



US Army Corps
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Fox Point Storm Surge Barrier System Vulnerability Assessment

Appendix B. Hydrology

April 2026





**US Army Corps
of Engineers®**

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B.1. Introduction

This document is the climate literature reviews and appendices as part of the Fox Point Vulnerability Assessment. The Fox Point Storm Surge Barrier System is located in the city of Providence, Rhode Island, and is a federally authorized and constructed coastal storm risk management project. The System is in an area known as Fox Point, located on the Providence River, approximately 1,000 feet upstream of the confluence of the Providence and Seekonk Rivers. The feature is located immediately south of the Rhode Island Energy power plant, about 0.2 miles north of Fox Point and one mile south of downtown Providence. The system provides coastal storm risk management against storm surge flooding from hurricanes and other coastal storms to approximately 280 acres of downtown Providence. Construction began in July 1960 and was completed in January 1966, at a cost of \$15 million (\$163,000,000 in July 2025). The Corps of Engineers Cape Cod Canal Project Office operates and maintains the barrier's elements located within the Providence River banks, while the city of Providence operates and maintains the rest of the structure. The area behind the barrier includes a commercial and industrial center, transportation facilities, public utilities, and many homes. The barrier itself is a 700-foot-long concrete structure, with an elevation of +24.2 feet referenced to North American Vertical Datum of 1988 (NAVD88), that extends westward across the Providence River from Tockwotton Street, near Fox Point, to Globe Street, near the power plant. The structure contains three Tainter gate openings that prevent the entry of floodwaters from the bay when closed and allow the passage of small vessels when open. Two earthfill dikes flank each side of the barrier. The eastern dike is 780 feet long and the western dike is 1,400 feet long.

As directed by Section 1218 of Public Law (P.L.) 115-270, the U.S. Army Corps of Engineers (USACE) is conducting an assessment of the durability and resilience of existing storm surge barriers and harbors of refuge within the North Atlantic Division (NAD). Congress requested that this assessment should give consideration as to how such barriers and harbors will survive and fully serve their planned levels of performance under current, near, and longer-term future predicted sea levels, storm surges, and storm strengths. As described in Section 1218 of P.L. 115-270 (America's Water Infrastructure Act of 2018, Appendix 1), a report is to be provided to the Committee on Transportation and Infrastructure of the House of Representatives and the Committee on Environment and Public Works of the Senate not later than one year after its enactment on October 23, 2018. Due to a lack of appropriations an interim report was completed and submitted to Congress in September 2019 and titled: U.S. Army Corps of Engineers (2019), Interim Report on New England Harbors of Refuge and Storm Surge Barriers (USACE 2019). The results of that report showed that the storm surge barriers are relatively robust to overtopping from changing sea levels through 2070, and with one exception, through 2120. However, changes in tide, storm surge, waves, and precipitation since the time the barriers were designed were not captured by the interim analysis. Therefore, there exists the potential that the current level of coastal storm risk management provided by these projects may be further diminished when these factors are fully considered. This analysis represents the additional work to account for the vulnerabilities identified in the 2019 interim report.

B.2. HEC-HMS Model Parameters

B.2.1. Loss Parameters (Initial Deficit Method):

Table B-1
May 23, 2024, calibration.

River	Sub-basin	Loss Rate in/hr	Initial Loss (in.)	Impervious %
Woonas.	S-1	0.248	1	10
Woonas.	S-2	0.248	1	4
Woonas.	S-3	0.236	1	17
Woonas.	S-4	0.239	2	47
Mosshasuck	S-10	0.238	0.1	17
Mosshasuck	S-7	0.443	0.1	53
Mosshasuck	S-8	0.329	0.1	49
Mosshasuck	S-9	0.167	0.1	47
Mosshasuck	S-6	0.362	0.1	67
Mosshasuck	S-5	0.160	1	72

Table B-2
July 4th, 2023, calibration.

River	Sub-basin	Loss Rate in/hr	Initial Loss (in.)	Impervious %
Woonas.	S-1	0.275	1.1	10
Woonas.	S-2	0.276	1.1	4
Woonas.	S-3	0.350	1.1	17
Woonas.	S-4	0.359	2	47
Mosshasuck	S-10	0.206	0.1	17
Mosshasuck	S-7	0.296	0.1	53
Mosshasuck	S-8	0.285	0.1	49
Mosshasuck	S-9	0.145	0.1	47
Mosshasuck	S-6	0.241	0.1	67
Mosshasuck	S-5	0.142	1	72

Table B-3
August 13, 2014, validation.

River	Sub-basin	Loss Rate in/hr	Initial Loss (in.)	Impervious %
Woonas.	S-1	0.261	1.1	10
Woonas.	S-2	0.262	1.1	4
Woonas.	S-3	0.293	1.1	17
Woonas.	S-4	0.299	2	47
Mosshasuck	S-10	0.222	1	17
Mosshasuck	S-7	0.370	1	53
Mosshasuck	S-8	0.307	1	49

River	Sub-basin	Loss Rate in/hr	Initial Loss (in.)	Impervious %
Mosshasuck	S-9	0.156	1	47
Mosshasuck	S-6	0.301	1	67
Mosshasuck	S-5	0.151	1	72

Table B-4
July 28, 2012, validation.

River	Sub-basin	Loss Rate in/hr	Initial Loss (in.)	Impervious %
Woonas.	S-1	0.261	1.1	10
Woonas.	S-2	0.262	1.1	4
Woonas.	S-3	0.293	1.1	17
Woonas.	S-4	0.299	2	47
Mosshasuck	S-10	0.222	0.1	17
Mosshasuck	S-7	0.370	0.1	53
Mosshasuck	S-8	0.307	0.1	49
Mosshasuck	S-9	0.156	0.1	47
Mosshasuck	S-6	0.301	0.1	67
Mosshasuck	S-5	0.151	1	72

B.2.2. Transform Method (Modified Clark)

Table B-5
May 23, 2024, calibration.

River	Sub-basin	Time of Concentration (hr)	Storage Coefficient
Woonas.	S-1	18.0	98.9
Woonas.	S-2	15.6	85.8
Woonas.	S-3	1.1	22.2
Woonas.	S-4	9.4	112.6
Mosshasuck	S-10	2.2	49.1
Mosshasuck	S-7	3.0	66.4
Mosshasuck	S-8	2.2	0.6
Mosshasuck	S-9	1.8	40.7
Mosshasuck	S-6	0.9	6.4
Mosshasuck	S-5	1.4	16.5

Table B-6
July 4, 2023, calibration.

River	Sub-basin	Time of Concentration (hr)	Storage Coefficient
Woonas.	S-1	9.0	27.0
Woonas.	S-2	7.8	23.4
Woonas.	S-3	1.1	14.4

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River	Sub-basin	Time of Concentration (hr)	Storage Coefficient
Woonas.	S-4	0.2	16.9
Mosshasuck	S-10	2.2	70.9
Mosshasuck	S-7	3.0	95.9
Mosshasuck	S-8	1.7	1.1
Mosshasuck	S-9	1.8	54.3
Mosshasuck	S-6	0.9	0.9
Mosshasuck	S-5	1.4	13.6

Table B-7
August 13, 2014, validation.

River	Sub-basin	Time of Concentration (hr)	Storage Coefficient
Woonas.	S-1	13.5	62.9
Woonas.	S-2	11.7	54.6
Woonas.	S-3	1.1	18.3
Woonas.	S-4	4.8	64.8
Mosshasuck	S-10	2.2	60.0
Mosshasuck	S-7	3.0	81.1
Mosshasuck	S-8	1.9	0.8
Mosshasuck	S-9	1.8	47.5
Mosshasuck	S-6	0.9	3.6
Mosshasuck	S-5	1.4	15.0

Table B-8
July 28, 2012, validation.

River	Sub-basin	Time of Concentration (hr)	Storage Coefficient
Woonas.	S-1	13.5	62.9
Woonas.	S-2	11.7	54.6
Woonas.	S-3	1.1	18.3
Woonas.	S-4	4.8	64.8
Mosshasuck	S-10	2.2	60.0
Mosshasuck	S-7	3.0	81.1
Mosshasuck	S-8	1.9	0.8
Mosshasuck	S-9	1.8	47.5
Mosshasuck	S-6	0.9	3.6
Mosshasuck	S-5	1.4	15.0

B.2.3. Baseflow Parameters (Recession Method)

Table B-9
May 23, 2024, calibration.

River	Sub-basin	Initial Discharge (cfs/mi ²)	Recession Constant	Ratio to Peak
Woonas.	S-1	2.9	0.4	0.4
Woonas.	S-2	2.9	0.4	0.4
Woonas.	S-3	2.9	0.6	0.5
Woonas.	S-4	2.5	0.6	0.5
Mosshasuck	S-10	1	0.1	0.1
Mosshasuck	S-7	1	0.1	0.1
Mosshasuck	S-8	1	0.1	0.1
Mosshasuck	S-9	1	0.1	0.1
Mosshasuck	S-6	1	0.1	0.1
Mosshasuck	S-5	1	0.2	0.1

Table B-10
July 4, 2023, calibration.

River	Sub-basin	Initial Discharge (cfs/mi ²)	Recession Constant	Ratio to Peak
Woonas.	S-1	0.5	0.9	0.4
Woonas.	S-2	0.5	0.9	0.4
Woonas.	S-3	0.5	0.9	0.4
Woonas.	S-4	0.6	0.9	0.3
Mosshasuck	S-10	0	0.1	0.05
Mosshasuck	S-7	0	0.1	0.05
Mosshasuck	S-8	0	0.1	0.05
Mosshasuck	S-9	0	0.1	0.05
Mosshasuck	S-6	0.05	0.1	0.05
Mosshasuck	S-5	0.05	0.8	0.7

Table B-11
August 13, 2014, validation.

River	Sub-basin	Initial Discharge (cfs/mi ²)	Recession Constant	Ratio to Peak
Woonas.	S-1	0.3	0.65	0.4
Woonas.	S-2	0.3	0.65	0.4
Woonas.	S-3	0.3	0.75	0.45
Woonas.	S-4	0.3	0.75	0.4
Mosshasuck	S-10	1.0	0.10	0.08
Mosshasuck	S-7	1.0	0.10	0.08
Mosshasuck	S-8	1.0	0.10	0.08
Mosshasuck	S-9	1.0	0.10	0.08
Mosshasuck	S-6	0.4	0.10	0.08

River	Sub-basin	Initial Discharge (cfs/mi ²)	Recession Constant	Ratio to Peak
Mosshasuck	S-5	0.4	0.50	0.4

Table B-12
July 28, 2012, validation.

River	Sub-basin	Initial Discharge (cfs/mi ²)	Recession Constant	Ratio to Peak
Woonas.	S-1	0.35	0.65	0.4
Woonas.	S-2	0.35	0.65	0.4
Woonas.	S-3	0.35	0.75	0.45
Woonas.	S-4	0.00	0.75	0.4
Mosshasuck	S-10	0.40	0.10	0.08
Mosshasuck	S-7	0.40	0.10	0.08
Mosshasuck	S-8	1.00	0.10	0.08
Mosshasuck	S-9	1.00	0.10	0.08
Mosshasuck	S-6	1.00	0.10	0.08
Mosshasuck	S-5	1.00	0.50	0.4

B.2.4. Routing Parameters (Muskingum)

Table B-13
Routing parameter for all calibrations and validations.

River	Reach in HMS	Muskingum K	Muskingum X	Number of Subreaches
Woonas.	Reach 1	2.390	0.2	1
Woonas.	React 2	3.260	0.1	1
Providence	Reach 3	0.450	0.2	1
Mosshasuck	Reach 4	0.980	0.2	47

B.3. Bulletin 17C analysis

Table B-14
Woonasquatucket River 17C analysis: Frequency curve.

% chance exceedance	Computed Flow (cfs)	Variance Log (EMA)	Confidence Limits (flow in cfs): 0.05	Confidence Limits (flow in cfs): 0.95
0.2	2569.9	0.0073124	3914.4	2002.6
0.5	2208.4	0.00512	3128.2	1788.1
1	1948.6	0.0037729	2617.4	1621.7
2	1699.5	0.0026865	2169.2	1450.7

Table B-15
HMS results Woonasquatucket.

% chance exceedance	Computed Flow (cfs)
0.2	2421
1	1526
2	1220

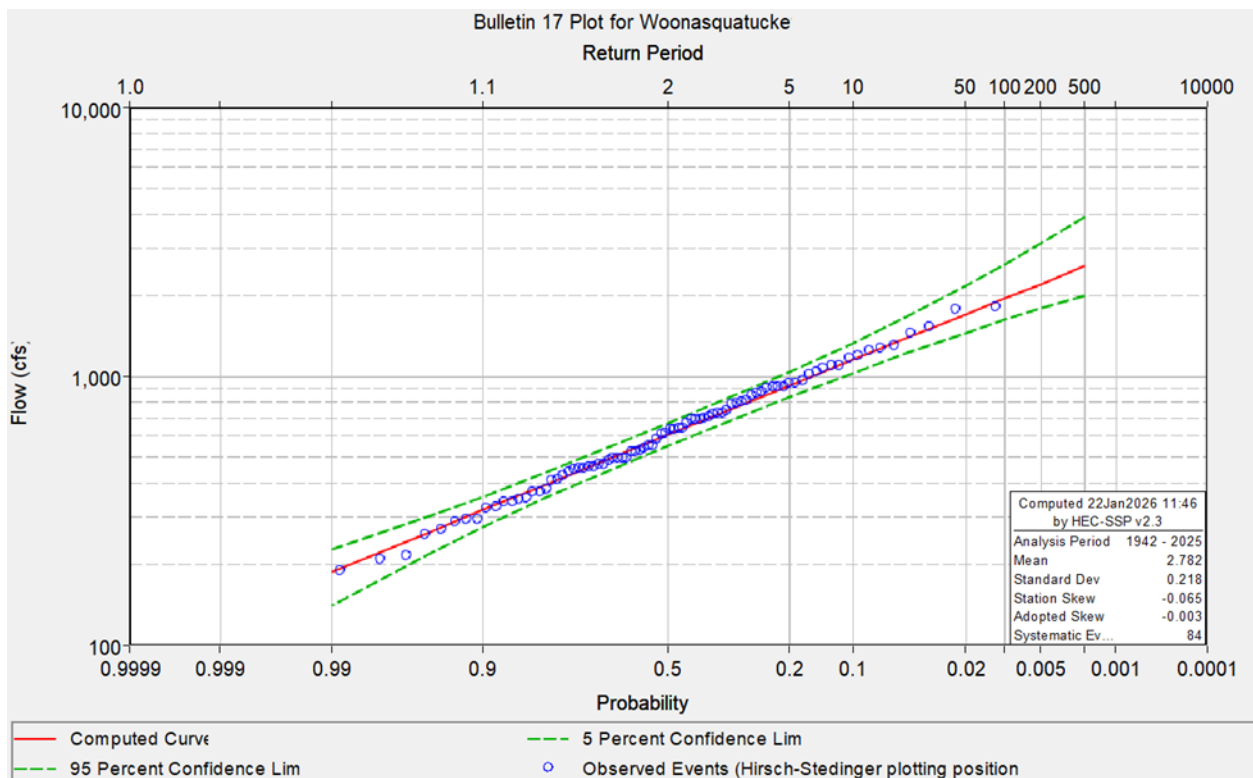


Figure B-1. Bulletin 17 plot for Woonasquatucket.

Table B-16
Moshassuck River 17C analysis: Frequency curve.

% chance exceedance	Computed Flow (cfs)	Variance Log (EMA)	Confidence Limits (flow in cfs): 0.05	Confidence Limits (flow in cfs): 0.95
0.2	2789.9	0.0063801	4108.8	2174.6
0.5	2453.2	0.0042685	3372.2	2001.9
1	2212.6	0.003016	2895	1865.4
2	1982.7	0.0020439	2476	1722

Table B-17
HMS results Moshassuck.

% chance exceedance	Computed Flow (cfs)
0.2	3969
1	2833
2	2434

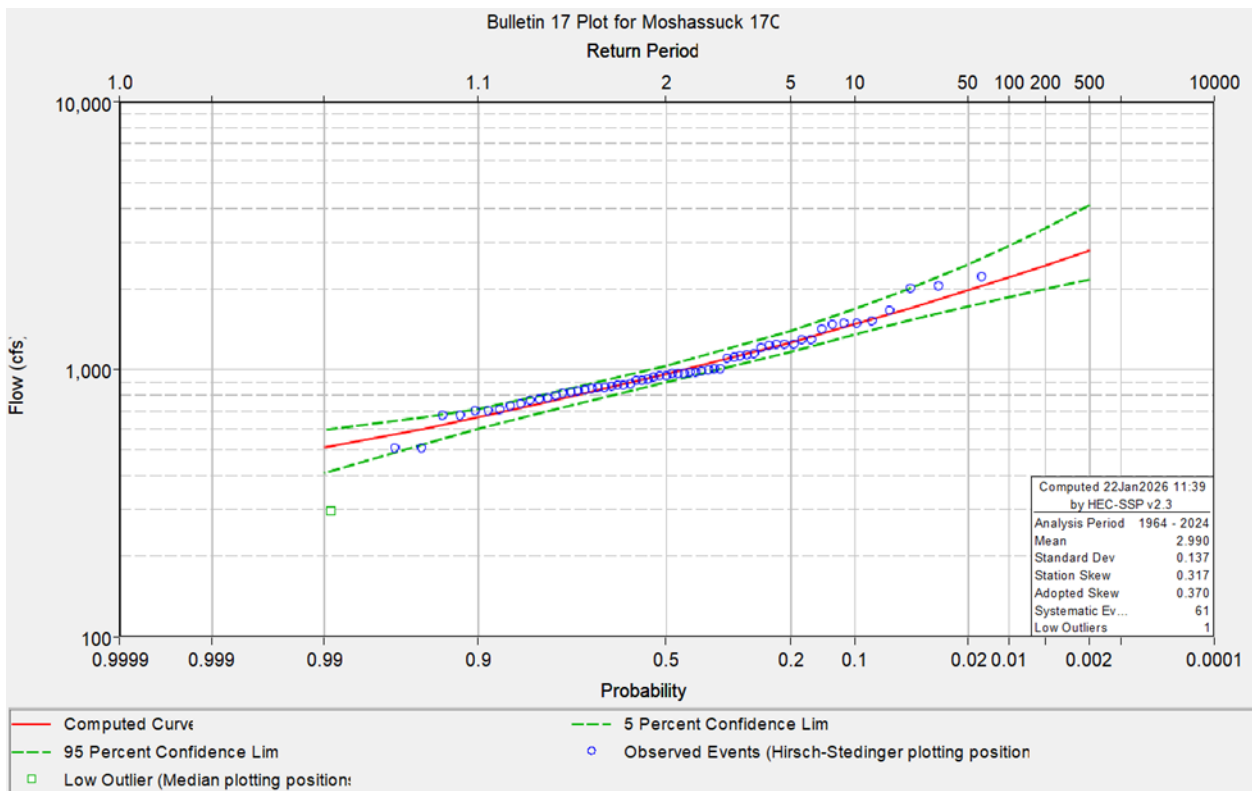


Figure B-2. Bulletin 17 plot for Moshassuck.

