



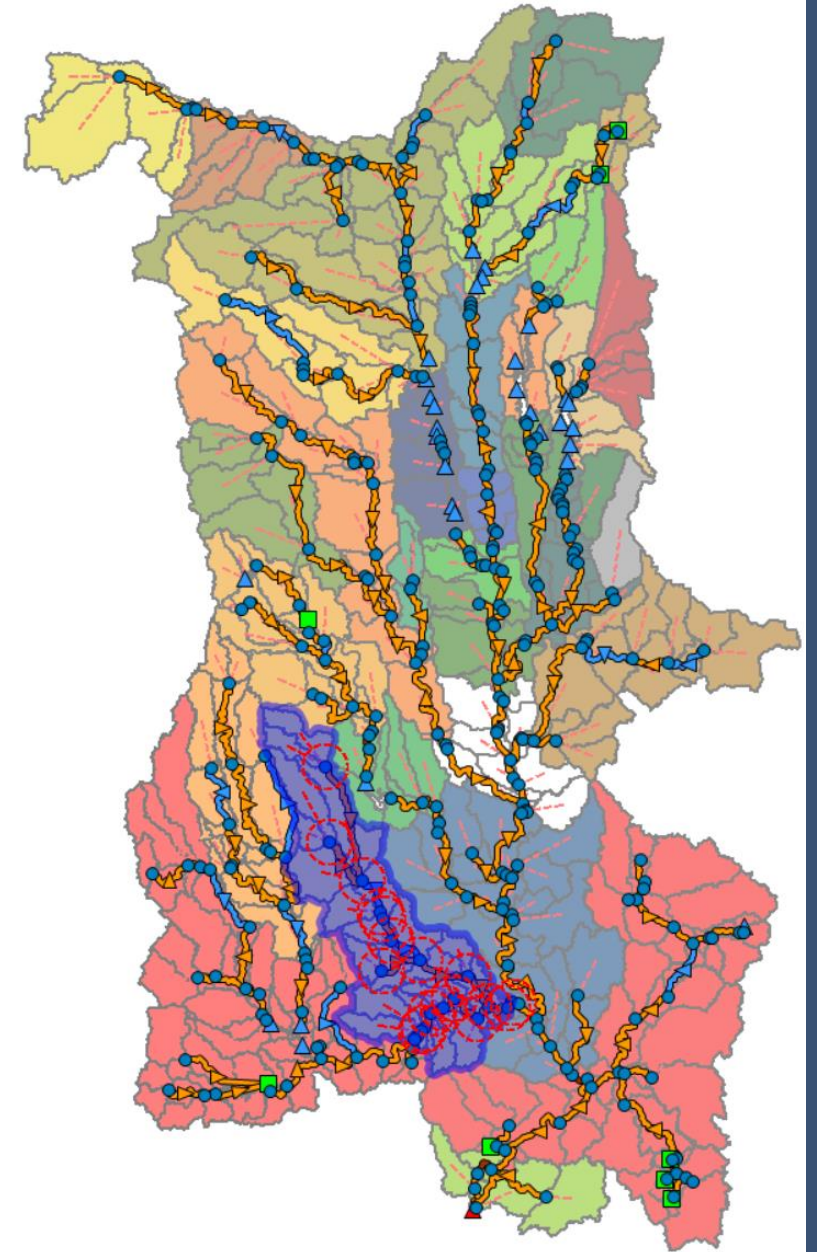
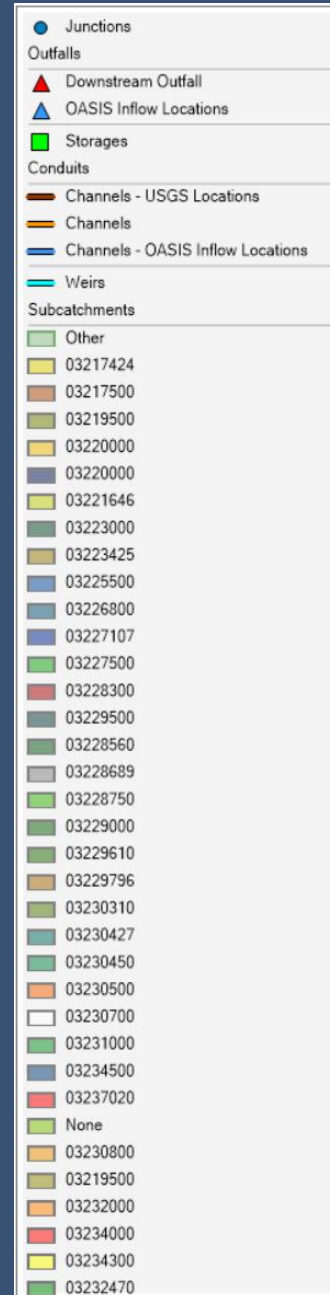
Central Ohio Regional Water Study SWMM Model Calibration and Validation



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Notes on Calibration Approach



Notes on Calibration Approach

Calibration Approach - Initial Parameter Assignments and Adjustments

- The initial parameter values assigned to all SWMM model components (e.g., subcatchments, conduits, junctions) are summarized in the “*CORWS__SWMM_Model_Development.pptx*” PowerPoint slides.
- Simulated streamflow was compared to observed streamflow data from 27 USGS stream gauges.
 - Each gauge had calibration and validation periods defined independently depending on data availability.
- The SWMM model was calibrated by adjusting the following model parameters:
 - **Monthly RTK values**
 - *RTK values were used to account for slow inflow responses to channels due to groundwater and snowmelt.*
 - **Subcatchment Parameters – A majority of subcatchments had low impervious area, making parameters related to the runoff and infiltration on pervious surfaces most sensitive to adjustments. The following subcatchment parameters were adjusted independently for calibration:**
 - *Manning’s N for pervious surfaces*
 - *Depression storage for pervious surfaces*
 - *Curve Number*
 - *Monthly depression storage pattern*

Notes on Calibration Approach

Scaling subcatchment parameters with no downstream gauge to calibrate to

- For subcatchments that did not have a nearby downstream USGS gauge available for calibration, the parameter adjustments of the nearest upstream/neighbor drainage area were applied. These subcatchments were given assigned the USGS gauge ID of neighboring calibrated rainage area followed by “_Scaled”.
- For example, subcatchment parameters from an area without a downstream gauge were scaled using the same scaling as subcatchments with the tag 03219500. Therefore, these subcatchments were tagged as 03219500_Scaled.
- The Calibration Tag attribute can be found in the packaged (pcz) models.

Notes on Calibration Approach

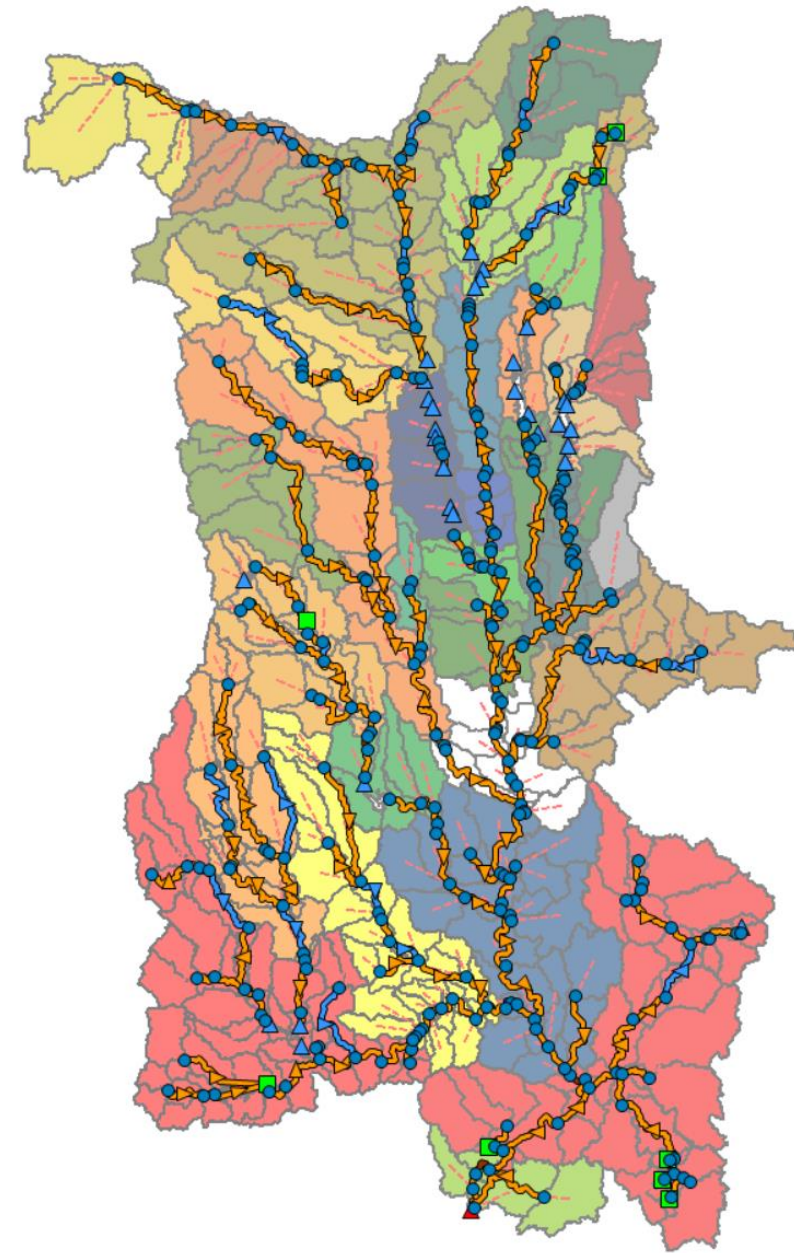
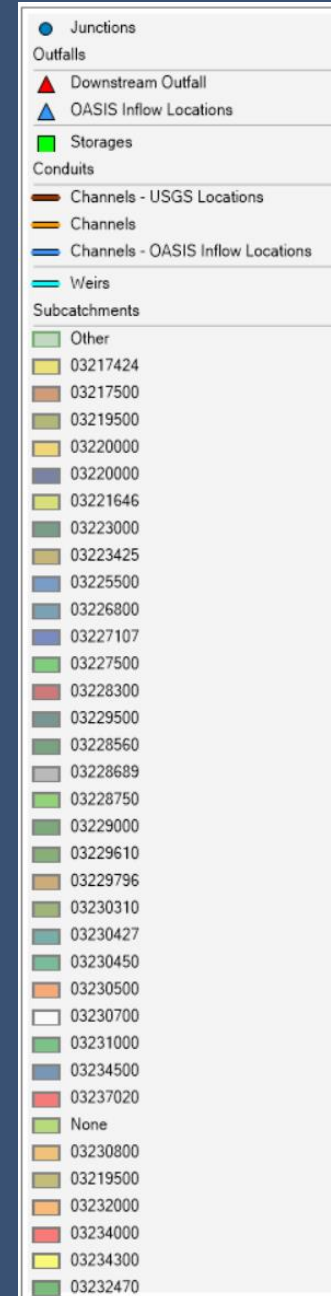
Calibration Approach

- The calibration and validation process compared average simulated stream flows against observed stream flows aggregated by year, season and month.
- The following slides summarize the calibration and validation performed at each USGS stream gauge and provide the following information
 - **Introduction Slide**
 - *Includes USGS gauges ID, USGS gauge description and graphic of the immediate drainage area*
 - **Calibration and Validation Summary Slide**
 - *Includes Calibration/Validation time frame, comments related to the calibration, and table summarizing error between annual mean flows*
 - **Computed vs. Observed plots and statistics**
 - *Statistics are automatically computed and include the following:*
 - *Integral square error rating*
 - *Integral square error (ISE)*
 - *Nash-Sutcliffe efficiency (NSE; R^2)*
 - *Pearson correlation coefficient (r)*
 - *Simple Least Squares (LSE)*
 - *Simple least squares dimensionless (LSE dim)*
 - *Root mean square error (RMSE)*
 - *Root mean square error dimensionless (RMSE dim)*
 - *Mean absolute percentage error (MAPE)*
 - *Median absolute percentage error (MdAPE)*

USGS Gauge List

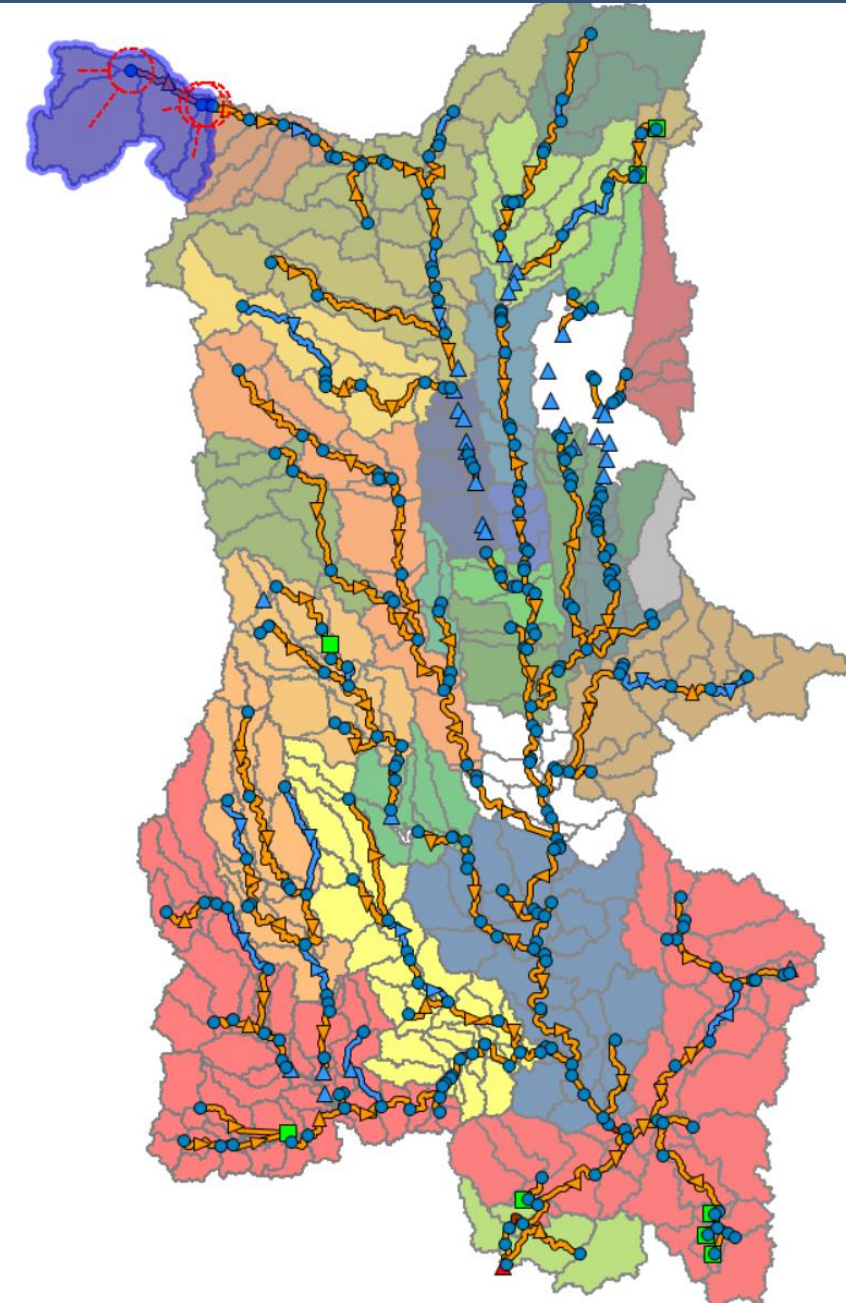
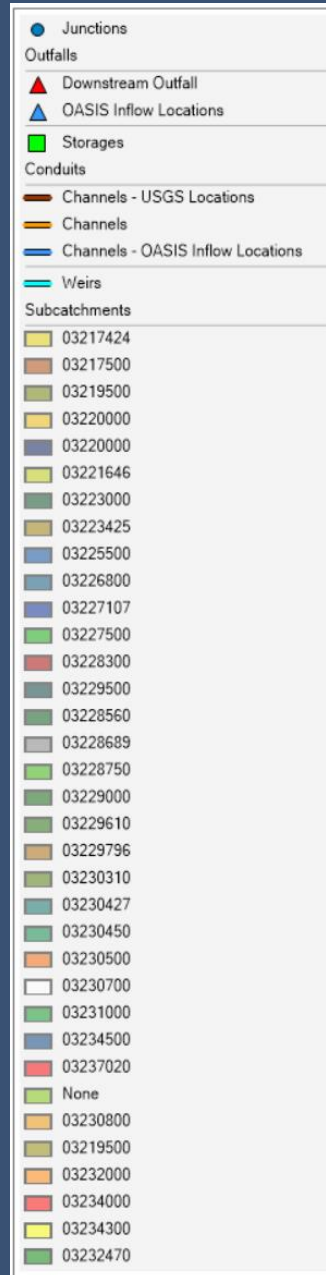
Model ID	USGS Gauge ID	USGS Description
Scioto And Paint	03217424	Scioto River at Kenton OH
Scioto And Paint	03217500	Scioto River at La Rue OH
Scioto And Paint	03219500	Scioto River near Prospect OH
Scioto And Paint	03220000	Mill Creek near Bellepoint OH
Scioto And Paint	03223000	Olentangy River at Claridon OH
Scioto And Paint	03223425	Whetstone Creek at My Gilead OH
Scioto And Paint	03228750	Alum Creek near Kilbourne OH
Scioto And Paint	03228300	Big Walnut Creek at Sunbury OH
Scioto And Paint	03226800	Olentangy River near Worthington OH
Scioto And Paint	03227107	Olentangy River at J H Herrick Dr at Columbus OH
Scioto And Paint	03228560	Rocky Fork at Gahanna OH
Scioto And Paint	03229000	Olentangy River near Worthington OH
Scioto And Paint	03227500	Scioto River at Columbus OH
Scioto And Paint	03229500	Big Walnut Creek at Rees OH
Scioto And Paint	03229610	Scioto River near Commercial Point OH
Scioto And Paint	03229796	Walnut Creek at Ashville OH
Scioto And Paint	03230310	Little Darby Creek at West Jefferson OH
Scioto And Paint	03230450	Hellbranch Run near Harrisburg OH
Scioto And Paint	03230500	Big Darby Creek at Darbyville OH
Scioto And Paint	03230700	Scioto River at Circleville OH
Scioto And Paint	03230800	Deer Creek at Mount Sterling OH
Scioto And Paint	03232000	Paint Creek near Greenfield OH
Scioto And Paint	03234000	Paint Creek near Bourneville OH
Scioto And Paint	03234300	Paint Creek at Chillicothe OH
Scioto And Paint	03234500	Scioto River at Higby OH
Scioto And Paint	03237020	Scioto River at Piketon OH
Licking	03145483	Raccoon Creek near Granville OH
Licking	03146000	North Fork Licking River at Utica OH
Licking	03146277	North Fork Licking River at Newark OH
Licking	03144816	South Fork Licking River at Kirkersville OH
Licking	03145000	South Fork Licking River near Hebron OH
Licking	03145173	South Fork Licking River at Heath OH
Licking	03145534	Raccoon Cr. bl. Wilson Street at Newark OH
Licking	03146402	N. Fk. Licking River at E. Main St. at Newark OH
Licking	03146500	Licking River near Newark OH
Hocking	03156400	Hocking River at Lancaster OH
Hocking	03157000	Clear Creek near Rockbridge OH
Hocking	03157500	Hocking River at Enterprise OH
Hocking	03159500	Hocking River at Athens OH
West Walhonding	03136175	Kokosing River near Lucerne OH
West Walhonding	03136500	Kokosing River at Mount Vernon OH
Upper Great Miami, Indiana, Ohio	03260706	Bokengehalas Creek at De Graff OH
Upper Great Miami, Indiana, Ohio	03261500	Great Miami River at Sidney OH
Upper Great Miami, Indiana, Ohio	03267000	Mad River near Urbana OH

Scioto and Paint Watershed Model



USGS Gauge 03217424

Scioto River at Kenton OH



Calibration Summary

USGS Gauge 03217424

- USGS Gauge 03217424
- Calibration Period
 - 01/01/2022 – 11/01/2023
 - *Note: PRISM data availability at time of calibration ended at 11/01/2024*
 - *Annual, seasonal and mean statistics for 2023 represent means between 01/01/2023 to 11/01/2023*
- Validation Period
 - Not enough data available
- Comments
 - None

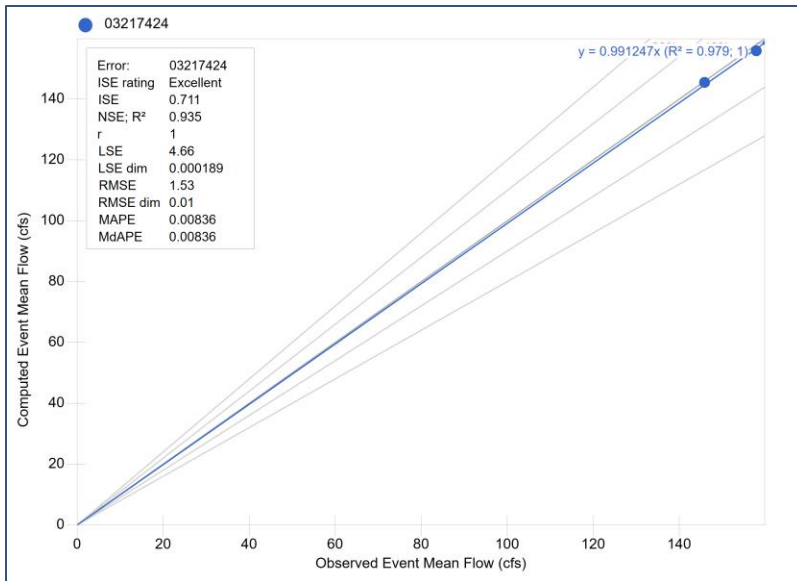
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2022	157.9	155.8	-1%
	2023	145.9	145.4	0%
Validation				N/A
				N/A

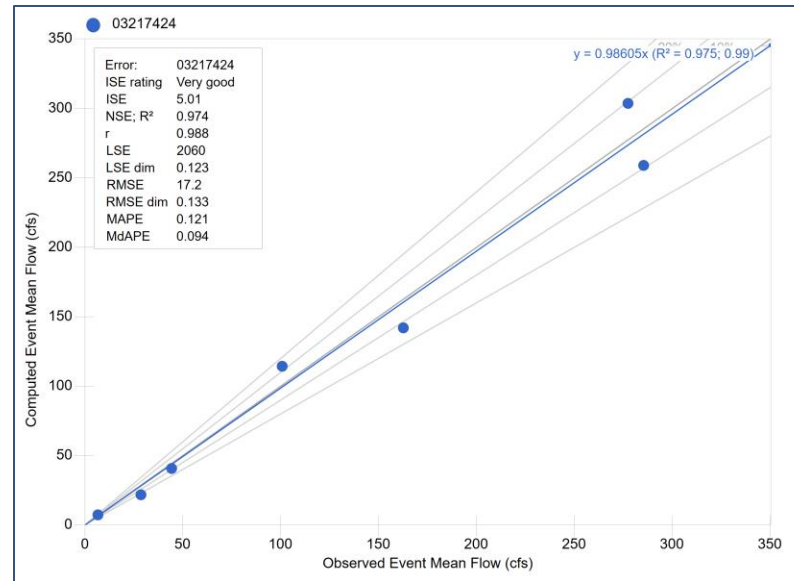
Calibration Summary

USGS Gauge 03217424

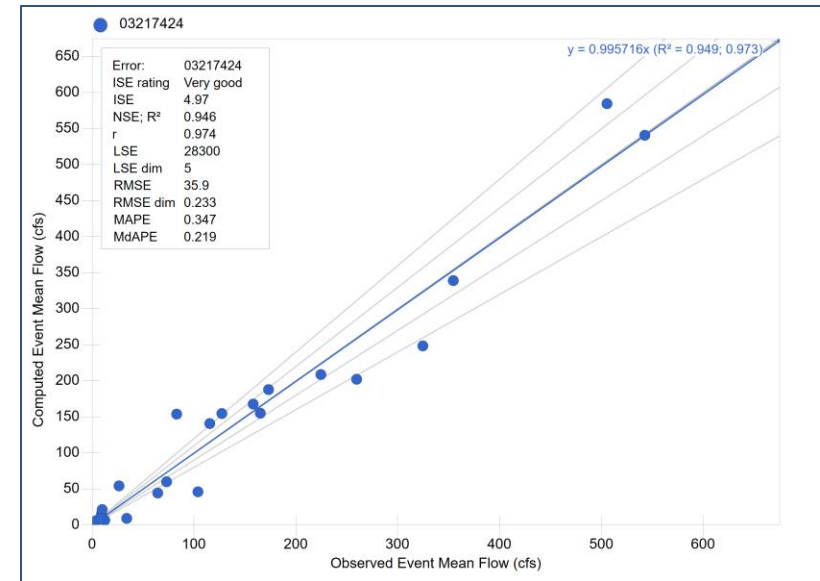
Annual Mean Flow



Seasonal Mean Flow



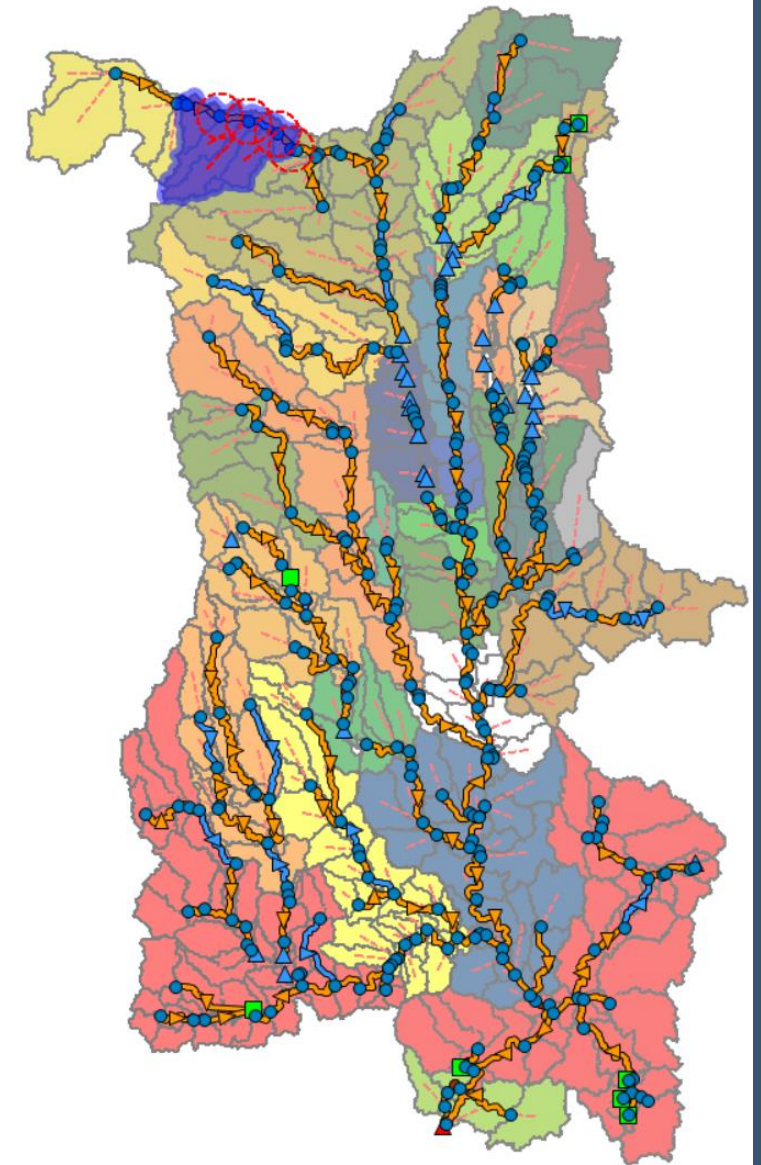
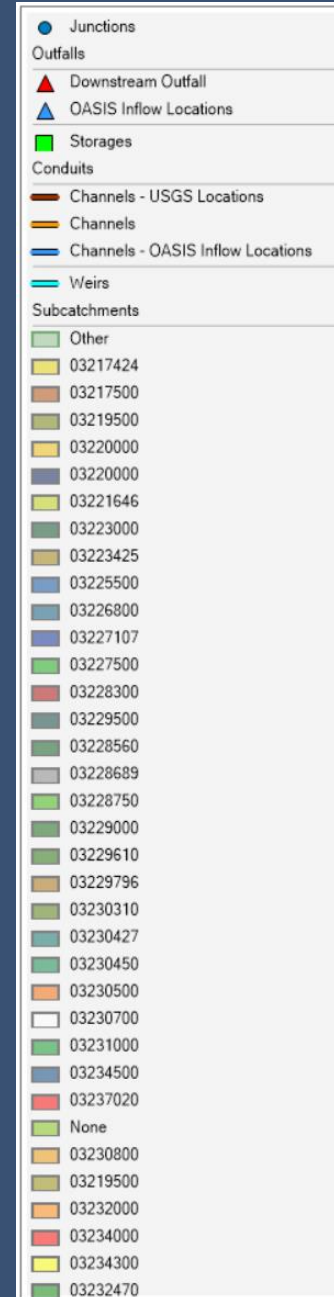
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03217500

Scioto River at La Rue OH



Calibration Summary

USGS Gauge 03217500

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - None

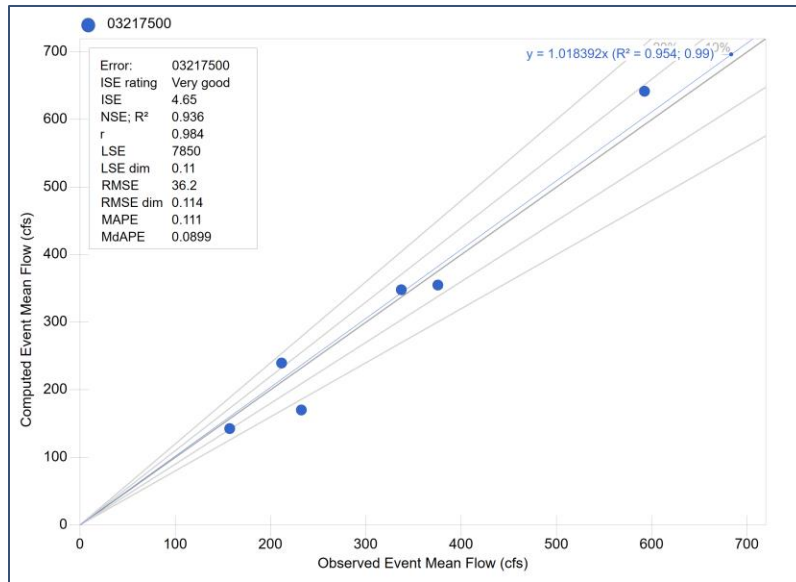
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	157.4	142.1	-10%
	2011	592.6	641.5	8%
	2012	211.7	239.2	13%
	2013	337.2	347.6	3%
	2014	232.4	169.8	-27%
	2015	375.8	354.7	-6%
Validation	2016	178.4	170.6	-4%
	2017	309.8	279.7	-10%
	2018	383.7	346.2	-10%
	2019	401.5	412.7	3%
	2020	288.4	339.3	18%
	2021	212.3	199.5	-6%
	2022	260.9	215.4	-17%

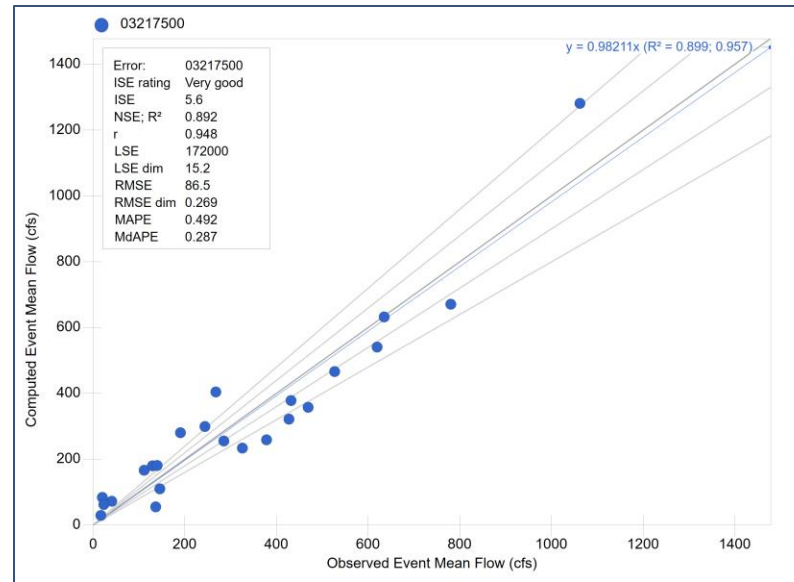
Calibration Summary

USGS Gauge 03217500

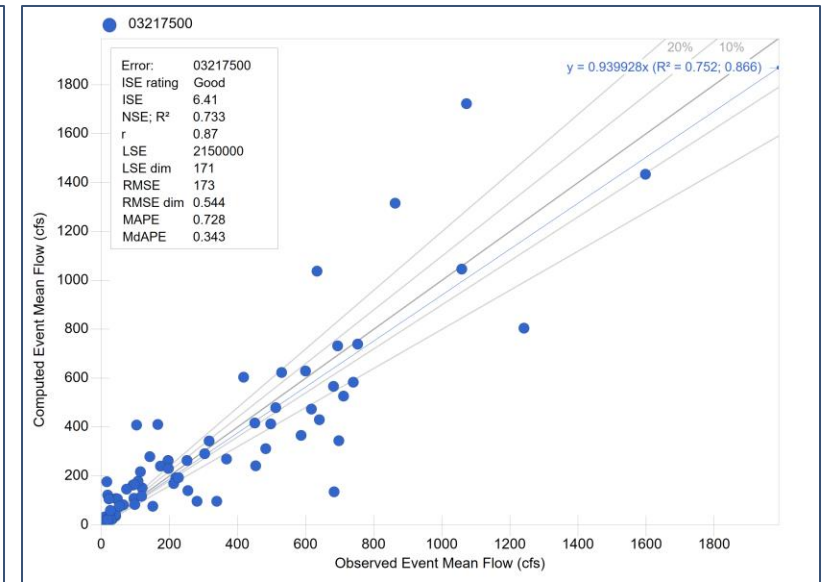
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

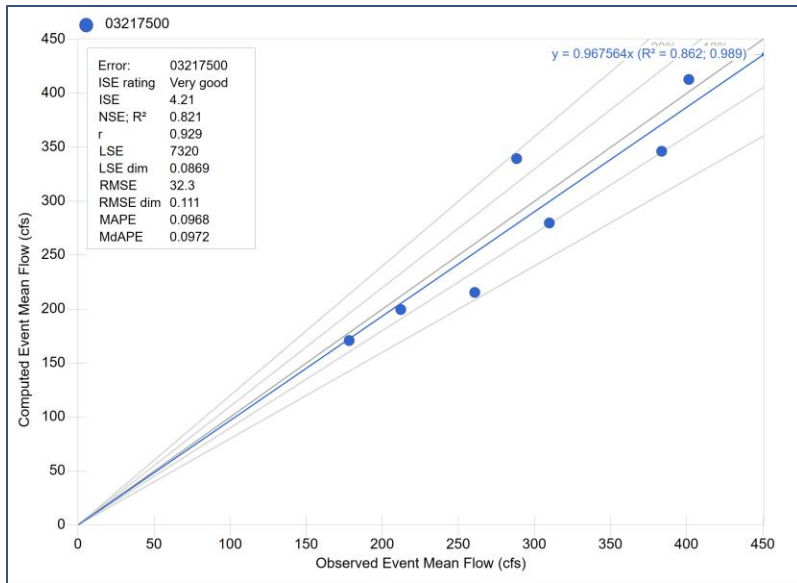


* 10% and 20% Error Bands Shown in Graphs

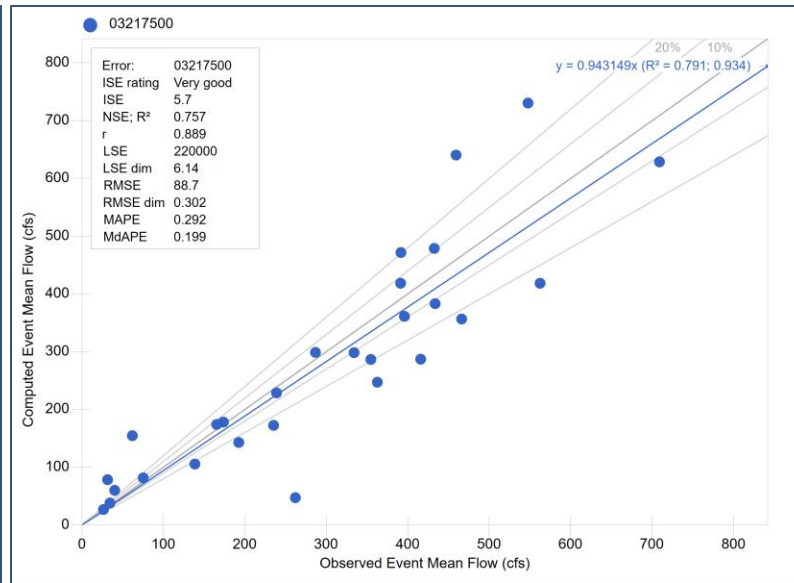
Validation Summary

USGS Gauge 03217500

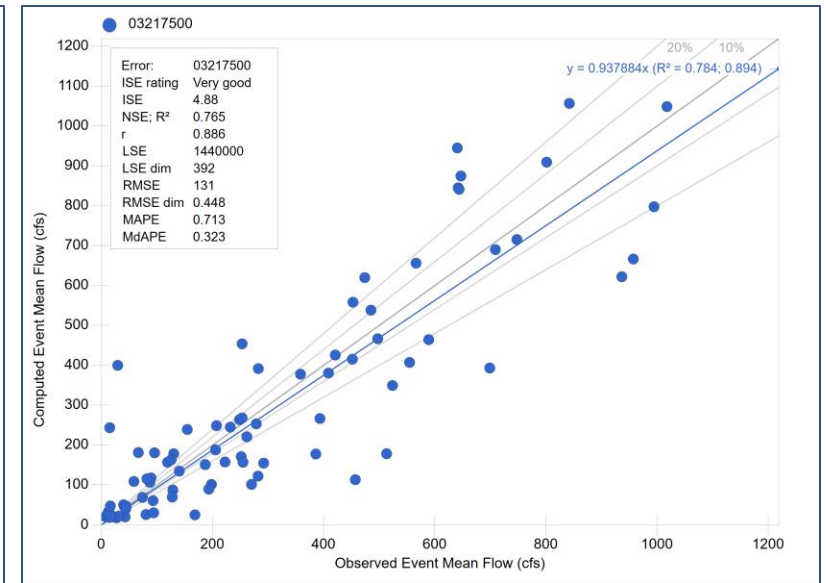
Annual Mean Flow



Seasonal Mean Flow



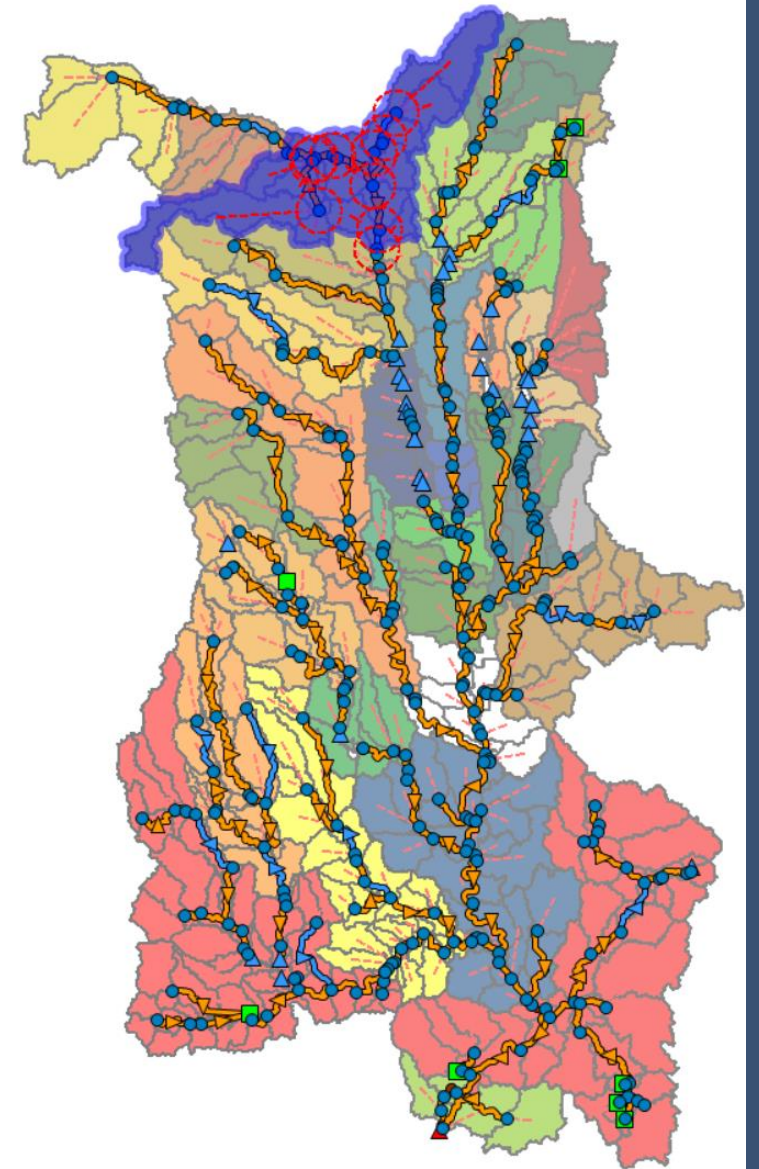
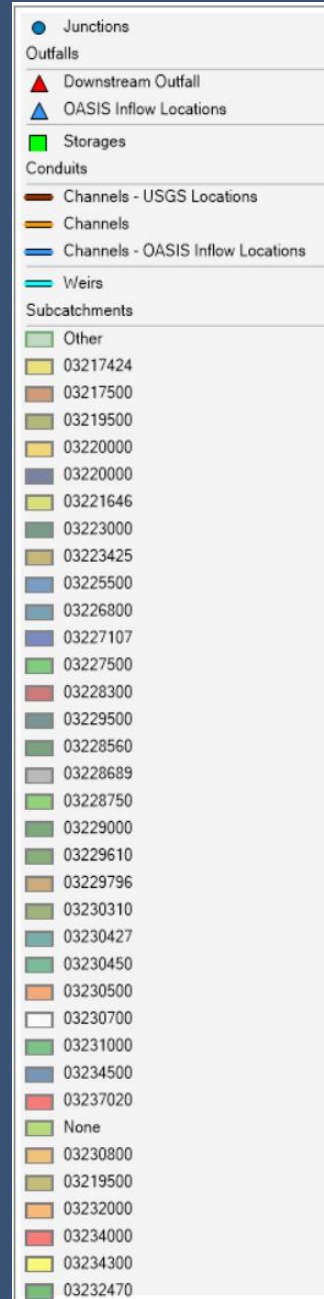
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03219500

Scioto River near Prospect OH



Calibration Summary

USGS Gauge 03219500

- Calibration Period
 - 01/01/2005 – 01/01/2010
- Validation Period
 - 01/01/2010 – 01/01/2023
- Comments
 - None

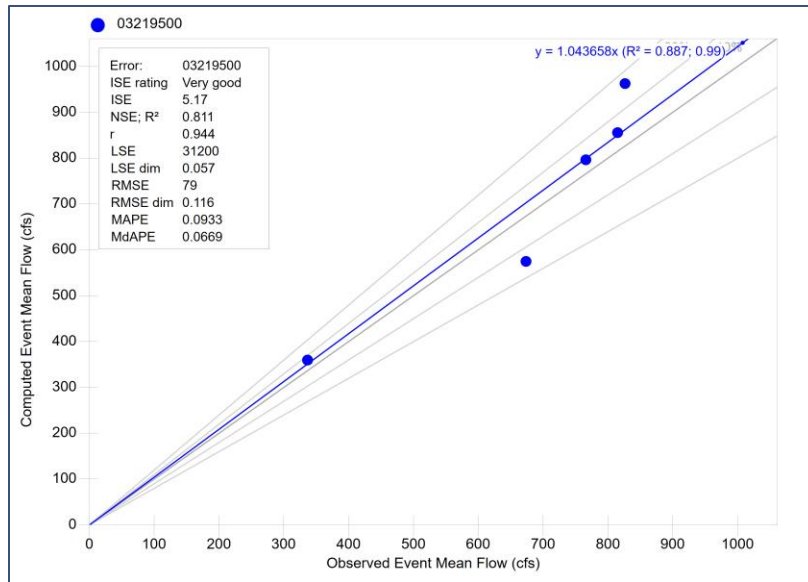
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2005	814.8	855.1	5%
	2006	673.4	574.7	-15%
	2007	766.1	796.0	4%
	2008	826.5	962.4	16%
	2009	336.5	359.0	7%
Validation	2010	392.5	316.6	-19%
	2011	1365.0	1336.0	-2%
	2012	509.9	525.5	3%
	2013	821.5	782.6	-5%
	2014	505.5	383.5	-24%
	2015	707.9	691.5	-2%
	2016	436.1	391.1	-10%
	2017	695.1	588.1	-15%
	2018	834.4	746.2	-11%
	2019	884.1	777.8	-12%
	2020	639.3	718.9	12%
	2021	480.2	411.9	-14%
	2022	571.3	456.4	-20%

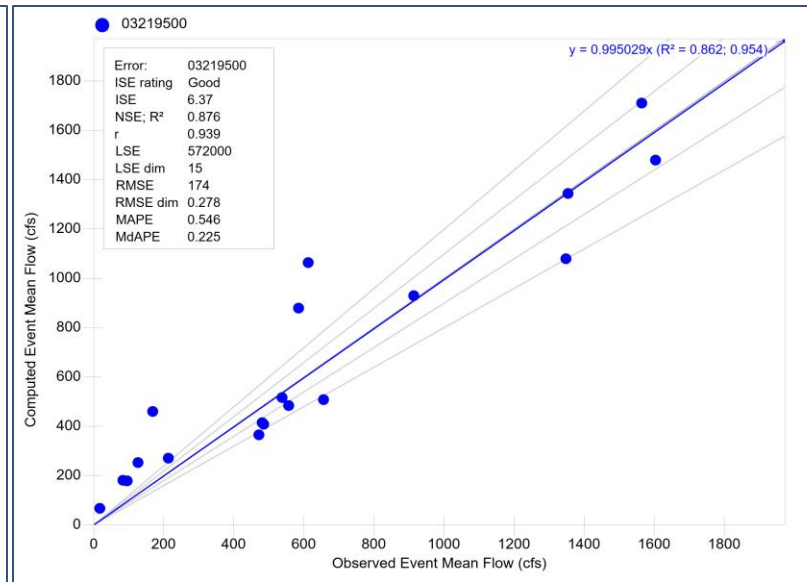
Calibration Summary

USGS Gauge 03219500

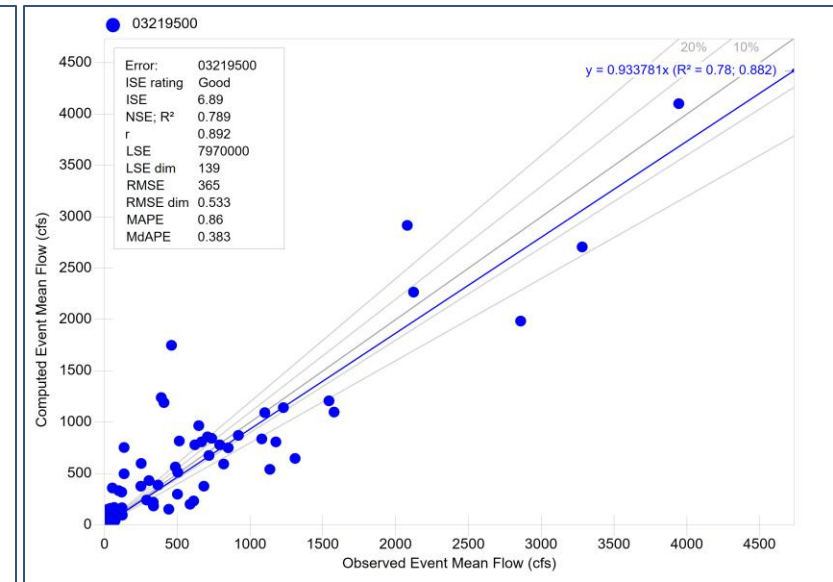
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

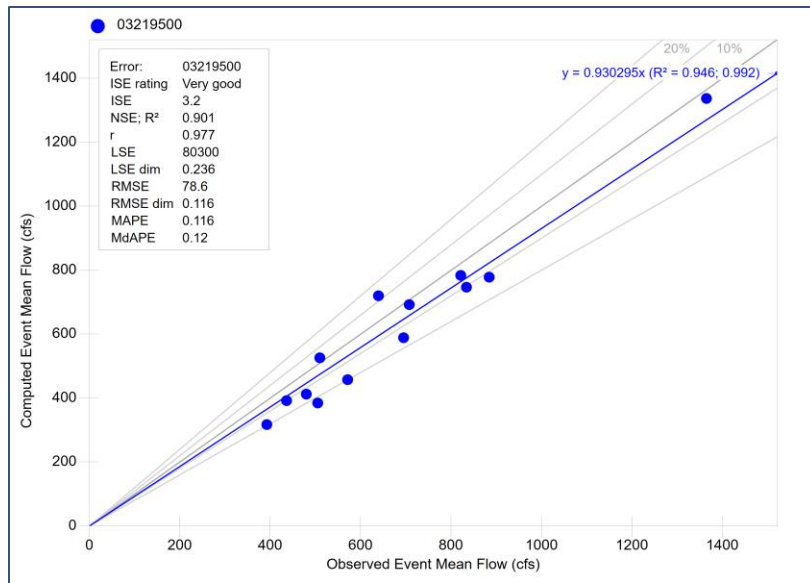


* 10% and 20% Error Bands Shown in Graphs

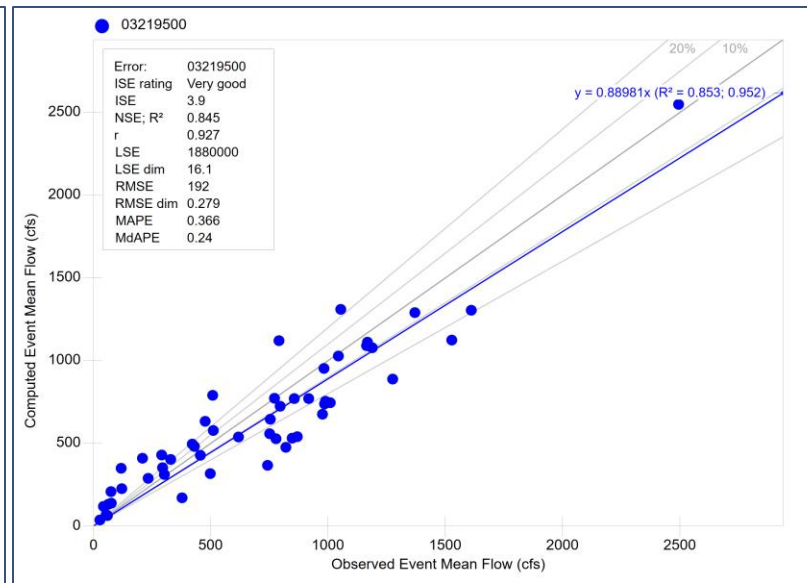
Validation Summary

USGS Gauge 03219500

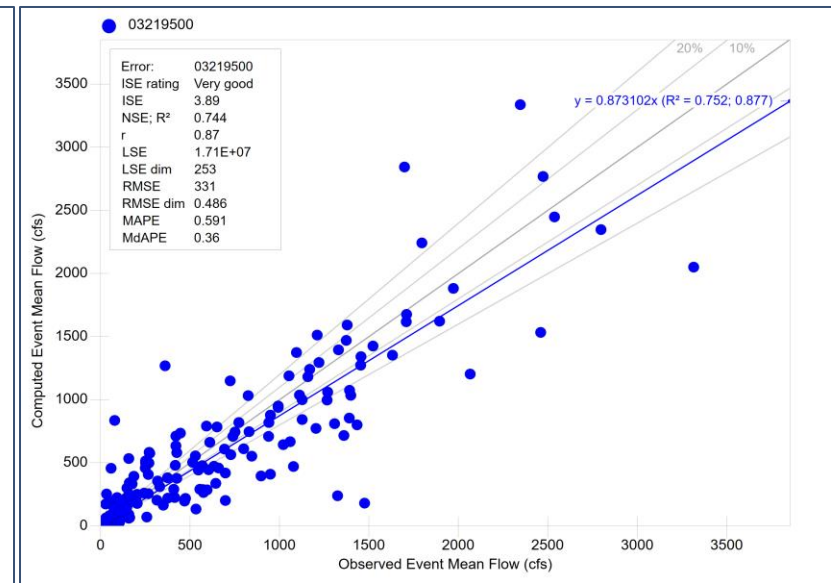
Annual Mean Flow



Seasonal Mean Flow



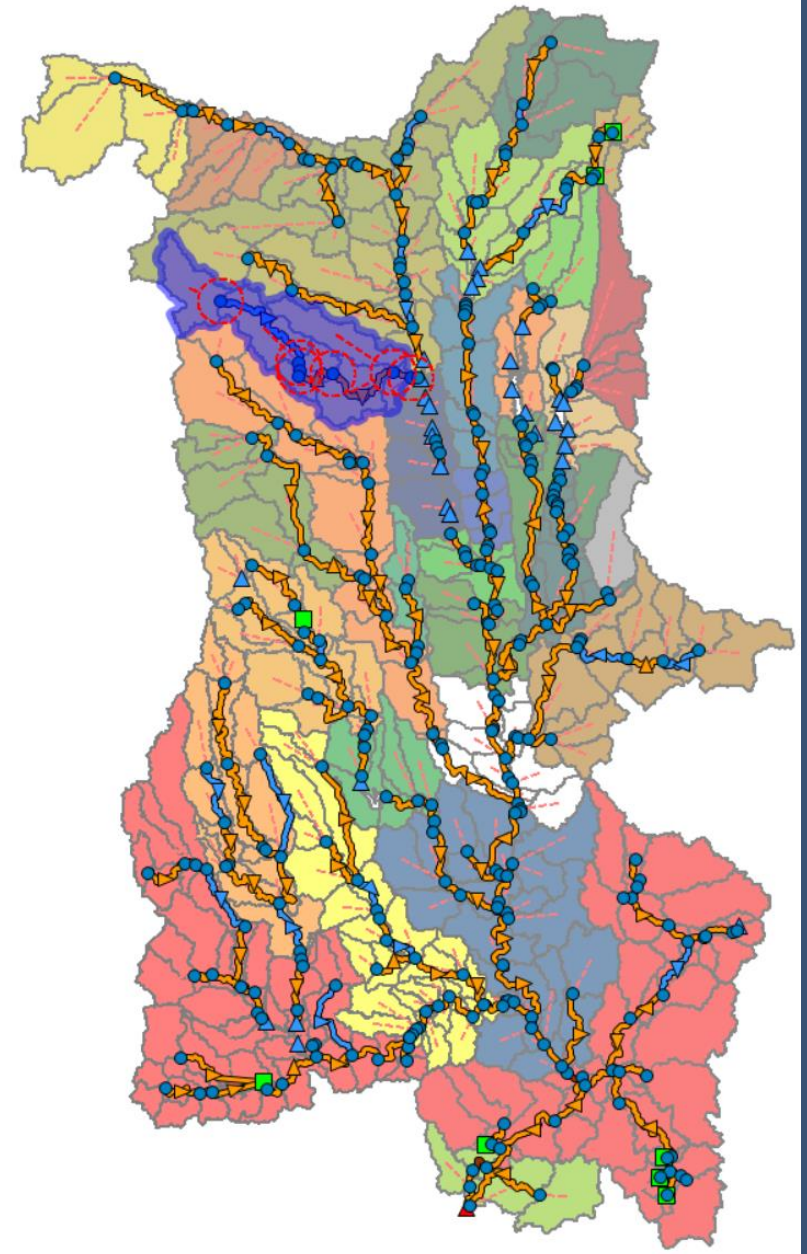
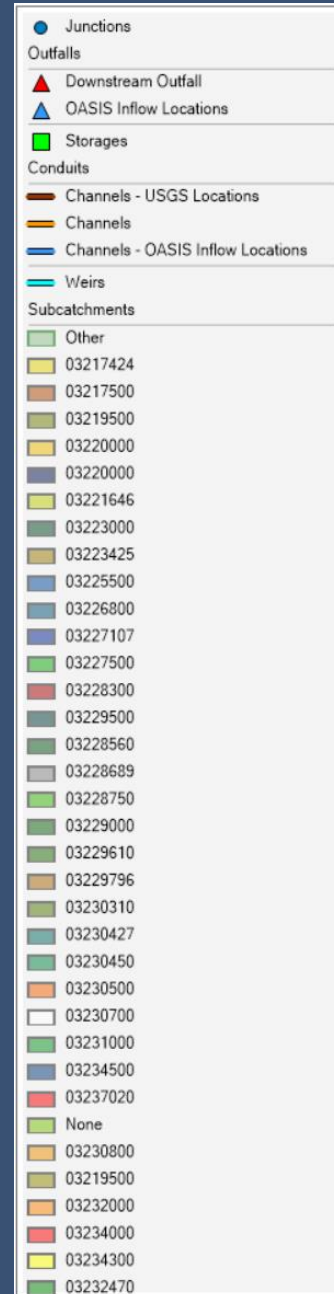
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03220000

Mill Creek near Bellepoint OH



Calibration Summary

USGS Gauge 03220000

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - None

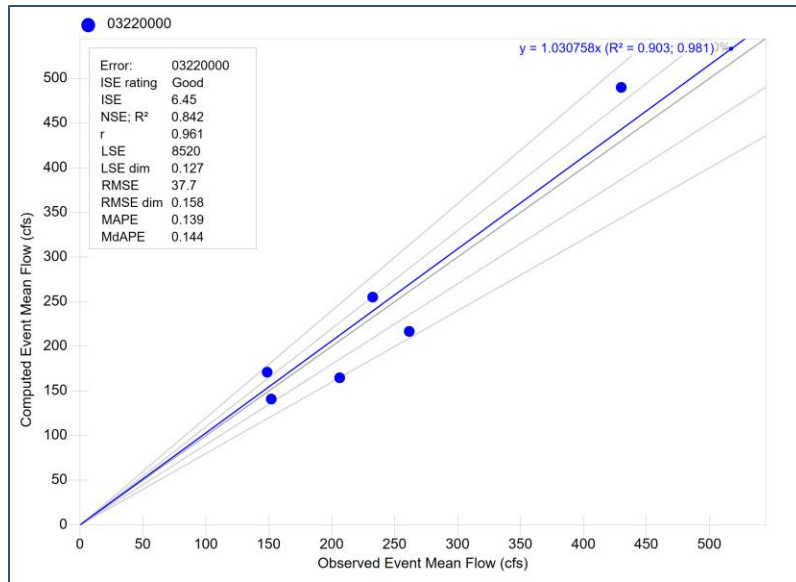
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	152.0	140.7	-7%
	2011	429.9	489.9	14%
	2012	148.8	171.0	15%
	2013	261.7	216.6	-17%
	2014	206.5	164.6	-20%
	2015	232.6	255.1	10%
Validation	2016	164.3	172.6	5%
	2017	236.5	203.4	-14%
	2018	338.6	325.2	-4%
	2019	292.0	288.6	-1%
	2020	229.3	297.0	30%
	2021	181.8	181.5	0%
	2022	231.3	228.2	-1%

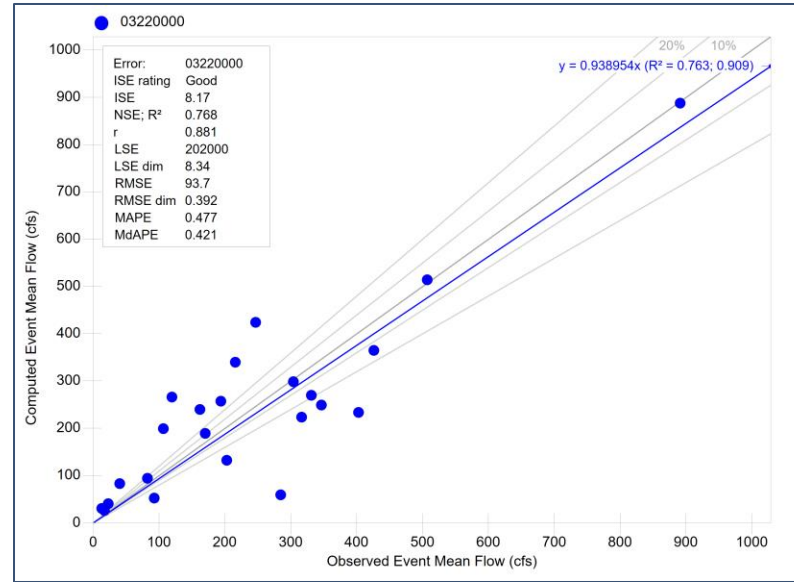
Calibration Summary

USGS Gauge 03220000

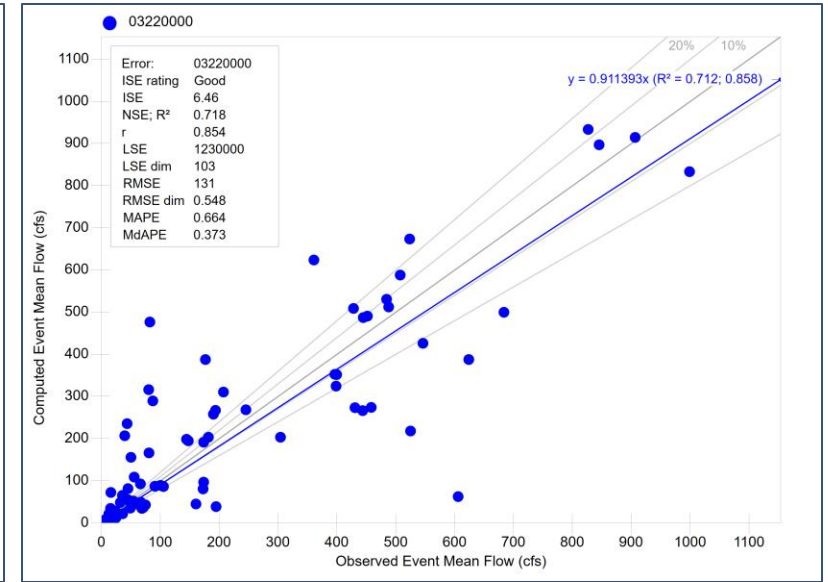
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

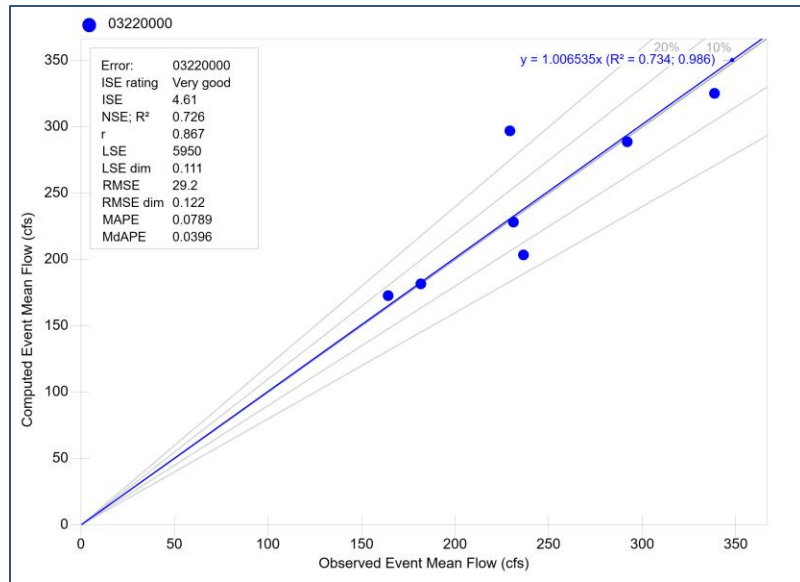


* 10% and 20% Error Bands Shown in Graphs

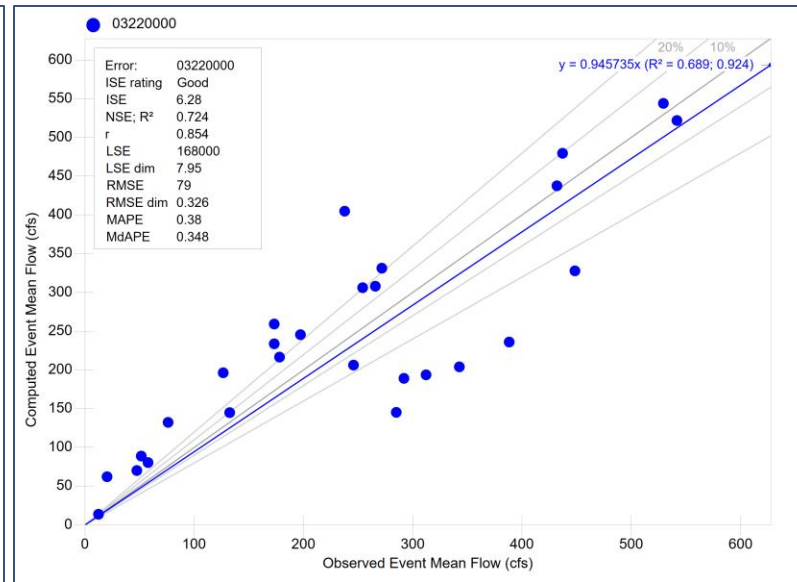
Validation Summary

USGS Gauge 03220000

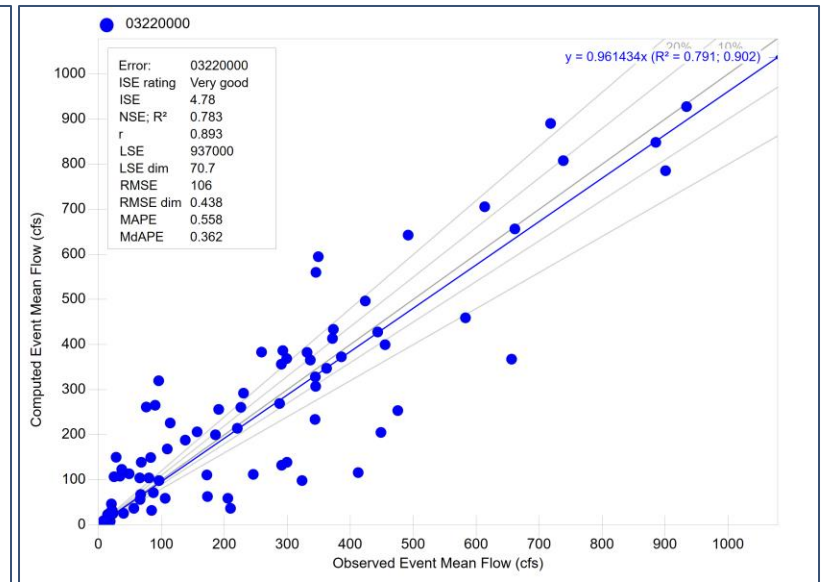
Annual Mean Flow



Seasonal Mean Flow



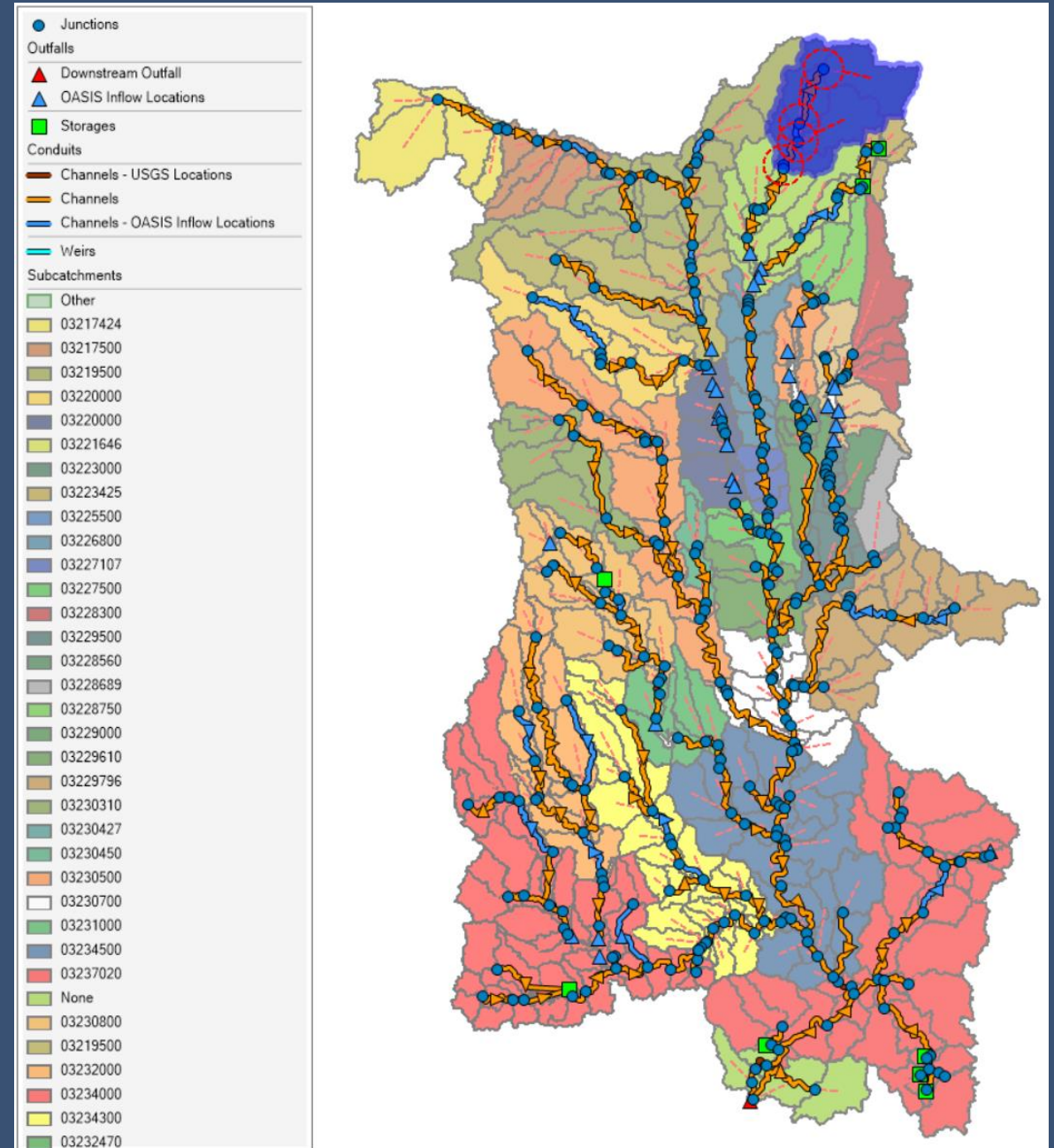
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03223000

Olentangy River at Claridon OH



Calibration Summary

USGS Gauge 03223000

- Calibration Period
 - 01/01/1990 – 01/01/1994
- Validation Period
 - 01/01/1994 – 01/01/1998
- Comments
 - None

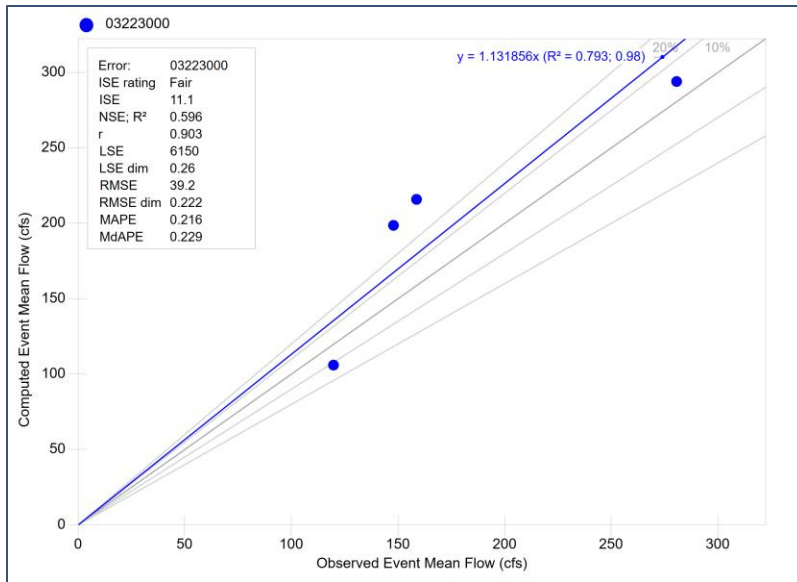
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	1990	280.7	293.8	5%
	1991	119.8	105.8	-12%
	1992	158.8	215.7	36%
	1993	148.0	198.4	34%
Validation	1994	121.1	120.9	0%
	1995	203.4	140.9	-31%
	1996	255.5	247.6	-3%
	1997	136.1	138.2	2%

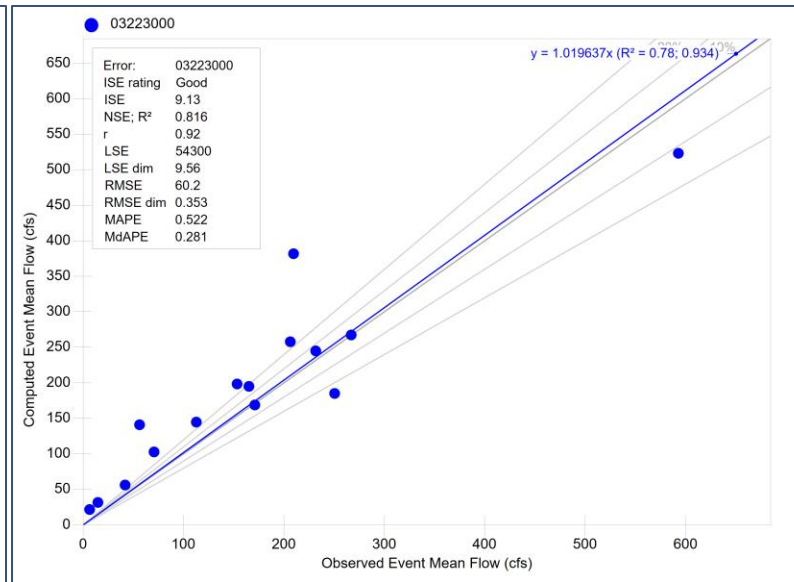
Calibration Summary

USGS Gauge 03223000

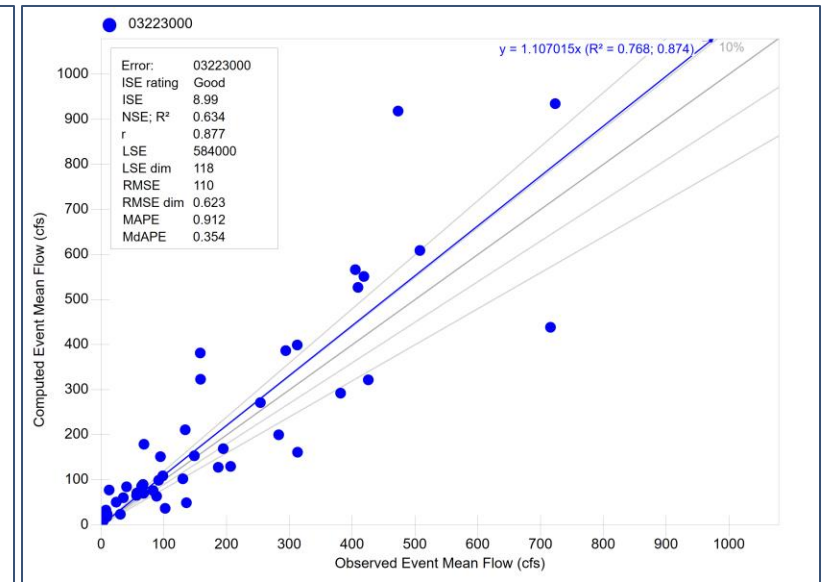
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

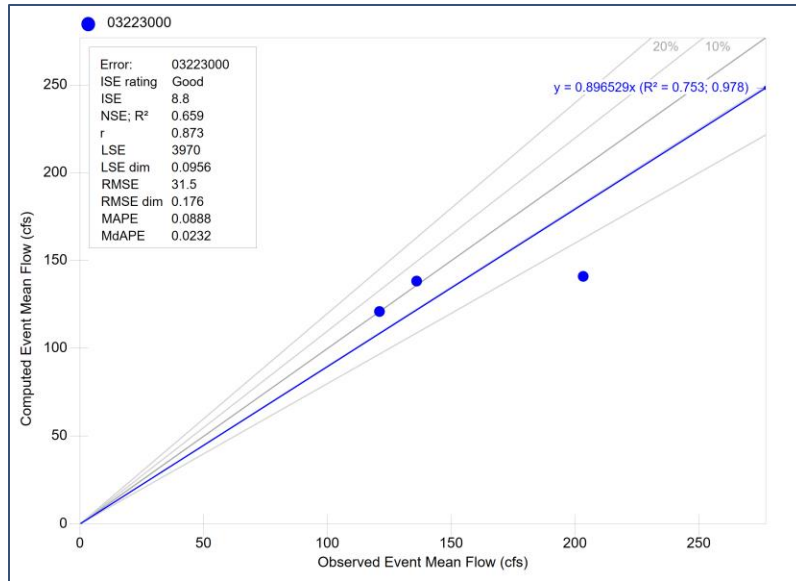


* 10% and 20% Error Bands Shown in Graphs

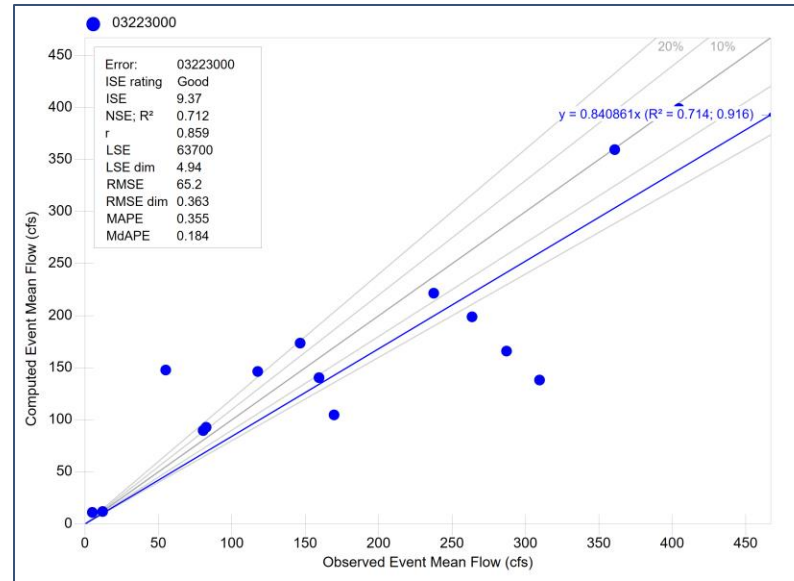
Validation Summary

USGS Gauge 03223000

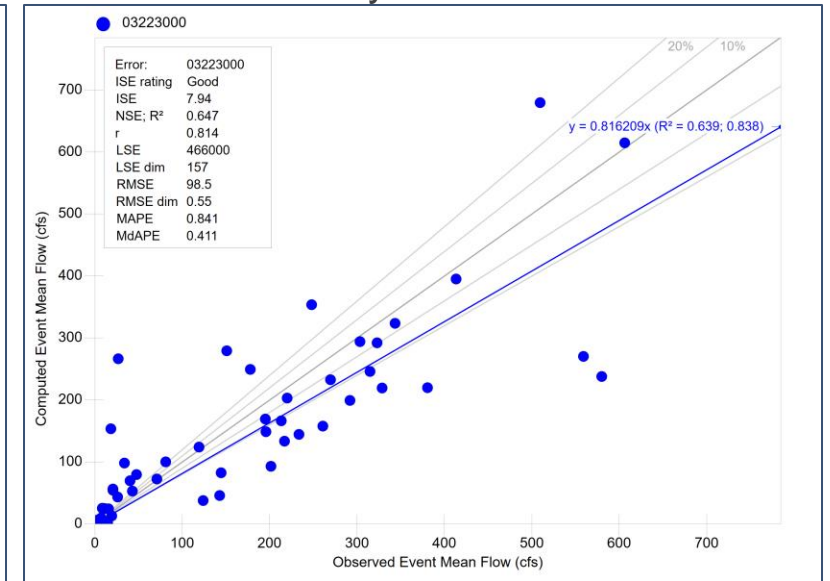
Annual Mean Flow



Seasonal Mean Flow



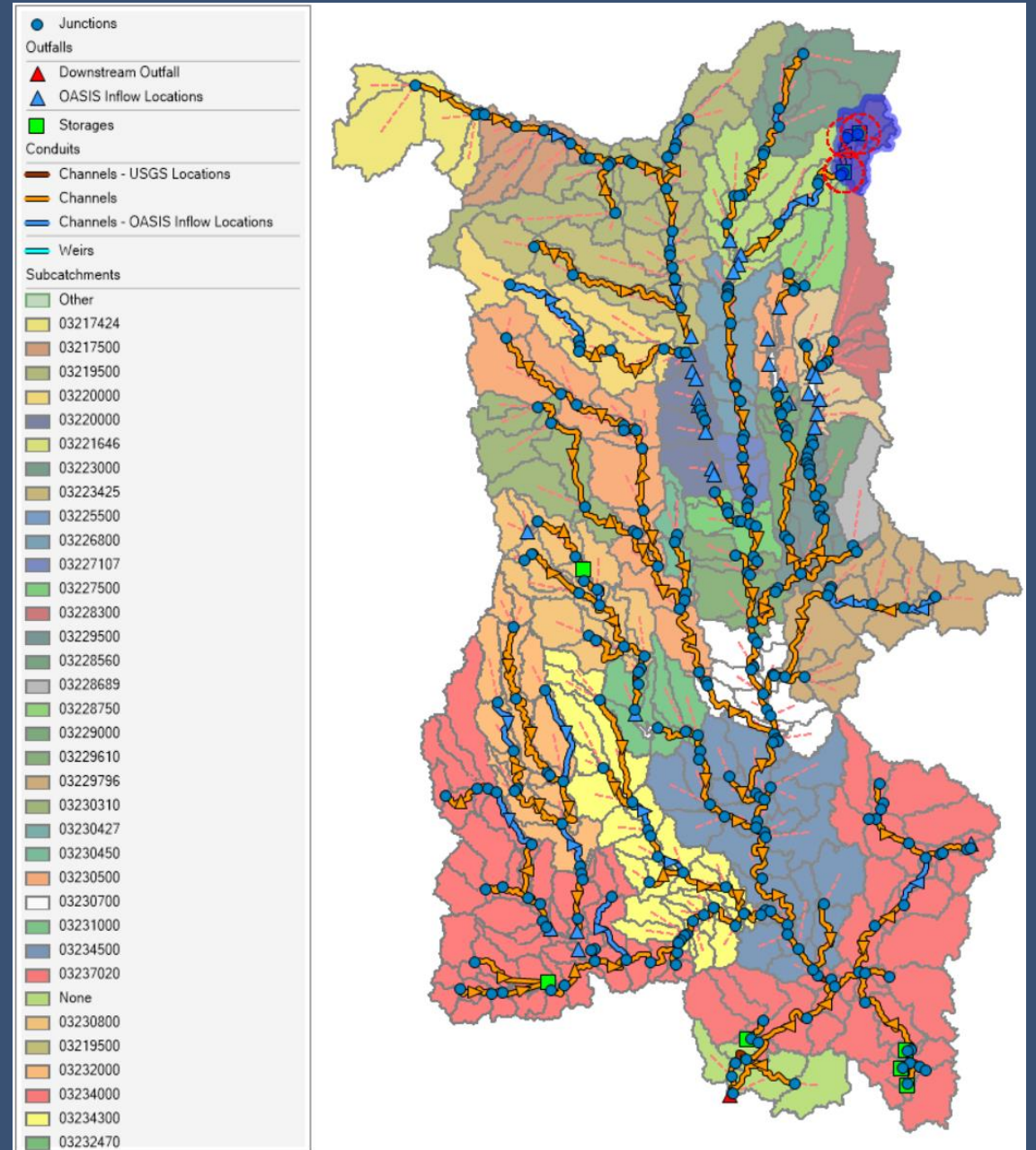
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03223425

Whetstone Creek at My Gilead OH



Calibration Summary

USGS Gauge 03223425

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - Two reservoirs in drainage area. Lake Candlewood did not have detailed Storage-Area-Elevation data. Lake Candlewood storage and weir parameters were assumed based on ODNR dam points attributes. Control rules were also unknown and not implemented.

