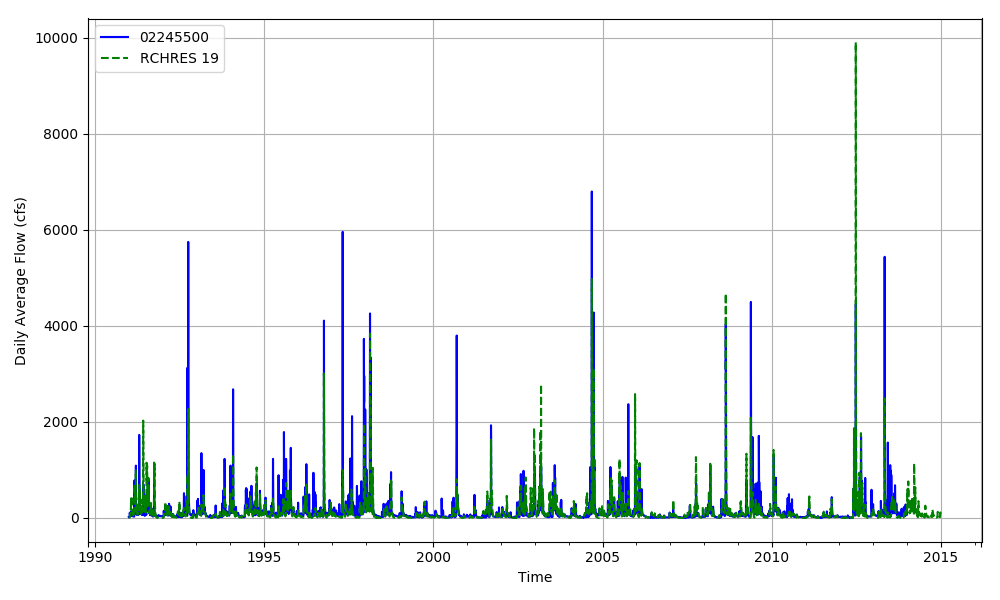


Figure 03080103-22: Daily flow for HSFP reach 19 and USGS station 02245500.

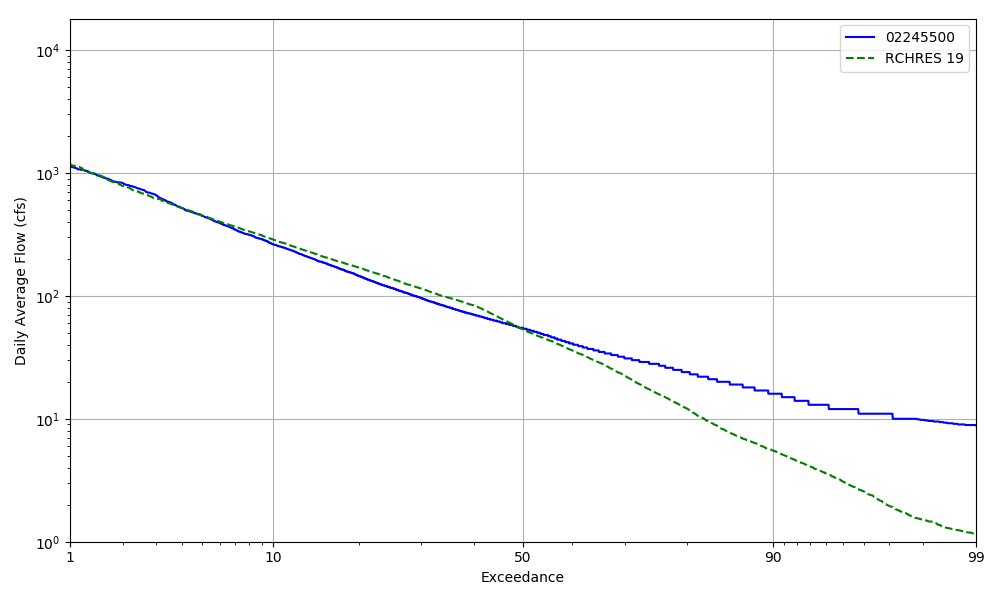


Figure 03080103-23: Daily exceedance for HSFP reach 19 and USGS station 02245500.

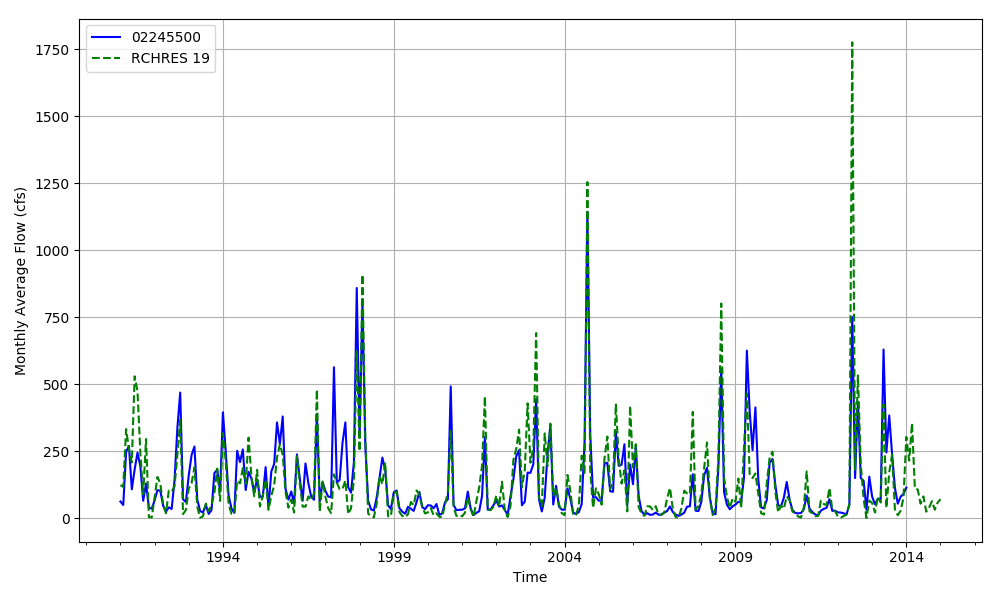


Figure 03080103-24: Monthly flow for HSFP reach 19 and USGS station 02245500.

## HSPF Reach 21, USGS Gauge 02246000

Table 03080103-15: Comparison Statistics Between HSPF Reach 21 and USGS Gauge 02246000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 2.31 |
| Standard error | 92.25 |
| Relative bias | 0.01 |
| Relative standard error | 0.40 |
| Nash-Sutcliffe coefficient | 0.84 |
| Coefficient of efficiency | 0.58 |
| Index of agreement | 0.79 |

Table 03080103-16: Hydrologic Indices Between USGS Gauge 02246000 and HSPF Reach 21.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02246000 | Simulated Reach 21 | Percent Difference |
| MA1: Mean, all daily flows | 173.97 | 176.42 | 1.41 |
| MA2: Median, all daily flows | 71.00 | 69.79 | -1.70 |
| MA3: CV, all daily flows | 224.22 | 182.20 | -18.74 |
| MA4: CV, log of all daily flows | 115.45 | 119.91 | 3.86 |
| MA5: Mean daily flow / median daily flow | 2.45 | 2.53 | 3.16 |
| MA9: (Q10 - Q90) / median daily flow | 4.68 | 5.62 | 20.15 |
| MA10: (Q20 - Q80) / median daily flow | 2.27 | 3.13 | 38.25 |
| MA11: (Q25 - Q75) / median daily flow | 1.68 | 2.56 | 52.63 |
| MA12: Mean monthly flow, January | 131.64 | 160.02 | 21.56 |
| MA13: Mean monthly flow, February | 174.40 | 210.52 | 20.71 |
| MA14: Mean monthly flow, March | 166.72 | 200.87 | 20.49 |
| MA15: Mean monthly flow, April | 111.87 | 116.12 | 3.80 |
| MA16: Mean monthly flow, May | 92.05 | 89.29 | -3.00 |
| MA17: Mean monthly flow, June | 186.80 | 203.38 | 8.88 |
| MA18: Mean monthly flow, July | 174.53 | 202.30 | 15.91 |
| MA19: Mean monthly flow, August | 239.31 | 248.63 | 3.89 |
| MA20: Mean monthly flow, September | 282.34 | 233.02 | -17.47 |
| MA21: Mean monthly flow, October | 245.66 | 190.72 | -22.37 |
| MA22: Mean monthly flow, November | 82.02 | 60.45 | -26.29 |
| MA23: Mean monthly flow, December | 120.62 | 119.29 | -1.10 |
| ML1: Mean minimum monthly flow, January | 56.50 | 34.12 | -39.62 |
| ML2: Mean minimum monthly flow, February | 59.43 | 47.34 | -20.36 |
| ML3: Mean minimum monthly flow, March | 54.48 | 39.11 | -28.20 |
| ML4: Mean minimum monthly flow, April | 33.11 | 16.19 | -51.10 |
| ML5: Mean minimum monthly flow, May | 19.50 | 13.00 | -33.33 |
| ML6: Mean minimum monthly flow, June | 29.48 | 29.37 | -0.37 |
| ML7: Mean minimum monthly flow, July | 41.42 | 50.40 | 21.67 |
| ML8: Mean minimum monthly flow, August | 53.30 | 57.95 | 8.72 |
| ML9: Mean minimum monthly flow, September | 55.82 | 40.15 | -28.07 |
| ML10: Mean minimum monthly flow, October | 49.57 | 21.27 | -57.08 |
| ML11: Mean minimum monthly flow, November | 41.39 | 14.74 | -64.39 |
| ML12: Mean minimum monthly flow, December | 47.92 | 28.78 | -39.95 |
| ML13: CV of minimum monthly flows | 69.80 | 120.37 | 72.45 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.19 | 0.04 | -76.70 |
| ML15: Mean minimum annual flow / mean annual flow | 0.10 | 0.02 | -77.50 |
| ML16: Median minimum annual flow / median annual flow | 0.18 | 0.03 | -80.33 |
| ML20: Ratio of baseflow volume to total flow volume | 0.34 | 0.34 | -1.91 |
| ML22: Mean annual minimum flow divided by catchment area | 0.16 | 0.03 | -82.08 |
| RA1: Mean of positive changes from one day to next (rise rate) | 106.36 | 92.97 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 415.21 | 421.85 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 49.43 | 32.15 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 486.59 | 461.34 |  |
| RA5: Ratio of days that are higher than previous day | 0.30 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.18 | 0.23 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.11 | 0.12 |  |
| RA8: Number of flow reversals from one day to the next | 89.12 | 74.08 |  |
| RA9: CV, number of flow reversals from one day to the next | 20.48 | 19.31 |  |

