

Appendix B: Hydrology Calibration and Validation Results

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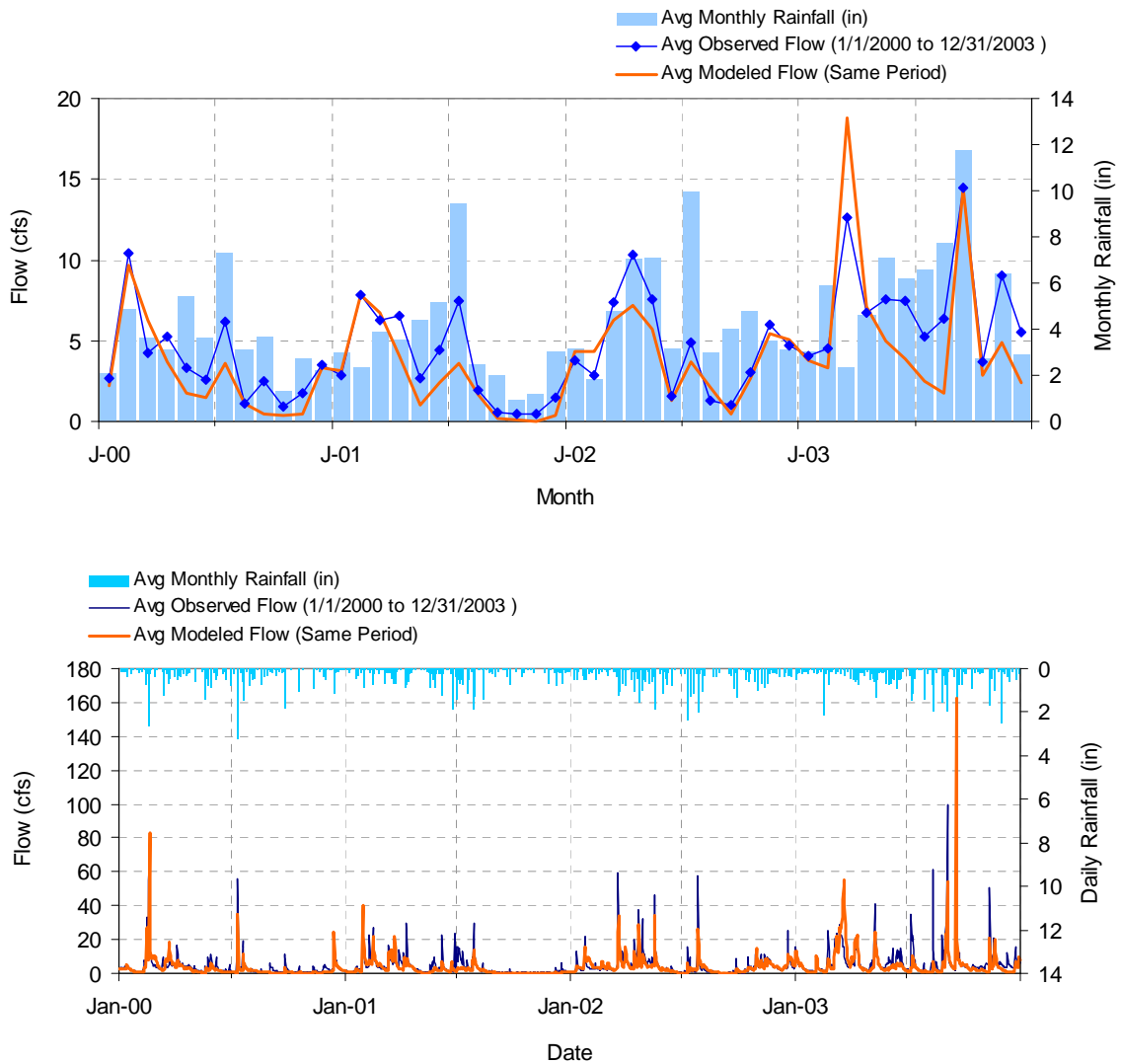
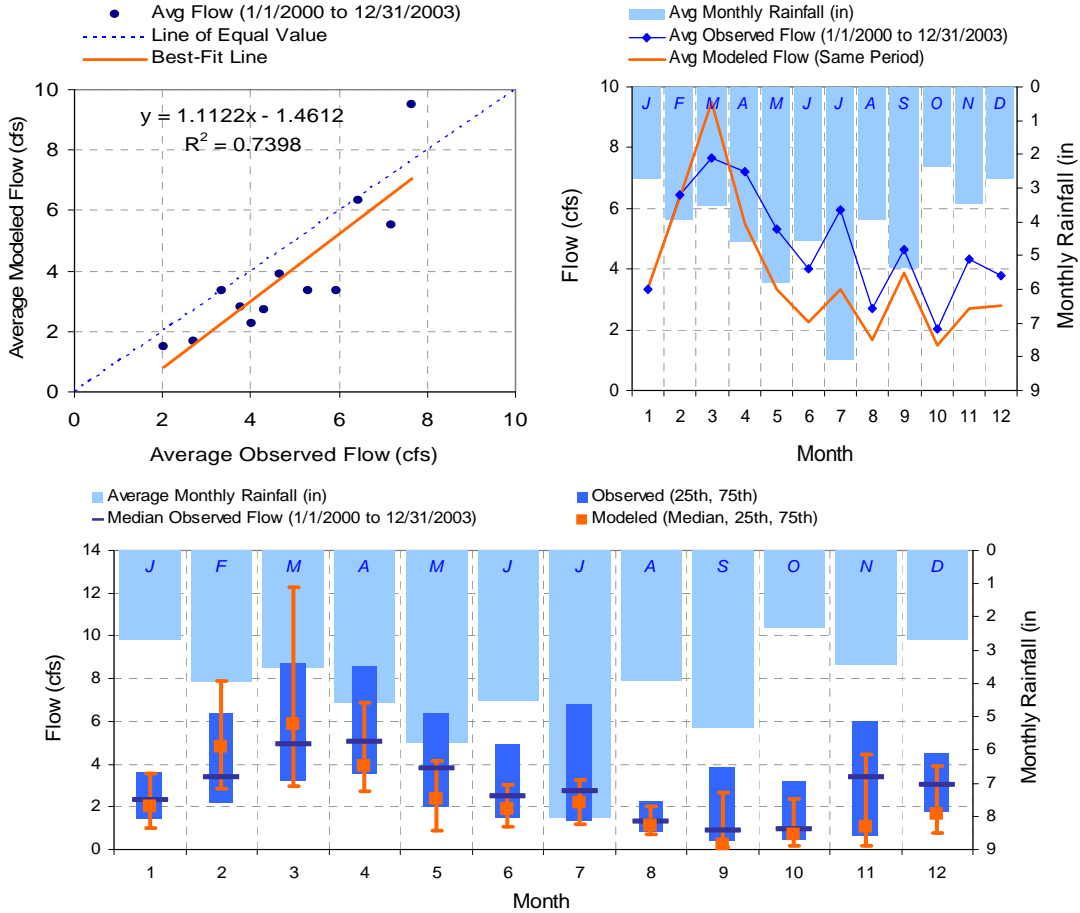


Figure B-1. Calibration at USGS gage 01594936 (N. Fork Sand Run)



LSPC Simulated Flow		Observed Flow Gage		
REACH OUTFLOW FROM SUBBASIN 310 4-Year Analysis Period: 1/1/2000 - 12/31/2003 Flow volumes are (inches/year) for upstream drainage area		USGS 01594936 NORTH FORK SAND RUN NEAR WILSON, MD Hydrologic Unit Code: 2070002 Latitude: 39.26030556 Longitude: -79.4097778 Drainage Area (sq-mi): 1.91		
Total Simulated In-stream Flow:	27.30	Total Observed In-stream Flow:	33.88	
Total of simulated highest 10% flows:	12.29	Total of Observed highest 10% flows:	14.28	
Total of Simulated lowest 50% flows:	3.16	Total of Observed Lowest 50% flows:	4.96	
Simulated Summer Flow Volume (months 7-9):	5.29	Observed Summer Flow Volume (7-9):	7.94	
Simulated Fall Flow Volume (months 10-12):	4.19	Observed Fall Flow Volume (10-12):	6.02	
Simulated Winter Flow Volume (months 1-3):	11.26	Observed Winter Flow Volume (1-3):	10.17	
Simulated Spring Flow Volume (months 4-6):	6.56	Observed Spring Flow Volume (4-6):	9.75	
Total Simulated Storm Volume:	5.15	Total Observed Storm Volume:	7.96	
Simulated Summer Storm Volume (7-9):	1.71	Observed Summer Storm Volume (7-9):	2.96	
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	1995-1999	2000-2004
Error in total volume:	-19.43	10	-1.43	7.35
Error in 50% lowest flows:	-36.37	10	-1.60	-3.91
Error in 10% highest flows:	-13.95	15	2.26	1.75
Seasonal volume error - Summer:	-33.34	30	13.27	-2.52
Seasonal volume error - Fall:	-30.50	30	4.49	12.42
Seasonal volume error - Winter:	10.75	30	-18.21	13.31
Seasonal volume error - Spring:	-32.74	30	1.90	6.11
Error in storm volumes:	-35.36	20	1.13	12.07
Error in summer storm volumes:	-42.17	50	3.16	15.42
Nash-Sutcliffe Coefficient of Efficiency, E:	0.480	Model accuracy increases as E or E' approaches 1.0	0.688	0.814
Baseline adjusted coefficient (Garrick), E':	0.436		0.517	0.549