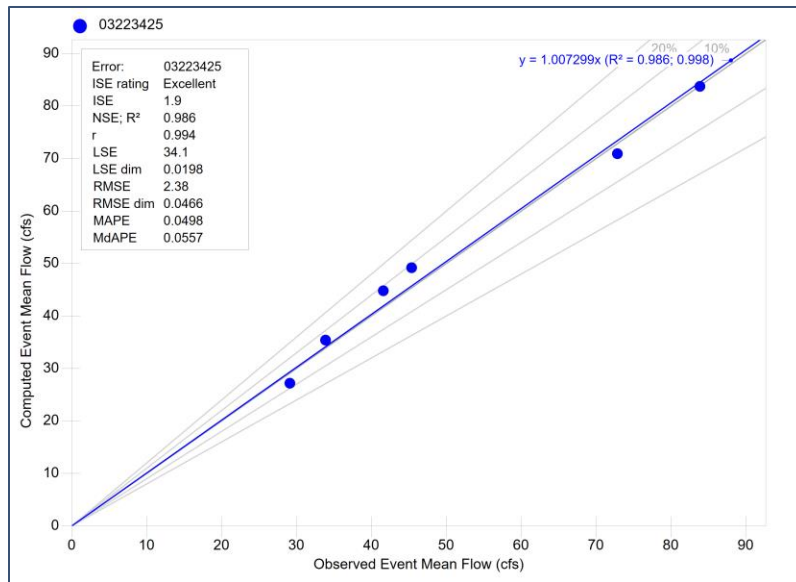
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	29.2	27.1	-7%
	2011	83.9	83.7	0%
	2012	45.4	49.2	8%
	2013	72.9	70.9	-3%
	2014	33.9	35.4	4%
	2015	41.6	44.8	8%
Validation	2016	36.8	30.8	-16%
	2017	50.5	48.6	-4%
	2018	57.4	66.6	16%
	2019	61.4	57.0	-7%
	2020	51.7	64.4	25%
	2021	38.5	49.6	29%
	2022	48.4	48.7	0%

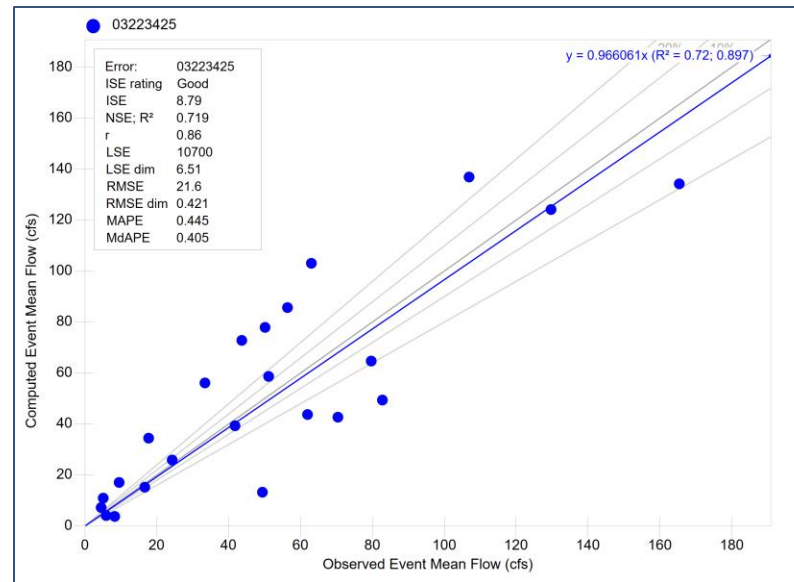
Calibration Summary

USGS Gauge 03223425

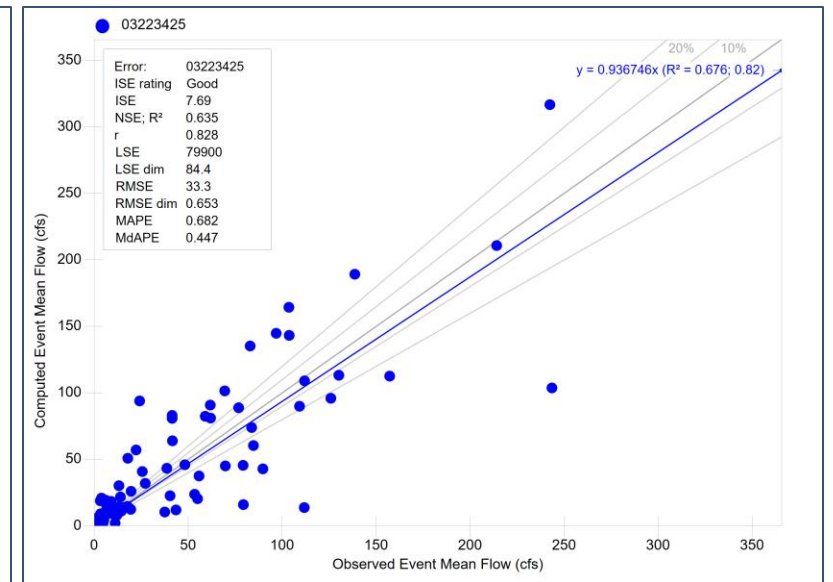
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

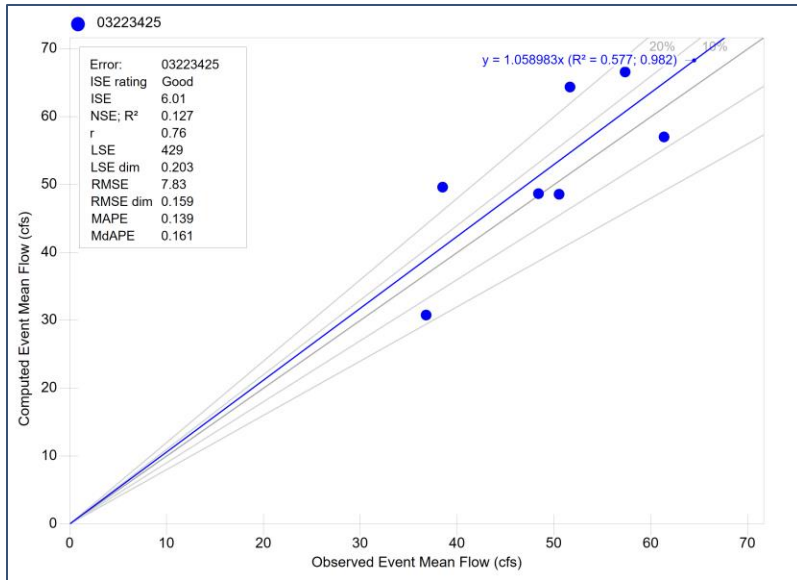


* 10% and 20% Error Bands Shown in Graphs

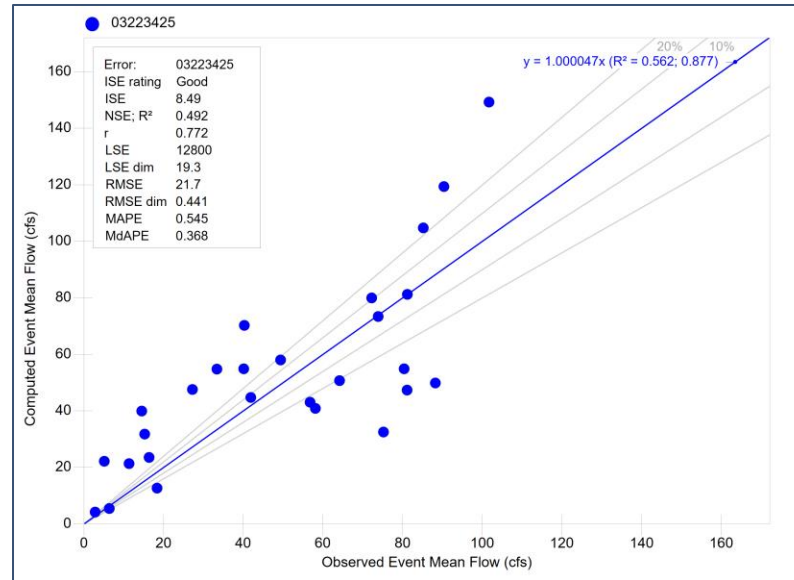
Validation Summary

USGS Gauge 03223425

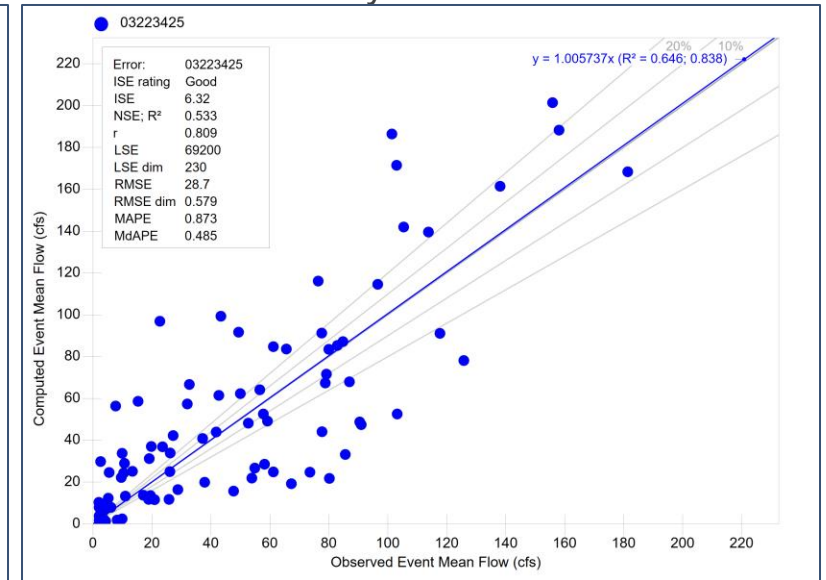
Annual Mean Flow



Seasonal Mean Flow



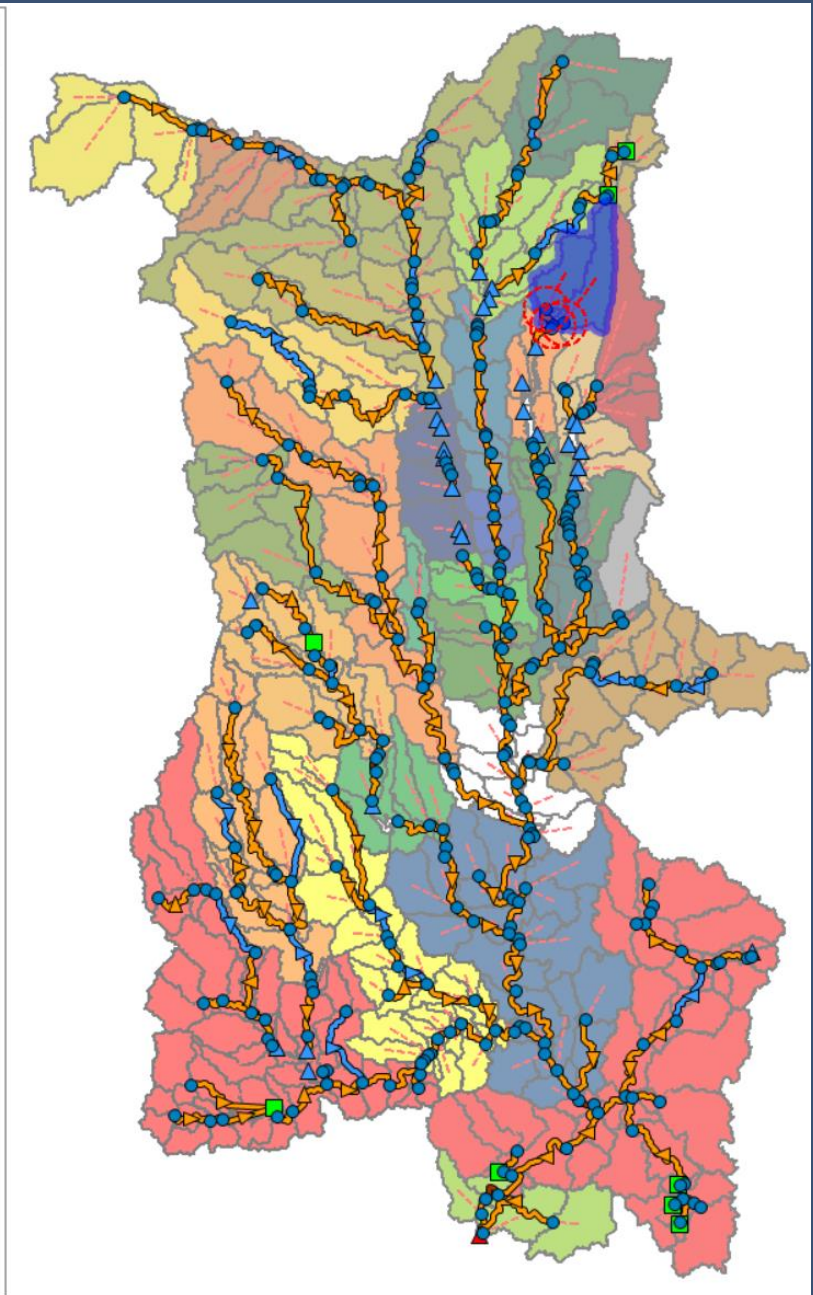
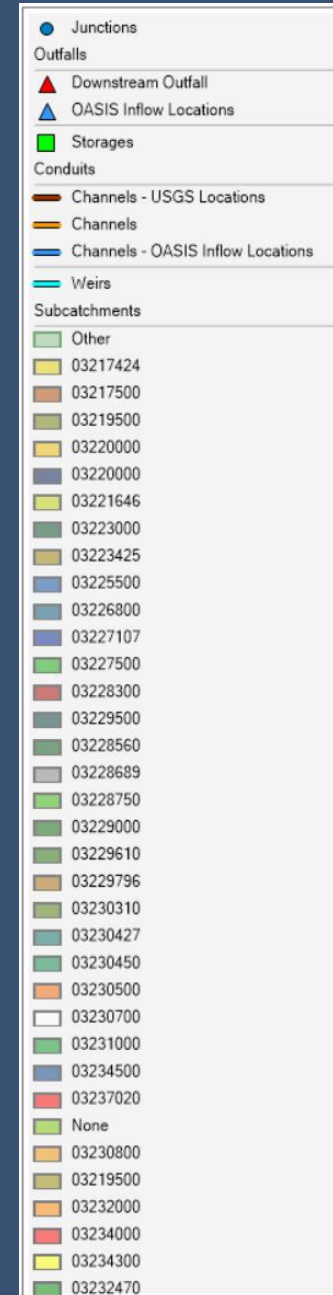
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03228750

Alum Creek near Kilbourne OH



Calibration Summary

USGS Gauge 03228750

- Calibration Period
 - 01/01/2000 – 01/01/2012
- Validation Period
 - 01/01/2012 – 01/01/2023
- Comments
 - None

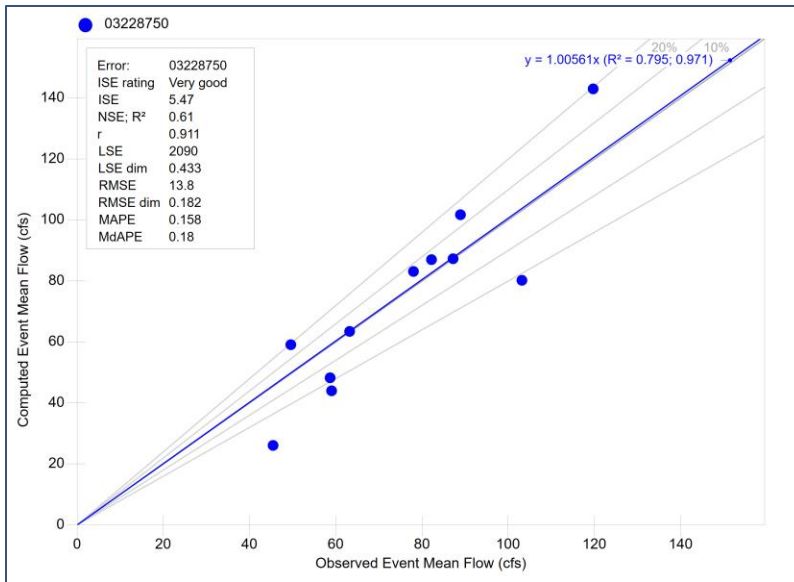
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2001	59.1	43.9	-26%
	2002	49.6	58.9	19%
	2003	103.2	80.1	-22%
	2004	89.0	101.5	14%
	2005	87.2	87.1	0%
	2006	63.3	63.3	0%
	2007	78.1	83.0	6%
	2008	82.2	86.9	6%
	2009	58.7	48.2	-18%
	2010	45.5	26.0	-43%
	2011	119.7	142.8	19%
Validation	2012	46.2	77.1	67%
	2013	85.0	93.3	10%
	2014	90.2	68.2	-24%
	2015	113.5	103.8	-9%
	2016	58.8	53.7	-9%
	2017	93.9	67.4	-28%
	2018	122.2	123.9	1%
	2019	114.1	125.1	10%
	2020	92.6	105.4	14%
	2021	84.4	65.7	-22%
	2022	98.8	85.9	-13%

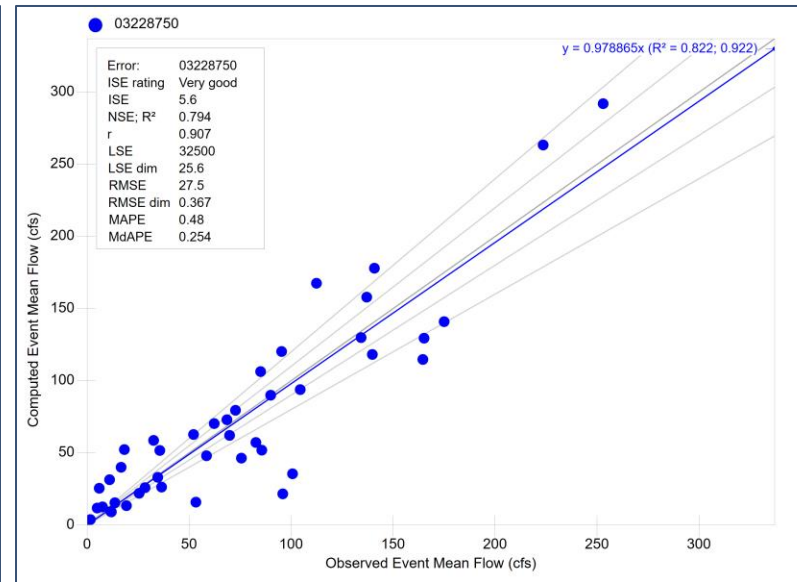
Calibration Summary

USGS Gauge 03228750

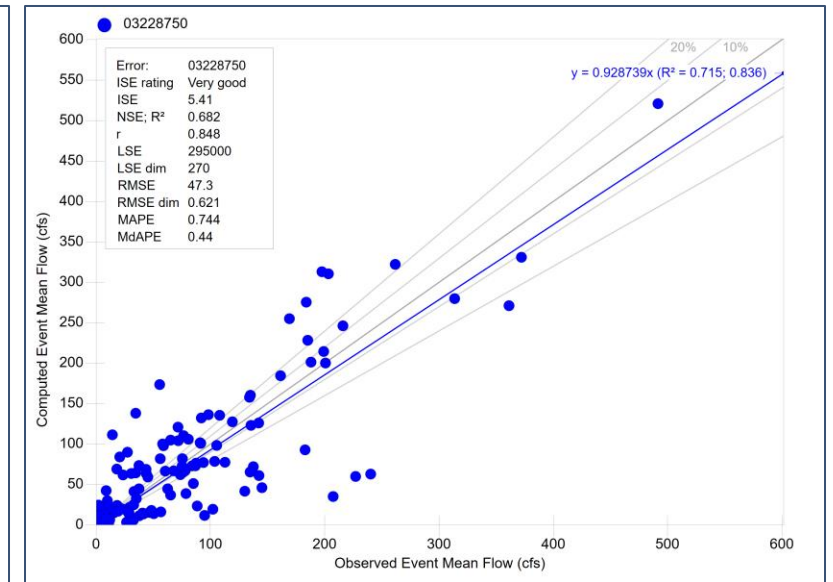
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

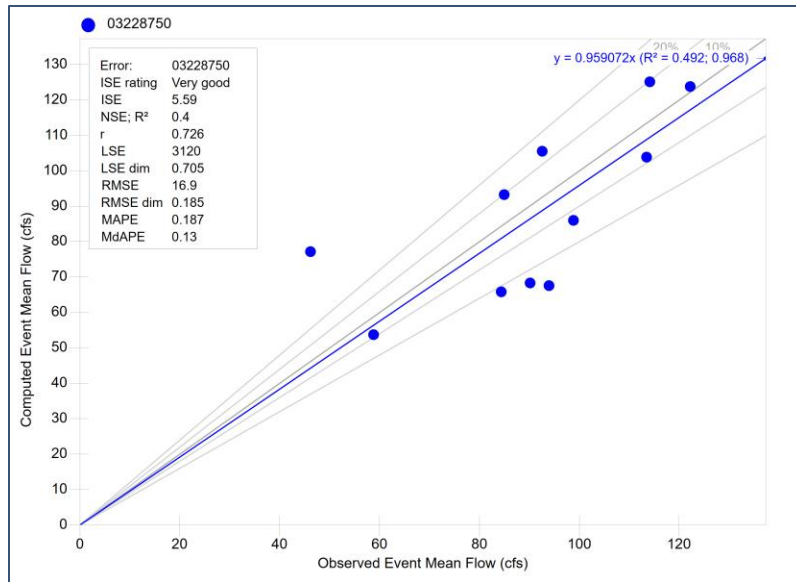


* 10% and 20% Error Bands Shown in Graphs

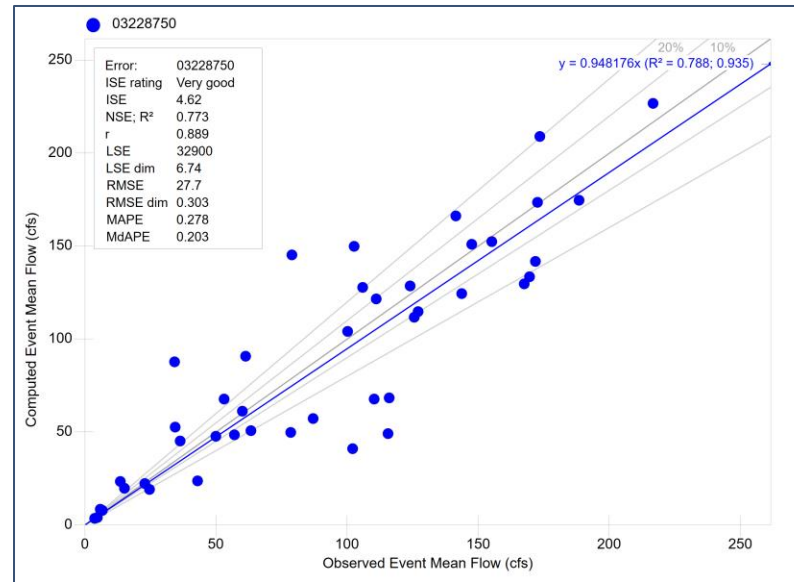
Validation Summary

USGS Gauge 03228750

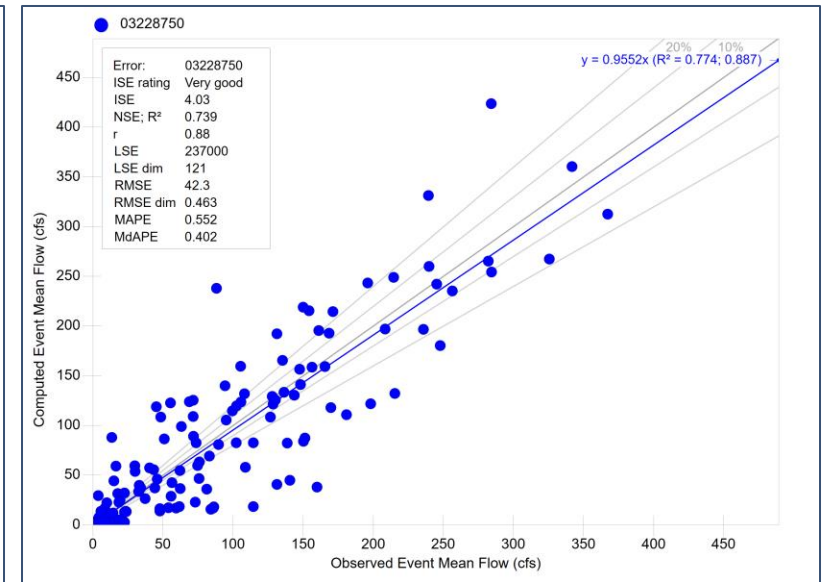
Annual Mean Flow



Seasonal Mean Flow



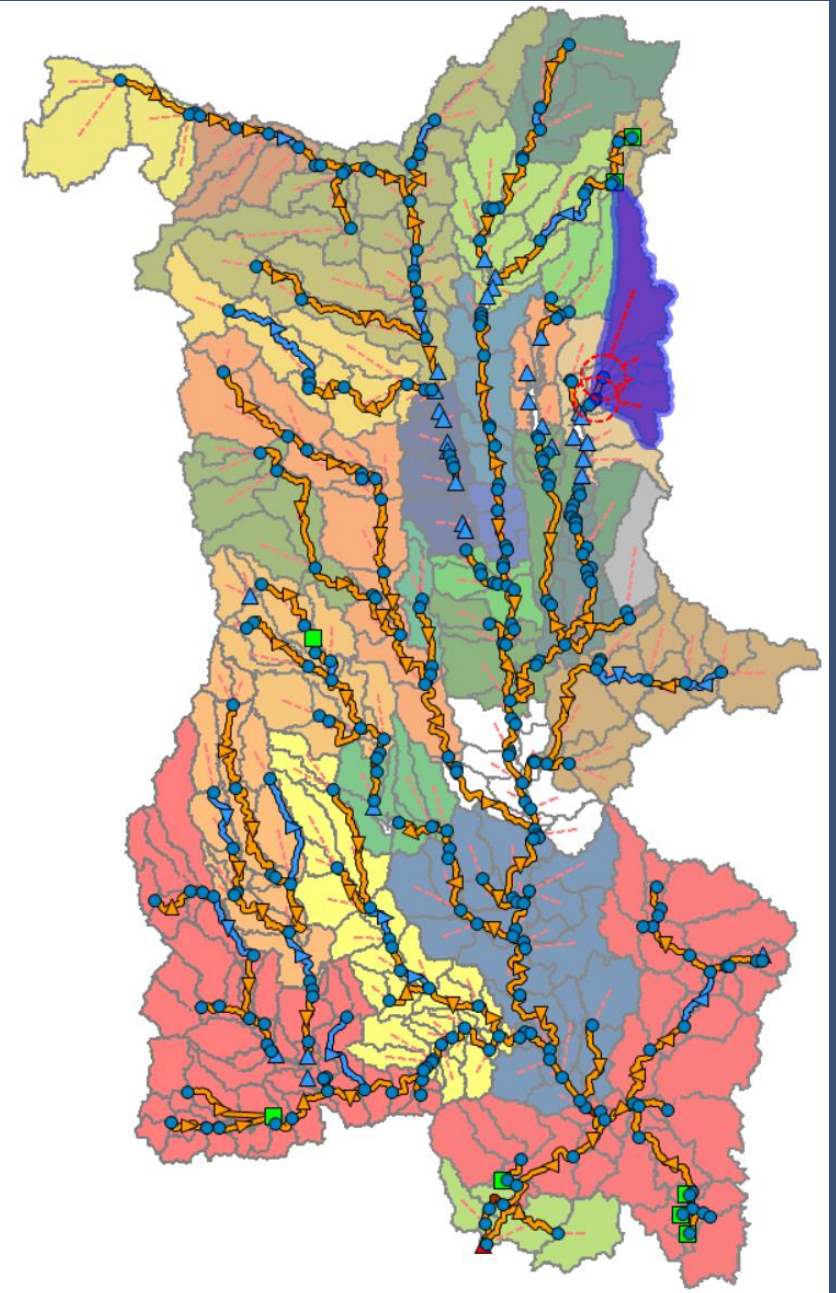
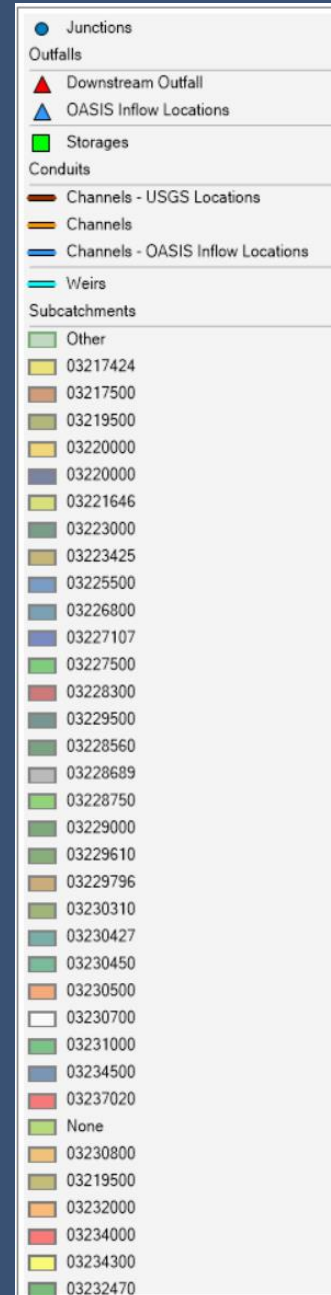
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03228300

Big Walnut Creek at Sunbury OH



Calibration Summary

USGS Gauge 03228300

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - None

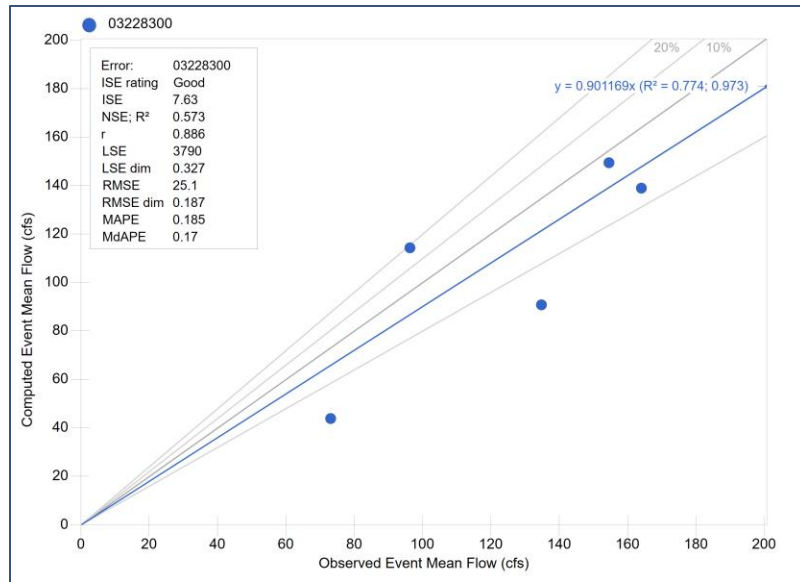
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	73.2	43.8	-40%
	2011	183.1	181.5	-1%
	2012	96.3	114.3	19%
	2013	154.6	149.4	-3%
	2014	134.8	90.8	-33%
	2015	164.1	138.9	-15%
Validation	2016	90.8	91.4	1%
	2017	131.3	125.2	-5%
	2018	185.6	167.6	-10%
	2019	159.0	201.2	27%
	2020	159.0	155.5	-2%
	2021	141.0	95.5	-32%
	2022	150.6	135.9	-10%

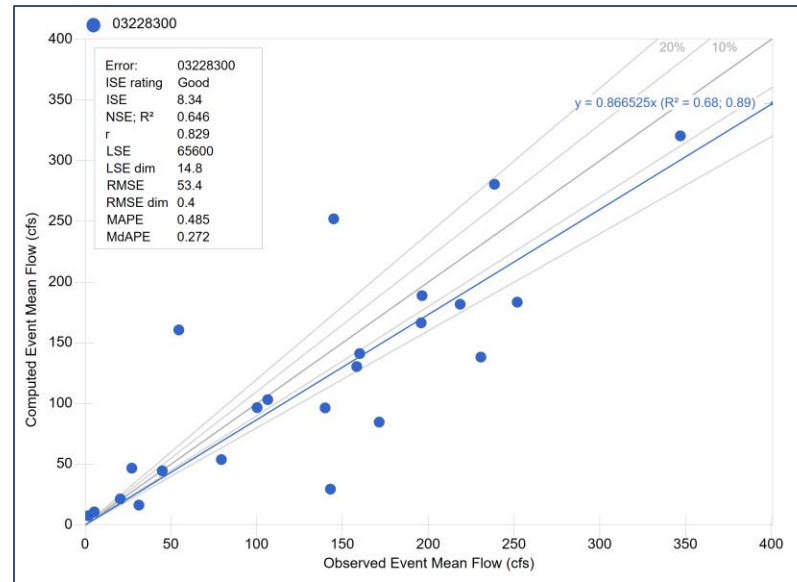
Calibration Summary

USGS Gauge 03228300

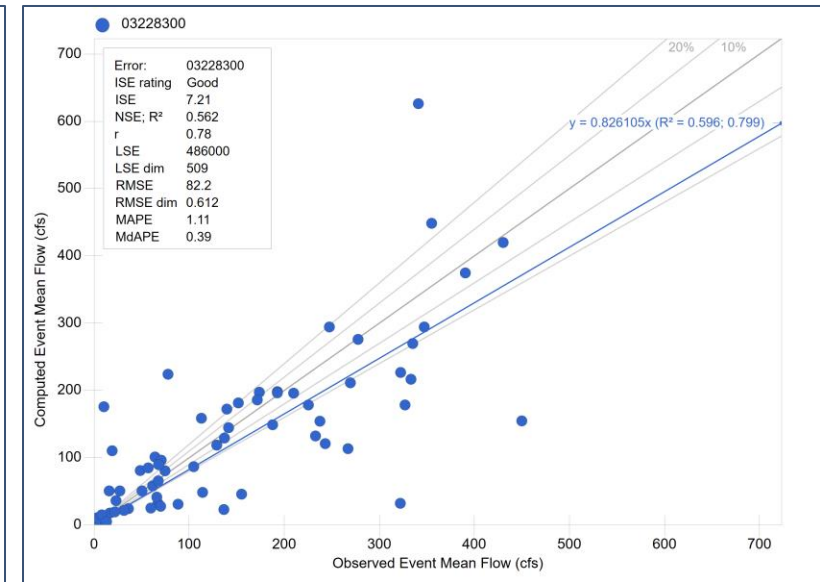
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

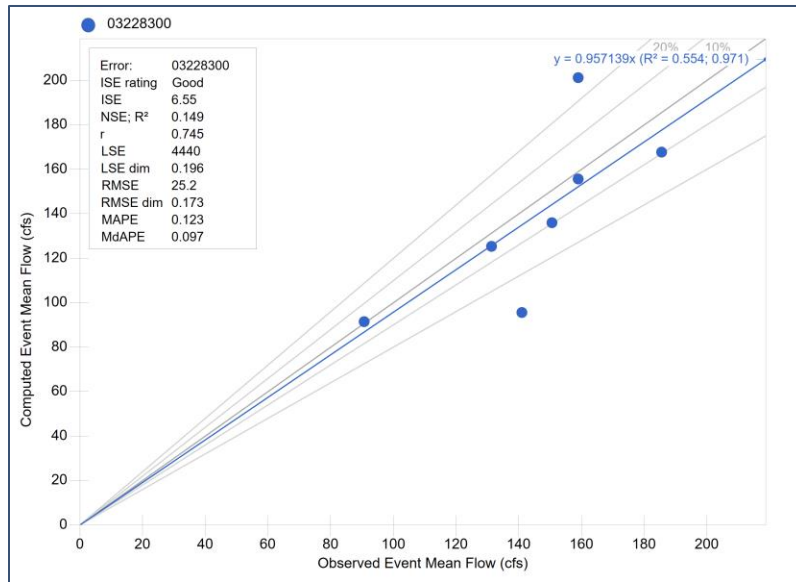


* 10% and 20% Error Bands Shown in Graphs

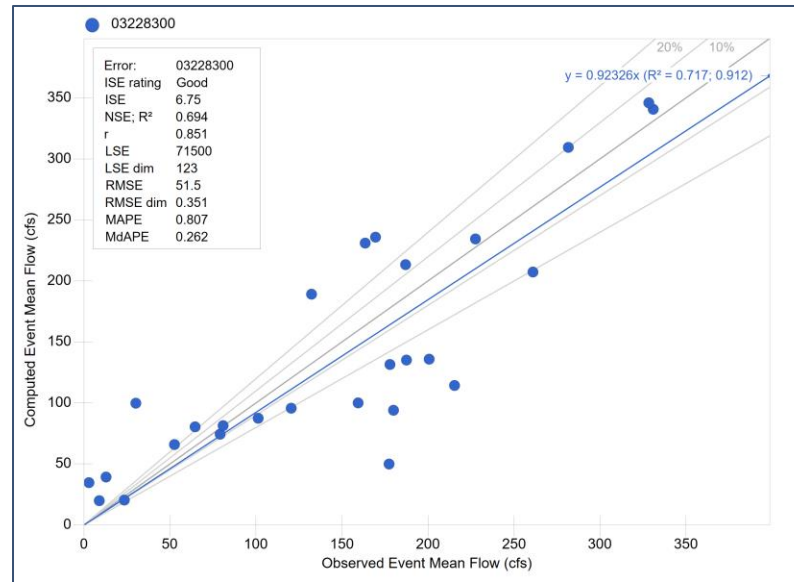
Validation Summary

USGS Gauge 03228300

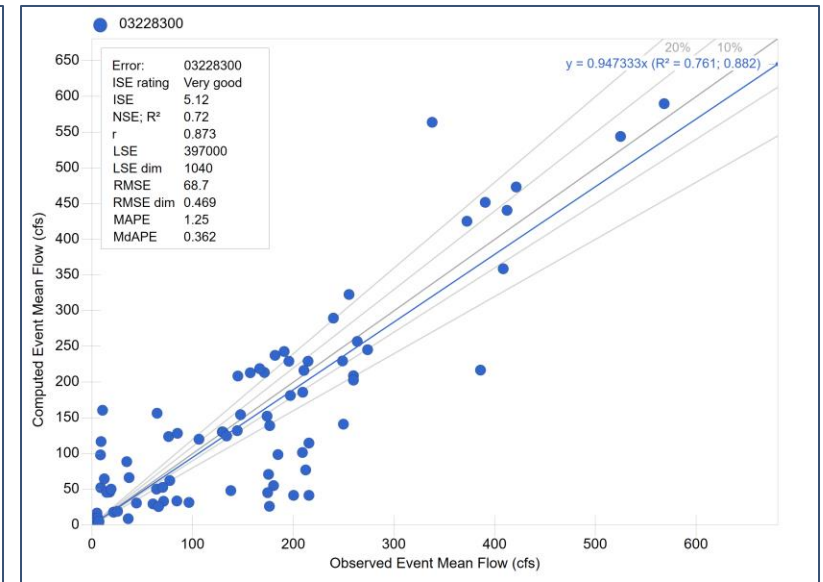
Annual Mean Flow



Seasonal Mean Flow



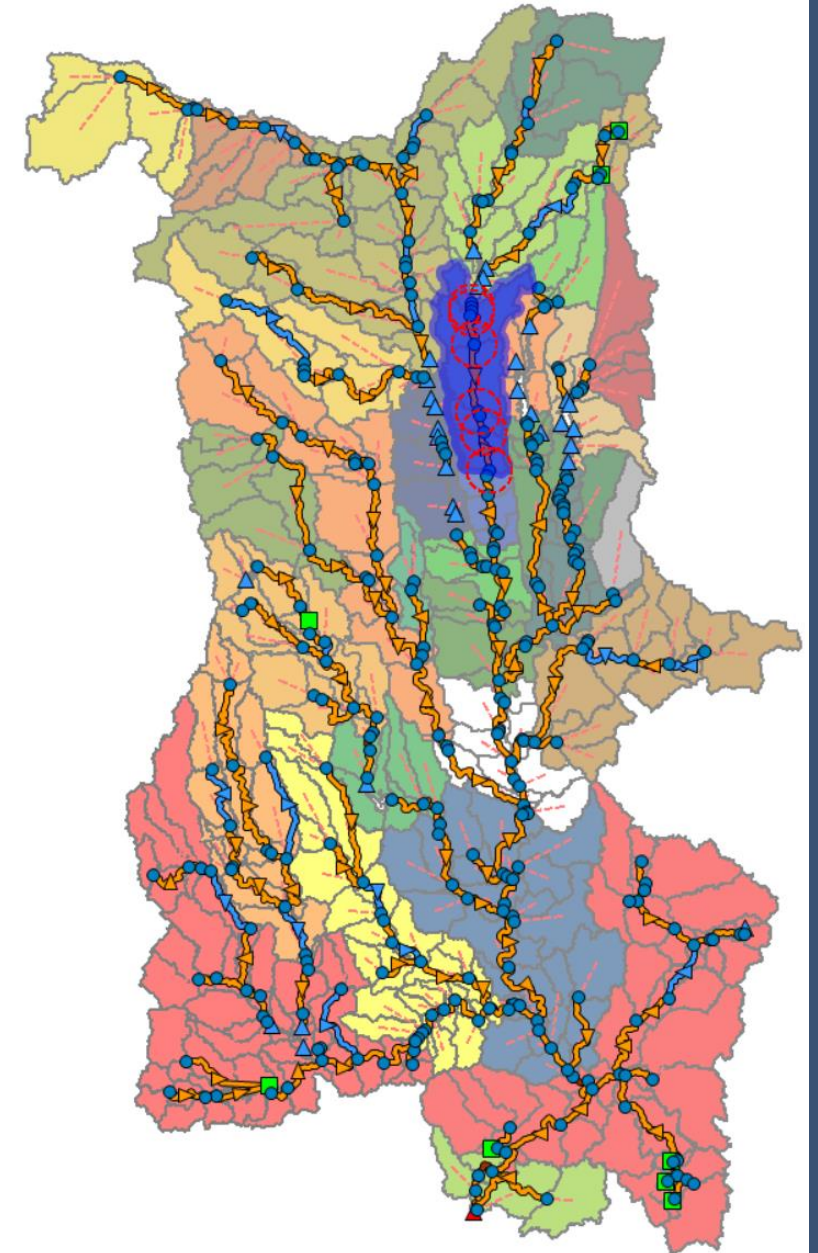
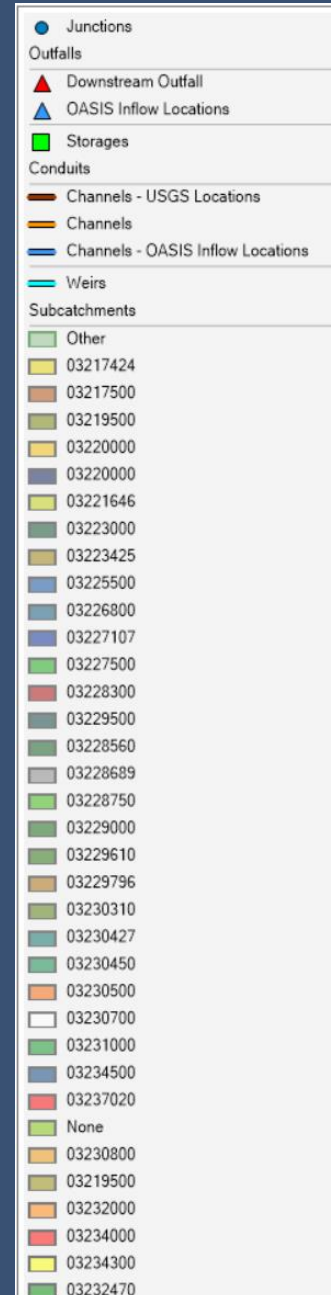
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03226800

Olentangy River near Worthington OH



Calibration Summary

USGS Gauge 03226800

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - **Upstream USGS gauge 03225500 used as boundary condition**
 - *Overflow from Delaware lake. Downstream flow is heavily influenced by releases from the dam that are handled in OASIS.*

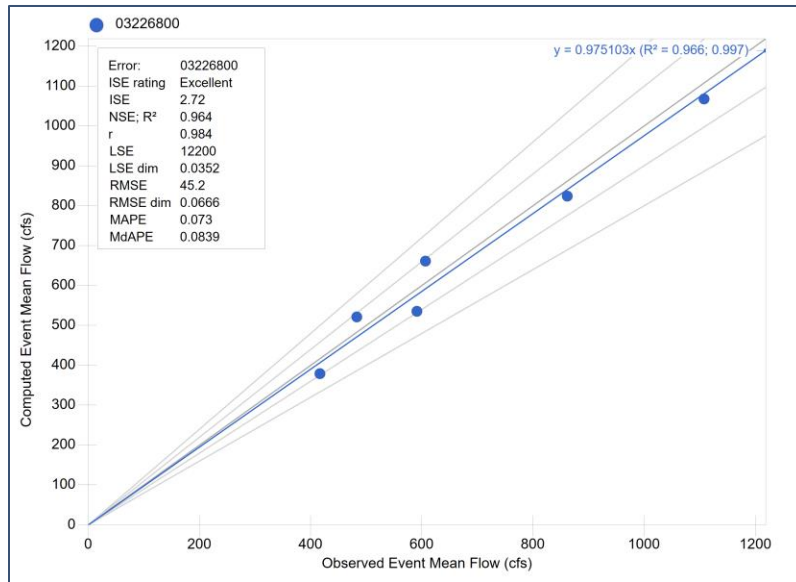
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	417.3	378.7	-9%
	2011	1108.0	1067.0	-4%
	2012	483.1	521.1	8%
	2013	861.9	823.4	-4%
	2014	591.7	535.0	-10%
	2015	606.7	660.8	9%
Validation	2016	483.2	461.8	-4%
	2017	652.2	671.9	3%
	2018	796.4	831.3	4%
	2019	839.6	864.9	3%
	2020	704.4	755.2	7%
	2021	567.2	563.7	-1%
	2022	612.2	642.7	5%

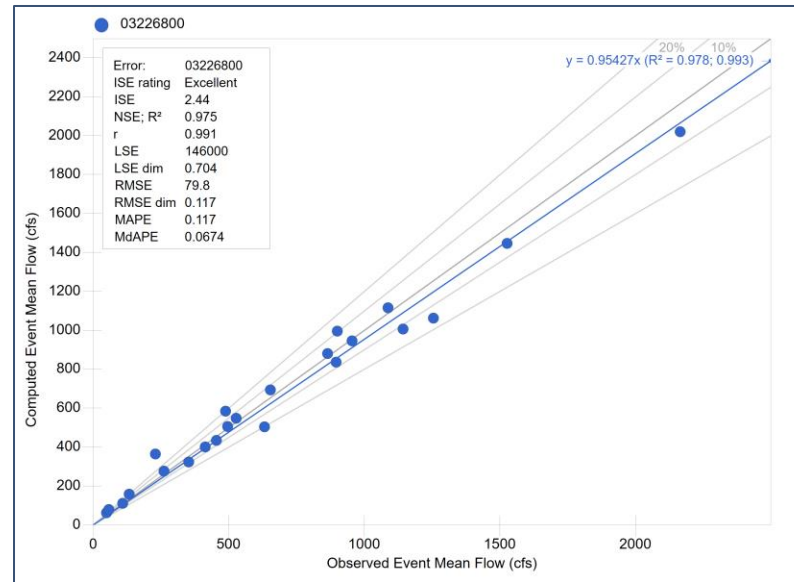
Calibration Summary

USGS Gauge 03226800

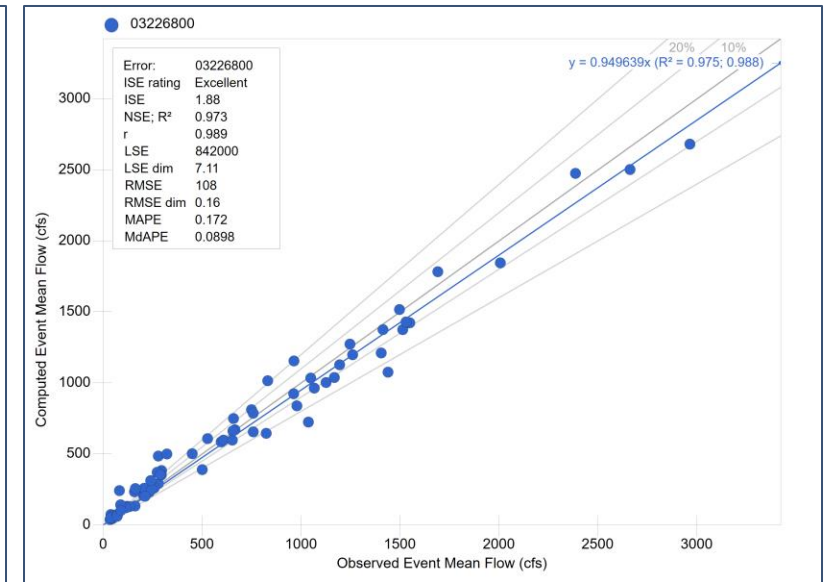
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

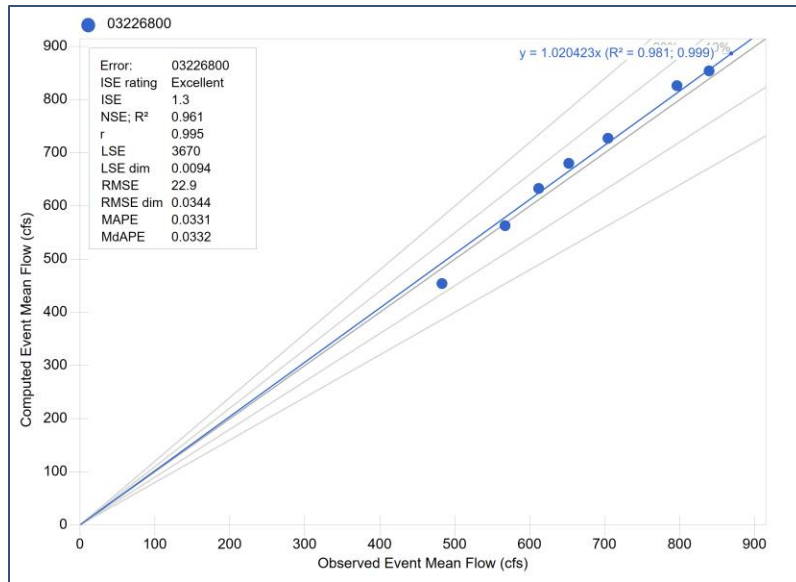


* 10% and 20% Error Bands Shown in Graphs

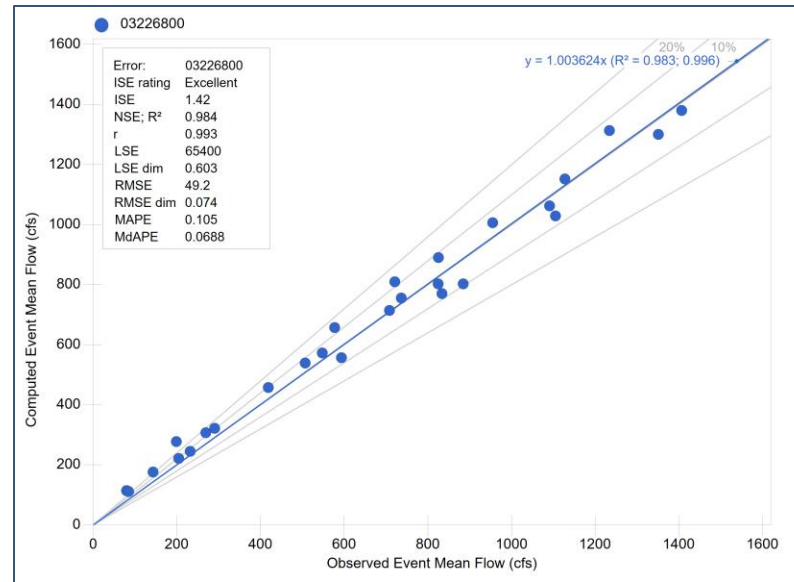
Validation Summary

USGS Gauge 03226800

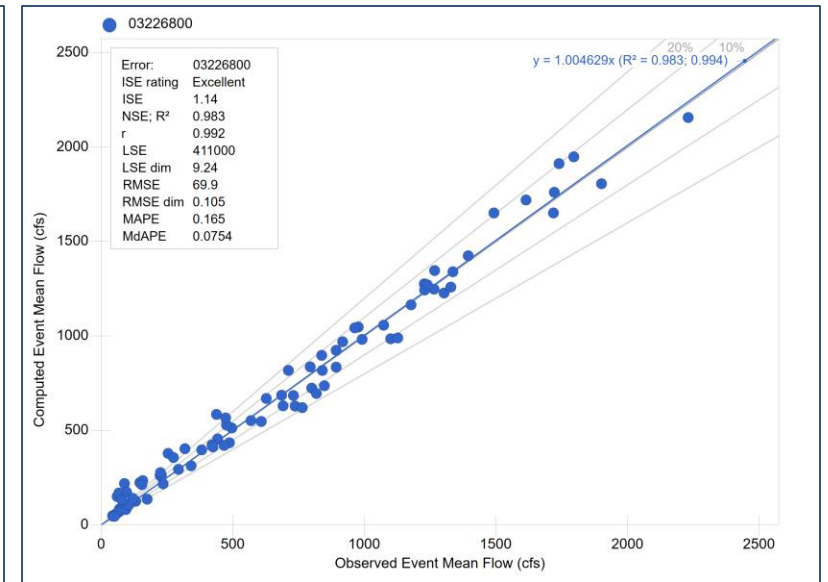
Annual Mean Flow



Seasonal Mean Flow



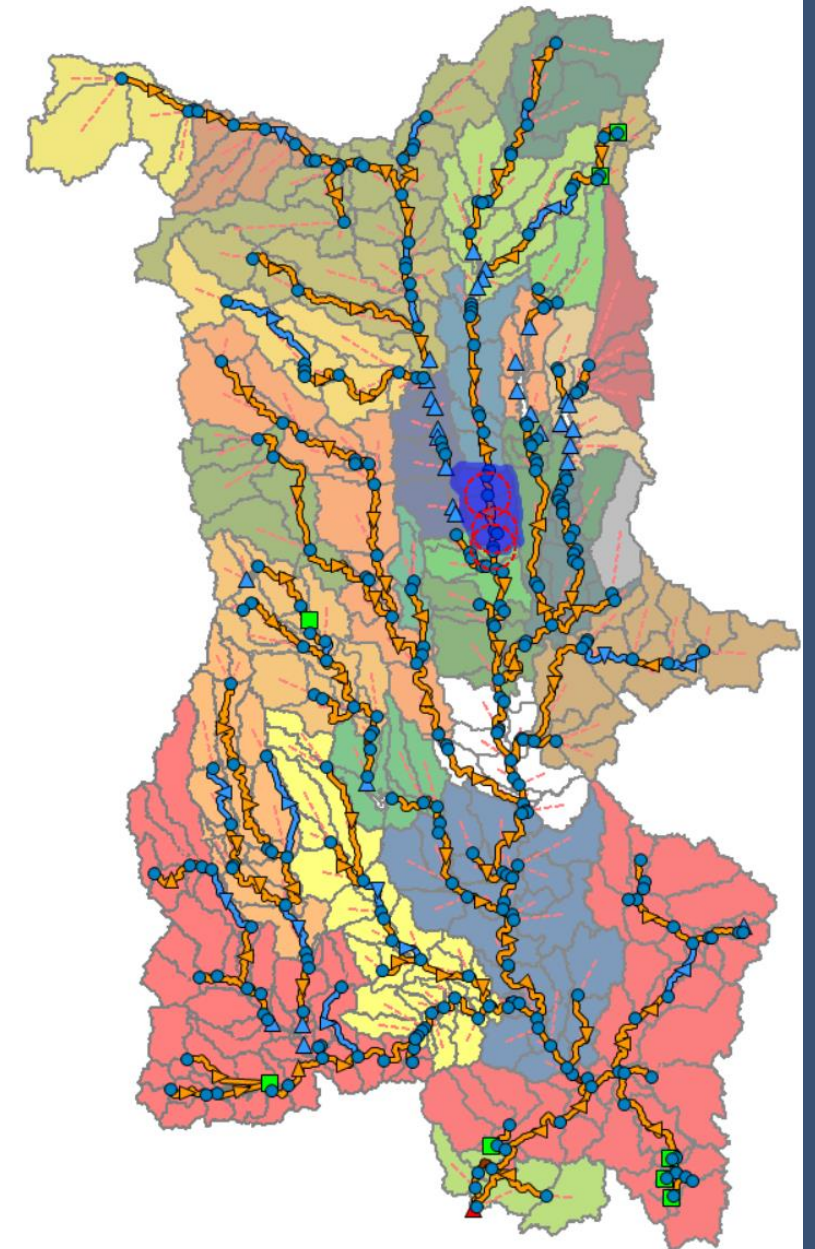
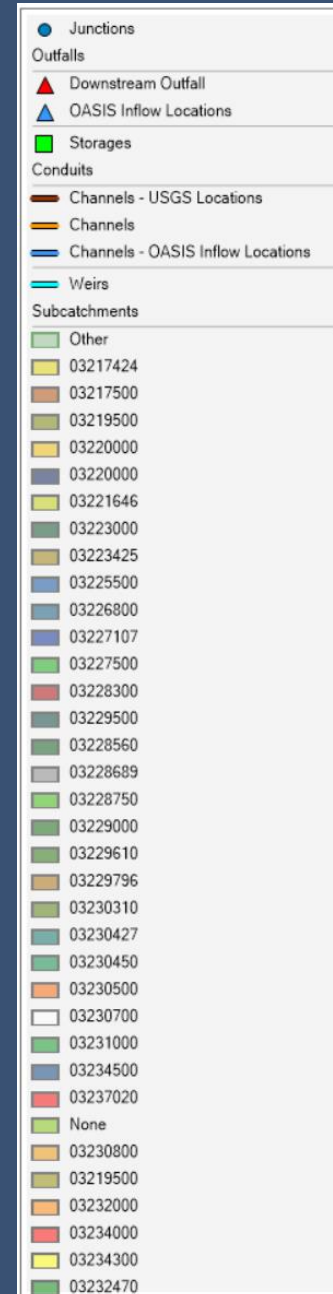
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03227107

Olentangy River at J H Herrick Dr at Columbus OH



Calibration Summary

USGS Gauge 03227107

- Calibration Period
 - 01/01/2015 – 01/01/2023
- Validation Period
 - None
- Comments
 - **Upstream USGS gauge 03225500 used as boundary condition**
 - *Overflow from Delaware lake. Downstream flow is influenced by releases from the dam that are handled in OASIS.*

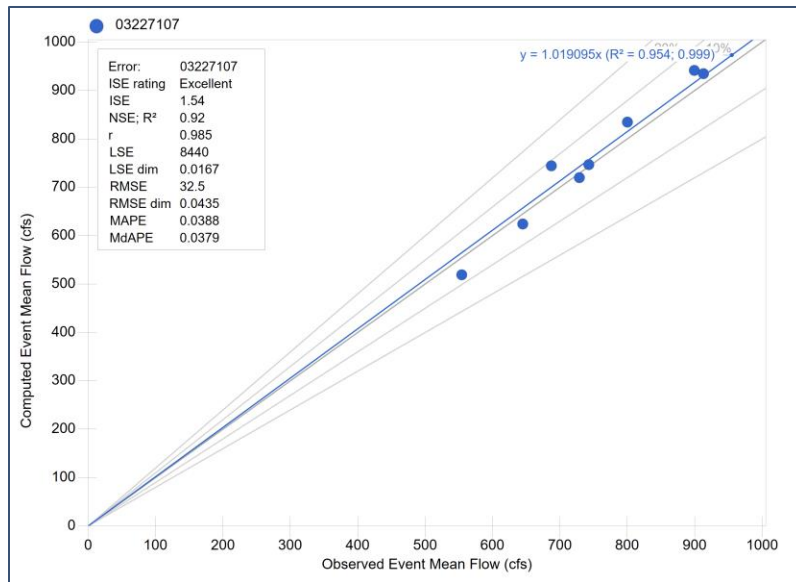
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2015	687.4	744.4	8%
	2016	554.3	519.1	-6%
	2017	742.8	746.6	1%
	2018	899.5	941.5	5%
	2019	913.2	934.7	2%
	2020	800.2	834.6	4%
	2021	644.8	623.7	-3%
	2022	729.2	720	-1%

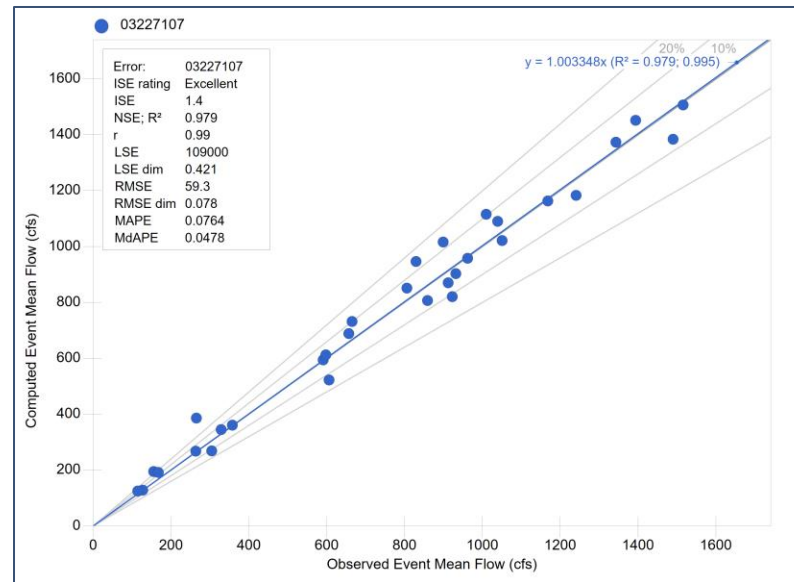
Calibration Summary

USGS Gauge 03227107

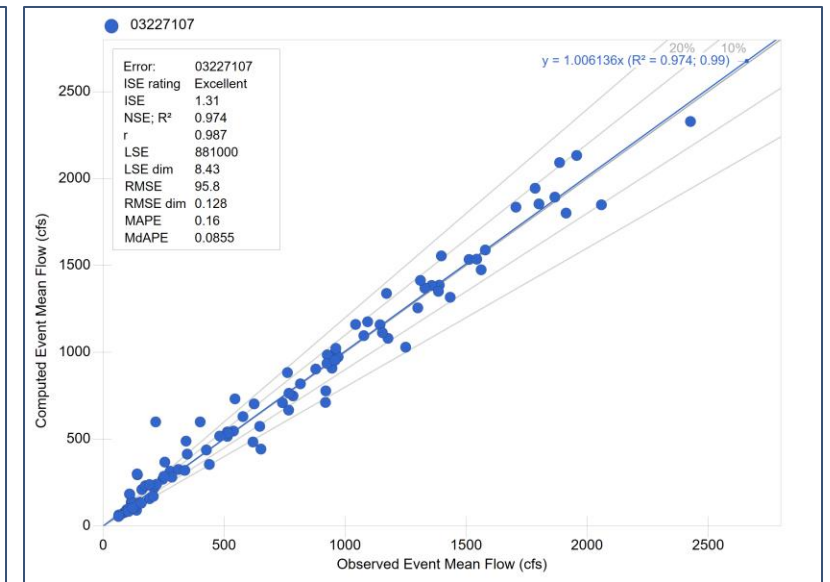
Annual Mean Flow



Seasonal Mean Flow



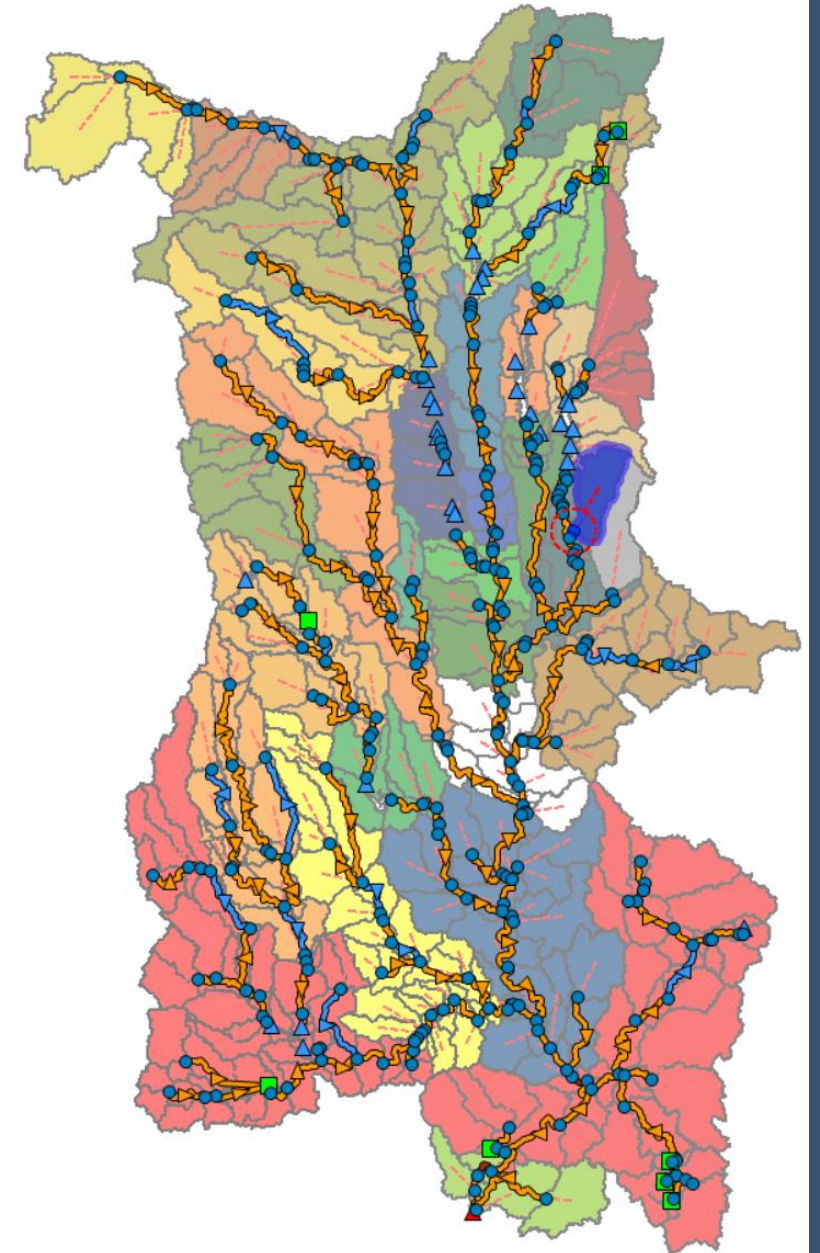
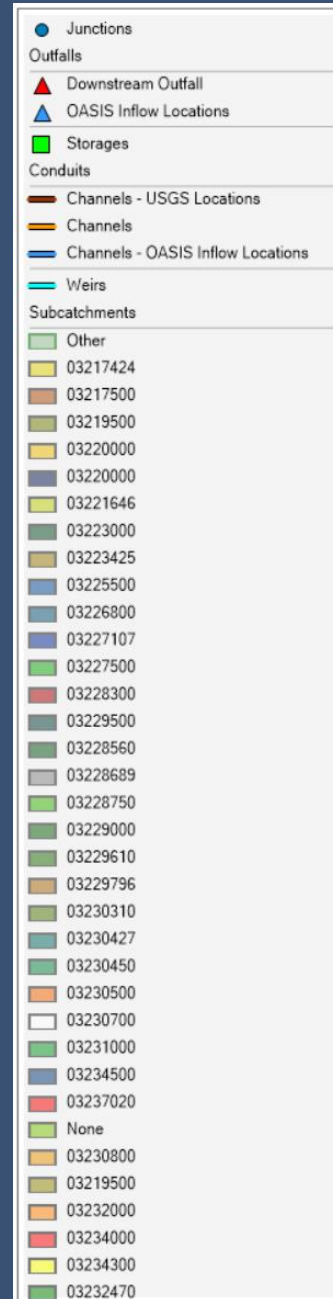
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03228560

Rocky Fork at Gahanna OH



Calibration Summary

USGS Gauge 03228560

- Calibration Period
 - 01/01/2004 – 01/01/2007
- Validation Period
 - None
- Comments
 - Not enough data at meter for full calibration. Used gauge for calibration between 2004 and 2007.
 - Further calibration performed at gauge 03229500

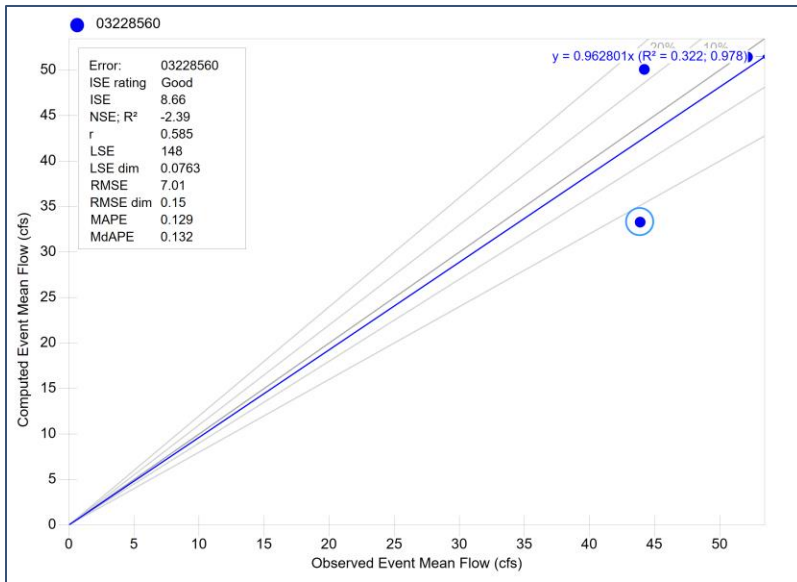
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2004	52.1	51.4	-1%
	2005	44.2	50.1	13%
	2006	43.9	33.3	-24%