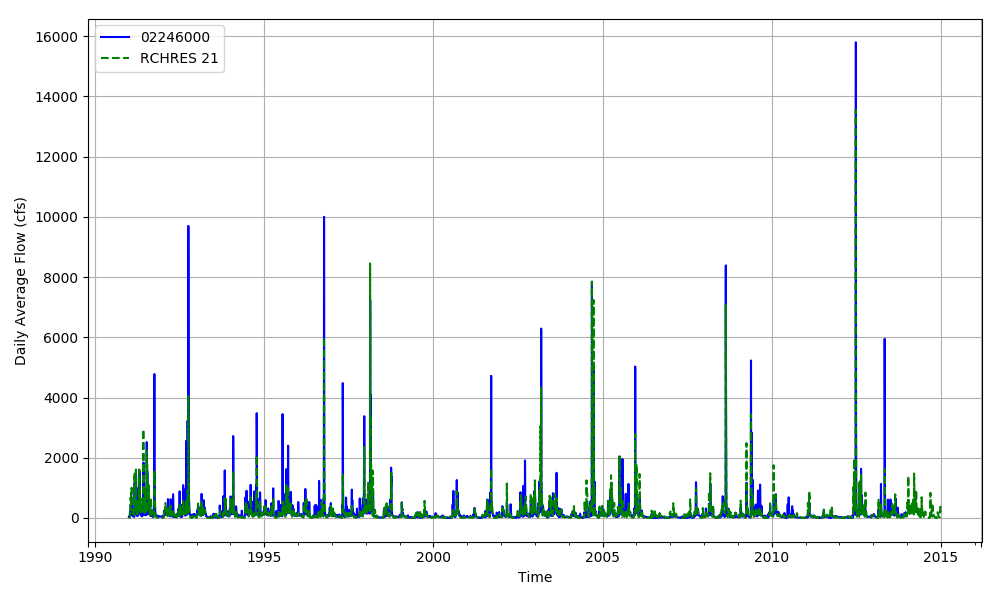


Figure 03080103-25: Daily flow for HSFP reach 21 and USGS station 02246000.

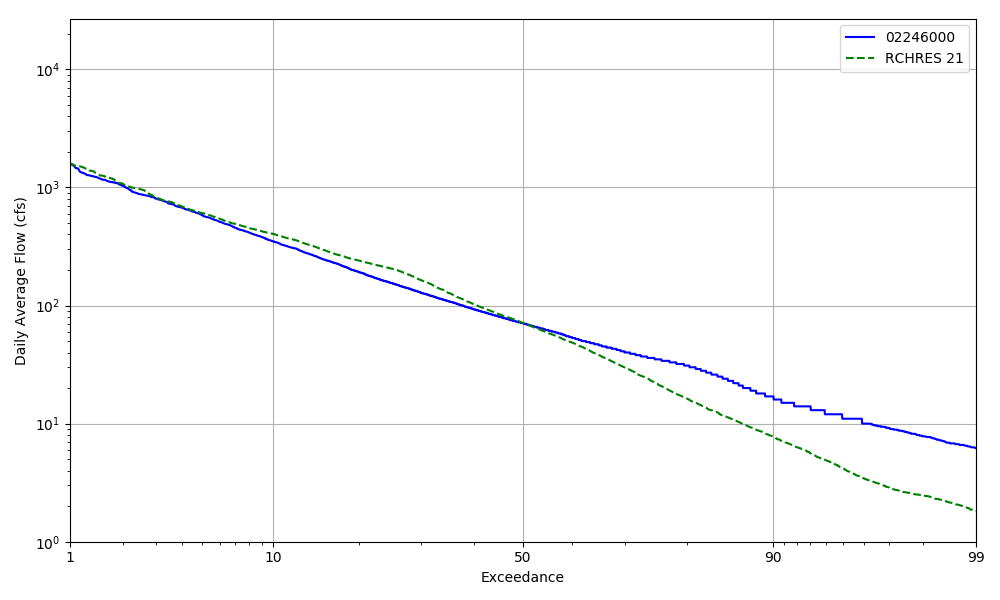


Figure 03080103-26: Daily exceedance for HSFP reach 21 and USGS station 02246000.

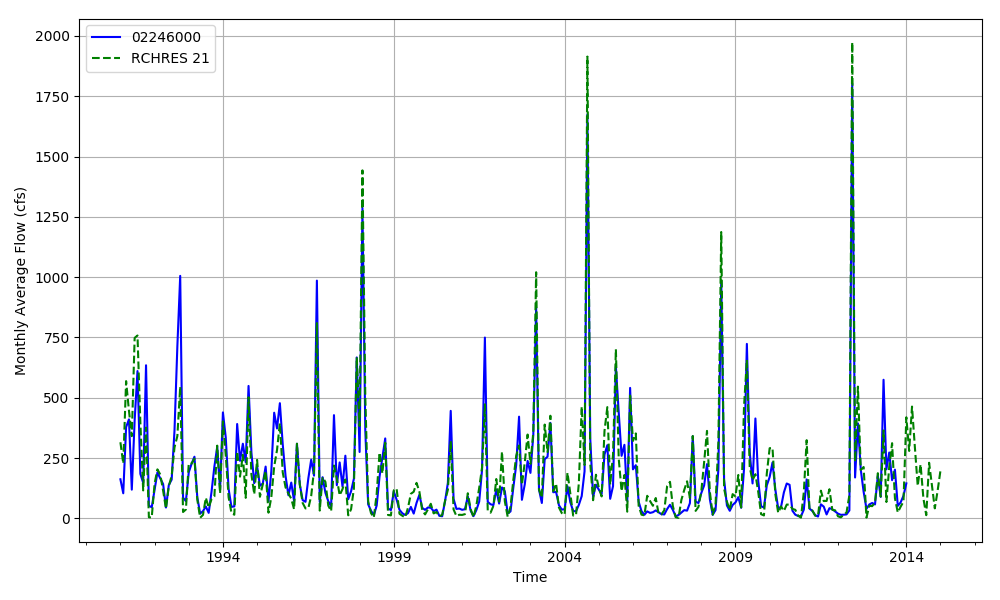


Figure 03080103-27: Monthly flow for HSFP reach 21 and USGS station 02246000.