Figure B-2. Calibration at USGS gage 01594936 (N. Fork Sand Run)

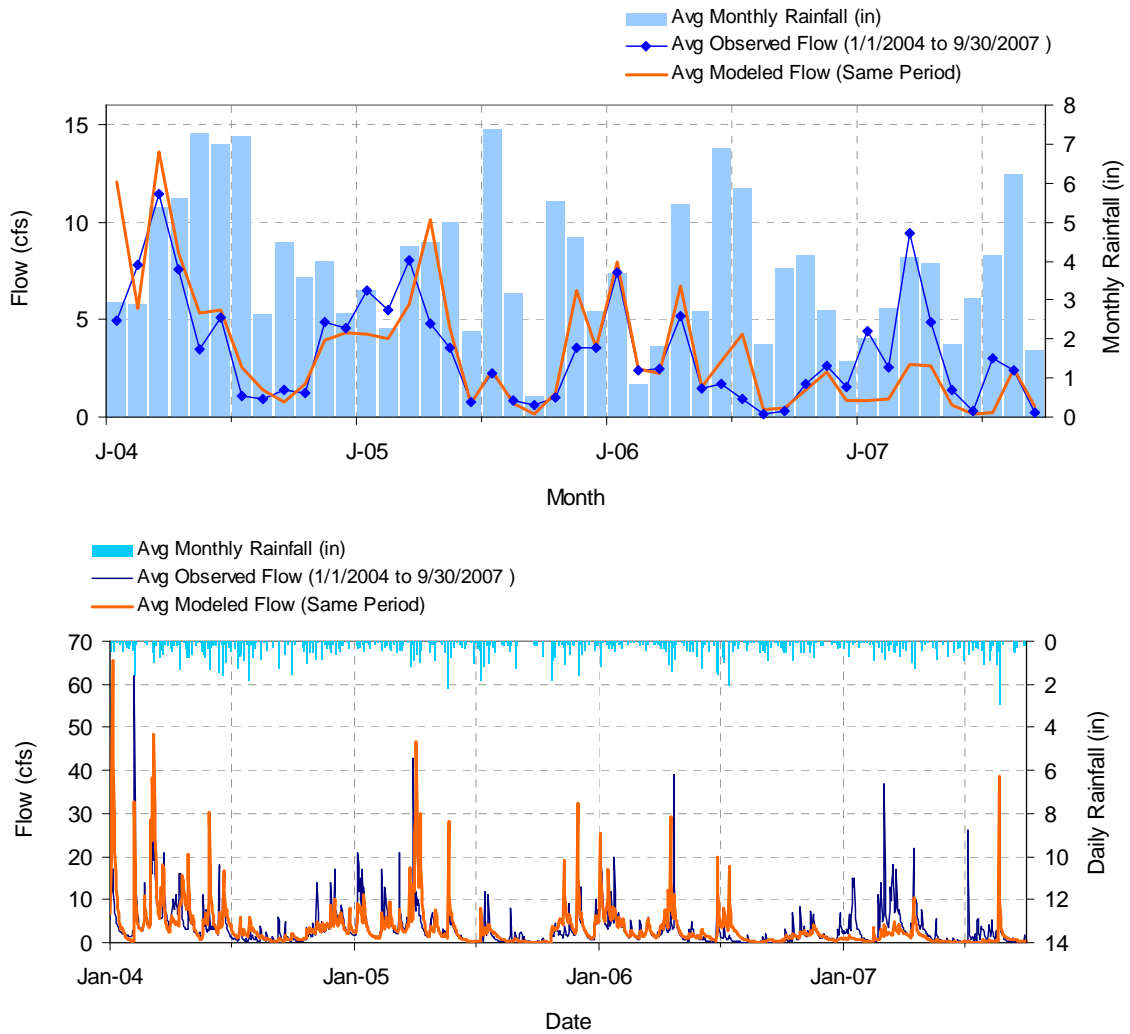
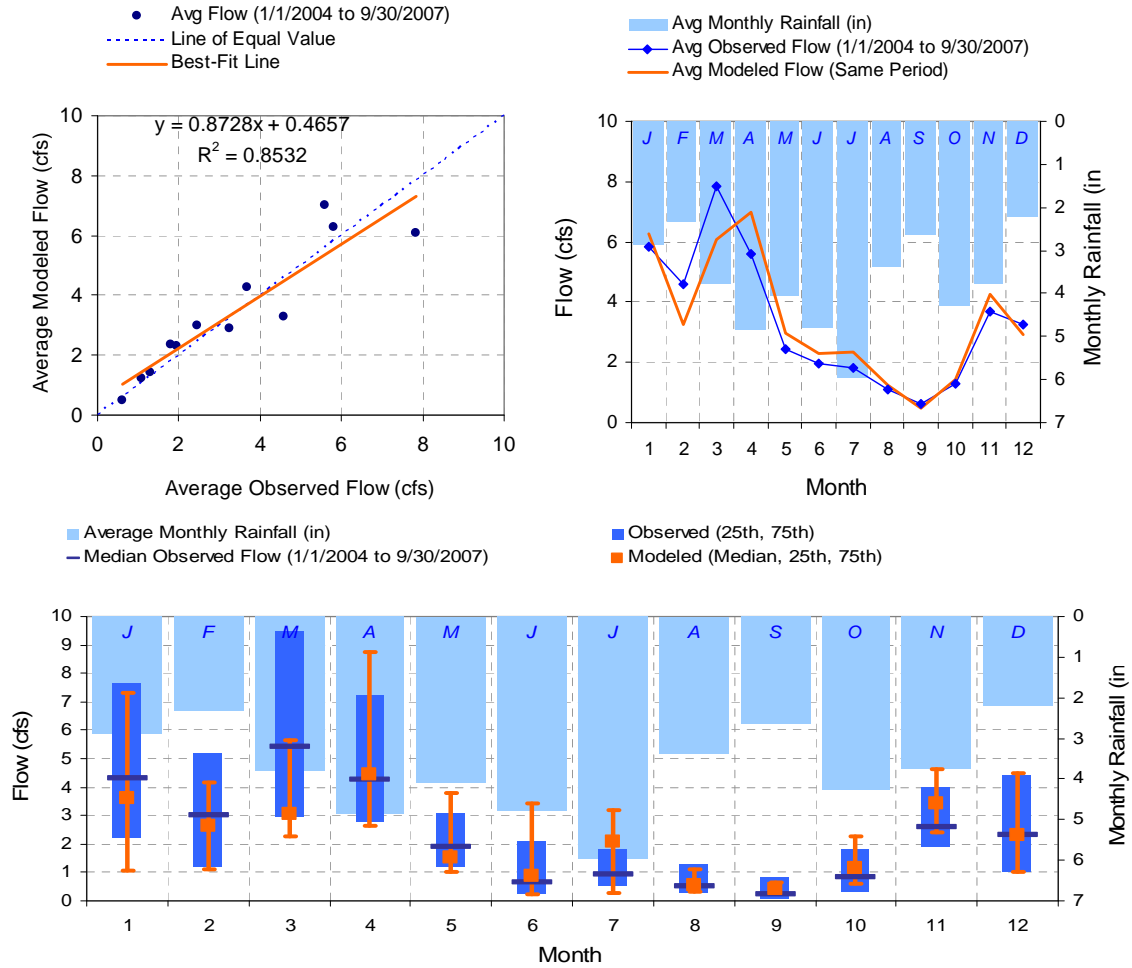