B.4. Calibration Hydrographs & Summary Tables

B.4.1. March 24, 2024, Calibration Event

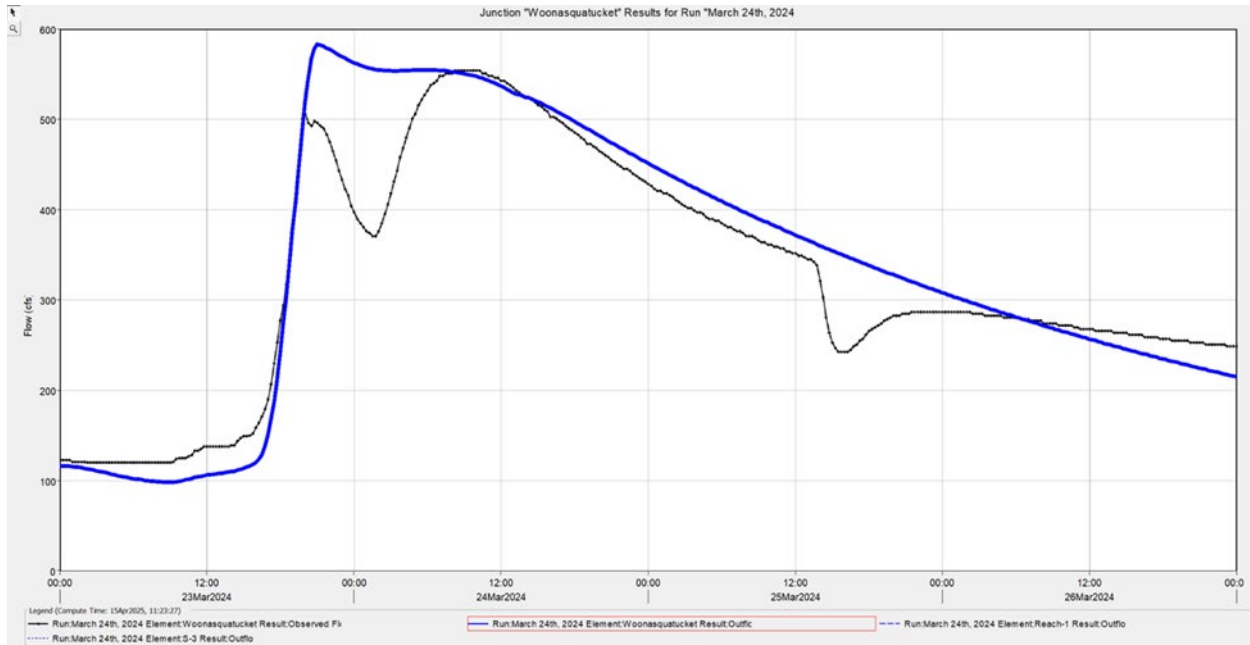


Figure B-3. Comparison of HEC-HMS simulation results vs. observed data at the Woonasquatucket USGS gage in Centerdale.

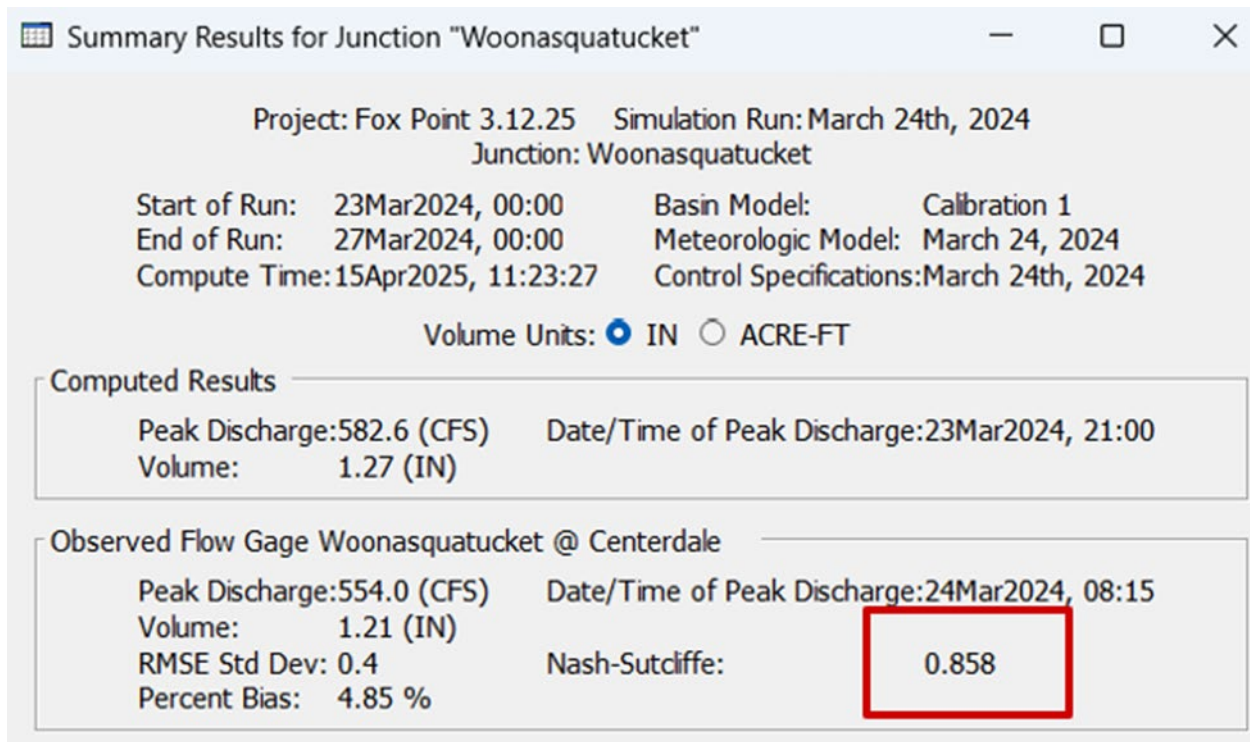


Figure B-4. Woonasquatucket calibration results summary table for March 24, 2024.

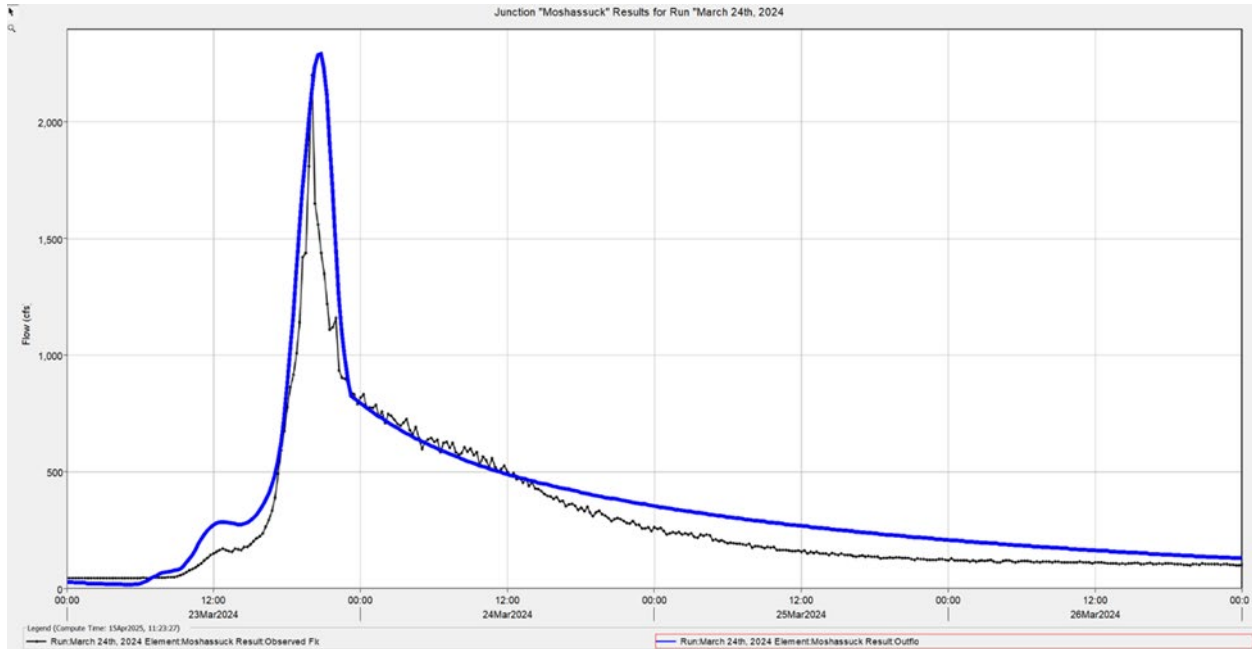


Figure B-5. Comparison of HEC-HMS simulation results vs. observed data at the Moshassuck River USGS gage in Providence.

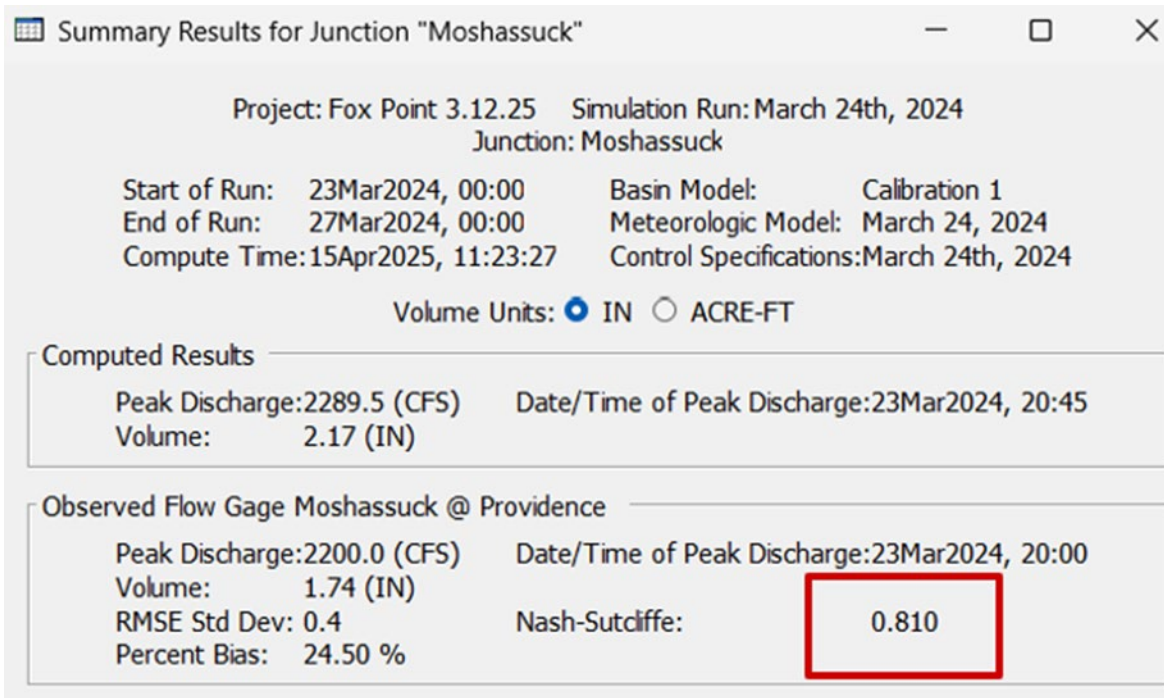


Figure B-6. Moshassuck River calibration results summary table for March 24, 2024.

B.4.2. July 4, 2023, Calibration Event

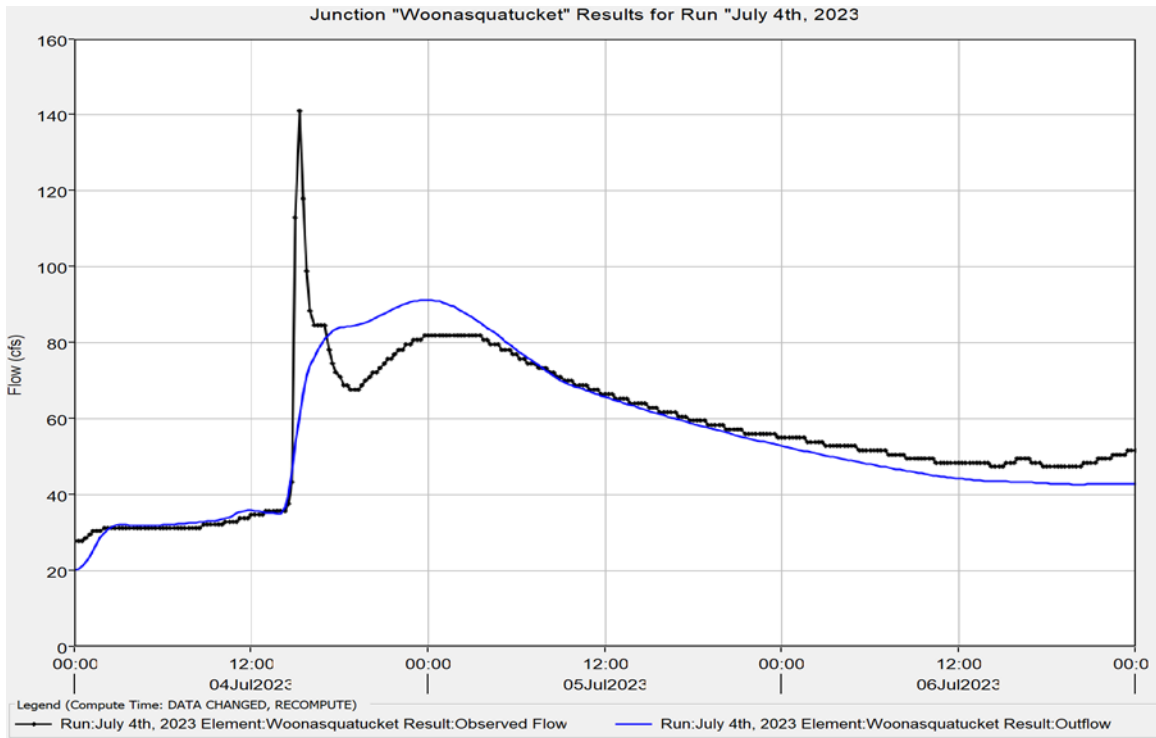


Figure B-7. Comparison of HEC-HMS simulation results vs. observed data at the Woonasquatucket USGS gage in Centerdale.

Project: Fox Point 3.12.25		Simulation Run: July 4th, 2023	
Junction: Woonasquatucket			
Start of Run: 04Jul2023, 00:00	Basin Model: Calibration 2		
End of Run: 07Jul2023, 00:00	Meteorologic Model: July 04, 2023		
Compute Time: DATA CHANGED, RECOMPUTE	Control Specifications: July 4th, 2023		
Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> ACRE-FT			
Computed Results			
Peak Discharge: 91.3 (CFS)	Date/Time of Peak Discharge: 05Jul2023, 00:00		
Volume: 0.15 (IN)			
Observed Flow Gage Woonasquatucket @ Centerdale			
Peak Discharge: 141.0 (CFS)	Date/Time of Peak Discharge: 04Jul2023, 15:15		
Volume: 0.16 (IN)			
RMSE Std Dev: 0.5	Nash-Sutcliffe:	0.760	
Percent Bias: -1.72 %			

Figure B-8. Woonasquatucket calibration results summary table for July 4, 2023.