## HSPF Reach 25, USGS Gauge 02246025

Table 03080103-17: Comparison Statistics Between HSPF Reach 25 and USGS Gauge 02246025.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -7.33 |
| Standard error | 236.99 |
| Relative bias | -0.02 |
| Relative standard error | 0.61 |
| Nash-Sutcliffe coefficient | 0.63 |
| Coefficient of efficiency | 0.43 |
| Index of agreement | 0.73 |

Table 03080103-18: Hydrologic Indices Between USGS Gauge 02246025 and HSPF Reach 25.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02246025 | Simulated Reach 25 | Percent Difference |
| MA1: Mean, all daily flows | 465.79 | 476.66 | 2.33 |
| MA2: Median, all daily flows | 282.00 | 244.96 | -13.14 |
| MA3: CV, all daily flows | 106.04 | 116.52 | 9.89 |
| MA4: CV, log of all daily flows | 83.27 | 99.79 | 19.84 |
| MA5: Mean daily flow / median daily flow | 1.65 | 1.95 | 17.81 |
| MA9: (Q10 - Q90) / median daily flow | 2.82 | 3.96 | 40.38 |
| MA10: (Q20 - Q80) / median daily flow | 1.52 | 2.18 | 43.24 |
| MA11: (Q25 - Q75) / median daily flow | 1.11 | 1.70 | 54.10 |
| MA12: Mean monthly flow, January | 301.22 | 285.59 | -5.19 |
| MA13: Mean monthly flow, February | 292.43 | 309.94 | 5.99 |
| MA14: Mean monthly flow, March | 401.26 | 482.35 | 20.21 |
| MA15: Mean monthly flow, April | 347.89 | 284.56 | -18.21 |
| MA16: Mean monthly flow, May | 187.12 | 151.40 | -19.09 |
| MA17: Mean monthly flow, June | 193.85 | 214.77 | 10.79 |
| MA18: Mean monthly flow, July | 342.74 | 423.54 | 23.57 |
| MA19: Mean monthly flow, August | 539.72 | 554.93 | 2.82 |
| MA20: Mean monthly flow, September | 614.08 | 654.37 | 6.56 |
| MA21: Mean monthly flow, October | 406.24 | 363.76 | -10.46 |
| MA22: Mean monthly flow, November | 208.93 | 138.27 | -33.82 |
| MA23: Mean monthly flow, December | 271.60 | 293.18 | 7.95 |
| ML1: Mean minimum monthly flow, January | 167.03 | 135.82 | -18.68 |
| ML2: Mean minimum monthly flow, February | 155.18 | 132.54 | -14.59 |
| ML3: Mean minimum monthly flow, March | 136.64 | 139.24 | 1.91 |
| ML4: Mean minimum monthly flow, April | 100.82 | 88.25 | -12.46 |
| ML5: Mean minimum monthly flow, May | 137.87 | 136.35 | -1.10 |
| ML6: Mean minimum monthly flow, June | 89.00 | 83.30 | -6.40 |
| ML7: Mean minimum monthly flow, July | 115.50 | 183.45 | 58.83 |
| ML8: Mean minimum monthly flow, August | 191.80 | 204.77 | 6.76 |
| ML9: Mean minimum monthly flow, September | 205.90 | 223.90 | 8.74 |
| ML10: Mean minimum monthly flow, October | 124.00 | 137.20 | 10.65 |
| ML11: Mean minimum monthly flow, November | 69.77 | 77.83 | 11.55 |
| ML12: Mean minimum monthly flow, December | 111.20 | 109.97 | -1.10 |
| ML13: CV of minimum monthly flows | 97.03 | 86.12 | -11.25 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.04 | 0.15 | 256.87 |
| ML15: Mean minimum annual flow / mean annual flow | 0.03 | 0.08 | 190.13 |
| ML16: Median minimum annual flow / median annual flow | 0.02 | 0.17 | 907.26 |
| ML20: Ratio of baseflow volume to total flow volume | 0.37 | 0.39 | 6.44 |
| ML22: Mean annual minimum flow divided by catchment area | 21428.73 | 21428.92 | 0.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 157.56 | 192.87 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 277.67 | 363.46 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 129.22 | 77.72 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 226.04 | 357.61 |  |
| RA5: Ratio of days that are higher than previous day | 0.45 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.23 | 0.15 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.22 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 114.86 | 46.43 |  |
| RA9: CV, number of flow reversals from one day to the next | 63.76 | 61.42 |  |

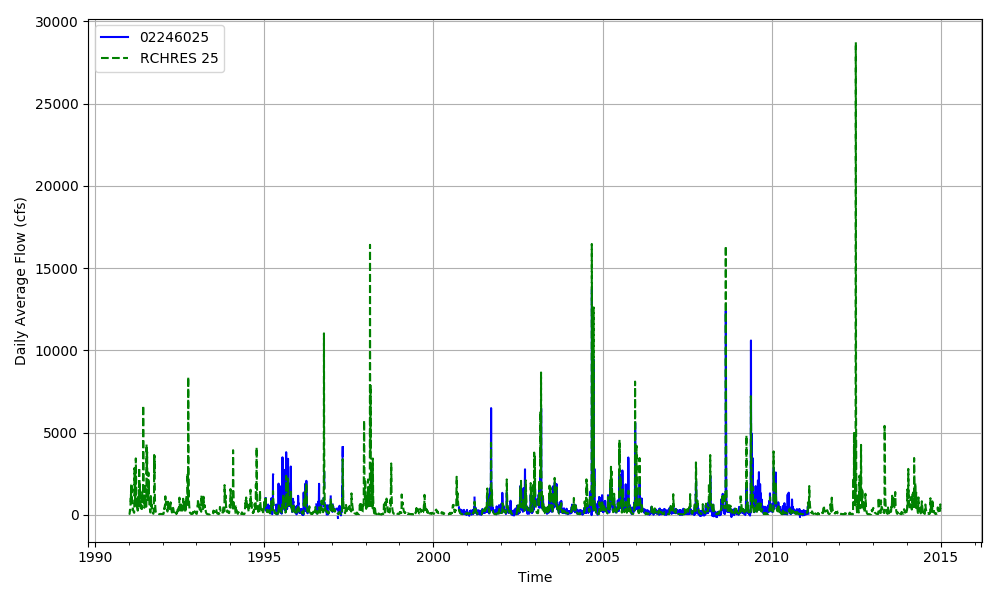


Figure 03080103-28: Daily flow for HSFP reach 25 and USGS station 02246025.

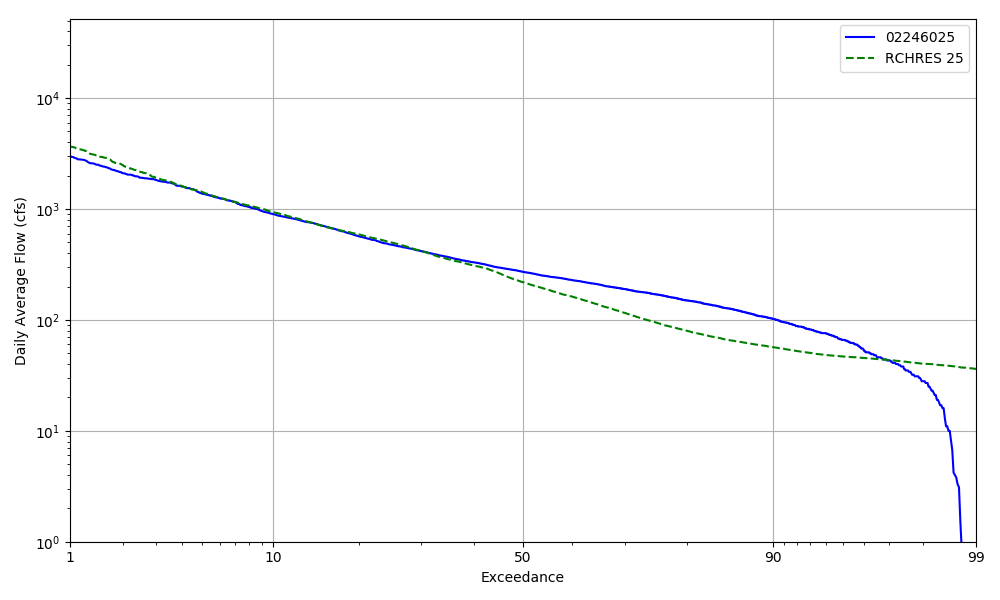


Figure 03080103-29: Daily exceedance for HSFP reach 25 and USGS station 02246025.