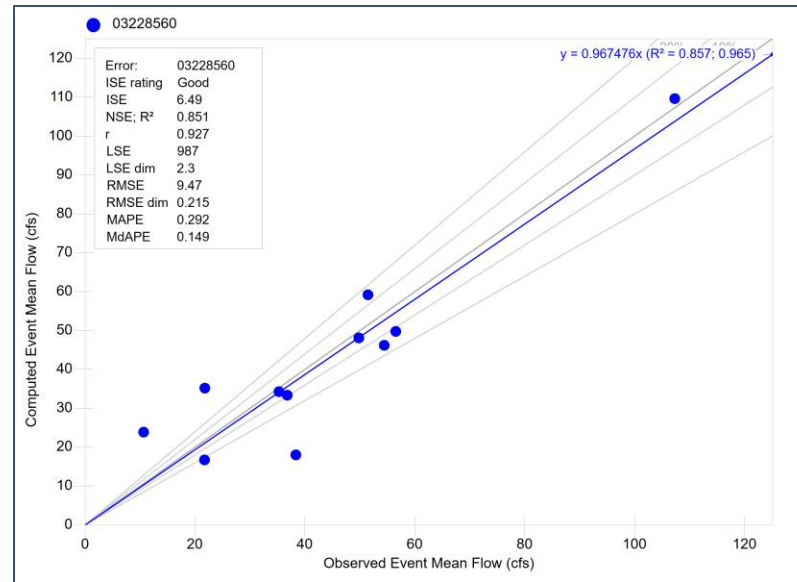
Calibration Summary

USGS Gauge 03228560

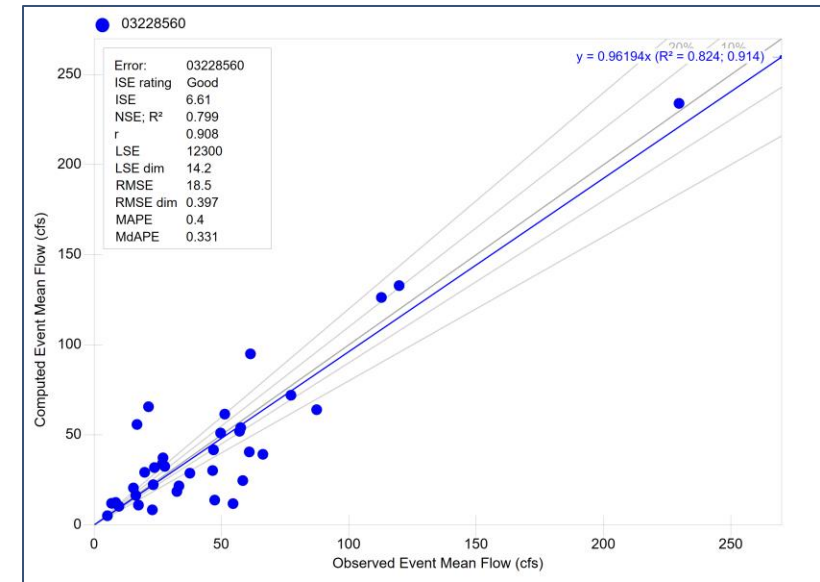
Annual Mean Flow



Seasonal Mean Flow



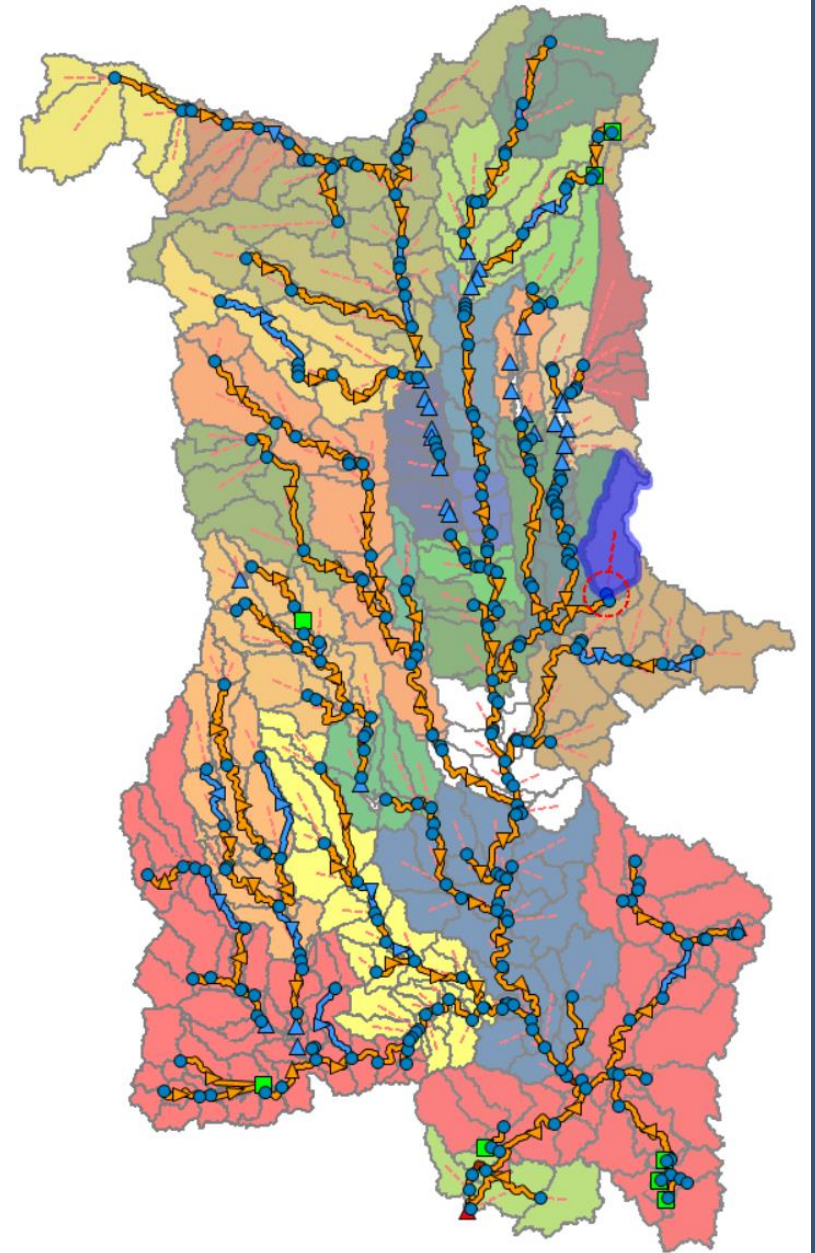
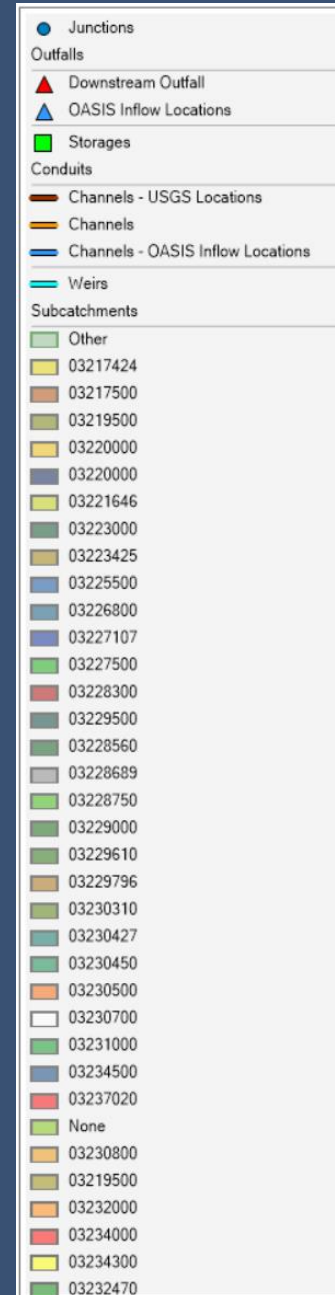
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03228689

Blacklick Creek near Pickerington OH



Calibration Summary

USGS Gauge 03228689

- Calibration Period
 - 01/01/2022 – 01/01/2024
- Validation Period
 - None
- Comments
 - Not enough data at meter for full calibration. Used gauge for calibration between 2022 and 2024.
 - Further calibration performed at gauge 03229500
 - Note: PRISM data availability at time of calibration ended at 11/01/2024
 - Annual, seasonal and mean statistics for 2023 represent means between 01/01/ 2023 to 11/01/2023

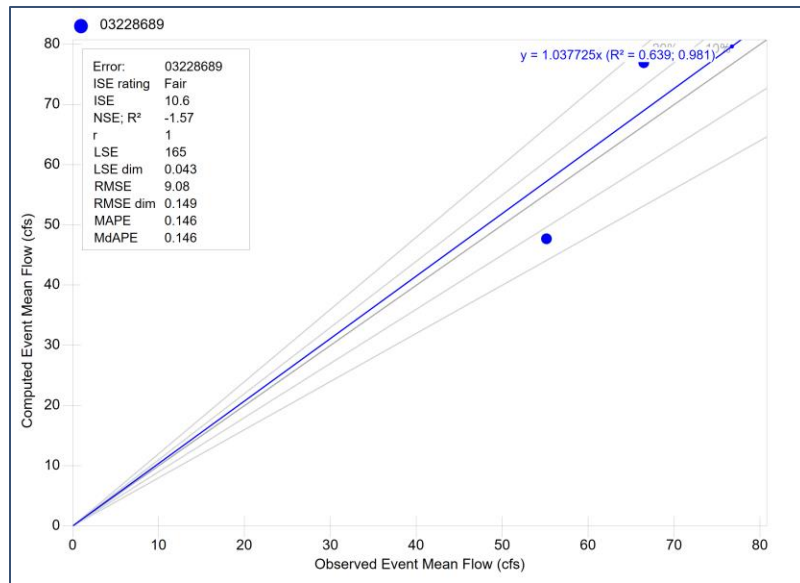
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2022	66.5	76.9	16%
	2023	55.2	47.7	-14%

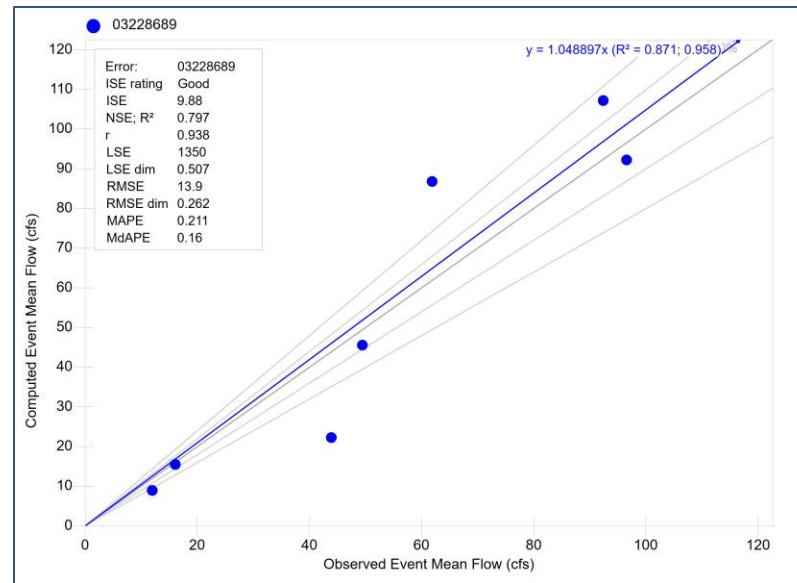
Calibration Summary

USGS Gauge 03228689

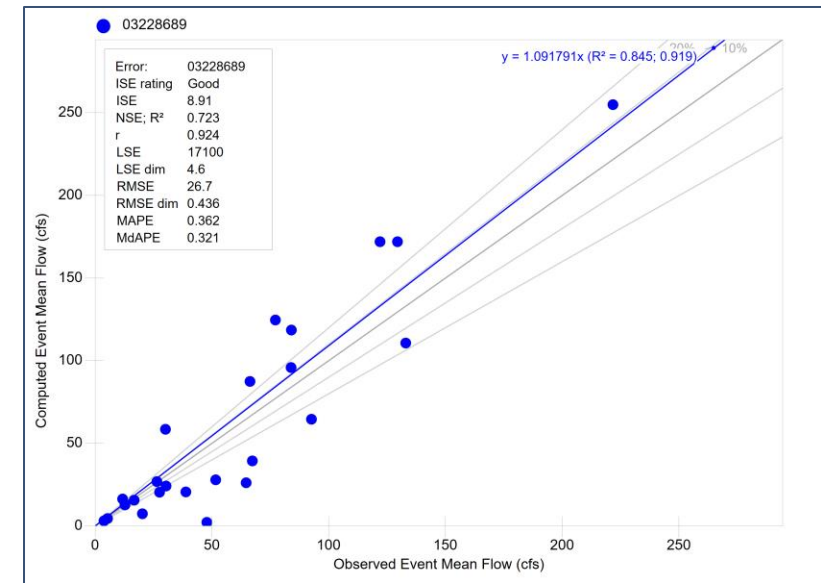
Annual Mean Flow



Seasonal Mean Flow



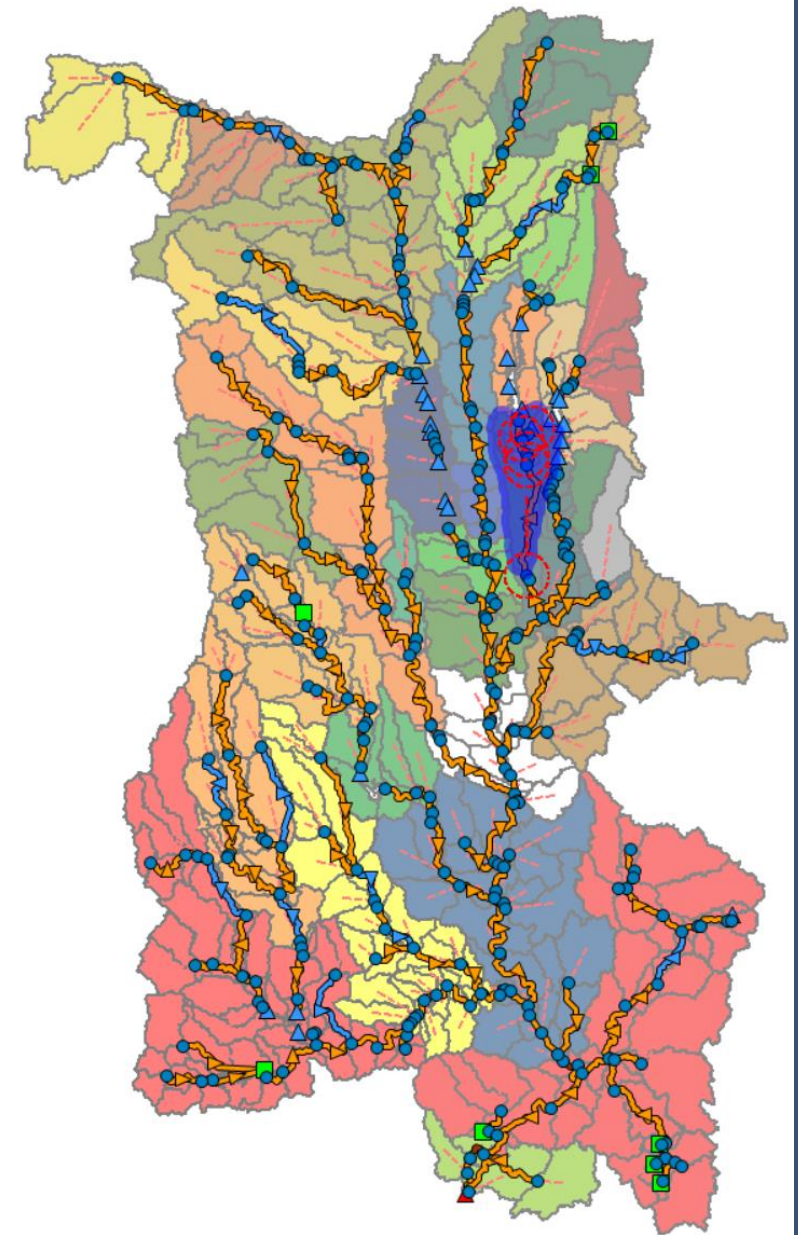
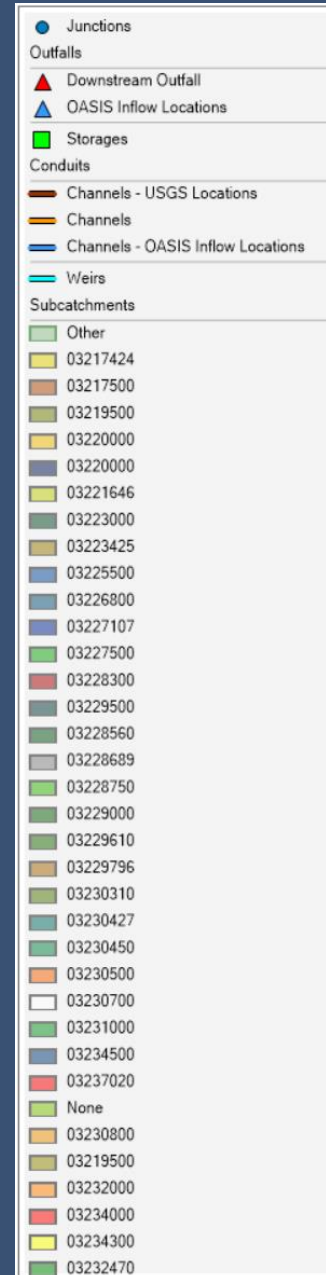
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03229000

Olentangy River near Worthington OH



Calibration Summary

USGS Gauge 03229000

- Calibration Period
 - 01/01/1989 – 01/01/1994
- Validation Period
 - 01/01/1994 – 01/01/1998
- Comments
 - *Upstream USGS gauge 03228805 used as boundary condition.*
 - *Overflow from Alum Creek Reservoir. Downstream flow is heavily*
 - *Downstream flow is heavily influenced by releases from the dam that are handled in OASIS.*
 - *Westerville Reservoir was represented in SWMM model as a simple rectangular reservoir for calibration of the drainage area only. In the main model, the reservoir is not explicitly modeled. This reservoir is represented in the OASIS model.*

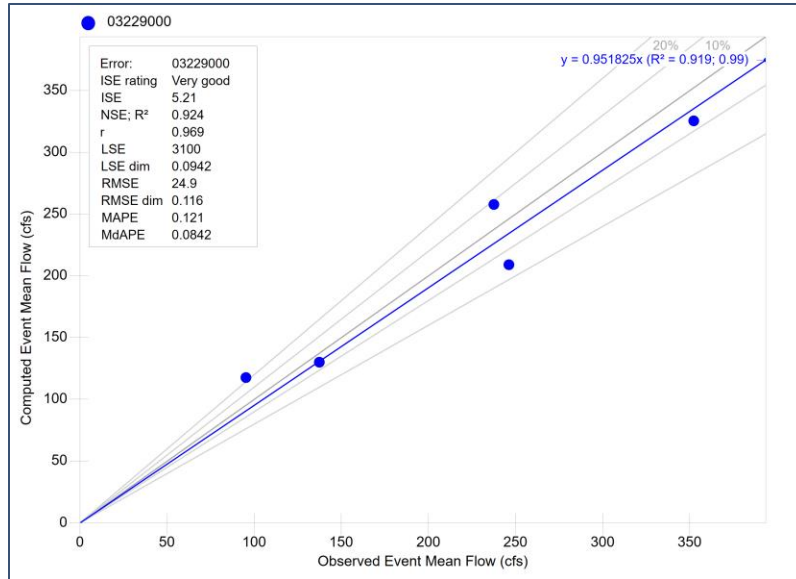
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	1989	246.3	208.8	-15%
	1990	352.4	325.2	-8%
	1991	137.5	130.0	-5%
	1992	95.3	117.6	23%
	1993	237.6	257.6	8%
Validation	1994	141.8	141.9	0%
	1995	243.7	250.6	3%
	1996	291.4	317.5	9%
	1997	178.8	177.5	-1%

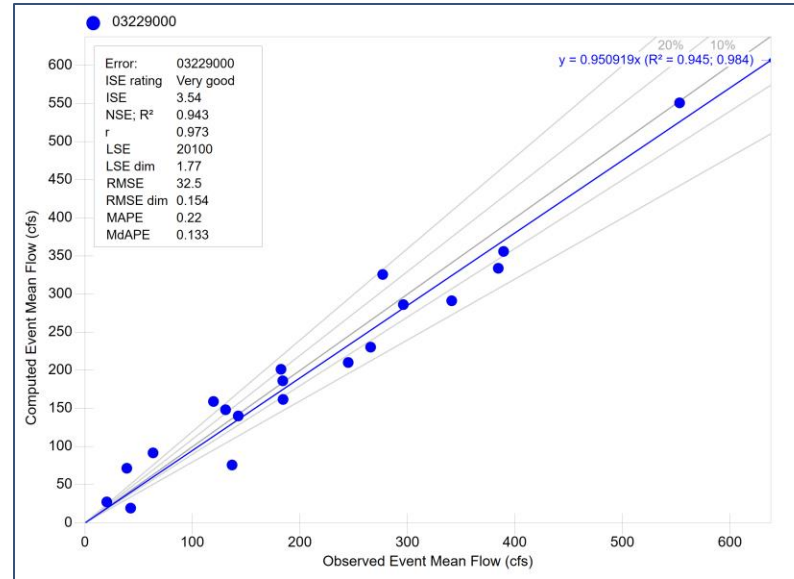
Calibration Summary

USGS Gauge 03229000

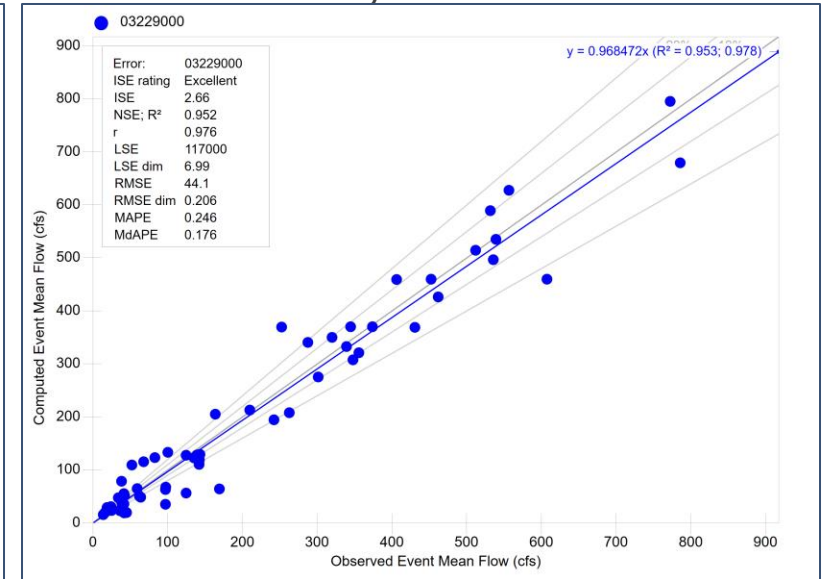
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

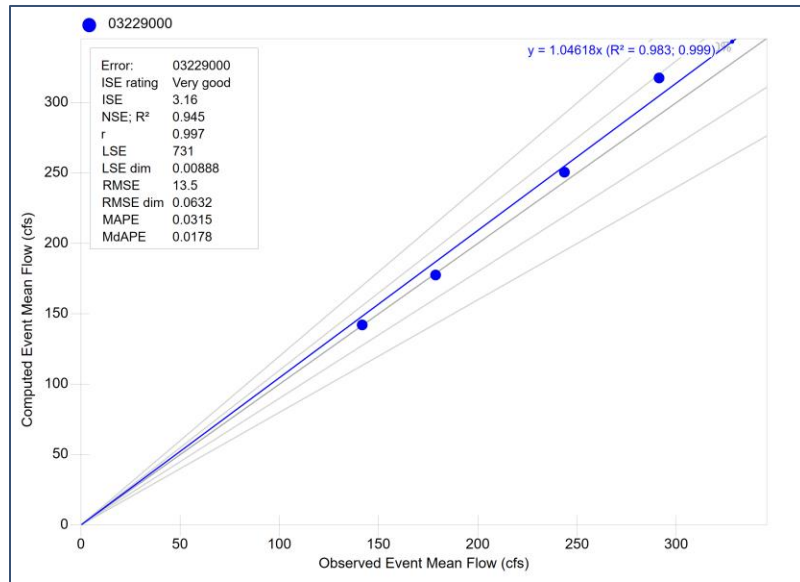


* 10% and 20% Error Bands Shown in Graphs

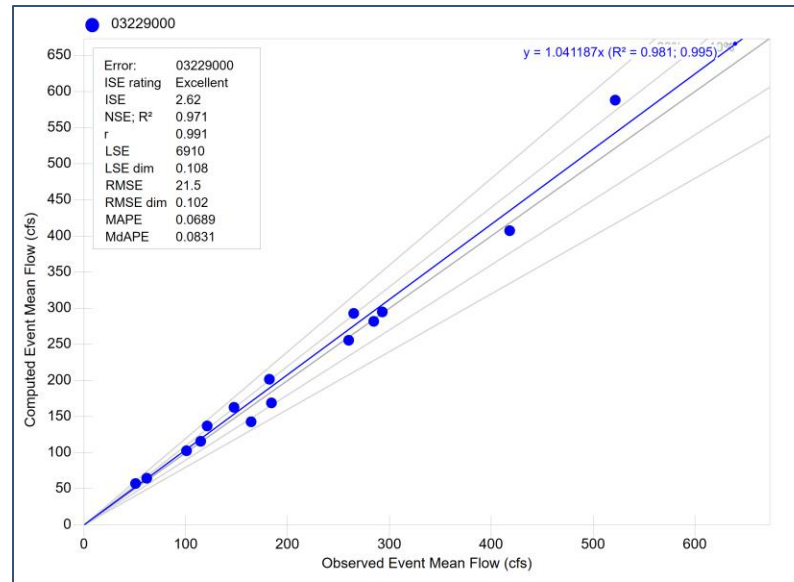
Validation Summary

USGS Gauge 03229000

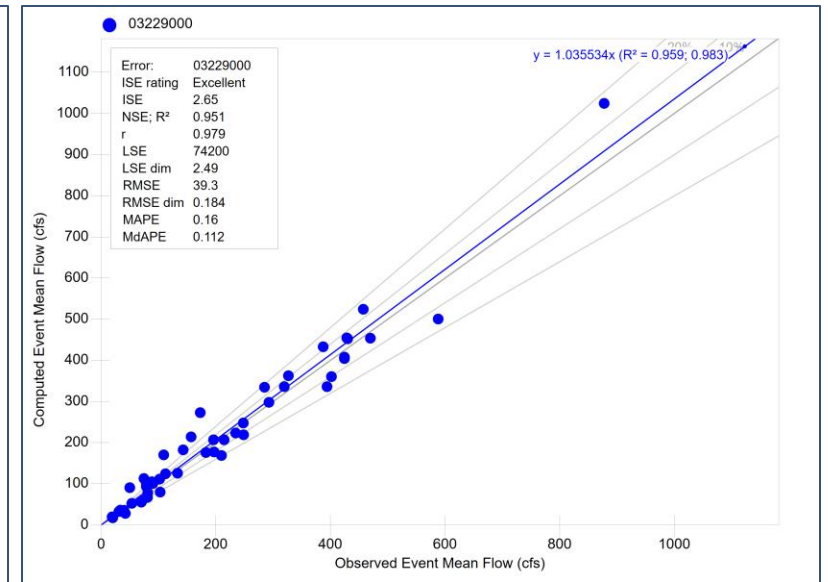
Annual Mean Flow



Seasonal Mean Flow



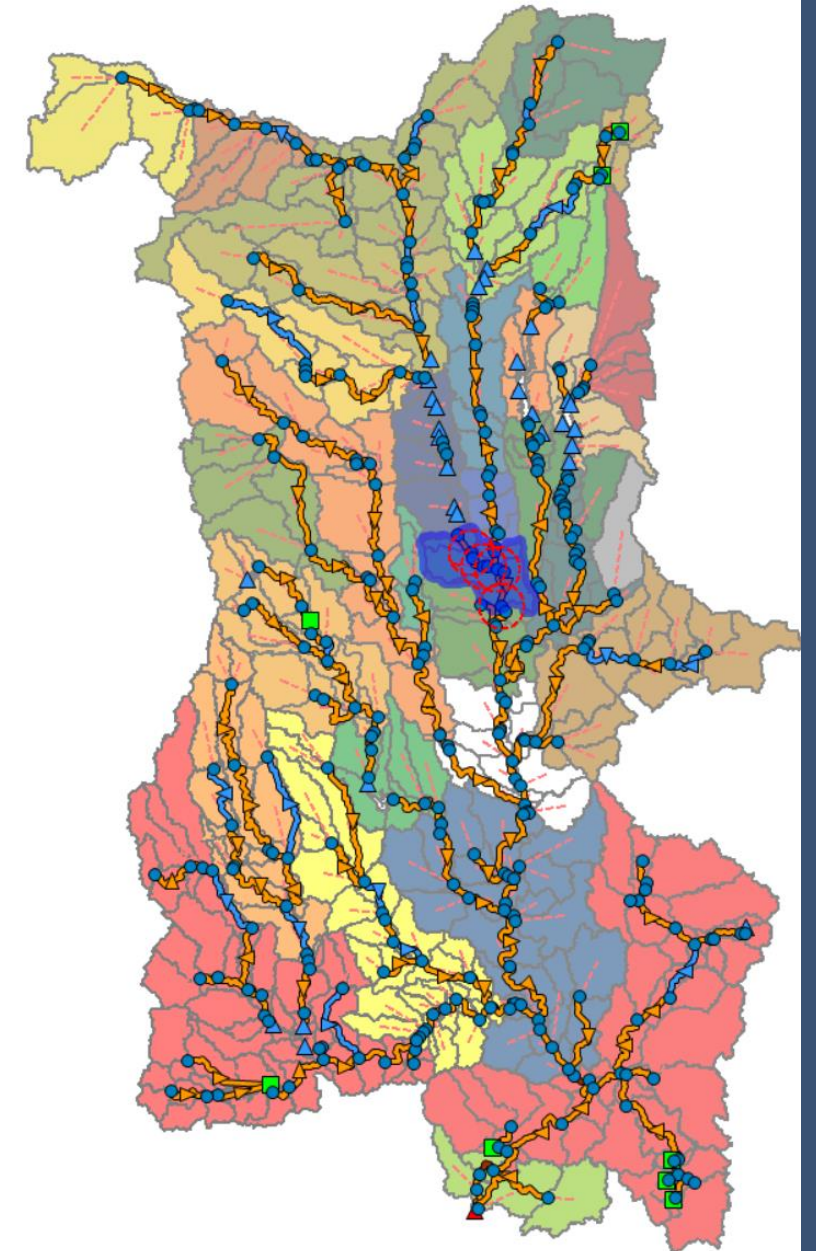
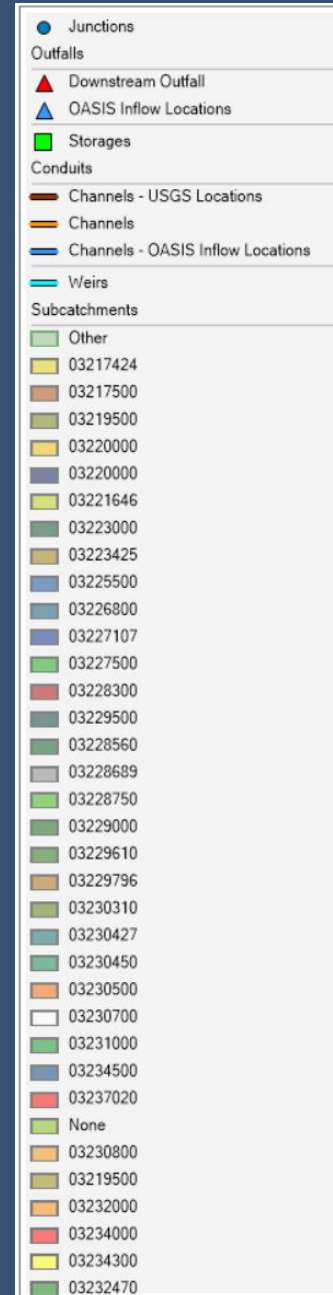
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03227500

Scioto River at Columbus OH



Calibration Summary

USGS Gauge 03227500

- Calibration Period
 - 01/01/2015 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023
- Comments
 - *Upstream USGS gauges 03221646 and 03225500 used as boundary condition to account for overflows from Griggs reservoir and Delaware Lake.*
 - *The Dublin Rd Water Treatment Plant Historical Withdrawals were also accounted for during calibration.*

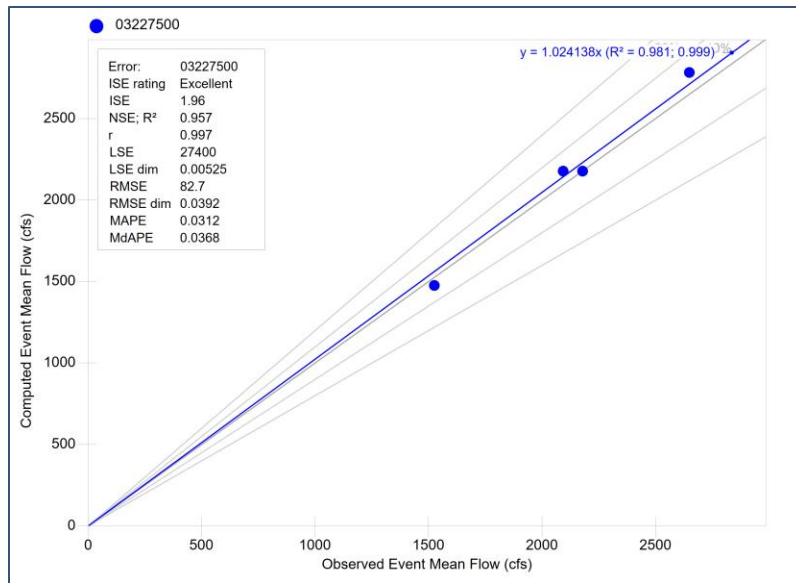
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2015	2093.0	2177.0	4%
	2016	1526.0	1475.0	-3%
	2017	2179.0	2177.0	0%
	2018	2649.0	2782.0	5%
	2019	2623.0	2674.0	2%
	2020	2144.0	2240.0	4%
	2021	1630.0	1705.0	5%
	2022	1982.0	2058.0	4%

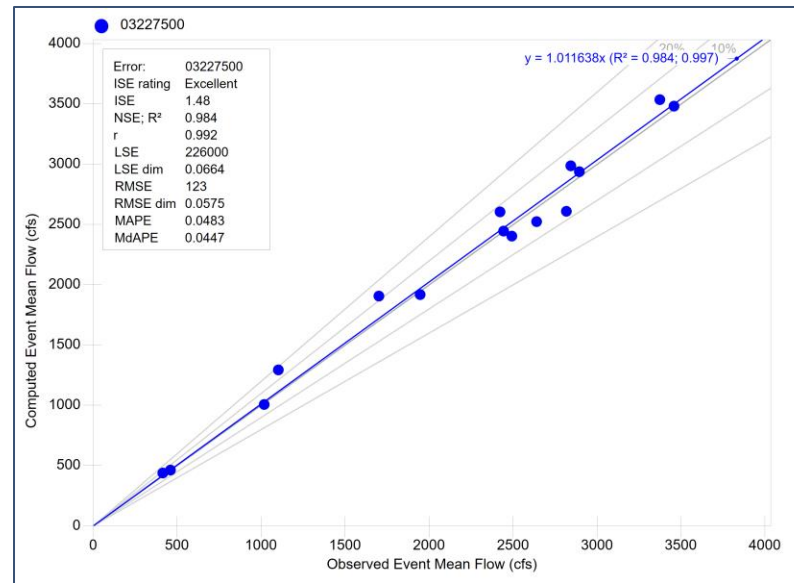
Calibration Summary

USGS Gauge 03227500

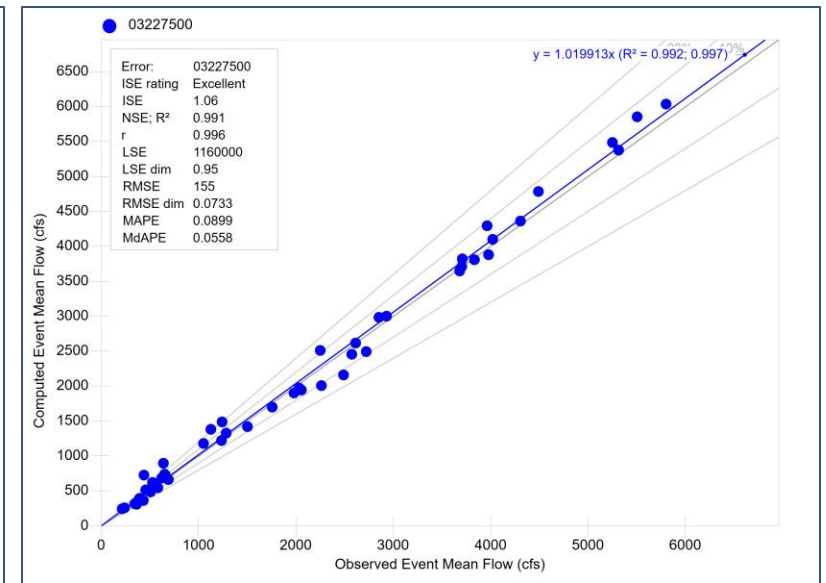
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

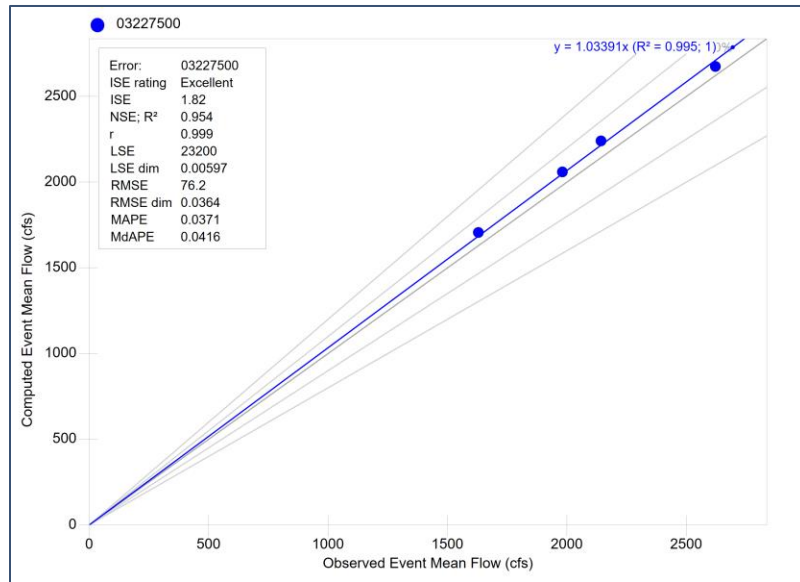


* 10% and 20% Error Bands Shown in Graphs

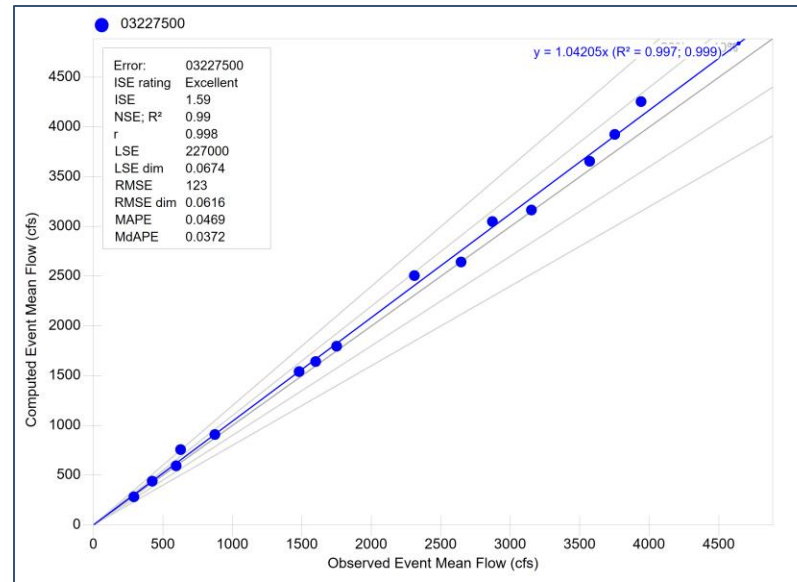
Validation Summary

USGS Gauge 03227500

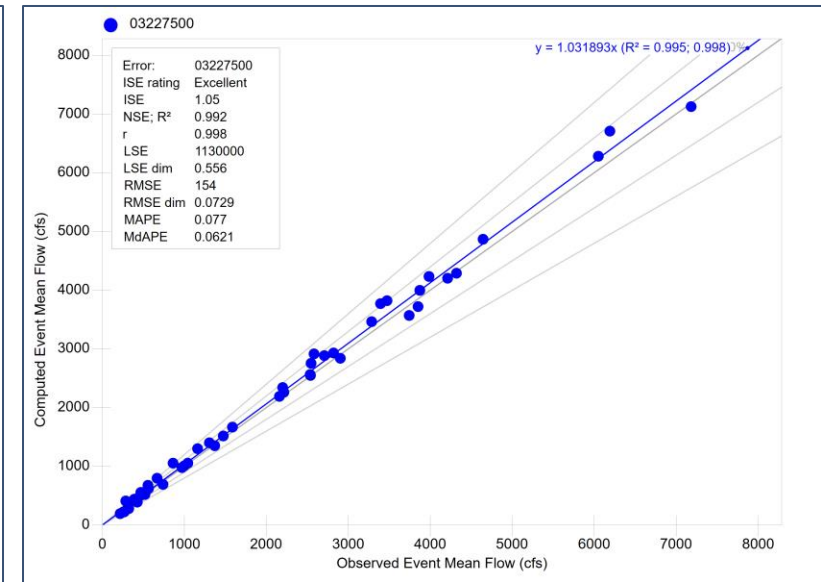
Annual Mean Flow



Seasonal Mean Flow



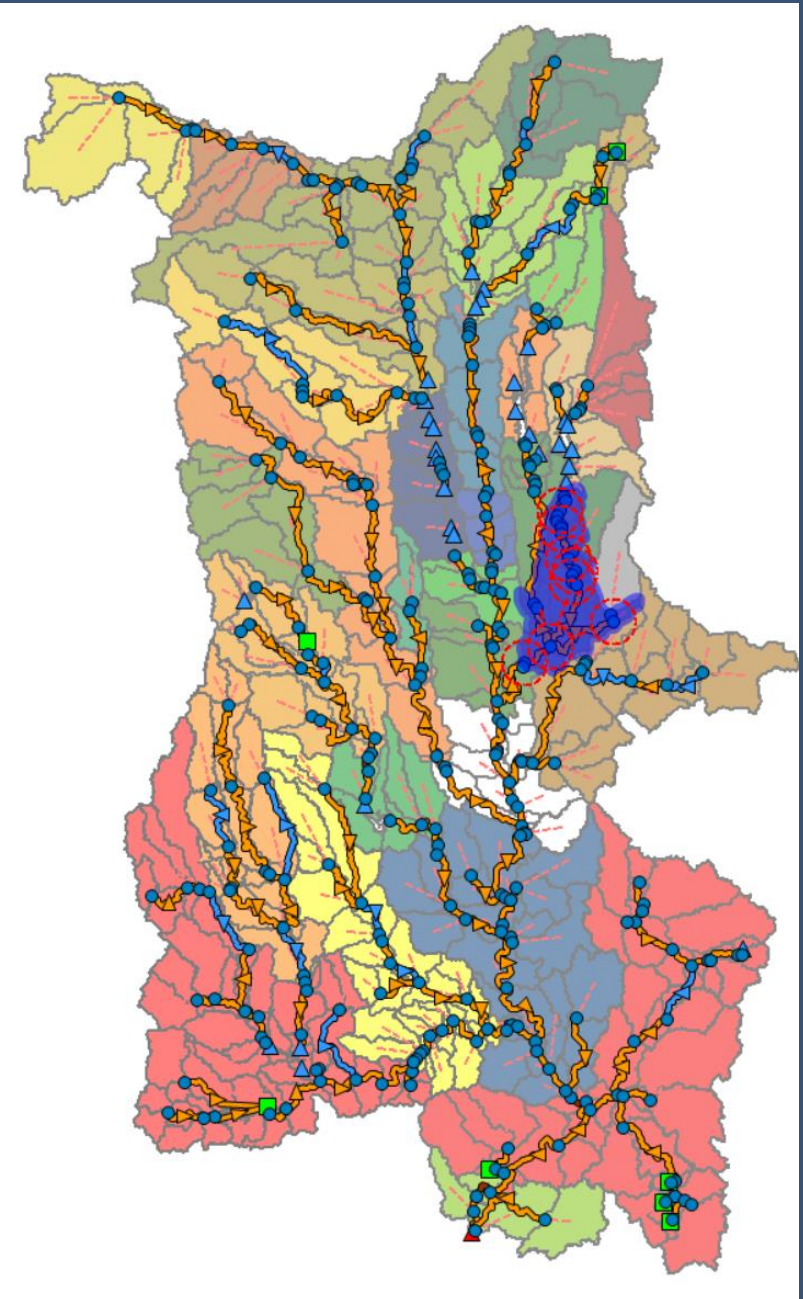
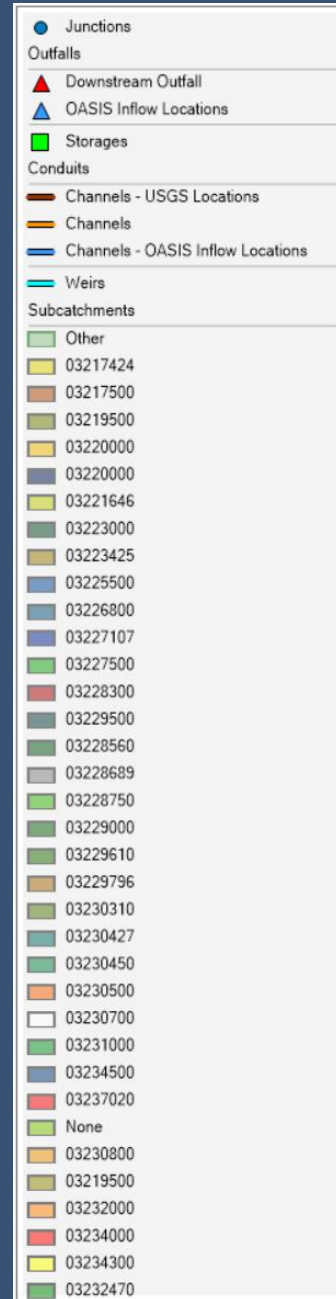
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03229500

Big Walnut Creek at Rees OH



Calibration Summary

USGS Gauge 03229500

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - *Upstream USGS gauge 03228805 used as boundary condition - Overflow from Alum Creek Reservoir. Downstream flow is heavily influenced by releases from the dam.*
 - *The Hap Cremean Water Treatment Plant Historical Withdrawals were also accounted for during calibration.*
 - *Westerville Reservoir was represented in SWMM model as a simple rectangular reservoir for calibration of the drainage area only. In the main model, the reservoir is not explicitly modeled. This reservoir is represented in the OASIS model.*

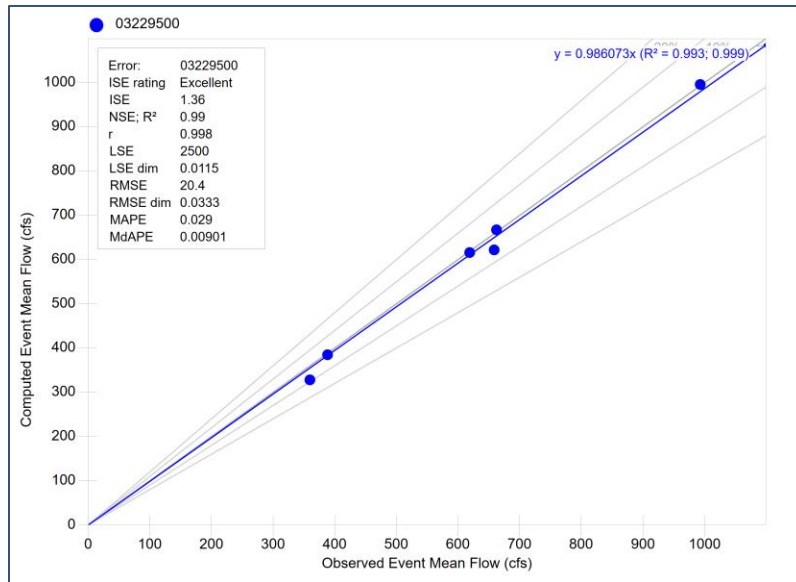
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	359.7	327.3	-9%
	2011	992.8	995.4	0%
	2012	388.5	384.2	-1%
	2013	619.2	614.9	-1%
	2014	658.5	621.2	-6%
	2015	662.4	666.7	1%
Validation	2016	471.9	500.2	6%
	2017	582.8	636.6	9%
	2018	946.4	1046.0	11%
	2019	806.6	859.5	7%
	2020	734.5	740.6	1%
	2021	596.3	600.7	1%
	2022	745.9	801.8	7%

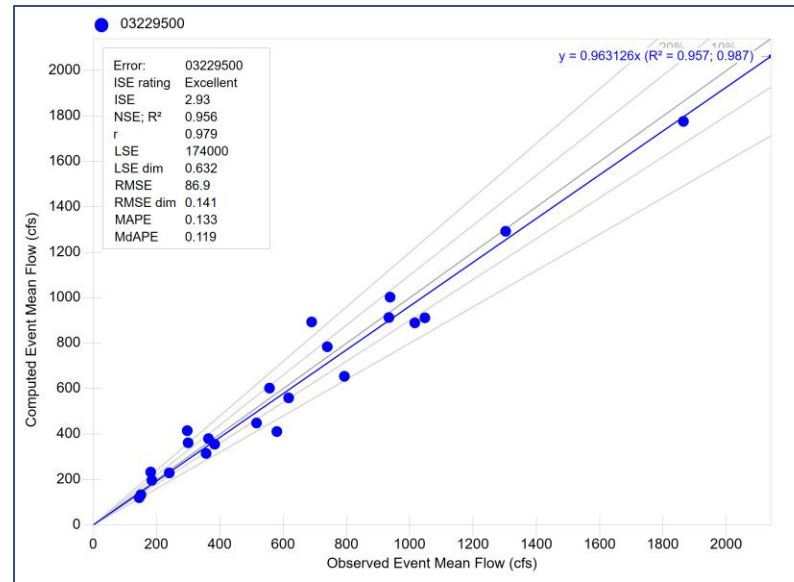
Calibration Summary

USGS Gauge 03229500

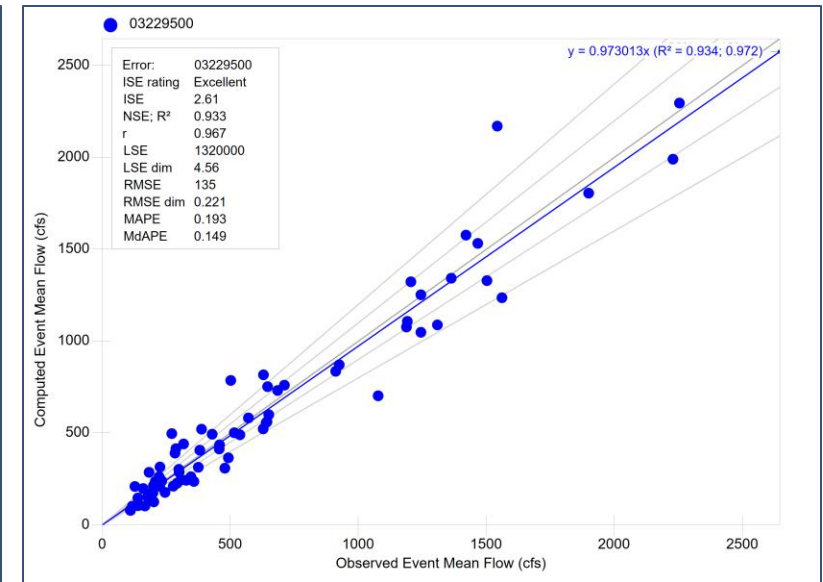
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

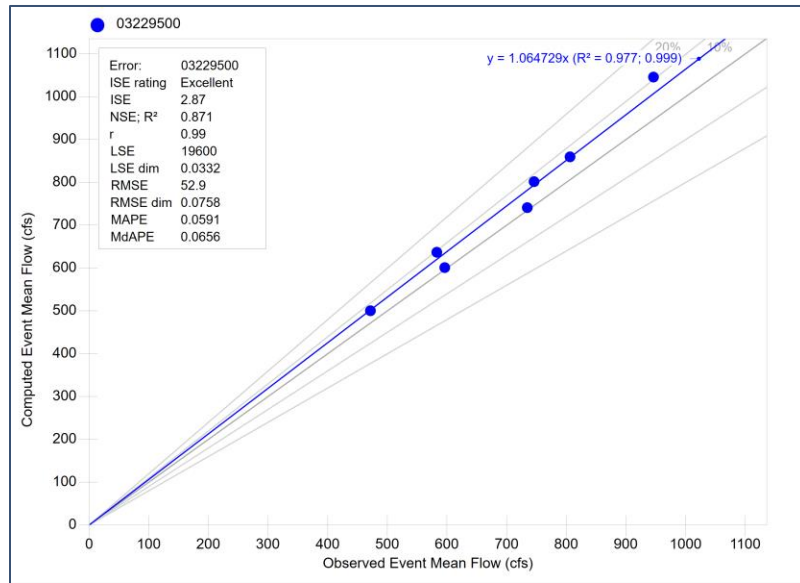


* 10% and 20% Error Bands Shown in Graphs

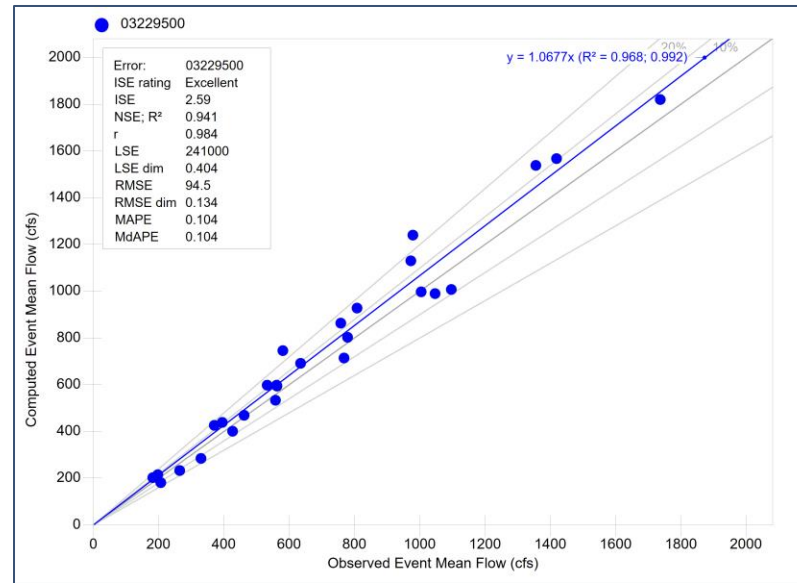
Validation Summary

USGS Gauge 03229500

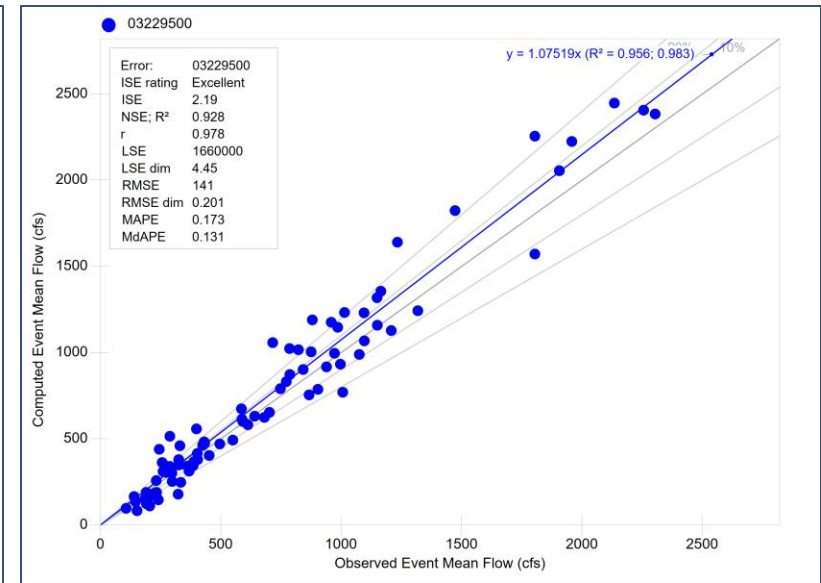
Annual Mean Flow



Seasonal Mean Flow



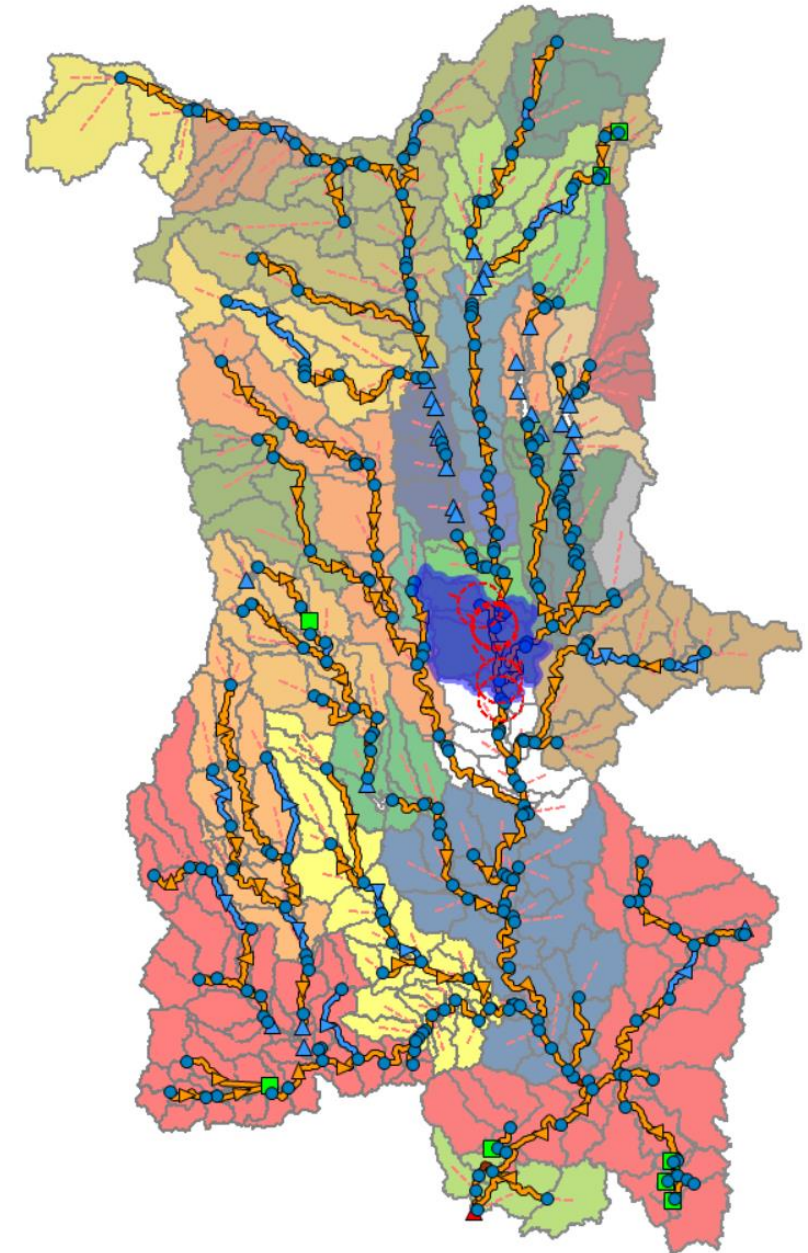
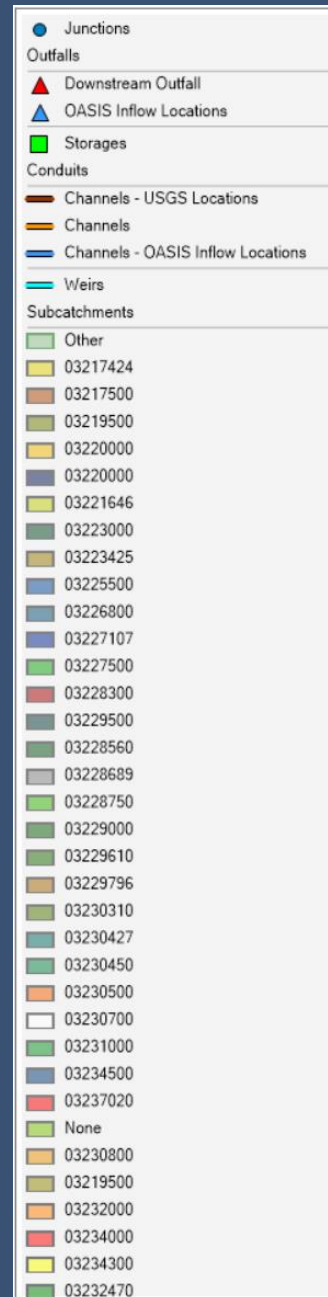
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03229610

Scioto River near Commercial Point OH



Calibration Summary

USGS Gauge 03229610

- Calibration Period
 - 01/01/2015 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023
- Comments
 - *Upstream USGS gauges 03221646, 03225500, 03228805 and 03228500 were used for upstream boundary conditions.*
 - *The Dublin and Hap Cremean Water Treatment Plant Historical Withdrawals were accounted for during calibration.*
 - *Return flows from the Jackson Pike and Columbus Southerly wastewater treatment plants were accounted for during calibration.*
 - *Westerville Reservoir was represented in SWMM model as a simple rectangular reservoir for calibration of the drainage area only. In the main model, the reservoir is not explicitly modeled. This reservoir is represented in the OASIS model.*

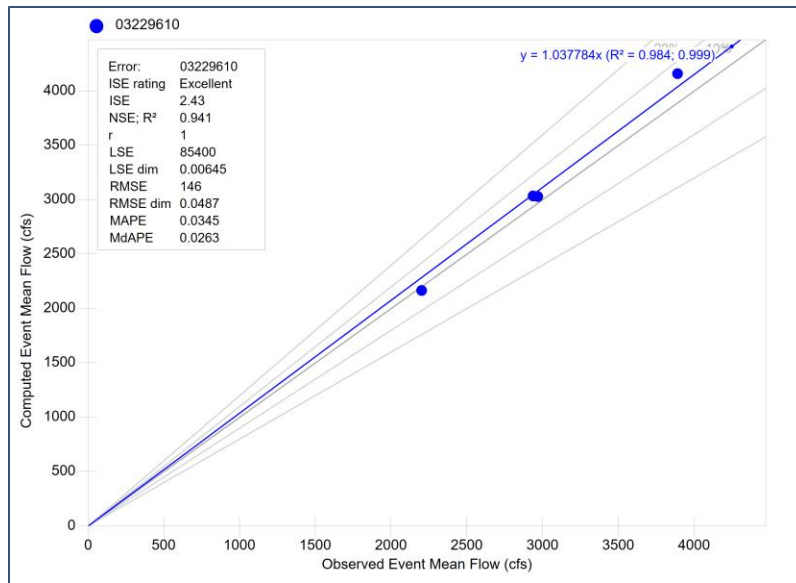
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2015	2970.0	3029.0	2%
	2061	2202.0	2165.0	-2%
	2017	2938.0	3034.0	3%
	2018	3892.0	4159.0	7%
Validation	2019	3753.0	3648.0	-3%
	2020	3126.0	3249.0	4%
	2021	2455.0	2495.0	2%
	2022	3011.0	3141.0	4%

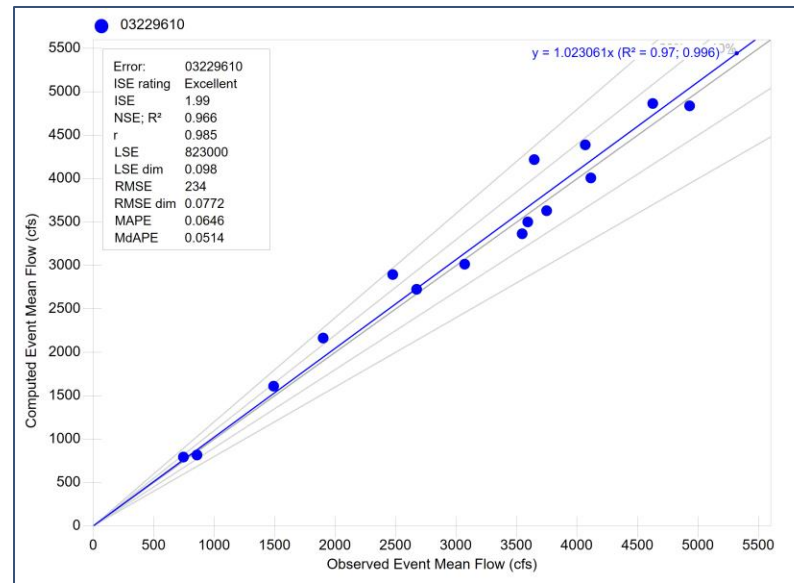
Calibration Summary

USGS Gauge 03229610

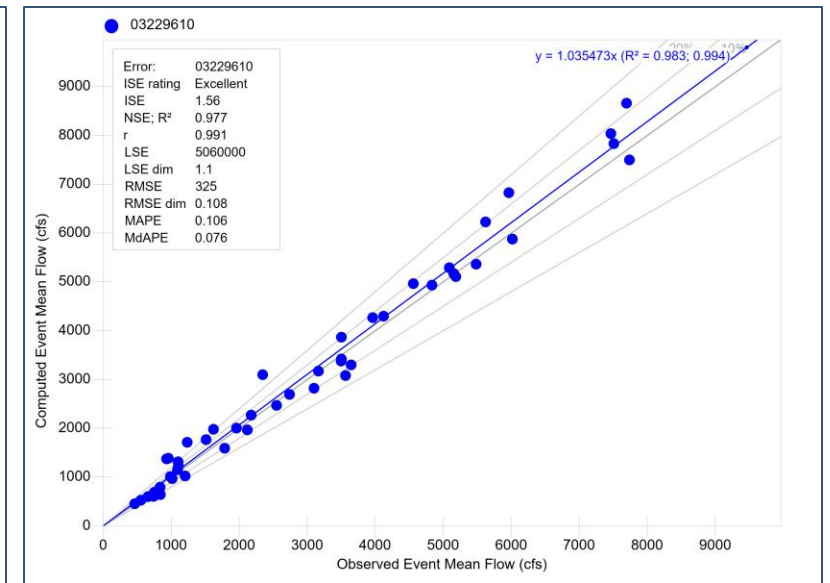
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

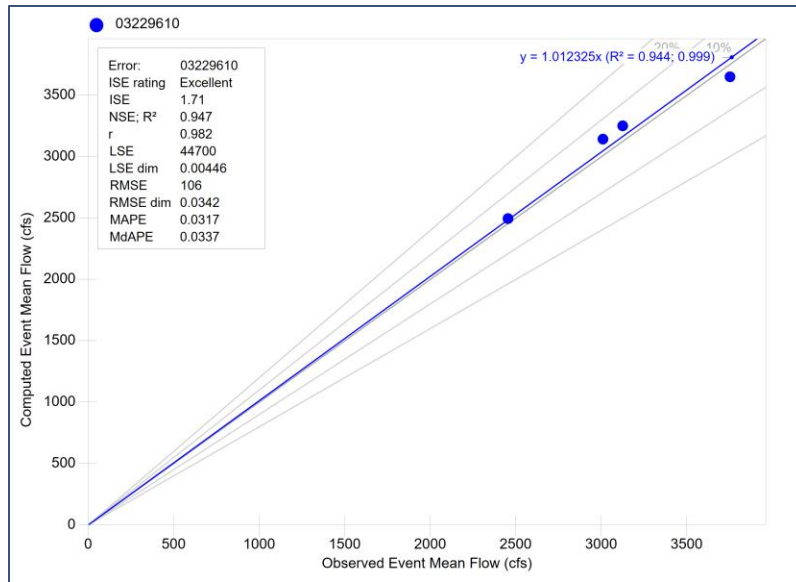


* 10% and 20% Error Bands Shown in Graphs

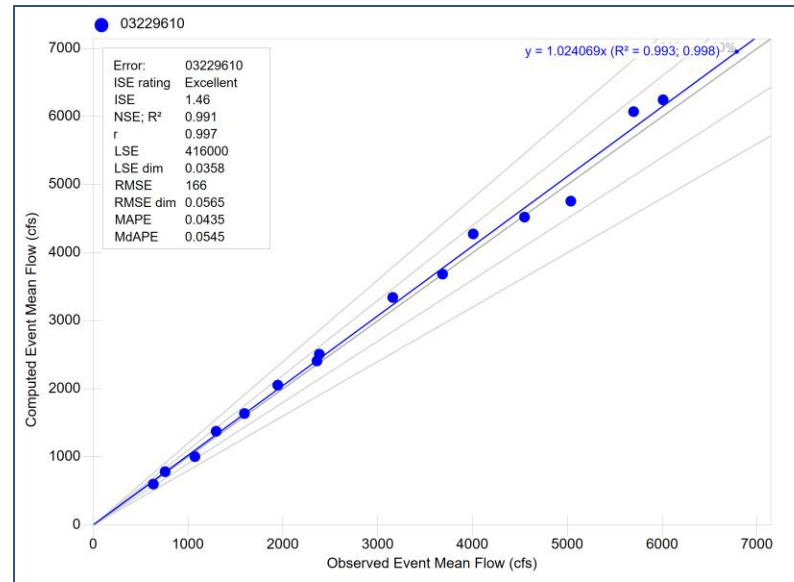
Validation Summary

USGS Gauge 03229610

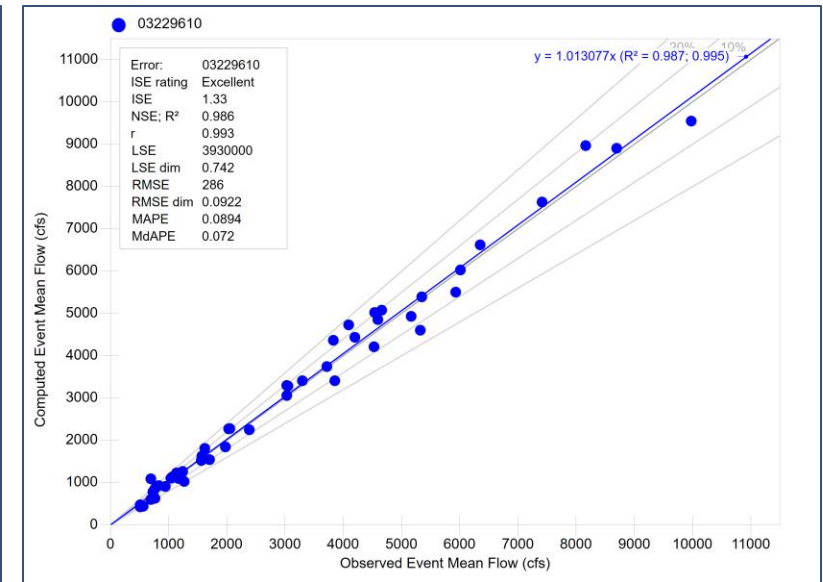
Annual Mean Flow



Seasonal Mean Flow



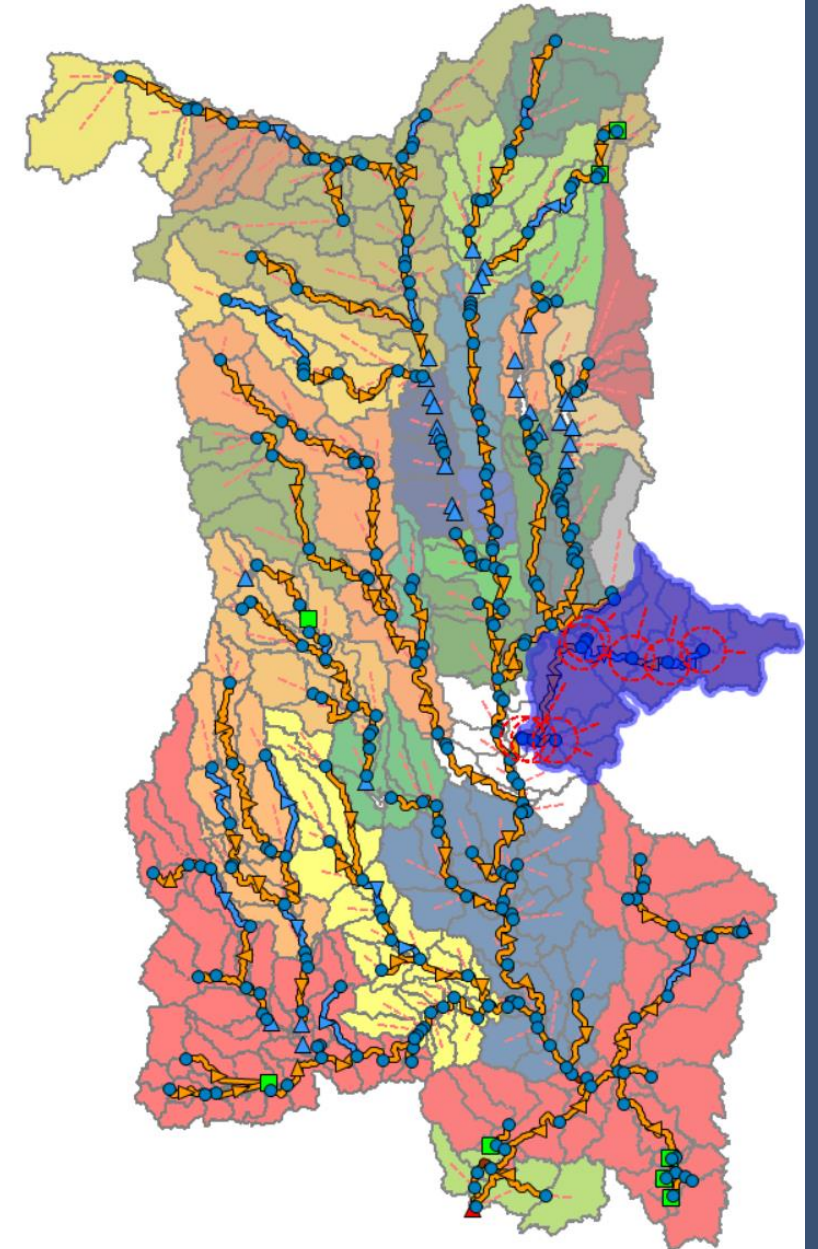
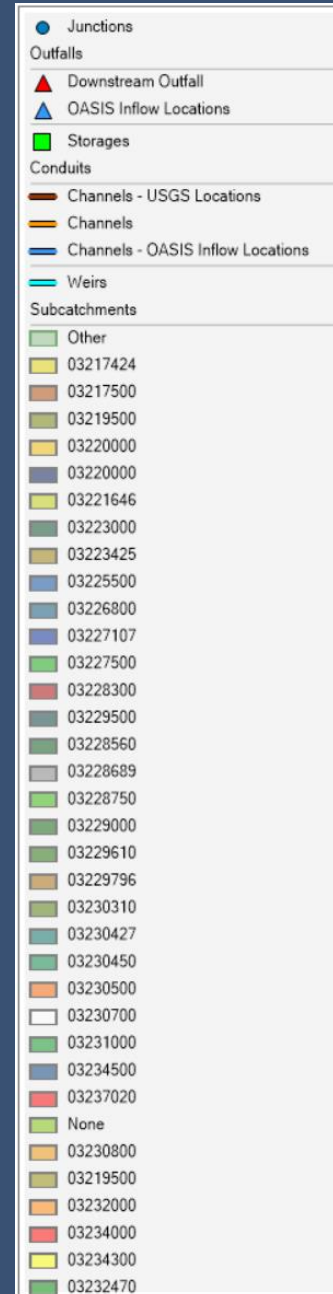
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03229796

Walnut Creek at Ashville OH



Calibration Summary

USGS Gauge 03229796

- Calibration Period
 - 01/01/2010 – 01/01/2017
- Validation Period
 - 01/01/2017 – 01/01/2023
- Comments
 - *None*

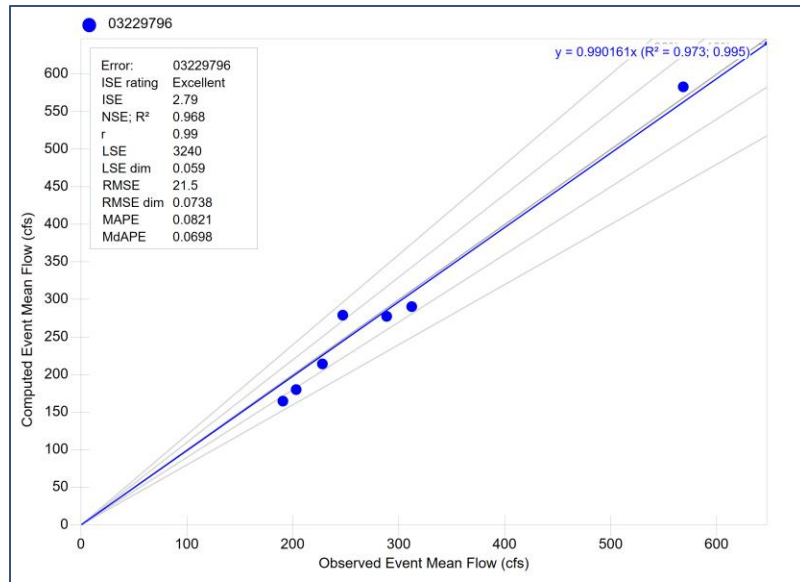
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	203.2	180.0	-11%
	2011	568.6	583.0	3%
	2012	190.7	164.7	-14%
	2013	247.2	279.1	13%
	2014	288.6	277.3	-4%
	2015	312.2	290.4	-7%
	2016	228.1	214.2	-6%
Validation	2017	393.9	391.6	-1%
	2018	483.5	588.7	22%
	2019	466.7	396.5	-15%
	2020	366.7	345.6	-6%
	2021	229.8	247.7	8%
	2022	382.5	360.7	-6%