Figure B-3. Validation at USGS gage 01594936 (N. Fork Sand Run)



LSPC Simulated Flow		Observed Flow Gage		
REACH OUTFLOW FROM SUBBASIN 310		USGS 01594936 NORTH FORK SAND RUN NEAR WILSON, MD		
3.75-Year Analysis Period: 1/1/2004 - 9/30/2007 Flow volumes are (inches/year) for upstream drainage area		Hydrologic Unit Code: 2070002 Latitude: 39.26030556 Longitude: -79.4097778 Drainage Area (sq-mi): 1.91		
Total Simulated In-stream Flow:	24.27	Total Observed In-stream Flow:	23.98	
Total of simulated highest 10% flows:	10.95	Total of Observed highest 10% flows:	10.07	
Total of Simulated lowest 50% flows:	2.78	Total of Observed Lowest 50% flows:	2.72	
Simulated Summer Flow Volume (months 7-9):	2.60	Observed Summer Flow Volume (7-9):	2.27	
Simulated Fall Flow Volume (months 10-12):	4.07	Observed Fall Flow Volume (10-12):	3.91	
Simulated Winter Flow Volume (months 1-3):	9.88	Observed Winter Flow Volume (1-3):	11.50	
Simulated Spring Flow Volume (months 4-6):	7.72	Observed Spring Flow Volume (4-6):	6.29	
Total Simulated Storm Volume:	3.91	Total Observed Storm Volume:	5.12	
Simulated Summer Storm Volume (7-9):	0.49	Observed Summer Storm Volume (7-9):	0.76	
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	<i>1995-1999</i>	<i>2000-2004</i>
Error in total volume:	1.24	10	-1.43	7.35
Error in 50% lowest flows:	2.03	10	-1.60	-3.91
Error in 10% highest flows:	8.66	15	2.26	1.75
Seasonal volume error - Summer:	14.34	30	13.27	-2.52
Seasonal volume error - Fall:	4.15	30	4.49	12.42
Seasonal volume error - Winter:	-14.04	30	-18.21	13.31
Seasonal volume error - Spring:	22.62	30	1.90	6.11
Error in storm volumes:	-23.57	20	1.13	12.07
Error in summer storm volumes:	-35.51	50	3.16	15.42
Nash-Sutcliffe Coefficient of Efficiency, E:	0.074	Model accuracy increases as E or E' approaches 1.0	0.688	0.814
Baseline adjusted coefficient (Garrick), E':	0.294		0.517	0.549

Figure B-4. Validation at USGS gage 01594936 (N. Fork Sand Run)

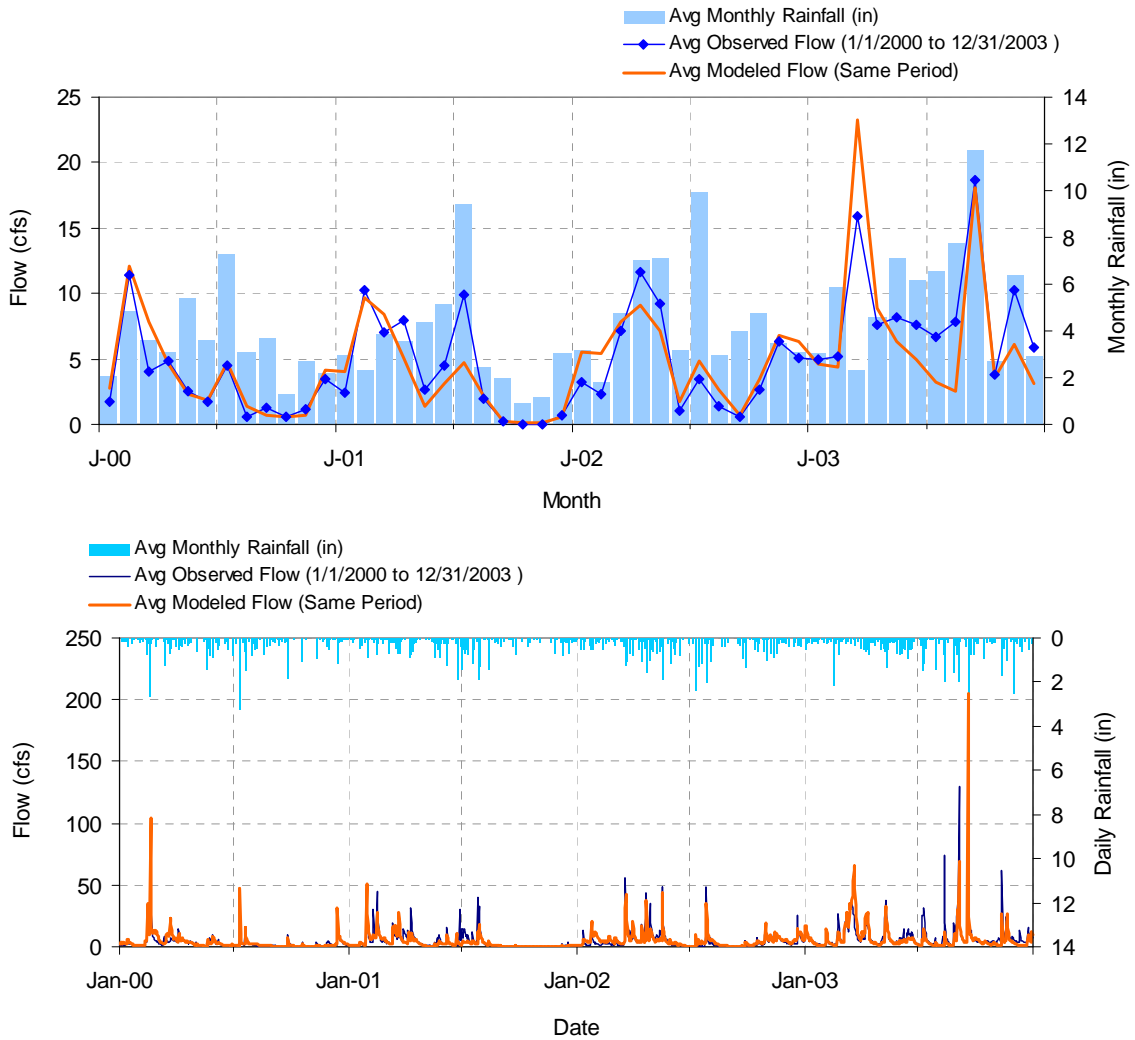
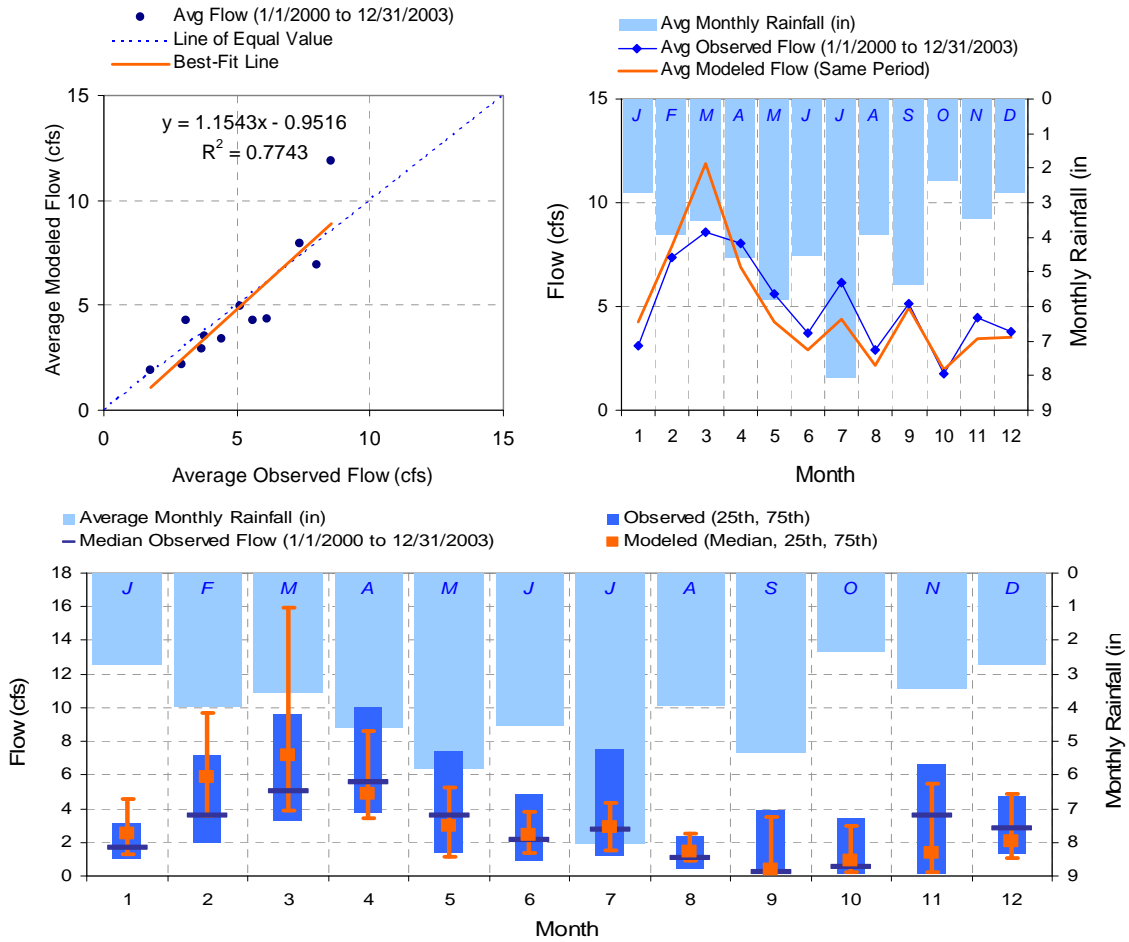