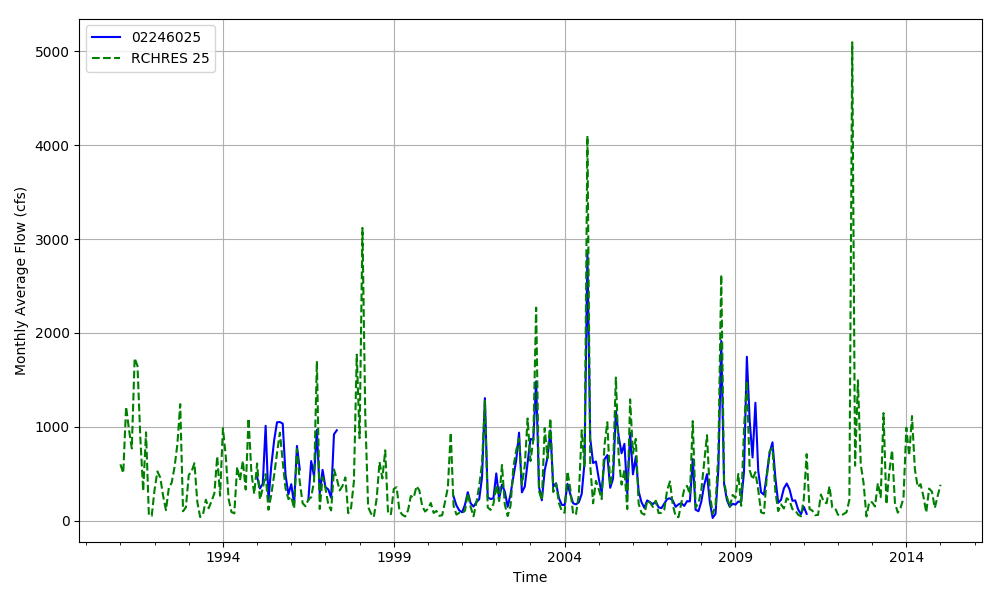


Figure 03080103-30: Monthly flow for HSFP reach 25 and USGS station 02246025.

## HSPF Reach 33, USGS Gauge 02246500

Table 03080103-19: Comparison Statistics Between HSPF Reach 33 and USGS Gauge 02246500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -1060.30 |
| Standard error | 6145.03 |
| Relative bias | -0.13 |
| Relative standard error | 0.92 |
| Nash-Sutcliffe coefficient | 0.16 |
| Coefficient of efficiency | 0.16 |
| Index of agreement | 0.54 |

Table 03080103-20: Hydrologic Indices Between USGS Gauge 02246500 and HSPF Reach 33.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02246500 | Simulated Reach 33 | Percent Difference |
| MA1: Mean, all daily flows | 14691.89 | 7057.86 | -51.96 |
| MA2: Median, all daily flows | 13000.00 | 4687.17 | -63.94 |
| MA3: CV, all daily flows | 61.13 | 84.71 | 38.58 |
| MA4: CV, log of all daily flows | 62.42 | 77.46 | 24.09 |
| MA5: Mean daily flow / median daily flow | 1.13 | 1.51 | 33.24 |
| MA9: (Q10 - Q90) / median daily flow | 1.93 | 2.73 | 41.90 |
| MA10: (Q20 - Q80) / median daily flow | 1.26 | 1.59 | 25.74 |
| MA11: (Q25 - Q75) / median daily flow | 1.02 | 1.19 | 17.18 |
| MA12: Mean monthly flow, January | 11887.27 | 4906.38 | -58.73 |
| MA13: Mean monthly flow, February | 12264.96 | 5954.16 | -51.45 |
| MA14: Mean monthly flow, March | 12445.62 | 5581.80 | -55.15 |
| MA15: Mean monthly flow, April | 11746.03 | 3783.37 | -67.79 |
| MA16: Mean monthly flow, May | 11163.44 | 3155.54 | -71.73 |
| MA17: Mean monthly flow, June | 11529.34 | 5793.77 | -49.75 |
| MA18: Mean monthly flow, July | 11831.54 | 6787.68 | -42.63 |
| MA19: Mean monthly flow, August | 12439.67 | 8555.78 | -31.22 |
| MA20: Mean monthly flow, September | 15663.93 | 10107.44 | -35.47 |
| MA21: Mean monthly flow, October | 11943.63 | 8072.12 | -32.41 |
| MA22: Mean monthly flow, November | 11067.94 | 4337.72 | -60.81 |
| MA23: Mean monthly flow, December | 11540.33 | 5032.82 | -56.39 |
| ML1: Mean minimum monthly flow, January | 1794.74 | 3517.67 | 96.00 |
| ML2: Mean minimum monthly flow, February | 1497.11 | 4021.53 | 168.62 |
| ML3: Mean minimum monthly flow, March | 1823.26 | 3861.85 | 111.81 |
| ML4: Mean minimum monthly flow, April | 2103.58 | 2710.20 | 28.84 |
| ML5: Mean minimum monthly flow, May | 1988.00 | 2228.78 | 12.11 |
| ML6: Mean minimum monthly flow, June | 2456.32 | 3670.15 | 49.42 |
| ML7: Mean minimum monthly flow, July | 2435.42 | 4888.07 | 100.71 |
| ML8: Mean minimum monthly flow, August | 2403.15 | 5481.54 | 128.10 |
| ML9: Mean minimum monthly flow, September | 2269.60 | 5713.97 | 151.76 |
| ML10: Mean minimum monthly flow, October | 2397.35 | 6054.36 | 152.54 |
| ML11: Mean minimum monthly flow, November | 2358.62 | 4132.52 | 75.21 |
| ML12: Mean minimum monthly flow, December | 1406.11 | 3394.06 | 141.38 |
| ML13: CV of minimum monthly flows | 131.60 | 69.17 | -47.44 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.01 | 0.35 | 3033.54 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.26 | 2399.38 |
| ML16: Median minimum annual flow / median annual flow | 0.01 | 0.34 | 6413.17 |
| ML20: Ratio of baseflow volume to total flow volume | 0.20 | 0.69 | 249.92 |
| ML22: Mean annual minimum flow divided by catchment area | 9092.31 | 9108.37 | 0.18 |
| RA1: Mean of positive changes from one day to next (rise rate) | 7535.77 | 1392.42 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 103.67 | 409.55 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 7587.37 | 559.95 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 93.11 | 369.16 |  |
| RA5: Ratio of days that are higher than previous day | 0.50 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.49 | 0.05 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.47 | 0.03 |  |
| RA8: Number of flow reversals from one day to the next | 113.77 | 46.14 |  |
| RA9: CV, number of flow reversals from one day to the next | 43.04 | 45.33 |  |

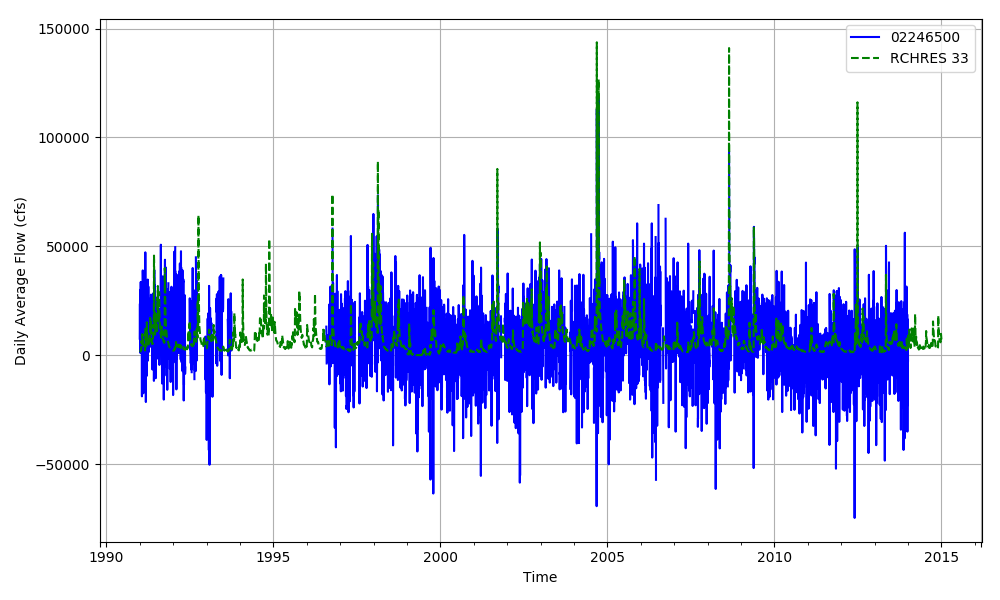


Figure 03080103-31: Daily flow for HSFP reach 33 and USGS station 02246500.