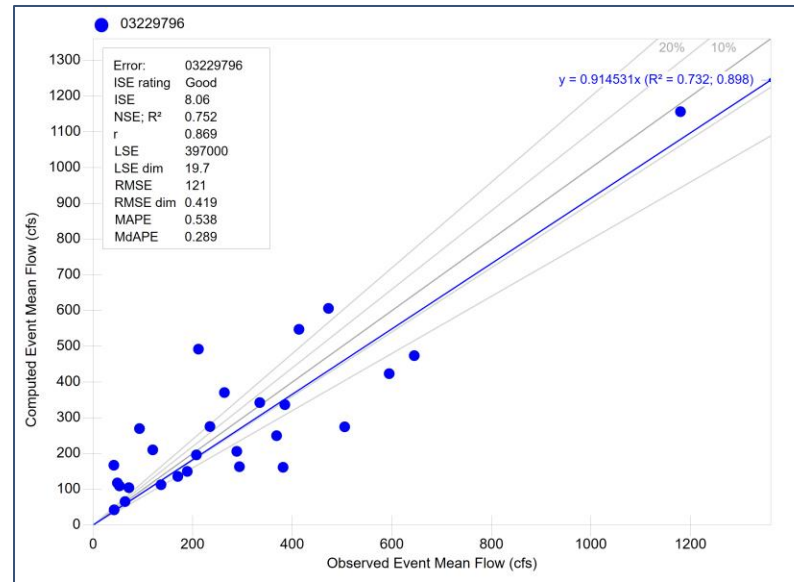
Calibration Summary

USGS Gauge 03229796

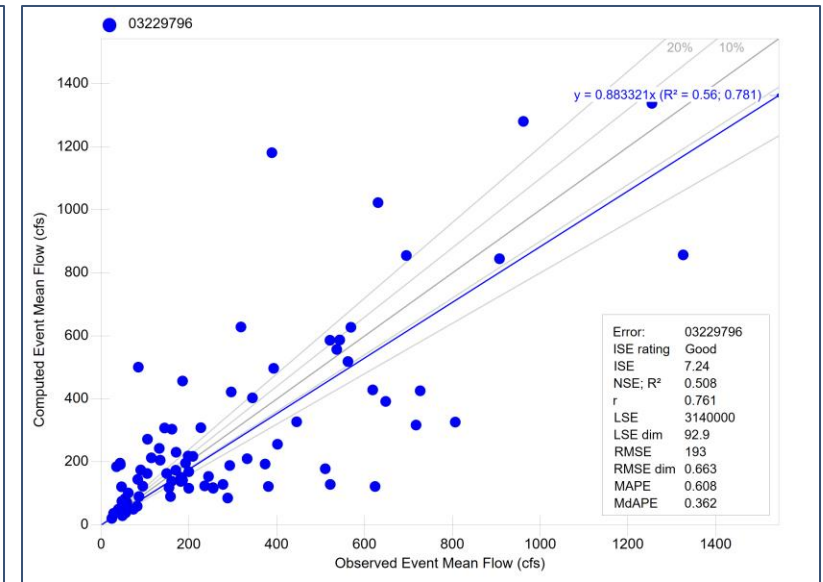
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

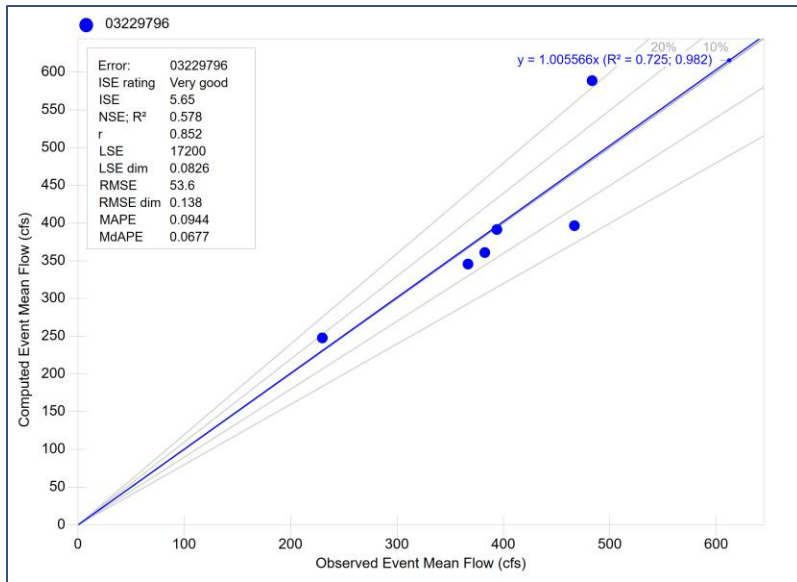


* 10% and 20% Error Bands Shown in Graphs

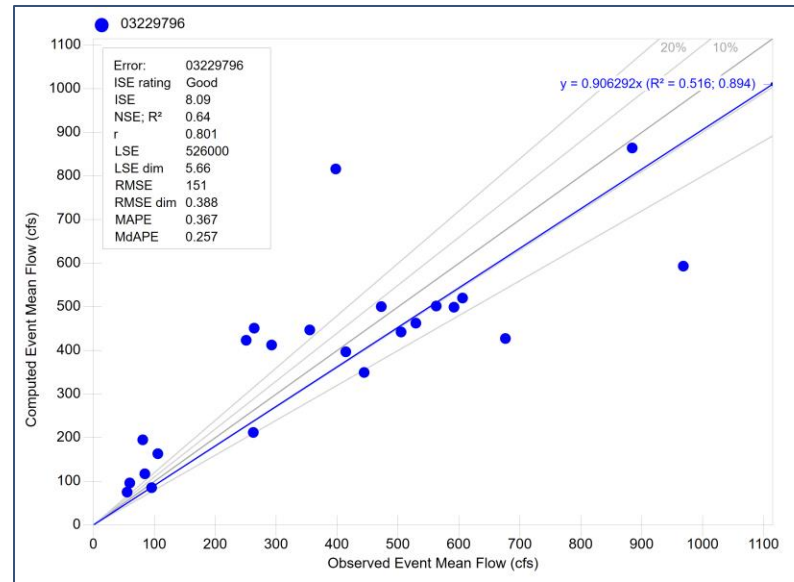
Validation Summary

USGS Gauge 03229796

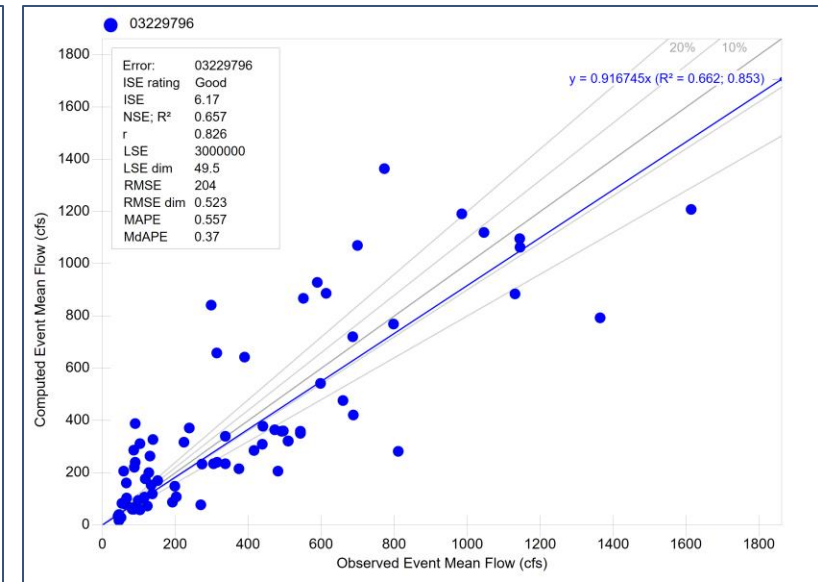
Annual Mean Flow



Seasonal Mean Flow



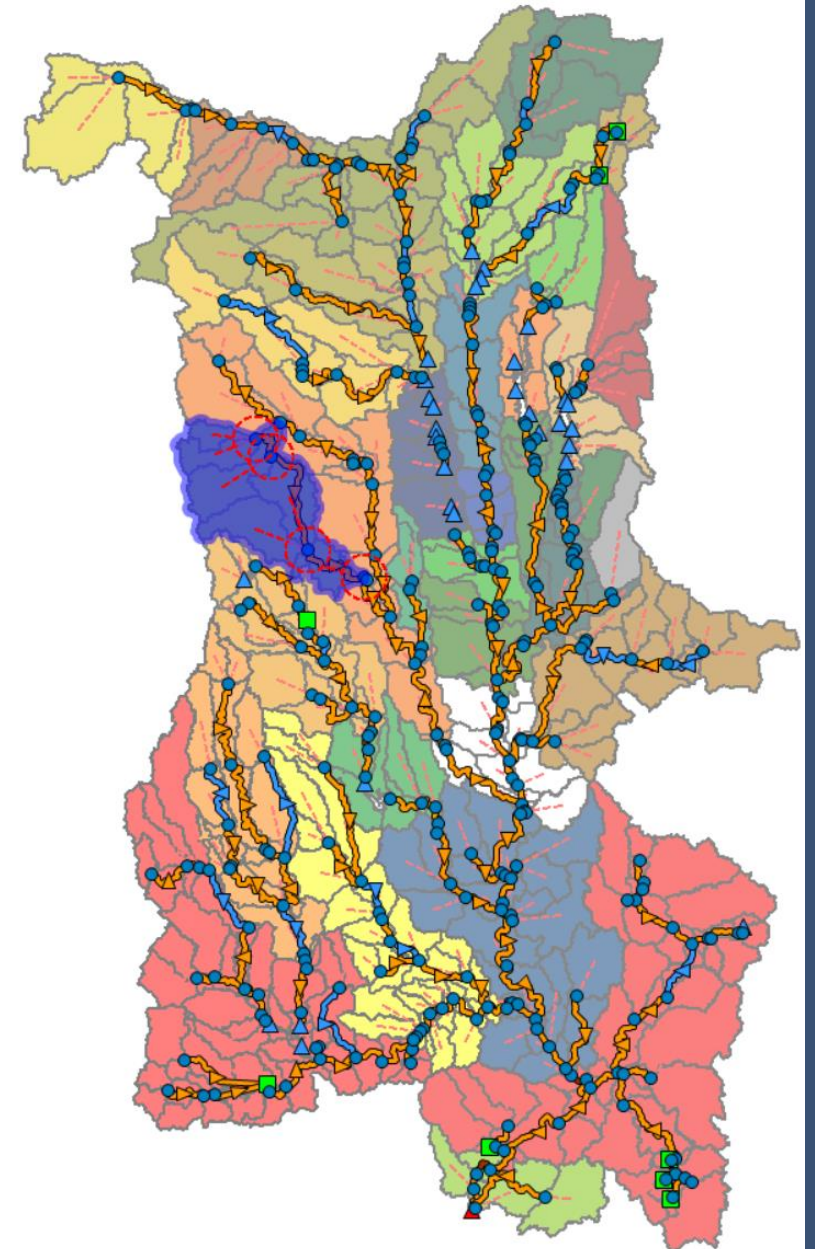
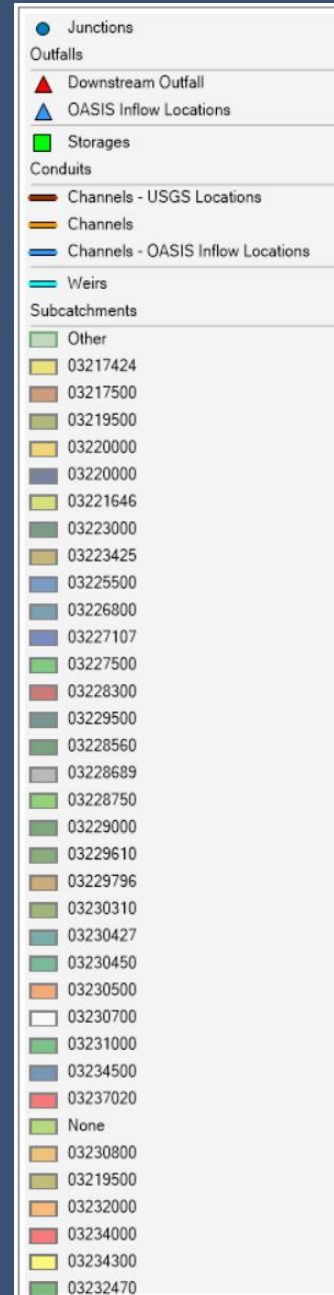
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03230310

Little Darby Creek at West Jefferson OH



Calibration Summary

USGS Gauge 03230310

- Calibration Period
 - 01/01/2010 – 01/01/2017
- Validation Period
 - 01/01/2017 – 01/01/2023
- Comments
 - *None*

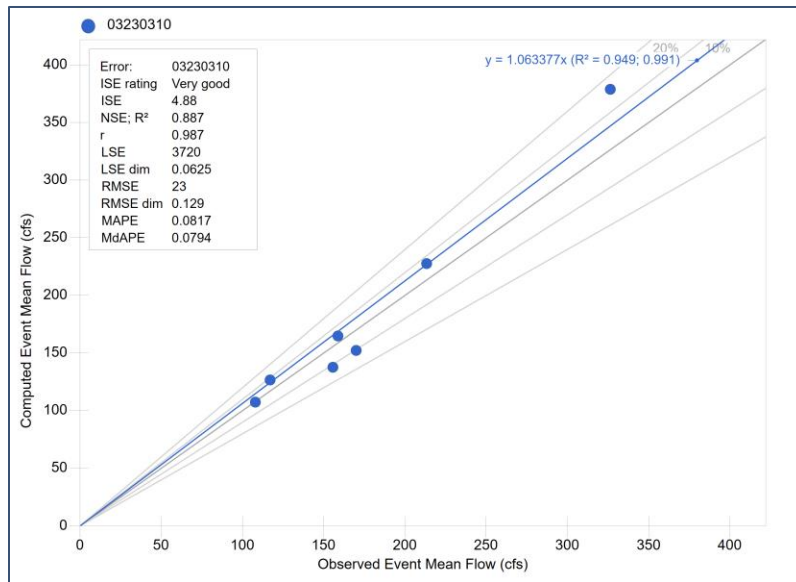
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	155.7	137.7	-12%
	2011	326.5	379.5	16%
	2012	108.0	107.4	-1%
	2013	170.1	152.1	-11%
	2014	158.8	164.9	4%
	2015	213.5	227.7	7%
	2016	117.2	126.6	8%
Validation	2017	198.9	205.7	3%
	2018	294.4	329.1	12%
	2019	221.5	172.7	-22%
	2020	157.1	198.4	26%
	2021	143.9	168.5	17%
	2022	196.4	187.8	-4%

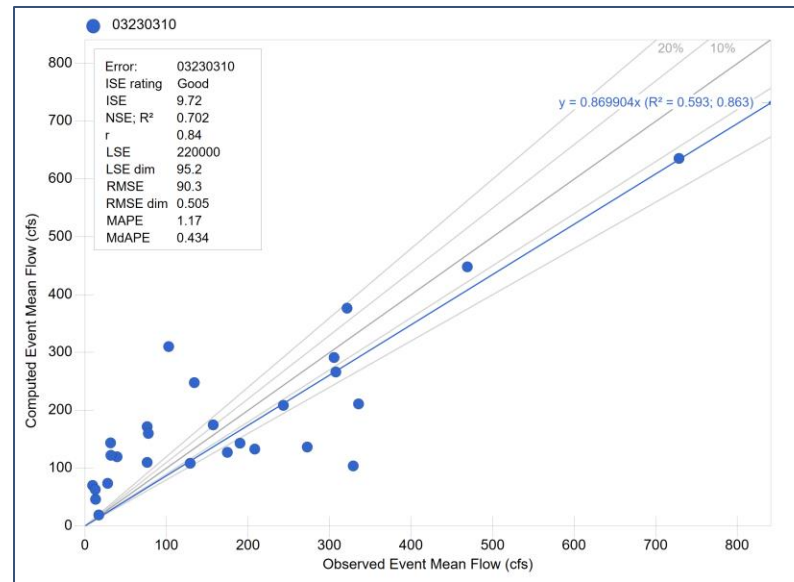
Calibration Summary

USGS Gauge 03230310

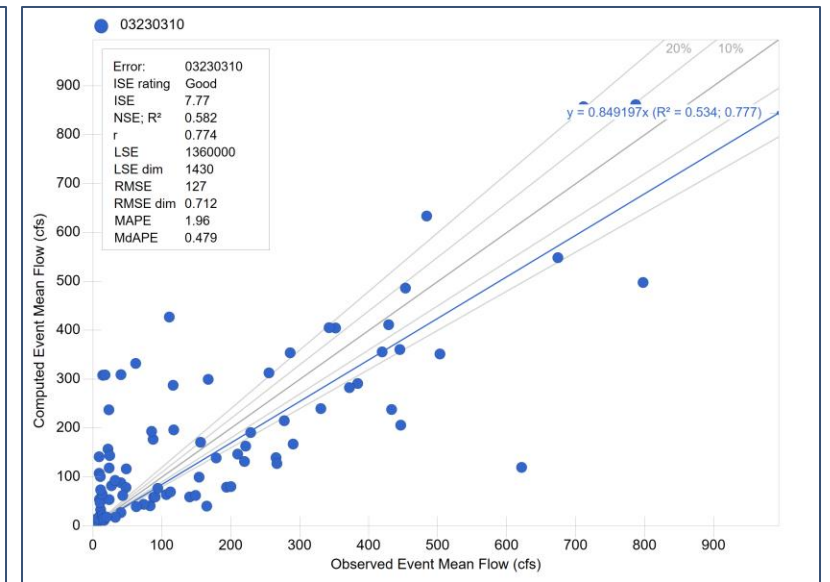
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

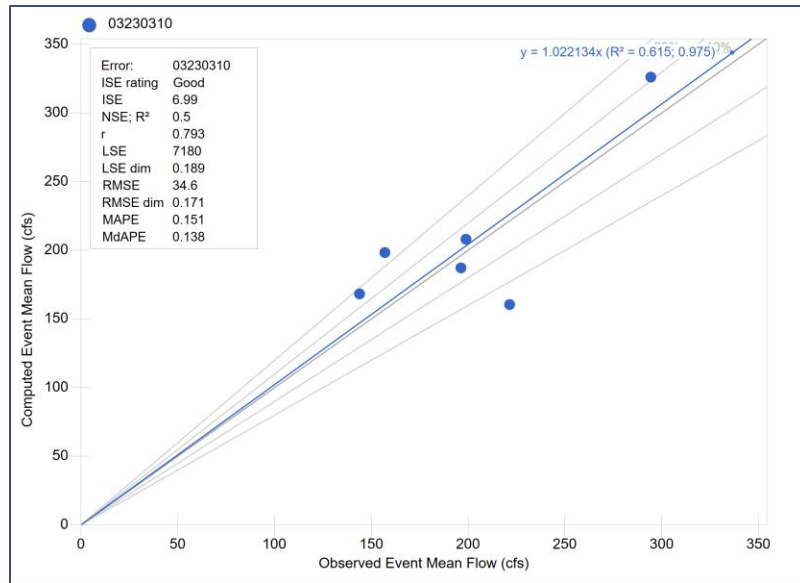


* 10% and 20% Error Bands Shown in Graphs

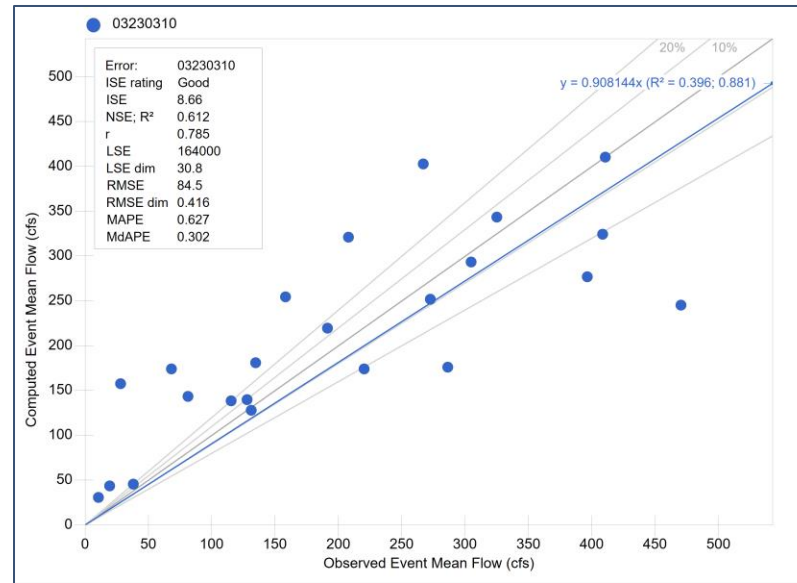
Validation Summary

USGS Gauge 03230310

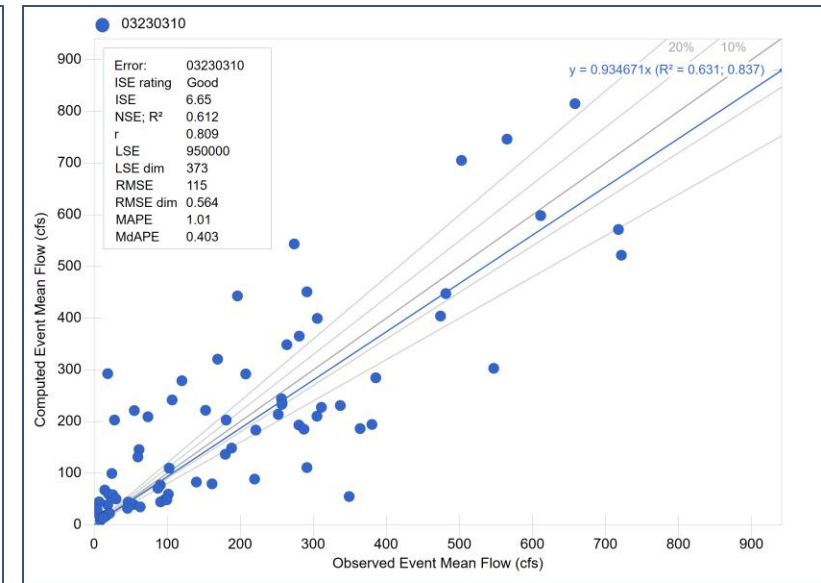
Annual Mean Flow



Seasonal Mean Flow



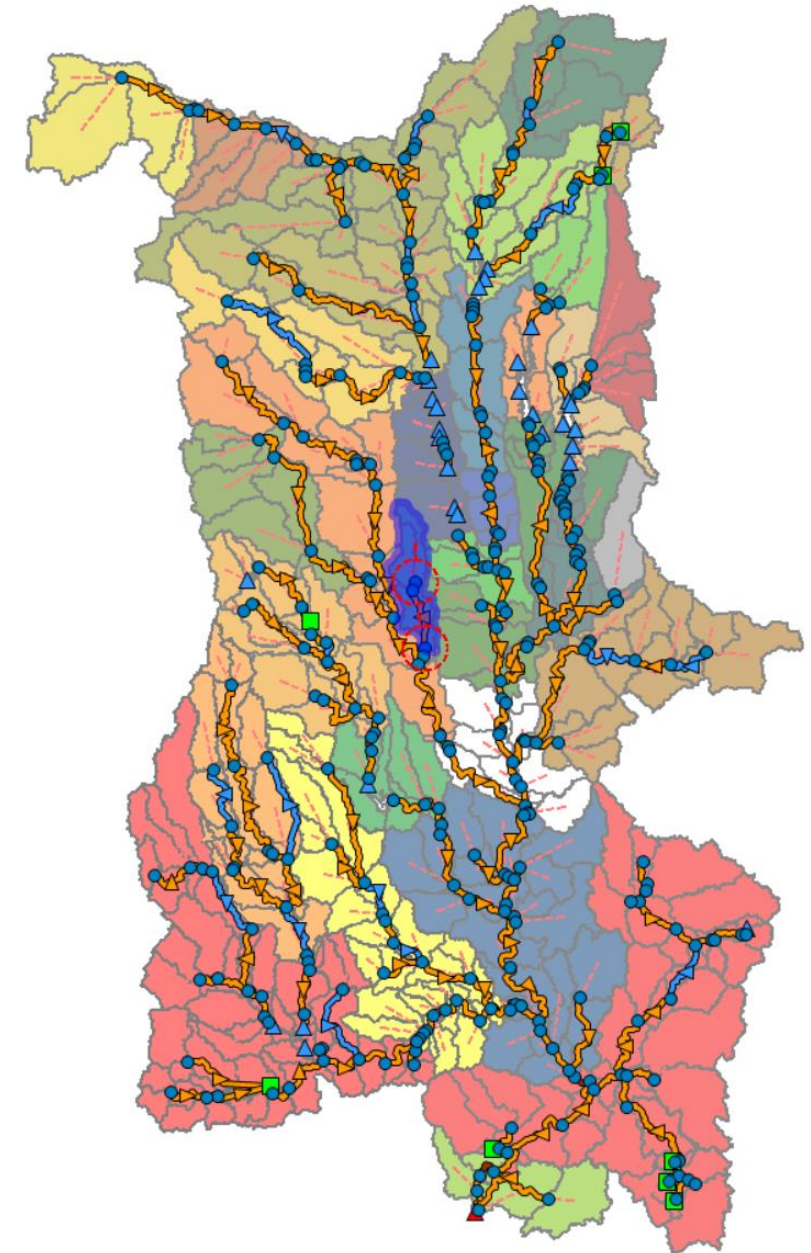
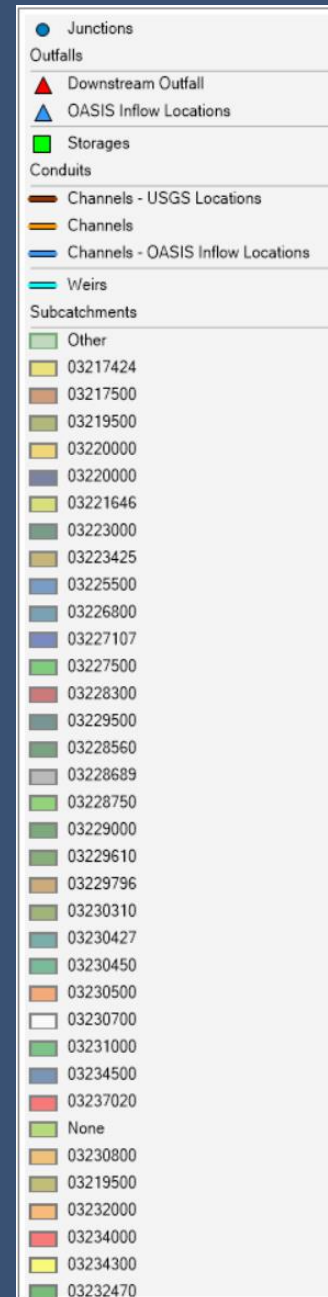
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03230450

Hellbranch Run near Harrisburg OH



Calibration Summary

USGS Gauge 03230450

- Calibration Period
 - 01/01/2010 – 01/01/2017
- Validation Period
 - 01/01/2017 – 01/01/2023
- Comments
 - *None*

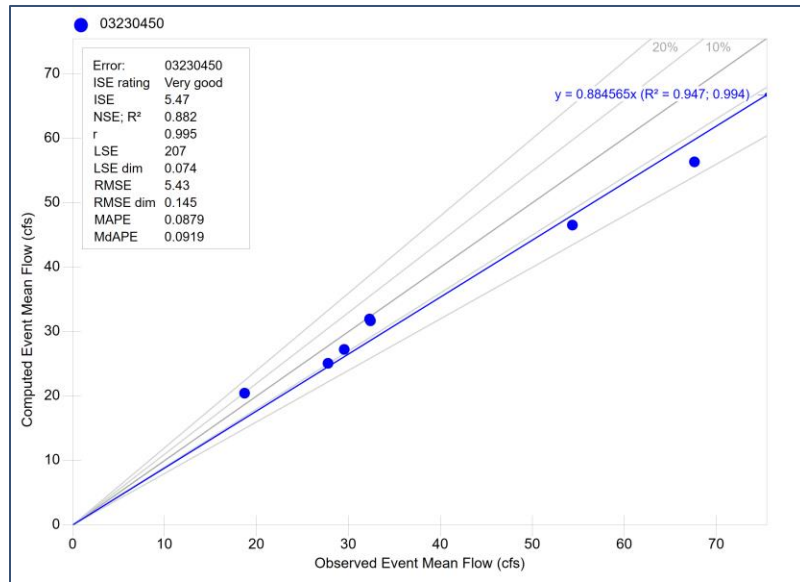
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	27.8	24.8	-11%
	2011	67.7	56.4	-17%
	2012	18.7	20.3	9%
	2013	32.4	31.7	-2%
	2014	32.3	32.1	-1%
	2015	54.4	46.5	-14%
	2016	29.6	27.2	-8%
Validation	2017	52.7	47.6	-10%
	2018	76.6	73.8	-4%
	2019	56.5	45.3	-20%
	2020	52.8	47.0	-11%
	2021	37.5	31.7	-16%
	2022	46.8	48.9	5%

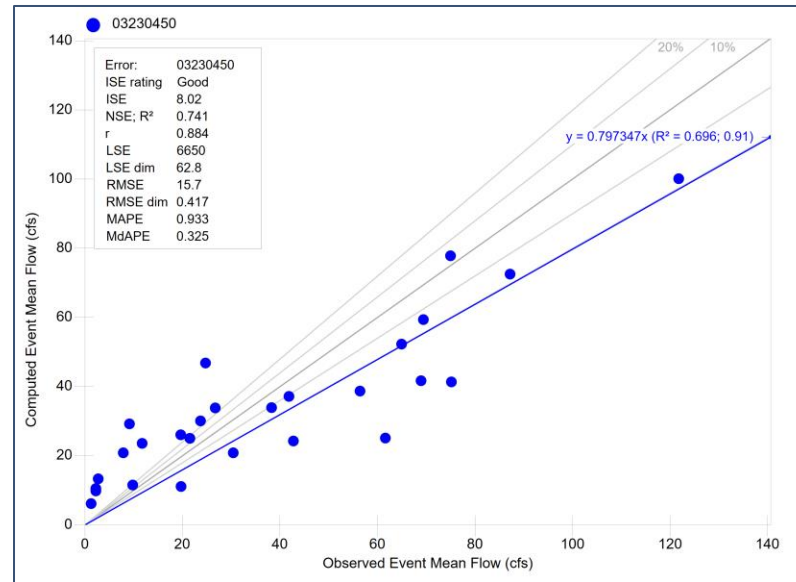
Calibration Summary

USGS Gauge 03230450

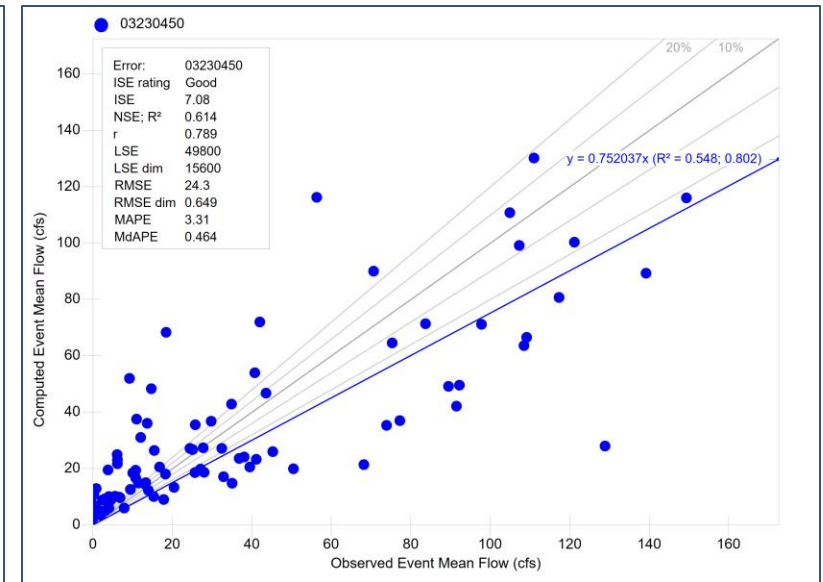
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

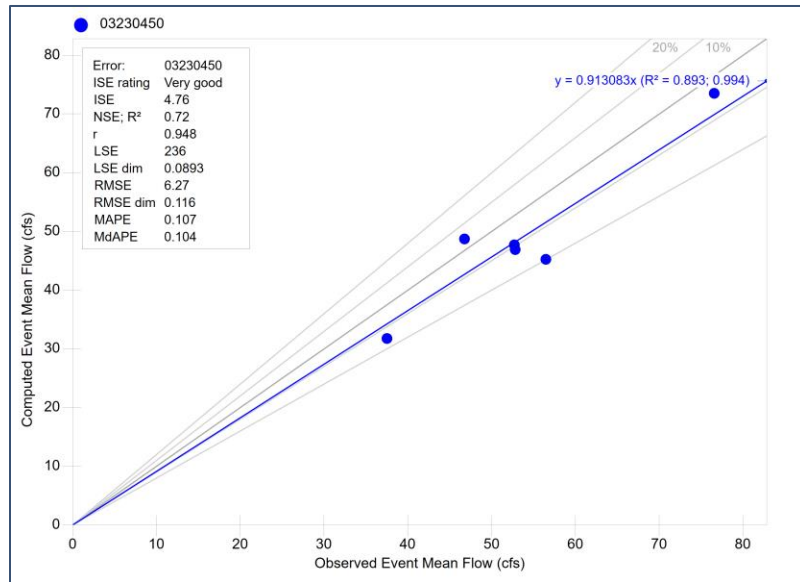


* 10% and 20% Error Bands Shown in Graphs

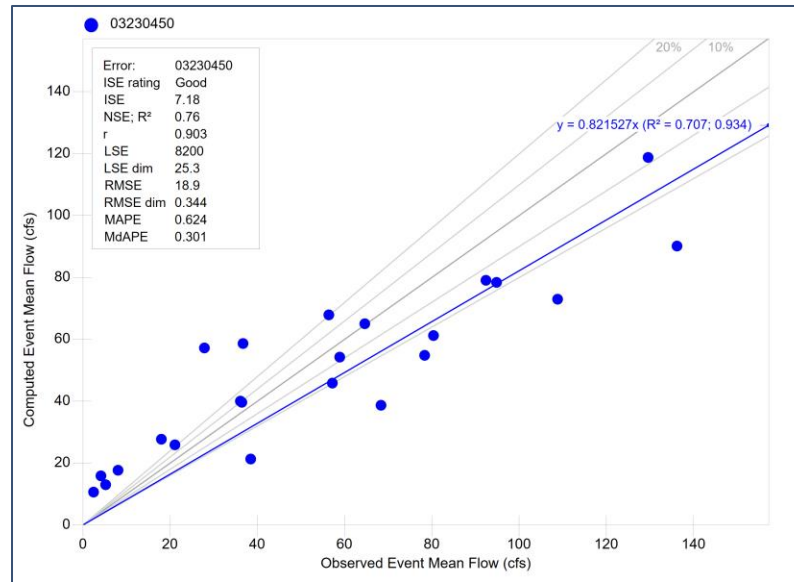
Validation Summary

USGS Gauge 03230450

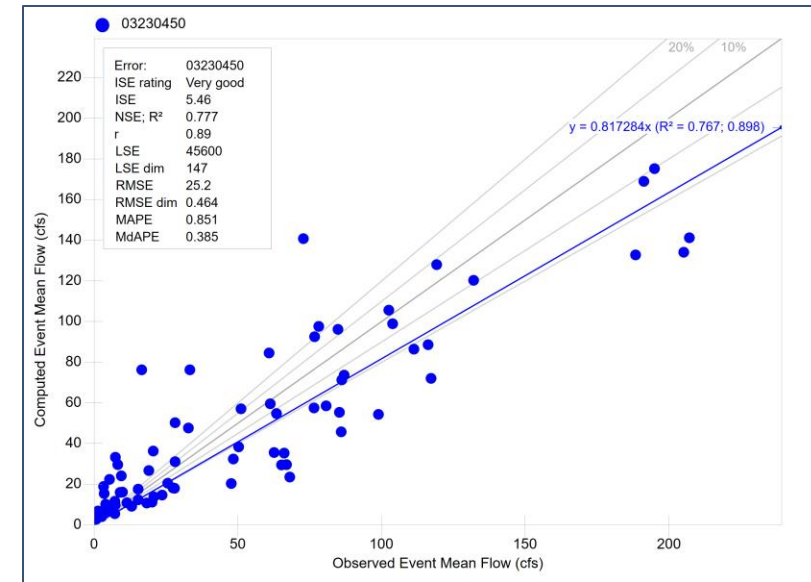
Annual Mean Flow



Seasonal Mean Flow



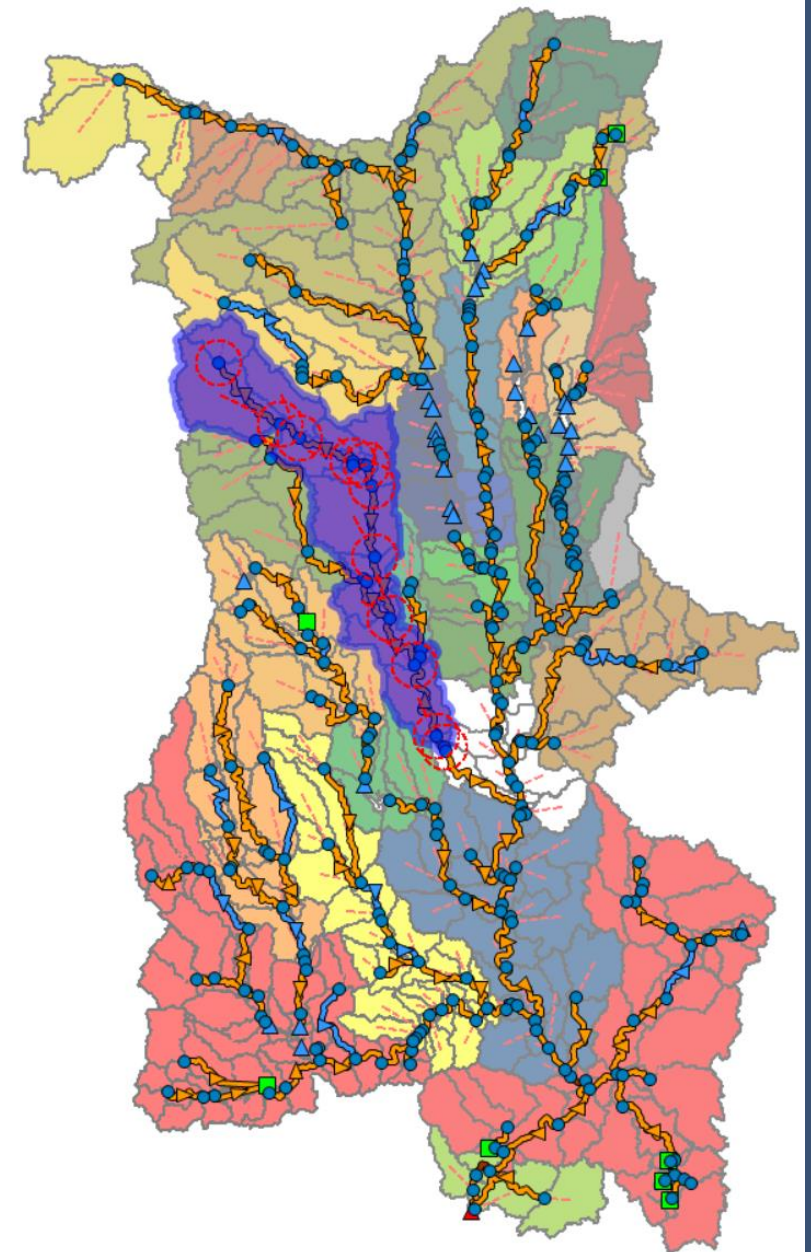
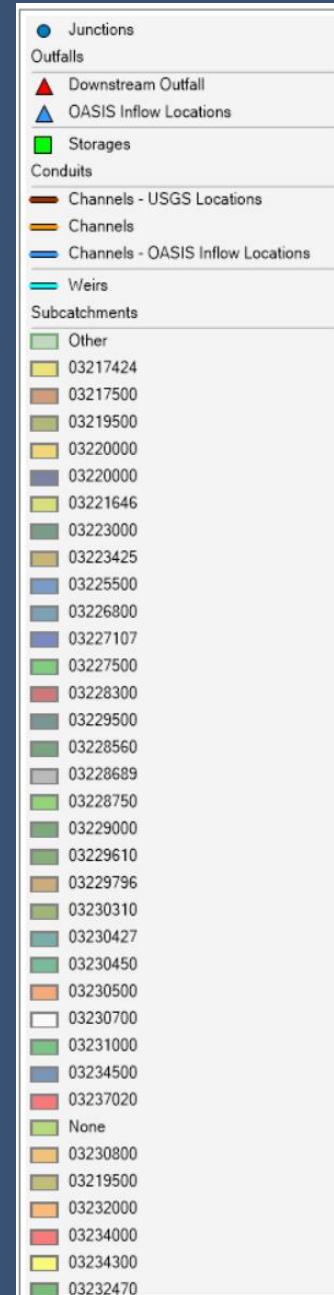
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03230500

Big Darby Creek at Darbyville OH



Calibration Summary

USGS Gauge 03230500

- Calibration Period
 - 01/01/2010 – 01/01/2017
- Validation Period
 - 01/01/2017 – 01/01/2023
- Comments
 - *None*

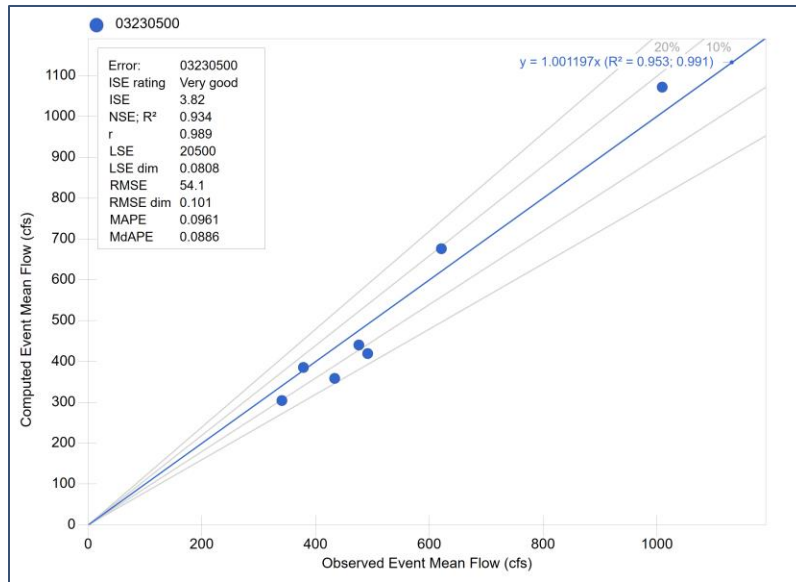
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	433.4	358.6	-17%
	2011	1009.0	1072.0	6%
	2012	340.6	304.0	-11%
	2013	491.4	419.0	-15%
	2014	476.1	440.1	-8%
	2015	621.1	676.1	9%
	2016	378.4	385.4	2%
Validation	2017	620.0	578.6	-7%
	2018	923.1	978.7	6%
	2019	716.8	667.7	-7%
	2020	560.3	619.8	11%
	2021	487.5	425.5	-13%
	2022	630.4	577.3	-8%

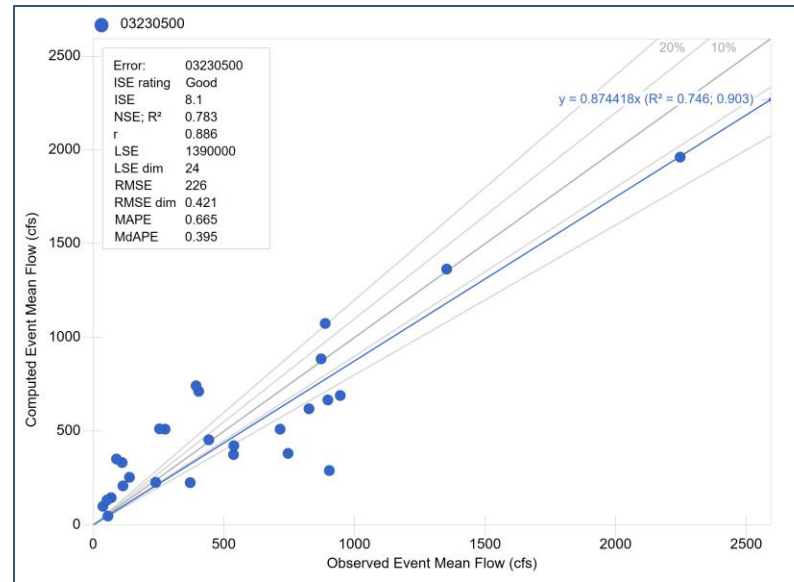
Calibration Summary

USGS Gauge 03230500

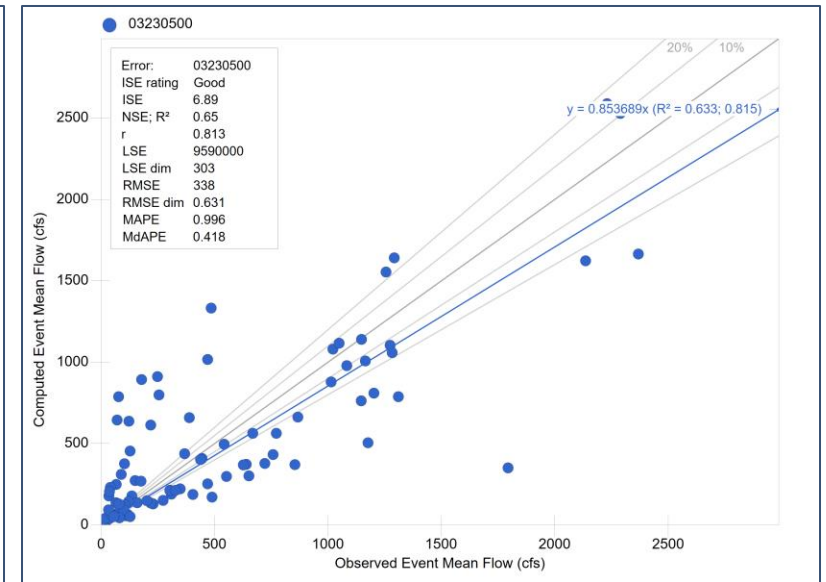
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

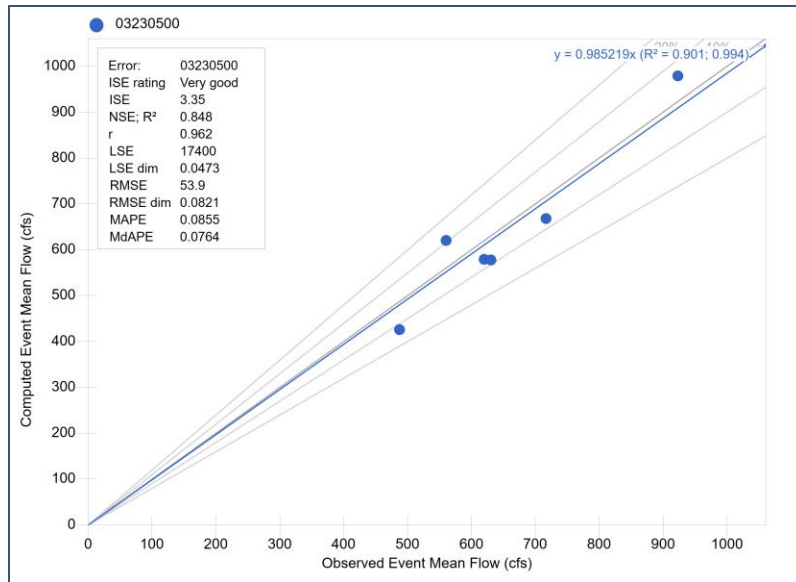


* 10% and 20% Error Bands Shown in Graphs

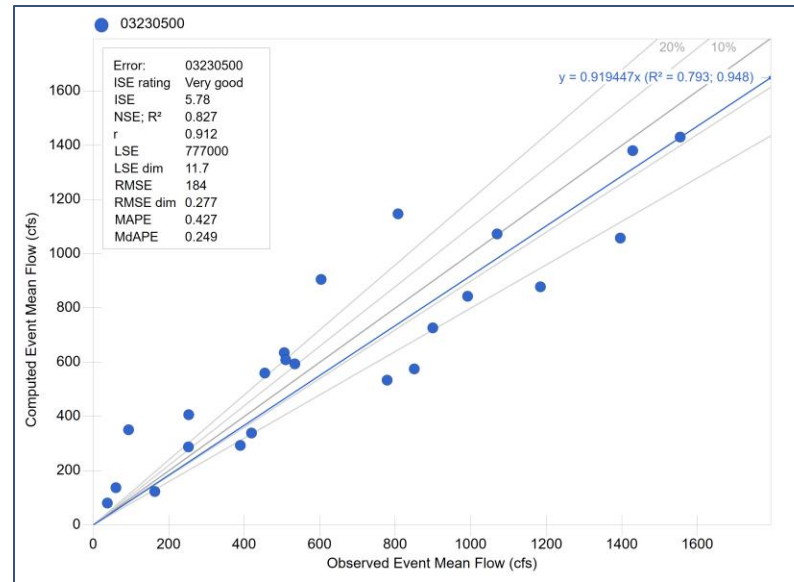
Validation Summary

USGS Gauge 03230500

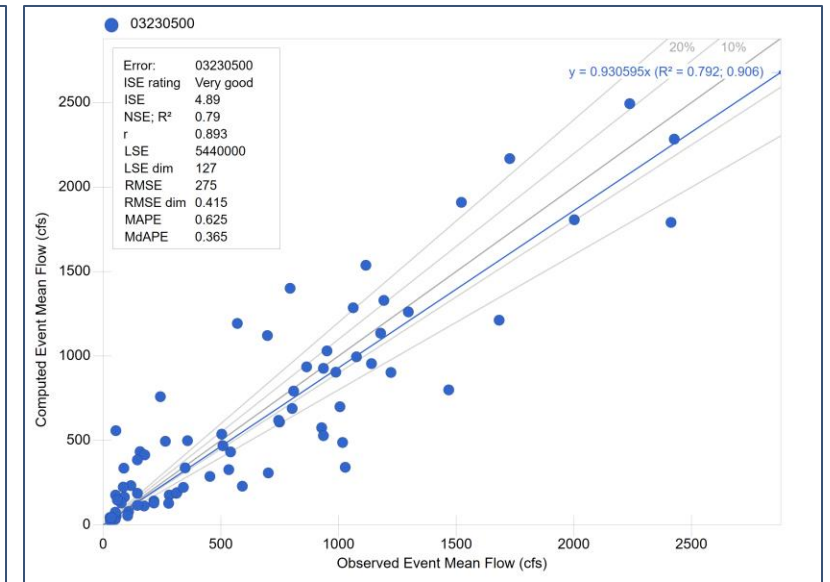
Annual Mean Flow



Seasonal Mean Flow



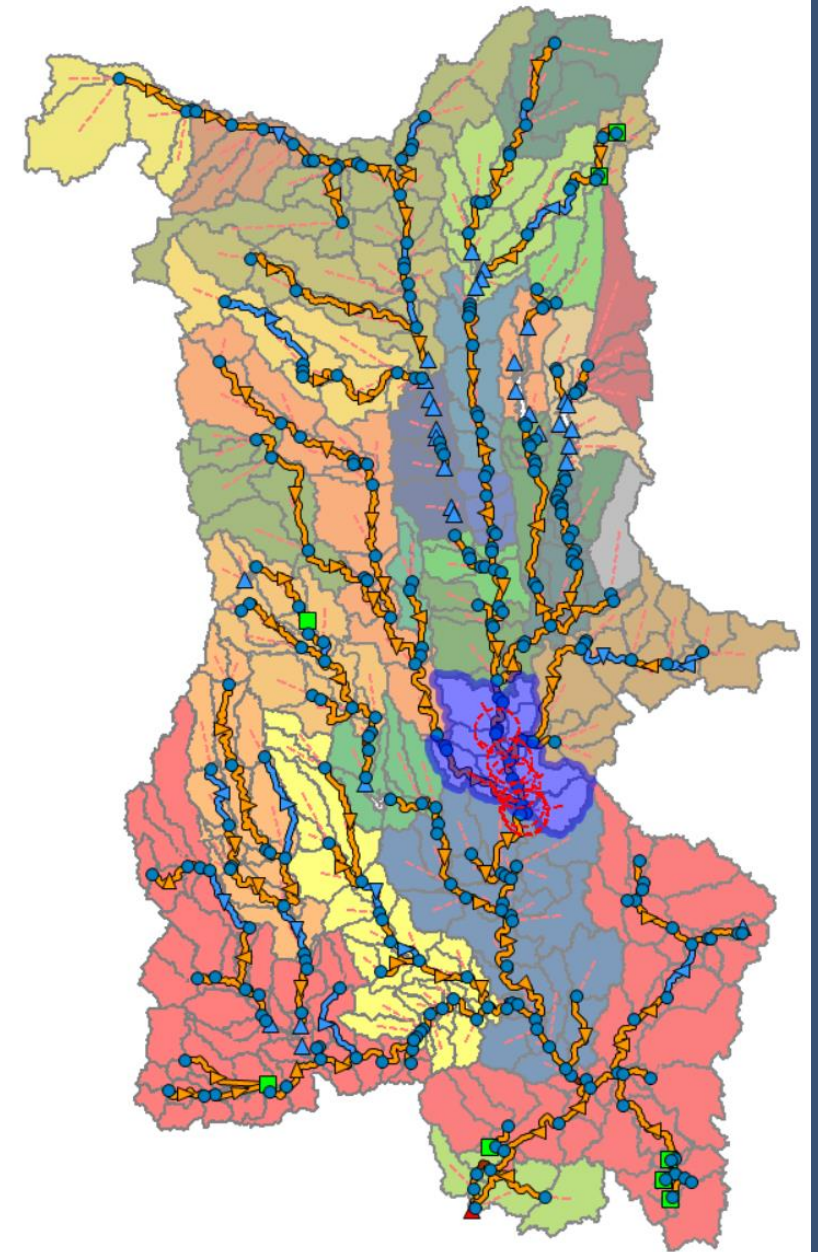
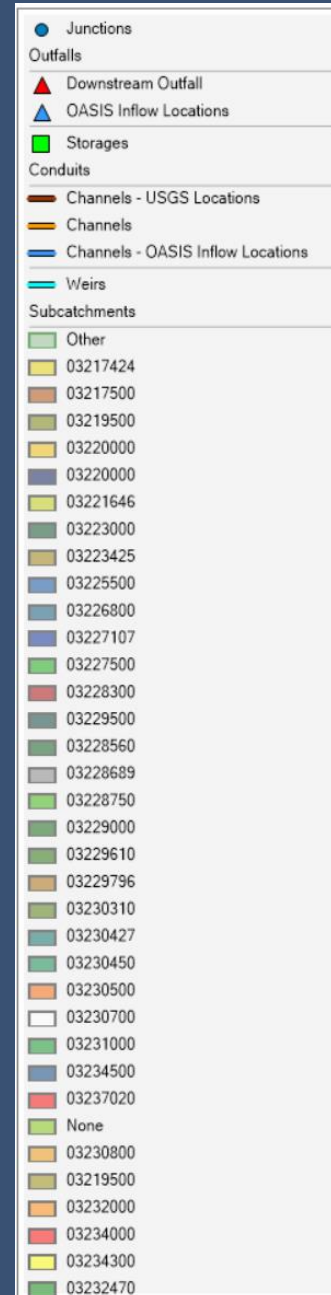
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03230700

Scioto River at Circleville OH



Calibration Summary

USGS Gauge 03230700

- Calibration Period
 - 01/01/2015 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023
- Comments
 - *Upstream USGS gauges 03221646, 03225500, 03228805 and 03228500 were used for upstream boundary conditions.*
 - *The Dublin and Hap Cremean Water Treatment Plant Historical Withdrawals were accounted for during calibration.*
 - *Return flows from the Jackson Pike and Columbus Southerly wastewater treatment plants were accounted for during calibration.*
 - *Westerville Reservoir was represented in SWMM model as a simple rectangular reservoir for calibration of the drainage area only. In the main model, the reservoir is not explicitly modeled. This reservoir is represented in the OASIS model.*

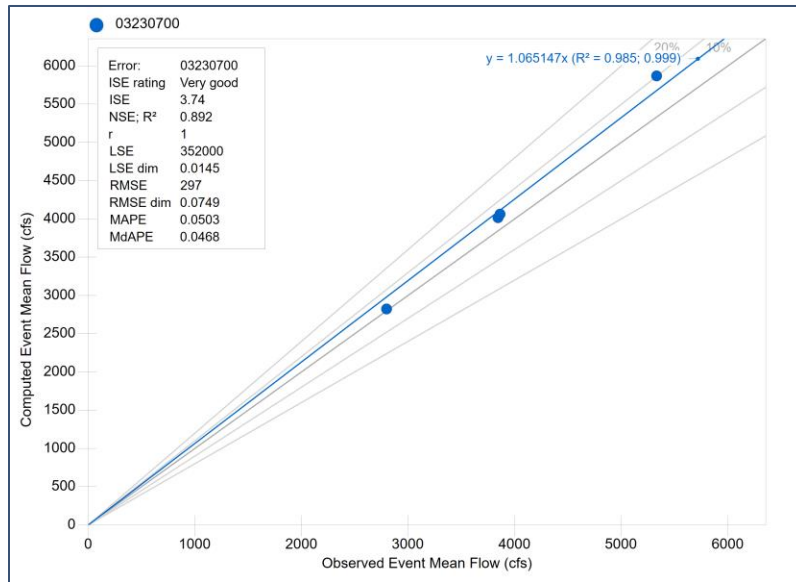
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2015	3846.0	4014.0	4%
	2016	2801.0	2821.0	1%
	2017	3866.0	4059.0	5%
	2018	5334.0	5869.0	10%
Validation	2019	4991.0	5036.0	1%
	2020	4082.0	4324.0	6%
	2021	3127.0	3182.0	2%
	2022	4078.0	4176.0	2%

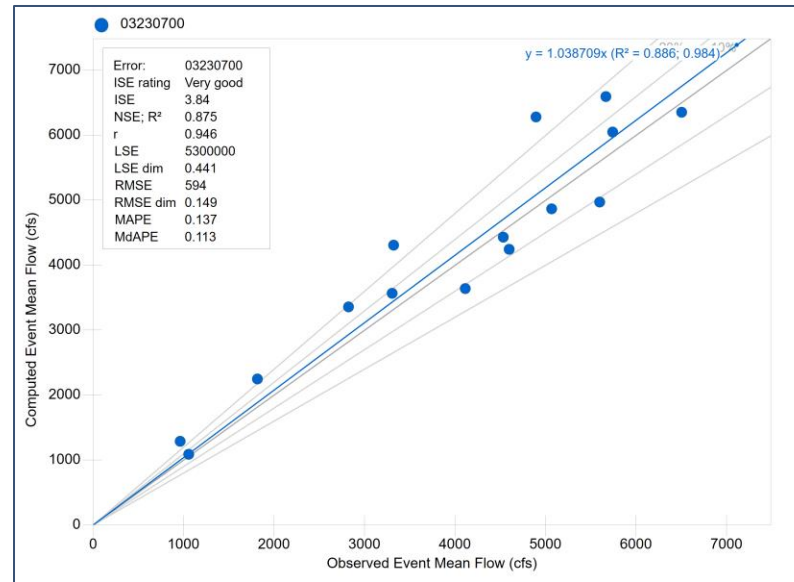
Calibration Summary

USGS Gauge 03230700

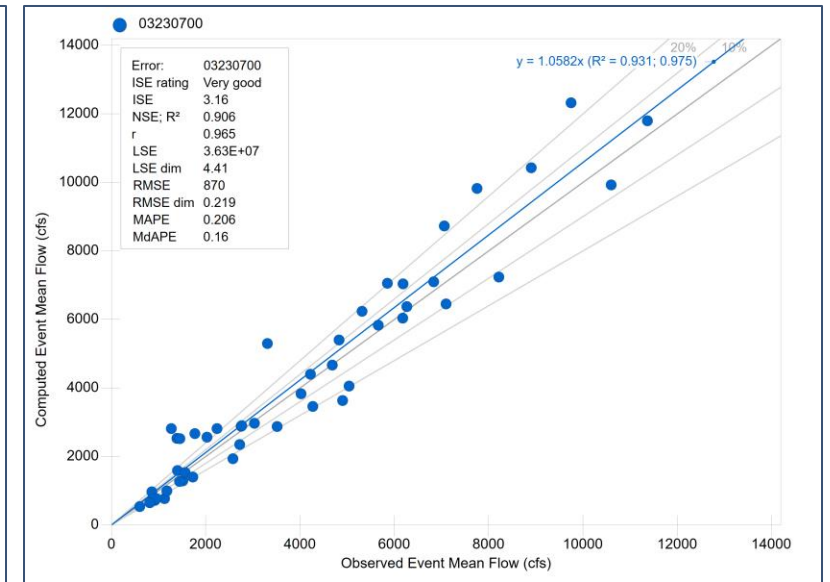
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

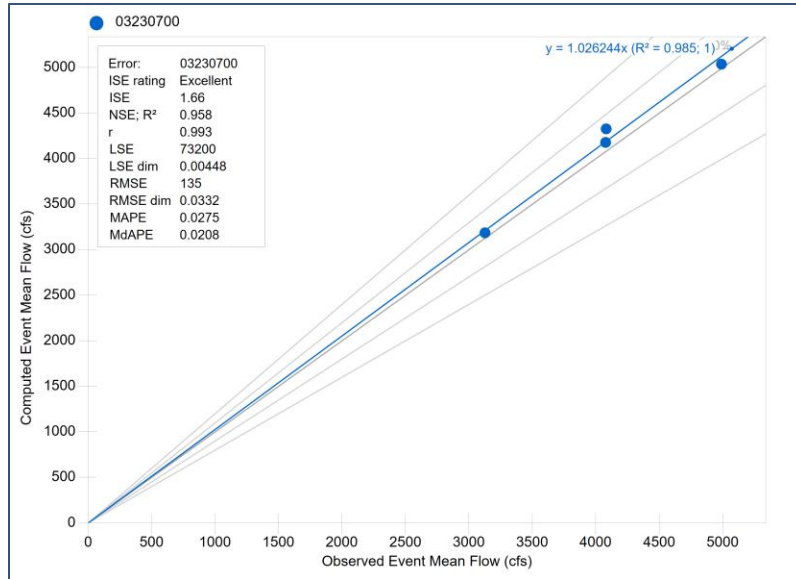


* 10% and 20% Error Bands Shown in Graphs

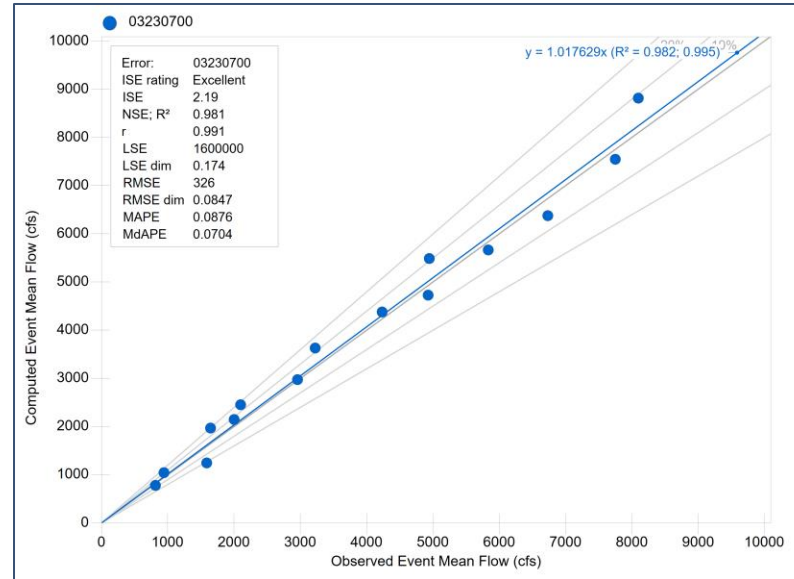
Validation Summary

USGS Gauge 03230700

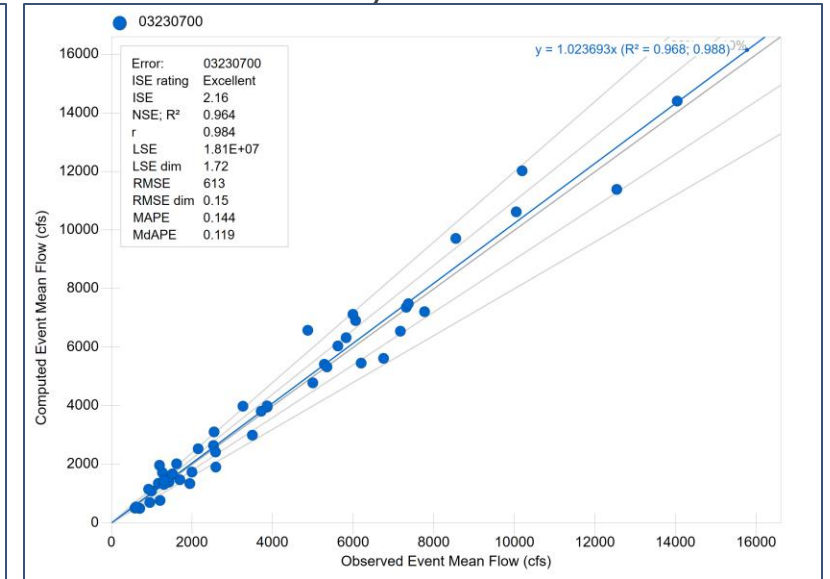
Annual Mean Flow



Seasonal Mean Flow



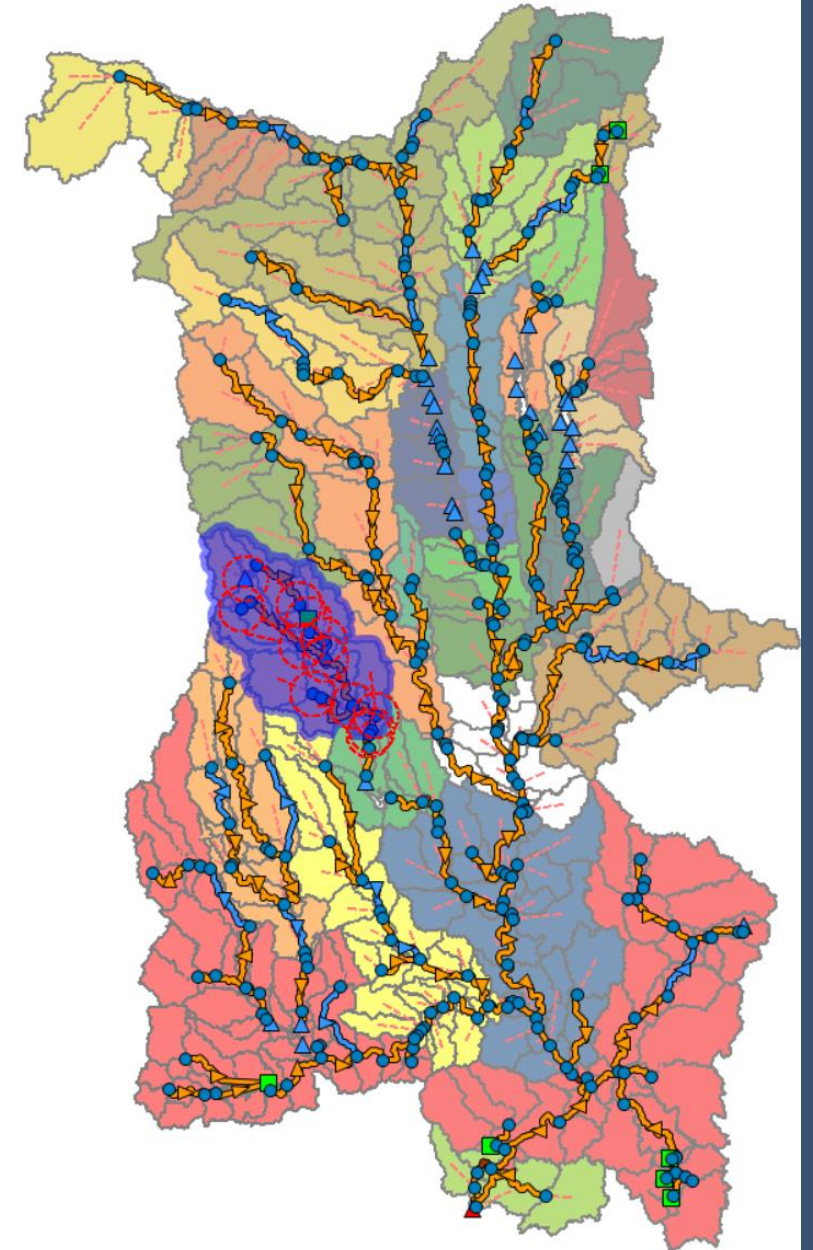
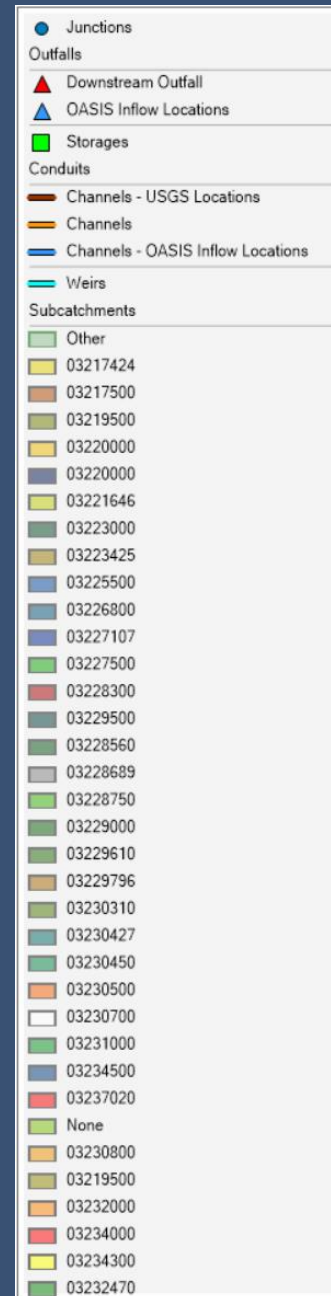
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03230800

Deer Creek at Mount Sterling OH



Calibration Summary

USGS Gauge 03230800

- Calibration Period
 - 01/01/2010 – 01/01/2015
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - *None*

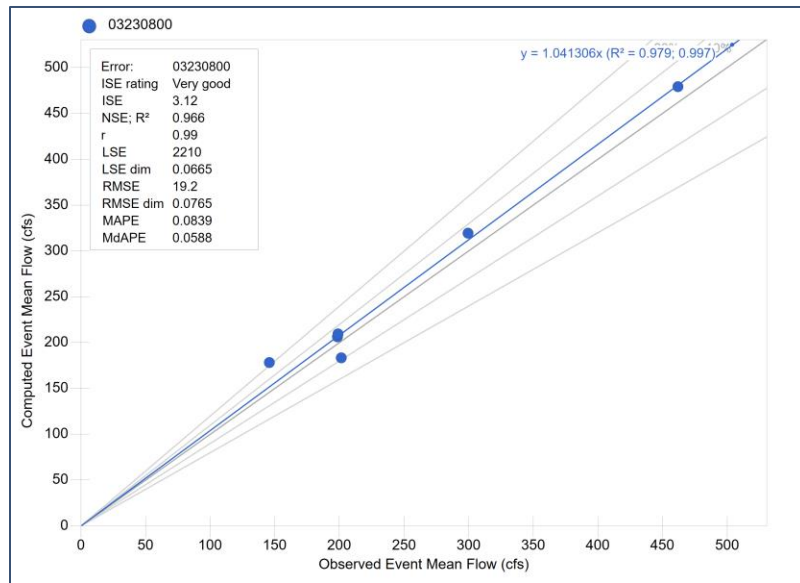
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2010	198.6	206.2	4%
	2011	462.1	479.0	4%
	2012	145.9	177.9	22%
	2013	201.6	183.3	-9%
	2014	199.1	209.3	5%
	2015	299.5	319.4	7%
Validation	2016	196.8	168.7	-14%
	2017	382.2	278.5	-27%
	2018	394.9	431.5	9%
	2019	312.6	352.0	13%
	2020	229.8	253.9	10%
	2021	236.0	220.4	-7%
	2022	282.3	277.8	-2%

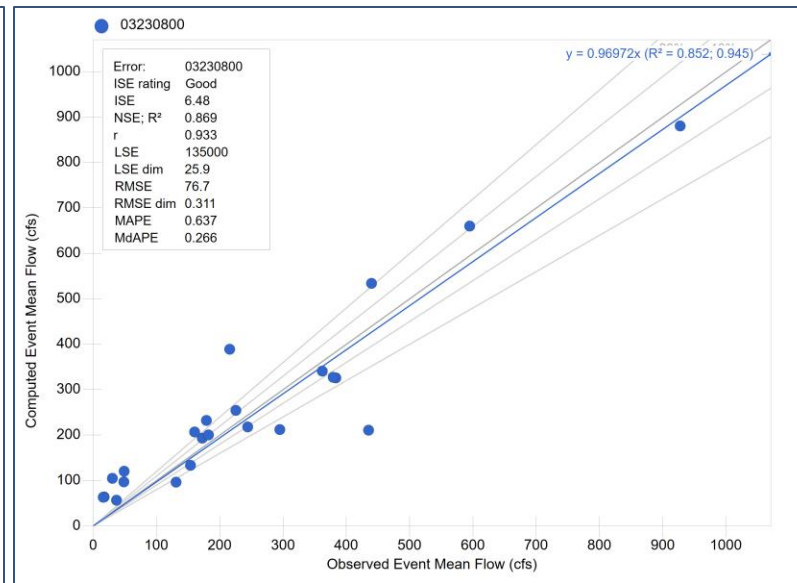
Calibration Summary

USGS Gauge 03230800

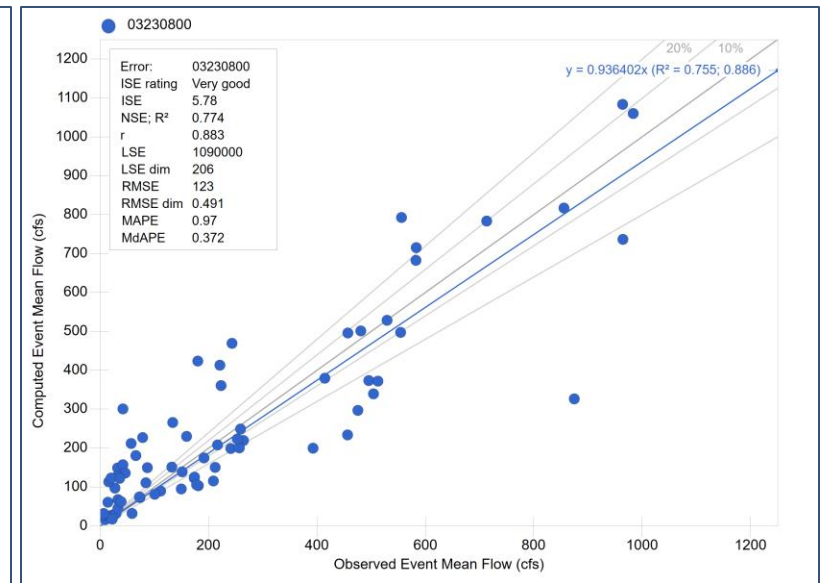
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