Figure B-5. Calibration at USGS gage 01594950 (McMillian F)



LSPC Simulated Flow		Observed Flow Gage	
REACH OUTFLOW FROM SUBBASIN 312		USGS 01594950 MCMILLAN F NEAR FORT PENDLETON, MD	
4-Year Analysis Period: 1/1/2000 - 12/31/2003 Flow volumes are (inches/year) for upstream drainage area		Hydrologic Unit Code: 2070002 Latitude: 39.27669444 Longitude: -79.3903056 Drainage Area (sq-mi): 2.3	
Total Simulated In-stream Flow:	28.68	Total Observed In-stream Flow:	29.69
Total of simulated highest 10% flows:	12.87	Total of Observed highest 10% flows:	13.54
Total of Simulated lowest 50% flows:	3.38	Total of Observed Lowest 50% flows:	3.02
Simulated Summer Flow Volume (months 7-9):	5.67	Observed Summer Flow Volume (7-9):	7.05
Simulated Fall Flow Volume (months 10-12):	4.40	Observed Fall Flow Volume (10-12):	4.94
Simulated Winter Flow Volume (months 1-3):	11.70	Observed Winter Flow Volume (1-3):	9.19
Simulated Spring Flow Volume (months 4-6):	6.91	Observed Spring Flow Volume (4-6):	8.51
Total Simulated Storm Volume:	5.65	Total Observed Storm Volume:	6.69
Simulated Summer Storm Volume (7-9):	1.93	Observed Summer Storm Volume (7-9):	2.55
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	<i>1995-1999</i>
Error in total volume:	-3.41		10
Error in 50% lowest flows:	12.22		10
Error in 10% highest flows:	-5.00		15
Seasonal volume error - Summer:	-19.57		30
Seasonal volume error - Fall:	-10.98		30
Seasonal volume error - Winter:	27.30		30
Seasonal volume error - Spring:	-18.80		30
Error in storm volumes:	-15.48		20
Error in summer storm volumes:	-24.61		50
Nash-Sutcliffe Coefficient of Efficiency, E:	0.568	Model accuracy increases as E or E' approaches 1.0	0.688
Baseline adjusted coefficient (Garrick), E':	0.507		0.517
			2000-2004
			-1.43
			-3.91
			2.26
			13.27
			4.49
			-18.21
			1.90
			1.13
			3.16
			0.814
			0.549

Figure B-6. Calibration at USGS gage 01594950 (McMillian F)

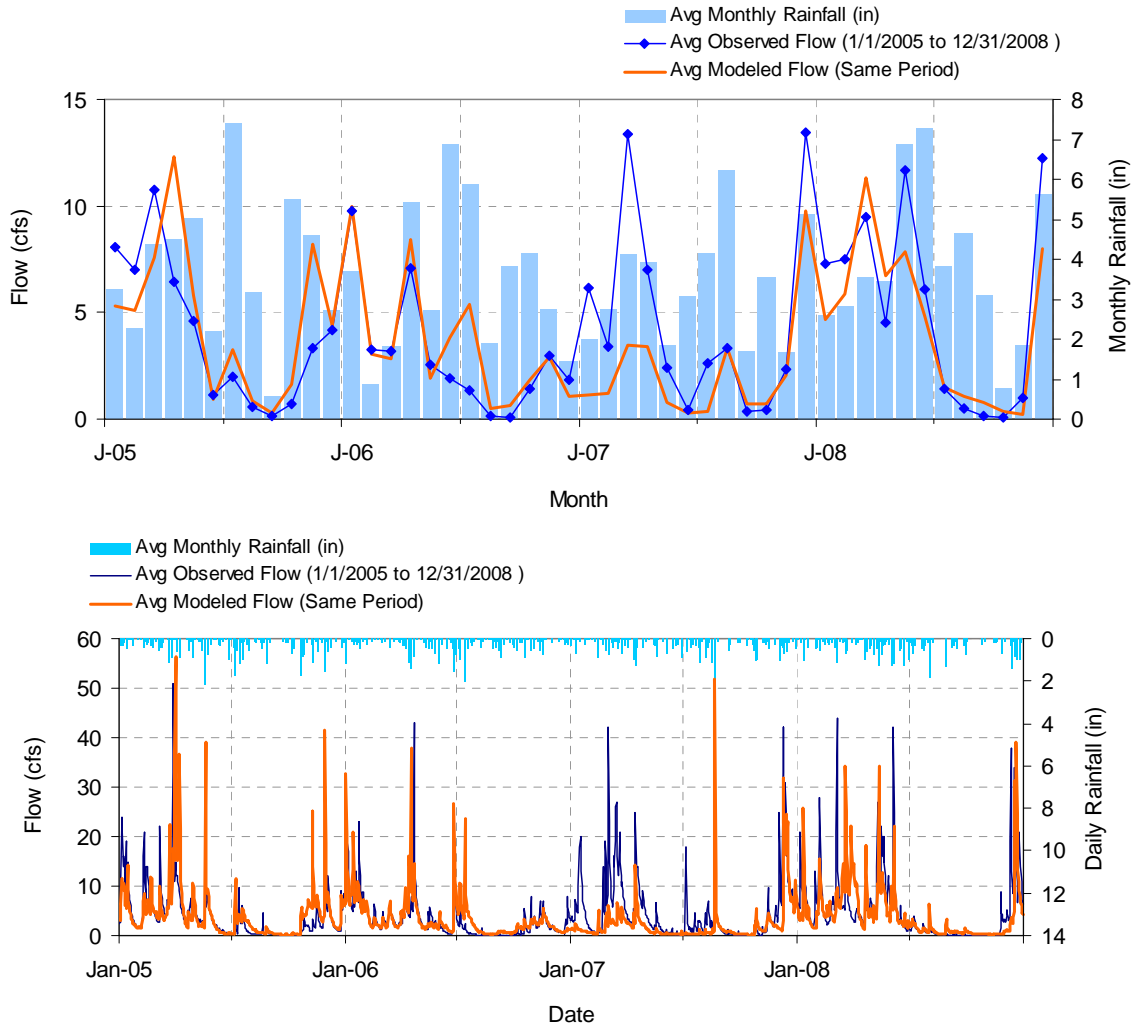
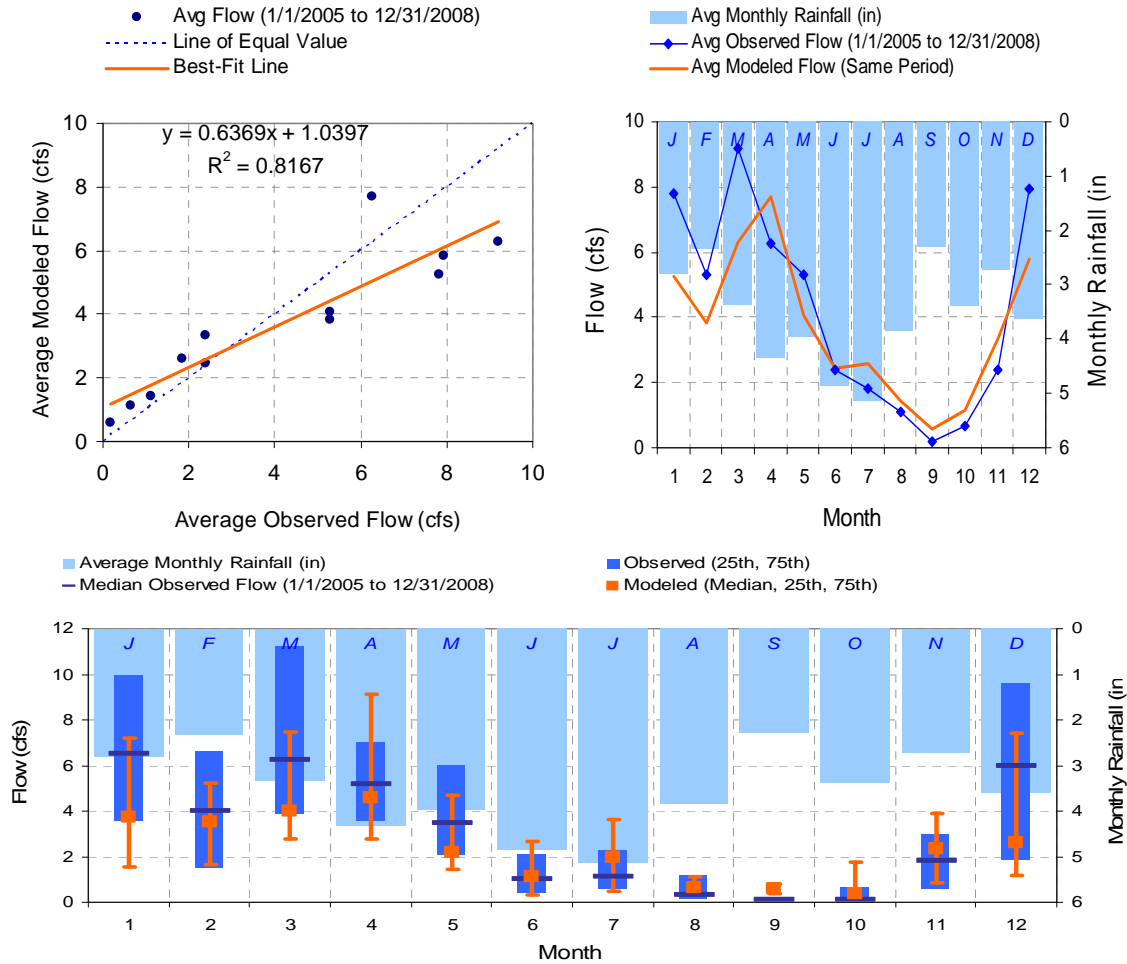