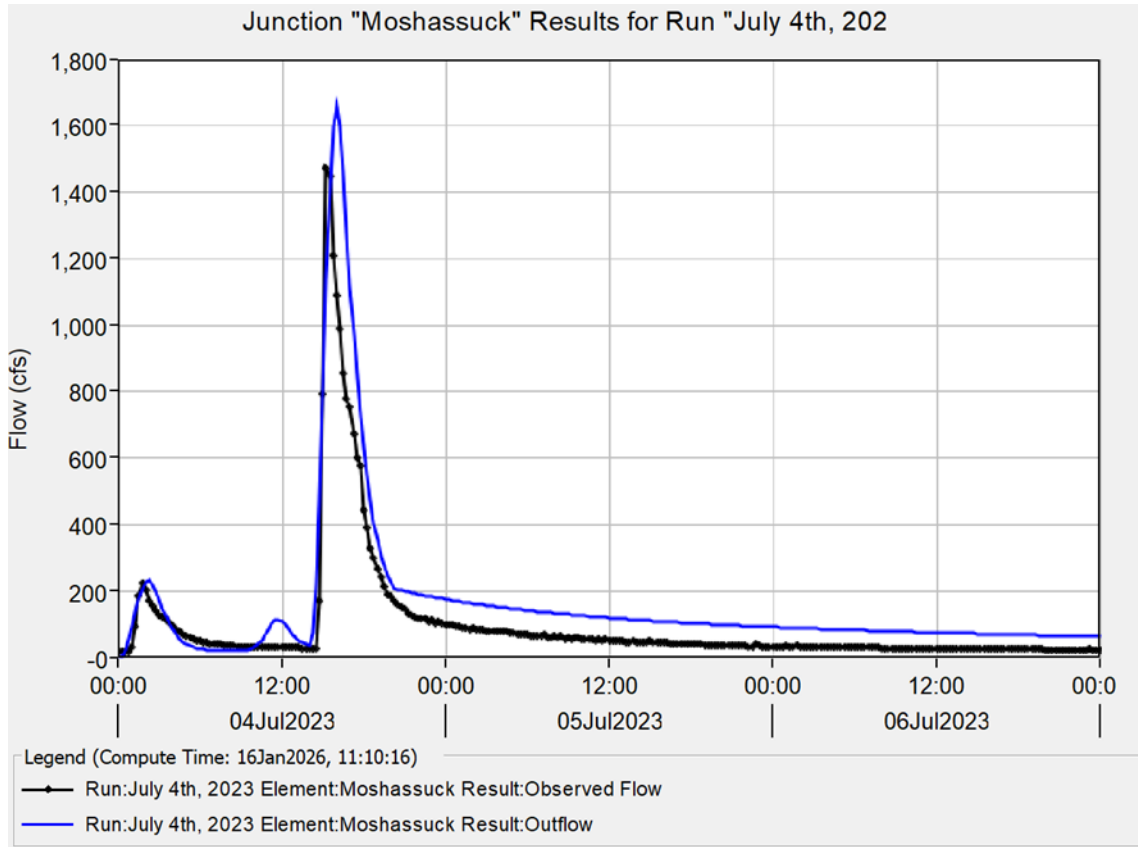


Figure B-9. Comparison of HEC-HMS simulation results vs. observed data at the Moshassuck River USGS gage in Providence.

Project: Fox Point 3.12.25		Simulation Run: July 4th, 2023	
Junction: Moshassuck			
Start of Run: 04Jul2023, 00:00	Basin Model: Calibration 2		
End of Run: 07Jul2023, 00:00	Meteorologic Model: July 04, 2023		
Compute Time: 16Jan2026, 11:10:16	Control Specifications: July 4th, 2023		
Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> ACRE-FT			
Computed Results			
Peak Discharge: 1658.7 (CFS)	Date/Time of Peak Discharge: 04Jul2023, 16:00		
Volume: 0.70 (IN)			
Observed Flow Gage Moshassuck @ Providence			
Peak Discharge: 1470.0 (CFS)	Date/Time of Peak Discharge: 04Jul2023, 15:15		
Volume: 0.42 (IN)			
RMSE Std Dev: 0.5	Nash-Sutcliffe: 0.729		
Percent Bias: 64.60 %			

Figure B-10. Moshassuck calibration results summary table for July 4, 2023.

B.4.3. August 13, 2014, Validation Event

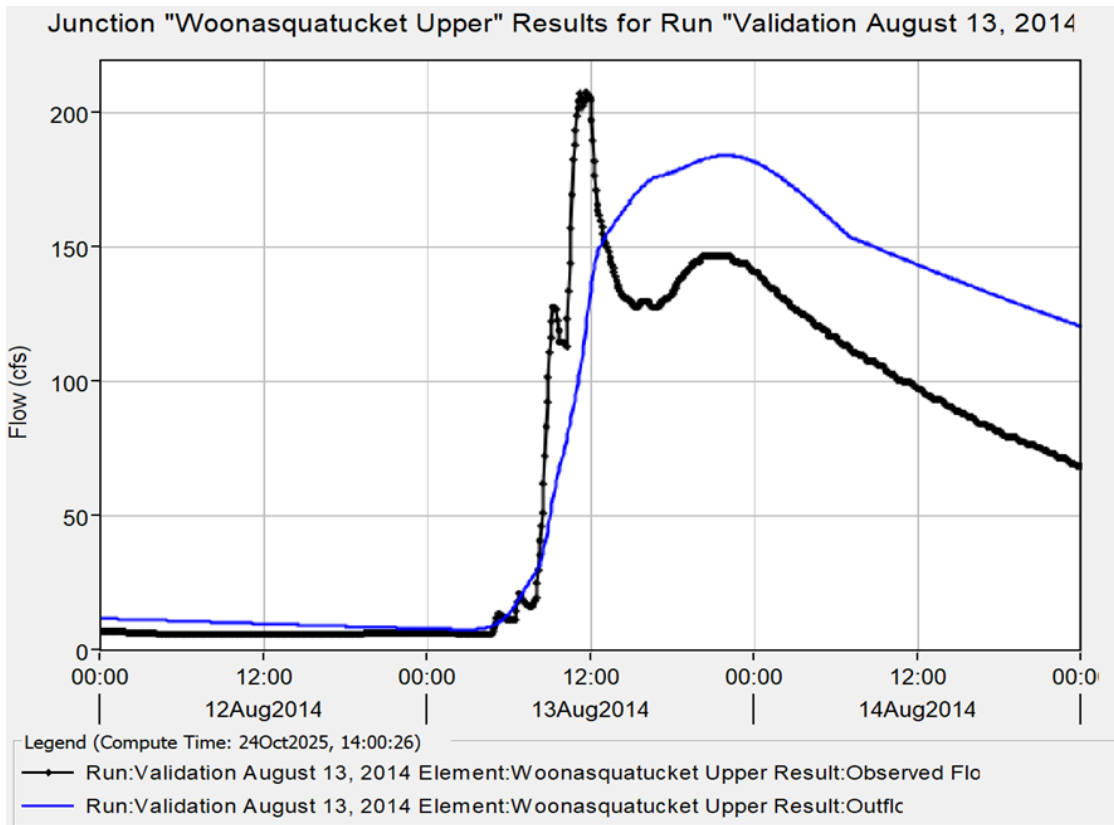


Figure B-11. Comparison of HEC-HMS simulation results vs. observed data at the Woonasquatucket USGS gage in Centerdale.

Project: Fox Point 3.12.25		Simulation Run: Validation August 13, 2014	
Junction: Woonasquatucket Upper			
Start of Run: 12Aug2014, 00:00	Basin Model: Calibration Average - Aug13		
End of Run: 15Aug2014, 00:00	Meteorologic Model: August 13, 2014		
Compute Time:24Oct2025, 14:00:26	Control Specifications:August 13th, 2014		
Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> ACRE-FT			
Computed Results			
Peak Discharge:184.4 (CFS)	Date/Time of Peak Discharge:13Aug2014, 21:55		
Volume: 0.24 (IN)			
Observed Flow Gage Woonasquatucket @ Centerdale			
Peak Discharge:208.0 (CFS)	Date/Time of Peak Discharge:13Aug2014, 11:45		
Volume: 0.19 (IN)			
RMSE Std Dev: 0.6	Nash-Sutcliffe: 0.648		
Percent Bias: 28.35 %			

Figure B-12. Woonasquatucket calibration results summary table for August 13, 2014.

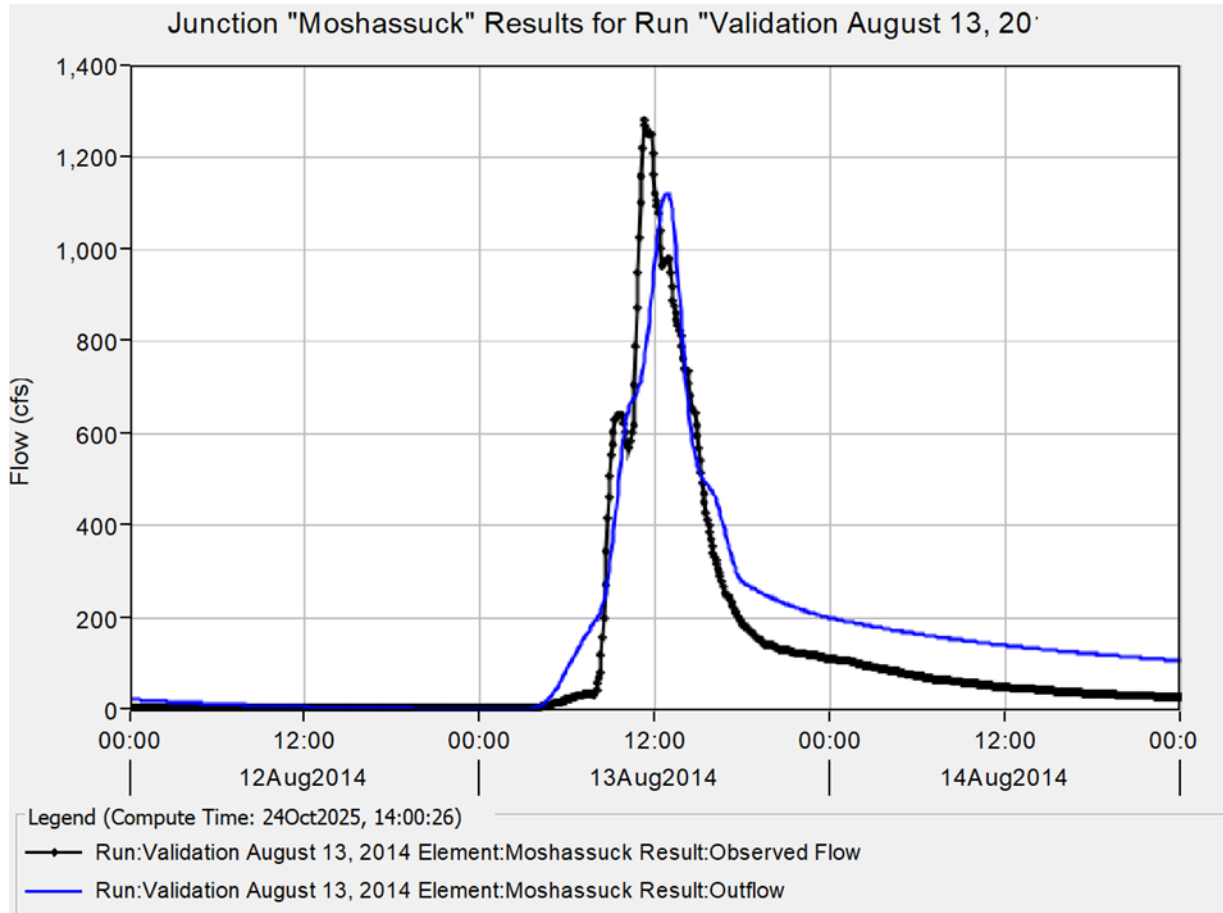


Figure B-13. Comparison of HEC-HMS simulation results vs. observed data at the Moshassuck River USGS gage in Providence.

Project: Fox Point 3.12.25		Simulation Run: Validation August 13, 2014	
Junction: Moshassuck			
Start of Run: 12Aug2014, 00:00	Basin Model: Calibration Average - Aug13		
End of Run: 15Aug2014, 00:00	Meteorologic Model: August 13, 2014		
Compute Time:24Oct2025, 14:00:26	Control Specifications:August 13th, 2014		
Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> ACRE-FT			
Computed Results			
Peak Discharge:1121.1 (CFS)	Date/Time of Peak Discharge:13Aug2014, 12:50		
Volume: 0.72 (IN)			
Observed Flow Gage Moshassuck @ Providence			
Peak Discharge:1280.0 (CFS)	Date/Time of Peak Discharge:13Aug2014, 11:15		
Volume: 0.54 (IN)			
RMSE Std Dev: 0.4	Nash-Sutcliffe: 0.866		
Percent Bias: 32.98 %			

Figure B-14. Moshassuck calibration results summary table for August 13, 2014.

B.4.4. July 28, 2012, Validation Event

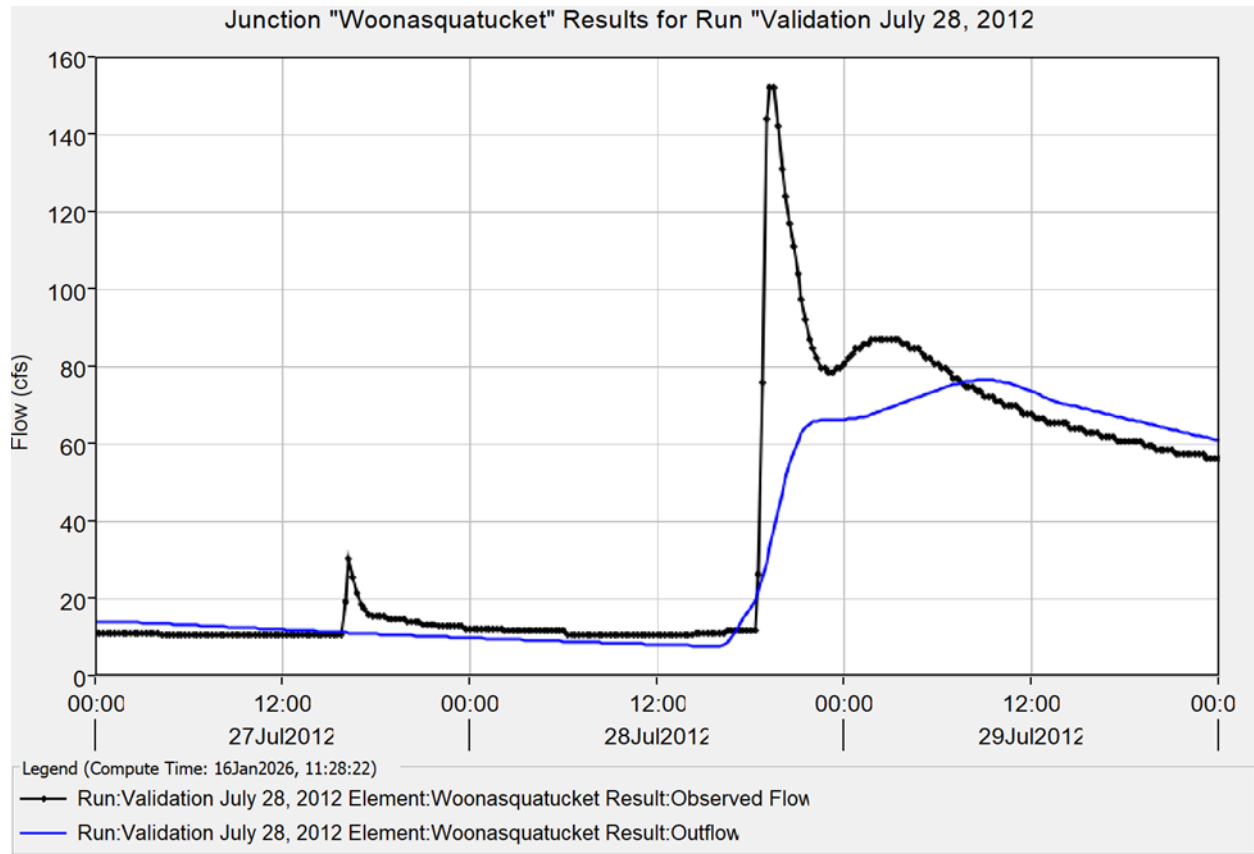


Figure B-15. Comparison of HEC-HMS simulation results vs. observed data at the Woonasquatucket USGS gage in Centerdale.

Project: Fox Point 3.12.25		Simulation Run: Validation July 28, 2012	
Junction: Woonasquatucket			
Start of Run: 27Jul2012, 00:00	Basin Model: Calibration Average - Jul28		
End of Run: 30Jul2012, 00:00	Meteorologic Model: July 28, 2012		
Compute Time:16Jan2026, 11:28:22	Control Specifications:July 28, 2012		
Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> ACRE-FT			
Computed Results			
Peak Discharge:76.4 (CFS)	Date/Time of Peak Discharge:29Jul2012, 09:00		
Volume: 0.09 (IN)			
Observed Flow Gage Woonasquatucket @ Centerdale			
Peak Discharge:152.0 (CFS)	Date/Time of Peak Discharge:28Jul2012, 19:15		
Volume: 0.11 (IN)			
RMSE Std Dev: 0.5	Nash-Sutcliffe:	0.737	
Percent Bias: -10.99 %			

Figure B-16. Woonasquatucket calibration results summary table for July 28, 2012.