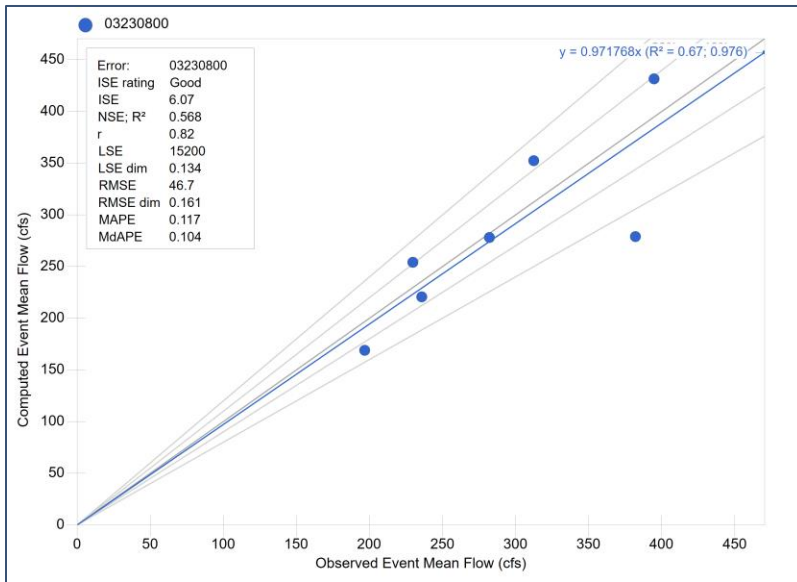


* 10% and 20% Error Bands Shown in Graphs

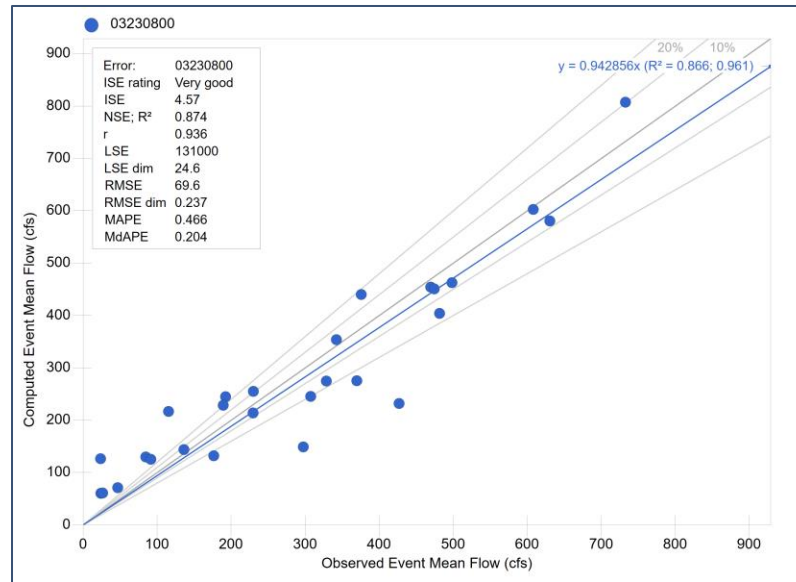
Validation Summary

USGS Gauge 03230800

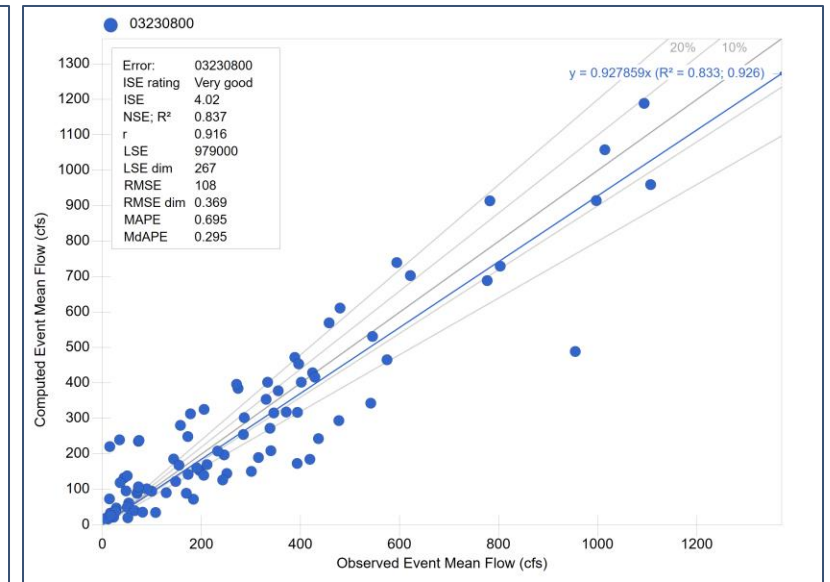
Annual Mean Flow



Seasonal Mean Flow



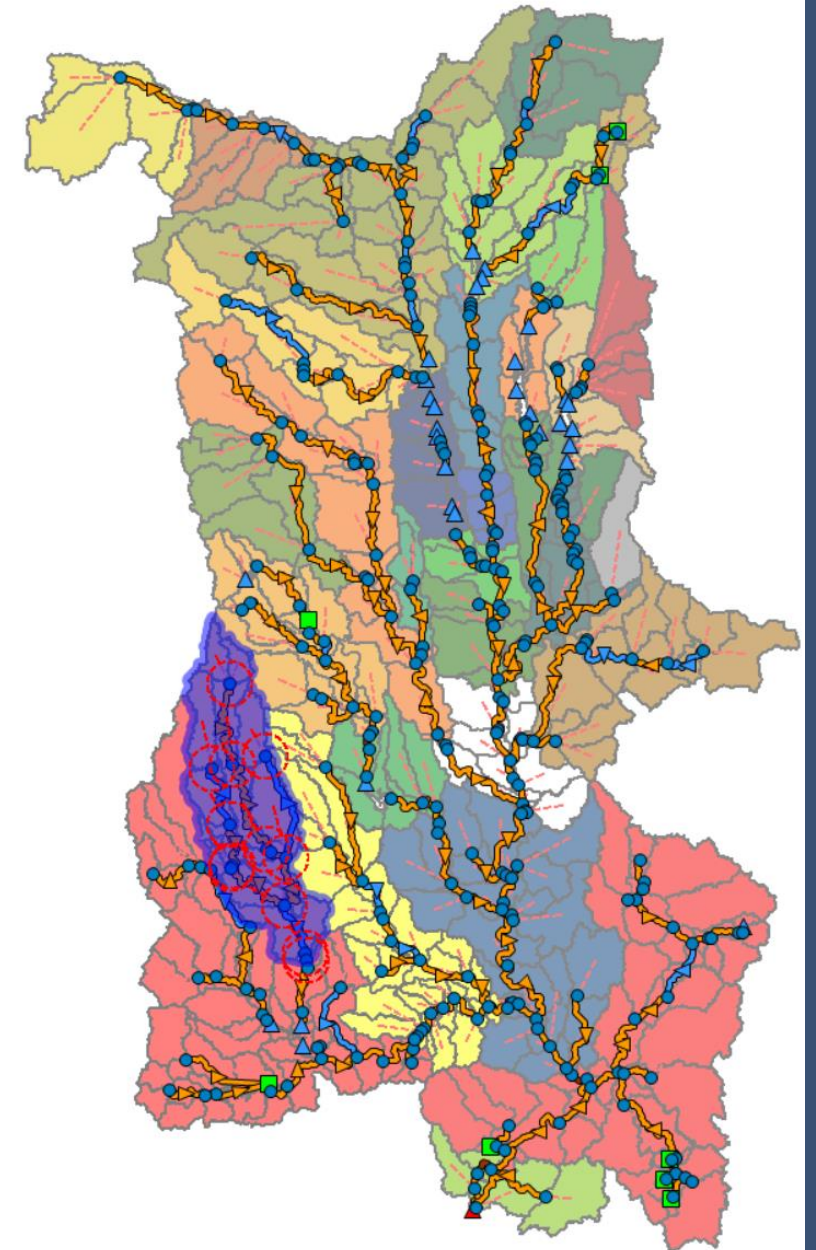
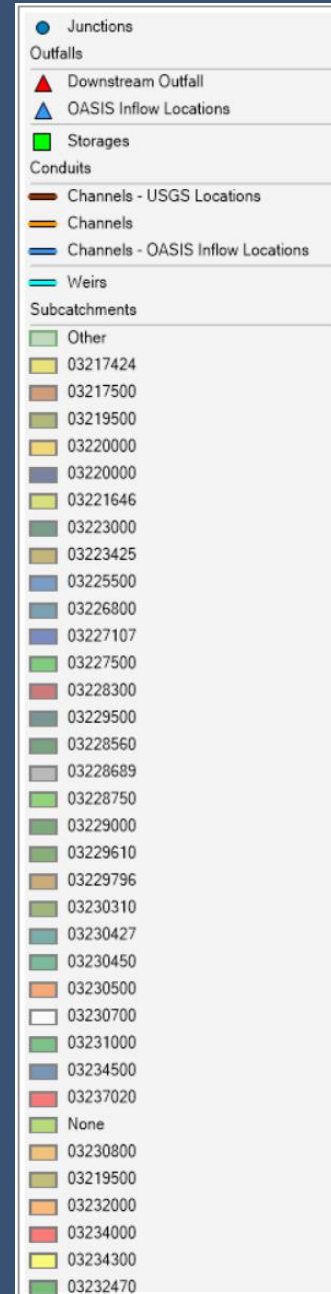
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03232000

Paint Creek near Greenfield OH



Calibration Summary

USGS Gauge 03232000

- Calibration Period
 - 01/01/2014 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023
- Comments
 - *None*

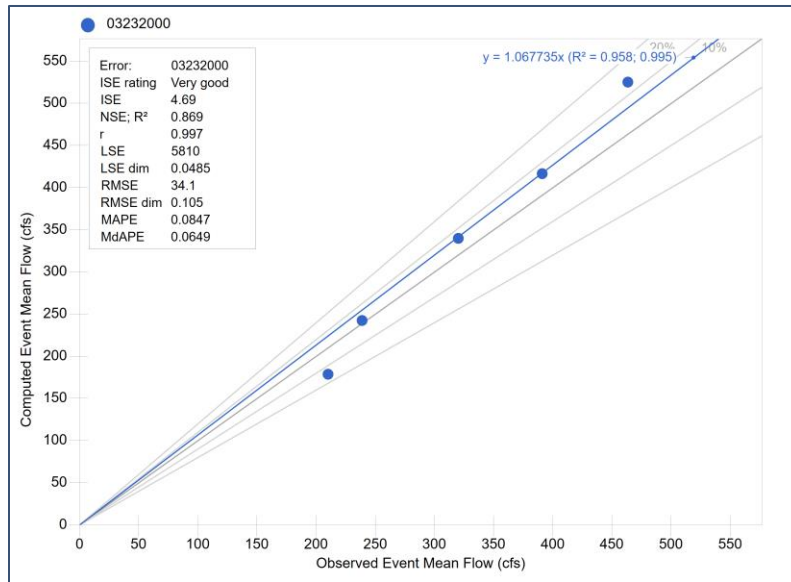
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2014	238.9	242.3	1%
	2015	320.3	339.8	6%
	2016	210.2	178.4	-15%
	2017	391.1	416.5	6%
	2018	463.6	524.9	13%
Validation	2019	431.3	446.9	4%
	2020	265.3	286.4	8%
	2021	263.4	277.0	5%
	2022	348.0	353.1	1%

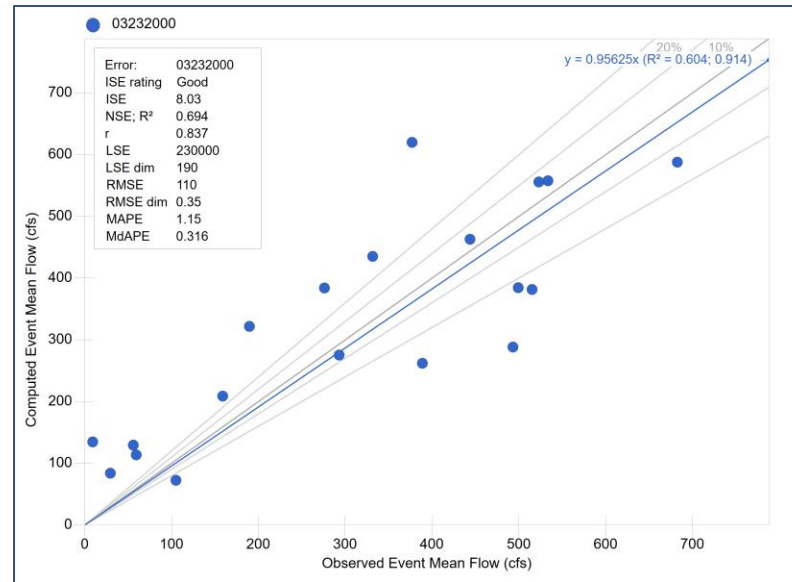
Calibration Summary

USGS Gauge 03232000

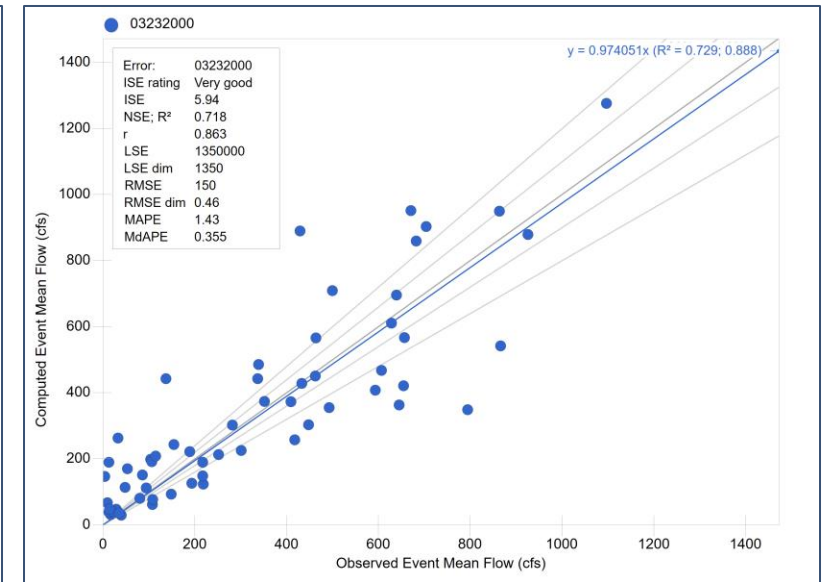
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

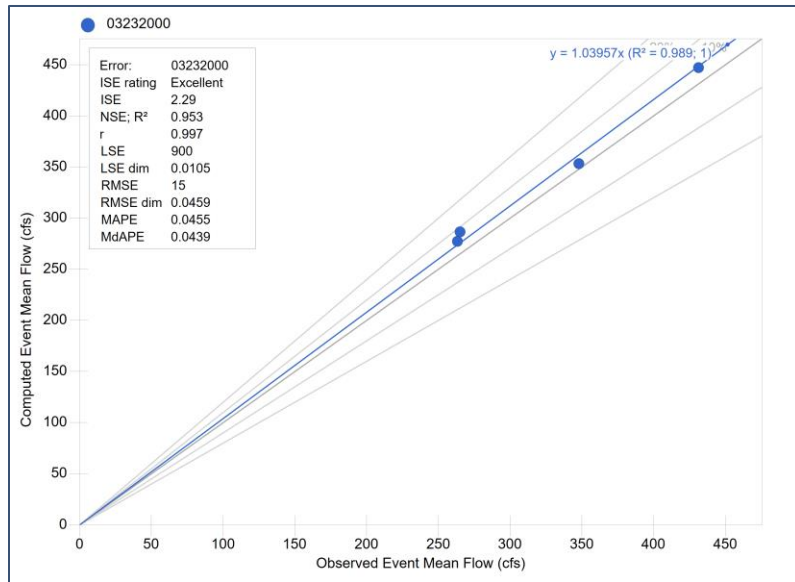


* 10% and 20% Error Bands Shown in Graphs

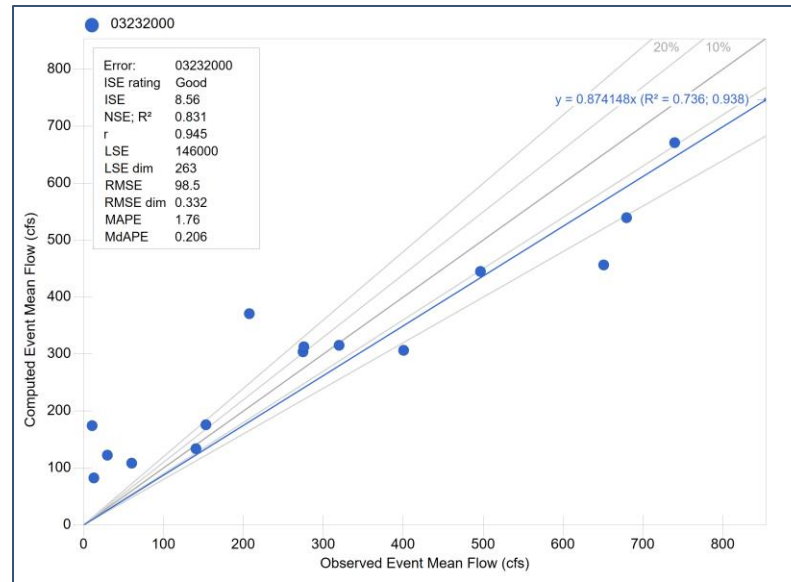
Validation Summary

USGS Gauge 03232000

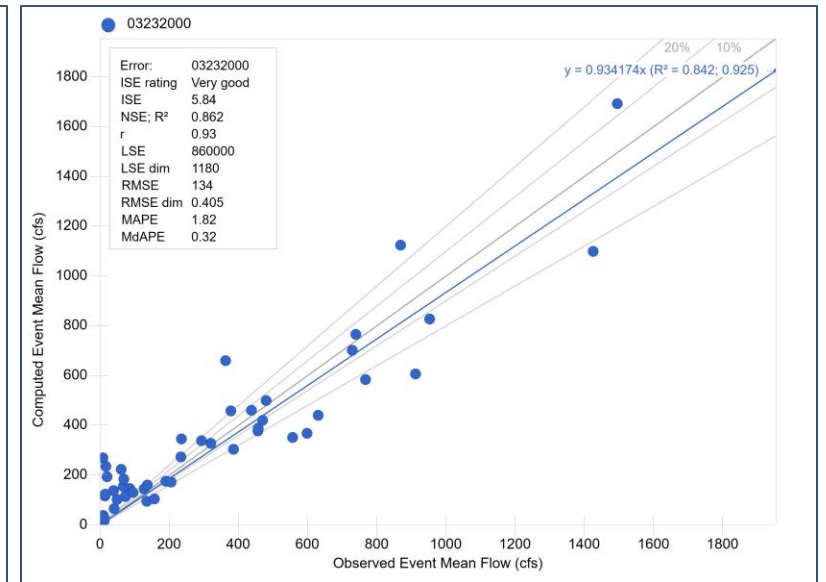
Annual Mean Flow



Seasonal Mean Flow



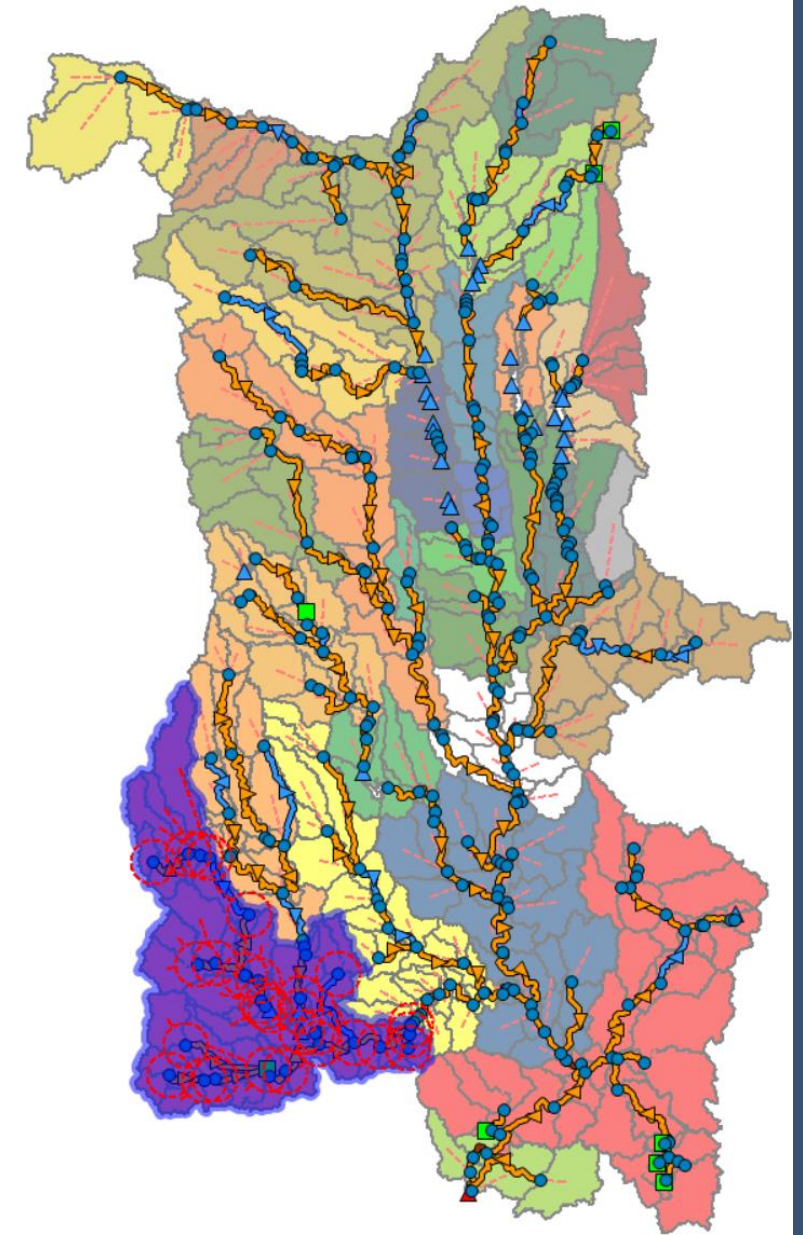
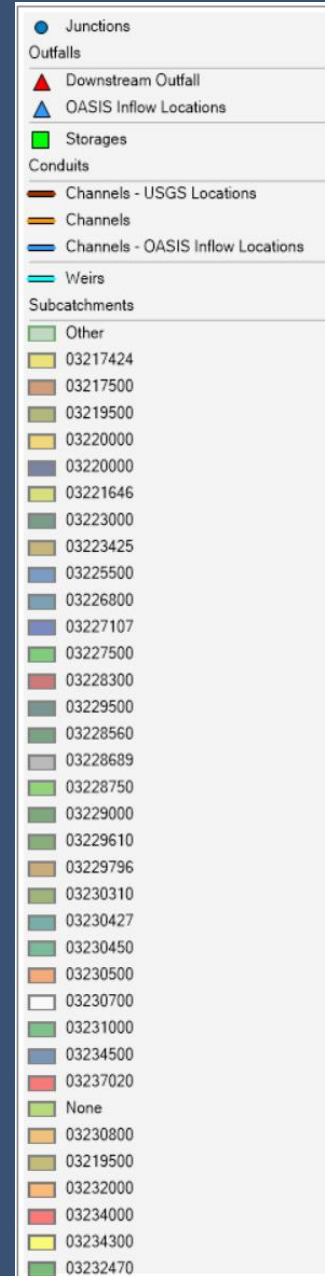
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03234000

Paint Creek near Bourneville OH



Calibration Summary

USGS Gauge 03234000

- Calibration Period
 - 01/01/2014 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023
- Comments
 - *None*

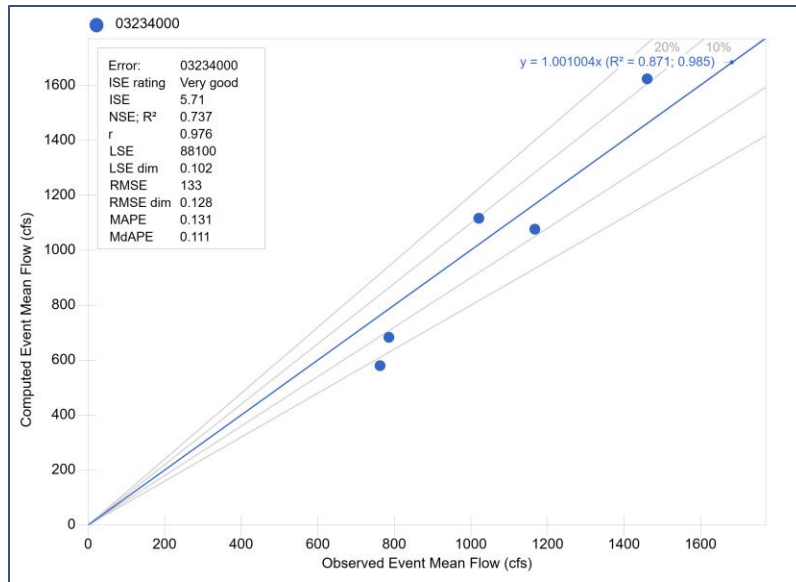
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2014	785.9	854.0	9%
	2015	1021.0	1116.0	9%
	2016	762.9	579.1	-24%
	2017	1167.0	1076.0	-8%
	2018	1461.0	1623.0	11%
Validation	2019	1486.0	1367.0	-8%
	2020	941.7	877.6	-7%
	2021	911.0	873.2	-4%
	2022	1040.0	1041.0	0%

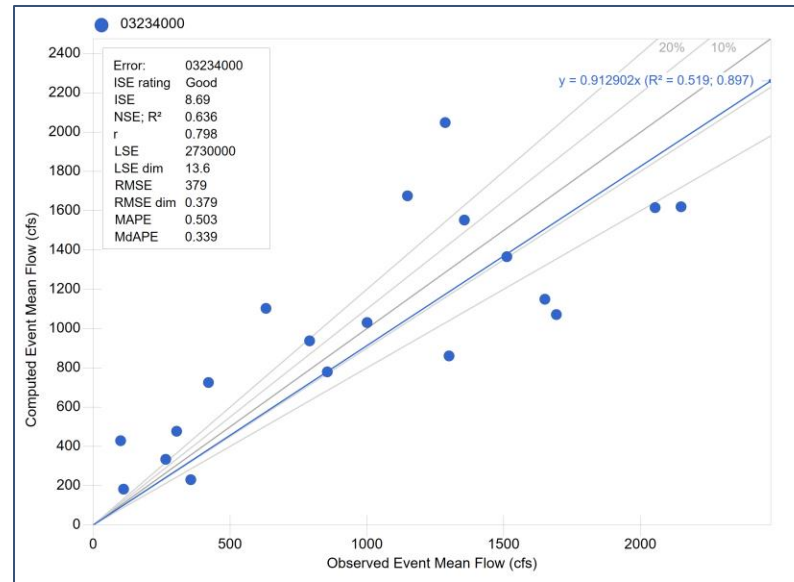
Calibration Summary

USGS Gauge 03234000

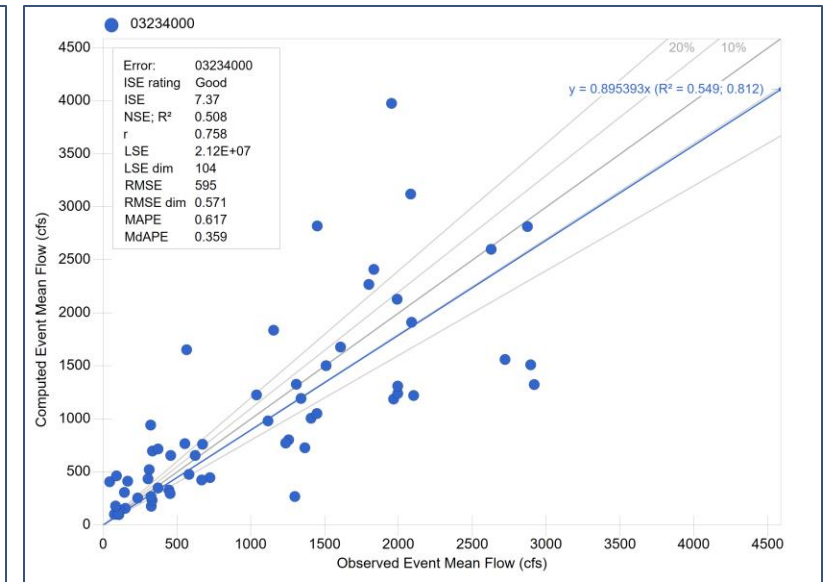
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

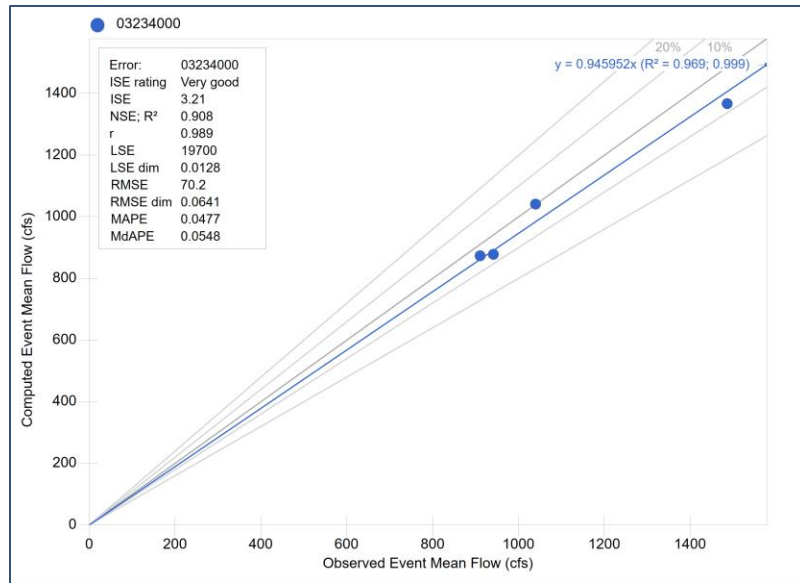


* 10% and 20% Error Bands Shown in Graphs

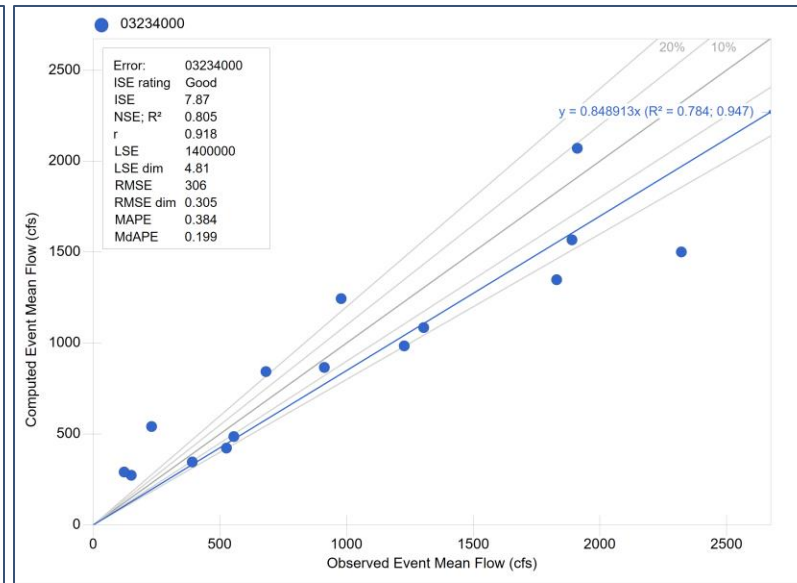
Validation Summary

USGS Gauge 03234000

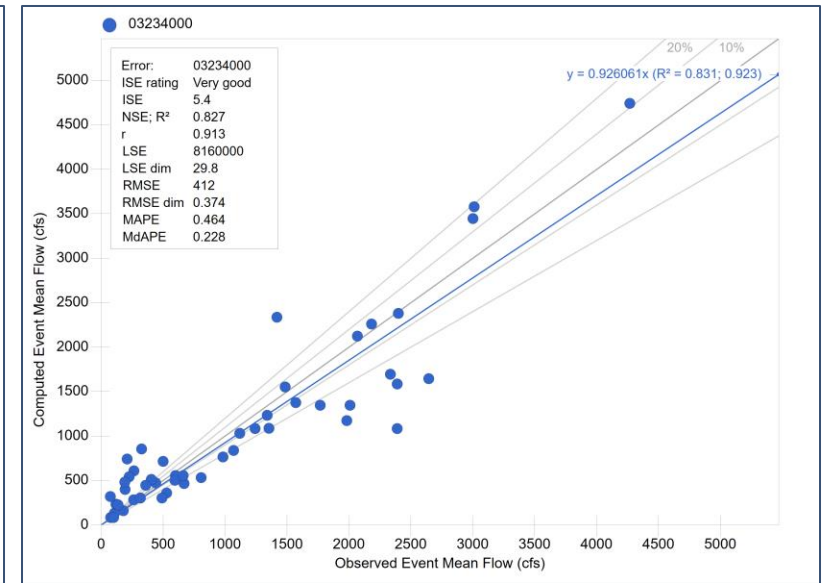
Annual Mean Flow



Seasonal Mean Flow



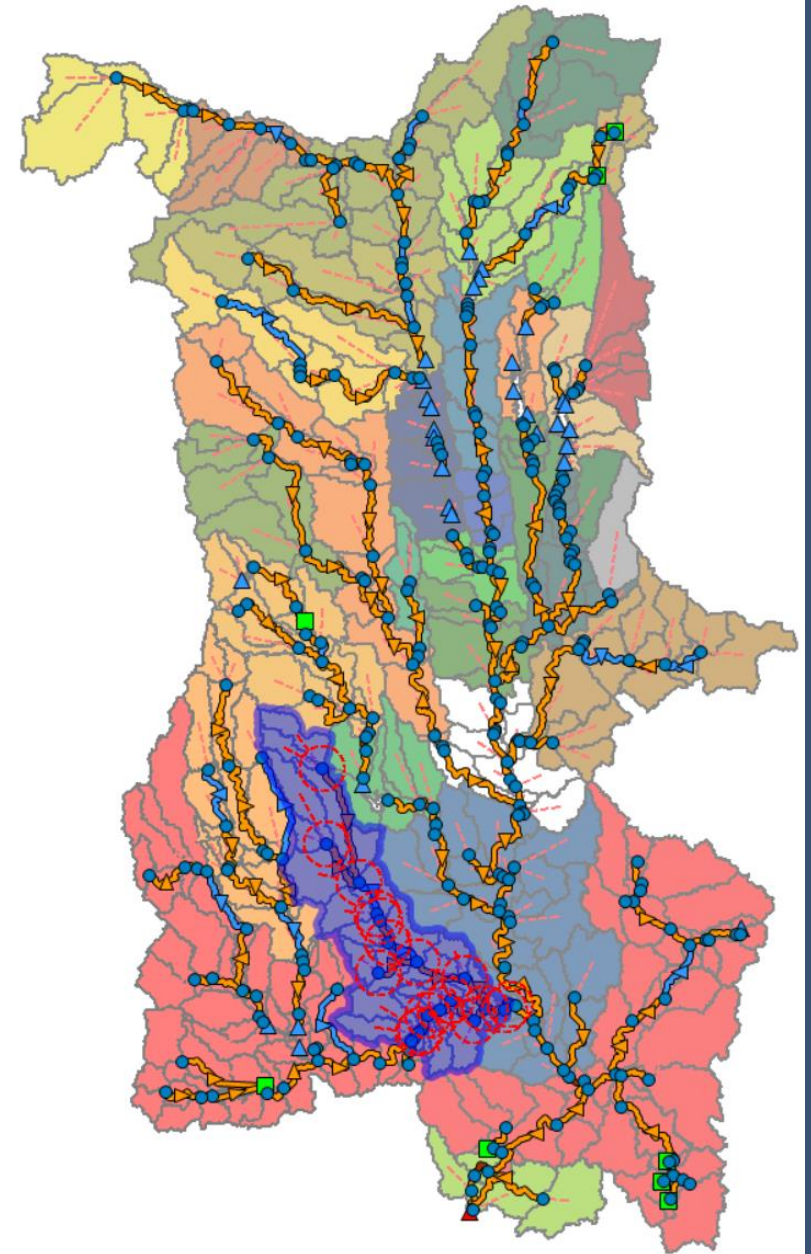
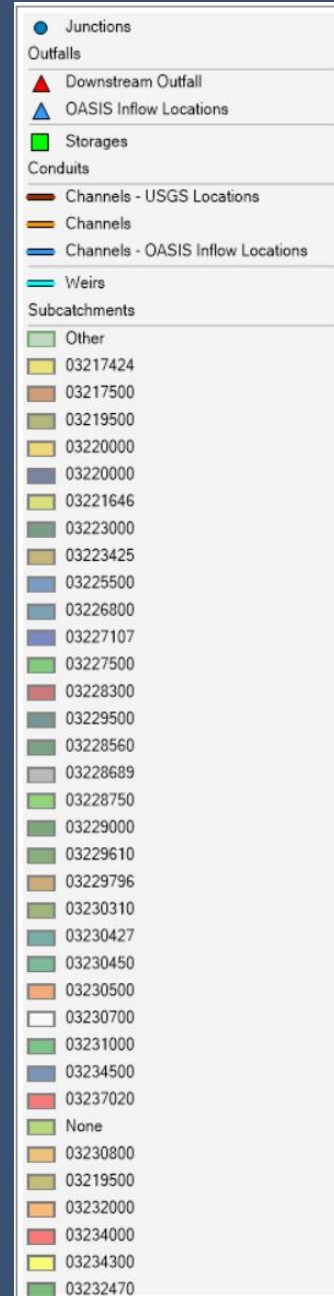
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03234300

Paint Creek at Chillicothe OH



Calibration Summary

USGS Gauge 03234300

- Calibration Period
 - 01/01/2011 – 01/01/2017
- Validation Period
 - 01/01/2017 – 01/01/2023
- Comments
 - *None*

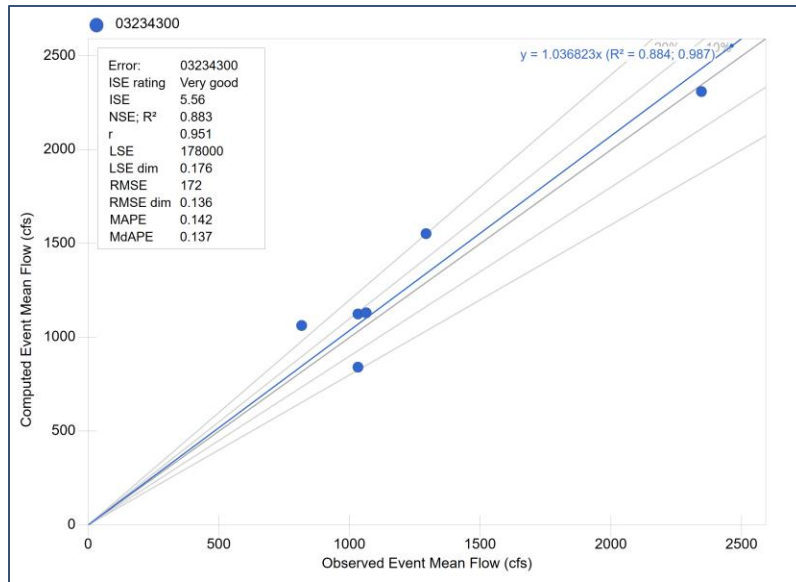
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2011	2347.0	2309.0	-2%
	2012	816.9	1062.0	30%
	2013	1033.0	1123.0	9%
	2014	1064.0	1130.0	6%
	2015	1293.0	1551.0	20%
	2016	1032.0	839.5	-19%
Validation	2017	1538.0	1546.0	1%
	2018	2097.0	2189.0	4%
	2019	2119.0	1925.0	-9%
	2020	1258.0	1229.0	-2%
	2021	1140.0	1128.0	-1%
	2022	1406.0	1453.0	3%

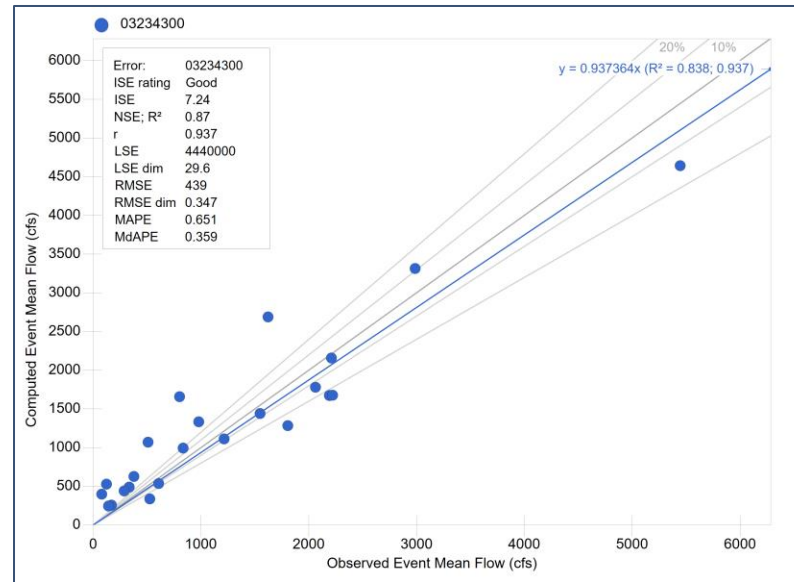
Calibration Summary

USGS Gauge 03234300

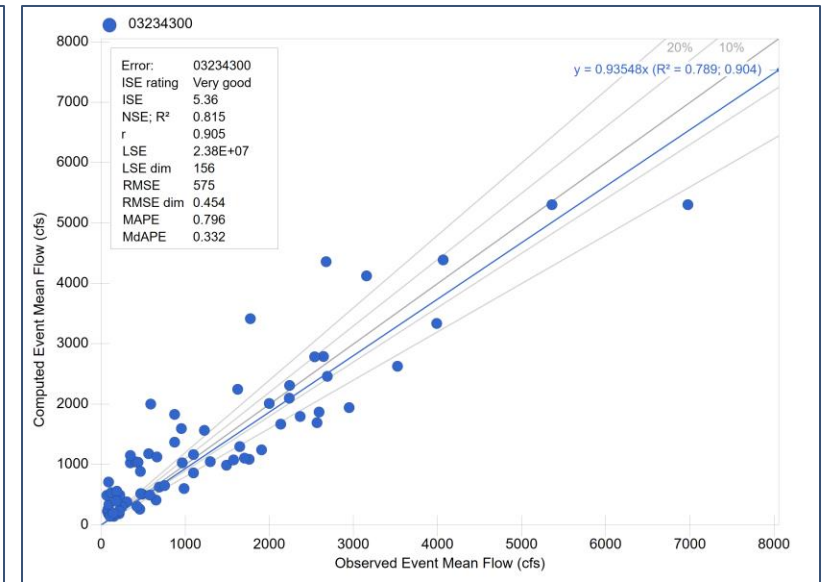
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

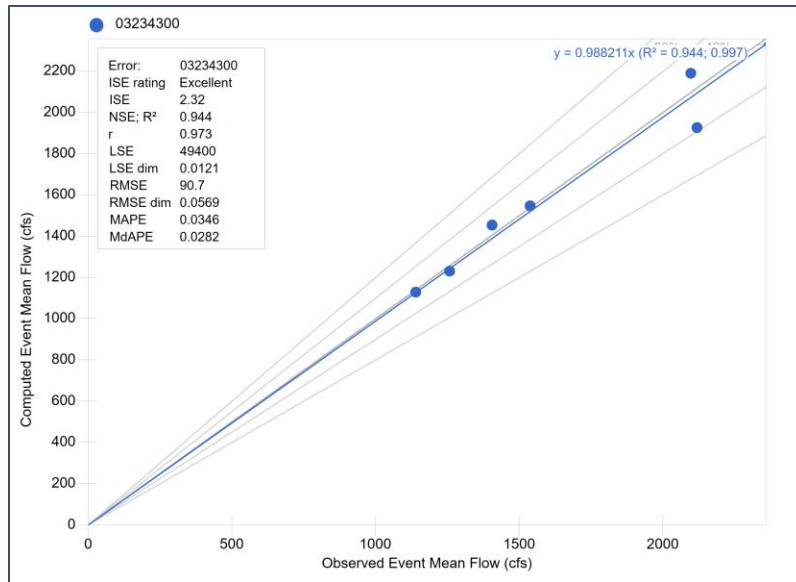


* 10% and 20% Error Bands Shown in Graphs

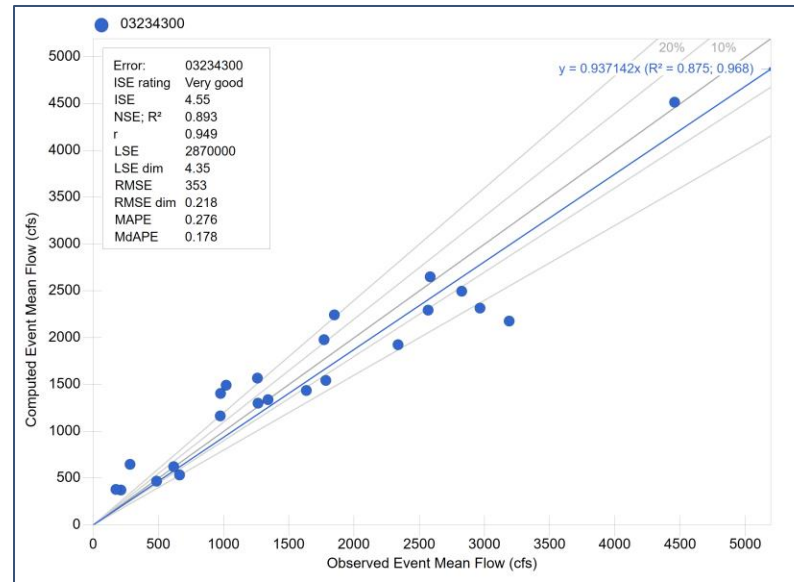
Validation Summary

USGS Gauge 03234300

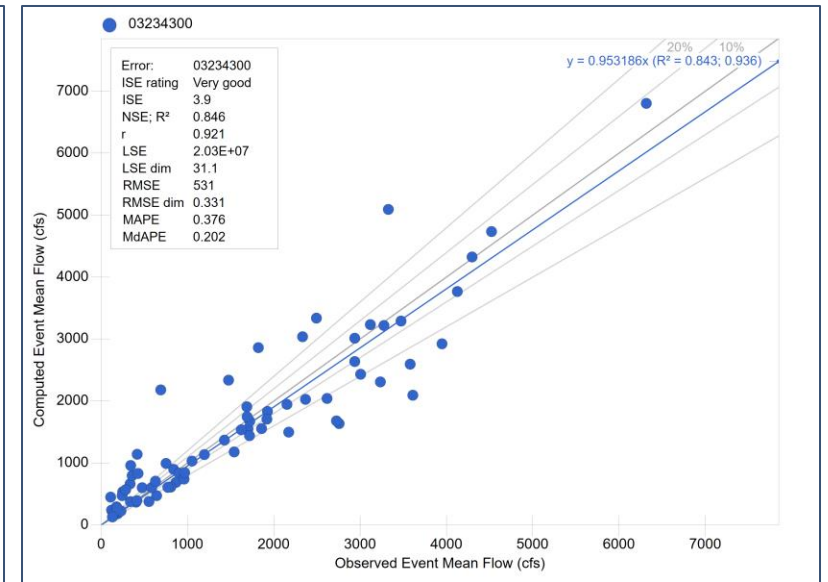
Annual Mean Flow



Seasonal Mean Flow



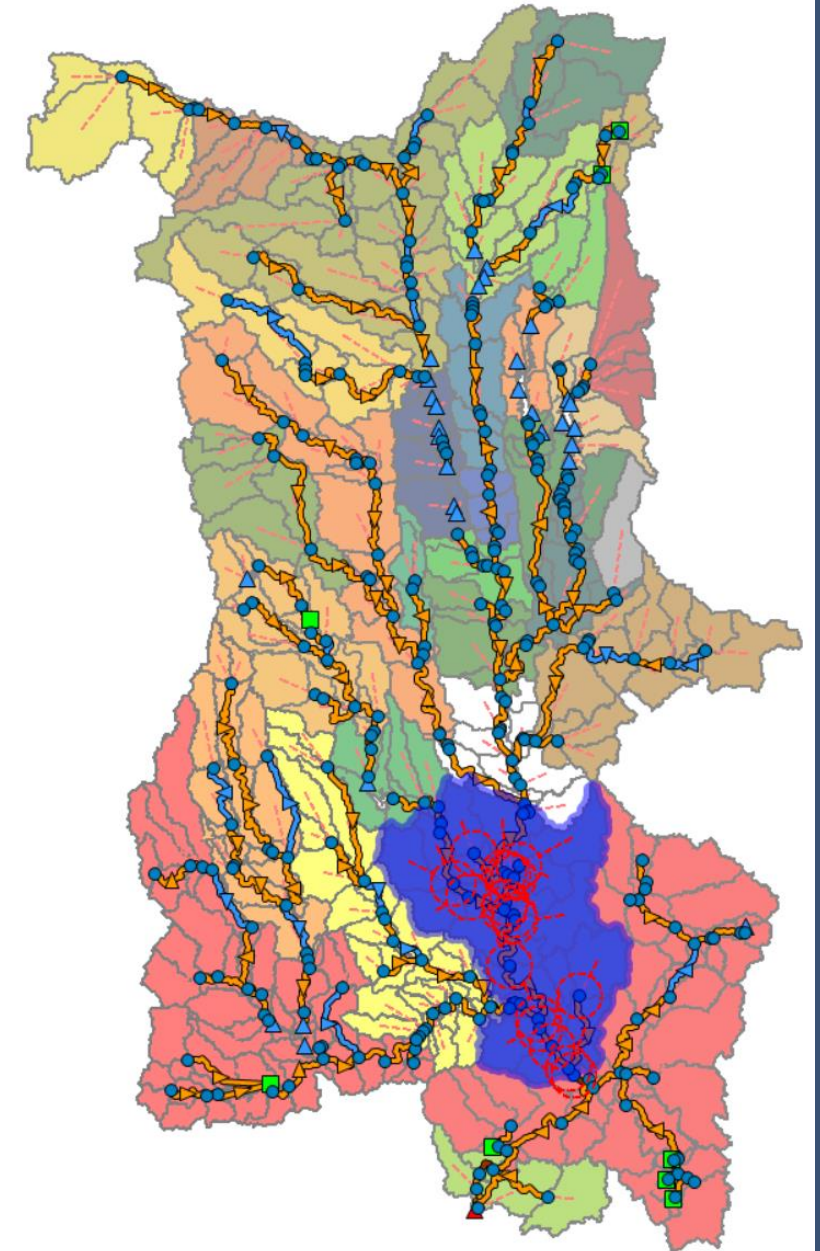
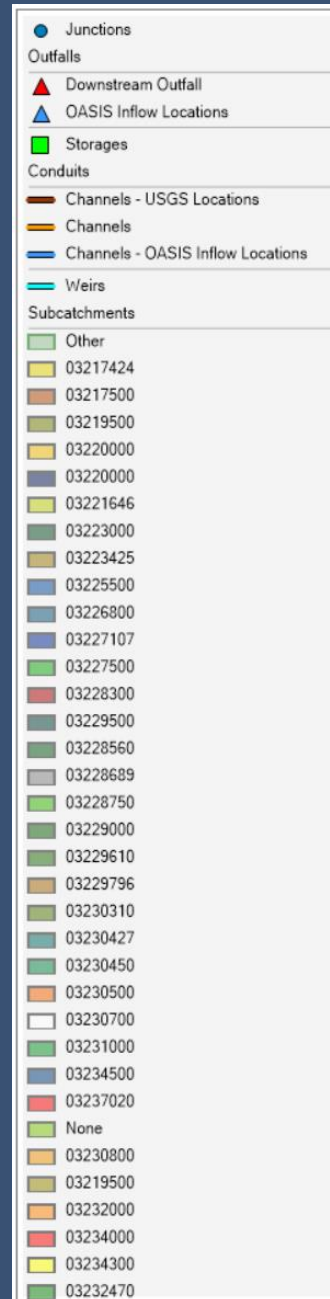
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03234500

Scioto River at Higby OH



Calibration Summary

USGS Gauge 03234500

- Calibration Period
 - 01/01/2015 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023

- Comments

- *Period of record results from calibration/validation models USGS gauges 03230700, 03231500 and 03234300 were used as for upstream boundary conditions to account for upstream reservoir releases and water and wastewater treatment plant withdrawals and returns.*

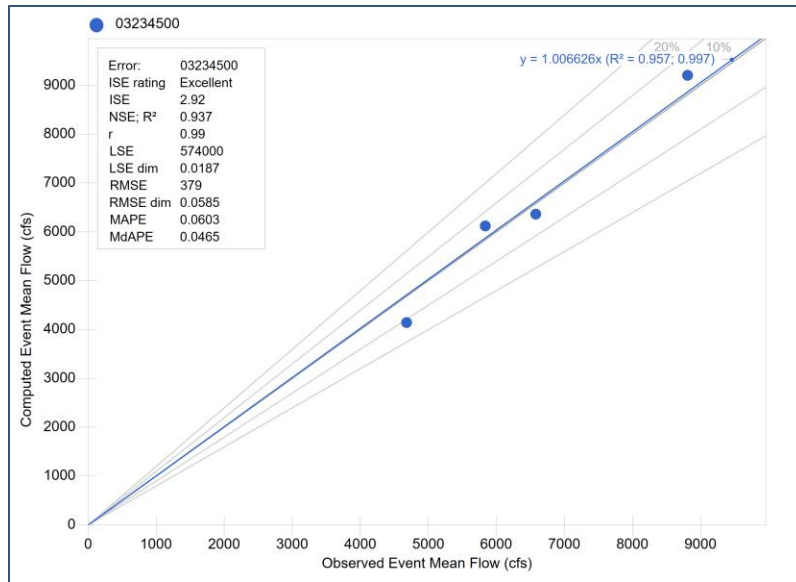
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2015	5839.0	6120.0	5%
	2016	4680.0	4141.0	-12%
	2017	6580.0	6362.0	-3%
	2018	8809.0	9205.0	4%
Validation	2019	8480.0	7969.0	-6%
	2020	6231.0	6176.0	-1%
	2021	4904.0	4698.0	-4%
	2022	6351.0	6445.0	1%

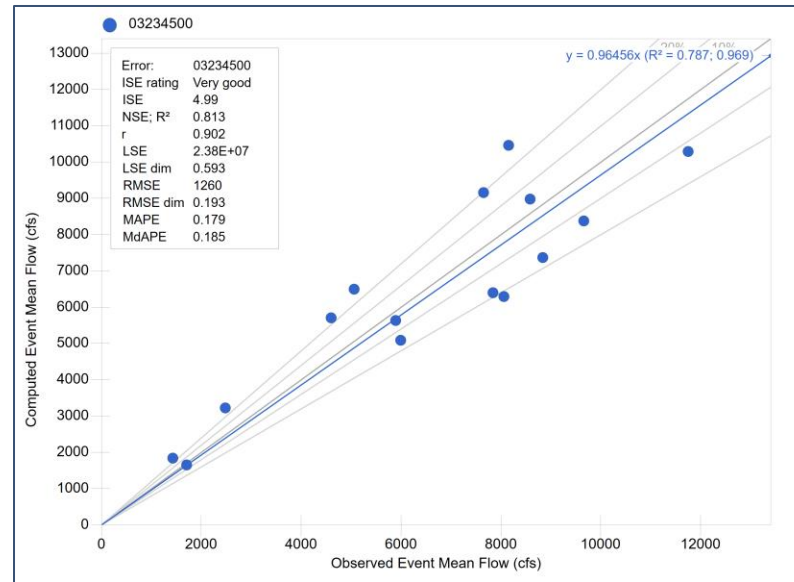
Calibration Summary

USGS Gauge 03234500

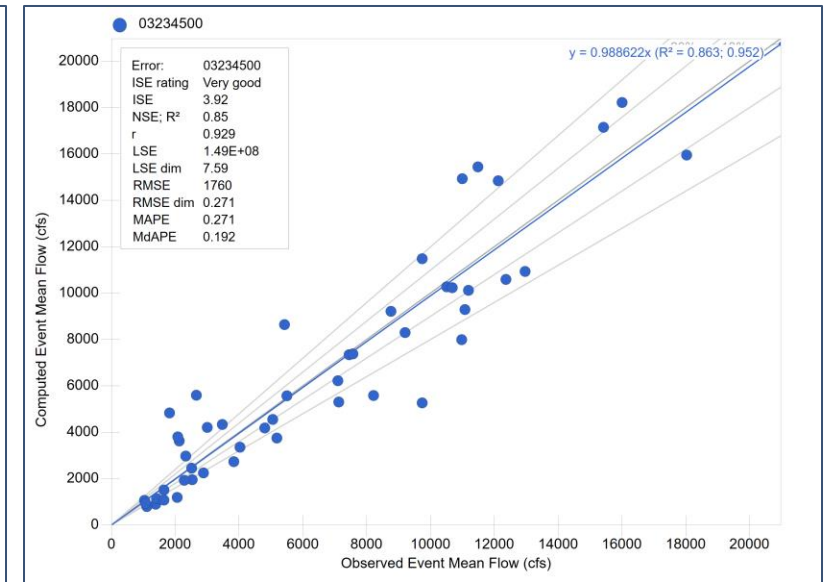
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

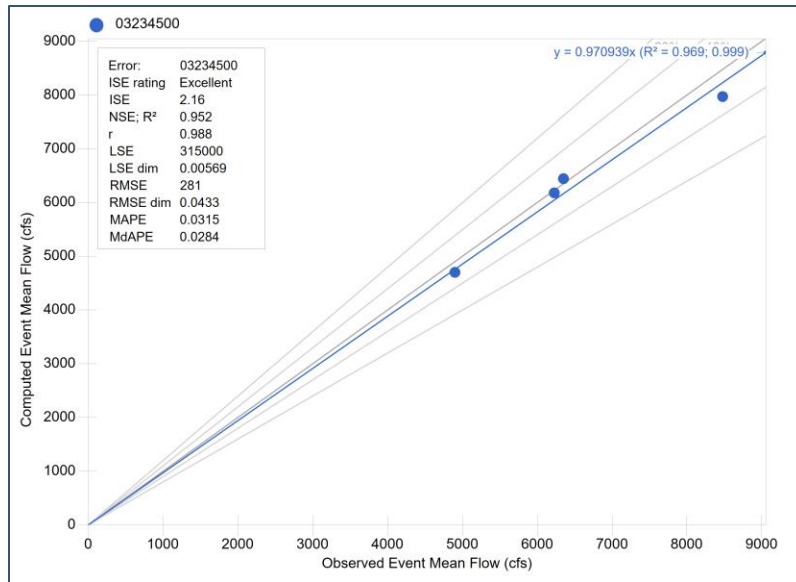


* 10% and 20% Error Bands Shown in Graphs

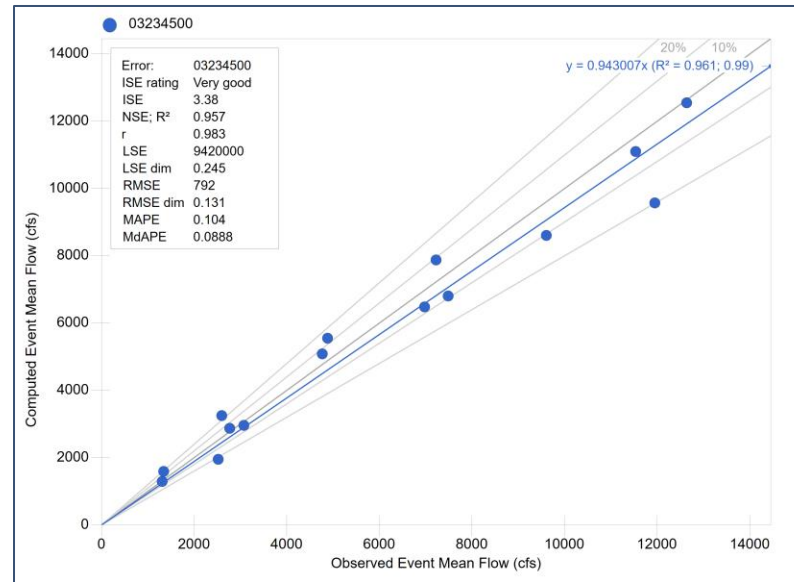
Validation Summary

USGS Gauge 03234500

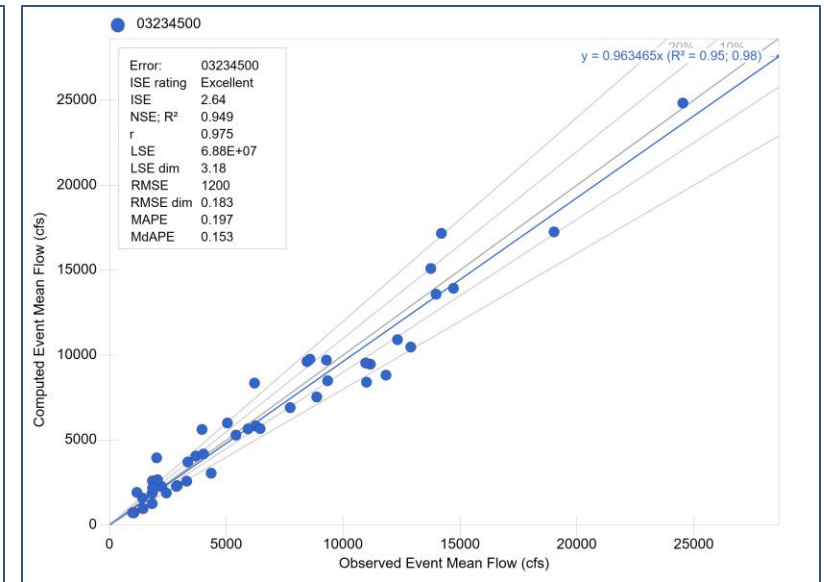
Annual Mean Flow



Seasonal Mean Flow



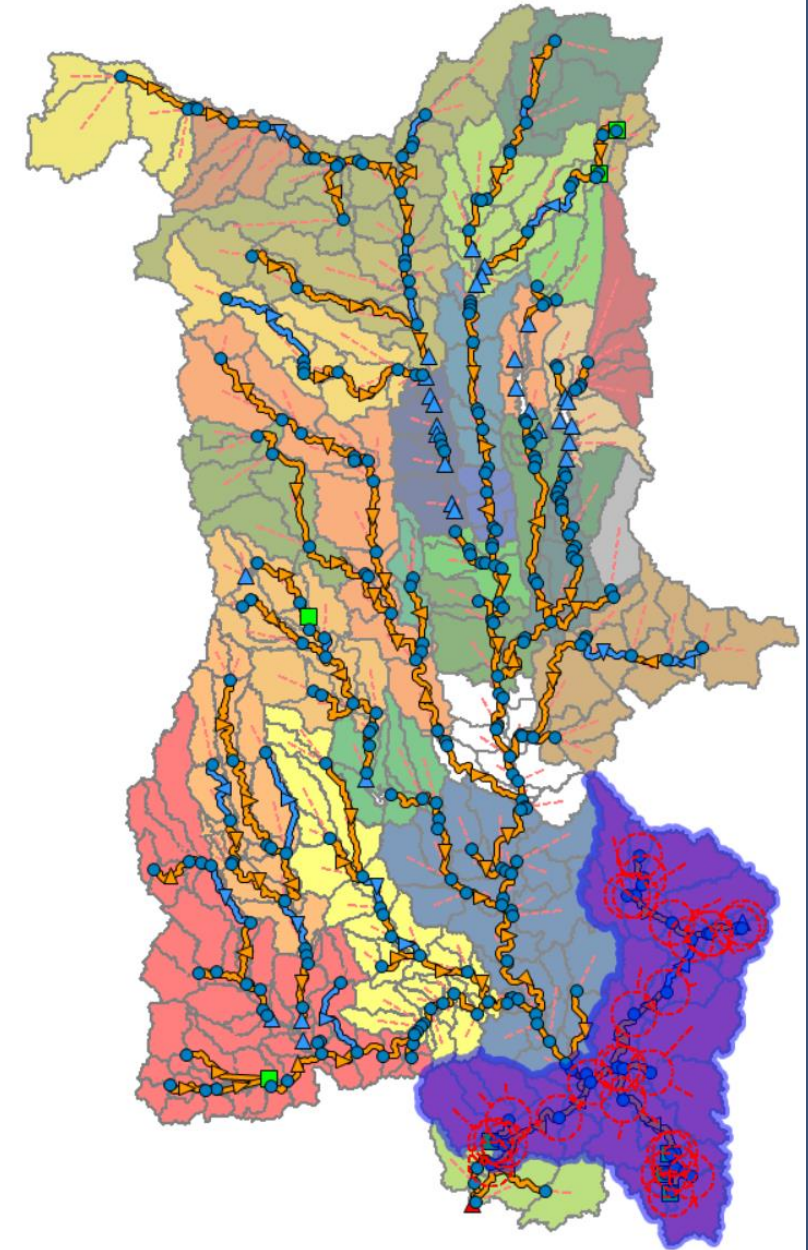
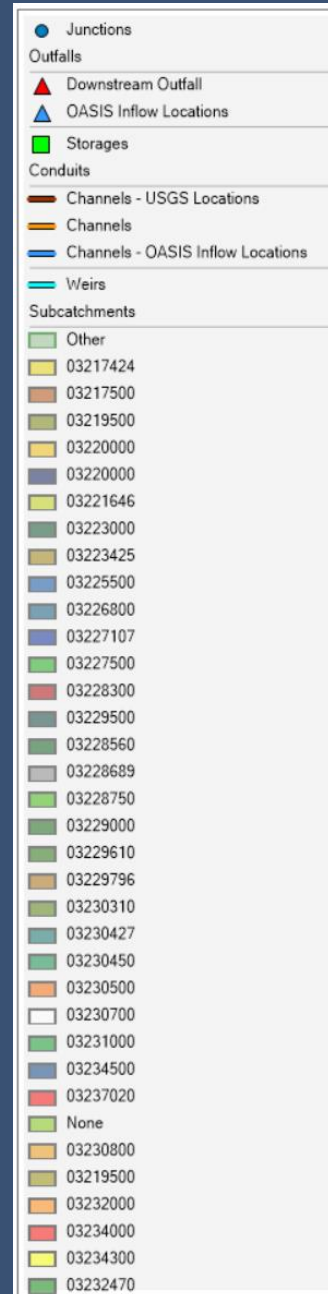
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03237020

Scioto River at Piketon OH



Calibration Summary

USGS Gauge 03237020

- Calibration Period
 - 01/01/2015 – 01/01/2019
- Validation Period
 - 01/01/2019 – 01/01/2023

- Comments

- *Period of record results from calibration/validation models USGS gauges 03230700, 03231500 and 03234300 were used as for upstream boundary conditions to account for upstream reservoir releases and water and wastewater treatment plant withdrawals and returns.*

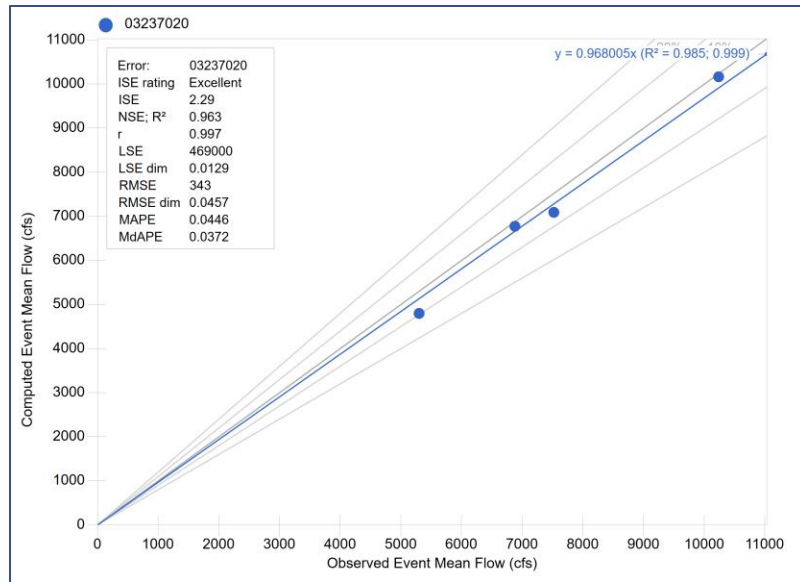
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2015	6884.0	6771.0	-2%
	2016	5304.0	4794.0	-10%
	2017	7525.0	7089.0	-6%
	2018	10240.0	10160.0	-1%
Validation	2019	9822.0	8707.0	-11%
	2020	7406.0	6842.0	-8%
	2021	5703.0	5204.0	-9%
	2022	7567.0	7171.0	-5%

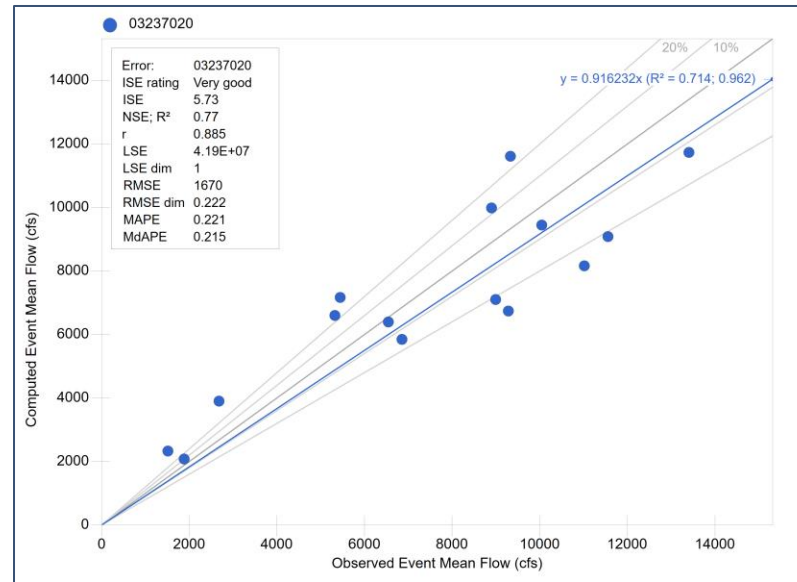
Calibration Summary

USGS Gauge 03237020

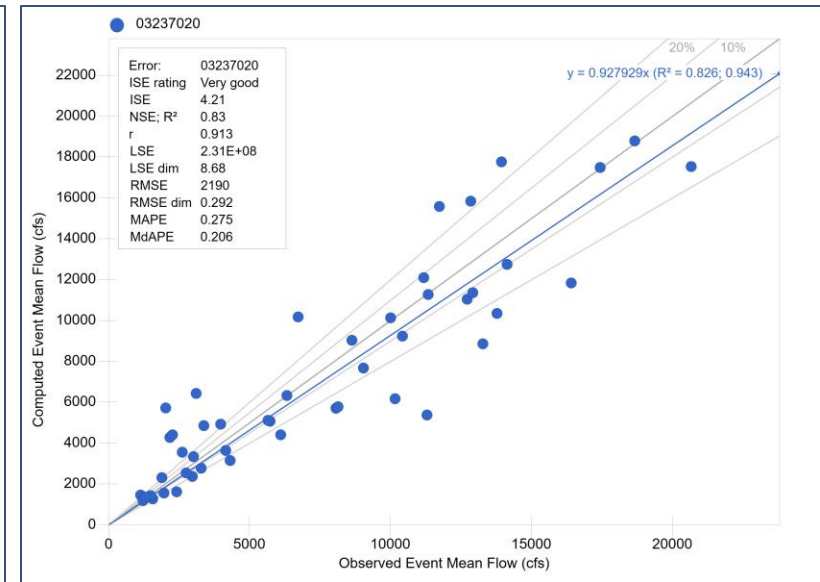
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

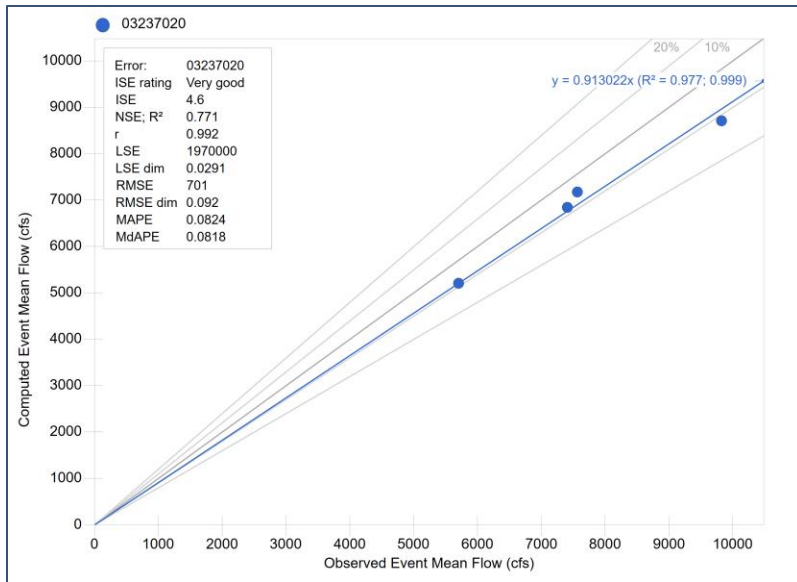


* 10% and 20% Error Bands Shown in Graphs

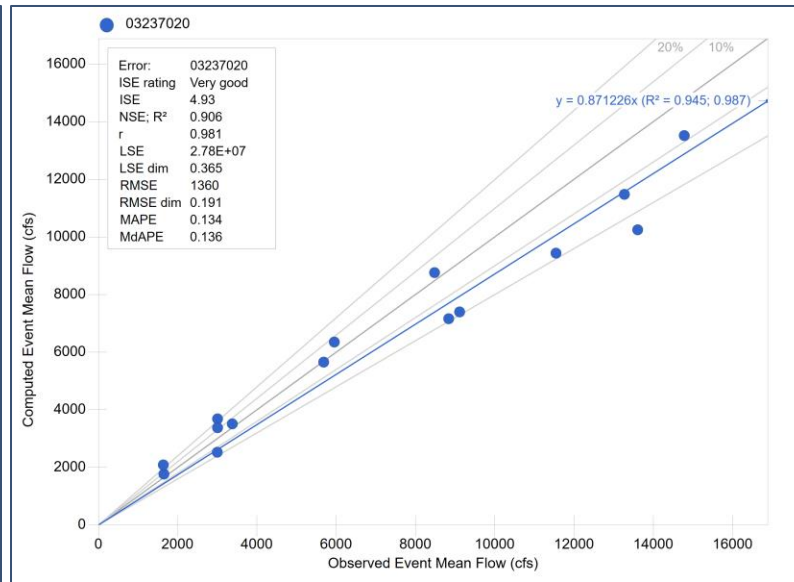
Validation Summary

USGS Gauge 03237020

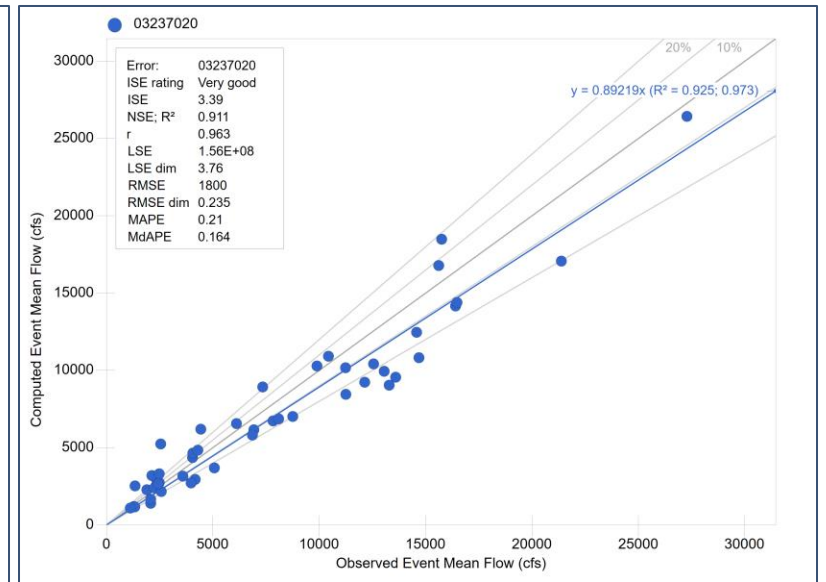
Annual Mean Flow



Seasonal Mean Flow

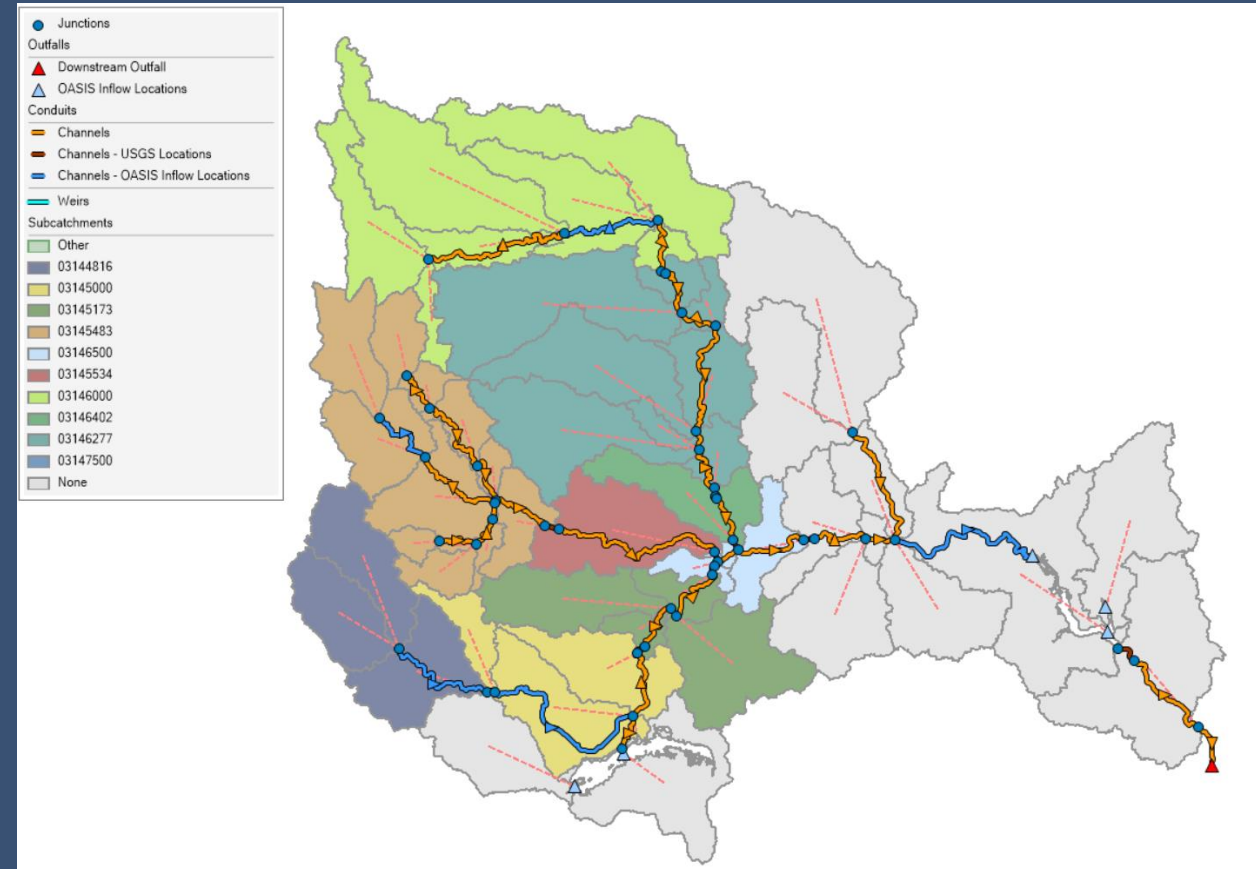


Monthly Mean Flow



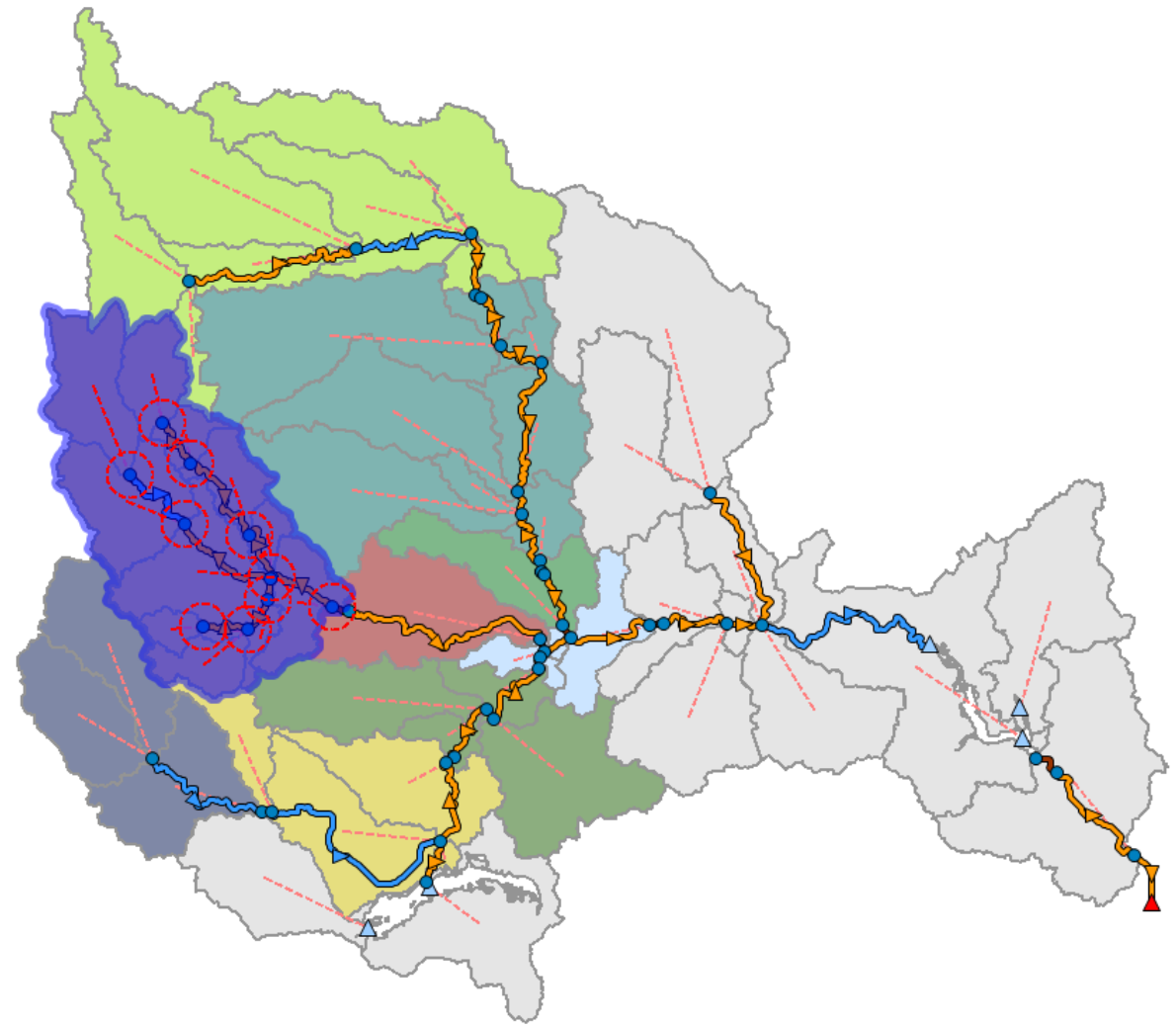
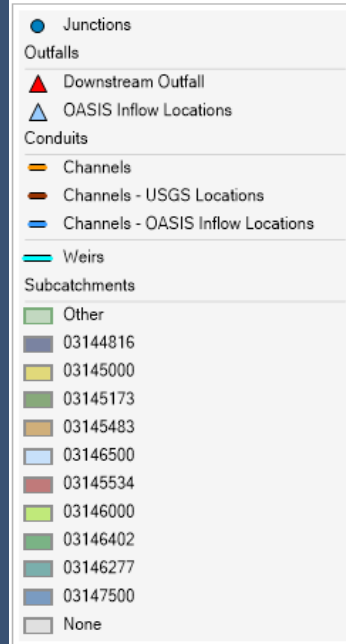
* 10% and 20% Error Bands Shown in Graphs