Figure B-7. Validation at USGS gage 01594950 (McMillian F)



LSPC Simulated Flow		Observed Flow Gage		
REACH OUTFLOW FROM SUBBASIN 312		USGS 01594950 MCMILLAN F NEAR FORT PENDLETON, MD		
4-Year Analysis Period: 1/1/2005 - 12/31/2008 Flow volumes are (inches/year) for upstream drainage area		Hydrologic Unit Code: 2070002 Latitude: 39.27669444 Longitude: -79.3903056 Drainage Area (sq-mi): 2.3		
Total Simulated In-stream Flow:	21.94	Total Observed In-stream Flow:	24.84	
Total of simulated highest 10% flows:	9.58	Total of Observed highest 10% flows:	10.76	
Total of Simulated lowest 50% flows:	2.38	Total of Observed Lowest 50% flows:	2.13	
Simulated Summer Flow Volume (months 7-9):	2.31	Observed Summer Flow Volume (7-9):	1.57	
Simulated Fall Flow Volume (months 10-12):	5.12	Observed Fall Flow Volume (10-12):	5.46	
Simulated Winter Flow Volume (months 1-3):	7.54	Observed Winter Flow Volume (1-3):	10.95	
Simulated Spring Flow Volume (months 4-6):	6.98	Observed Spring Flow Volume (4-6):	6.86	
Total Simulated Storm Volume:	3.66	Total Observed Storm Volume:	4.26	
Simulated Summer Storm Volume (7-9):	0.49	Observed Summer Storm Volume (7-9):	0.41	
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	1995-1999	2000-2004
Error in total volume:	-11.66	10	-1.43	7.35
Error in 50% lowest flows:	11.56	10	-1.60	-3.91
Error in 10% highest flows:	-10.97	15	2.26	1.75
Seasonal volume error - Summer:	46.86	30	13.27	-2.52
Seasonal volume error - Fall:	-6.32	30	4.49	12.42
Seasonal volume error - Winter:	-31.08	30	-18.21	13.31
Seasonal volume error - Spring:	1.66	30	1.90	6.11
Error in storm volumes:	-14.10	20	1.13	12.07
Error in summer storm volumes:	19.01	50	3.16	15.42
Nash-Sutcliffe Coefficient of Efficiency, E:	0.208	Model accuracy increases as E or E' approaches 1.0	0.688	0.814
Baseline adjusted coefficient (Garrick), E':	0.361		0.517	0.549

Figure B-8. Validation at USGS gage 01594950 (McMillian F)