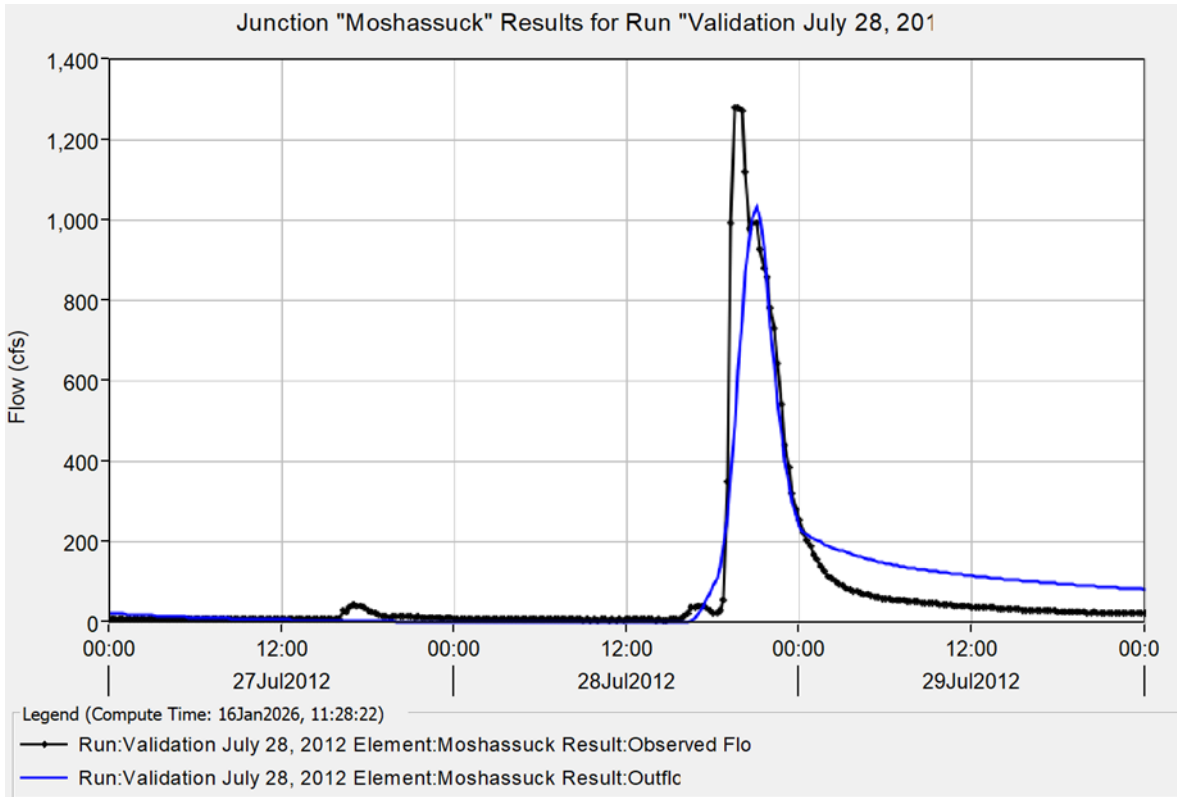


Figure B-17. Comparison of HEC-HMS simulation results vs. observed data at the Moshassuck River USGS gage in Providence.

Project: Fox Point 3.12.25		Simulation Run: Validation July 28, 2012	
Junction: Moshassuck			
Start of Run: 27Jul2012, 00:00	Basin Model: Calibration Average - Jul28		
End of Run: 30Jul2012, 00:00	Meteorologic Model: July 28, 2012		
Compute Time:16Jan2026, 11:28:22	Control Specifications:July 28, 2012		
Volume Units: <input checked="" type="radio"/> IN <input type="radio"/> ACRE-FT			
Computed Results			
Peak Discharge:1031.7 (CFS)	Date/Time of Peak Discharge:28Jul2012, 21:00		
Volume: 0.42 (IN)			
Observed Flow Gage Moshassuck @ Providence			
Peak Discharge:1280.0 (CFS)	Date/Time of Peak Discharge:28Jul2012, 19:30		
Volume: 0.37 (IN)			
RMSE Std Dev: 0.4	Nash-Sutcliffe: 0.822		
Percent Bias: 14.15 %			

Figure B-18. Moshassuck calibration results summary table for July 28, 2012.

B.4.5. Calibration & Validation Results

Table B-18
March 24, 2024, calibration.

	Woonasquatucket River	Moshassuck River
Nash Sutcliffe Score	0.86	0.81
Percent Bias (%)	4.86	24.5
Obs. Peak Flow (cfs)	554	2200
Comp. Peak Flow (cfs)	583	2289
Obs. Volume (in.)	1.21	1.74
Comp. Volume (in.)	1.27	2.17

Table B-19
July 4, 2023, calibration.

	Woonasquatucket River	Moshassuck River
Nash Sutcliffe Score	0.76	0.73
Percent Bias (%)	-1.72	64
Obs. Peak Flow (cfs)	141	1470
Comp. Peak Flow (cfs)	91.3	1659
Obs. Volume (in.)	0.16	0.42
Comp. Volume (in.)	0.15	0.7

Table B-20
August 13, 2014, validation.

	Woonasquatucket River	Moshassuck River
Nash Sutcliffe Score	0.65	0.86
Percent Bias (%)	28.4	33
Obs. Peak Flow (cfs)	208	1280
Comp. Peak Flow (cfs)	185	1122
Obs. Volume (in.)	0.19	0.54
Comp. Volume (in.)	0.24	0.72

Table B-21
July 28, 2012, validation.

	Woonasquatucket River	Moshassuck River
Nash Sutcliffe Score	0.74	0.82
Percent Bias (%)	-11	14
Obs. Peak Flow (cfs)	152	1280
Comp. Peak Flow (cfs)	76	1032
Obs. Volume (in.)	11	0.37
Comp. Volume (in.)	0.09	0.42

B.5. HEC-HMS Peak Runoff

B.5.1. 24-Hour Storm Charts

B.5.1.1. 10-Year Discharge Charts

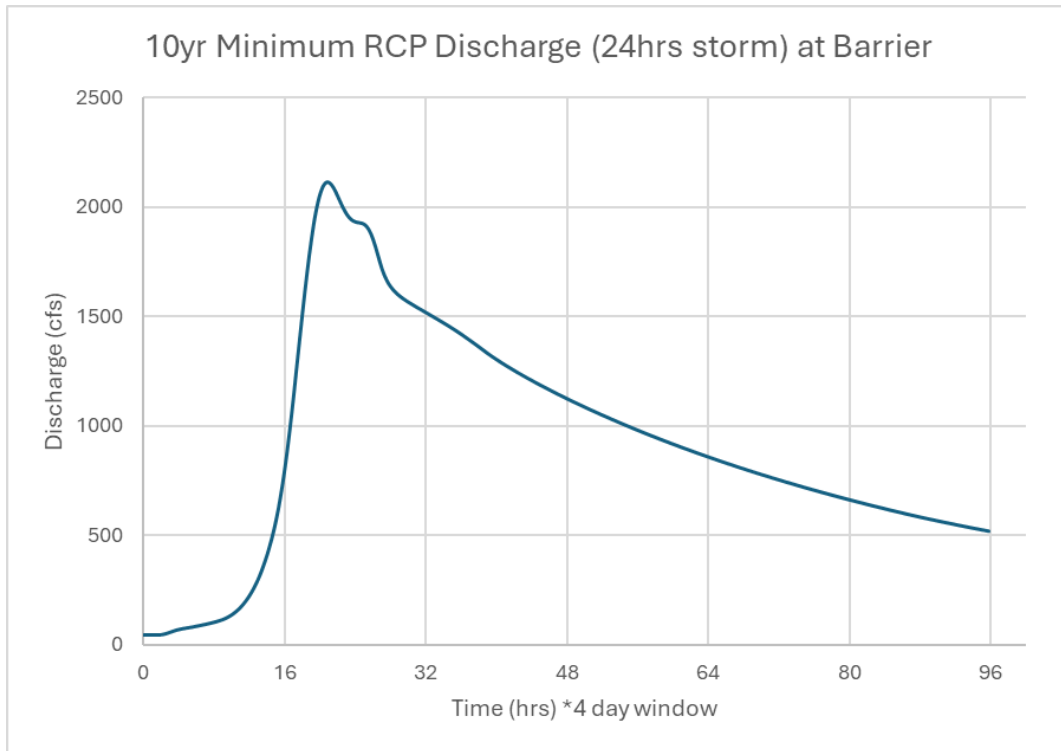


Figure B-19. 10-year minimum RCP discharge (24-hour storm) at barrier.

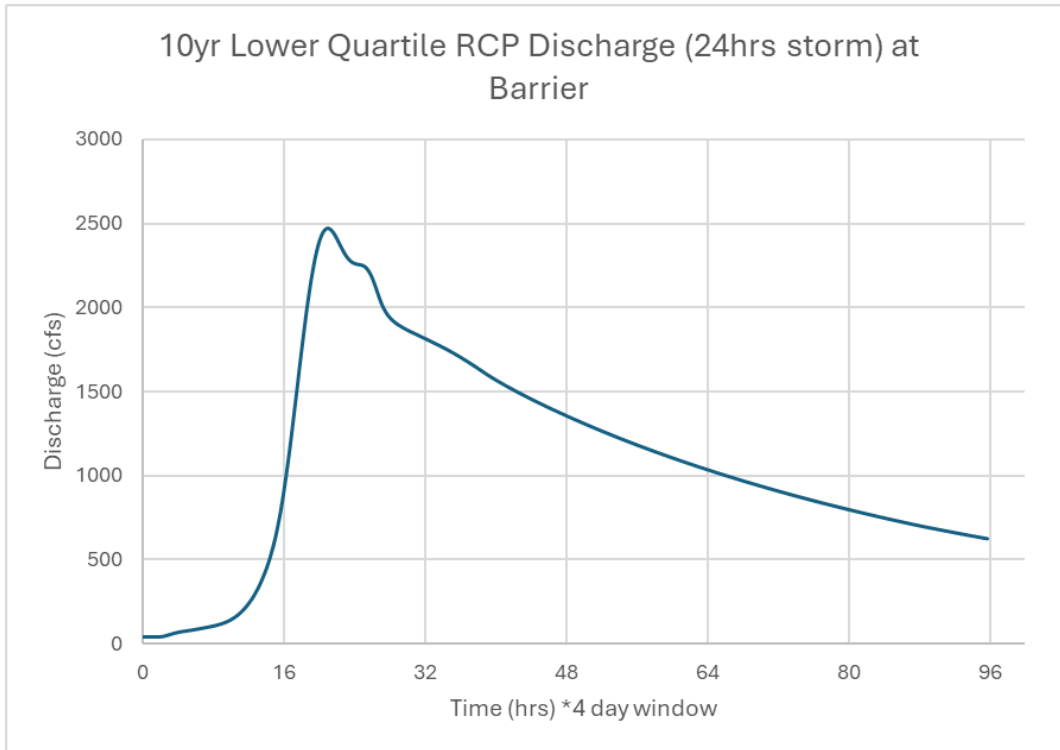


Figure B-20. 10-year lower quartile RCP discharge (24-hour storm) at barrier.

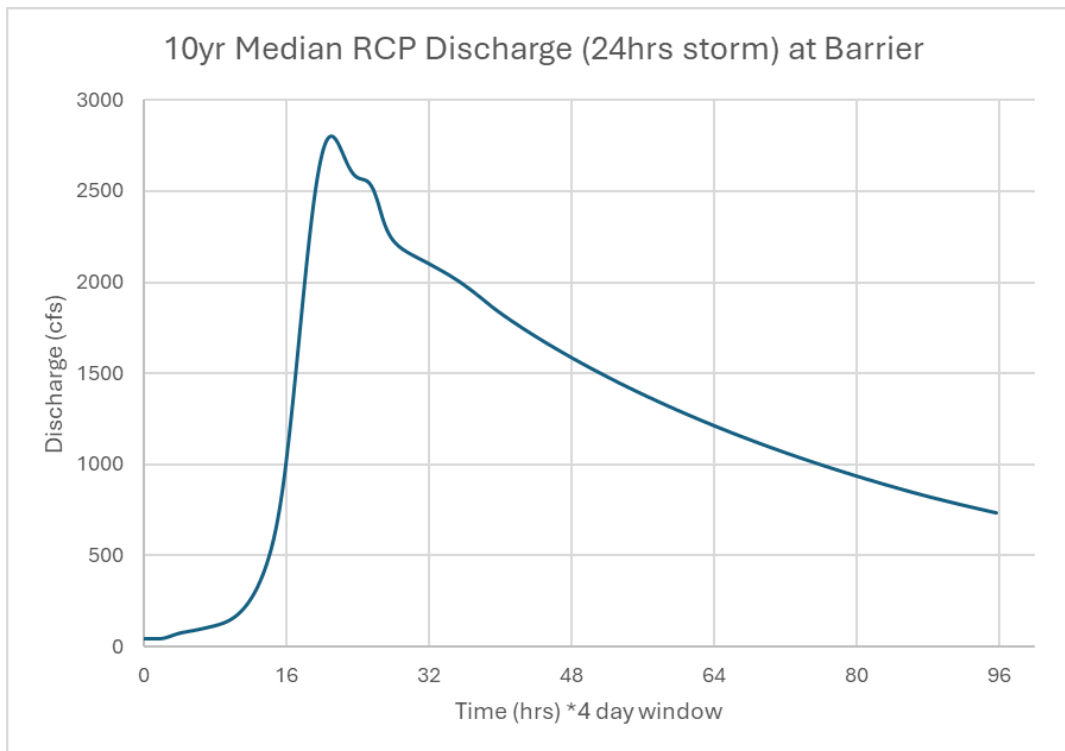


Figure B-21. 10-year median RCP discharge (24-hour storm) at barrier.

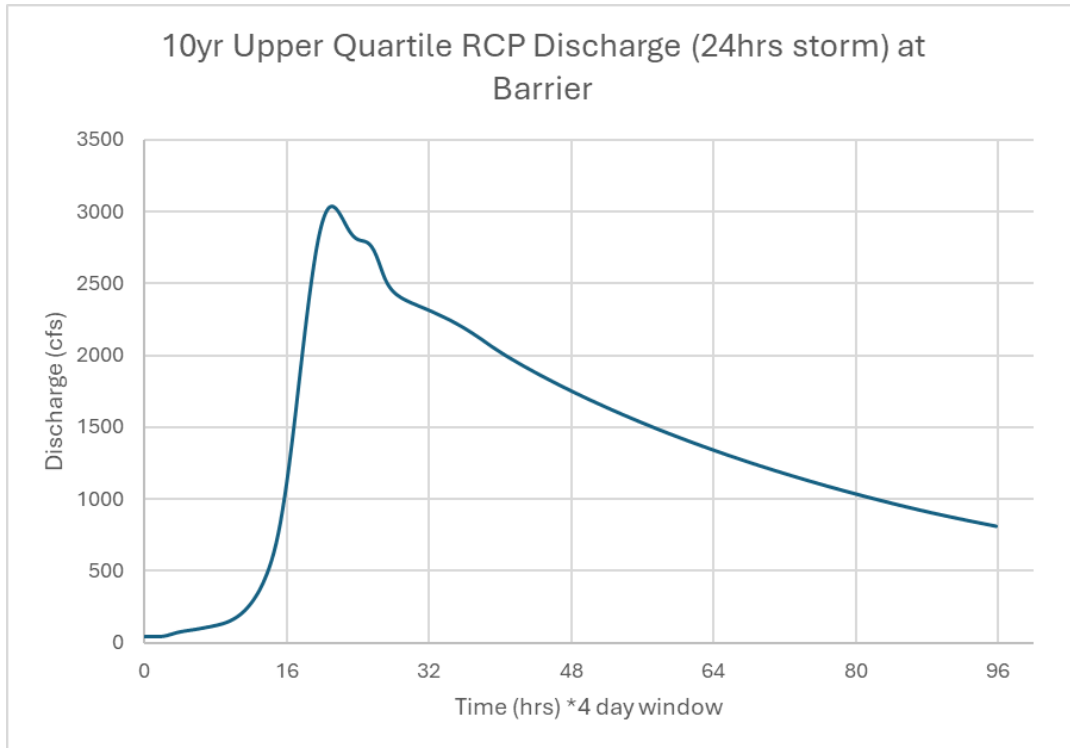


Figure B-22. 10-year upper quartile RCP discharge (24-hour storm) at barrier.

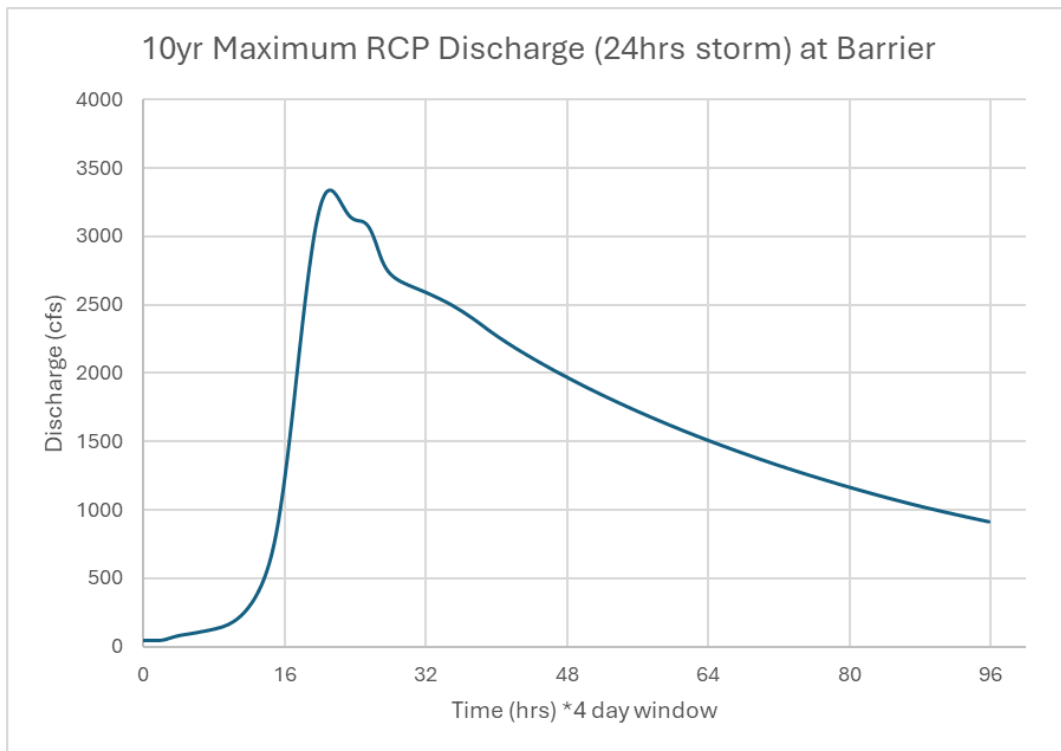


Figure B-23. 10-year maximum RCP discharge (24-hour storm) at barrier.