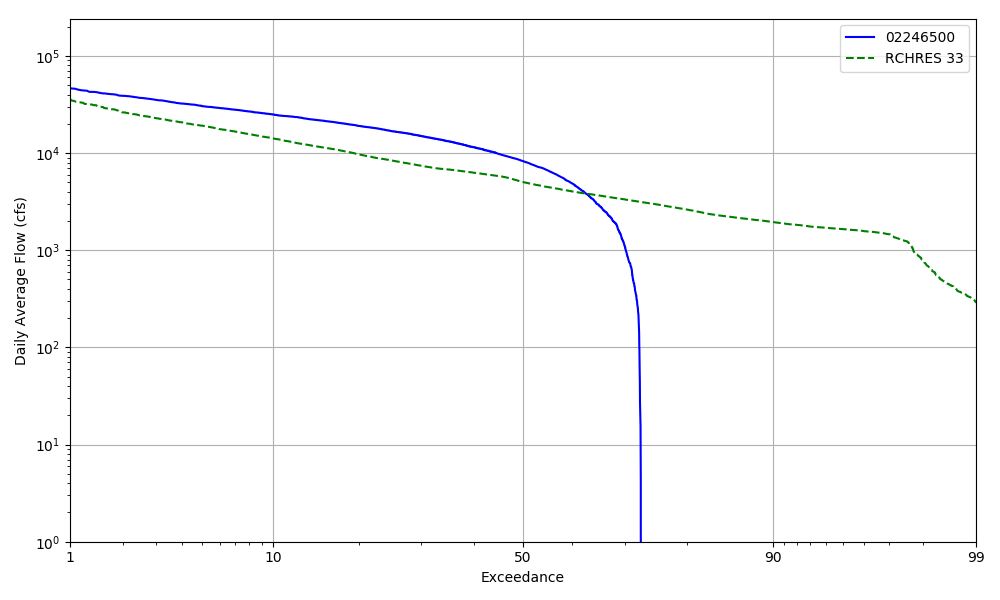


Figure 03080103-32: Daily exceedance for HSFP reach 33 and USGS station 02246500.

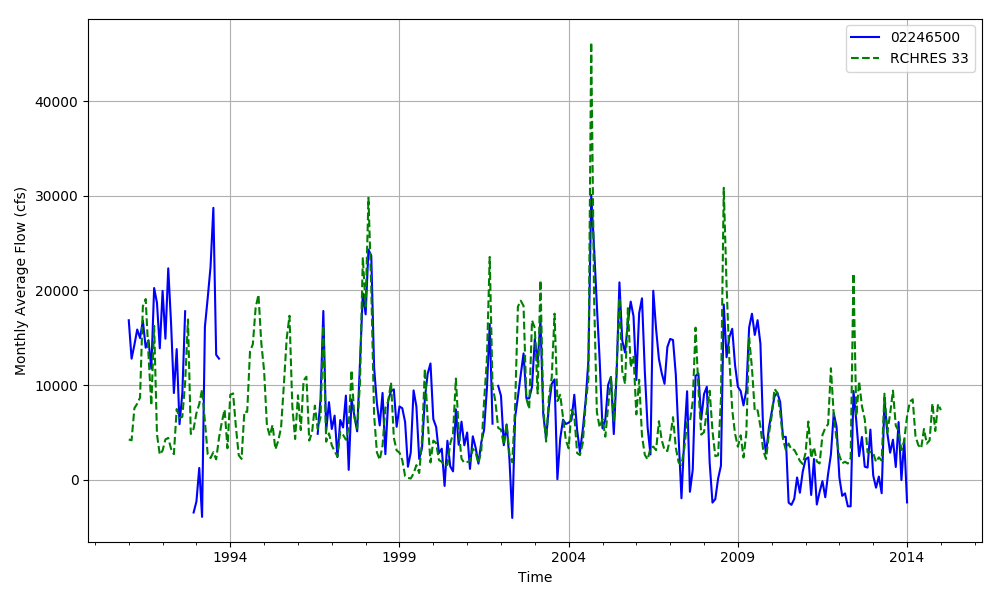


Figure 03080103-33: Monthly flow for HSFP reach 33 and USGS station 02246500.

## HSPF Reach 40, USGS Gauge 02244320

Table 03080103-21: Comparison Statistics Between HSPF Reach 40 and USGS Gauge 02244320.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -4.63 |
| Standard error | 73.91 |
| Relative bias | -0.06 |
| Relative standard error | 0.59 |
| Nash-Sutcliffe coefficient | 0.65 |
| Coefficient of efficiency | 0.52 |
| Index of agreement | 0.73 |

Table 03080103-22: Hydrologic Indices Between USGS Gauge 02244320 and HSPF Reach 40.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02244320 | Simulated Reach 40 | Percent Difference |
| MA1: Mean, all daily flows | 75.30 | 70.59 | -6.25 |
| MA2: Median, all daily flows | 9.00 | 22.41 | 149.04 |
| MA3: CV, all daily flows | 194.55 | 184.48 | -5.18 |
| MA4: CV, log of all daily flows | 168.95 | 139.74 | -17.29 |
| MA5: Mean daily flow / median daily flow | 8.37 | 3.15 | -62.36 |
| MA9: (Q10 - Q90) / median daily flow | 25.33 | 8.25 | -67.42 |
| MA10: (Q20 - Q80) / median daily flow | 13.43 | 3.87 | -71.21 |
| MA11: (Q25 - Q75) / median daily flow | 8.95 | 2.83 | -68.38 |
| MA12: Mean monthly flow, January | 48.79 | 61.32 | 25.68 |
| MA13: Mean monthly flow, February | 33.38 | 56.13 | 68.16 |
| MA14: Mean monthly flow, March | 50.01 | 57.56 | 15.09 |
| MA15: Mean monthly flow, April | 26.65 | 20.96 | -21.37 |
| MA16: Mean monthly flow, May | 2.95 | 13.79 | 368.23 |
| MA17: Mean monthly flow, June | 56.37 | 77.97 | 38.32 |
| MA18: Mean monthly flow, July | 86.20 | 78.11 | -9.38 |
| MA19: Mean monthly flow, August | 81.70 | 87.82 | 7.48 |
| MA20: Mean monthly flow, September | 195.14 | 124.63 | -36.13 |
| MA21: Mean monthly flow, October | 180.14 | 126.25 | -29.91 |
| MA22: Mean monthly flow, November | 82.34 | 69.31 | -15.82 |
| MA23: Mean monthly flow, December | 39.62 | 55.06 | 38.96 |
| ML1: Mean minimum monthly flow, January | 17.58 | 11.08 | -37.00 |
| ML2: Mean minimum monthly flow, February | 9.68 | 12.49 | 29.08 |
| ML3: Mean minimum monthly flow, March | 8.23 | 10.96 | 33.29 |
| ML4: Mean minimum monthly flow, April | 2.91 | 5.60 | 92.37 |
| ML5: Mean minimum monthly flow, May | 0.09 | 4.82 | 5300.23 |
| ML6: Mean minimum monthly flow, June | 13.36 | 10.02 | -25.01 |
| ML7: Mean minimum monthly flow, July | 37.43 | 20.96 | -44.00 |
| ML8: Mean minimum monthly flow, August | 27.96 | 20.76 | -25.73 |
| ML9: Mean minimum monthly flow, September | 38.33 | 16.55 | -56.82 |
| ML10: Mean minimum monthly flow, October | 53.28 | 21.57 | -59.53 |
| ML11: Mean minimum monthly flow, November | 21.59 | 15.18 | -29.71 |
| ML12: Mean minimum monthly flow, December | 12.04 | 10.77 | -10.52 |
| ML13: CV of minimum monthly flows | 194.89 | 121.32 | -37.75 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.00 | 0.05 | 3413.84 |
| ML15: Mean minimum annual flow / mean annual flow | 0.00 | 0.02 | 11062.30 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.05 |  |
| ML20: Ratio of baseflow volume to total flow volume | 0.43 | 0.34 | -21.25 |
| ML22: Mean annual minimum flow divided by catchment area | 0.00 | 0.01 | 11478.39 |
| RA1: Mean of positive changes from one day to next (rise rate) | 27.15 | 30.73 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 348.29 | 348.54 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 9.51 | 12.14 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 312.30 | 312.78 |  |
| RA5: Ratio of days that are higher than previous day | 0.22 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.21 | 0.18 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.11 | 0.11 |  |
| RA8: Number of flow reversals from one day to the next | 53.25 | 71.17 |  |
| RA9: CV, number of flow reversals from one day to the next | 17.56 | 9.62 |  |

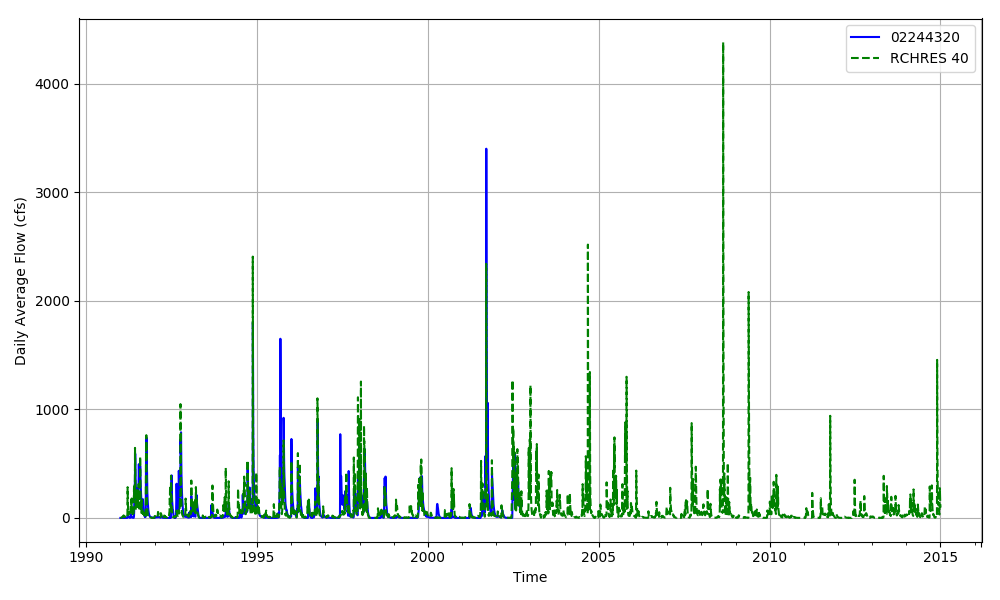


Figure 03080103-34: Daily flow for HSFP reach 40 and USGS station 02244320.