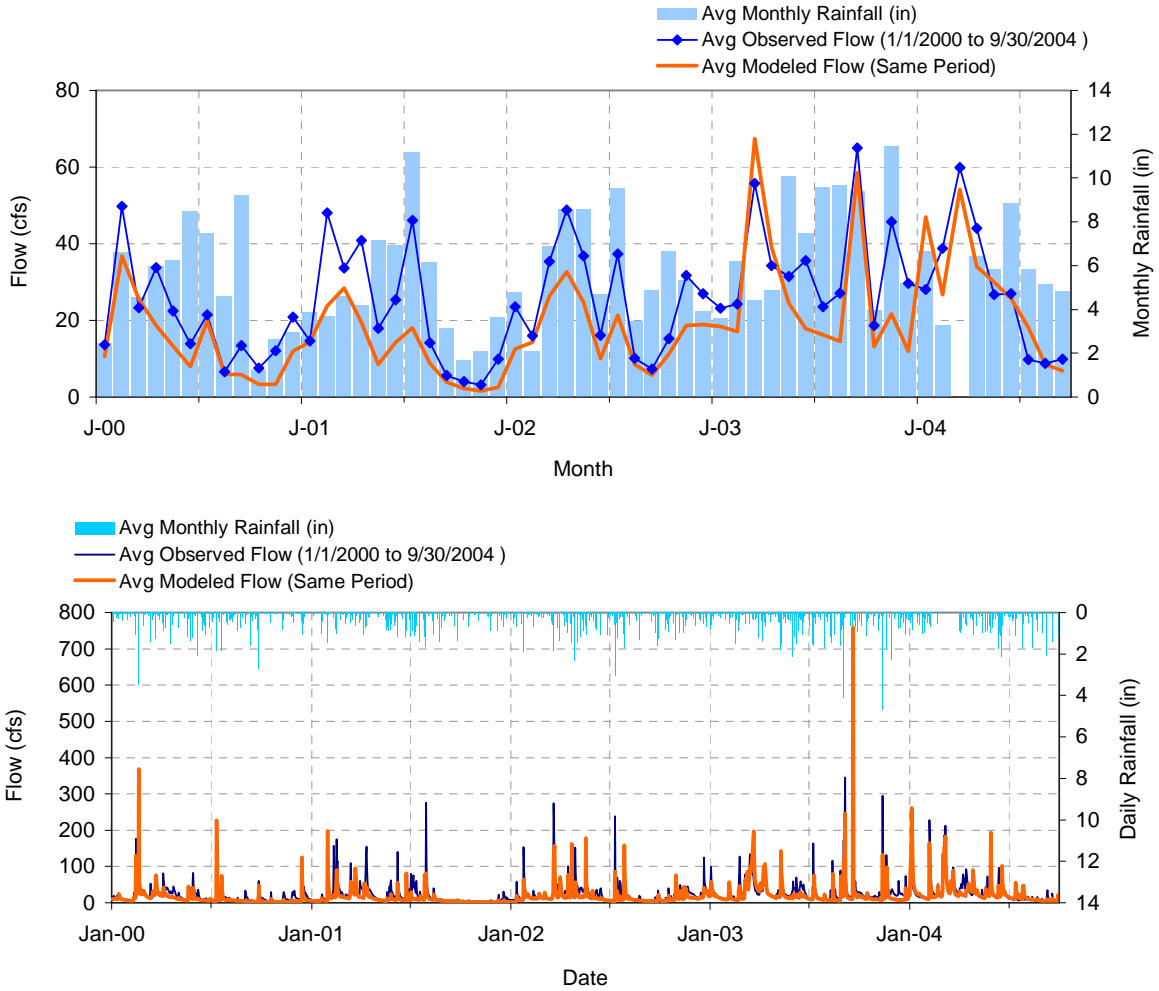
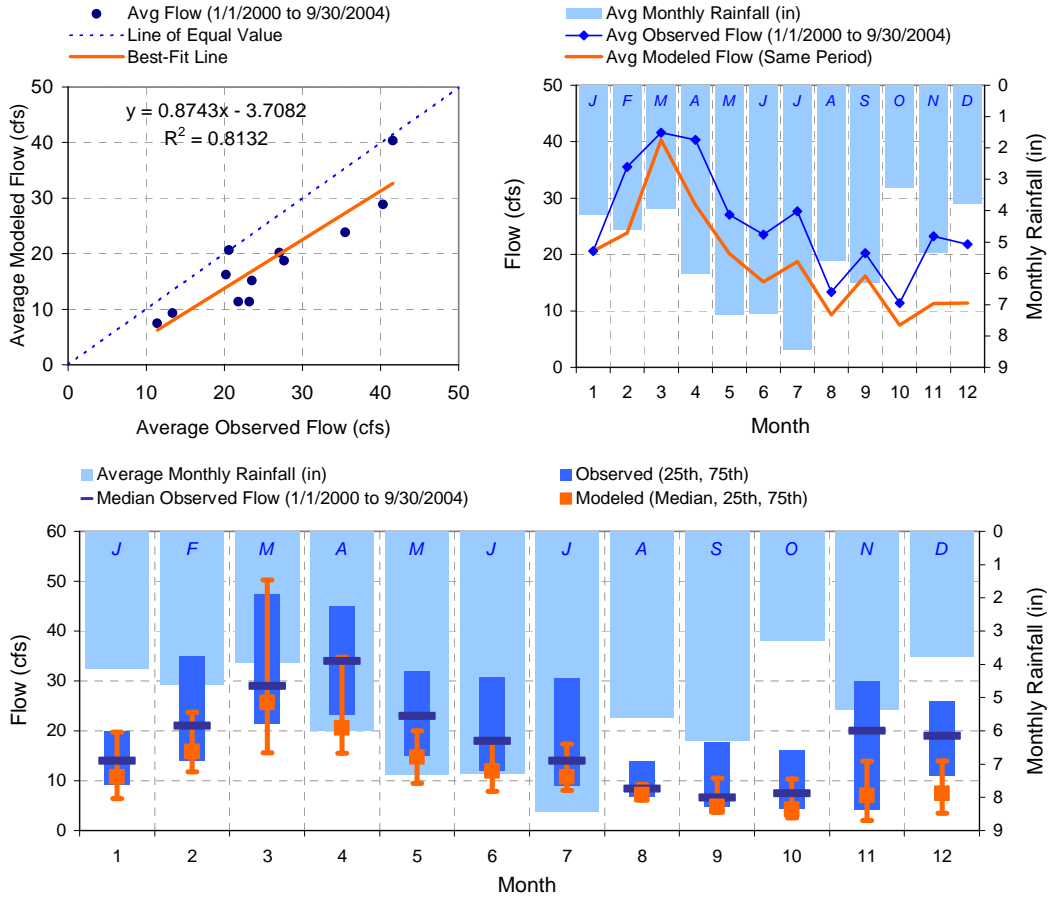


Figure B-9. Validation at USGS gage 01594930 (Laurel Run)



LSPC Simulated Flow		Observed Flow Gage		
REACH OUTFLOW FROM SUBBASIN 302		USGS 01594930 LAUREL RUN AT DOBBIN RD NEAR WILSON, MD		
4.75-Year Analysis Period: 1/1/2000 - 9/30/2004 Flow volumes are (inches/year) for upstream drainage area		Hydrologic Unit Code: 2070002 Latitude: 39.2436111 Longitude: -79.4283056 Drainage Area (sq-mi): 8.23		
Total Simulated In-stream Flow:	31.41	Total Observed In-stream Flow:	42.57	
Total of simulated highest 10% flows:	13.44	Total of Observed highest 10% flows:	15.55	
Total of Simulated lowest 50% flows:	5.36	Total of Observed Lowest 50% flows:	7.93	
Simulated Summer Flow Volume (months 7-9):	6.44	Observed Summer Flow Volume (7-9):	8.93	
Simulated Fall Flow Volume (months 10-12):	3.51	Observed Fall Flow Volume (10-12):	6.57	
Simulated Winter Flow Volume (months 1-3):	12.21	Observed Winter Flow Volume (1-3):	13.96	
Simulated Spring Flow Volume (months 4-6):	9.25	Observed Spring Flow Volume (4-6):	13.11	
Total Simulated Storm Volume:	6.67	Total Observed Storm Volume:	8.20	
Simulated Summer Storm Volume (7-9):	2.13	Observed Summer Storm Volume (7-9):	2.54	
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	<i>1995-1999</i>	<i>2000-2004</i>
Error in total volume:	-26.22	10	-1.43	7.35
Error in 50% lowest flows:	-32.45	10	-1.60	-3.91
Error in 10% highest flows:	-13.56	15	2.26	1.75
Seasonal volume error - Summer:	-27.87	30	13.27	-2.52
Seasonal volume error - Fall:	-46.52	30	4.49	12.42
Seasonal volume error - Winter:	-12.59	30	-18.21	13.31
Seasonal volume error - Spring:	-29.44	30	1.90	6.11
Error in storm volumes:	-18.66	20	1.13	12.07
Error in summer storm volumes:	-16.29	50	3.16	15.42
Nash-Sutcliffe Coefficient of Efficiency, E:	0.453	Model accuracy increases as E or E' approaches 1.0	0.688	0.814
Baseline adjusted coefficient (Garrick), E':	0.380		0.517	0.549

Figure B-10. Validation at USGS gage 01594930 (Laurel Run)