B.5.1.2. 25-Year Discharge Charts

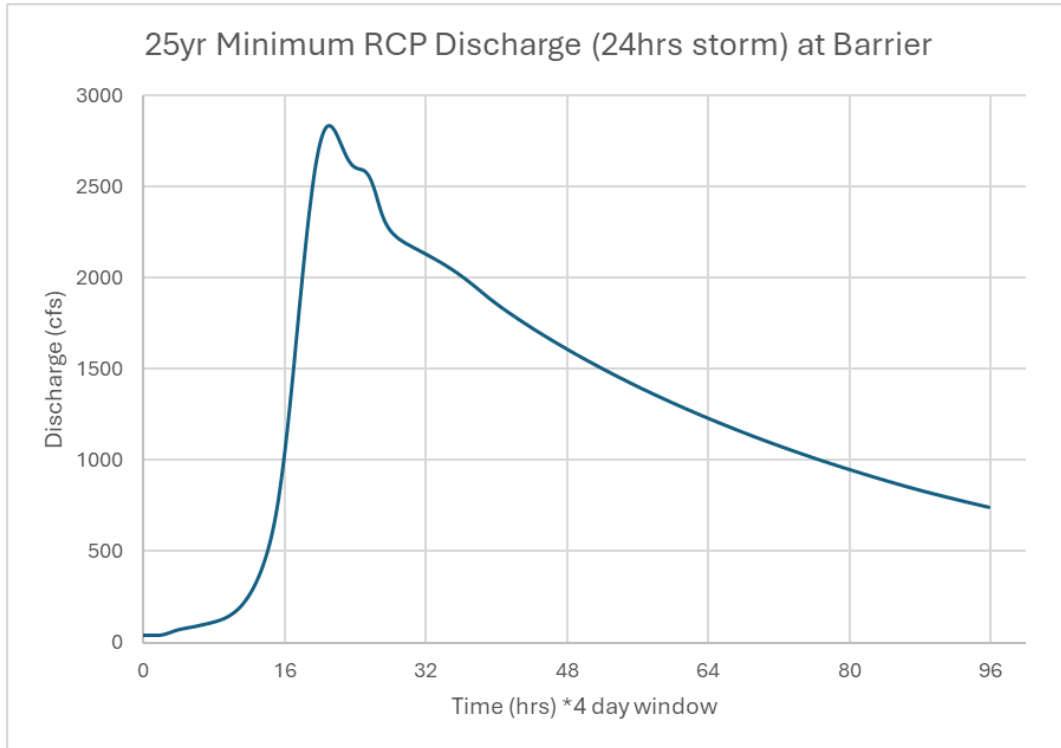


Figure B-24. 25-year minimum RCP discharge (24-hour storm) at barrier.

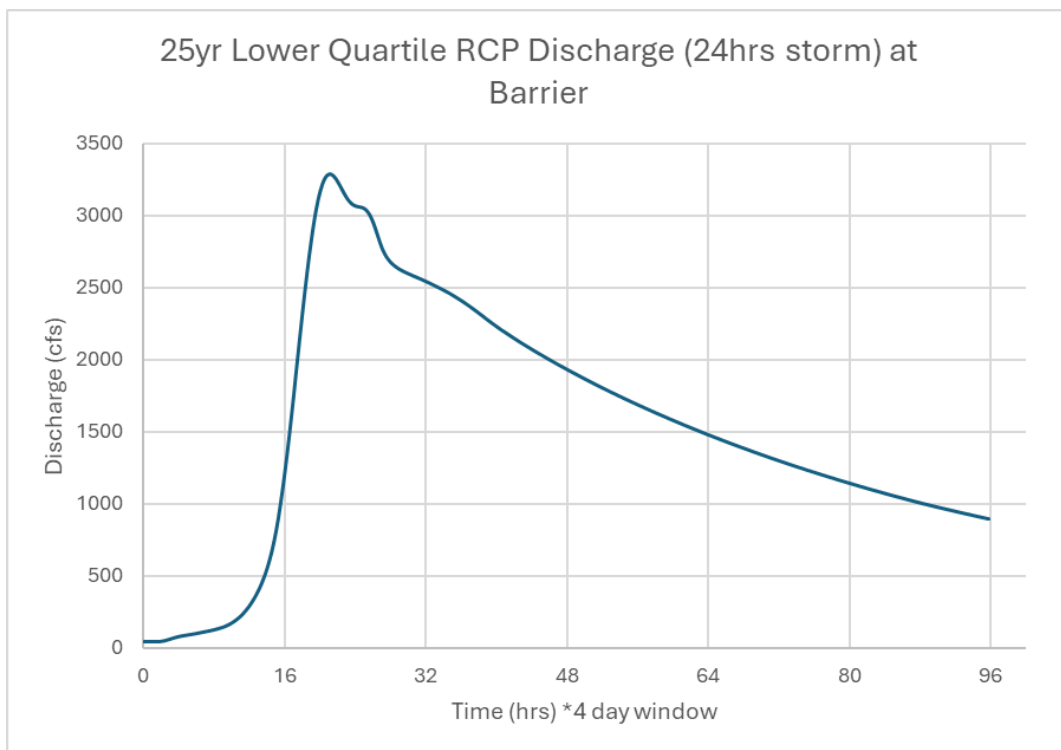


Figure B-25. 25-year lower quartile RCP discharge (24-hour storm) at barrier.

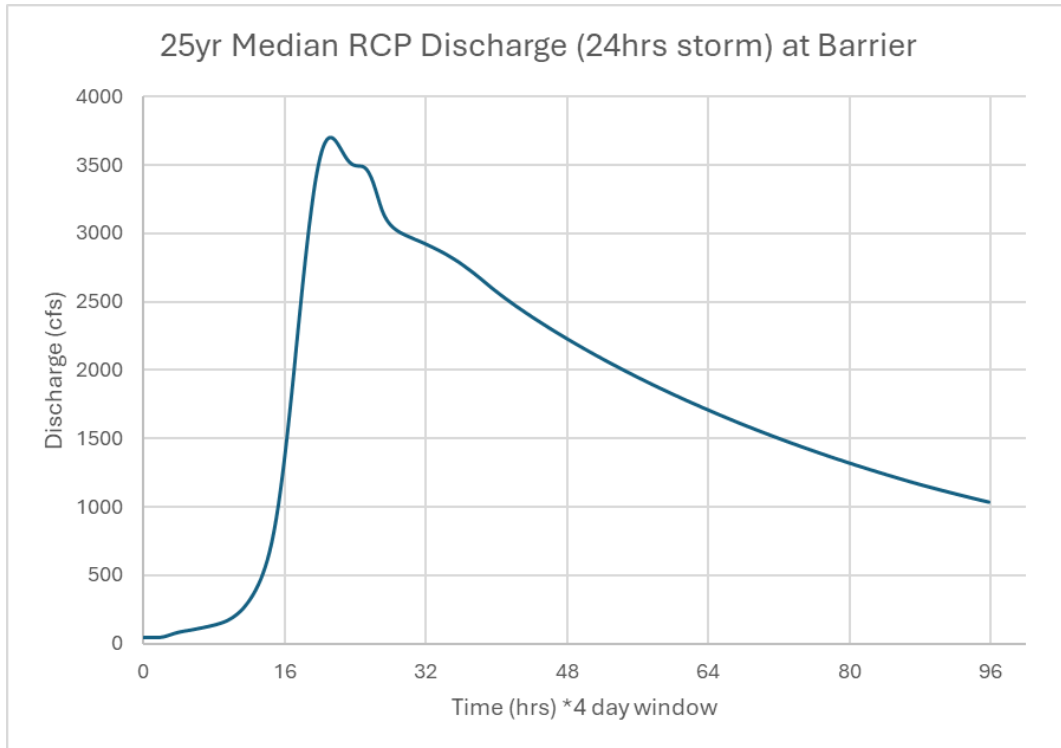


Figure B-26. 25-year median RCP discharge (24-hour storm) at barrier.

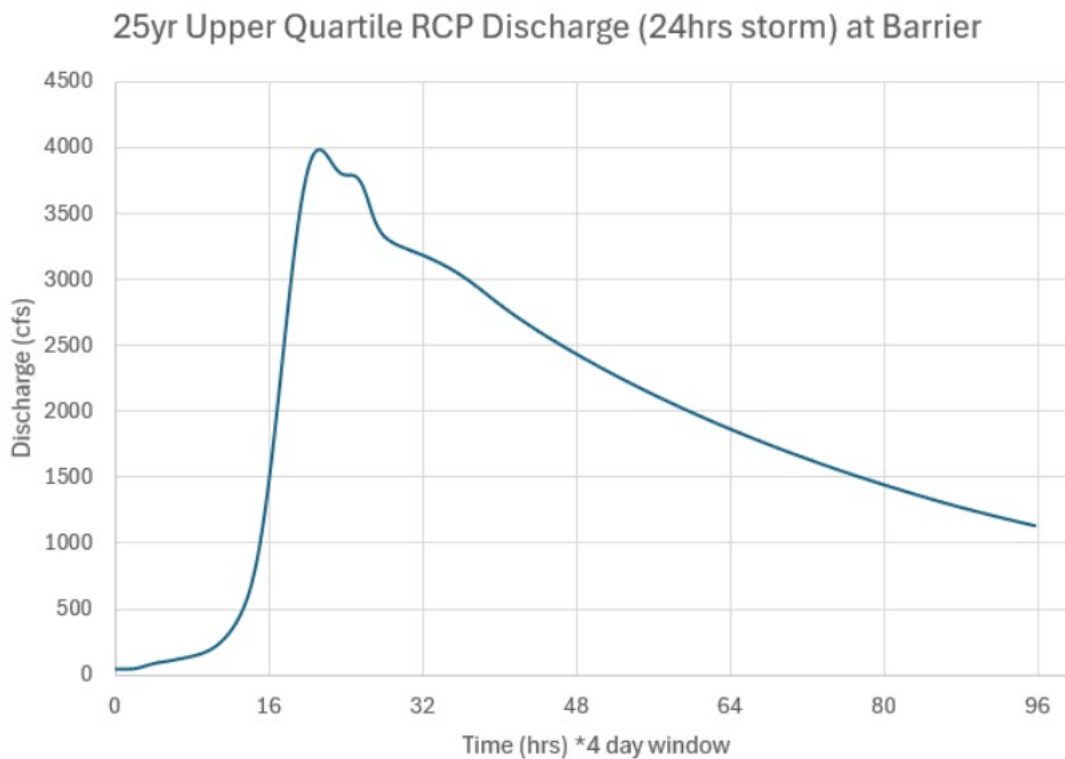


Figure B-27. 25-year upper quartile RCP discharge (24-hour storm) at barrier.

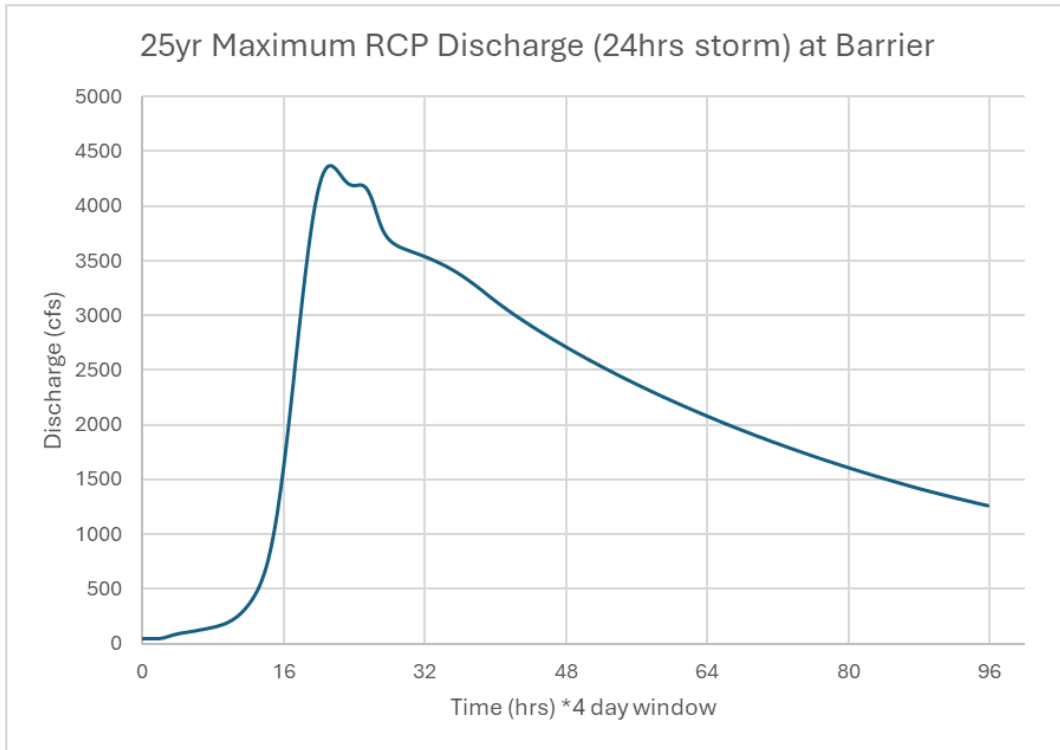


Figure B-28. 25-year maximum RCP discharge (24-hour storm) at barrier.

B.5.1.3. 50-Year Discharge Charts

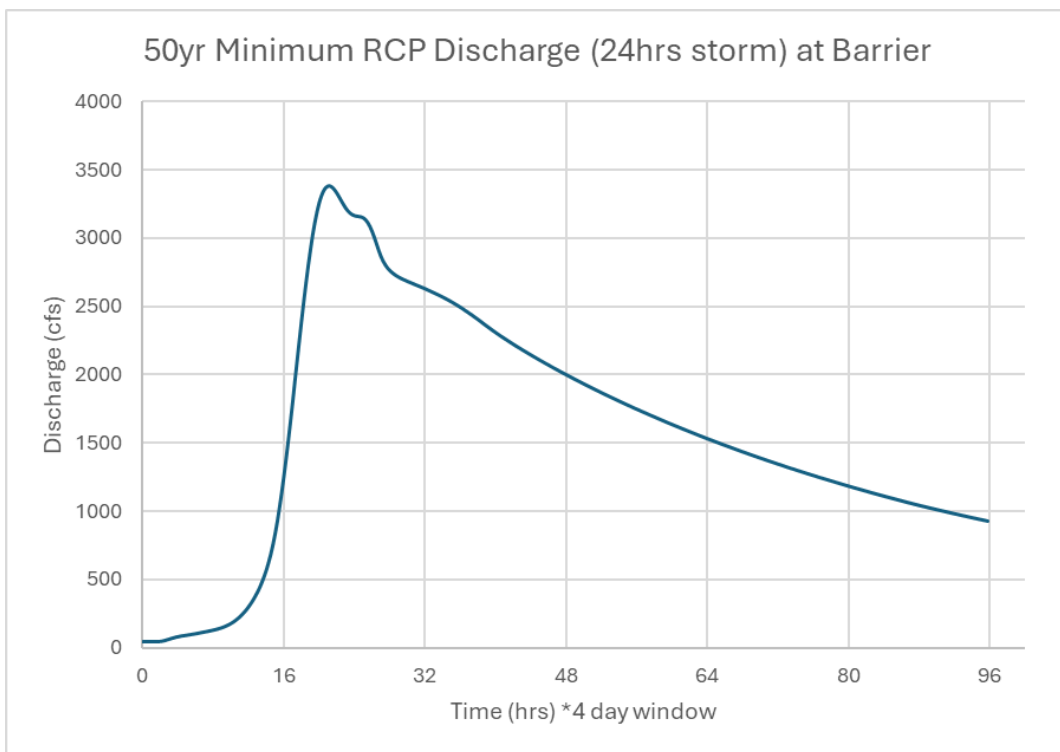


Figure B-29. 50-year minimum RCP discharge (24-hour storm) at barrier.

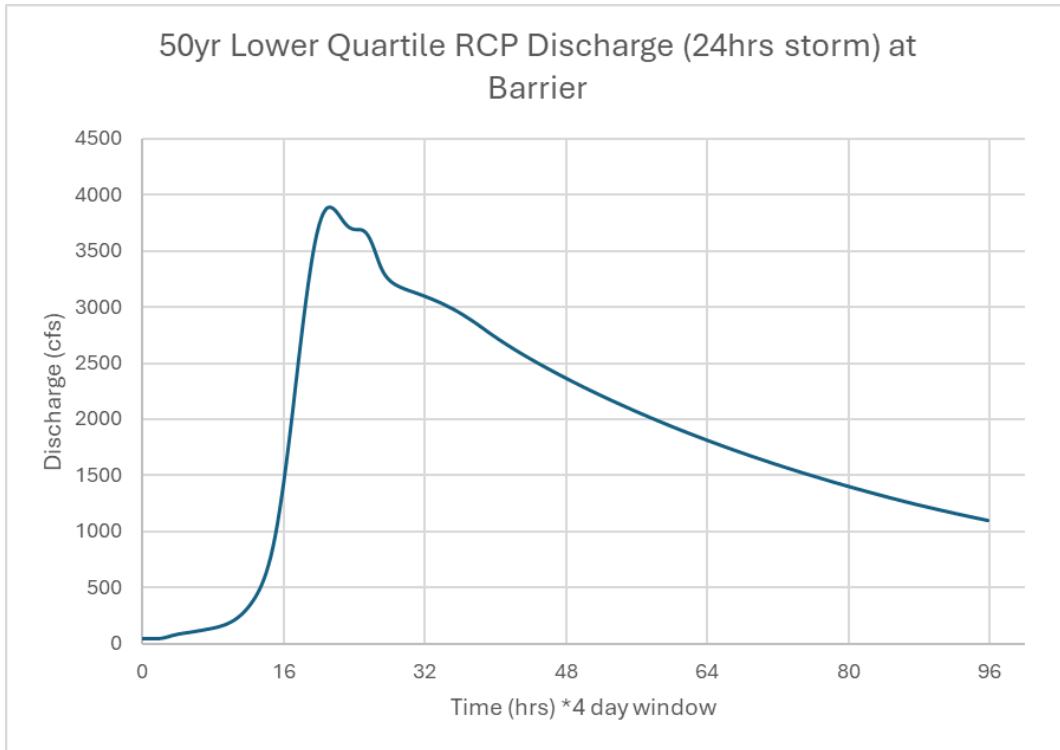


Figure B-30. 50-year lower quartile RCP discharge (24-hour storm) at barrier.