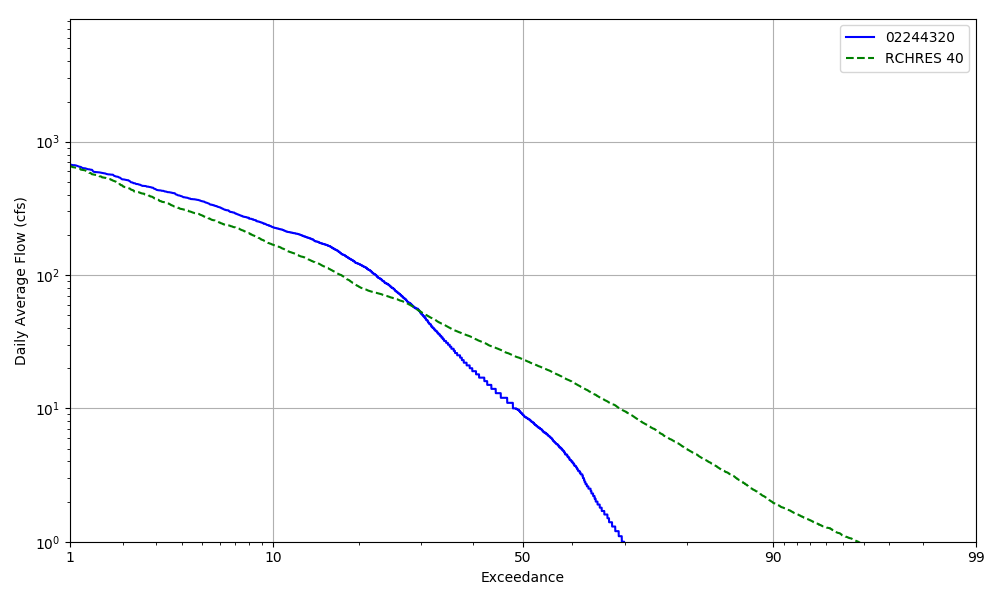


Figure 03080103-35: Daily exceedance for HSFP reach 40 and USGS station 02244320.

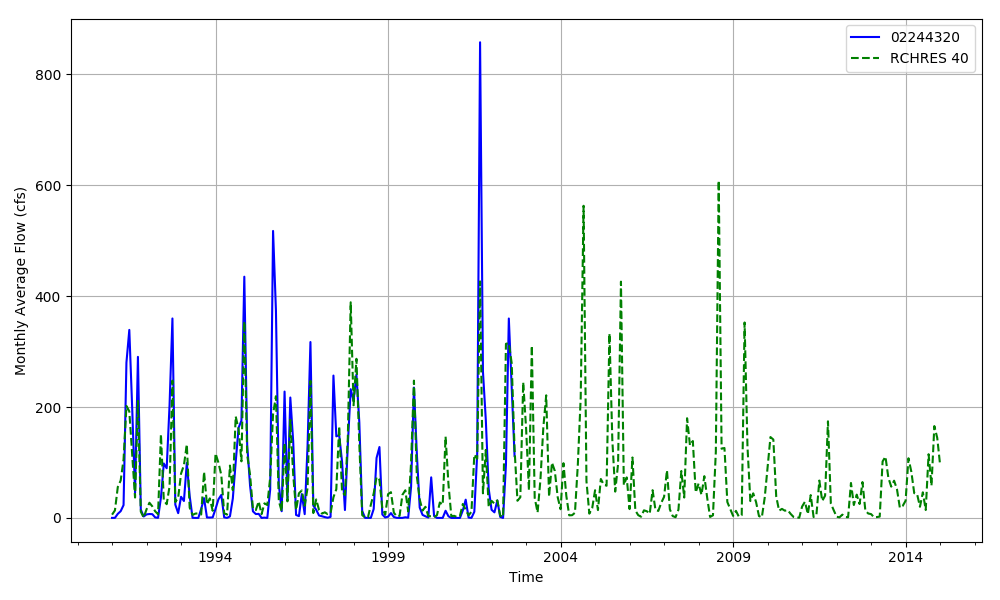


Figure 03080103-36: Monthly flow for HSFP reach 40 and USGS station 02244320.

## HSPF Reach 41, USGS Gauge 02244420

Table 03080103-23: Comparison Statistics Between HSPF Reach 41 and USGS Gauge 02244420.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 27.12 |
| Standard error | 88.44 |
| Relative bias | 0.33 |
| Relative standard error | 0.73 |
| Nash-Sutcliffe coefficient | 0.46 |
| Coefficient of efficiency | 0.38 |
| Index of agreement | 0.69 |

Table 03080103-24: Hydrologic Indices Between USGS Gauge 02244420 and HSPF Reach 41.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02244420 | Simulated Reach 41 | Percent Difference |
| MA1: Mean, all daily flows | 81.32 | 108.38 | 33.28 |
| MA2: Median, all daily flows | 21.00 | 38.36 | 82.65 |
| MA3: CV, all daily flows | 154.97 | 171.01 | 10.35 |
| MA4: CV, log of all daily flows | 148.87 | 135.04 | -9.29 |
| MA5: Mean daily flow / median daily flow | 3.87 | 2.83 | -27.03 |
| MA9: (Q10 - Q90) / median daily flow | 11.89 | 7.28 | -38.74 |
| MA10: (Q20 - Q80) / median daily flow | 5.74 | 3.39 | -41.01 |
| MA11: (Q25 - Q75) / median daily flow | 4.21 | 2.53 | -39.94 |
| MA12: Mean monthly flow, January | 74.29 | 99.13 | 33.43 |
| MA13: Mean monthly flow, February | 55.62 | 86.20 | 54.98 |
| MA14: Mean monthly flow, March | 74.96 | 82.59 | 10.18 |
| MA15: Mean monthly flow, April | 44.50 | 34.14 | -23.27 |
| MA16: Mean monthly flow, May | 7.41 | 23.28 | 214.04 |
| MA17: Mean monthly flow, June | 39.64 | 125.15 | 215.73 |
| MA18: Mean monthly flow, July | 78.44 | 120.47 | 53.58 |
| MA19: Mean monthly flow, August | 77.63 | 140.55 | 81.06 |
| MA20: Mean monthly flow, September | 172.86 | 205.47 | 18.86 |
| MA21: Mean monthly flow, October | 174.18 | 177.12 | 1.68 |
| MA22: Mean monthly flow, November | 92.71 | 96.77 | 4.38 |
| MA23: Mean monthly flow, December | 62.15 | 82.21 | 32.27 |
| ML1: Mean minimum monthly flow, January | 37.47 | 20.21 | -46.06 |
| ML2: Mean minimum monthly flow, February | 28.02 | 21.45 | -23.43 |
| ML3: Mean minimum monthly flow, March | 27.45 | 18.04 | -34.31 |
| ML4: Mean minimum monthly flow, April | 13.19 | 8.80 | -33.27 |
| ML5: Mean minimum monthly flow, May | 3.48 | 7.70 | 121.61 |
| ML6: Mean minimum monthly flow, June | 9.60 | 16.33 | 70.19 |
| ML7: Mean minimum monthly flow, July | 19.20 | 34.98 | 82.17 |
| ML8: Mean minimum monthly flow, August | 36.70 | 35.45 | -3.41 |
| ML9: Mean minimum monthly flow, September | 43.74 | 34.48 | -21.16 |
| ML10: Mean minimum monthly flow, October | 66.09 | 29.08 | -55.99 |
| ML11: Mean minimum monthly flow, November | 38.28 | 21.05 | -45.01 |
| ML12: Mean minimum monthly flow, December | 28.71 | 18.49 | -35.59 |
| ML13: CV of minimum monthly flows | 148.48 | 112.39 | -24.31 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.06 | 0.06 | -1.18 |
| ML15: Mean minimum annual flow / mean annual flow | 0.02 | 0.03 | 43.63 |
| ML16: Median minimum annual flow / median annual flow | 0.05 | 0.05 | 11.76 |
| ML20: Ratio of baseflow volume to total flow volume | 0.59 | 0.33 | -44.35 |
| ML22: Mean annual minimum flow divided by catchment area | 0.01 | 0.03 | 91.62 |
| RA1: Mean of positive changes from one day to next (rise rate) | 17.13 | 44.57 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 274.08 | 303.13 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 6.20 | 18.59 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 172.45 | 281.00 |  |
| RA5: Ratio of days that are higher than previous day | 0.24 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.14 | 0.17 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.11 |  |
| RA8: Number of flow reversals from one day to the next | 74.67 | 67.17 |  |
| RA9: CV, number of flow reversals from one day to the next | 14.57 | 15.60 |  |