Licking Watershed Model



USGS Gauge 03145483

Raccoon Creek near Granville OH



Calibration Summary

USGS Gauge 03145483

- Calibration Period
 - 01/01/2009 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2022
- Comments
 - *None*

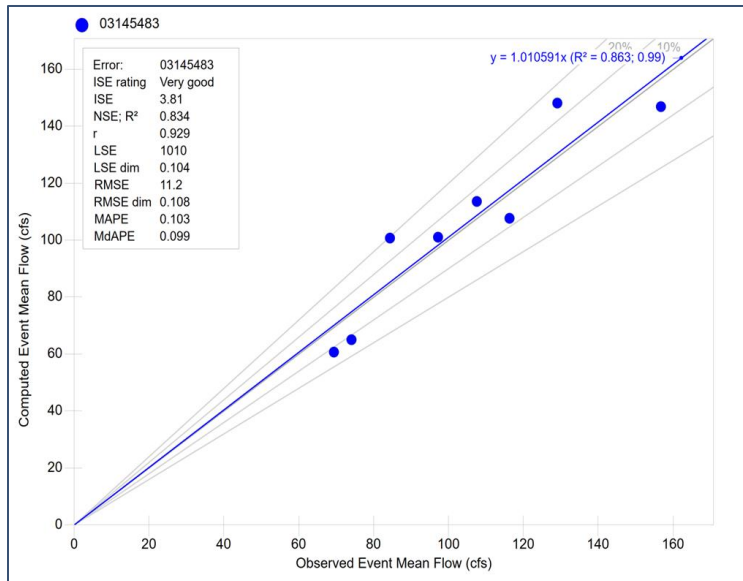
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2008	129.1	148.1	15%
	2009	74.2	65.2	-12%
	2010	69.4	60.9	-12%
	2011	156.8	147.1	-6%
	2012	84.4	100.8	19%
	2013	116.3	107.8	-7%
	2014	97.2	101.1	4%
	2015	107.6	113.7	6%
Validation	2016	70.6	72.4	3%
	2017	103.3	104.8	1%
	2018	167.8	146.1	-13%
	2019	128.0	125.8	-2%
	2020	131.0	148.7	14%
	2021	95.6	100.7	5%
	2022	121.8	114.6	-6%

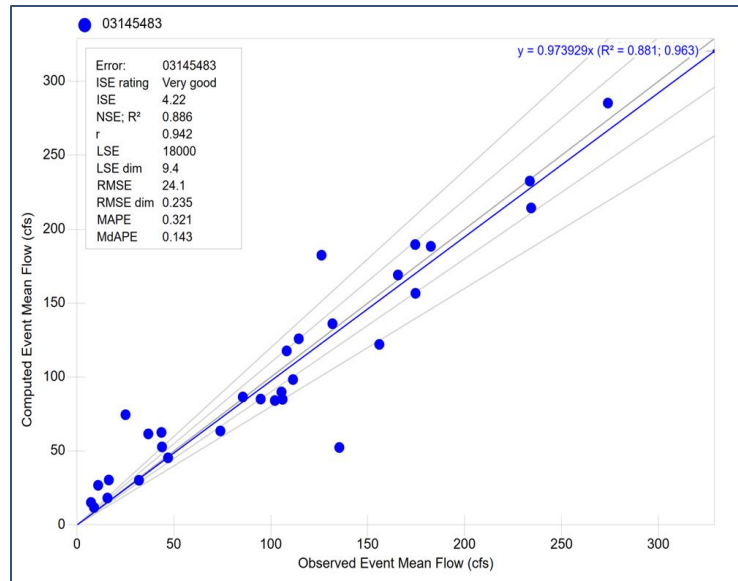
Calibration Summary

USGS Gauge 03145483

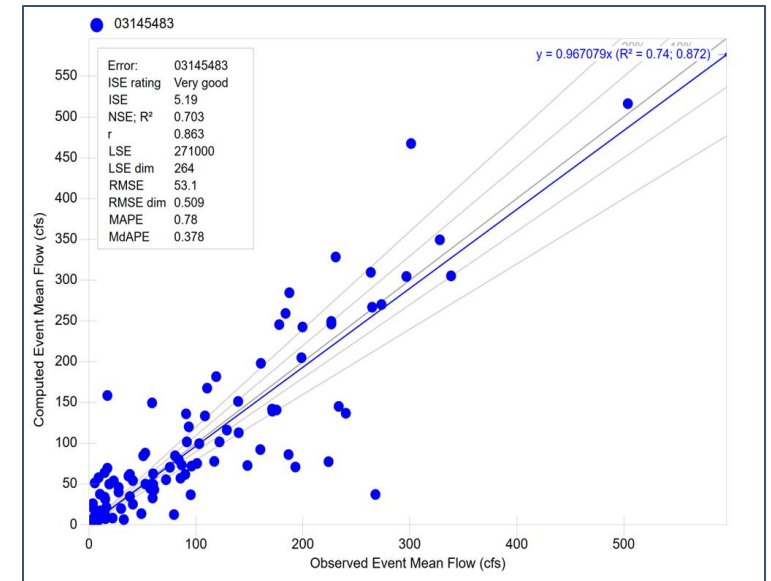
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

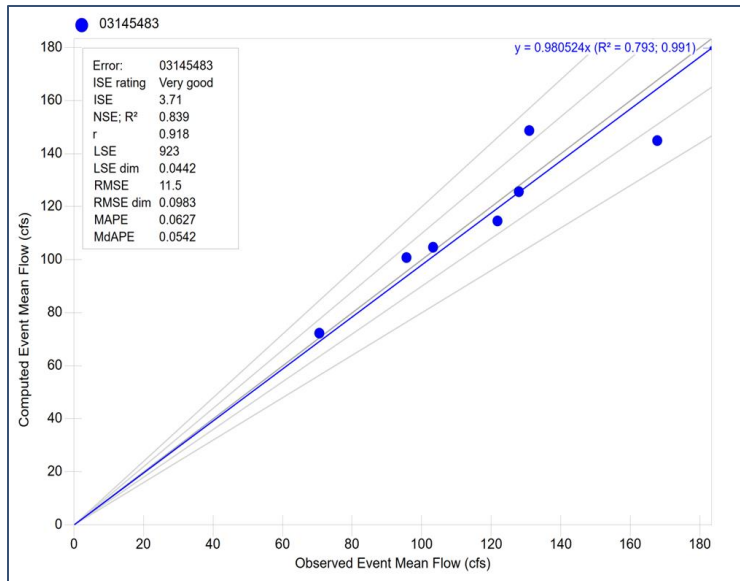


* 10% and 20% Error Bands Shown in Graphs

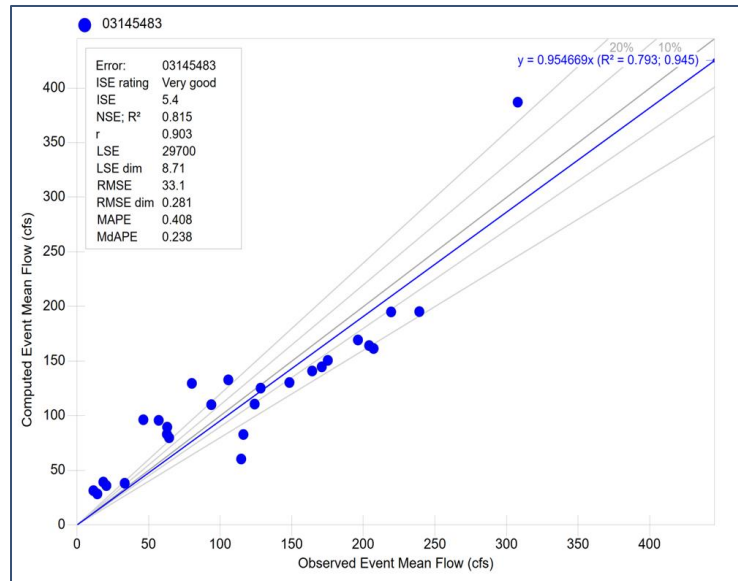
Validation Summary

USGS Gauge 03145483

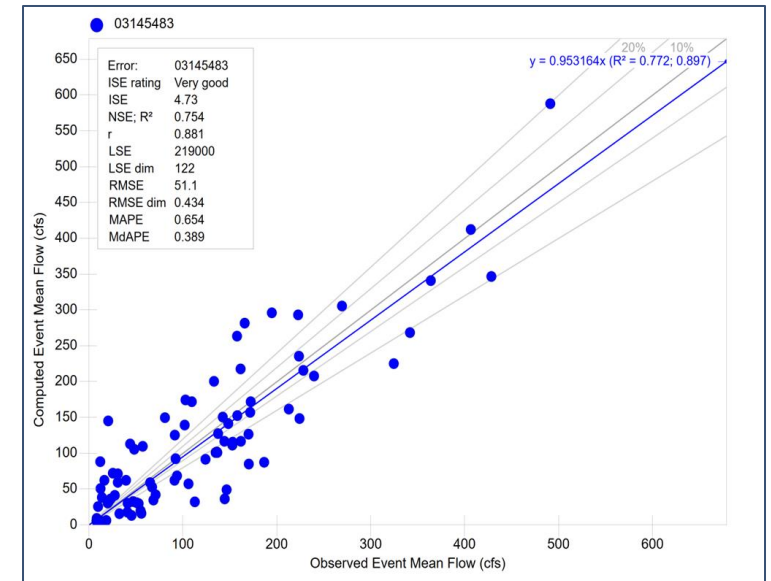
Annual Mean Flow



Seasonal Mean Flow



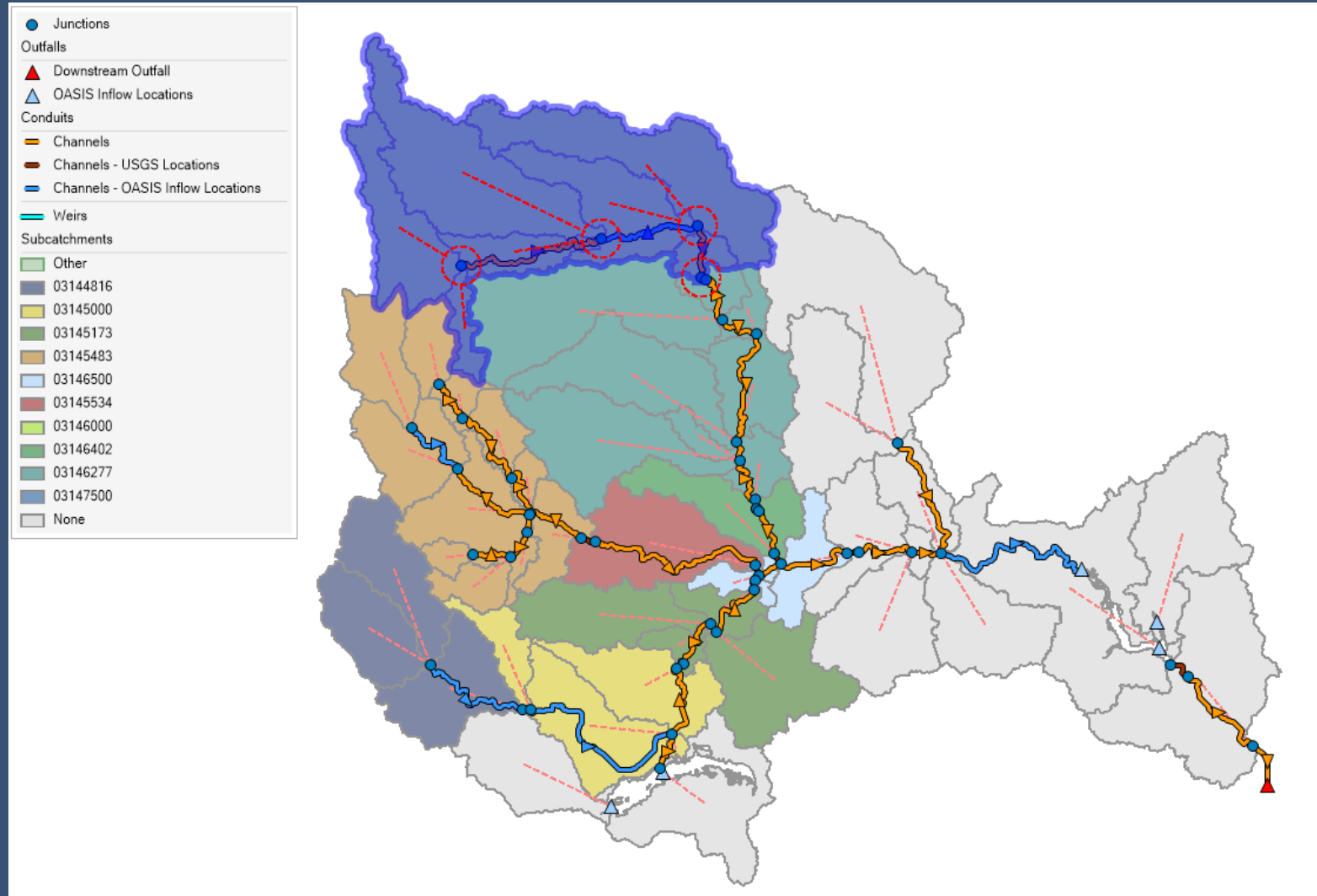
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03146000

North Fork Licking River at Utica OH



Calibration Summary

USGS Gauge 03146000

- Calibration Period
 - 01/01/2012 – 01/01/2018
- Validation Period
 - 01/01/2018 – 01/01/2022
- Comments
 - *None*

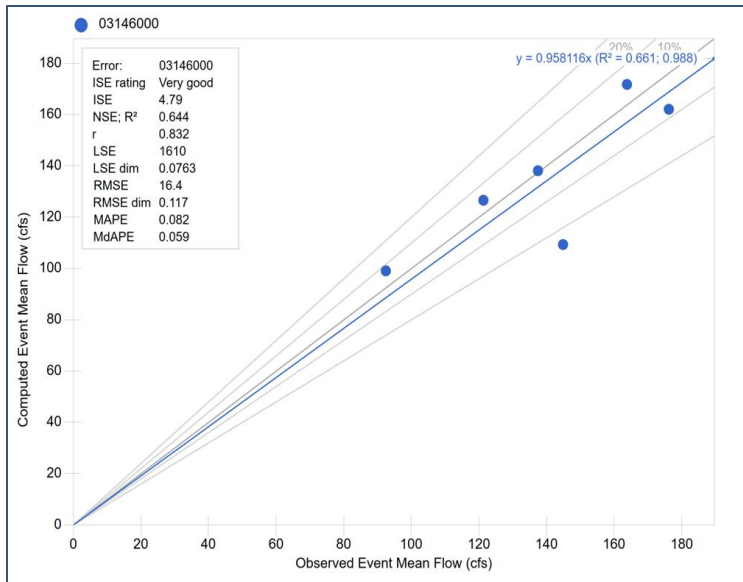
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2012	121.3	126.4	4.20%
	2013	163.8	171.6	4.76%
	2014	144.9	109.1	-24.71%
	2015	176.2	161.9	-8.12%
	2016	92.5	98.8	6.84%
	2017	137.5	138.1	0.44%
Validation	2018	221.3	188.2	-15%
	2019	165.4	182.4	10%
	2020	174.7	207.6	19%
	2021	146.2	117.3	-20%
	2022	155.7	160.1	3%

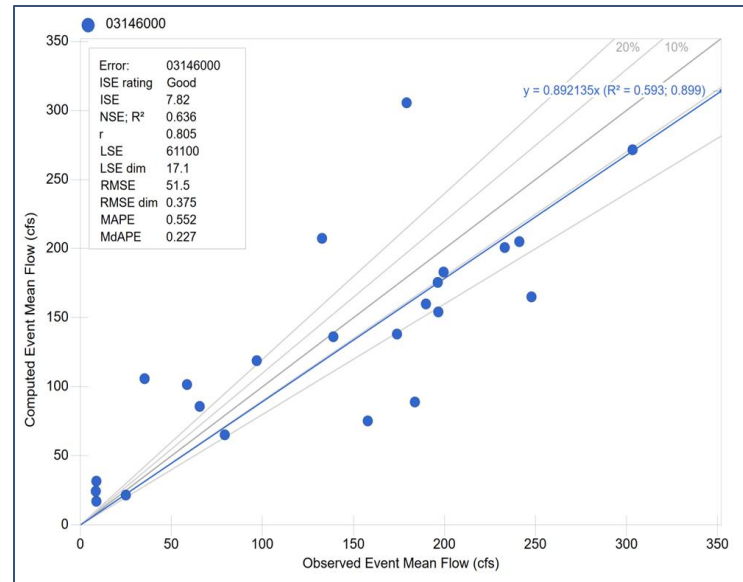
Calibration Summary

USGS Gauge 03146000

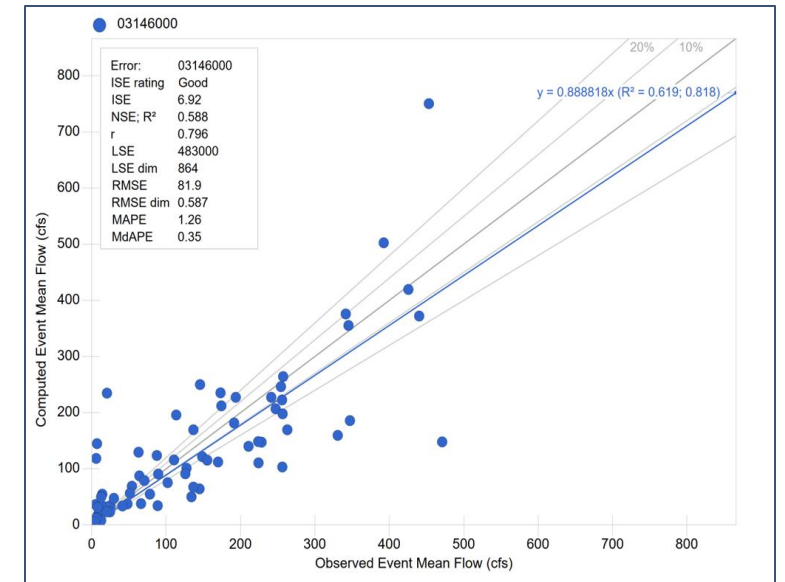
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

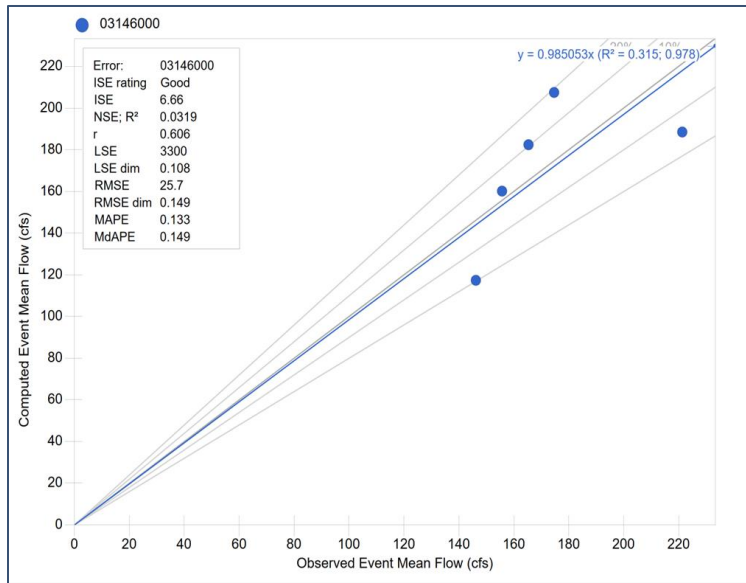


* 10% and 20% Error Bands Shown in Graphs

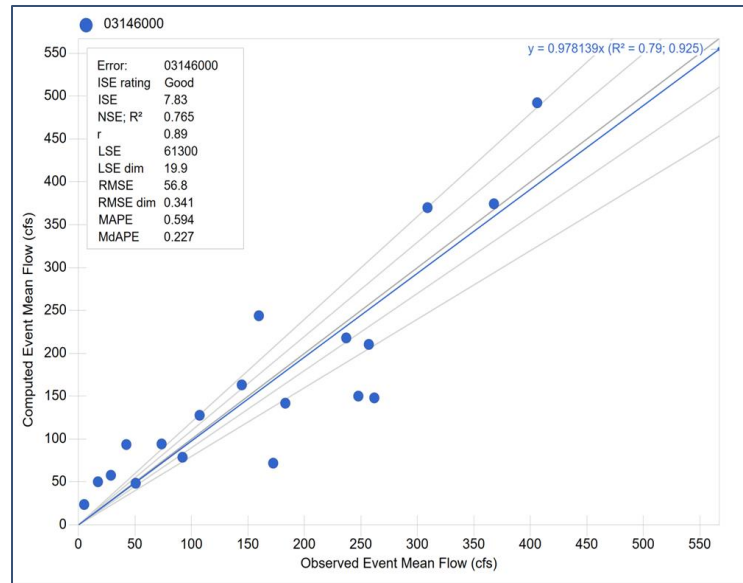
Validation Summary

USGS Gauge 03146000

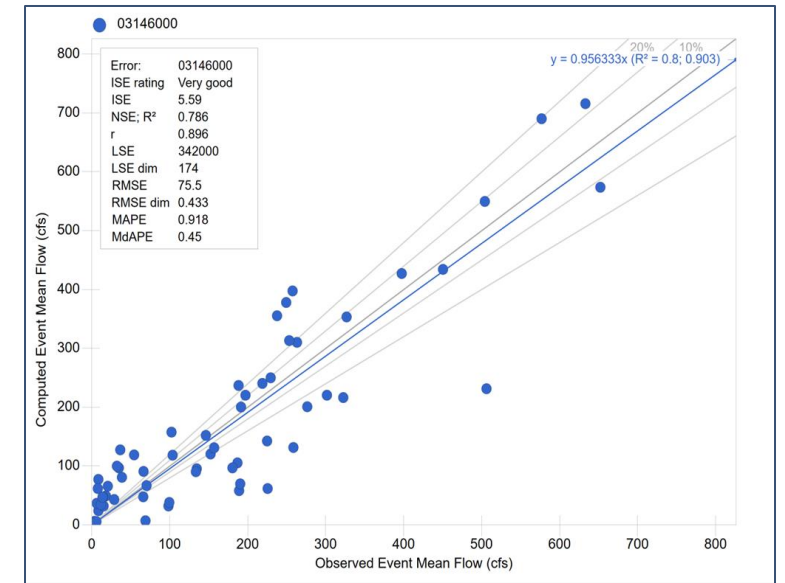
Annual Mean Flow



Seasonal Mean Flow



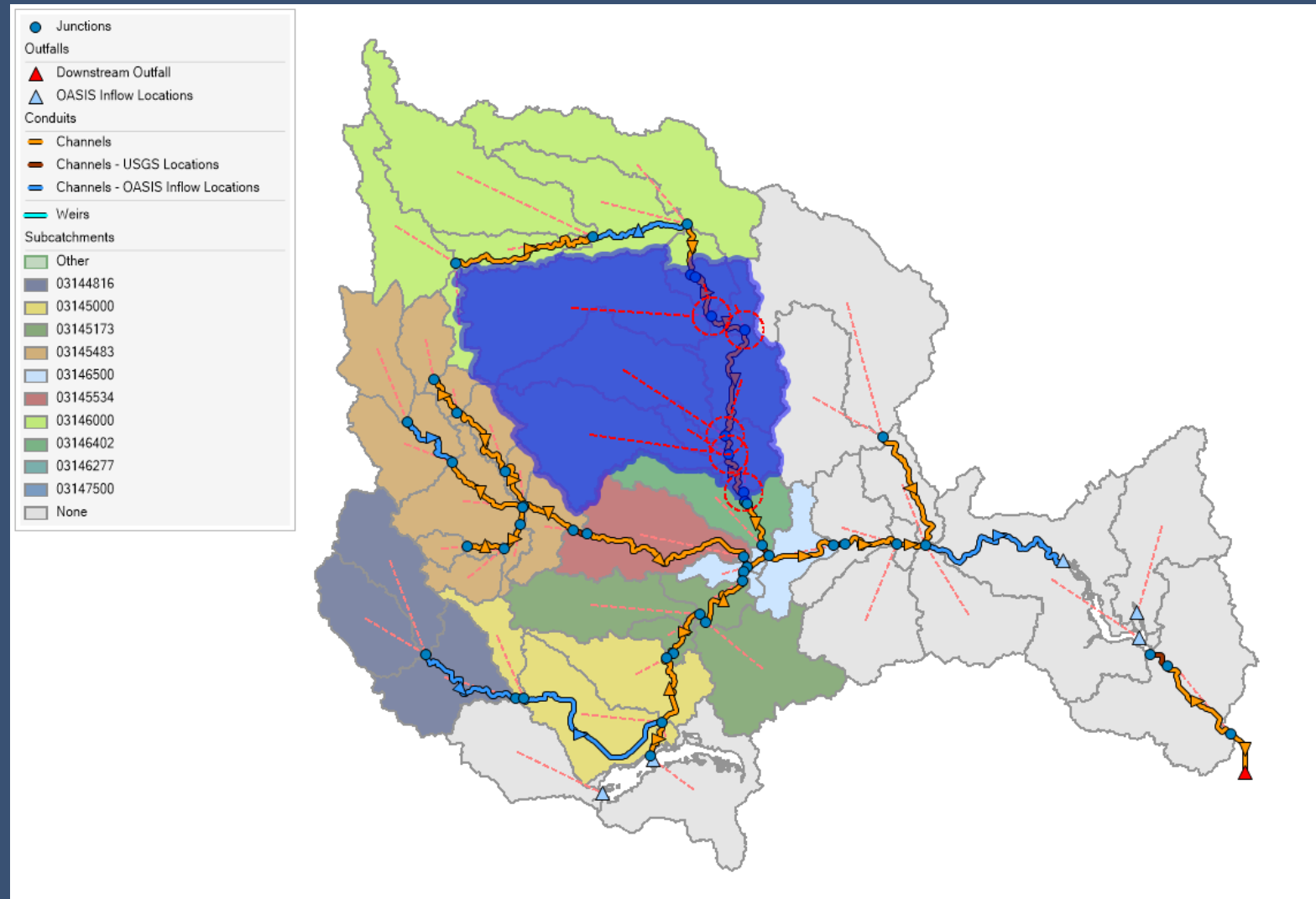
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03146277

North Fork Licking River at Newark OH



Calibration Summary

USGS Gauge 03146277

- Calibration Period
 - 01/01/2008 – 01/01/2009
- Validation Period
 - Not enough data available
- Comments
 - *Very little monitoring data available at this site.*

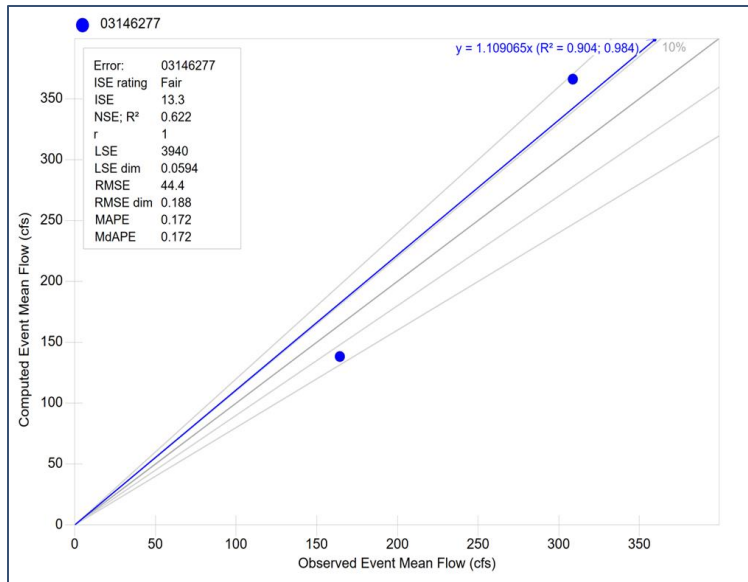
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2008	308.8	365.9	18%
	2009	164.3	138.2	-16%

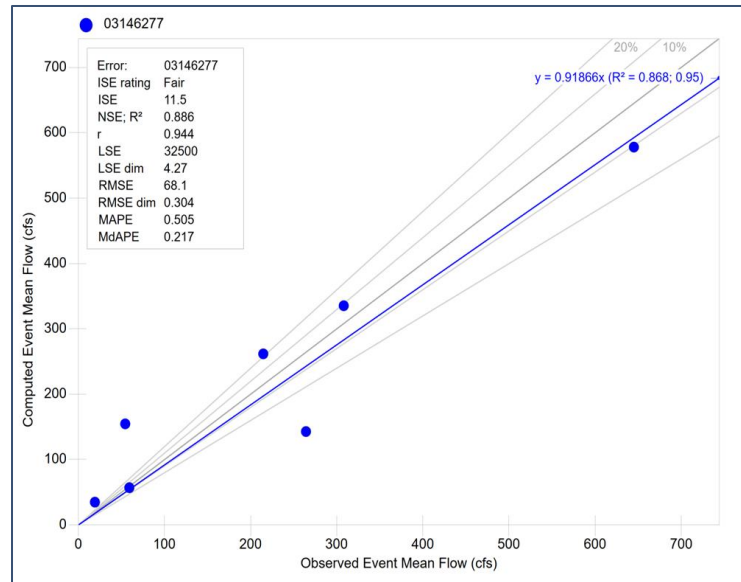
Calibration Summary

USGS Gauge 03146277

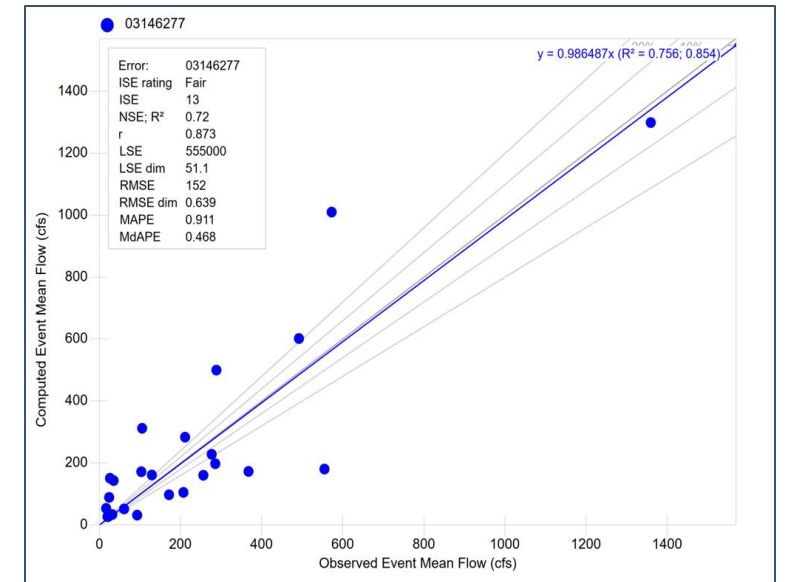
Annual Mean Flow



Seasonal Mean Flow



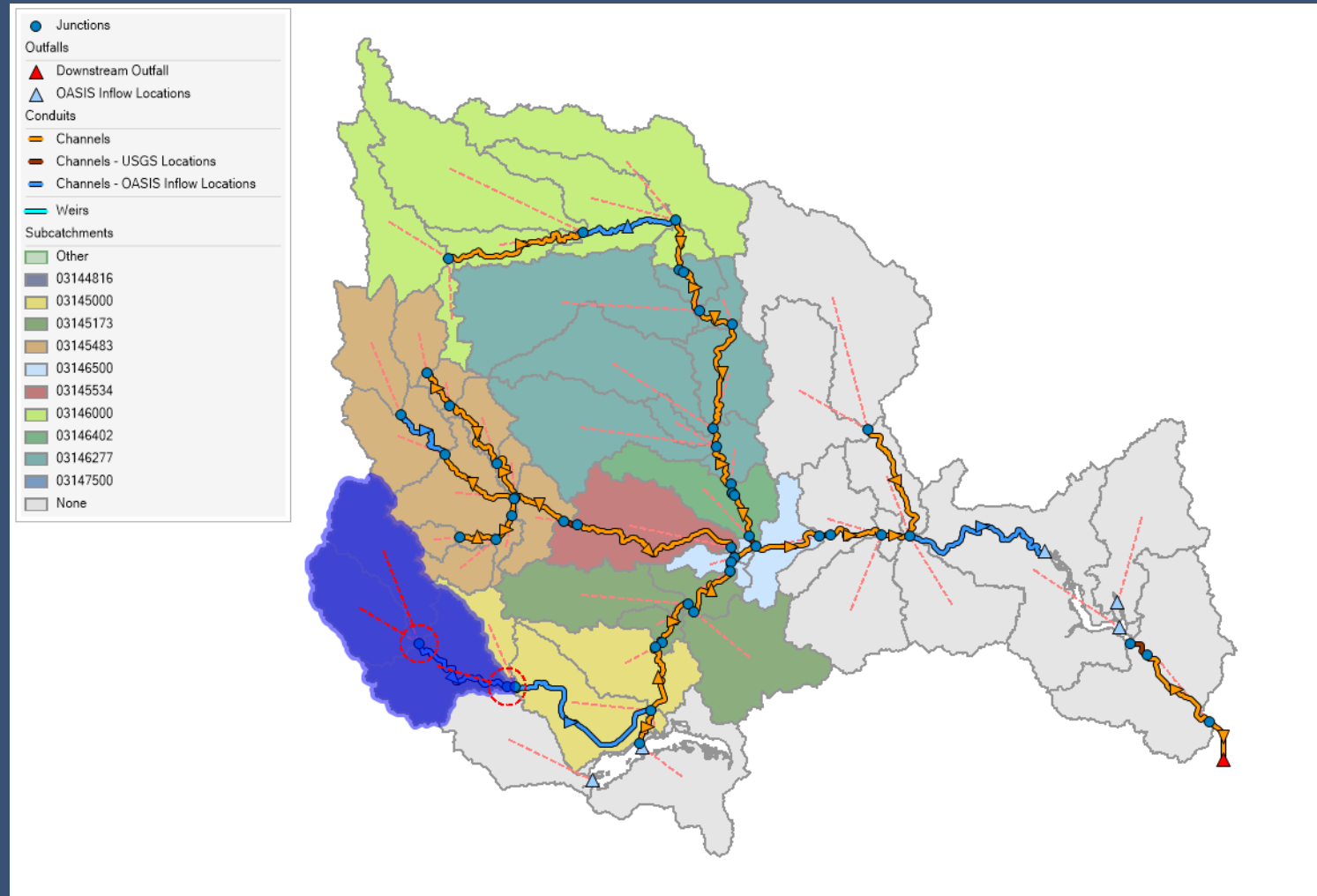
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03144816

South Fork Licking River at Kirkersville OH



Calibration Summary

USGS Gauge 03144816

- Calibration Period
 - 01/01/2008 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - *None*

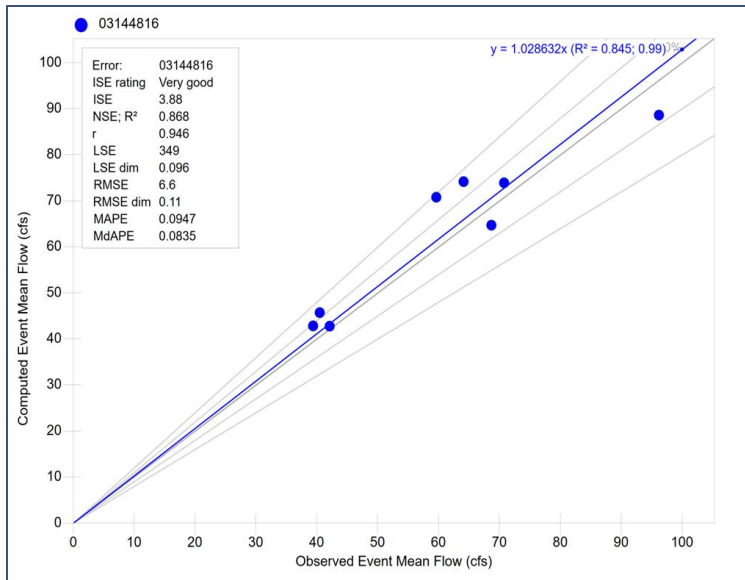
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2008	70.76	73.91	4%
	2009	39.37	42.84	9%
	2010	40.46	45.70	13%
	2011	96.17	88.58	-8%
	2012	42.11	42.72	1%
	2013	64.12	74.15	16%
	2014	68.68	64.71	-6%
	2015	59.60	70.79	19%
Validation	2016	42.20	52.68	25%
	2017	66.69	75.20	13%
	2018	105.30	96.90	-8%
	2019	79.94	70.36	-12%
	2020	82.54	84.48	2%
	2021	59.55	68.74	15%
	2022	72.06	72.16	0%

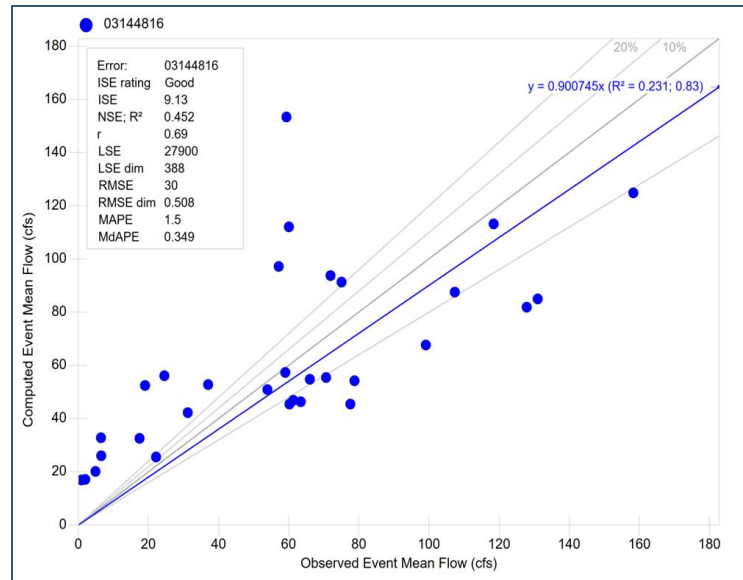
Calibration Summary

USGS Gauge 03144816

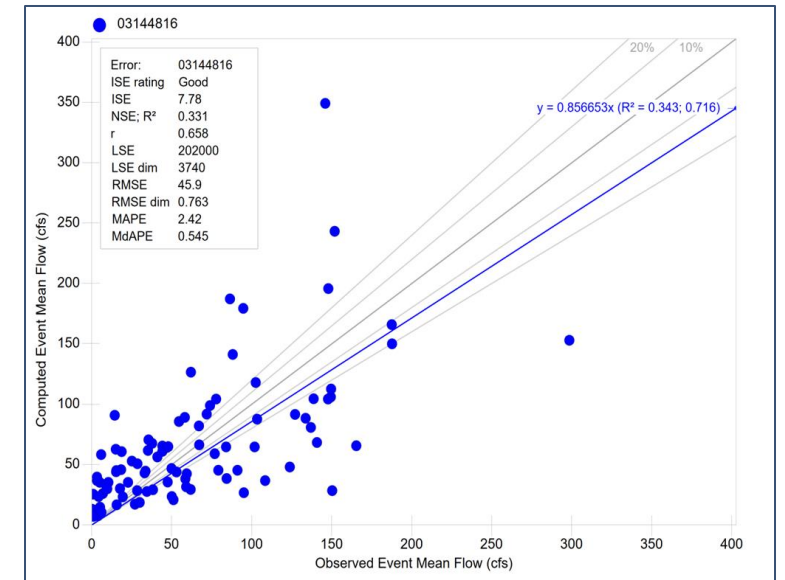
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

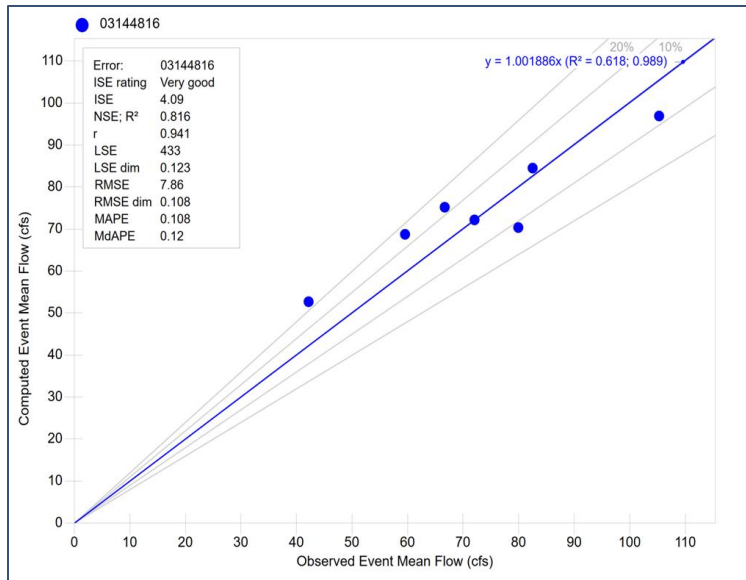


* 10% and 20% Error Bands Shown in Graphs

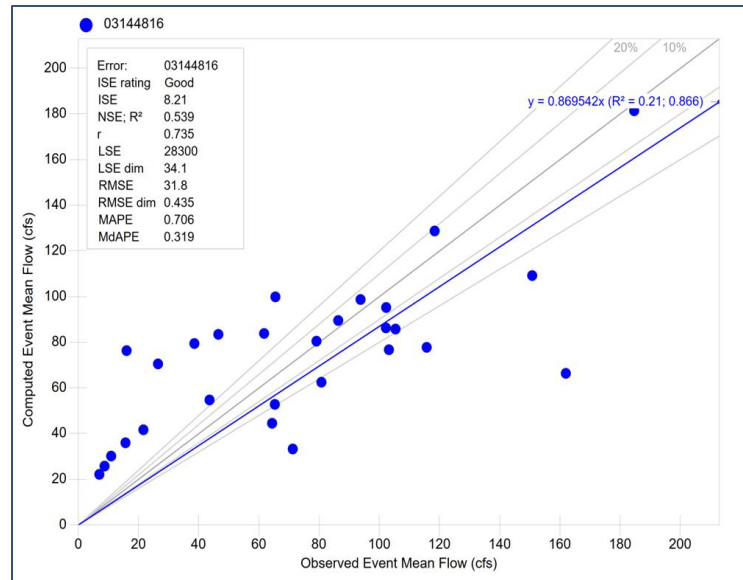
Validation Summary

USGS Gauge 03144816

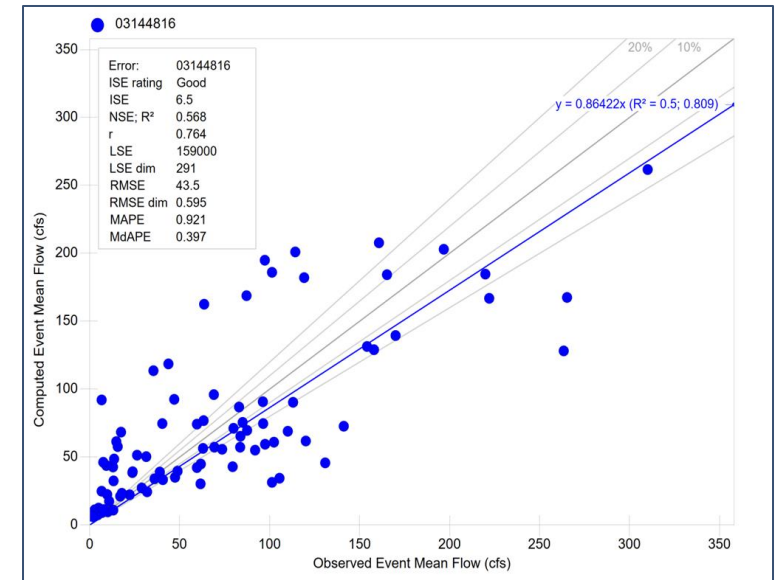
Annual Mean Flow



Seasonal Mean Flow



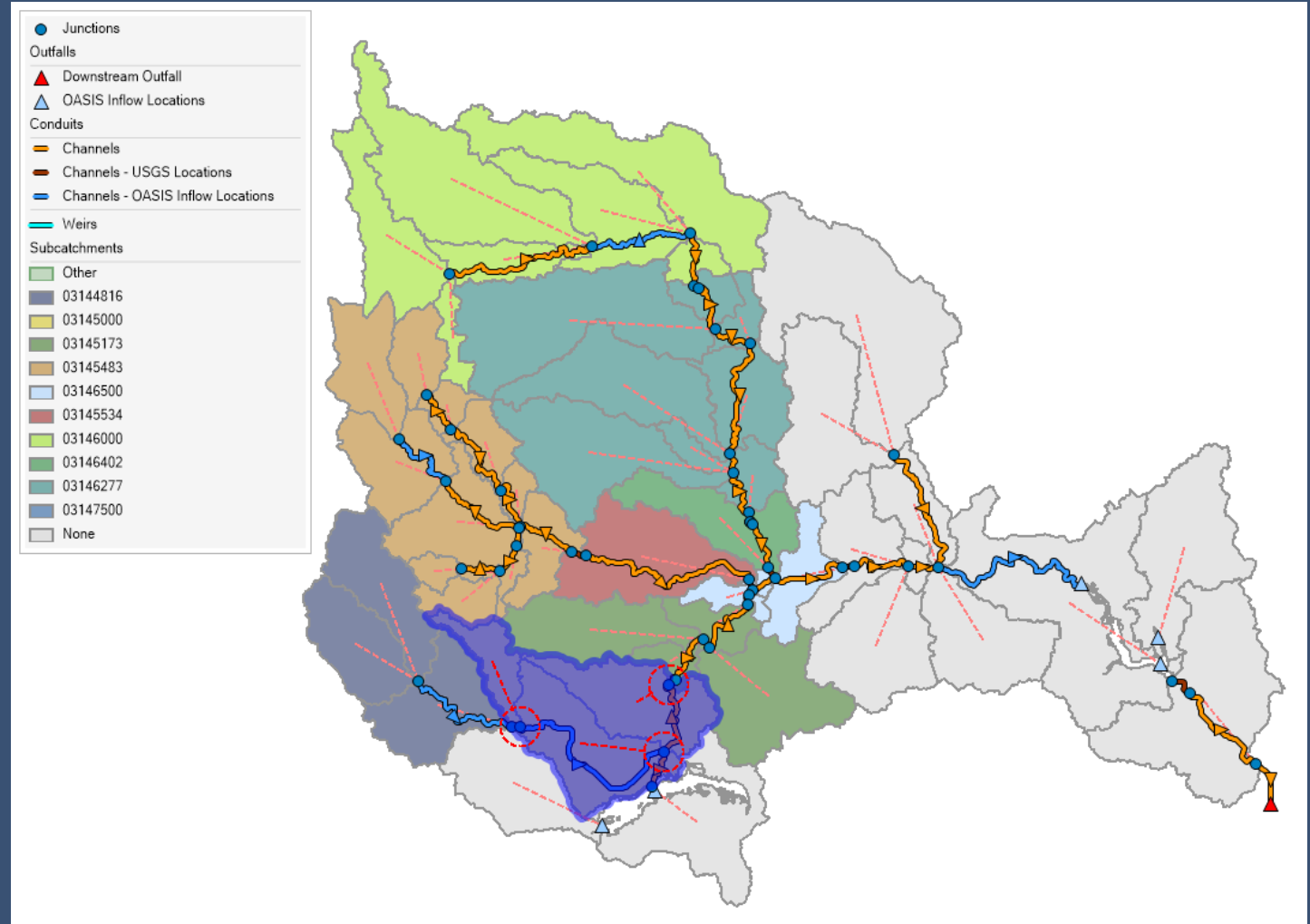
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03145000

South Fork Licking River near Hebron OH



Calibration Summary

USGS Gauge 03145000

- Calibration Period
 - 01/01/2013 – 01/01/2018
- Validation Period
 - 01/01/2018 – 01/01/2023
- Comments
 - *Flow meter is located downstream of Buckeye Lake. No Flow data was available immediately downstream of the Buckeye Lake dam.*
 - *To account for releases/overflows from Buckeye Lake, synthetic overflow times series was created as follows:*
 - *Run the SWMM model to generate runoff into Buckeye Lake.*
 - *An OASIS simulation was made that constrained buckeye lake elevations to match historical data to produce an overflow time series.*
 - *OASIS results of overflows from Buckeye Lake were used as an upstream boundary condition in the SWMM model for calibration.*

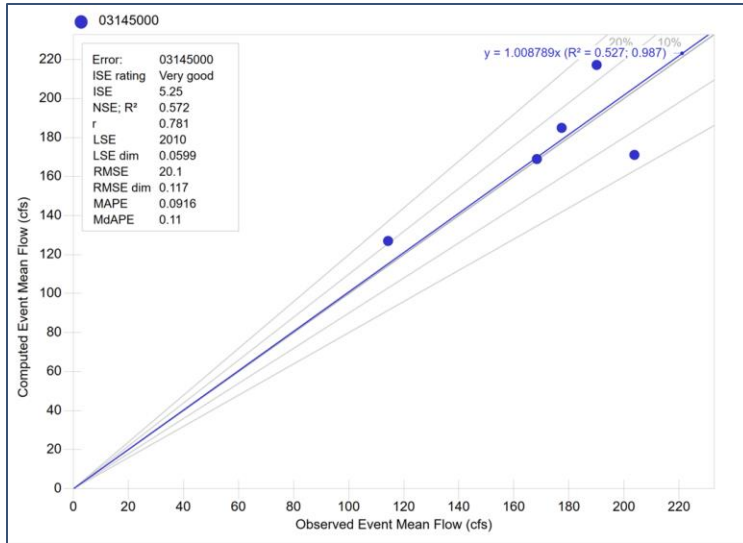
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2013	177.40	184.90	4%
	2014	203.80	171.10	-16%
	2015	168.40	168.90	0%
	2016	114.30	126.90	11%
	2017	190.10	217.10	14%
Validation	2018	276.80	290.50	5%
	2019	231.70	221.50	-4%
	2020	234.60	202.30	-14%
	2021	162.80	171.90	6%
	2022	221.50	211.40	-5%

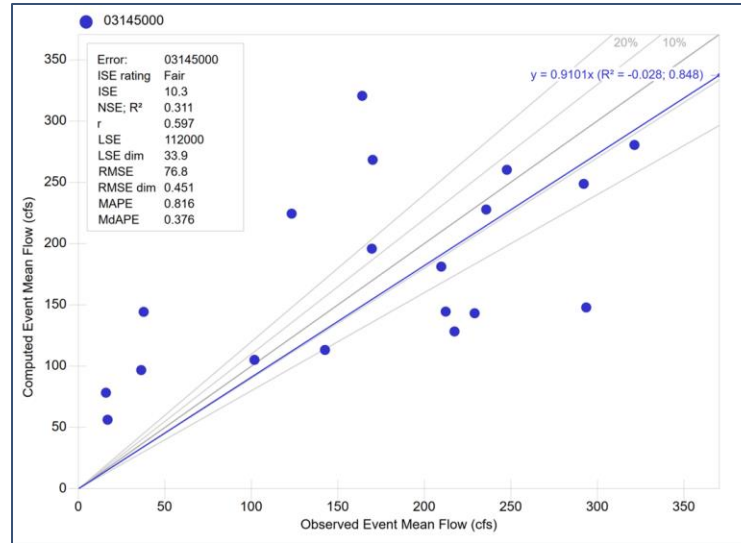
Calibration Summary

USGS Gauge 03145000

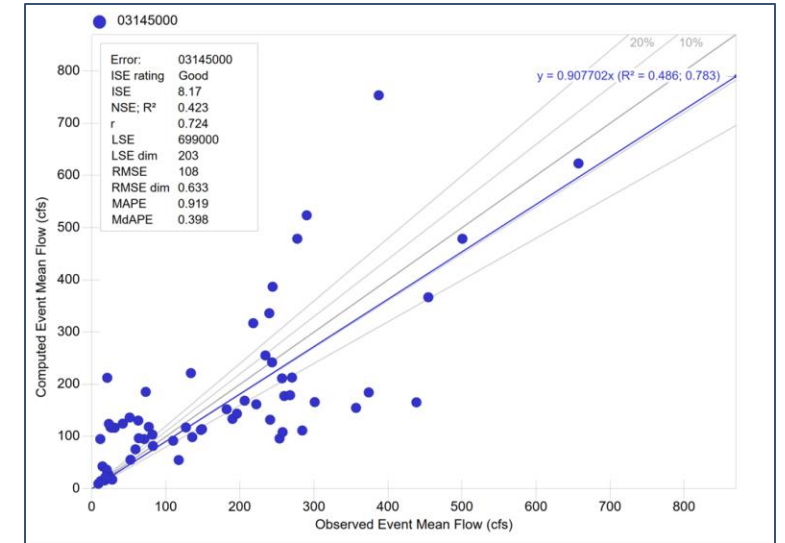
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

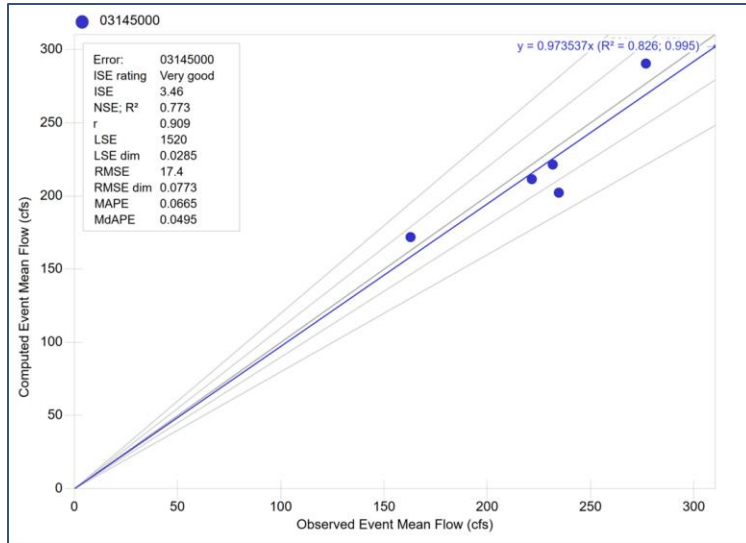


* 10% and 20% Error Bands Shown in Graphs

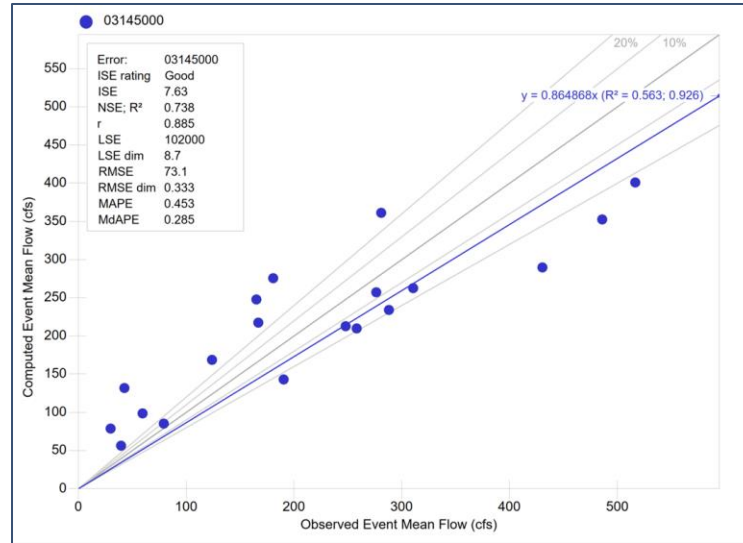
Validation Summary

USGS Gauge 03145000

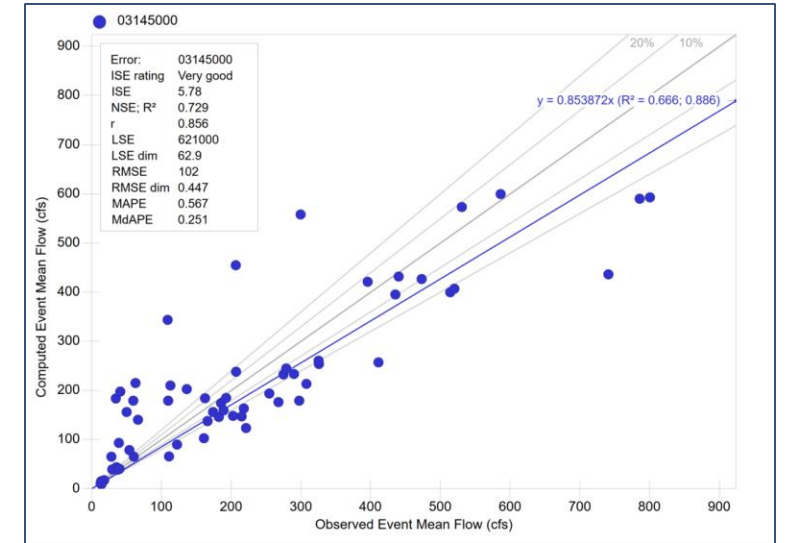
Annual Mean Flow



Seasonal Mean Flow



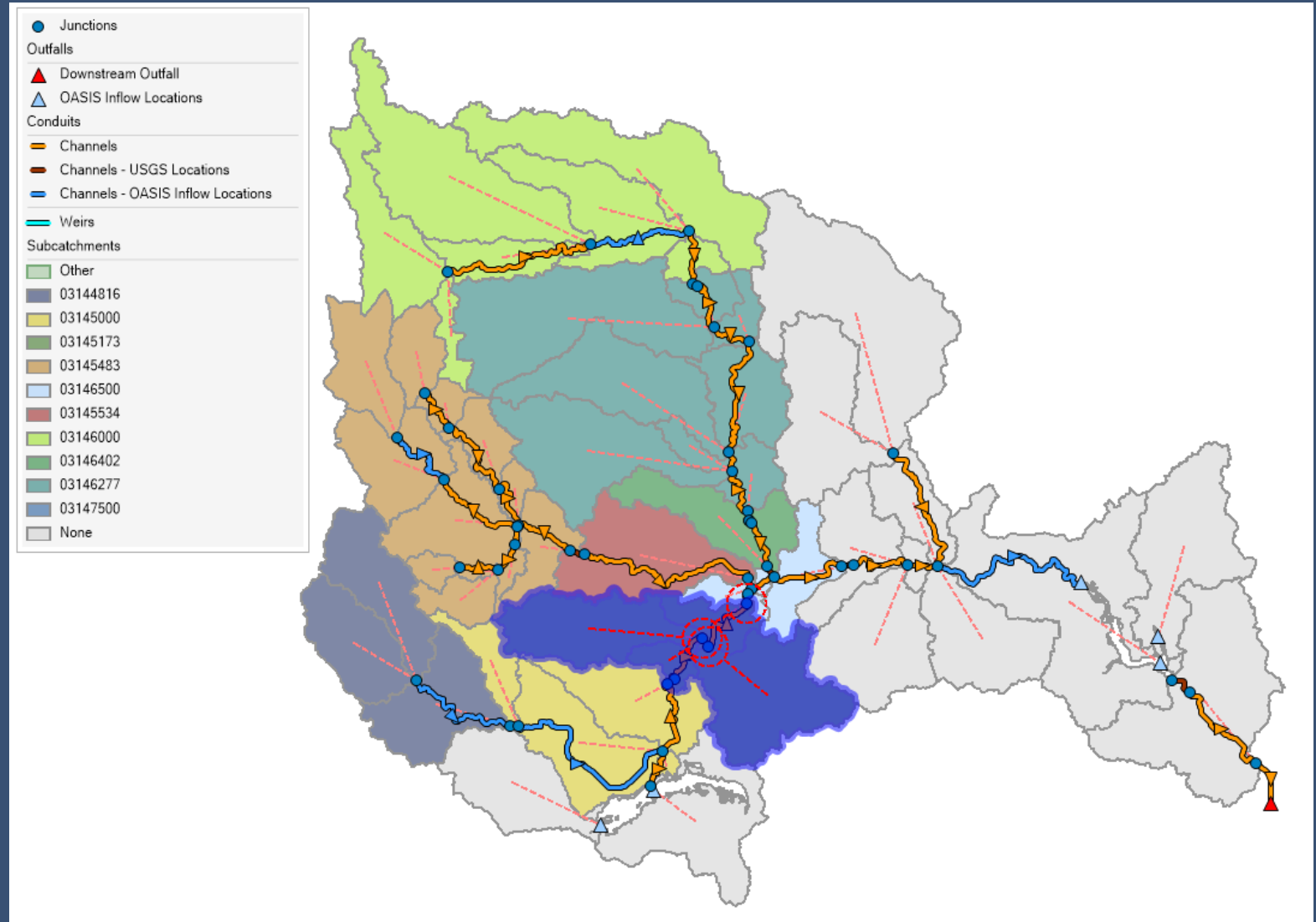
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03145173

South Fork Licking River at Heath OH



Calibration Summary

USGS Gauge 03145173

- Calibration Period
 - 01/01/2011 – 01/01/2017
- Validation Period
 - 01/01/2017 – 01/01/2023
- Comments
 - *Flow meter is located downstream of Buckeye Lake. No Flow data was available immediately downstream of the Buckeye Lake dam.*
 - *To account for releases/overflows from Buckeye Lake, synthetic overflow times series was created as follows:*
 - *Run the SWMM model to generate runoff into Buckeye Lake.*
 - *An OASIS simulation was made that constrained buckeye lake elevations to match historical data to produce an overflow time series.*
 - *OASIS results of overflows from Buckeye Lake were used as an upstream boundary condition in the SWMM model for calibration.*

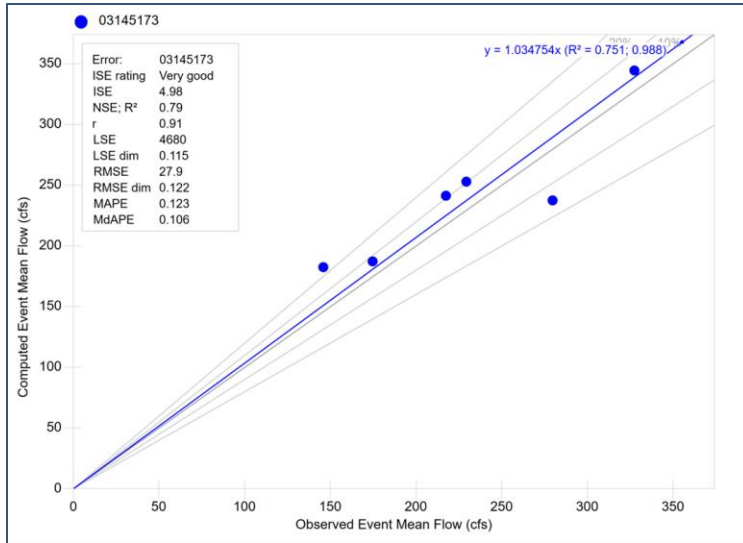
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2011	327.50	344.40	5%
	2012	174.80	187.20	7%
	2013	229.40	252.90	10%
	2014	279.70	237.30	-15%
	2015	217.50	241.30	11%
	2016	145.90	182.30	25%
Validation	2017	244.80	284.50	16%
	2018	385.70	394.00	2%
	2019	331.90	296.10	-11%
	2020	340.00	280.00	-18%
	2021	227.50	238.10	5%
	2022	330.80	286.10	-14%

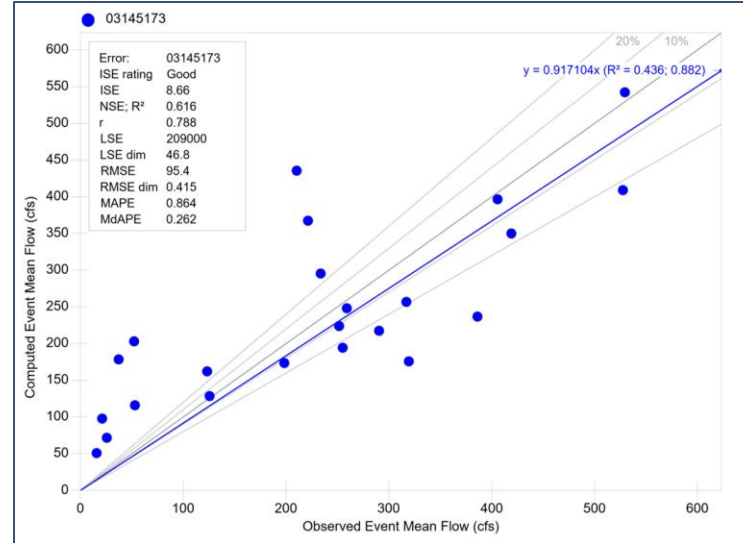
Calibration Summary

USGS Gauge 03145173

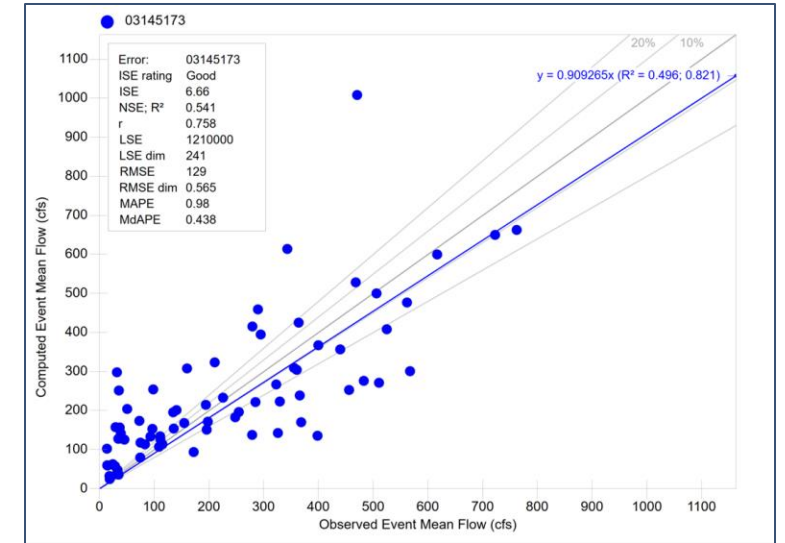
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

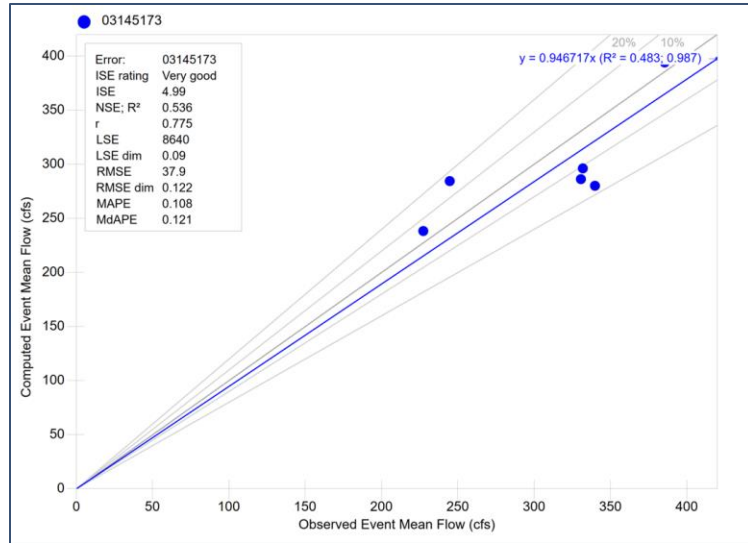


* 10% and 20% Error Bands Shown in Graphs

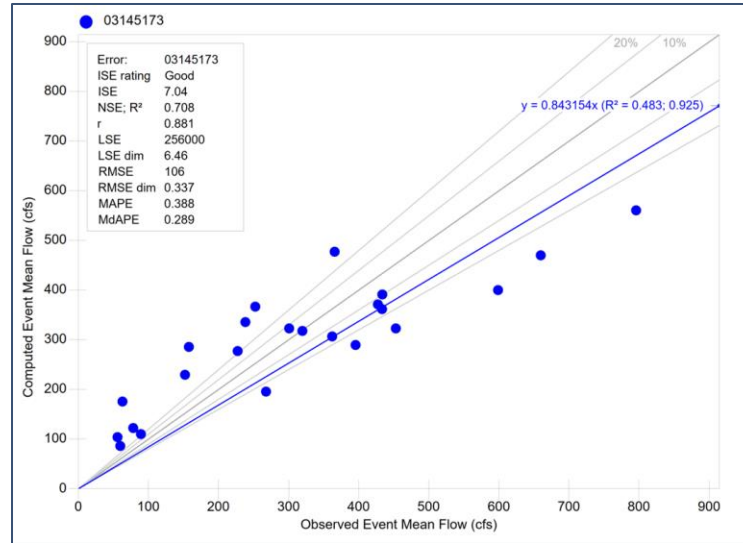
Validation Summary

USGS Gauge 03145173

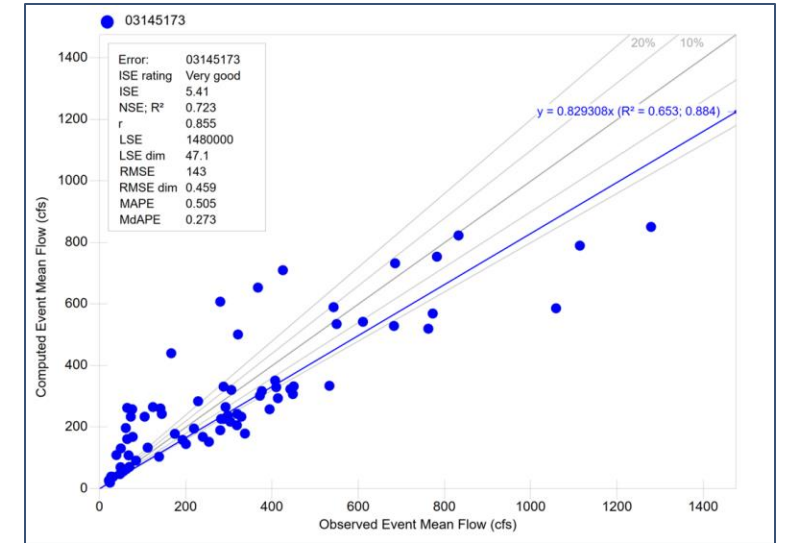
Annual Mean Flow



Seasonal Mean Flow



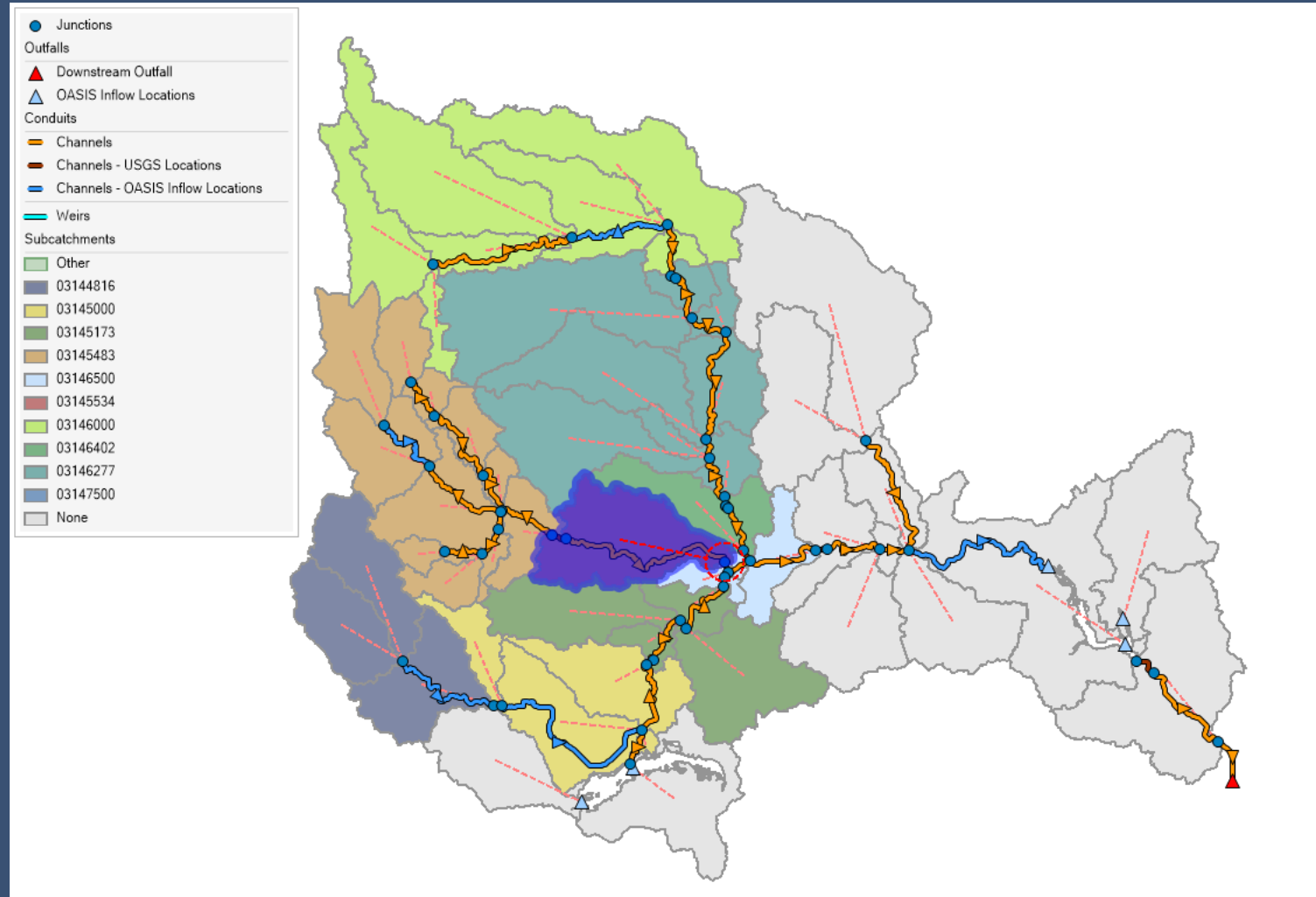
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03145534

Raccoon Cr. bl. Wilson Street at Newark OH



Calibration Summary

USGS Gauge 03145534

- Calibration Period
 - 01/01/2011 – 01/01/2016
- Validation Period
 - 01/01/2017 – 01/01/2022
- Comments
 - *None*

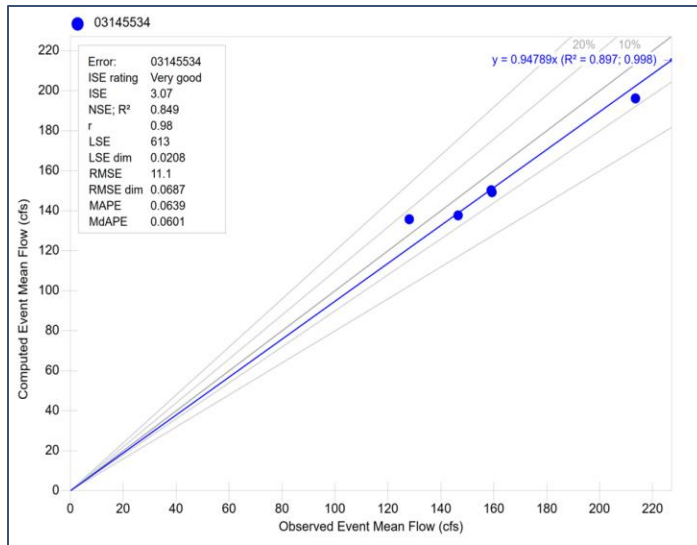
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2011	213.50	196.20	-8%
	2012	128.10	135.80	6%
	2013	159.30	149.30	-6%
	2014	146.50	137.70	-6%
	2015	159.00	150.20	-6%
Validation	2017	137.80	143.90	4%
	2018	235.40	189.80	-19%
	2019	202.70	165.50	-18%
	2020	196.30	192.70	-2%
	2021	154.40	140.60	-9%
	2022	195.20	156.20	-20%