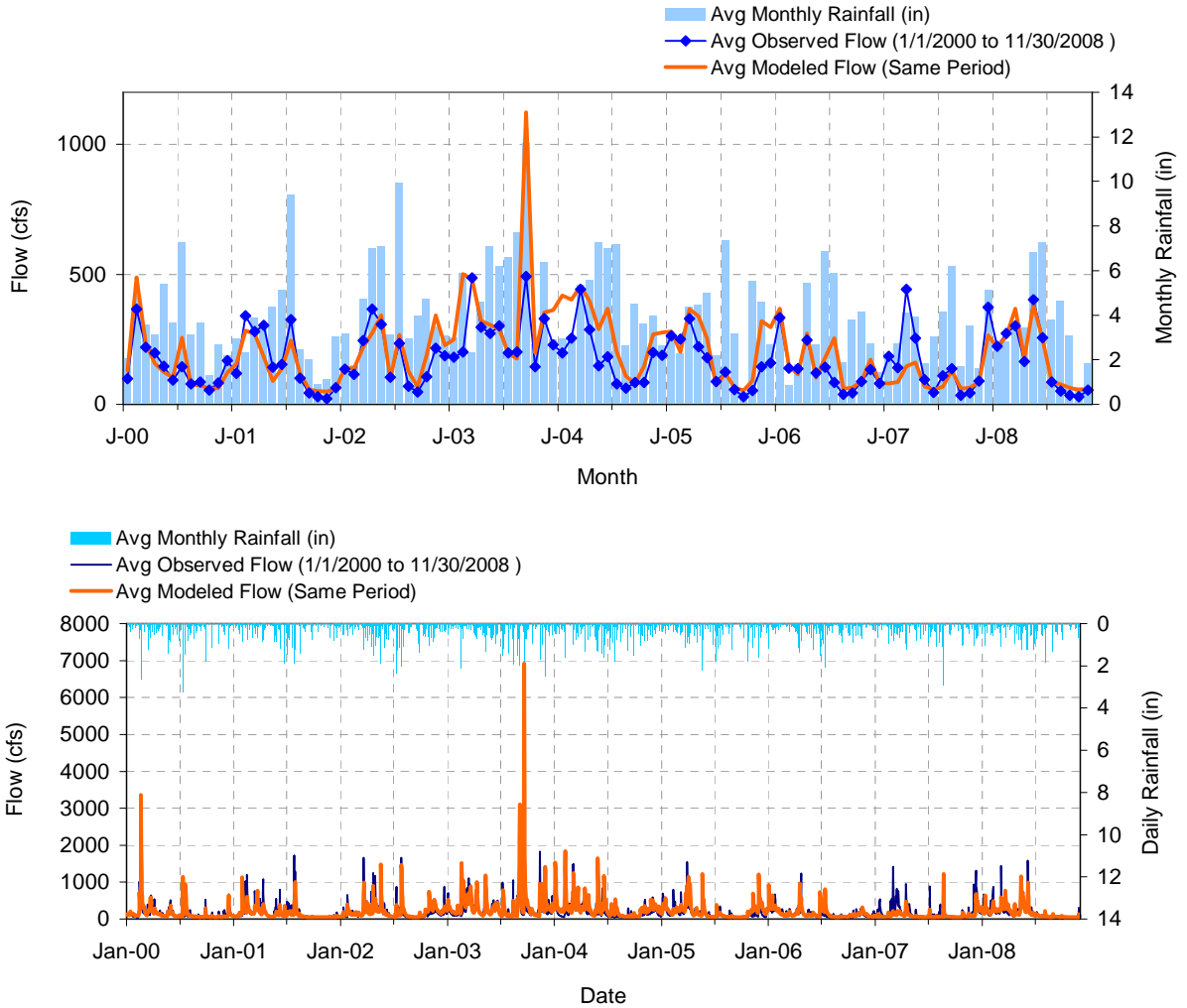
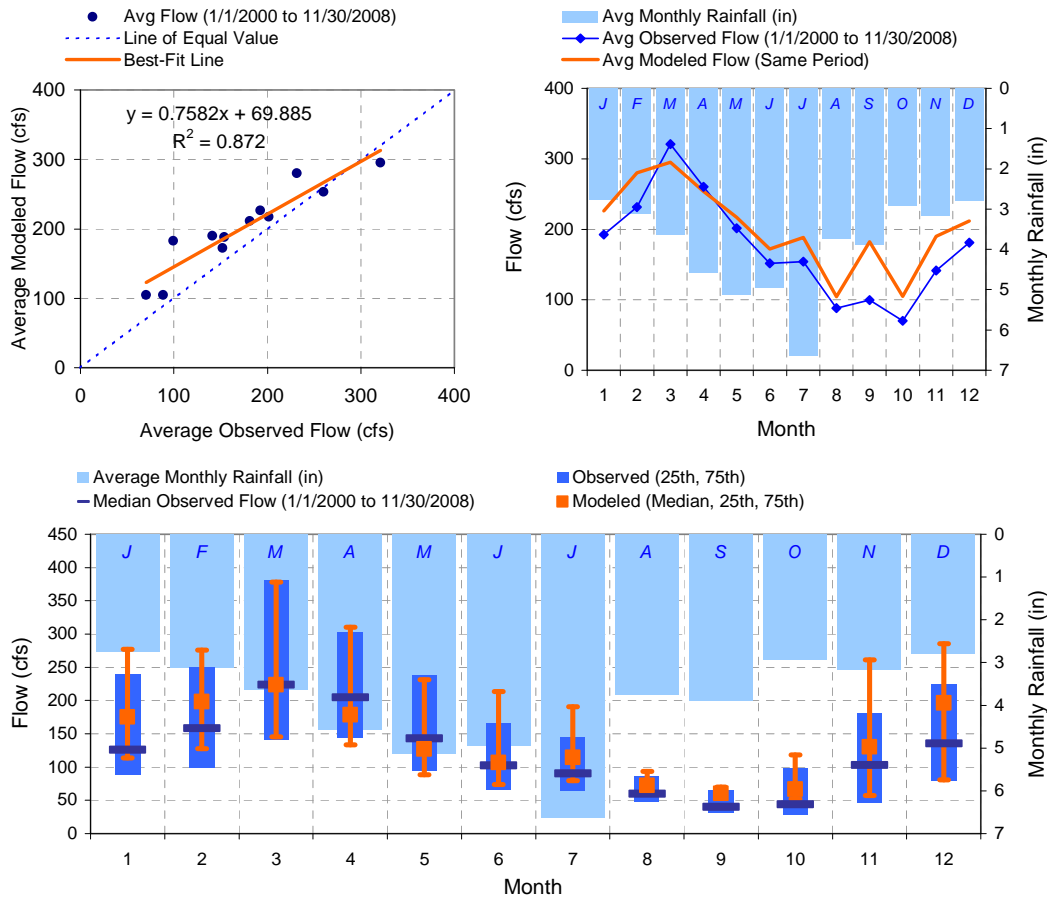


Figure B-11. Validation at USGS gage 01595000 (NBPR at Stever, MD)



LSPC Simulated Flow		Observed Flow Gage		
REACH OUTFLOW FROM SUBBASIN 13		USGS 01595000 NORTH BRANCH POTOMAC RIVER AT STEVER, MD		
8.92-Year Analysis Period: 1/1/2000 - 11/30/2008 Flow volumes are (inches/year) for upstream drainage area		Hydrologic Unit Code: 2070002 Latitude: 39.30188889 Longitude: -79.30688889 Drainage Area (sq-mi): 73.1		
Total Simulated In-stream Flow:	37.45	Total Observed In-stream Flow:	32.35	
Total of simulated highest 10% flows:	13.46	Total of Observed highest 10% flows:	11.96	
Total of Simulated lowest 50% flows:	7.19	Total of Observed Lowest 50% flows:	5.83	
Simulated Summer Flow Volume (months 7-9):	7.47	Observed Summer Flow Volume (7-9):	5.39	
Simulated Fall Flow Volume (months 10-12):	7.59	Observed Fall Flow Volume (10-12):	5.86	
Simulated Winter Flow Volume (months 1-3):	12.38	Observed Winter Flow Volume (1-3):	11.54	
Simulated Spring Flow Volume (months 4-6):	10.02	Observed Spring Flow Volume (4-6):	9.56	
Total Simulated Storm Volume:	9.27	Total Observed Storm Volume:	10.66	
Simulated Summer Storm Volume (7-9):	2.37	Observed Summer Storm Volume (7-9):	2.22	
<i>Errors (Simulated-Observed)</i>	<i>Error Statistics</i>	<i>Recommended Criteria</i>	<i>1995-1999</i>	<i>2000-2004</i>
Error in total volume:	15.75	10	-1.43	7.35
Error in 50% lowest flows:	23.35	10	-1.60	-3.91
Error in 10% highest flows:	12.47	15	2.26	1.75
Seasonal volume error - Summer:	38.46	30	13.27	-2.52
Seasonal volume error - Fall:	29.56	30	4.49	12.42
Seasonal volume error - Winter:	7.23	30	-18.21	13.31
Seasonal volume error - Spring:	4.77	30	1.90	6.11
Error in storm volumes:	-13.12	20	1.13	12.07
Error in summer storm volumes:	6.39	50	3.16	15.42
Nash-Sutcliffe Coefficient of Efficiency, E:	0.228	Model accuracy increases as E or E' approaches 1.0	0.688	0.814
Baseline adjusted coefficient (Garrick), E':	0.314		0.517	0.549

Figure B-12. Validation at USGS gage 01595000 (NBPR at Stever, MD)