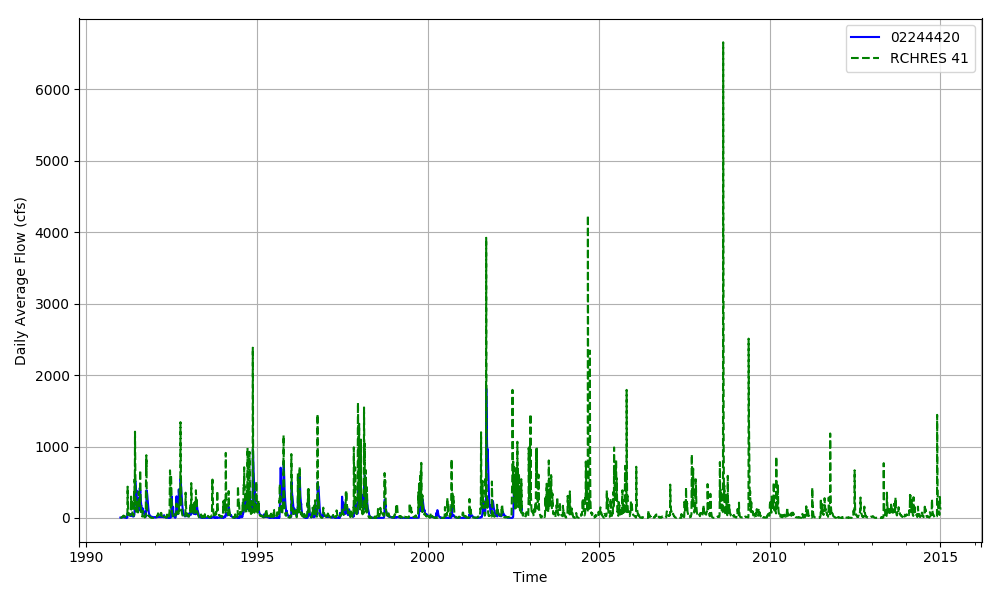


Figure 03080103-37: Daily flow for HSFP reach 41 and USGS station 02244420.

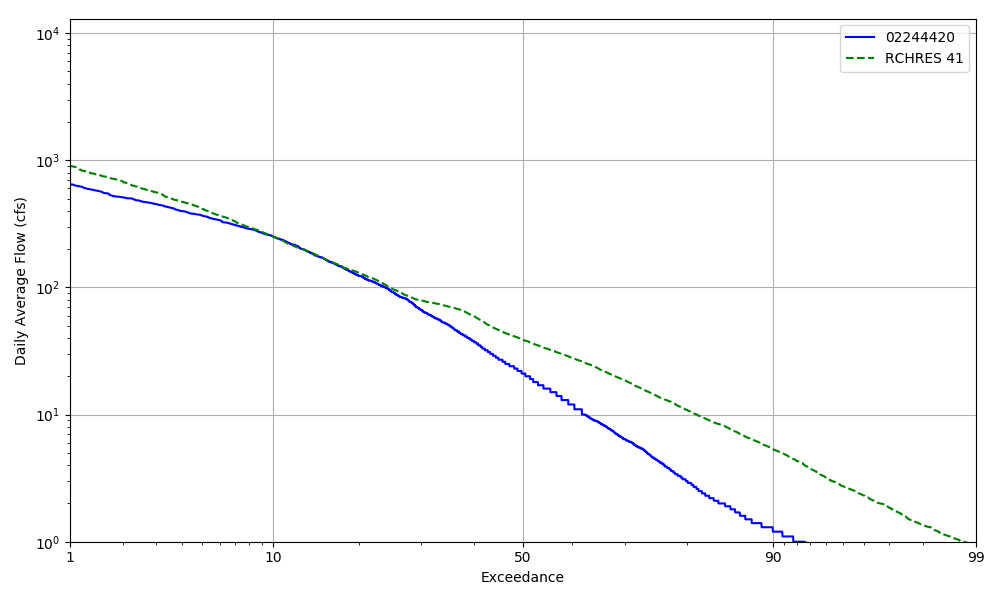


Figure 03080103-38: Daily exceedance for HSFP reach 41 and USGS station 02244420.

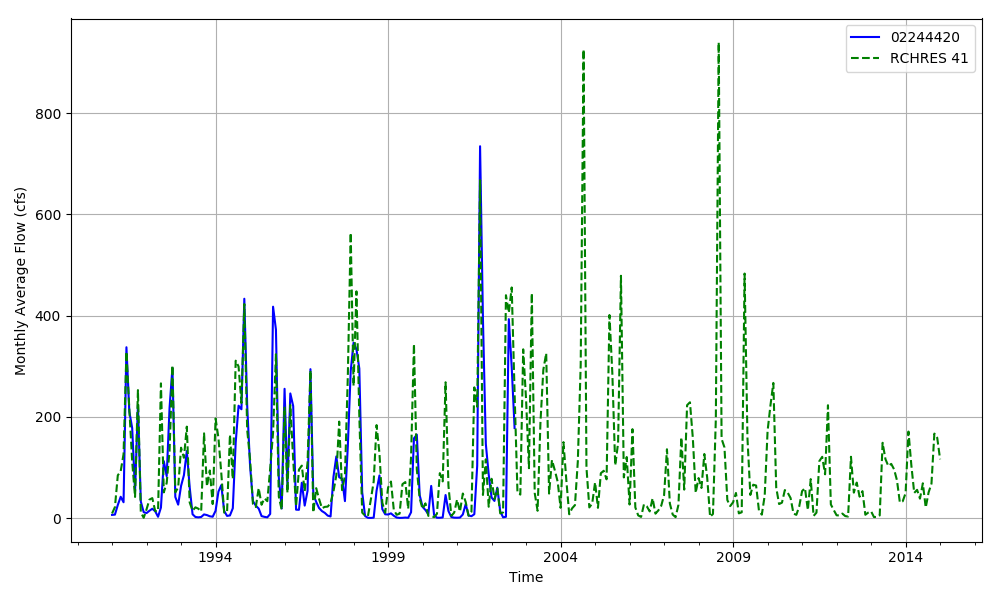


Figure 03080103-39: Monthly flow for HSFP reach 41 and USGS station 02244420.

## HSPF Reach 46, USGS Gauge 02244440

Table 03080103-25: Comparison Statistics Between HSPF Reach 46 and USGS Gauge 02244440.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 88.98 |
| Standard error | 579.54 |
| Relative bias | 0.18 |
| Relative standard error | 0.80 |
| Nash-Sutcliffe coefficient | 0.36 |
| Coefficient of efficiency | 0.24 |
| Index of agreement | 0.61 |