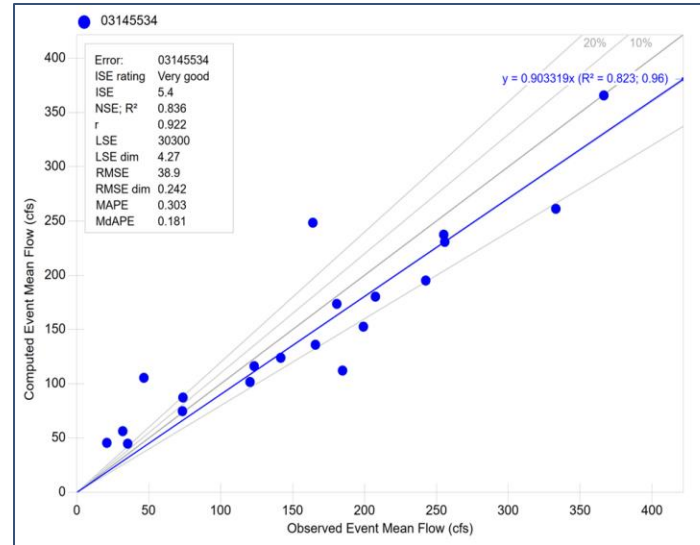
Calibration Summary

USGS Gauge 03145534

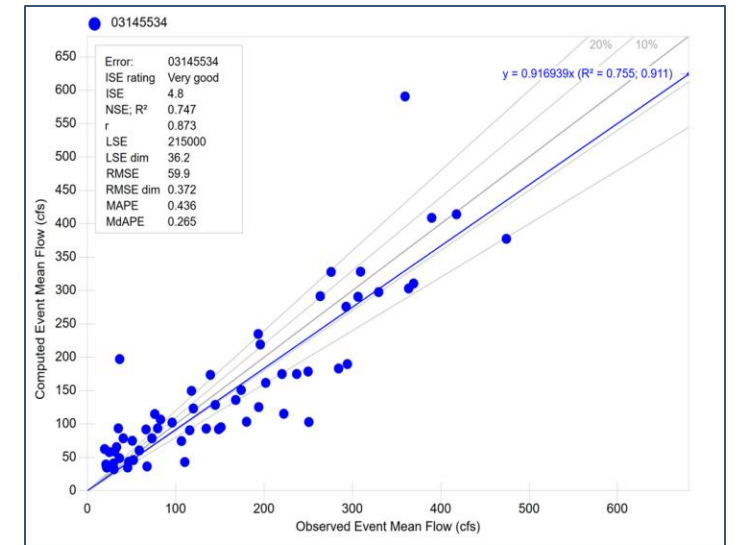
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

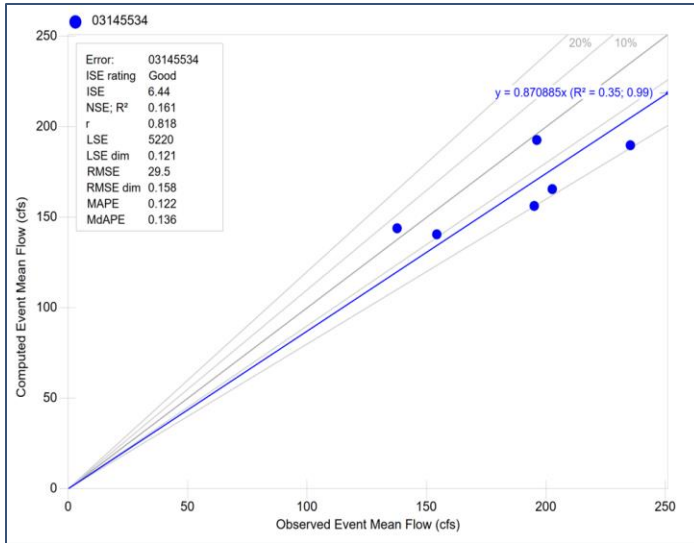


* 10% and 20% Error Bands Shown in Graphs

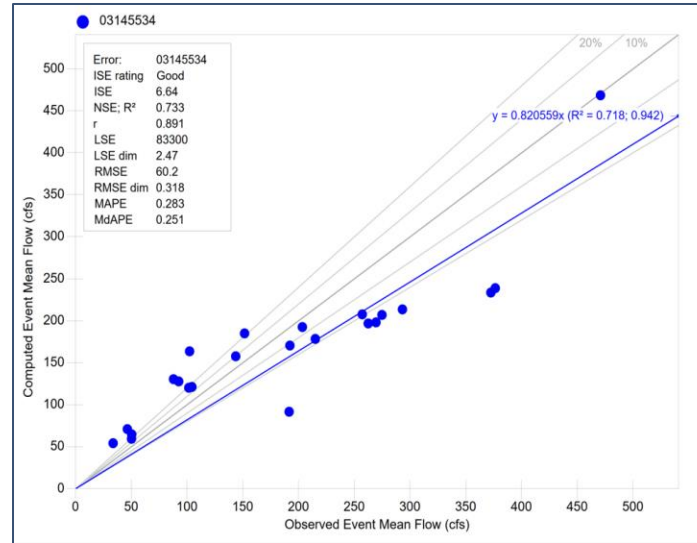
Validation Summary

USGS Gauge 03145534

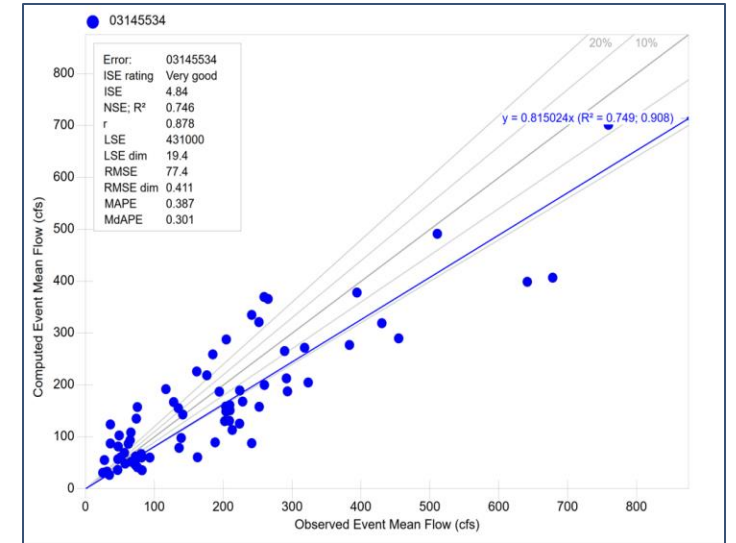
Annual Mean Flow



Seasonal Mean Flow



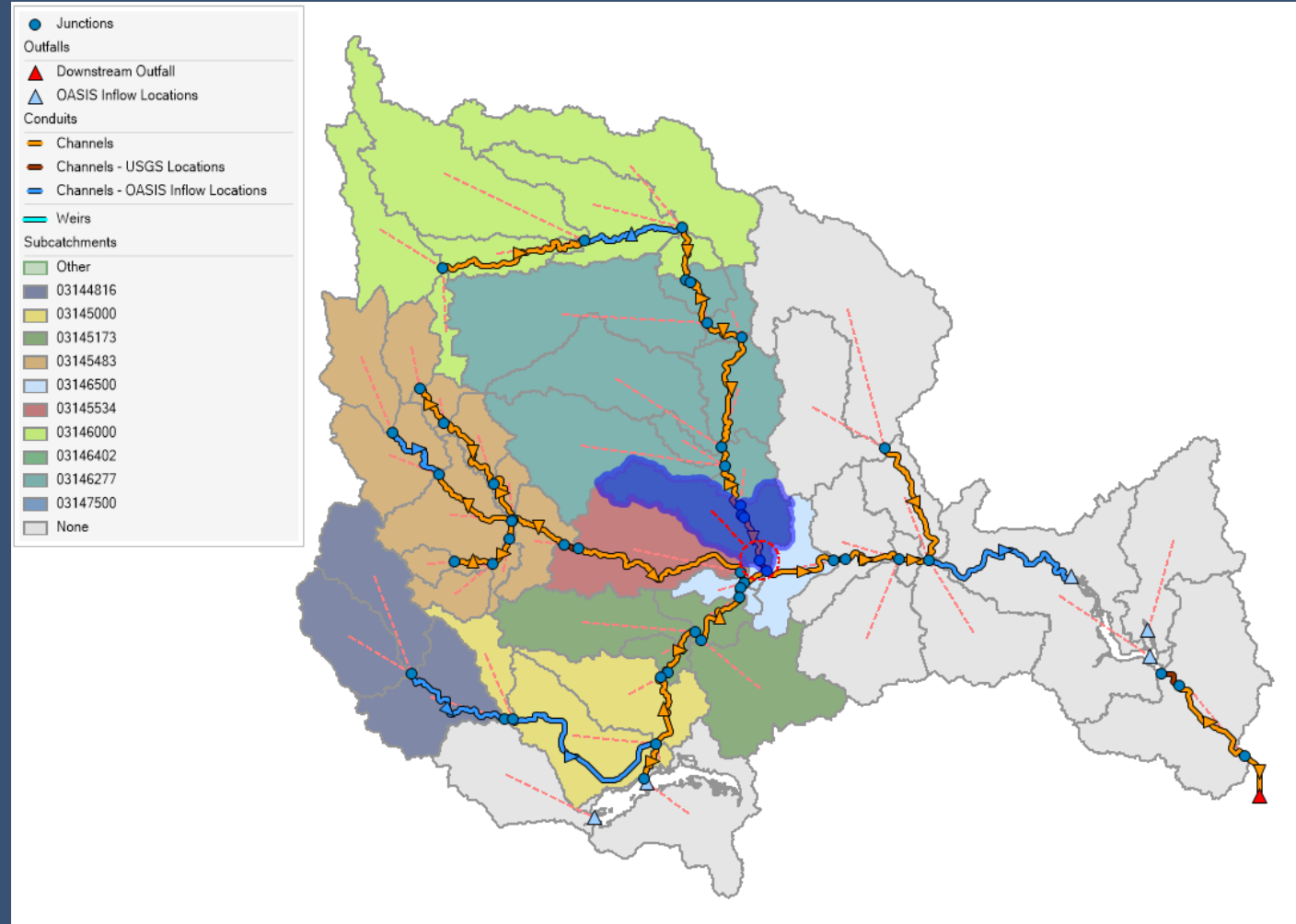
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03146402

N. Fk. Licking River at E. Main St. at Newark OH



Calibration Summary

USGS Gauge 03146402

- Calibration Period
 - 01/01/2011 – 01/01/2016
- Validation Period
 - 01/01/2017 – 01/01/2022
- Comments
 - *None*

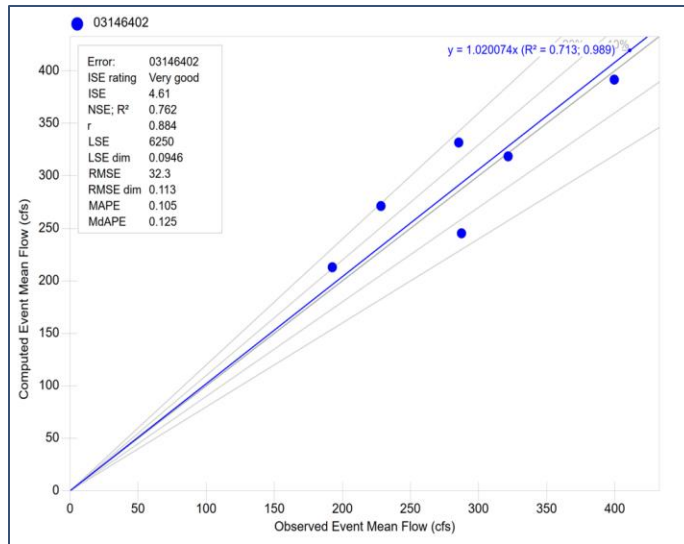
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2011	399.60	391.50	-2%
	2012	228.30	271.20	19%
	2013	285.40	331.70	16%
	2014	287.50	245.20	-15%
	2015	321.80	318.40	-1%
	2016	192.70	212.70	10%
Validation	2017	252.60	287.80	14%
	2018	448.30	380.80	-15%
	2019	353.80	349.20	-1%
	2020	373.10	374.50	0%
	2021	282.00	257.30	-9%
	2022	335.30	316.50	-6%

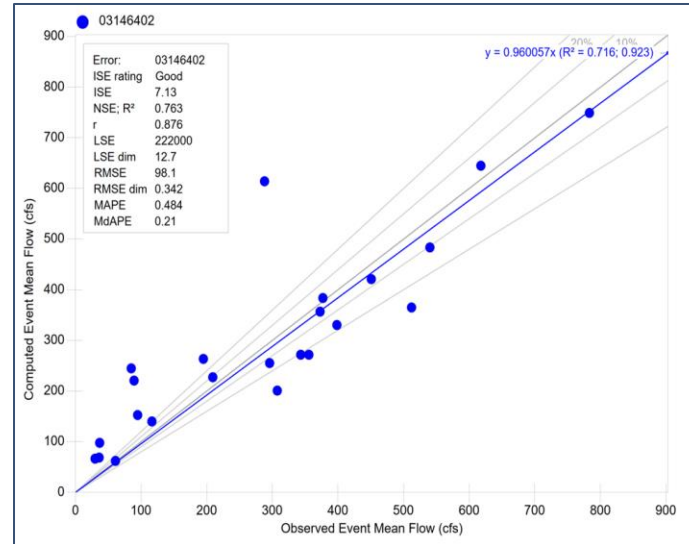
Calibration Summary

USGS Gauge 03146402

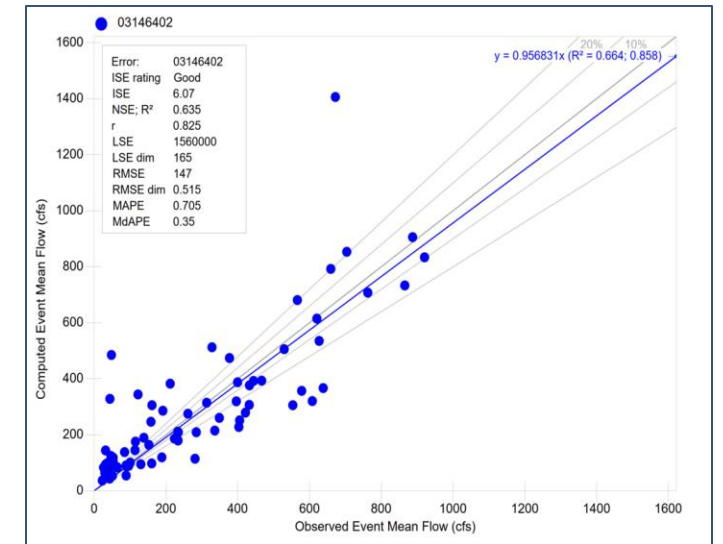
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

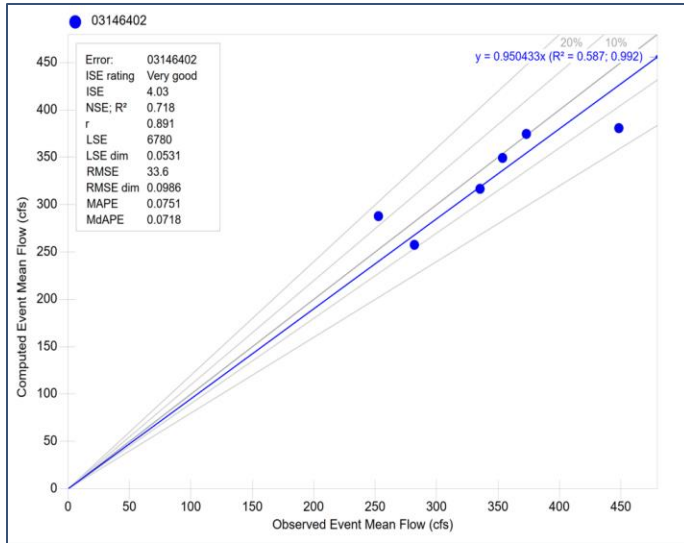


* 10% and 20% Error Bands Shown in Graphs

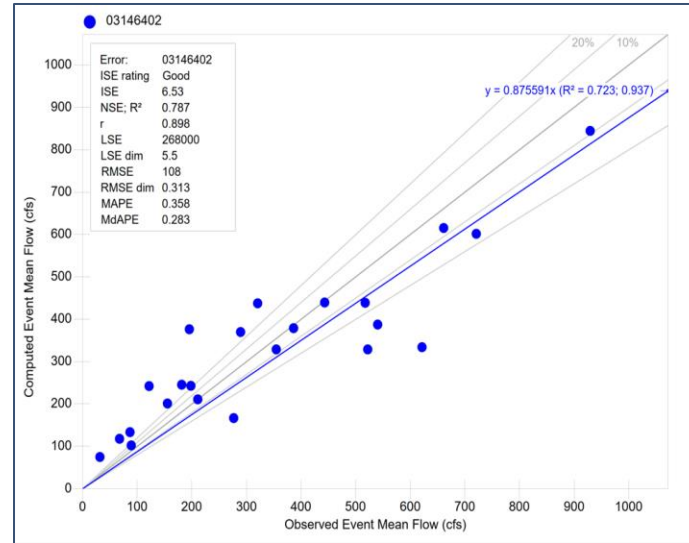
Validation Summary

USGS Gauge 03146402

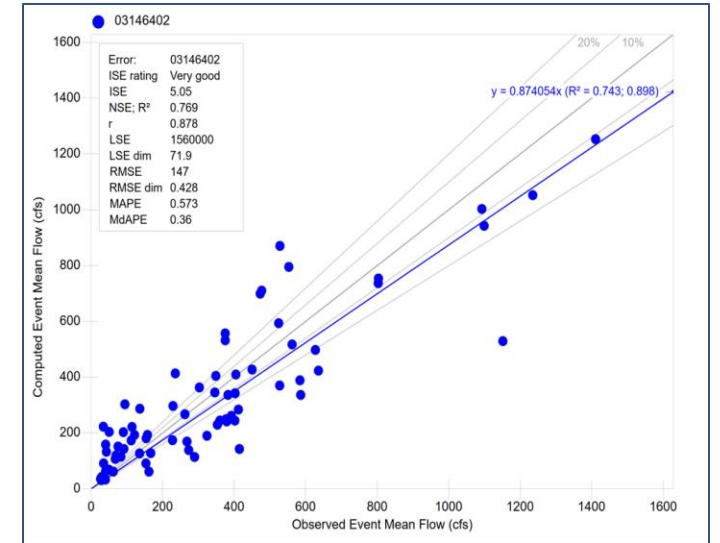
Annual Mean Flow



Seasonal Mean Flow



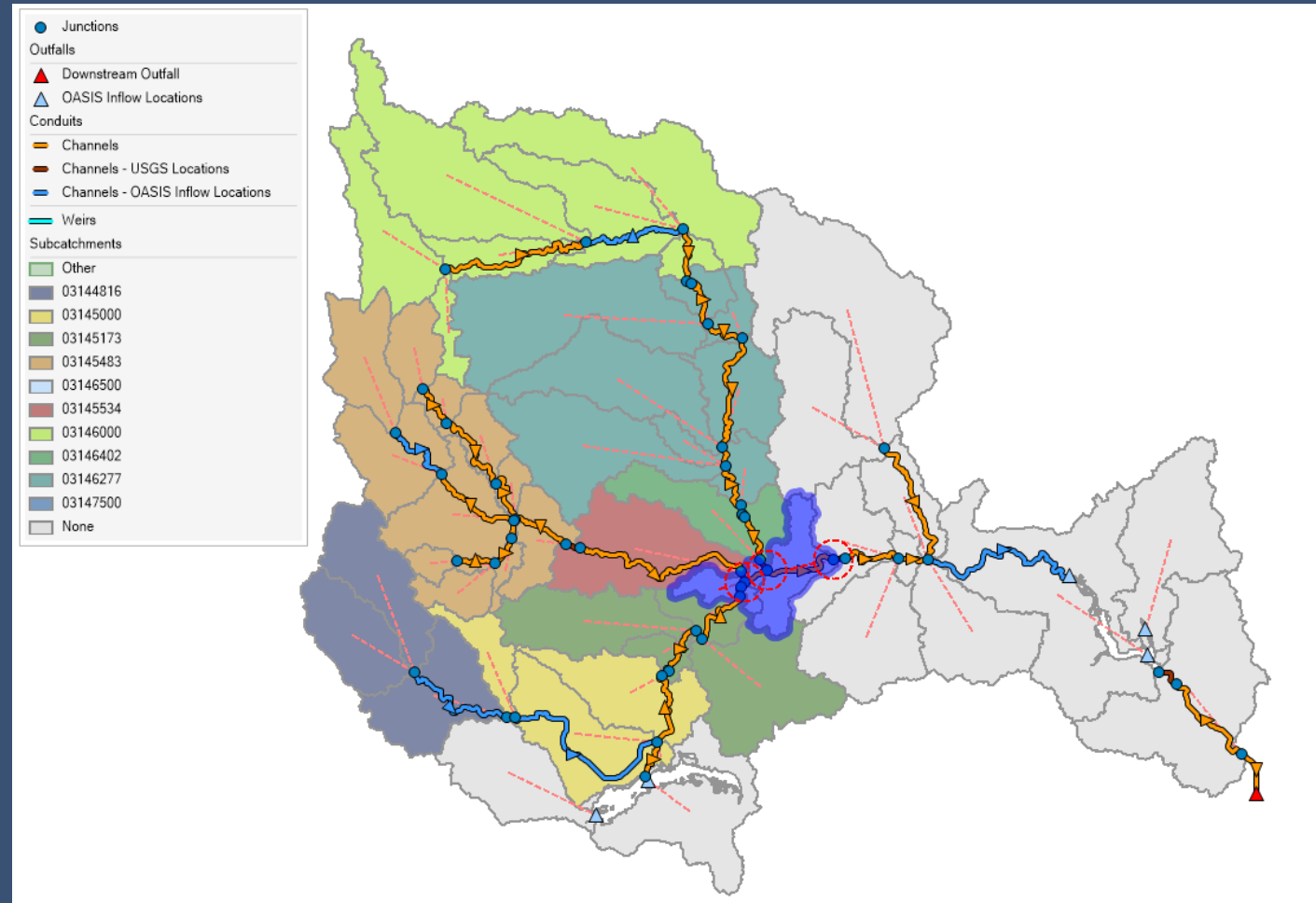
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03146500

Licking River near Newark OH



Calibration Summary

USGS Gauge 03146500

- Calibration Period
 - 01/01/2008 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2022
- Comments
 - *None*

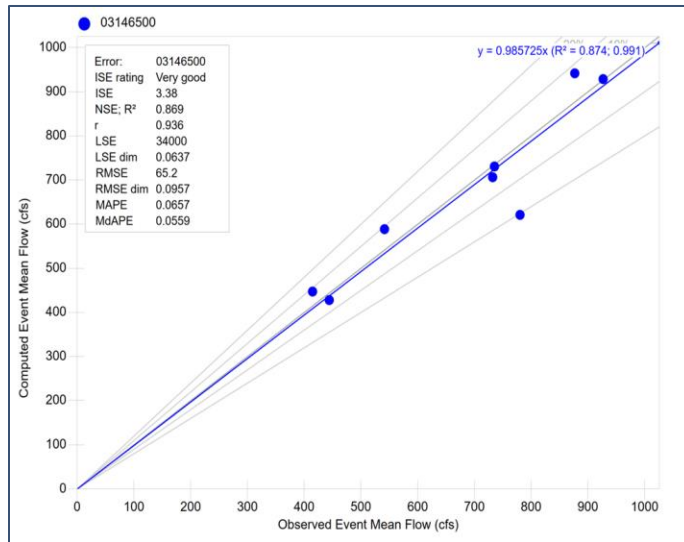
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2008	876.80	941.90	7%
	2009	414.70	446.80	8%
	2010	444.30	427.60	-4%
	2011	926.40	928.50	0%
	2012	541.40	588.70	9%
	2013	735.10	730.30	-1%
	2014	780.40	620.70	-20%
	2015	732.20	706.10	-4%
Validation	2016	471.70	502.80	7%
	2017	655.80	713.30	9%
	2018	1111.00	959.30	-14%
	2019	941.70	805.90	-14%
	2020	935.00	847.50	-9%
	2021	710.20	635.30	-11%
	2022	908.90	752.40	-17%

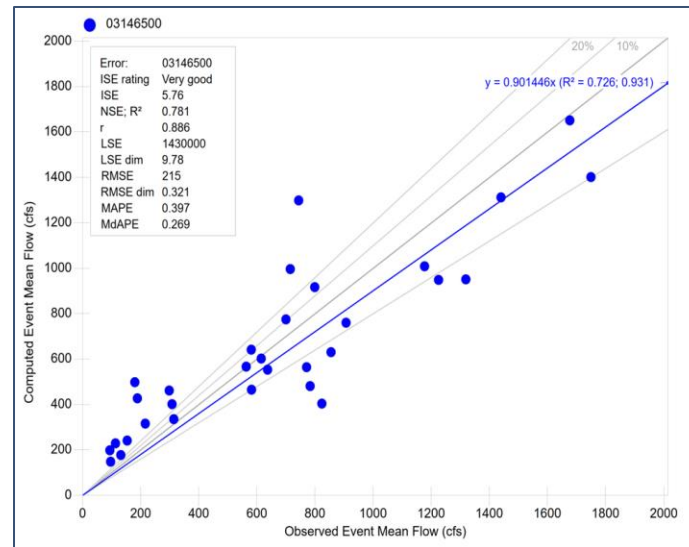
Calibration Summary

USGS Gauge 03146500

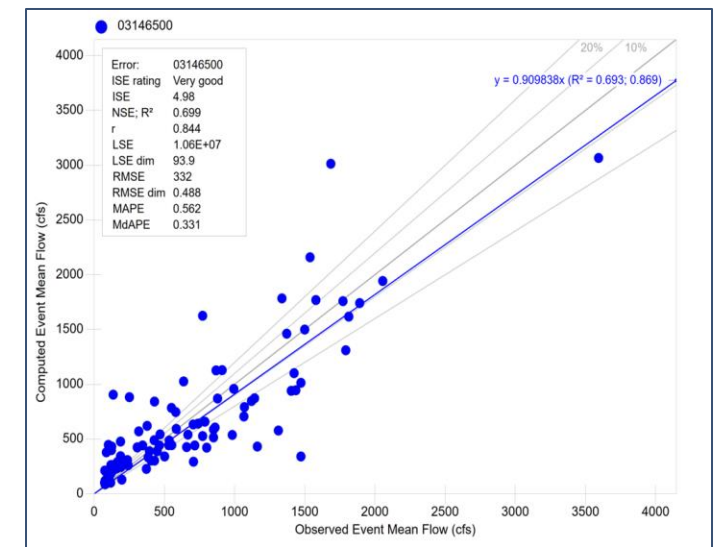
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

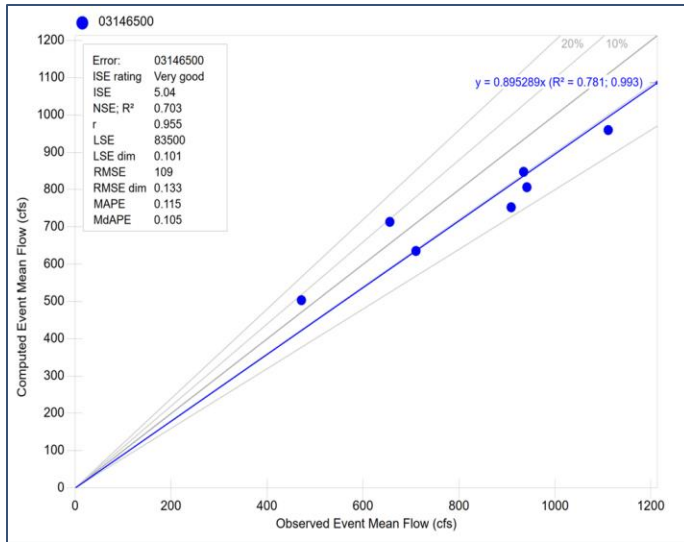


* 10% and 20% Error Bands Shown in Graphs

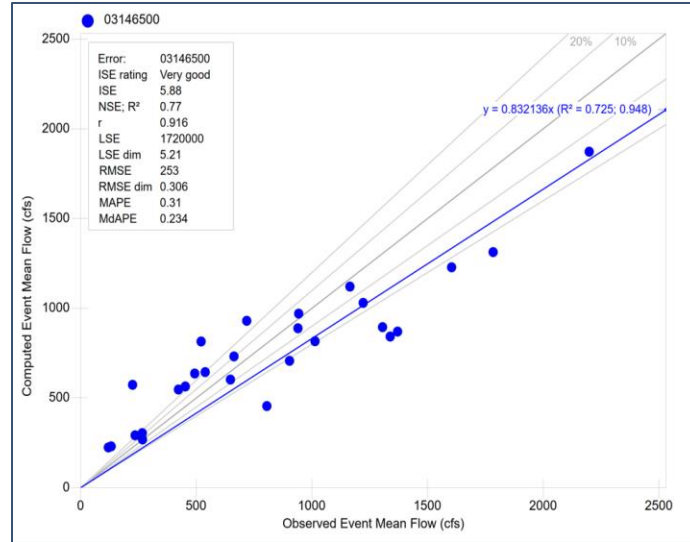
Validation Summary

USGS Gauge 03146500

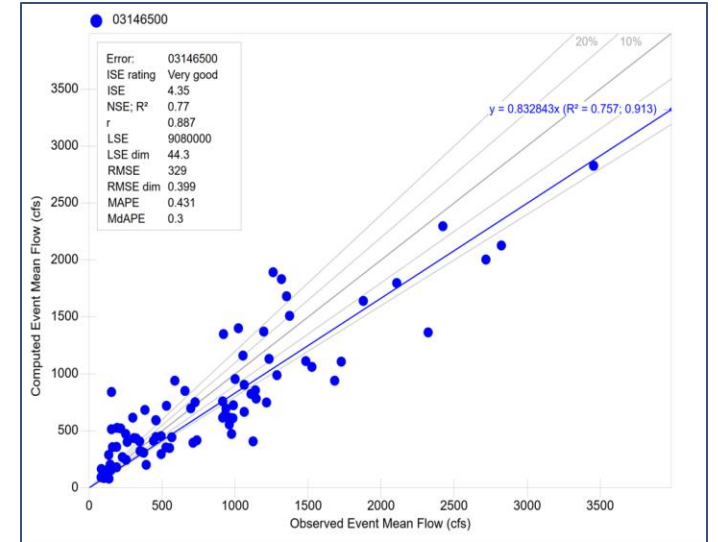
Annual Mean Flow



Seasonal Mean Flow

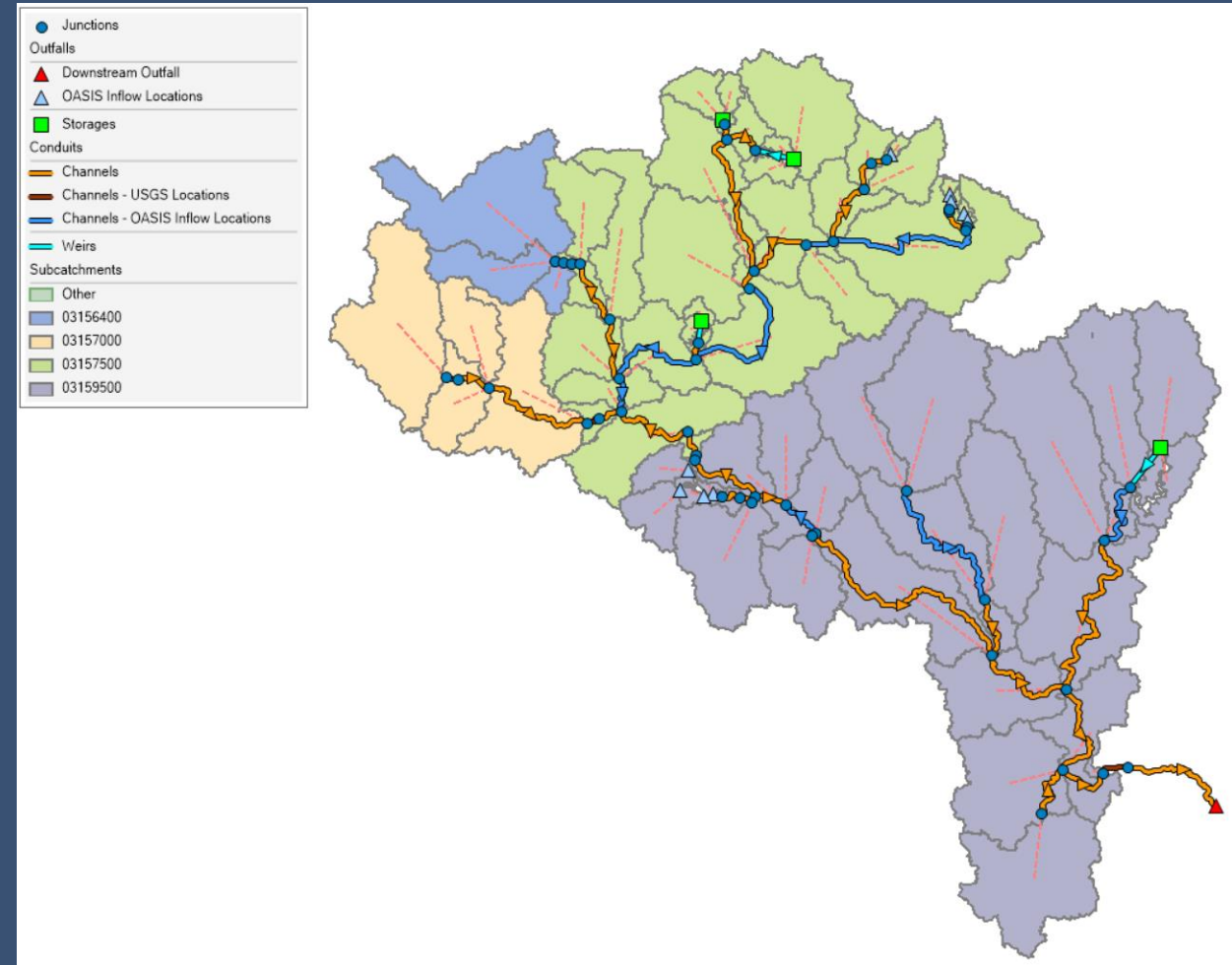


Monthly Mean Flow



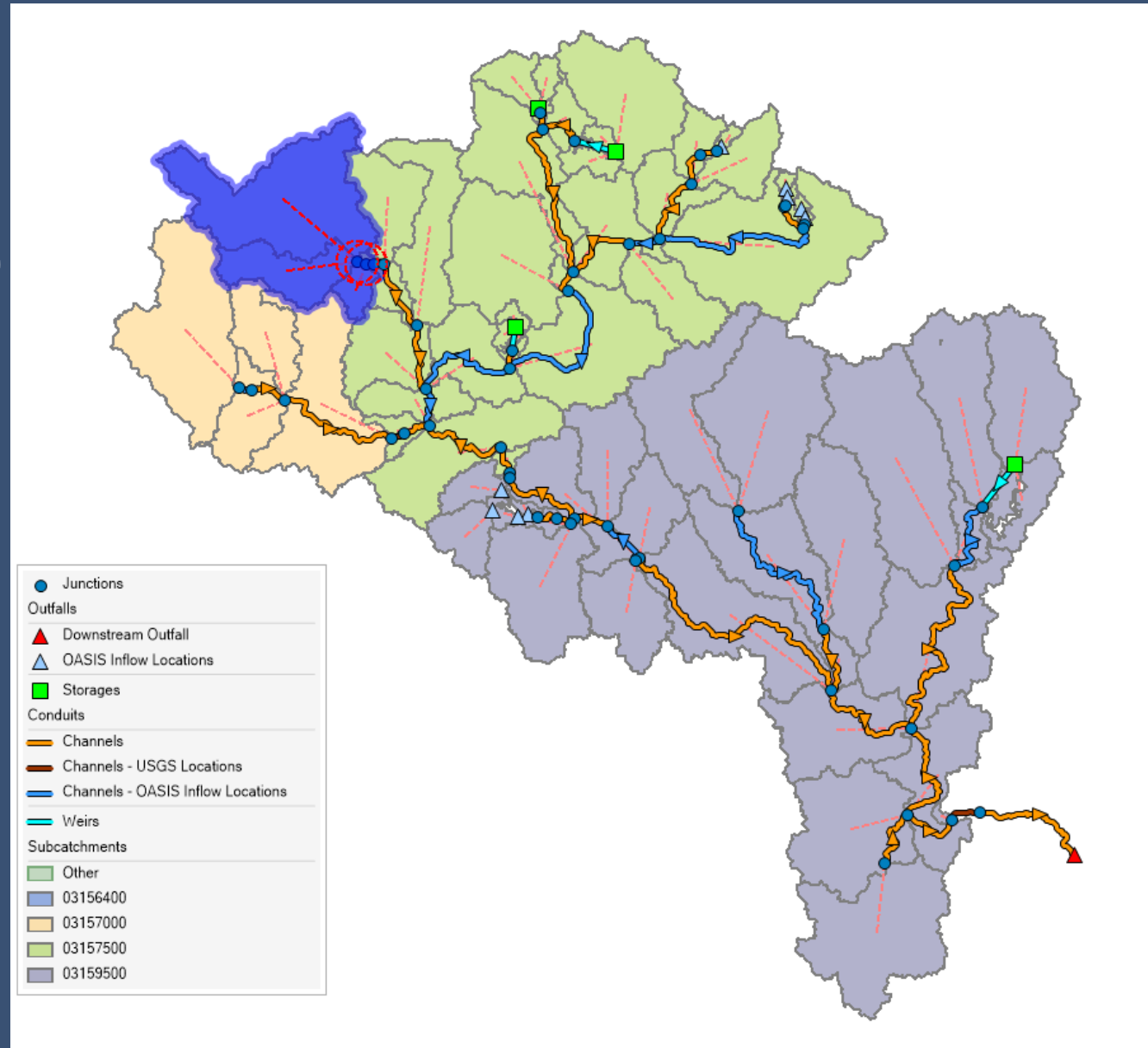
* 10% and 20% Error Bands Shown in Graphs

Hocking Watershed Model



USGS Gauge 03156400

Hocking River at Lancaster OH



Calibration Summary

USGS Gauge 03156400

- Calibration Period
 - 01/01/2022 – 01/01/2023
- Validation Period
 - Not enough data available
- Comments
 - *Little data available for calibration*

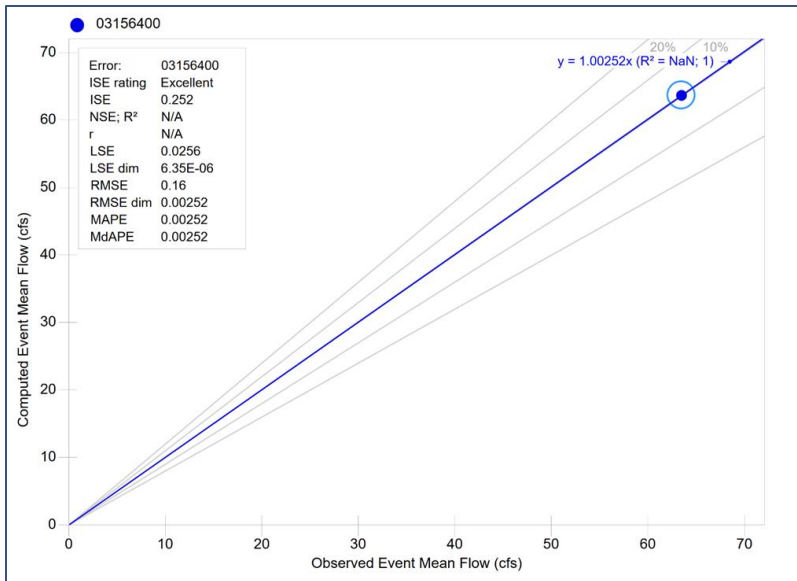
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2022	63.49	63.74	0%

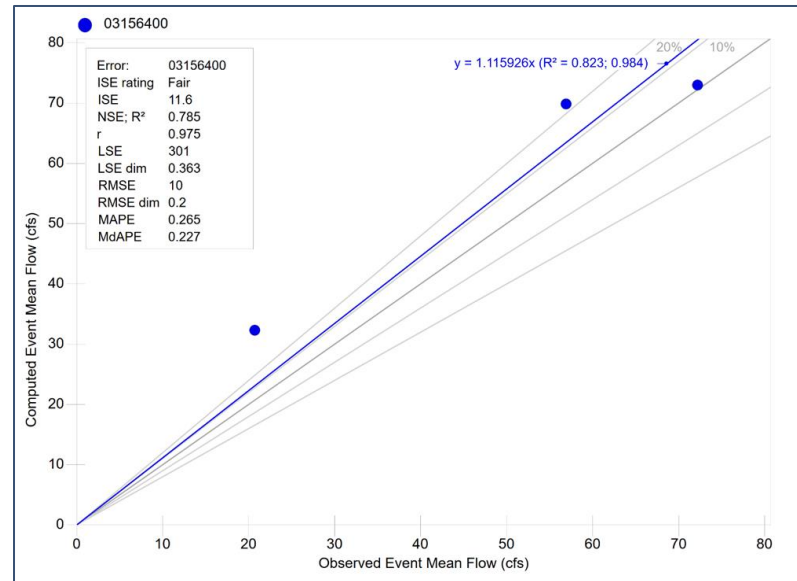
Calibration Summary

USGS Gauge 03156400

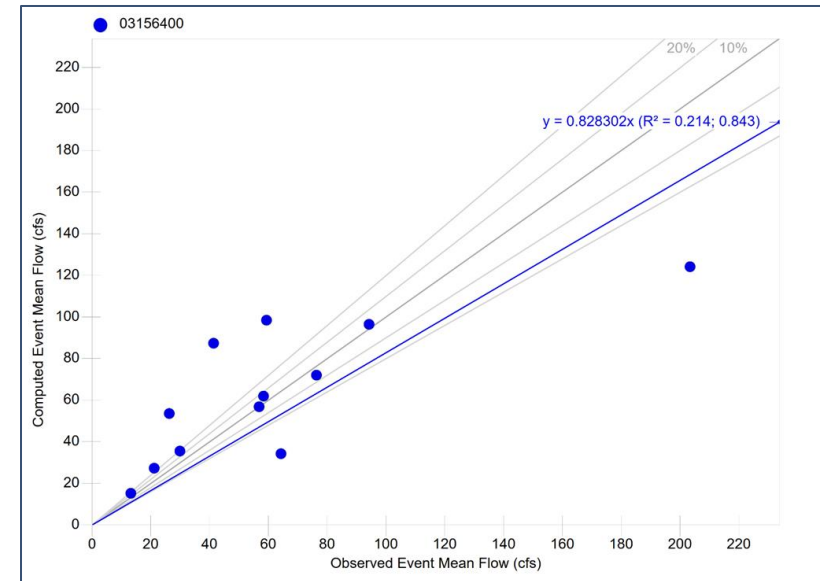
Annual Mean Flow



Seasonal Mean Flow



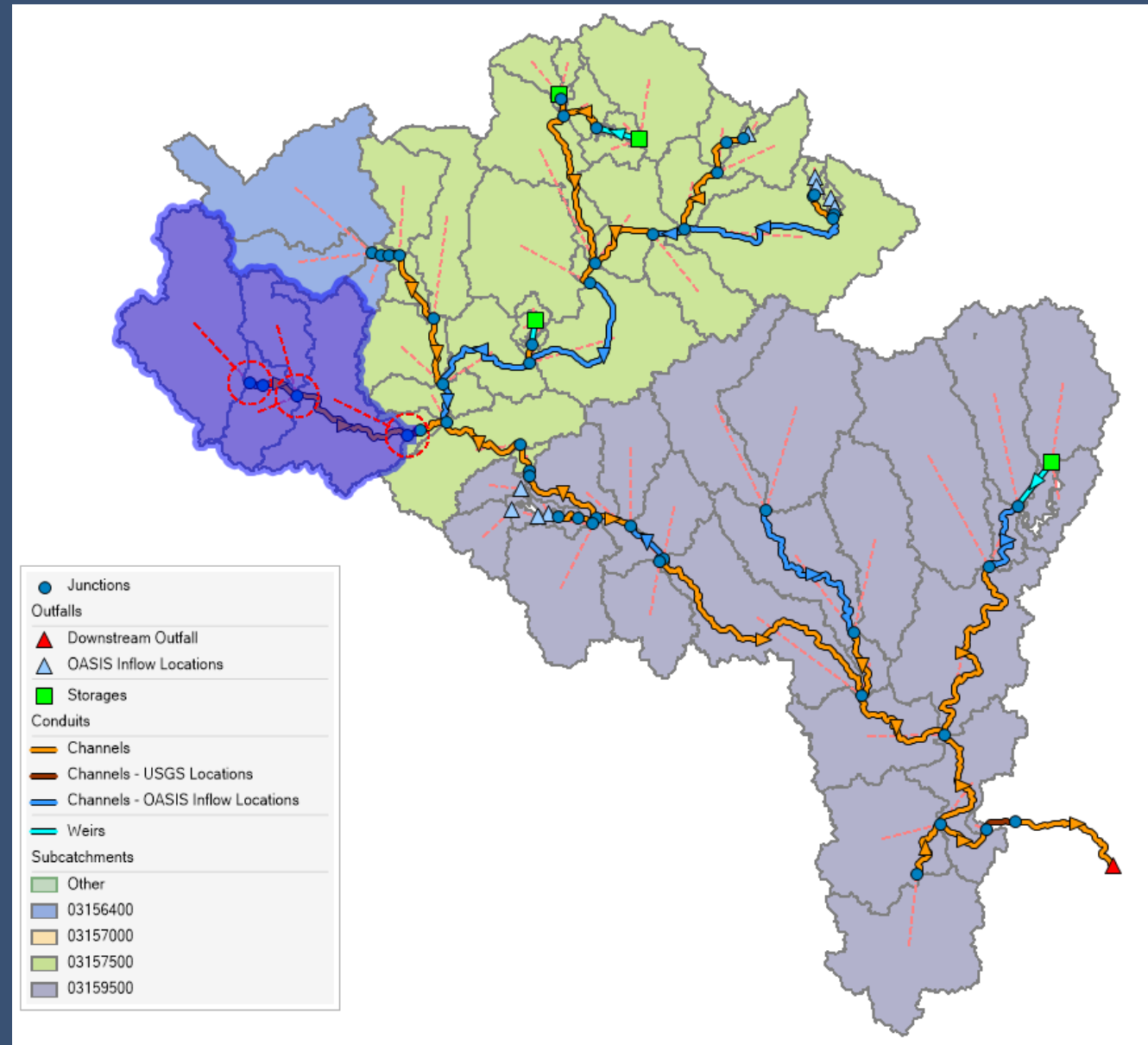
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03157000

Clear Creek near Rockbridge OH



Calibration Summary

USGS Gauge 03157000

- Calibration Period
 - 01/01/2004 – 01/01/2014
- Validation Period
 - 01/01/2014 – 01/01/2023
- Comments
 - *None*

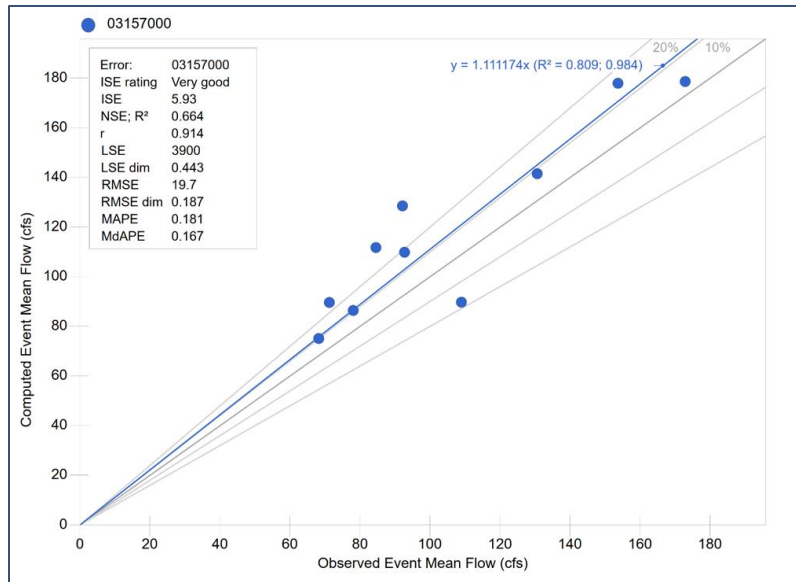
Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2004	153.7	177.8	16%
	2005	92.1	128.5	39%
	2006	109.0	89.7	-18%
	2007	92.8	109.8	18%
	2008	130.6	141.4	8%
	2009	71.3	89.5	26%
	2010	78.1	86.4	11%
	2011	172.9	178.6	3%
	2012	68.3	75.0	10%
	2013	84.6	111.7	32%
Validation	2014	77.8	92.1	18%
	2015	87.5	96.1	10%
	2016	76.9	92.1	20%
	2017	115.0	146.2	27%
	2018	161.4	165.3	2%
	2019	162.6	150.4	-8%
	2020	105.9	111.9	6%
	2021	75.08	89.64	19%
	2022	101.2	130.7	29%

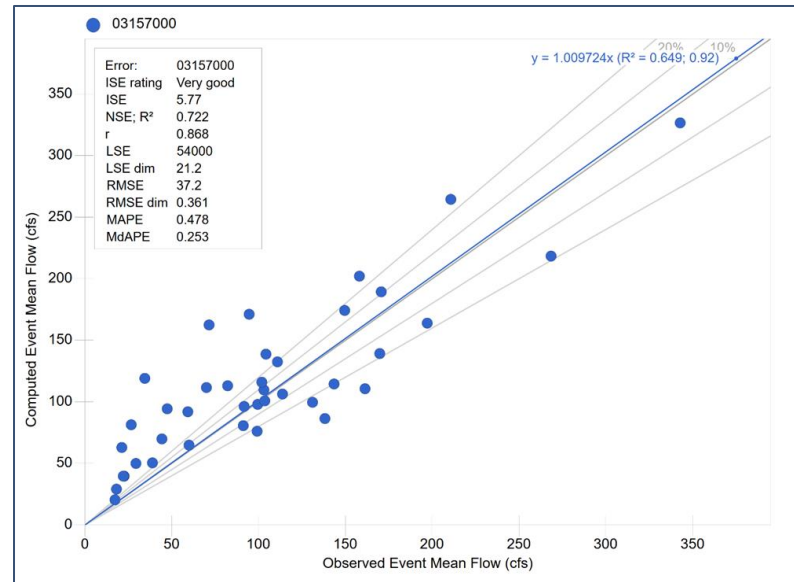
Calibration Summary

USGS Gauge 03157000

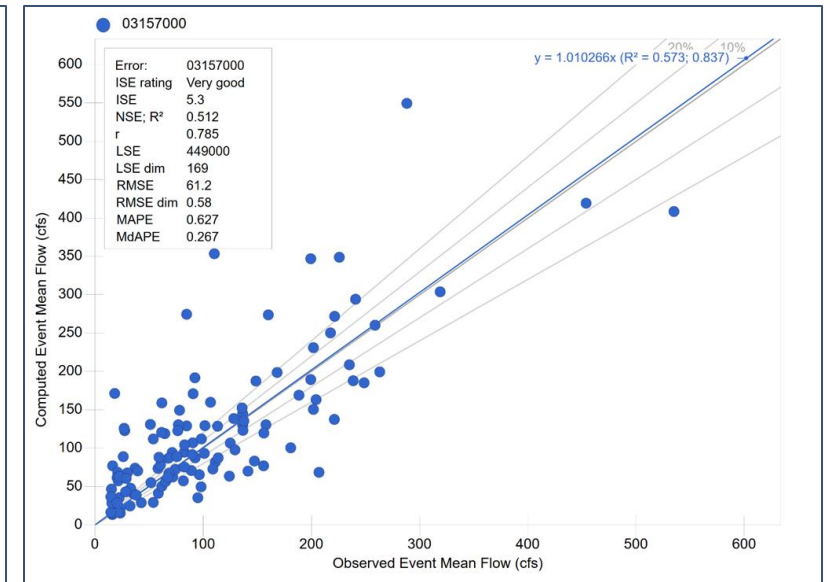
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

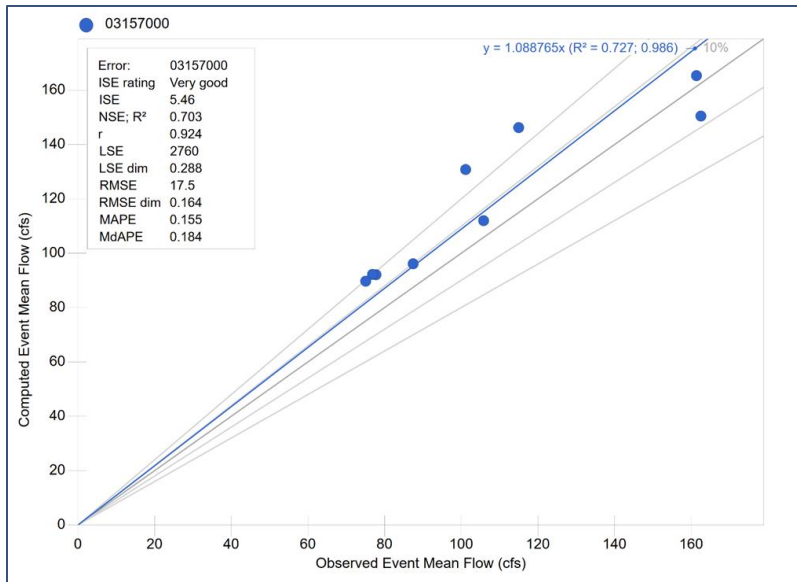


* 10% and 20% Error Bands Shown in Graphs

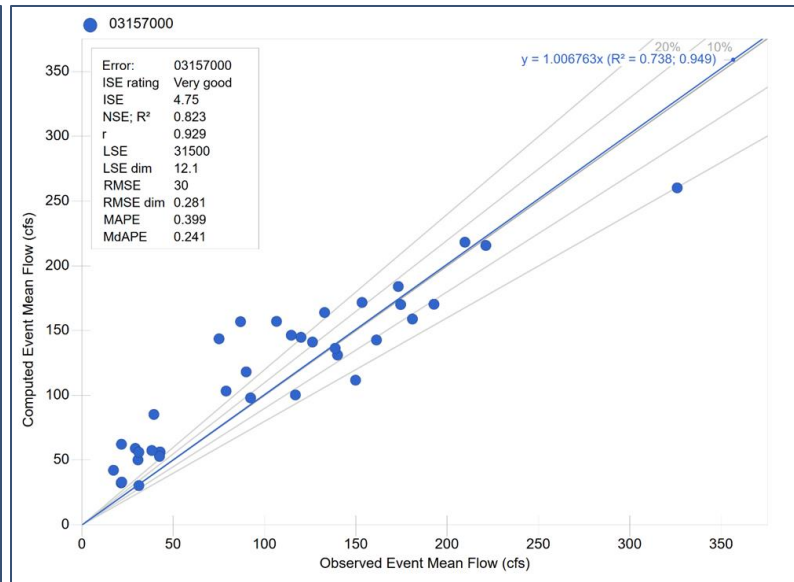
Validation Summary

USGS Gauge 03157000

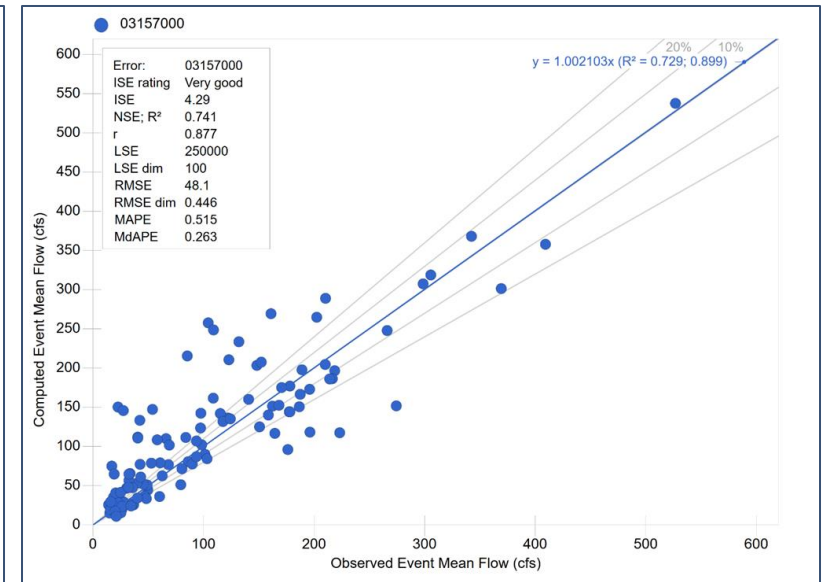
Annual Mean Flow



Seasonal Mean Flow



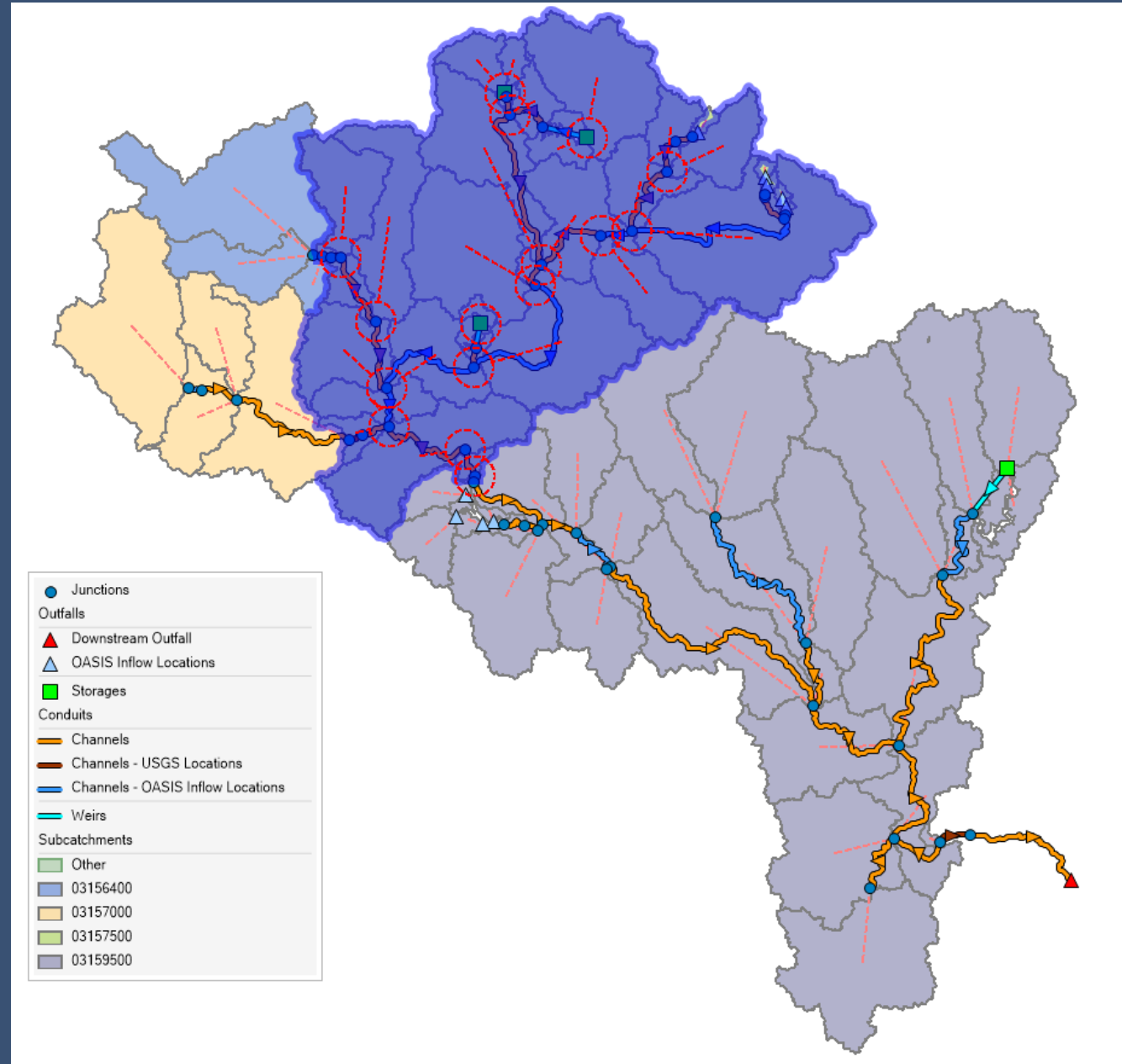
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03157500

Hocking River at Enterprise OH



Calibration Summary

USGS Gauge 03157500

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - *None*

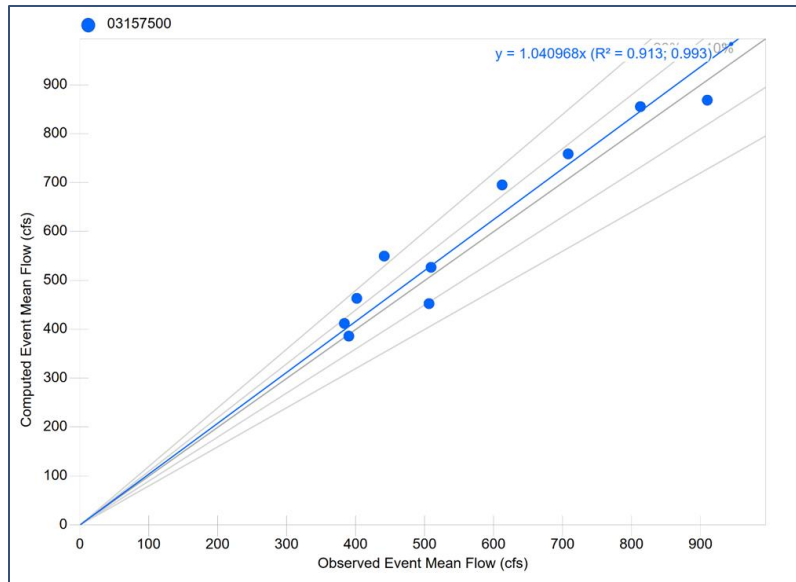
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2004	813.0	855.2	5%
	2005	612.6	694.9	13%
	2006	506.4	452.2	-11%
	2007	509.2	526.8	3%
	2008	708.1	758.4	7%
	2009	401.8	462.8	15%
	2010	390.1	386.0	-1%
	2011	910.2	868.2	-5%
	2012	383.7	411.7	7%
	2013	441.6	549.5	24%
Validation	2014	414.2	503.1	21%
	2015	421.7	518.8	23%
	2016	361.1	444.9	23%
	2017	599.3	679.8	13%
	2018	884.9	800.4	-10%
	2019	841.5	695.8	-17%
	2020	603.9	636.4	5%
	2021	390.6	495.9	27%
	2022	577.6	651.9	13%

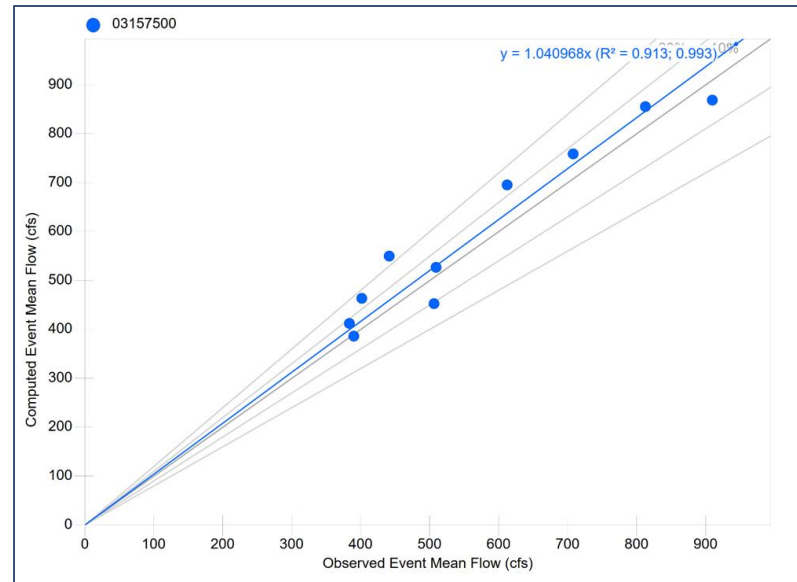
Calibration Summary

USGS Gauge 03157500

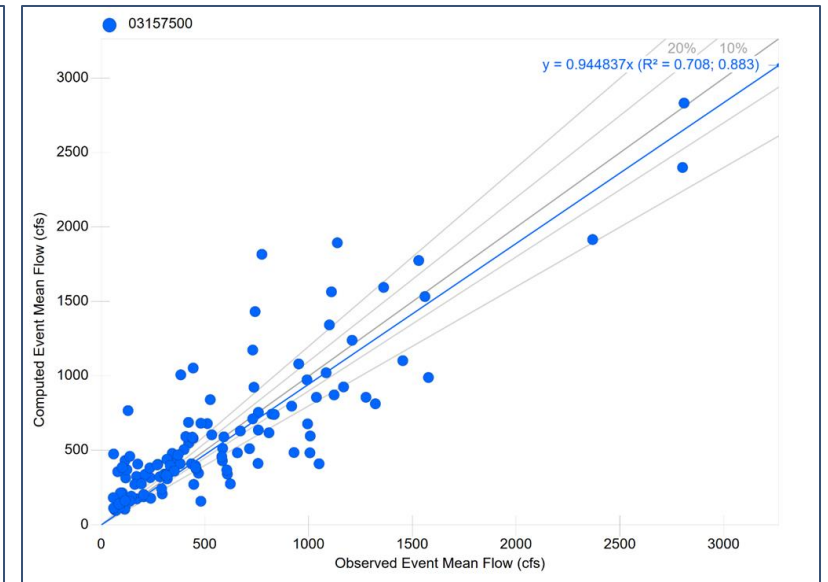
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

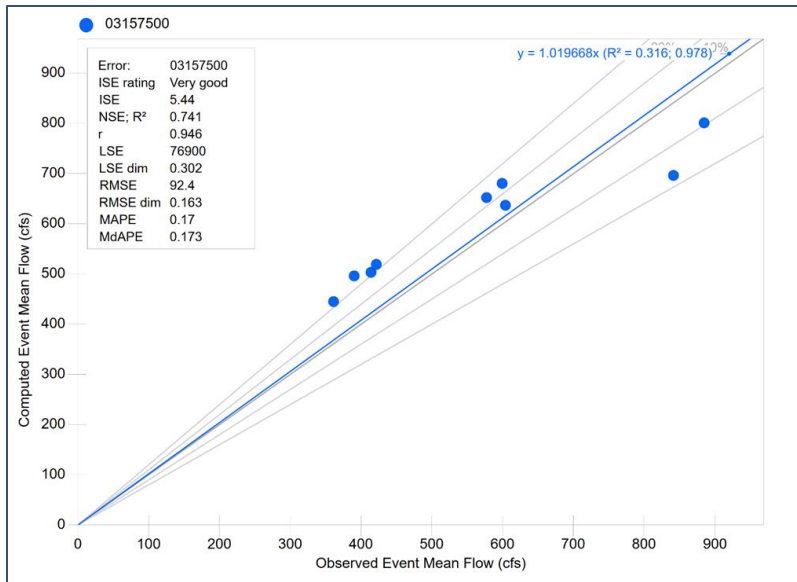


* 10% and 20% Error Bands Shown in Graphs

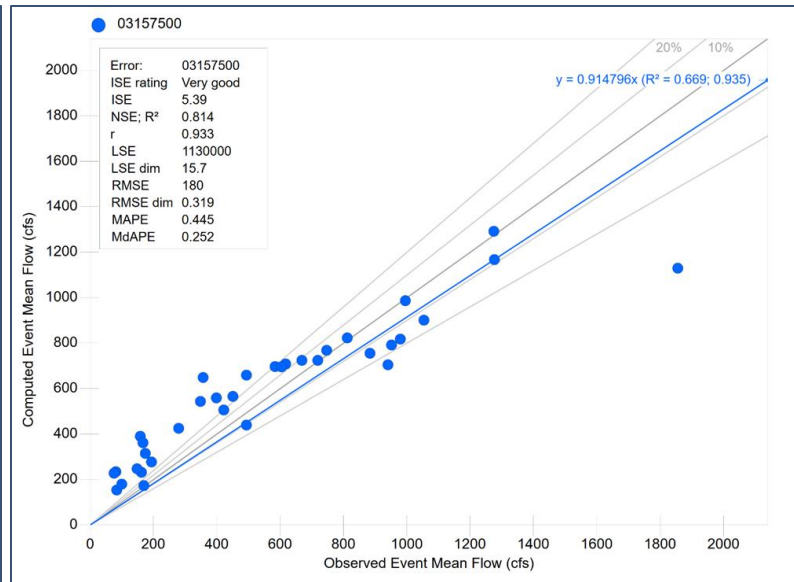
Validation Summary

USGS Gauge 03157500

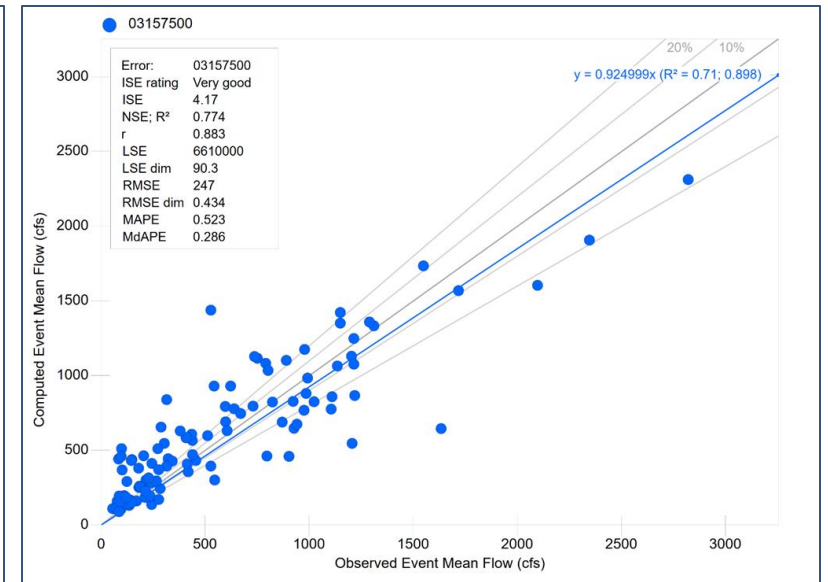
Annual Mean Flow



Seasonal Mean Flow



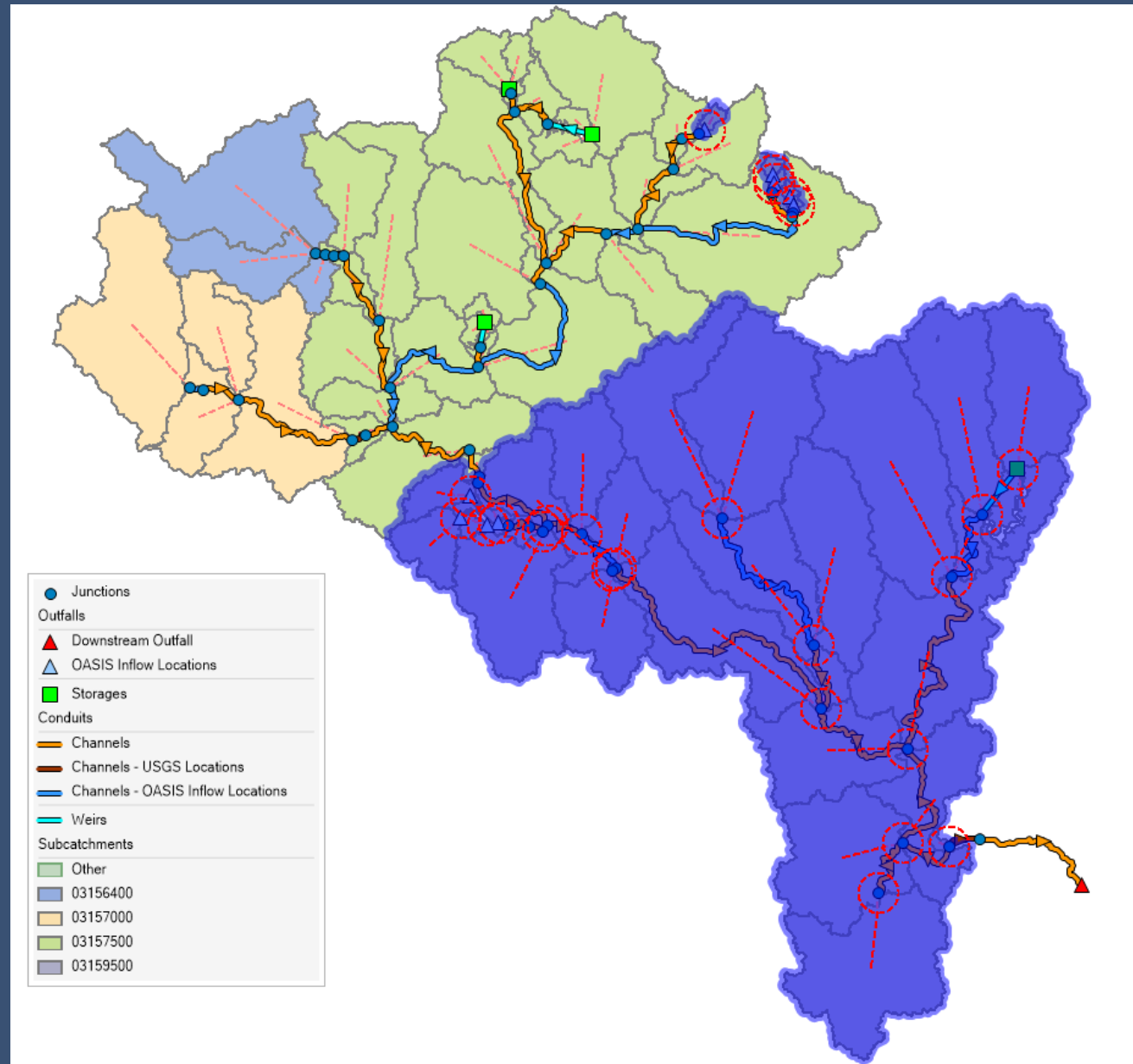
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03159500

Hocking River at Athens OH



Calibration Summary

USGS Gauge 03159500

- Calibration Period
 - 01/01/2004 – 01/01/2014
- Validation Period
 - 01/01/2014 – 01/01/2023
- Comments
 - *None*

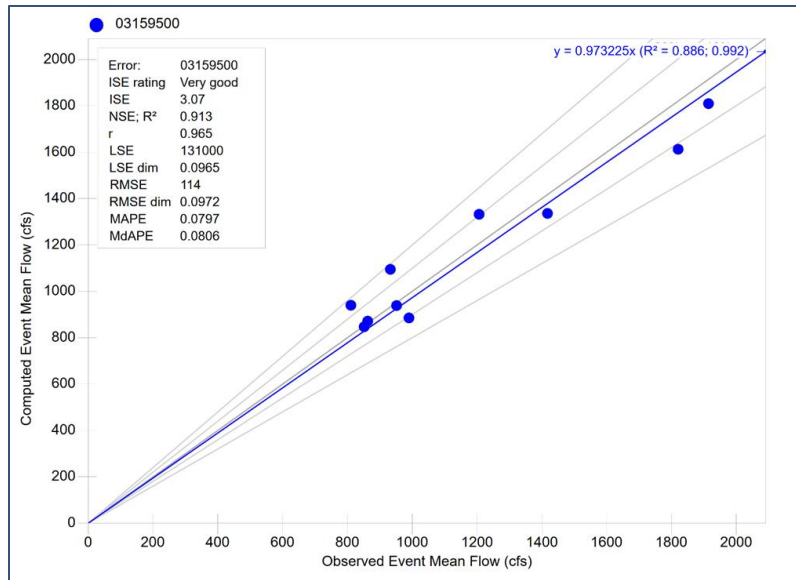
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2004	1821.0	1612.0	-11%
	2005	1207.0	1331.0	10%
	2006	989.9	884.9	-11%
	2007	951.8	937.6	-1%
	2008	1418.0	1335.0	-6%
	2009	811.3	939.4	16%
	2010	863.1	870.7	1%
	2011	1914.0	1809.0	-5%
	2012	851.6	846.7	-1%
	2013	933.0	1094.0	17%
Validation	2014	867.6	1023.0	18%
	2015	892.5	1036.0	16%
	2016	757.0	927.9	23%
	2017	1164.0	1419.0	22%
	2018	1944.0	1771.0	-9%
	2019	1621.0	1333.0	-18%
	2020	1232.0	1253.0	2%
	2021	848.1	1004	18%
	2022	1222	1252	2%