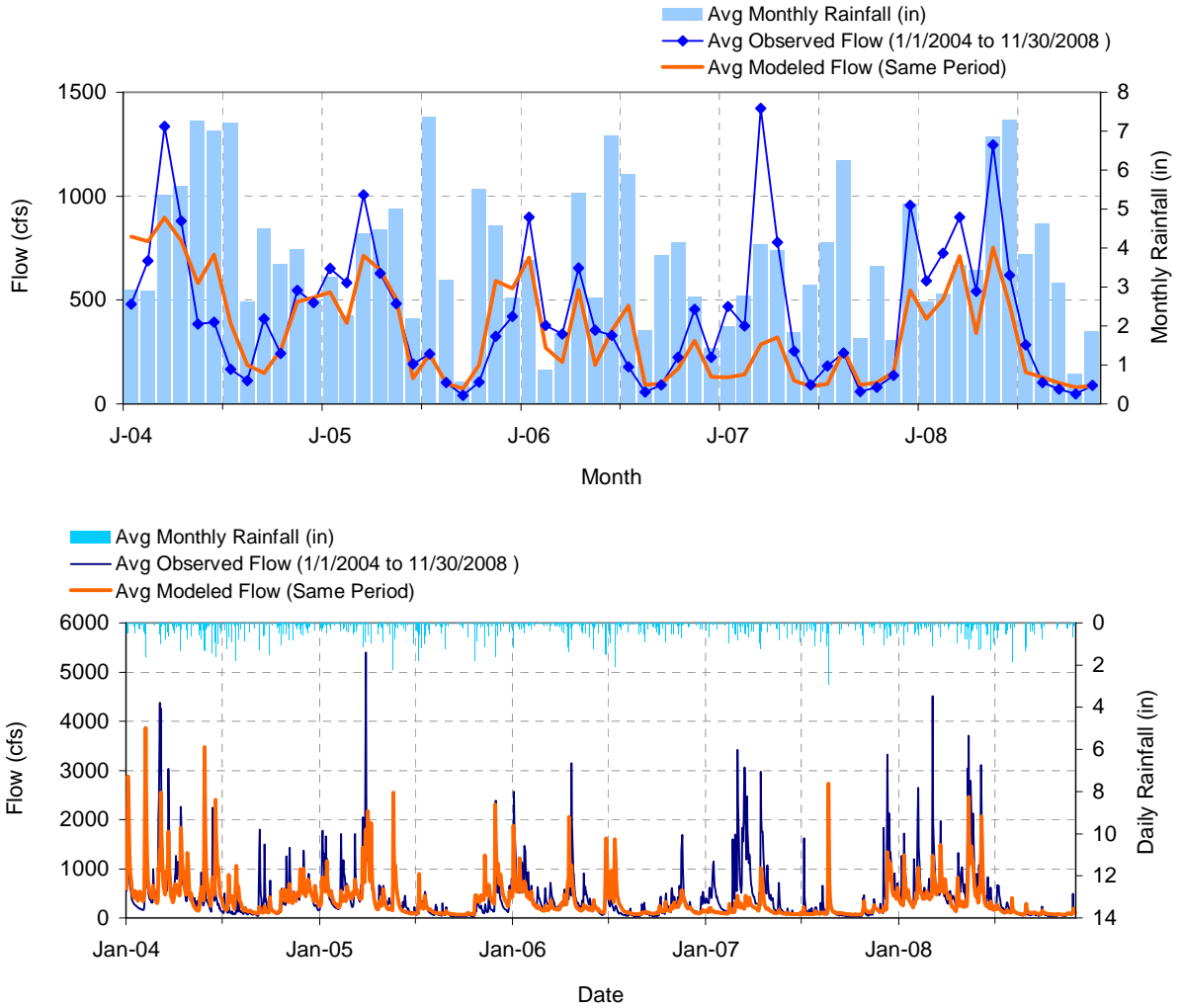
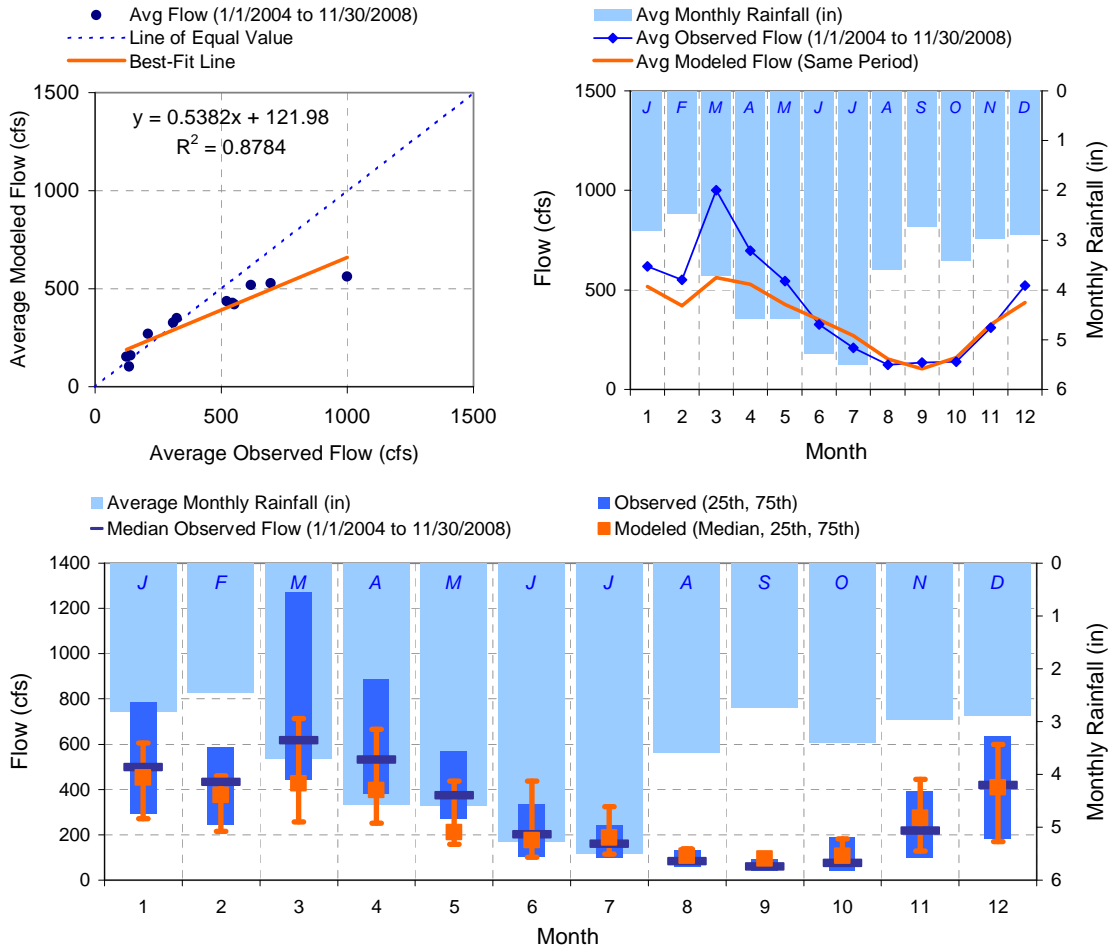


Figure B-13. Validation at USGS gage 01595500 (NBPR at Kitzmiller, MD)



LSPC Simulated Flow		Observed Flow Gage		
REACH OUTFLOW FROM SUBBASIN 22		USGS 01595500 NORTH BRANCH POTOMAC RIVER AT KITZMILLER, MD		
4.92-Year Analysis Period: 1/1/2004 - 11/30/2008 Flow volumes are (inches/year) for upstream drainage area		Hydrologic Unit Code: 2070002 Latitude: 39.3938889 Longitude: -79.1816944 Drainage Area (sq-mi): 225		
Total Simulated In-stream Flow:	21.29	Total Observed In-stream Flow:	25.95	
Total of simulated highest 10% flows:	7.48	Total of Observed highest 10% flows:	10.27	
Total of Simulated lowest 50% flows:	3.73	Total of Observed Lowest 50% flows:	3.74	
Simulated Summer Flow Volume (months 7-9):	2.72	Observed Summer Flow Volume (7-9):	2.42	
Simulated Fall Flow Volume (months 10-12):	4.29	Observed Fall Flow Volume (10-12):	4.47	
Simulated Winter Flow Volume (months 1-3):	7.62	Observed Winter Flow Volume (1-3):	11.06	
Simulated Spring Flow Volume (months 4-6):	6.65	Observed Spring Flow Volume (4-6):	7.99	
Total Simulated Storm Volume:	5.02	Total Observed Storm Volume:	8.50	
Simulated Summer Storm Volume (7-9):	0.64	Observed Summer Storm Volume (7-9):	0.92	
Errors (Simulated-Observed)	Error Statistics	Recommended Criteria	1995-1999	2000-2004
Error in total volume:	-17.96	10	-1.43	7.35
Error in 50% lowest flows:	-0.33	10	-1.60	-3.91
Error in 10% highest flows:	-27.21	15	2.26	1.75
Seasonal volume error - Summer:	12.23	30	13.27	-2.52
Seasonal volume error - Fall:	-4.01	30	4.49	12.42
Seasonal volume error - Winter:	-31.09	30	-18.21	13.31
Seasonal volume error - Spring:	-16.73	30	1.90	6.11
Error in storm volumes:	-40.95	20	1.13	12.07
Error in summer storm volumes:	-30.53	50	3.16	15.42
Nash-Sutcliffe Coefficient of Efficiency, E:	0.435	Model accuracy increases as E or E' approaches 1.0	0.688	0.814
Baseline adjusted coefficient (Garrick), E':	0.393		0.517	0.549

Figure B-14. Validation at USGS gage 01595500 (NBPR at Kitzmiller, MD)