Table 03080103-26: Hydrologic Indices Between USGS Gauge 02244440 and HSPF Reach 46.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02244440 | Simulated Reach 46 | Percent Difference |
| MA1: Mean, all daily flows | 1212.64 | 579.84 | -52.18 |
| MA2: Median, all daily flows | 912.00 | 220.04 | -75.87 |
| MA3: CV, all daily flows | 86.44 | 172.96 | 100.09 |
| MA4: CV, log of all daily flows | 78.08 | 129.92 | 66.39 |
| MA5: Mean daily flow / median daily flow | 1.33 | 2.64 | 98.19 |
| MA9: (Q10 - Q90) / median daily flow | 2.57 | 6.34 | 146.76 |
| MA10: (Q20 - Q80) / median daily flow | 1.58 | 3.13 | 98.53 |
| MA11: (Q25 - Q75) / median daily flow | 1.24 | 2.49 | 100.45 |
| MA12: Mean monthly flow, January | 878.93 | 427.63 | -51.35 |
| MA13: Mean monthly flow, February | 937.27 | 521.50 | -44.36 |
| MA14: Mean monthly flow, March | 1092.28 | 565.61 | -48.22 |
| MA15: Mean monthly flow, April | 818.97 | 203.74 | -75.12 |
| MA16: Mean monthly flow, May | 894.23 | 303.16 | -66.10 |
| MA17: Mean monthly flow, June | 918.20 | 550.35 | -40.06 |
| MA18: Mean monthly flow, July | 912.68 | 628.76 | -31.11 |
| MA19: Mean monthly flow, August | 1106.74 | 862.51 | -22.07 |
| MA20: Mean monthly flow, September | 1663.00 | 964.18 | -42.02 |
| MA21: Mean monthly flow, October | 1335.25 | 644.66 | -51.72 |
| MA22: Mean monthly flow, November | 1182.89 | 383.10 | -67.61 |
| MA23: Mean monthly flow, December | 999.98 | 424.94 | -57.51 |
| ML1: Mean minimum monthly flow, January | 104.28 | 123.14 | 18.09 |
| ML2: Mean minimum monthly flow, February | 131.11 | 149.60 | 14.11 |
| ML3: Mean minimum monthly flow, March | 75.72 | 143.91 | 90.06 |
| ML4: Mean minimum monthly flow, April | 94.74 | 47.33 | -50.04 |
| ML5: Mean minimum monthly flow, May | 142.48 | 71.79 | -49.61 |
| ML6: Mean minimum monthly flow, June | 124.00 | 149.25 | 20.36 |
| ML7: Mean minimum monthly flow, July | 165.41 | 182.57 | 10.38 |
| ML8: Mean minimum monthly flow, August | 163.30 | 211.66 | 29.61 |
| ML9: Mean minimum monthly flow, September | 91.18 | 172.96 | 89.68 |
| ML10: Mean minimum monthly flow, October | 191.65 | 160.28 | -16.37 |
| ML11: Mean minimum monthly flow, November | 156.74 | 109.21 | -30.32 |
| ML12: Mean minimum monthly flow, December | 87.28 | 103.69 | 18.80 |
| ML13: CV of minimum monthly flows | 142.74 | 112.49 | -21.19 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.01 | 0.08 | 705.72 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.04 | 411.83 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.06 | 1143.60 |
| ML20: Ratio of baseflow volume to total flow volume | 0.16 | 0.35 | 118.55 |
| ML22: Mean annual minimum flow divided by catchment area | 0.09 | 0.21 | 132.27 |
| RA1: Mean of positive changes from one day to next (rise rate) | 509.34 | 230.45 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 104.13 | 373.12 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 496.82 | 99.46 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 95.74 | 329.52 |  |
| RA5: Ratio of days that are higher than previous day | 0.49 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.44 | 0.15 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.43 | 0.10 |  |
| RA8: Number of flow reversals from one day to the next | 97.92 | 59.54 |  |
| RA9: CV, number of flow reversals from one day to the next | 28.17 | 28.65 |  |

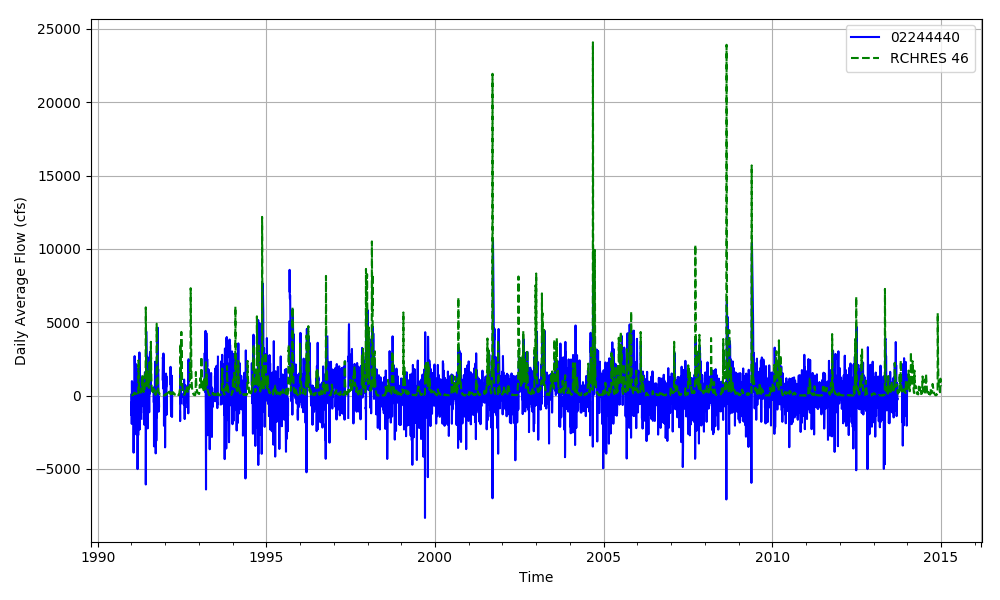


Figure 03080103-40: Daily flow for HSFP reach 46 and USGS station 02244440.

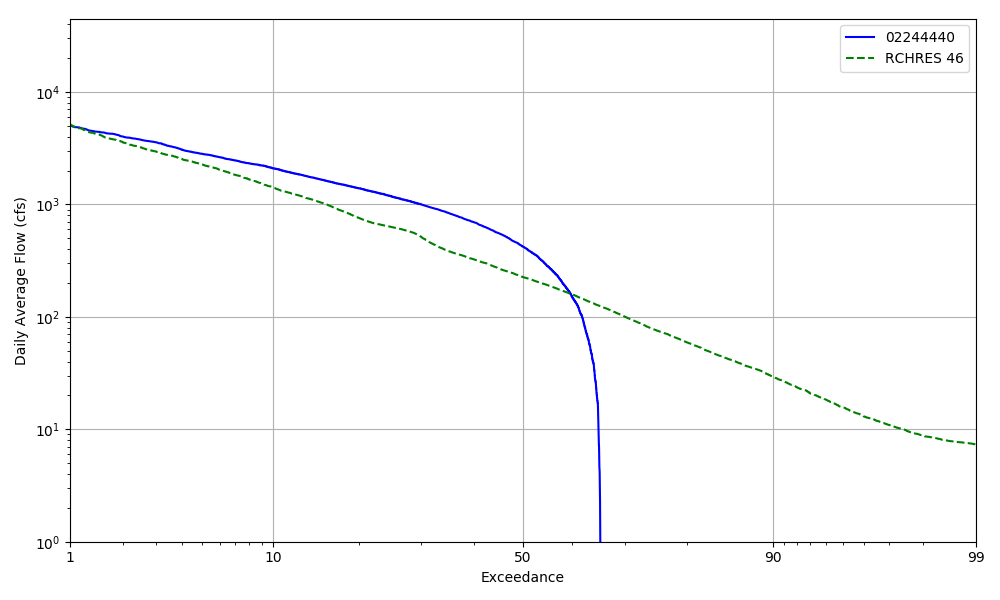


Figure 03080103-41: Daily exceedance for HSFP reach 46 and USGS station 02244440.

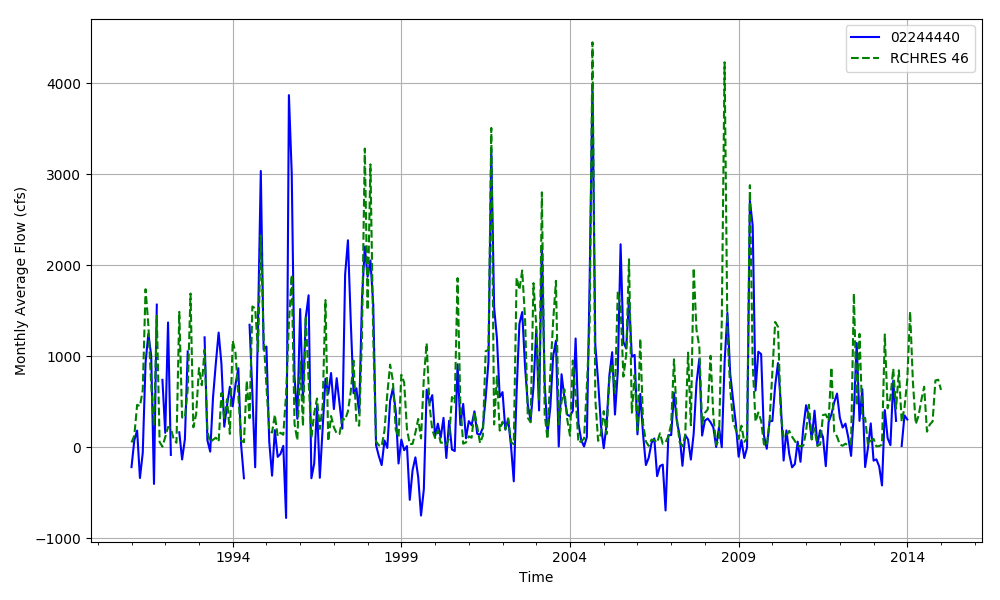


Figure 03080103-42: Monthly flow for HSFP reach 46 and USGS station 02244440.