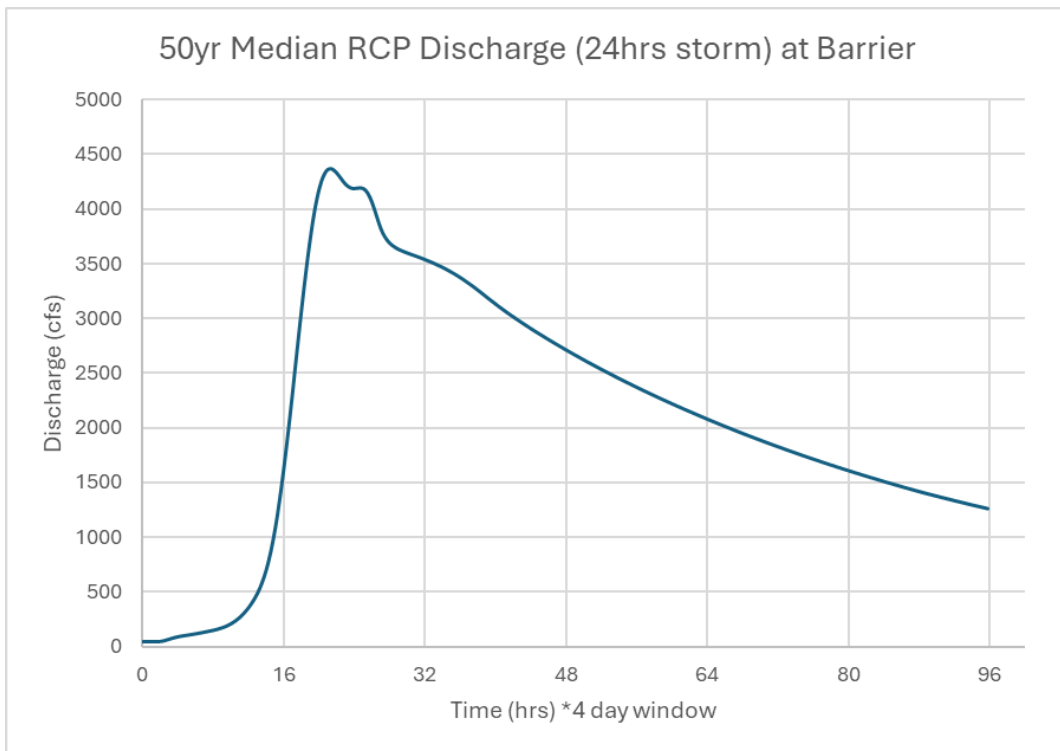


Figure B-31. 50-year median RCP discharge (24-hour storm) at barrier.

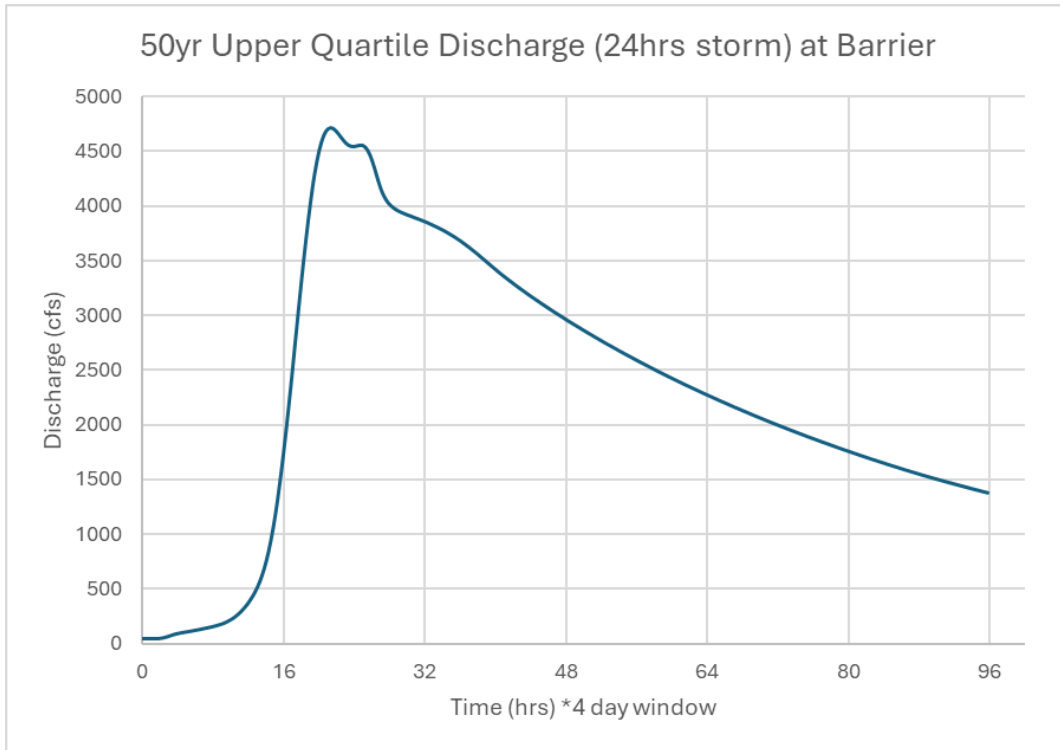


Figure B-32. 50-year upper quartile discharge (24-hour storm) at barrier.

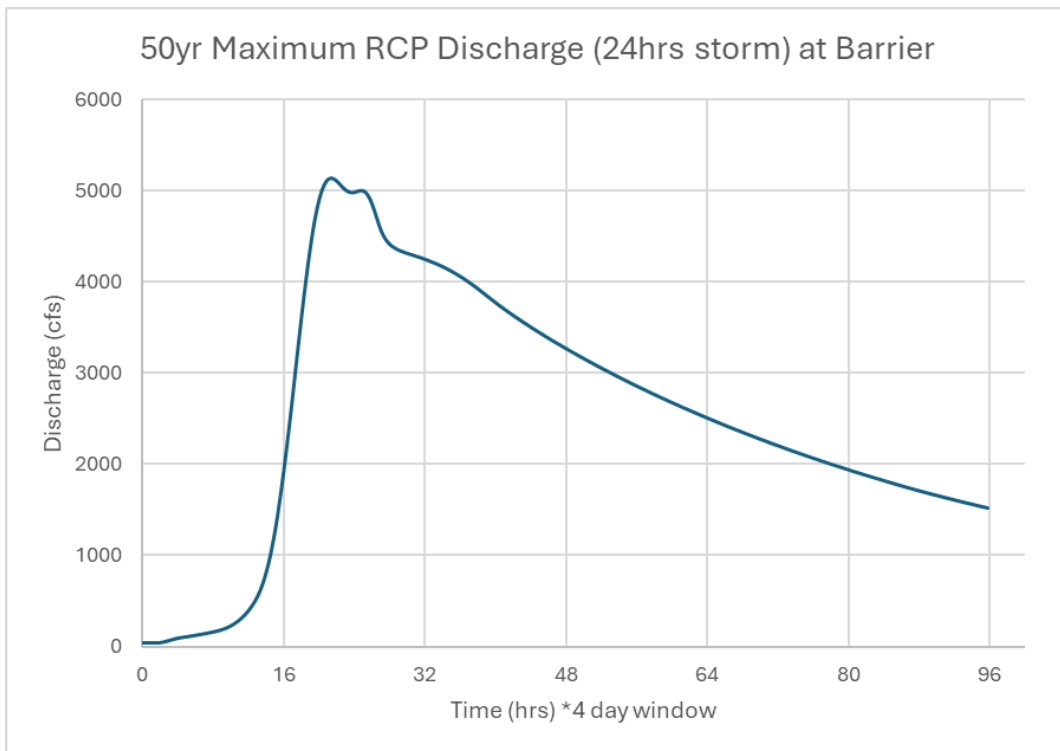


Figure B-33. 50-year maximum RCP discharge (24-hour storm) at barrier.

B.5.1.4. 100-Year Discharge Charts

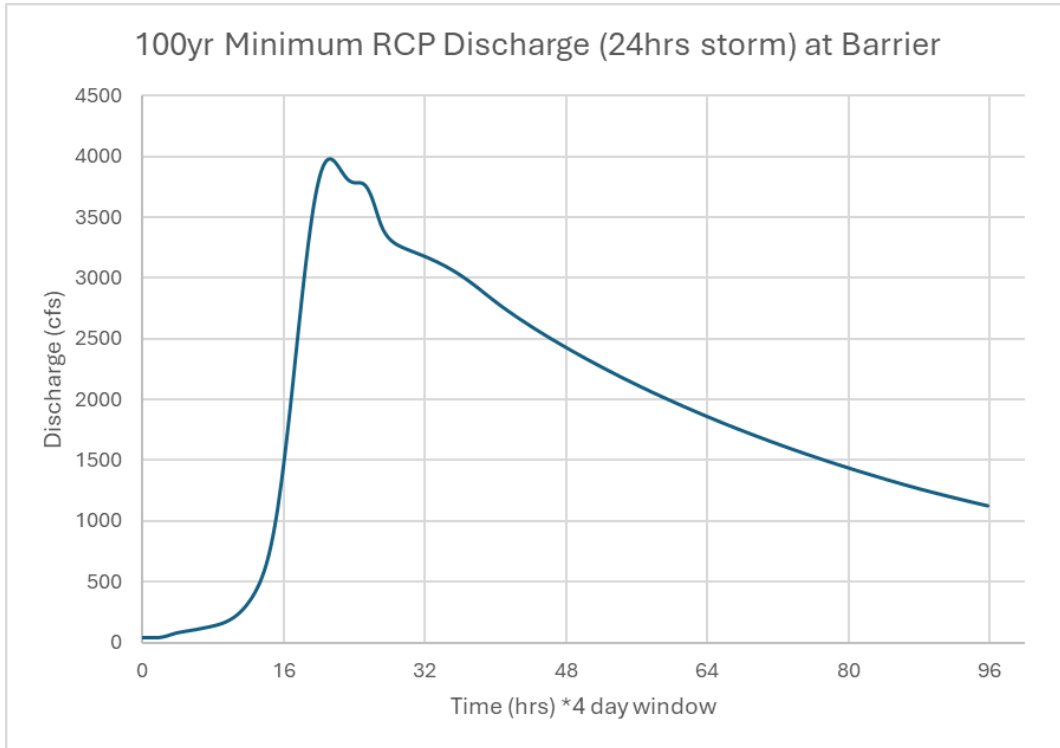


Figure B-34. 100-year minimum RCP discharge (24-hour storm) at barrier.

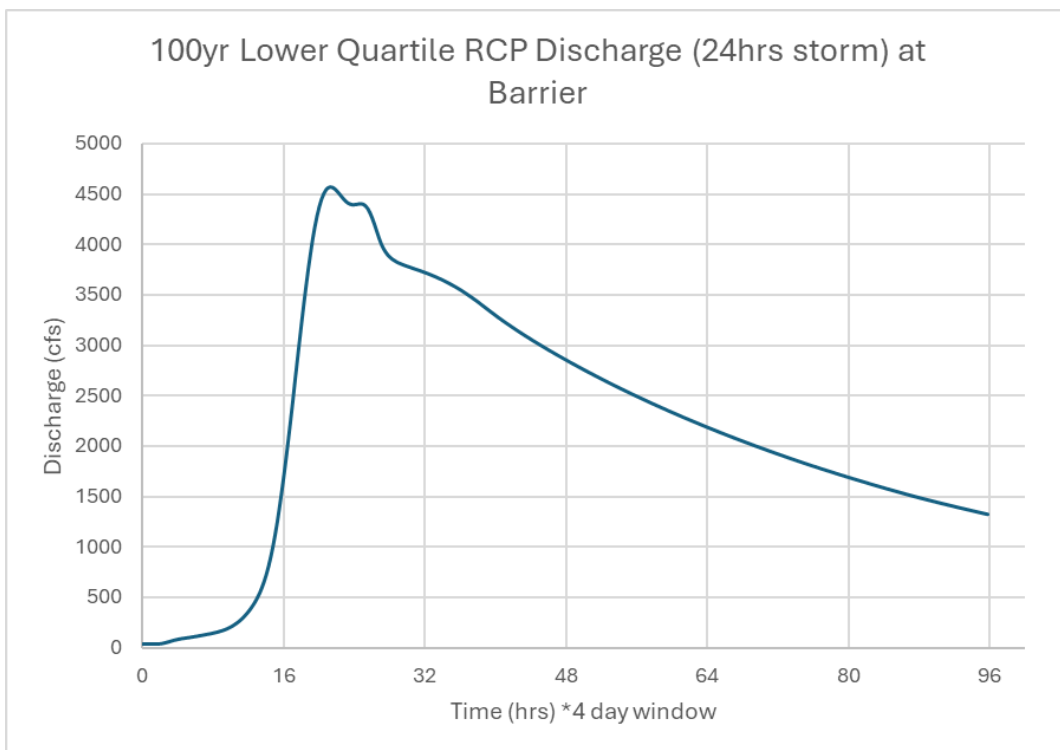


Figure B-35. 100-year lower quartile RCP discharge (24-hour storm) at barrier.

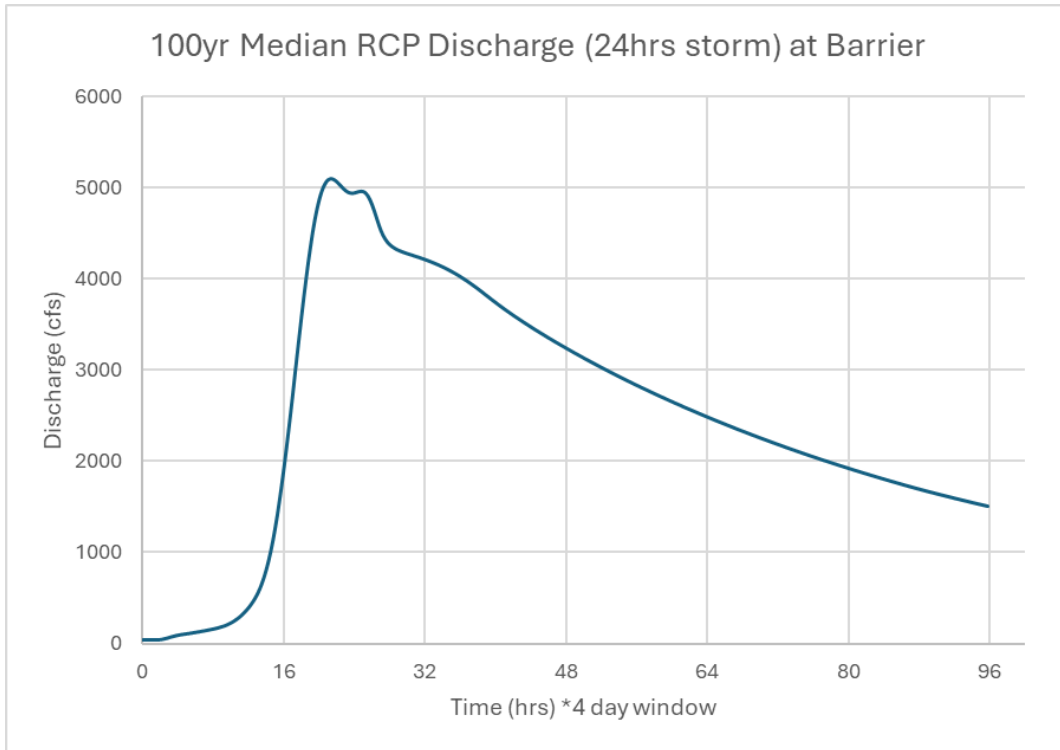


Figure B-36. 100-year median RCP discharge (24-hour storm) at barrier.