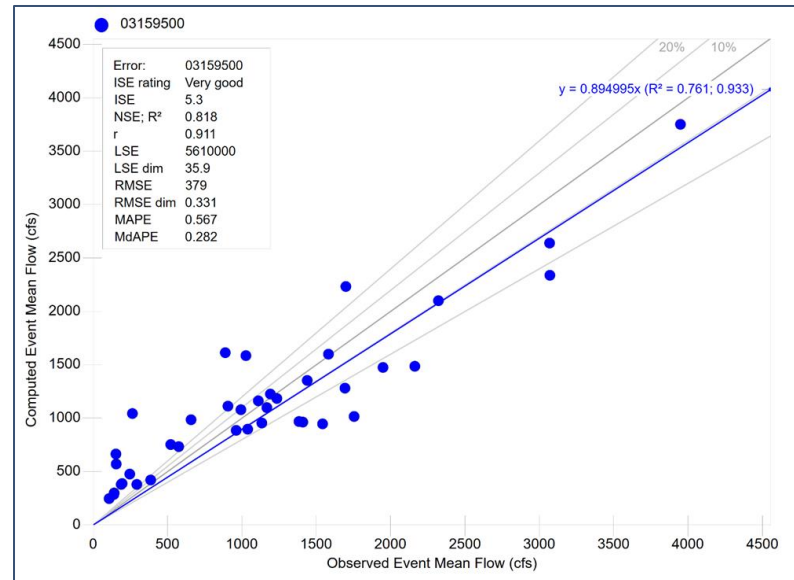
Calibration Summary

USGS Gauge 03159500

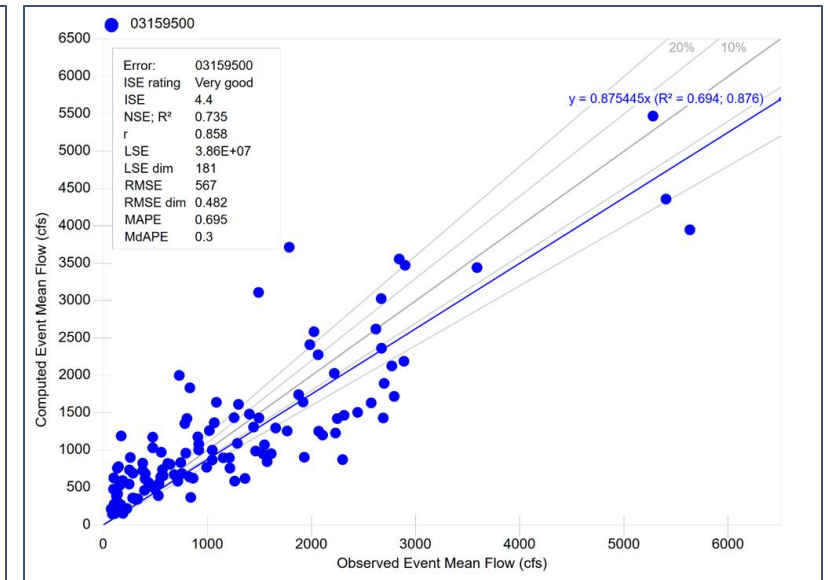
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

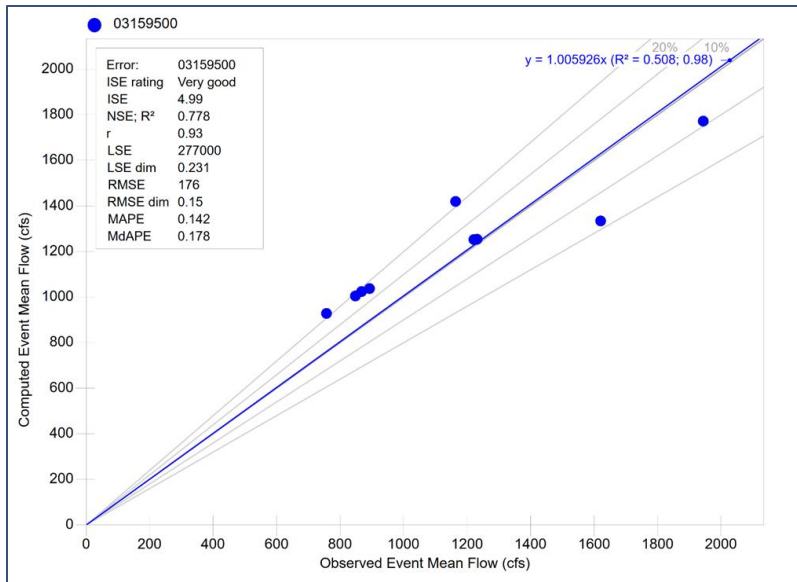


* 10% and 20% Error Bands Shown in Graphs

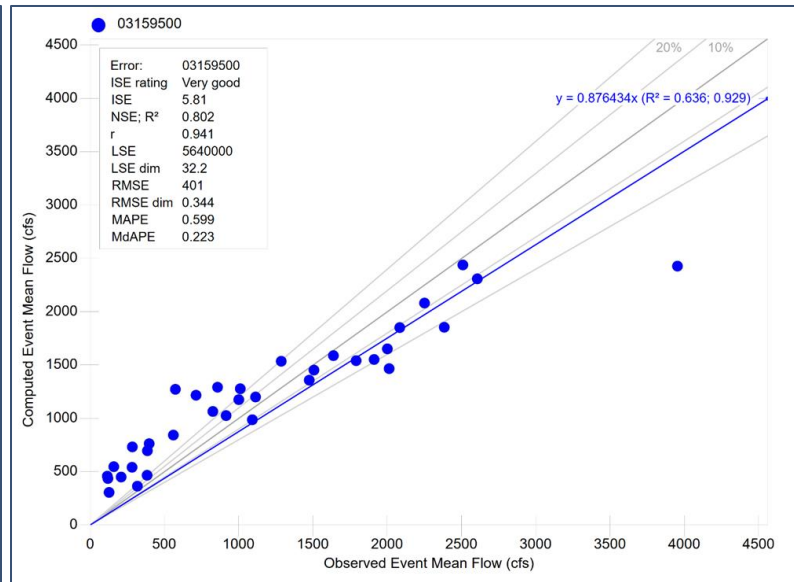
Validation Summary

USGS Gauge 03159500

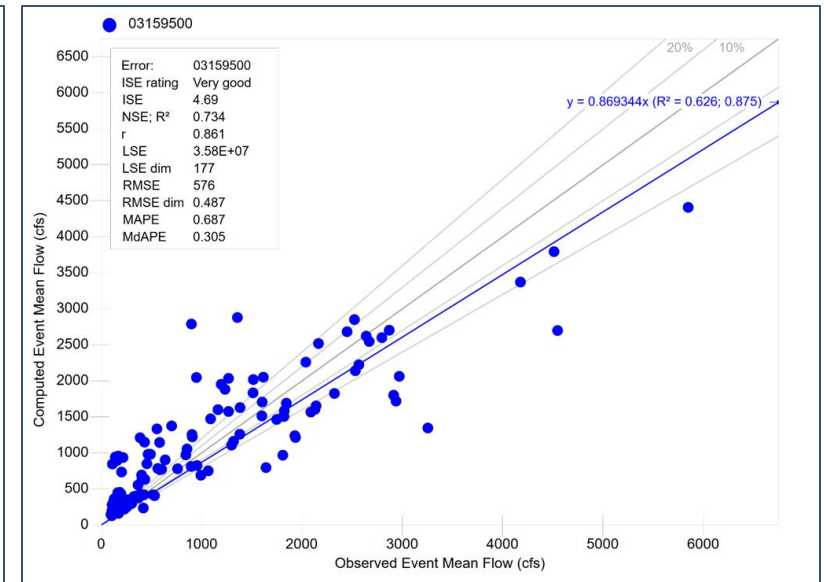
Annual Mean Flow



Seasonal Mean Flow

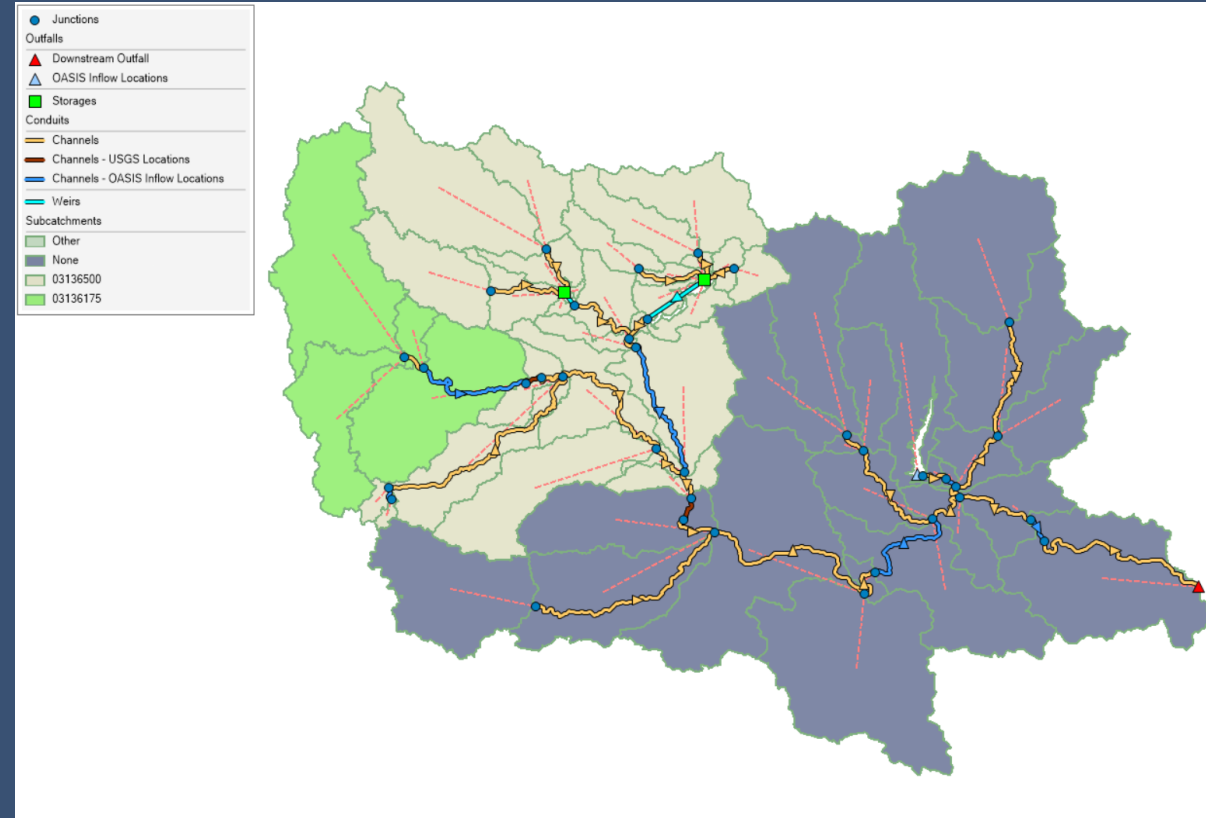


Monthly Mean Flow



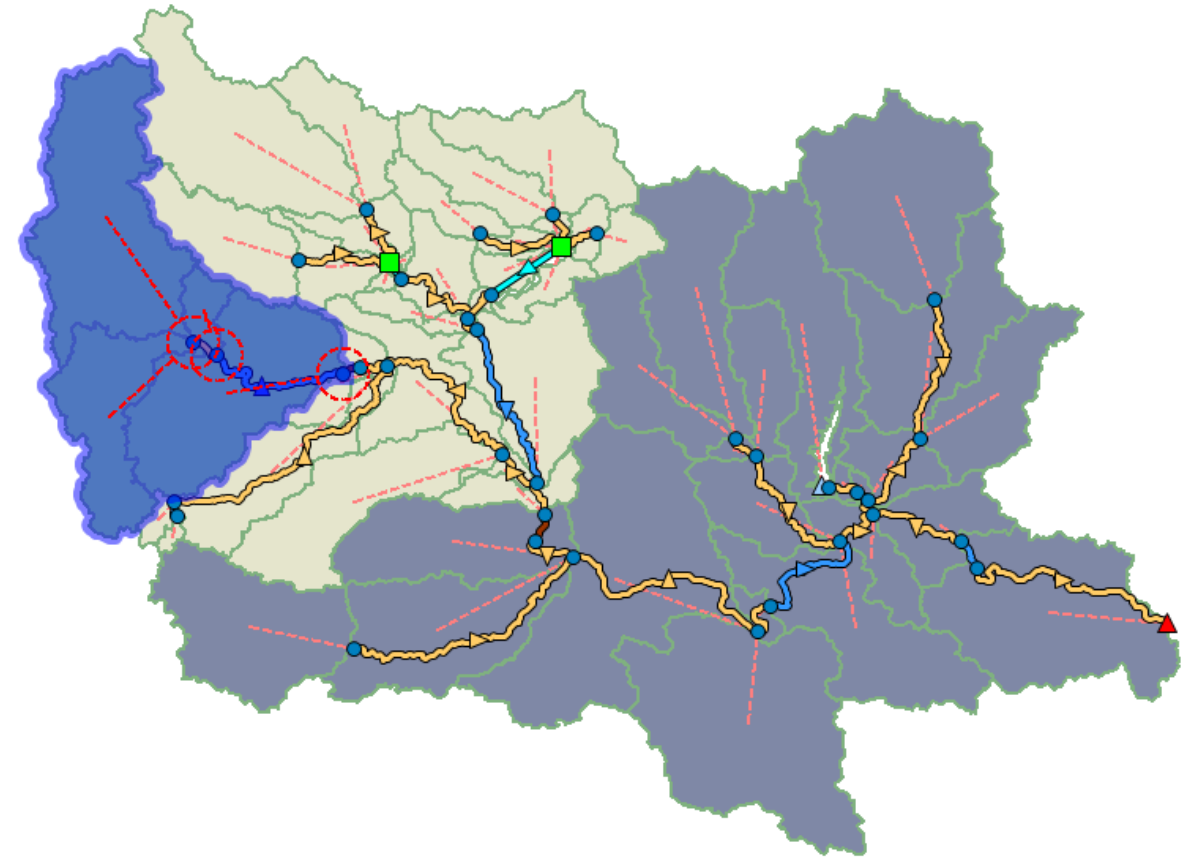
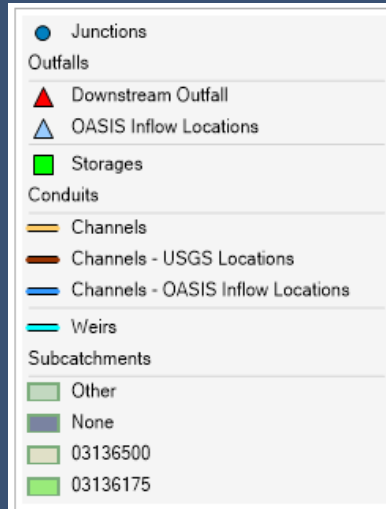
* 10% and 20% Error Bands Shown in Graphs

West Walhonding Watershed Model



USGS Gauge 03136175

Kokosing River near Lucerne OH



Calibration Summary

USGS Gauge 03136175

- Calibration Period
 - 01/01/2000 – 01/01/2004
- Validation Period
 - Not enough data available
- Comments
 - None

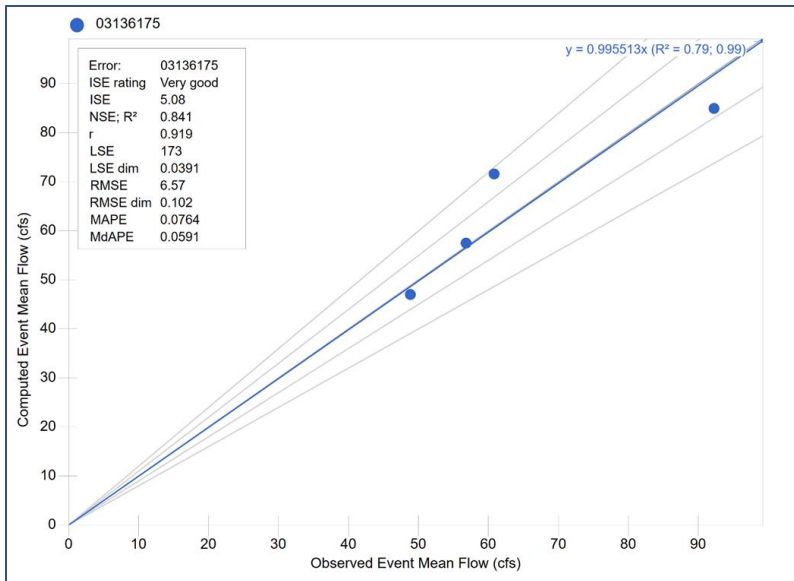
- Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2000	60.8	71.8	18%
	2001	48.9	47.0	-4%
	2002	56.8	57.0	0%
	2003	92.3	84.9	-8%

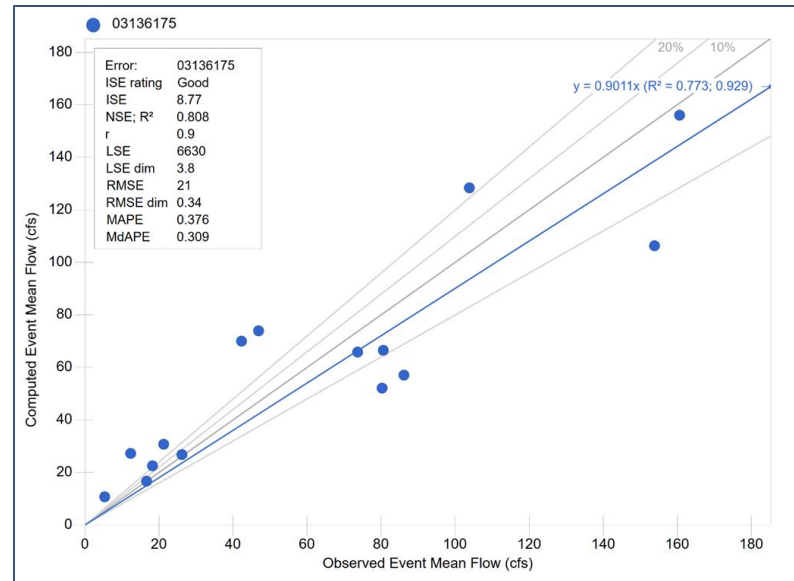
Calibration Summary

USGS Gauge 03136175

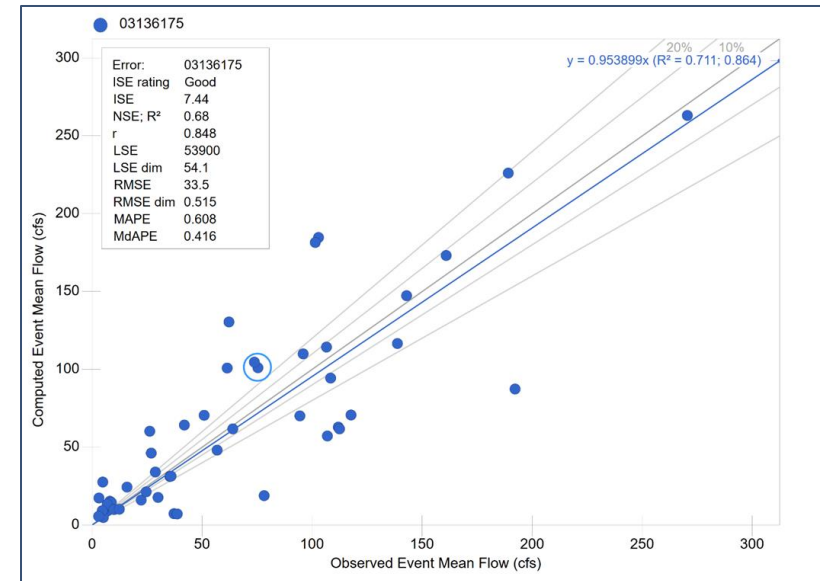
Annual Mean Flow



Seasonal Mean Flow



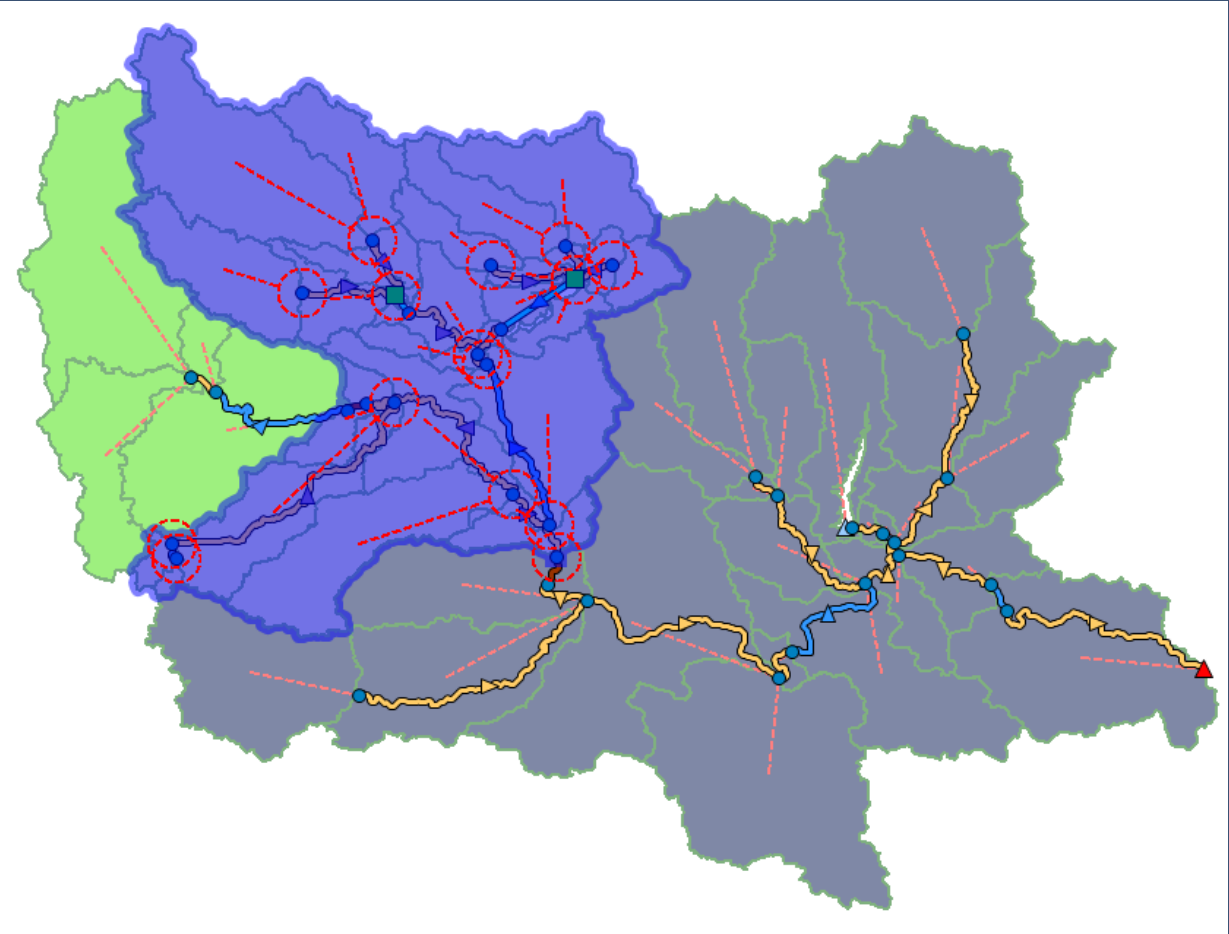
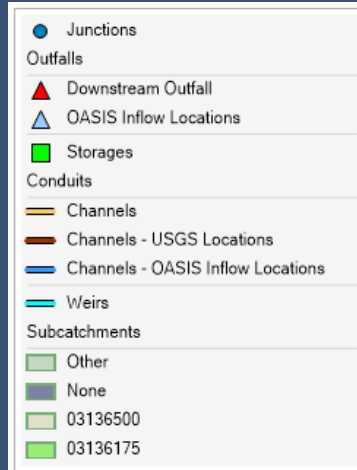
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03136500

Kokosing River at Mount Vernon OH



Calibration Summary

USGS Gauge 03136500

- Calibration Period
 - 01/01/2004 – 01/01/2014
- Validation Period
 - 01/01/2014 – 01/01/2024
- Comments
 - *None*

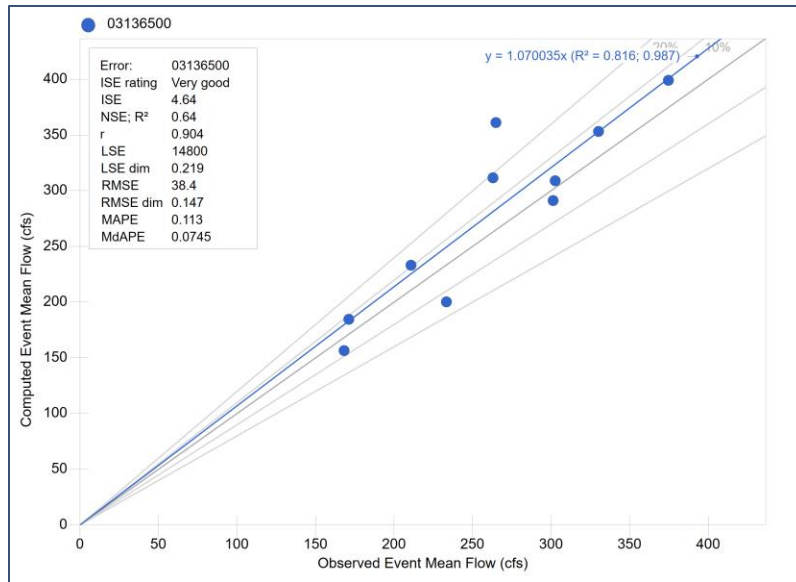
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2004	301.3	286.1	-5%
	2005	302.7	302.6	0%
	2006	233.3	198.8	-15%
	2007	263.0	306.0	16%
	2008	264.9	350.0	32%
	2009	171.2	176.8	3%
	2010	168.3	150.6	-11%
	2011	374.7	396.9	6%
	2012	210.9	229.5	9%
	2013	330.3	347.8	5%
Validation	2014	257.1	249.8	-3%
	2015	256.7	305.0	19%
	2016	198.8	227.4	14%
	2017	317.2	315.6	-1%
	2018	357.6	351.0	-2%
	2019	370.4	343.7	-7%
	2020	301.0	337.8	12%
	2021	211.1	233.3	11%
	2022	291.3	266.0	-9%
	2023	241.7	275.8	14%

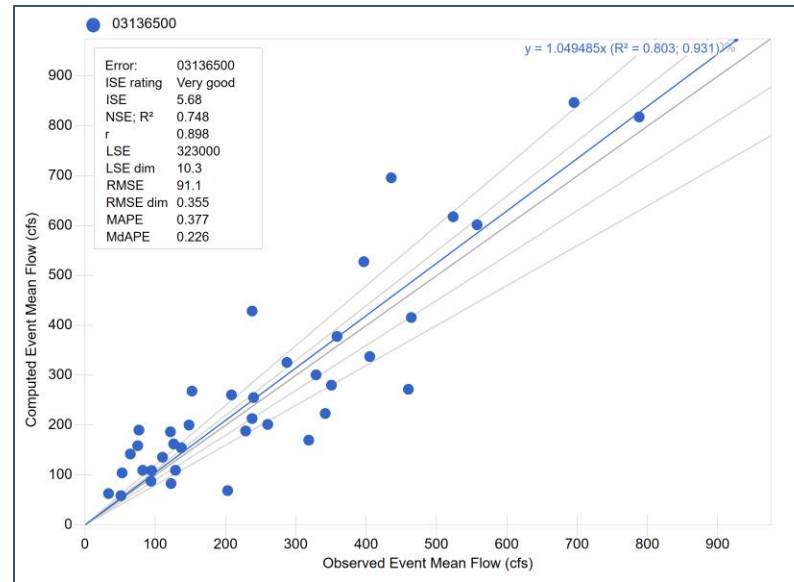
Calibration Summary

USGS Gauge 03136500

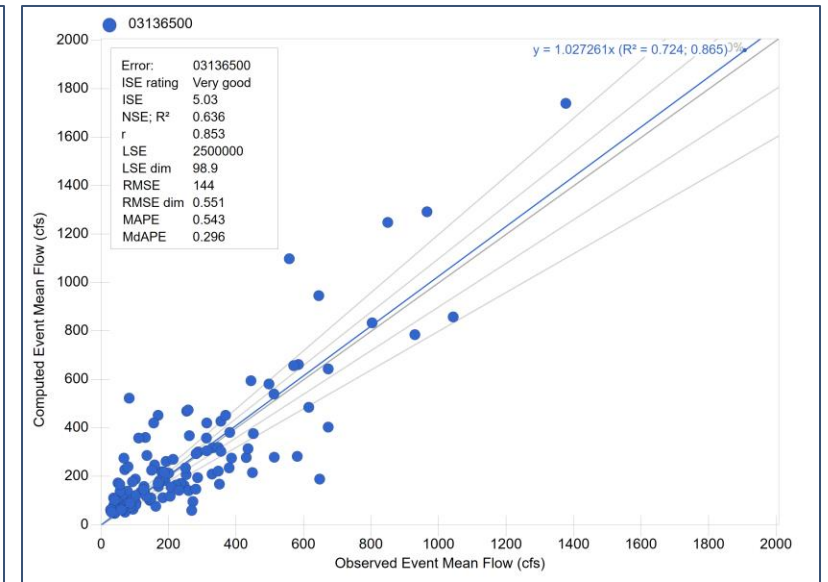
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

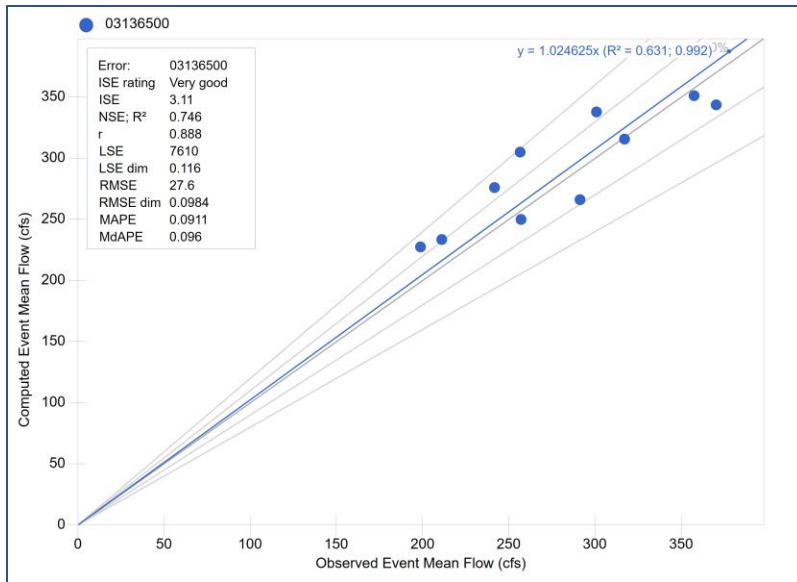


* 10% and 20% Error Bands Shown in Graphs

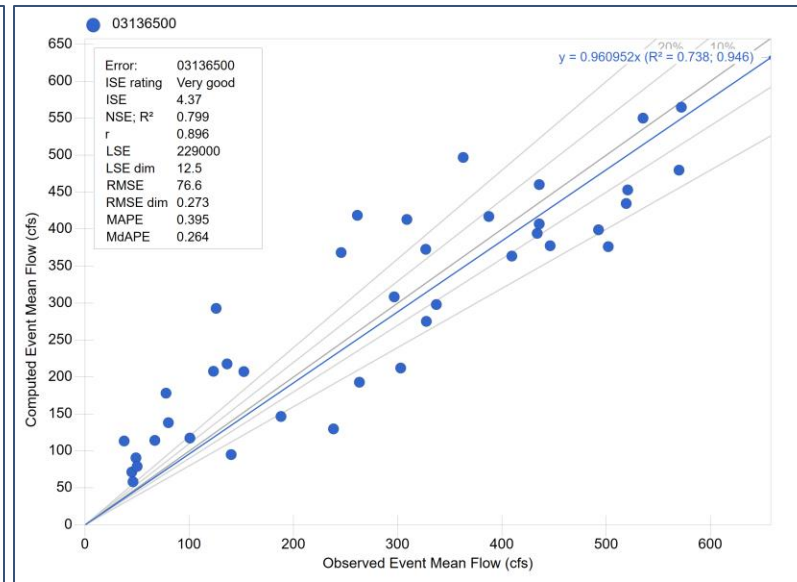
Validation Summary

USGS Gauge 03136500

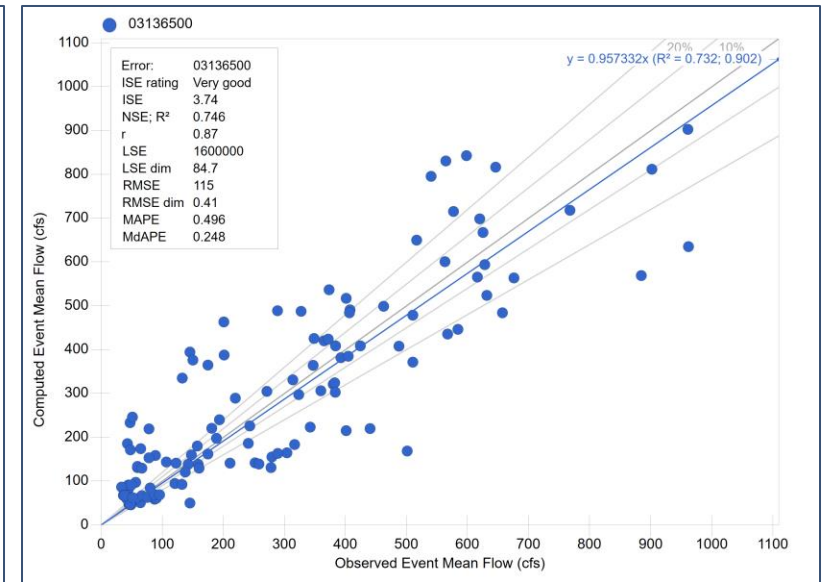
Annual Mean Flow



Seasonal Mean Flow

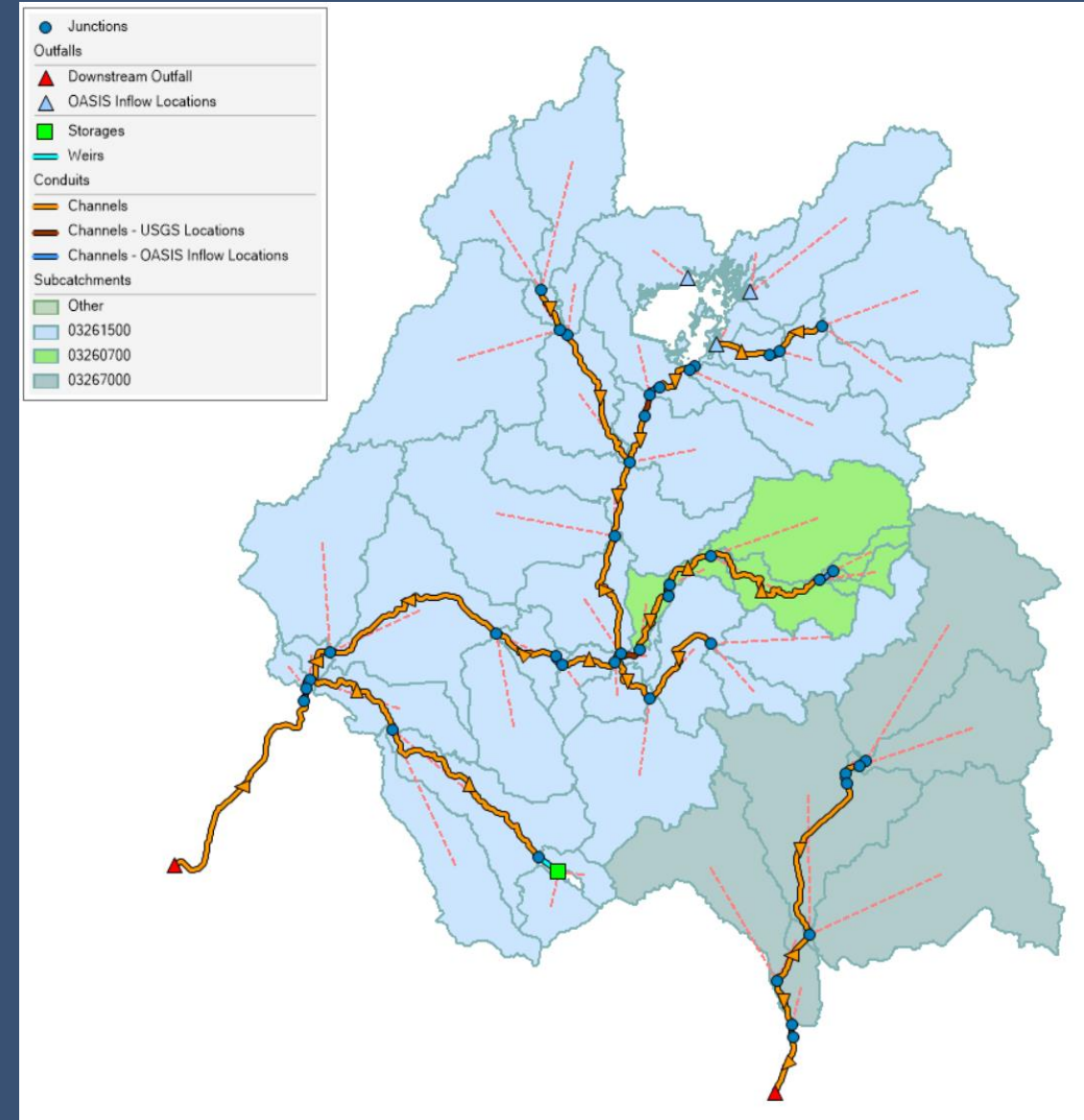


Monthly Mean Flow



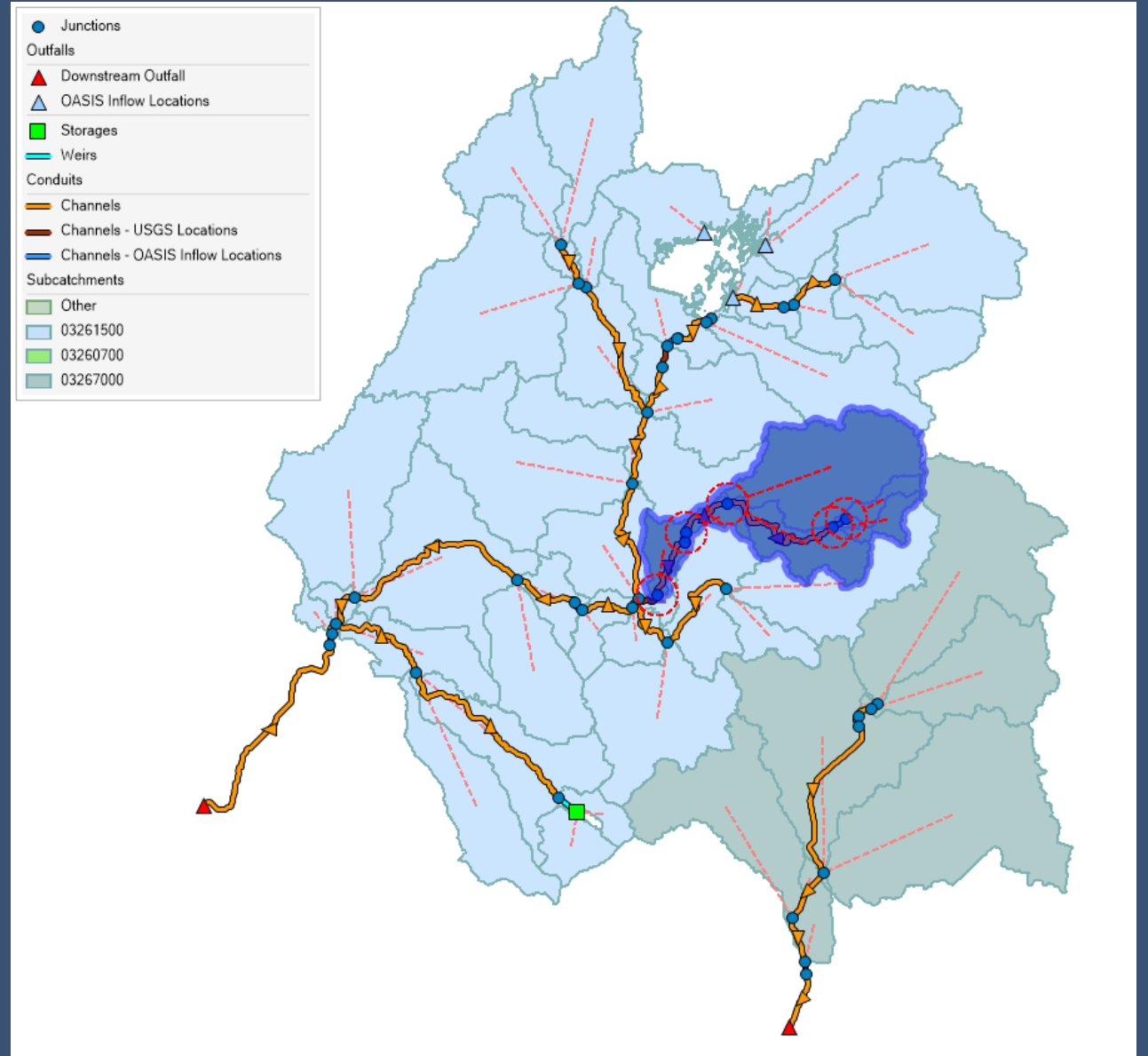
* 10% and 20% Error Bands Shown in Graphs

Upper Great Miami, Indiana, Ohio Watershed Model



USGS Gauge 03260706

Bokengehalas Creek at De Graff OH



Calibration Summary

USGS Gauge 03260706

- Calibration Period
 - 01/01/2005 – 01/01/2015
- Validation Period
 - Not enough data available
- Comments
 - None

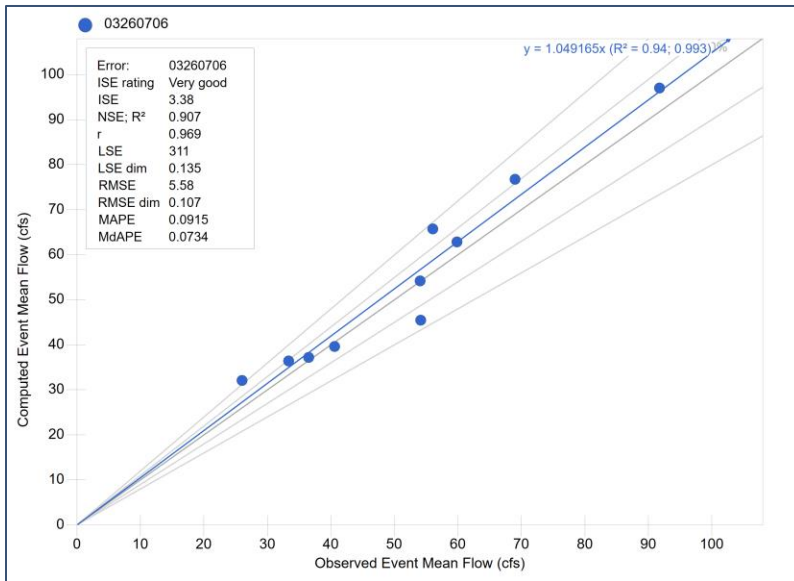
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2005	69.0	76.7	11%
	2006	54.2	45.4	-16%
	2007	54.1	54.2	0%
	2008	59.9	62.9	5%
	2009	26.0	32.0	23%
	2010	33.4	36.4	9%
	2011	91.8	97.0	6%
	2012	36.5	37.1	2%
	2013	56.1	65.7	17%
	2014	40.6	39.6	-2%
Validation	2016	35.9	47.8	33%
	2017	63.4	55.6	-12%
	2018	76.3	68.5	-10%
	2019	83.0	62.6	-25%
	2020	53.1	67.0	26%
	2021	40.2	43.8	9%
	2022	51.2	48.1	-6%

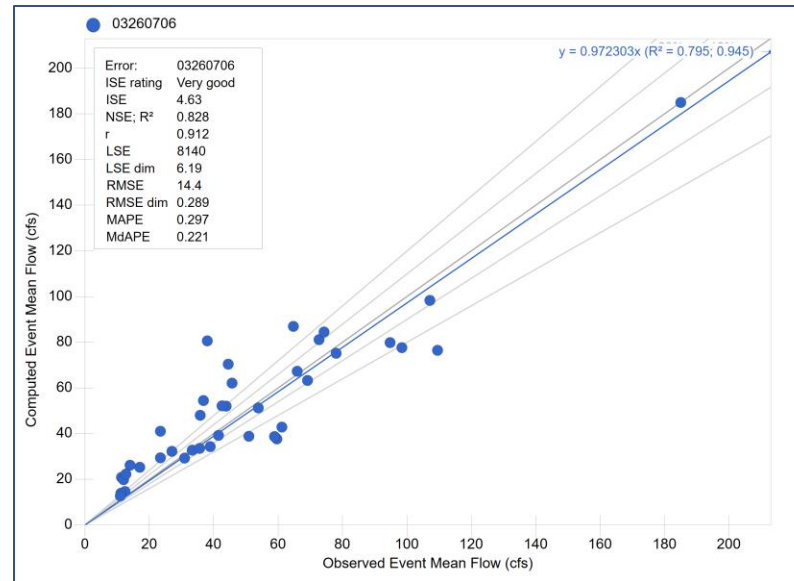
Calibration Summary

USGS Gauge 03260706

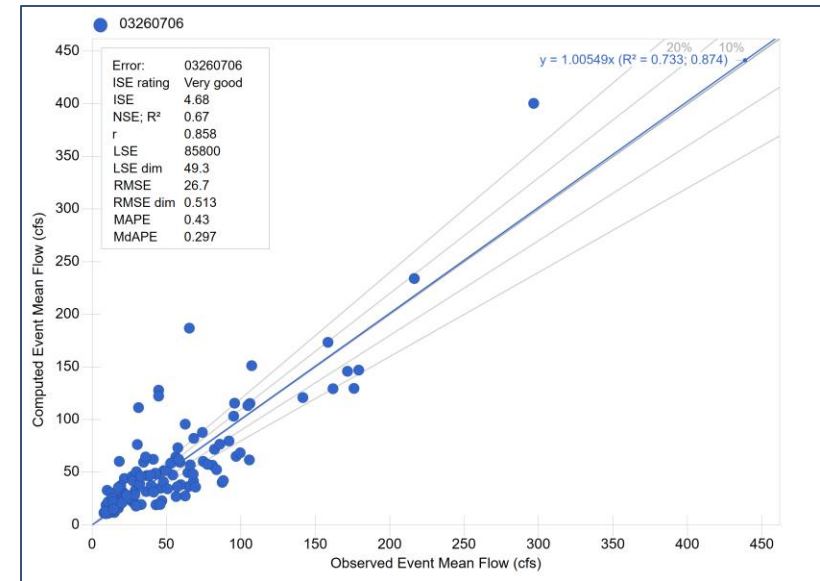
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

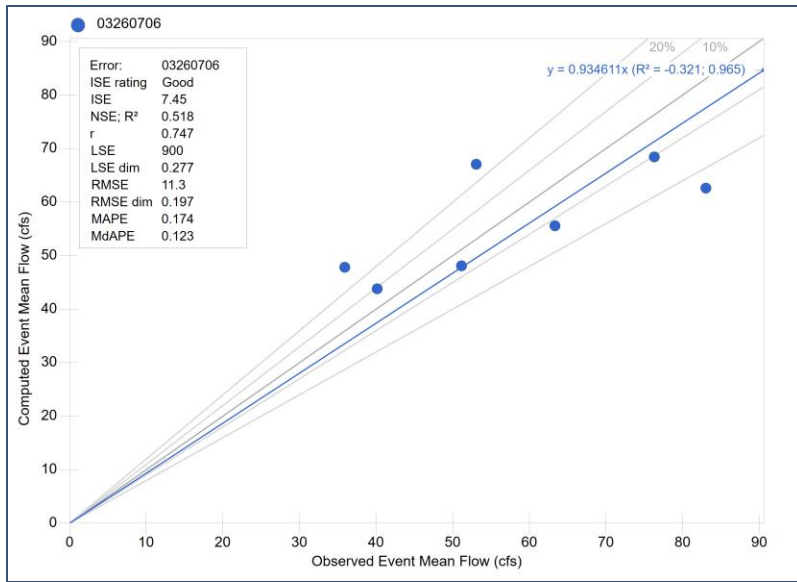


* 10% and 20% Error Bands Shown in Graphs

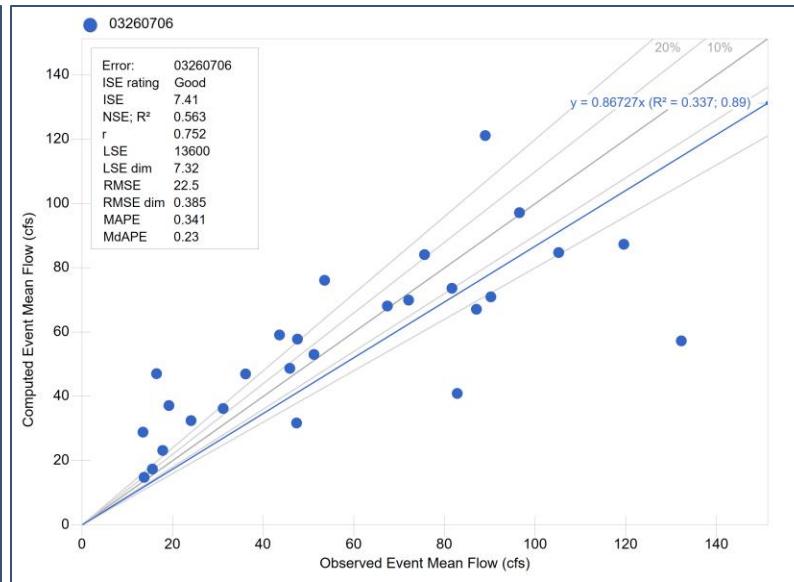
Validation Summary

USGS Gauge 03260706

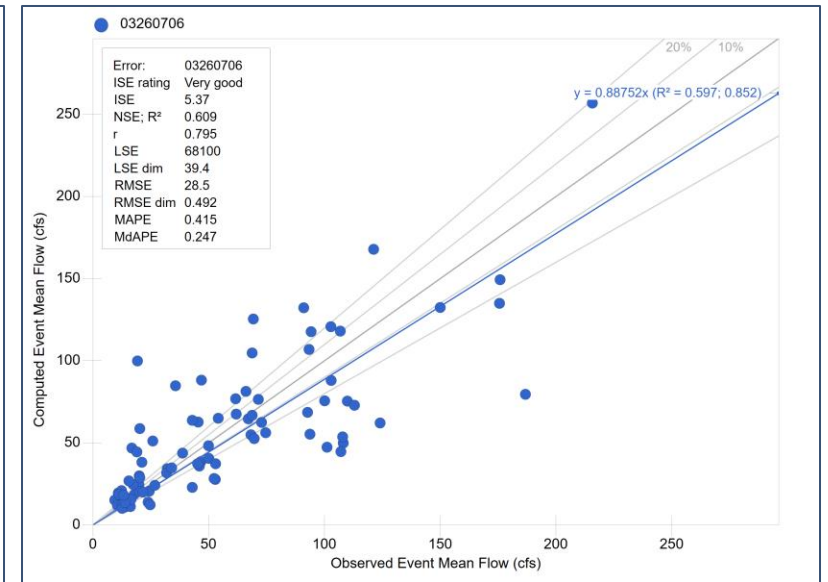
Annual Mean Flow



Seasonal Mean Flow



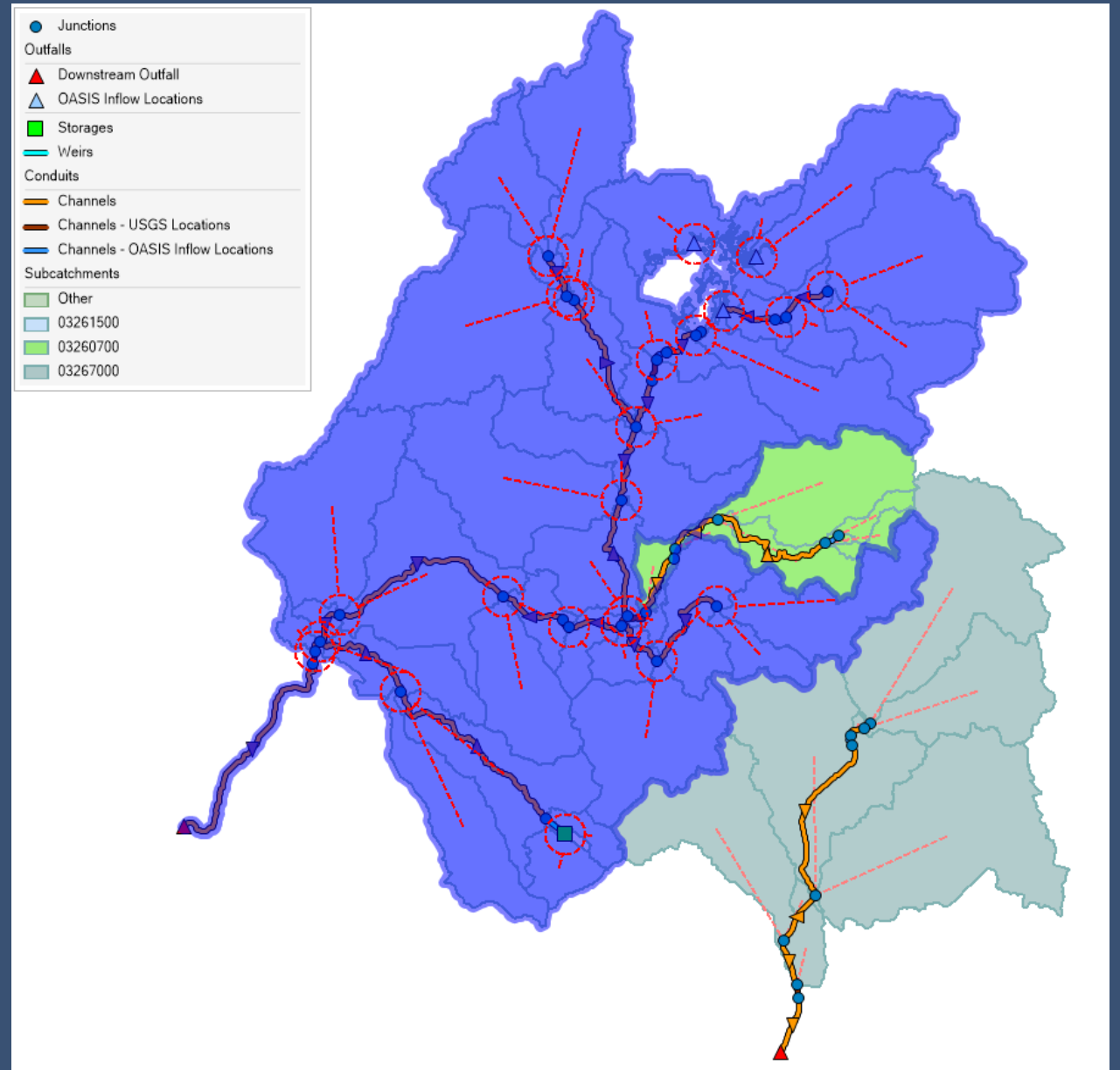
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge

Great Miami River at Sidney OH



Calibration Summary

USGS Gauge 03261500

- Calibration Period
 - 01/01/2004 – 01/01/2015
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - *None*

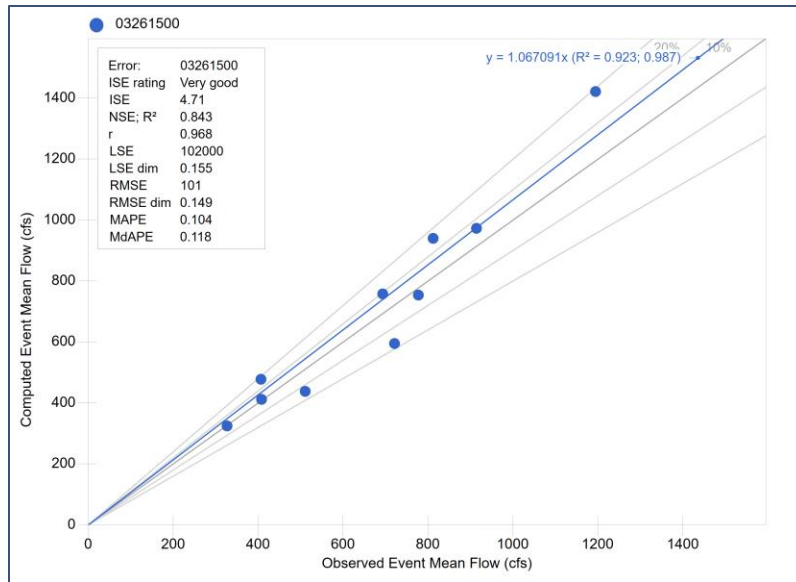
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2005	914.6	972.5	6%
	2006	721.5	594.6	-18%
	2007	777.8	753.4	-3%
	2008	812.3	939.8	16%
	2009	327.6	324.0	-1%
	2010	407.1	477.1	17%
	2011	1195.0	1421.0	19%
	2012	408.5	411.0	1%
	2013	693.9	757.7	9%
	2014	511.4	437.9	-14%
Validation	2016	375.8	499.8	33%
	2017	694.3	865.6	25%
	2018	778.0	929.0	19%
	2019	891.9	820.1	-8%
	2020	672.8	787.8	17%
	2021	551.3	553.5	0%
	2022	600.0	580.6	-3%

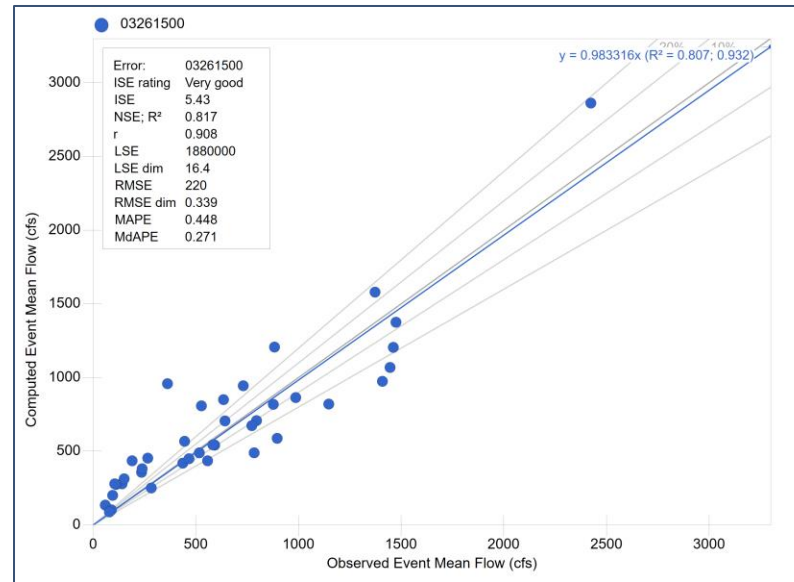
Calibration Summary

USGS Gauge 03261500

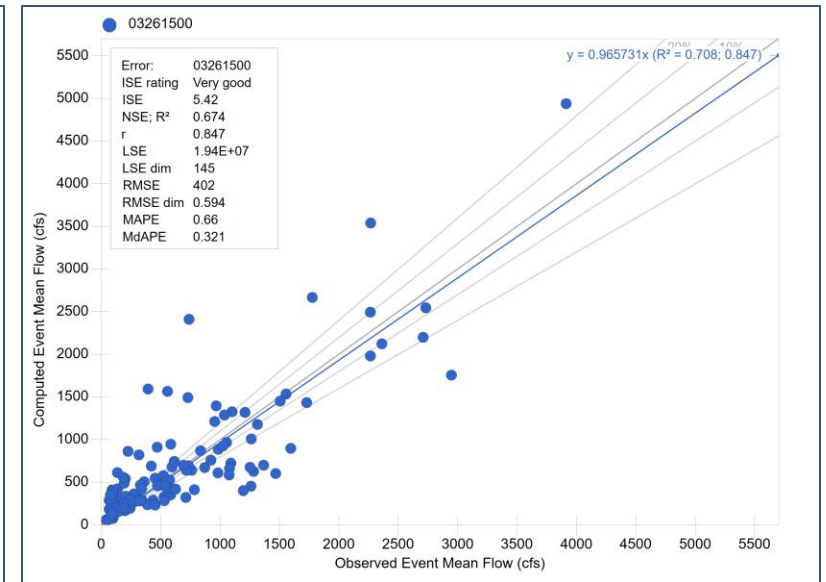
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

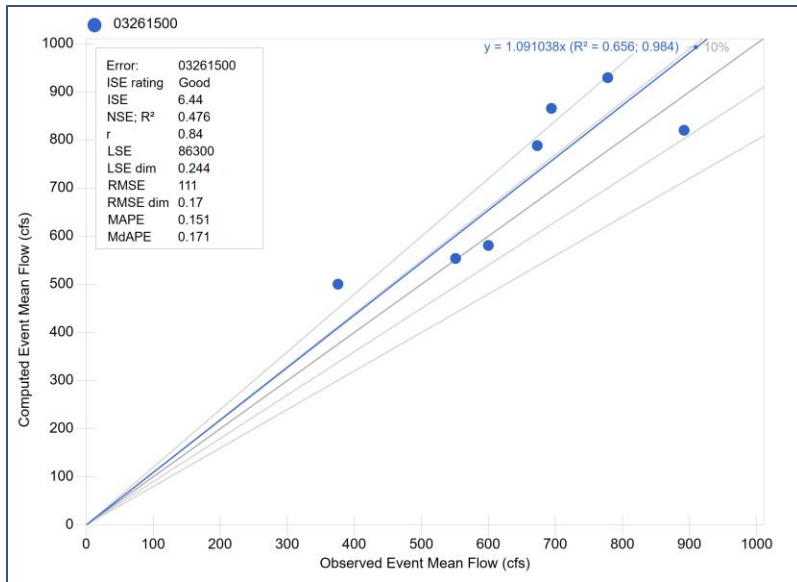


* 10% and 20% Error Bands Shown in Graphs

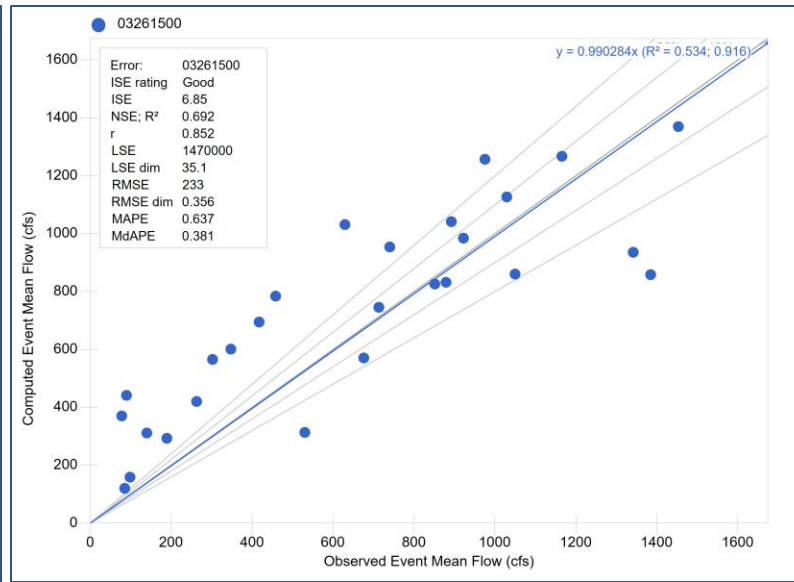
Validation Summary

USGS Gauge 03261500

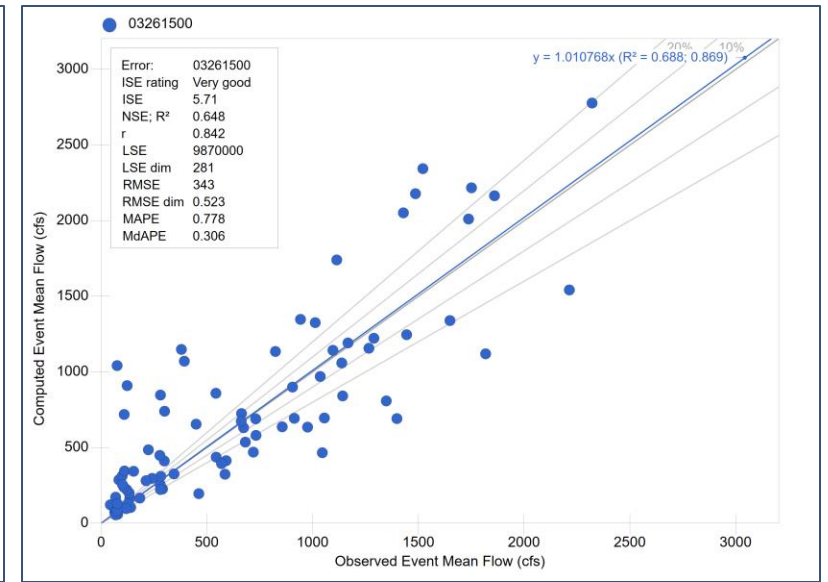
Annual Mean Flow



Seasonal Mean Flow



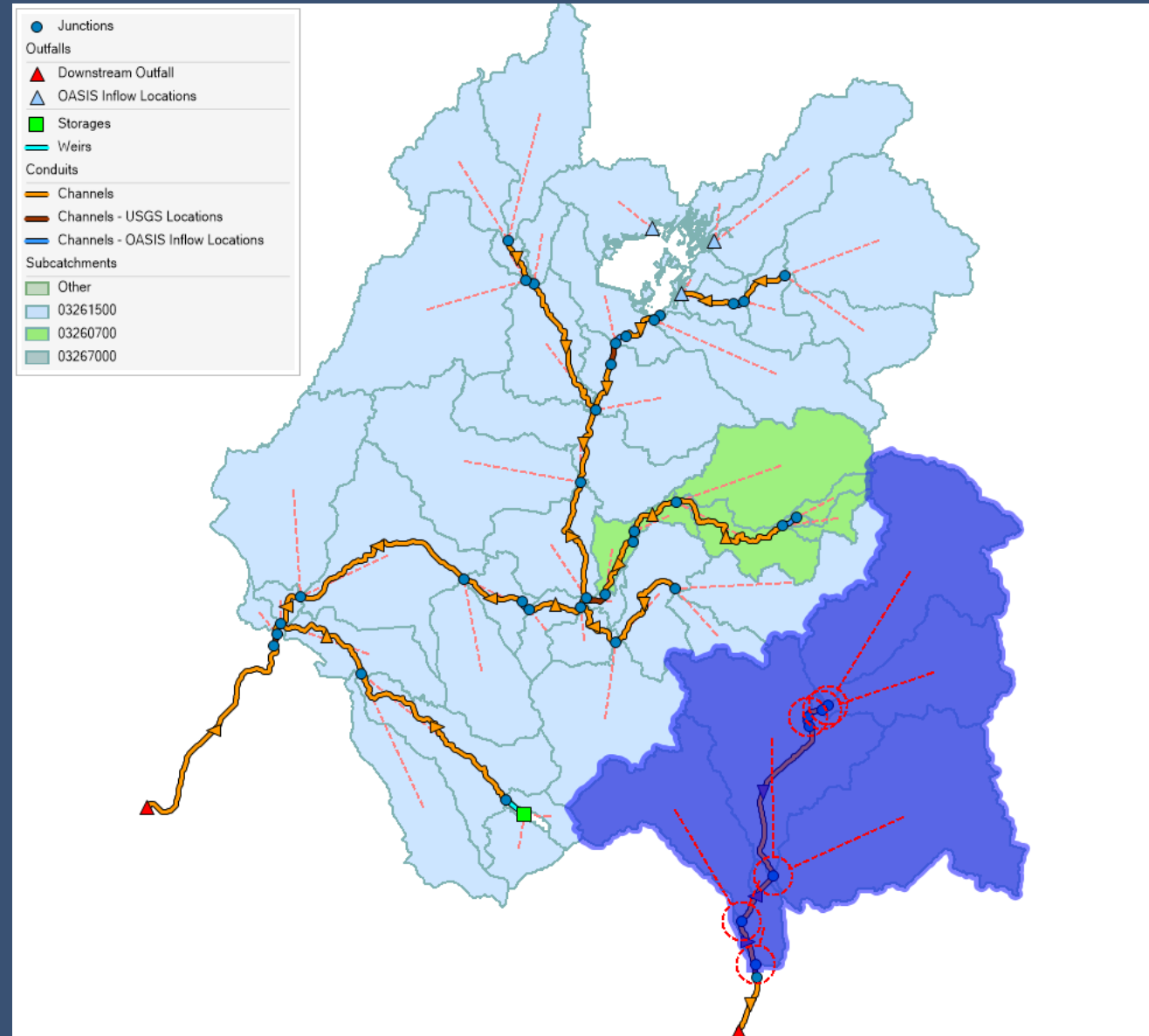
Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs

USGS Gauge 03267000

Mad River near Urbana OH



Calibration Summary

USGS Gauge 03267000

- Calibration Period
 - 01/01/2010 – 01/01/2016
- Validation Period
 - 01/01/2016 – 01/01/2023
- Comments
 - *None*

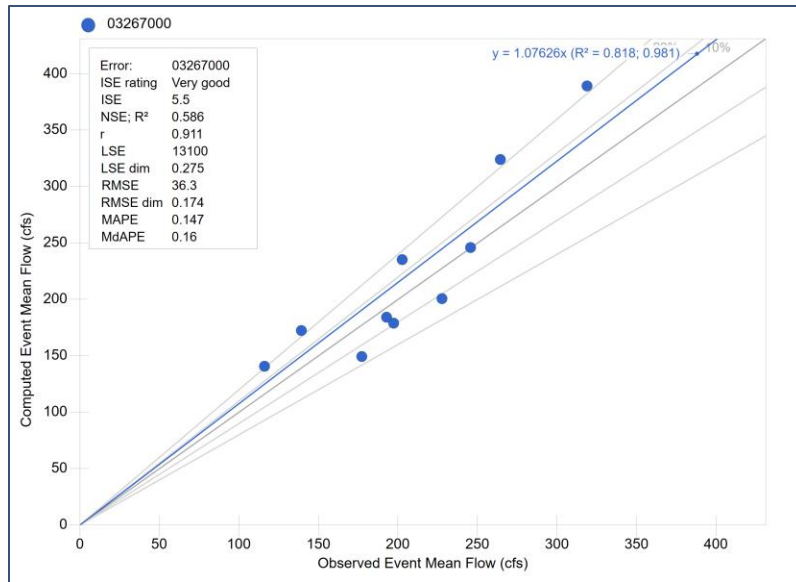
• Annual Fit Statistics Summary

	Year	Observed Annual Mean Flow (cfs)	Modelled Annual Mean Flow (cfs)	Error (%)
Calibration	2004	264.5	314.3	19%
	2005	192.9	171.5	-11%
	2006	227.8	187.5	-18%
	2007	245.7	238.1	-3%
	2008	116.2	133.9	15%
	2009	139.4	162.4	16%
	2010	319.0	367.0	15%
	2011	177.4	142.3	-20%
	2012	202.7	220.5	9%
	2013	197.4	174.5	-12%
Validation	2014	139.5	177.0	27%
	2015	168.7	213.2	26%
	2016	233.2	270.2	16%
	2017	308.4	256.1	-17%
	2018	212.4	238.0	12%
	2019	166.6	178.9	7%
	2020	231.8	211.4	-9%

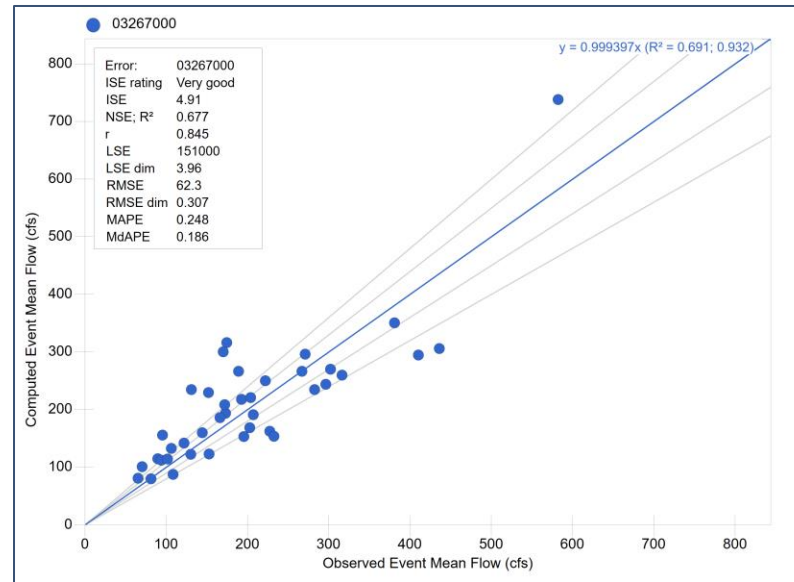
Calibration Summary

USGS Gauge 03267000

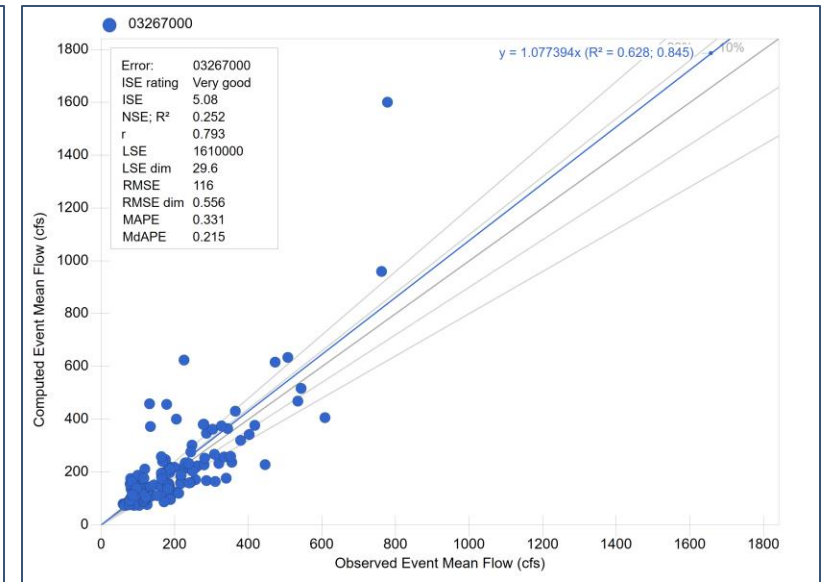
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow

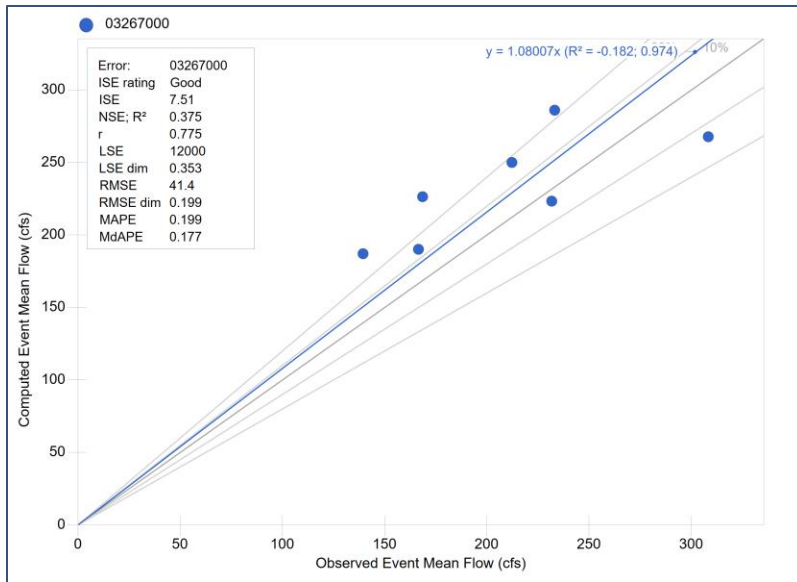


* 10% and 20% Error Bands Shown in Graphs

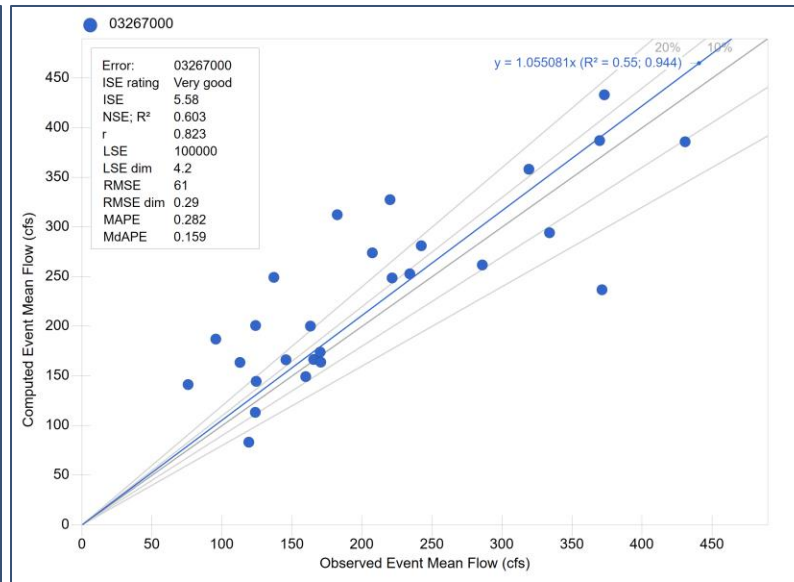
Validation Summary

USGS Gauge 03267000

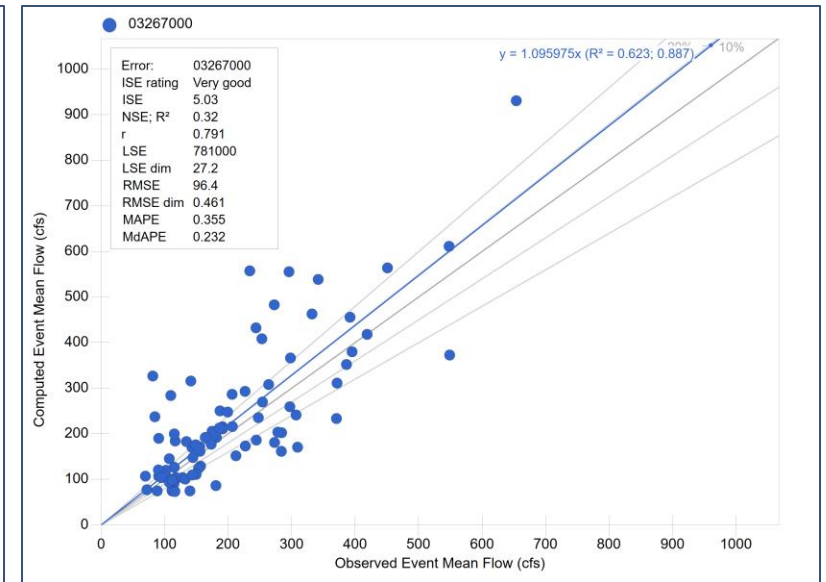
Annual Mean Flow



Seasonal Mean Flow



Monthly Mean Flow



* 10% and 20% Error Bands Shown in Graphs



Central Ohio Regional Water Study SWMM Model Calibration and Validation