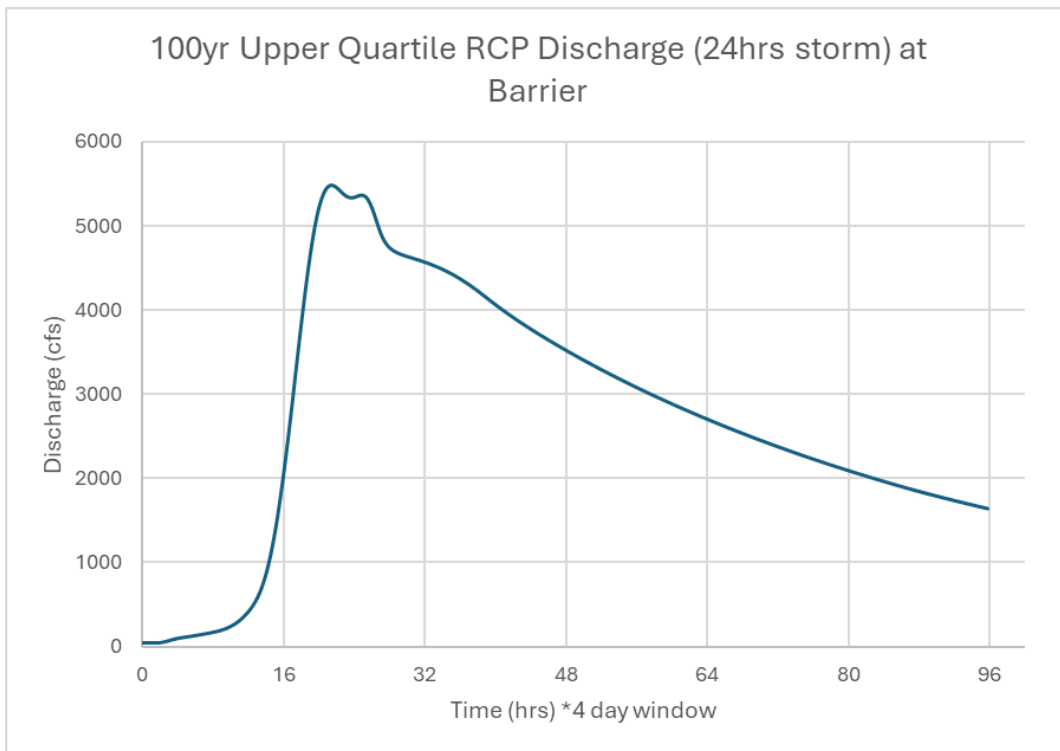


Figure B-37. 100-year upper quartile RCP discharge (24-hour storm) at barrier.

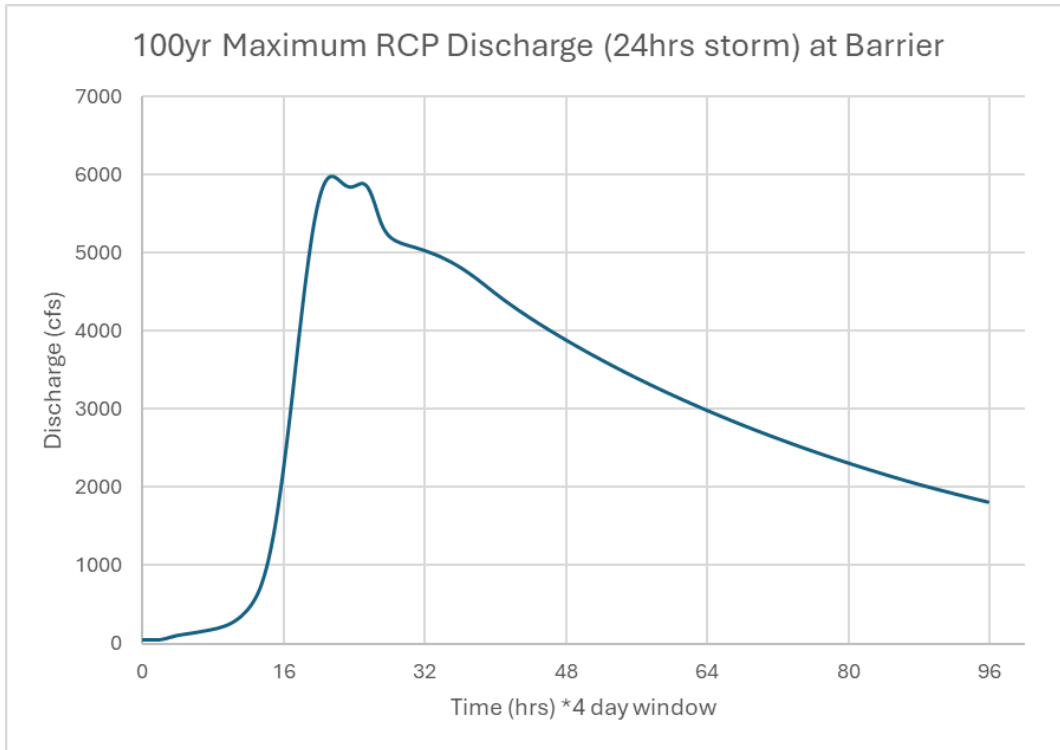


Figure B-38. 100-year maximum RCP discharge (24-hour storm) at barrier.

B.5.1.5. 500-Year Discharge Charts

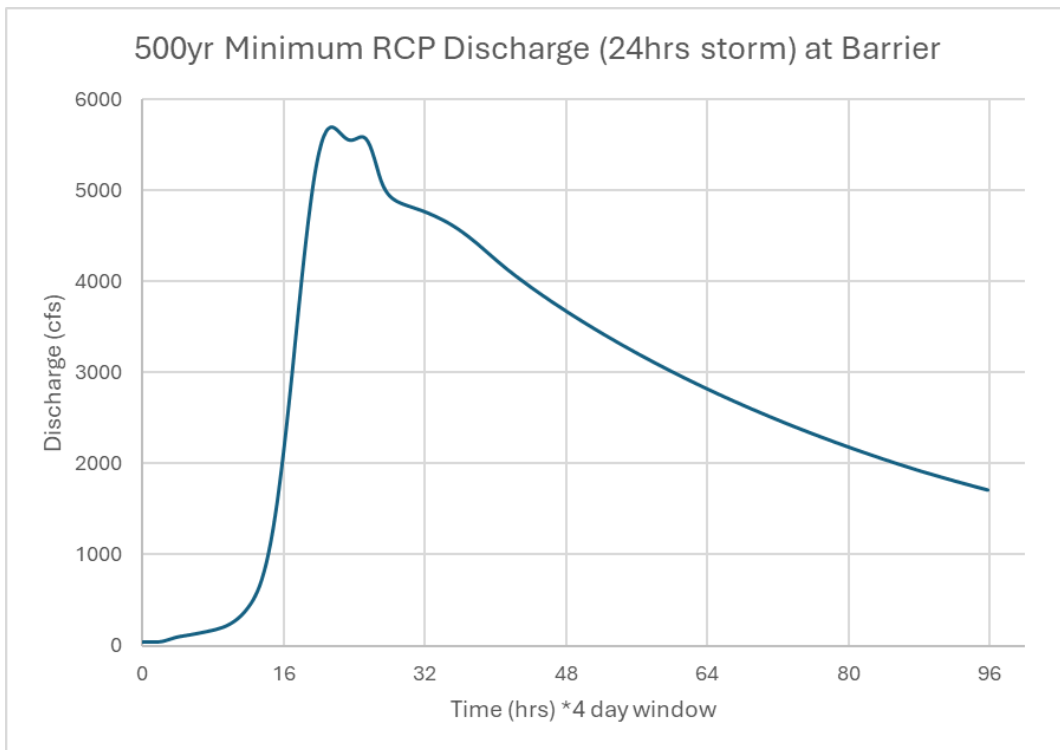


Figure B-39. 500-year minimum RCP discharge (24-hour storm) at barrier.

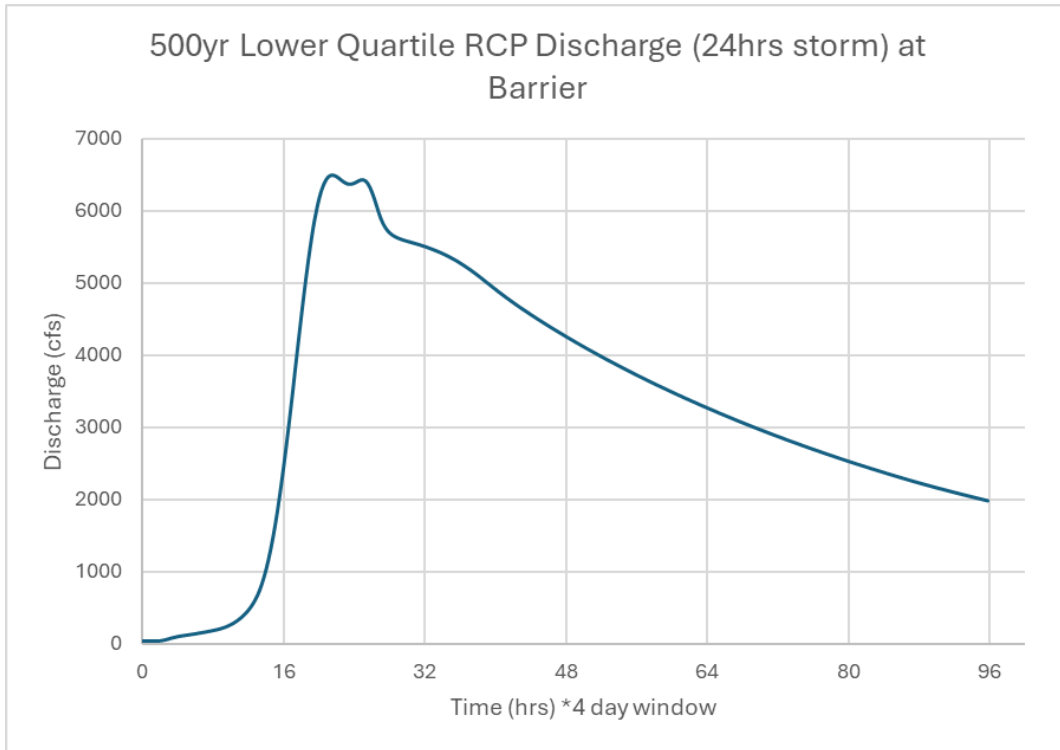


Figure B-40. 500-year lower quartile RCP discharge (24-hour storm) at barrier.

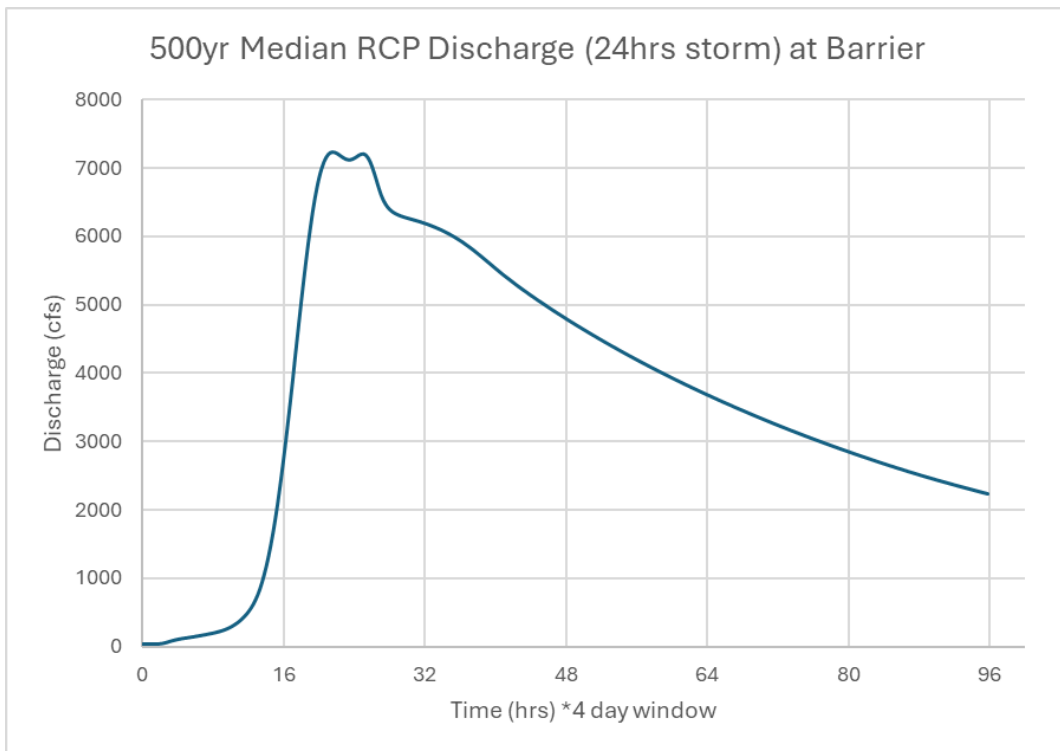


Figure B-41. 500-year median RCP discharge (24-hour storm) at barrier.

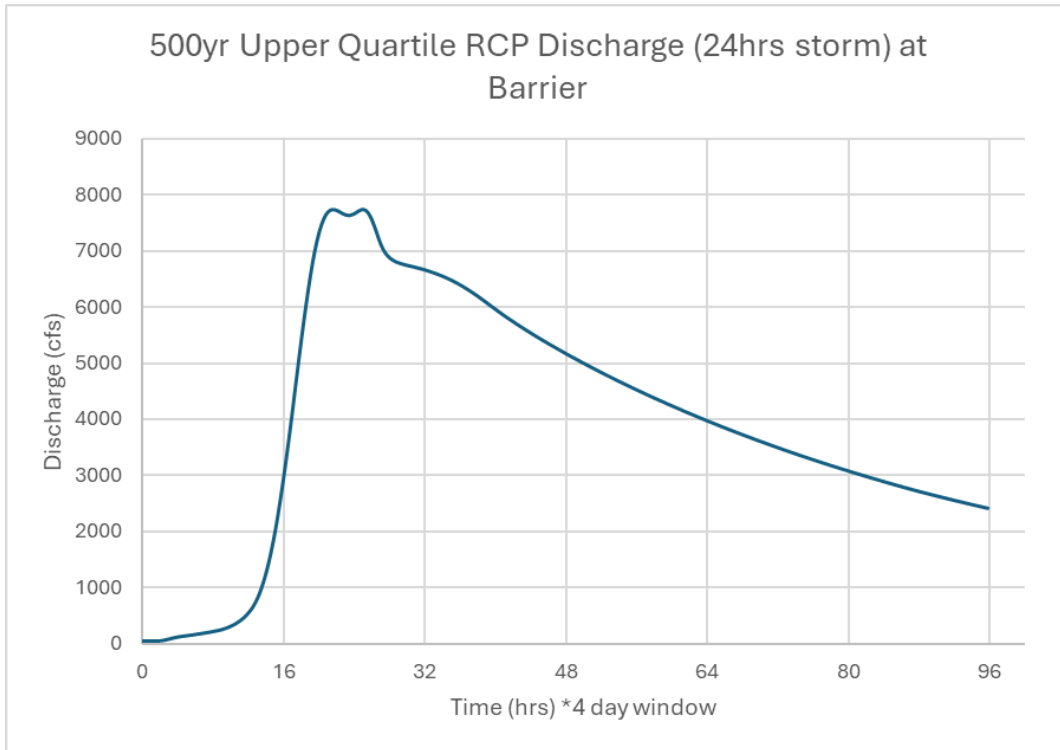


Figure B-42. 500-year upper quartile RCP discharge (24-hour storm) at barrier.

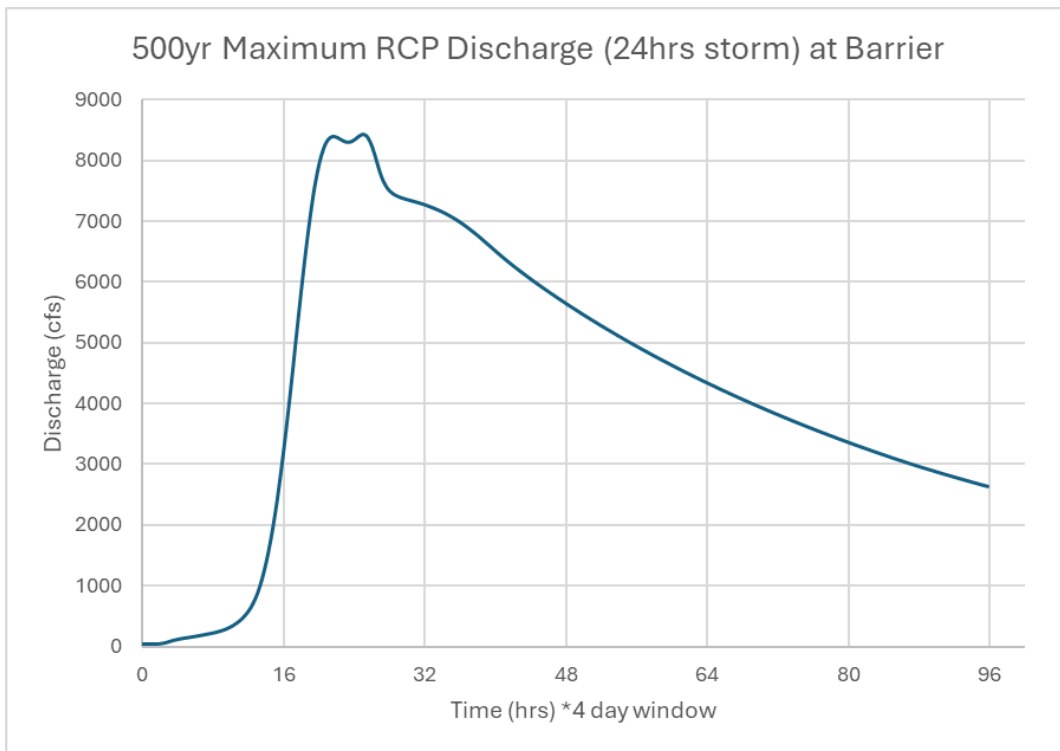


Figure B-43. 500-year maximum RCP discharge (24-hour storm) at barrier.

B.5.2. 72-Hour Storm Charts

B.5.2.1. 10-Year Discharge Charts

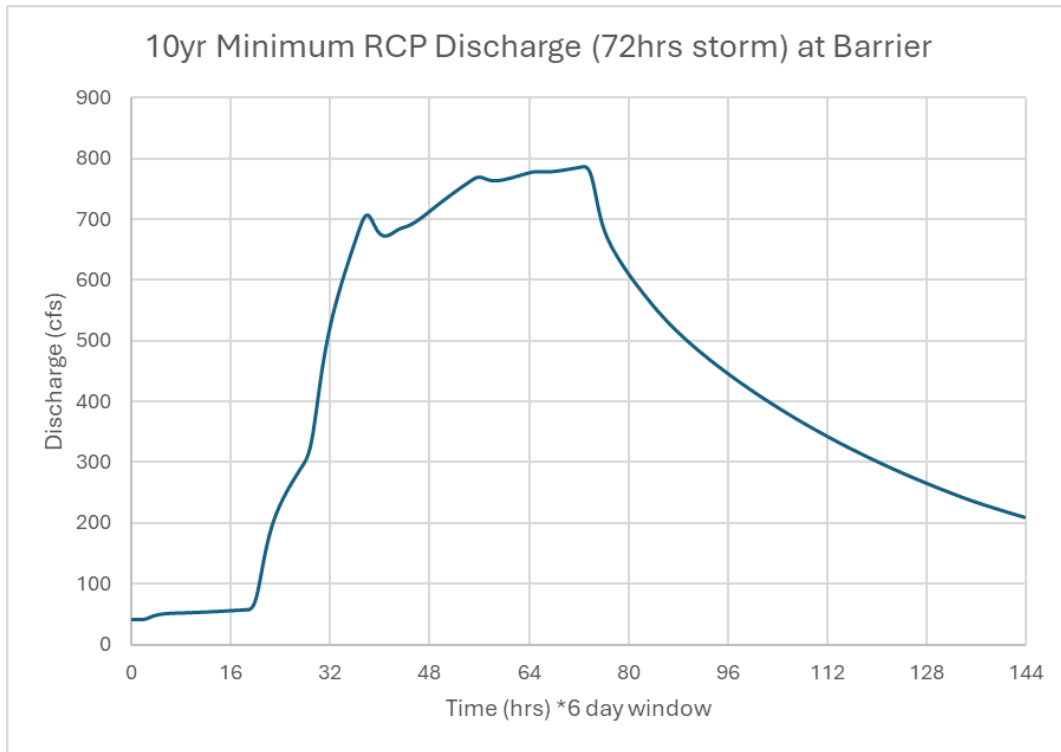


Figure B-44. 10-year minimum RCP discharge (72-hour storm) at barrier.

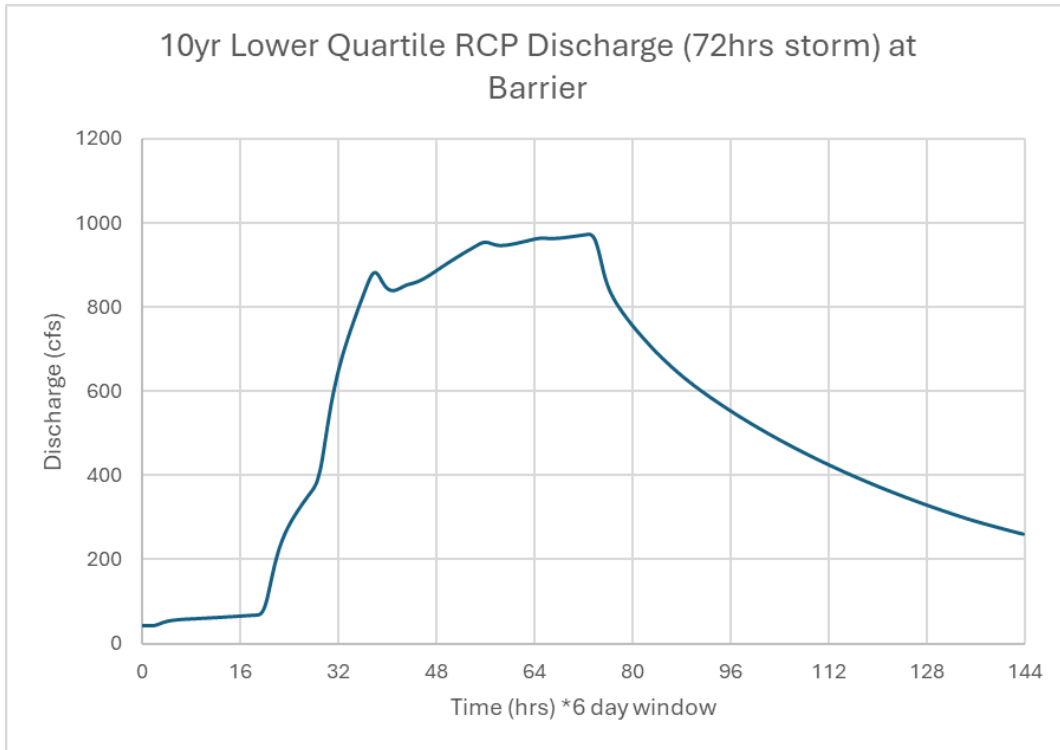


Figure B-45. 10-year lower quartile RCP discharge (72-hour storm) at barrier.

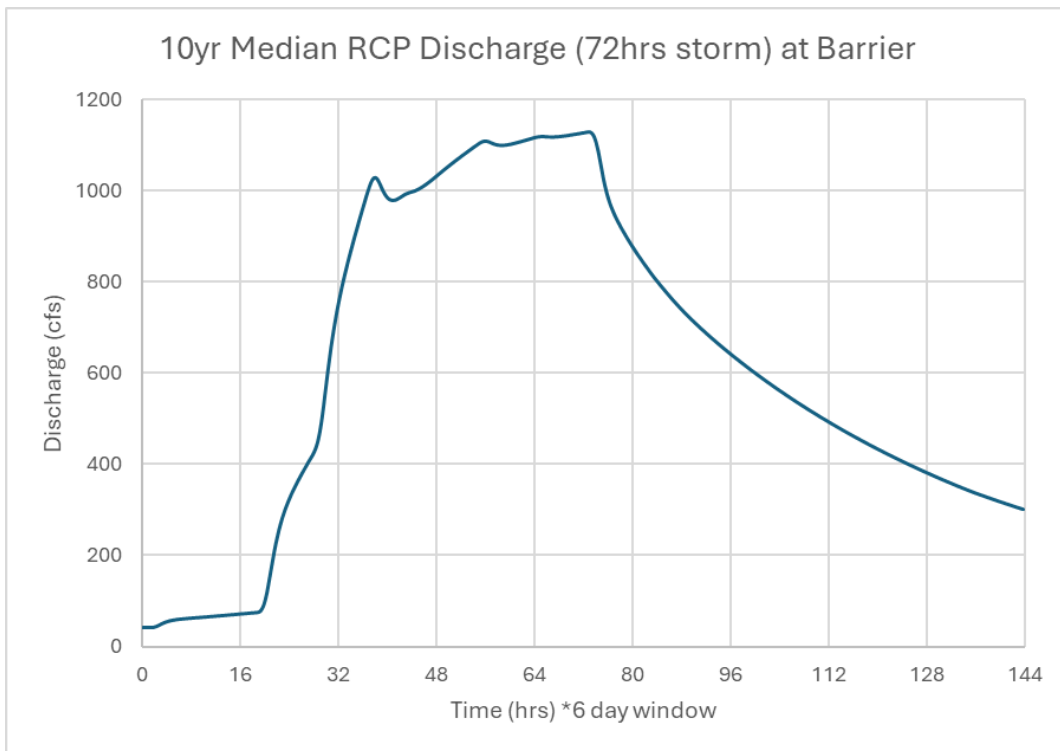


Figure B- 46. 10-year median RCP discharge (72-hour storm) at barrier.

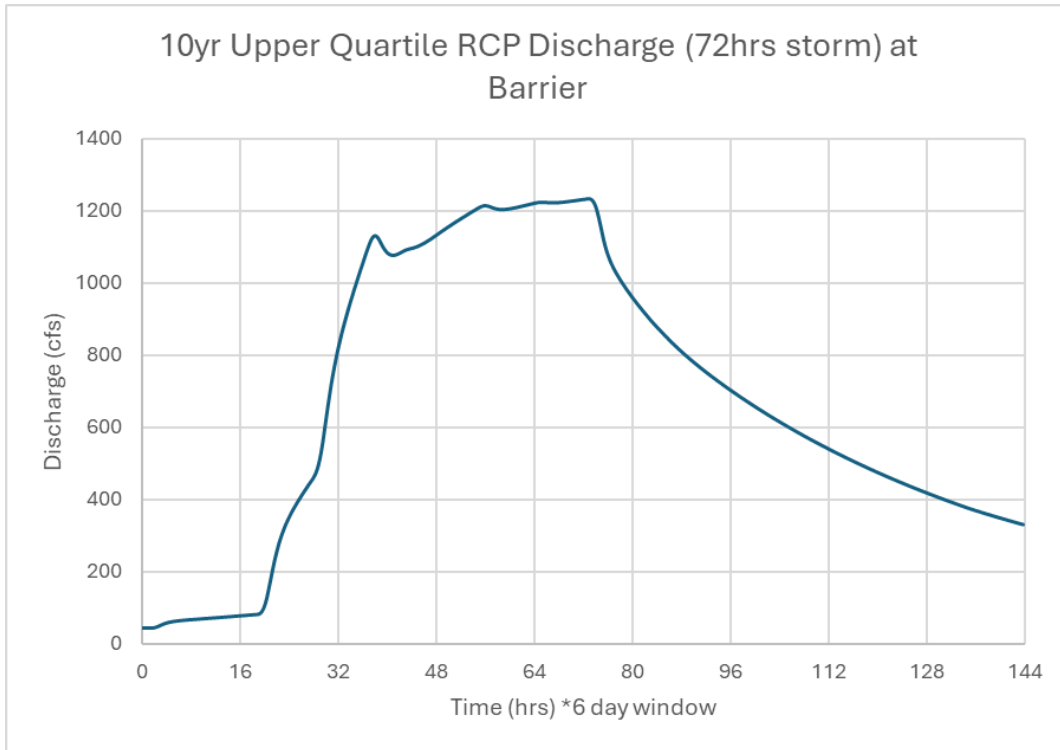


Figure B-47. 10-year upper quartile RCP discharge (72-hour storm) at barrier.

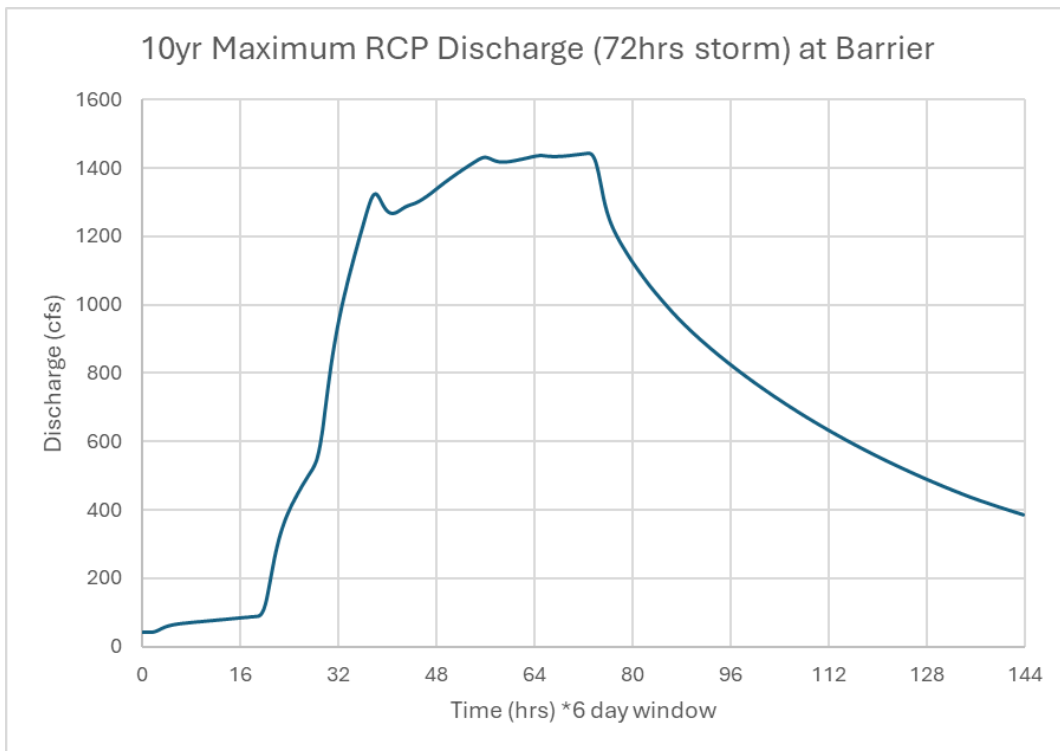


Figure B-48. 10-year maximum RCP discharge (72-hour storm) at barrier.

B.5.2.2. 25-Year Discharge Charts

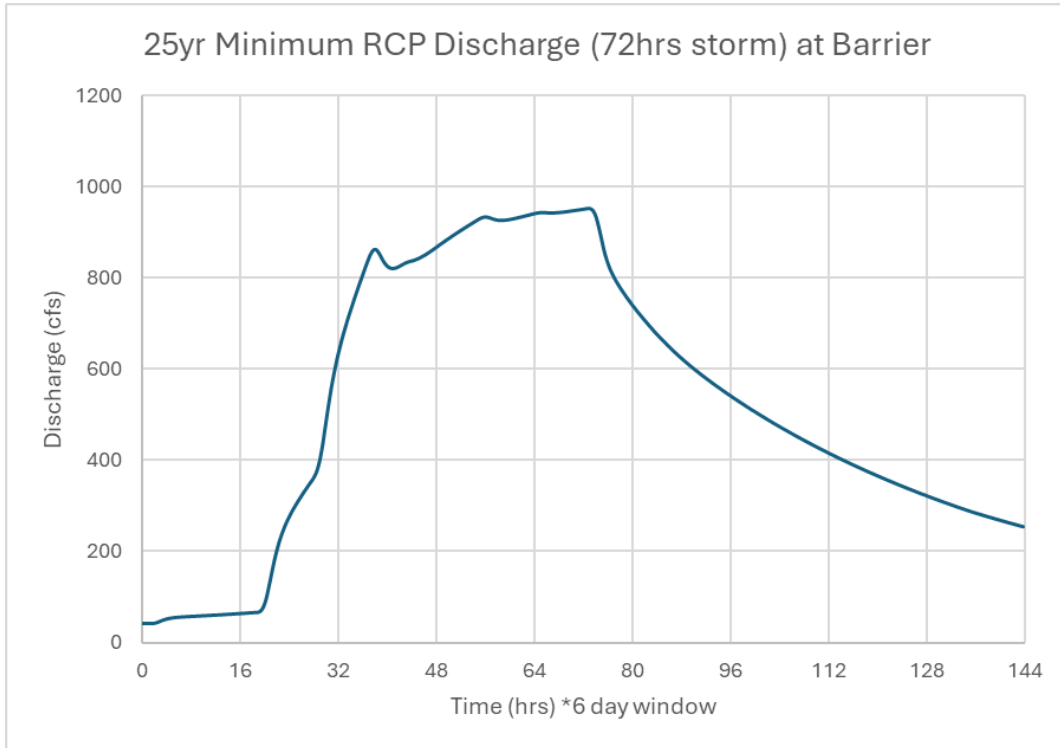


Figure B-49. 25-year minimum RCP discharge (72-hour storm) at barrier.

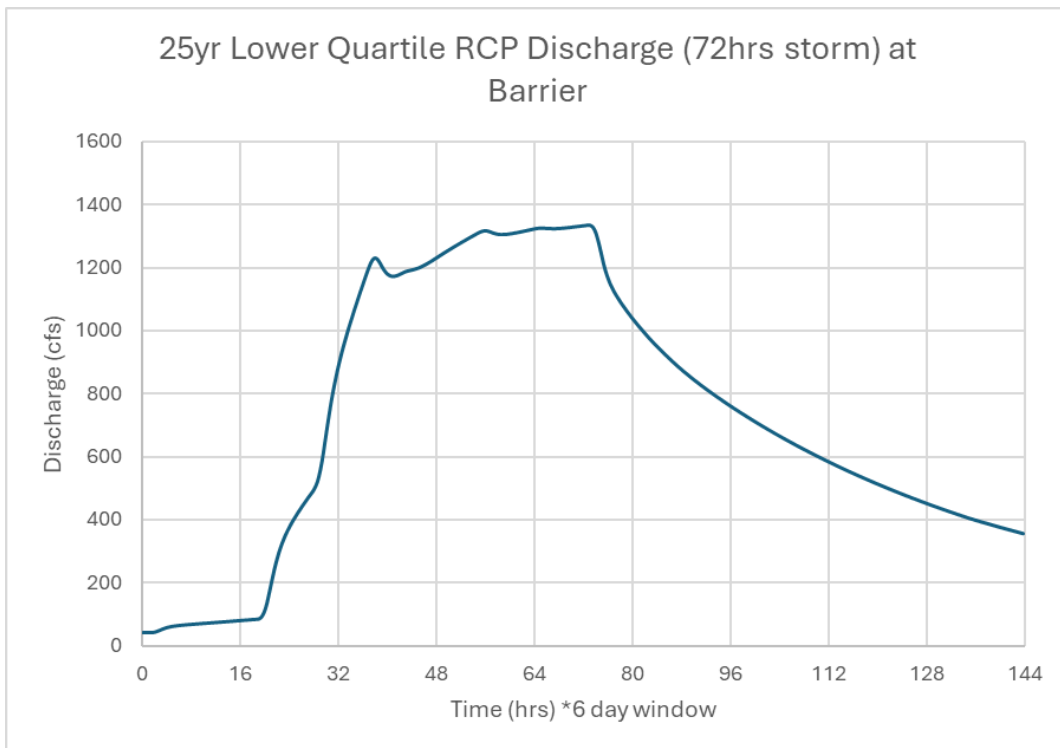


Figure B-50. 25-year lower quartile RCP discharge (72-hour storm) at barrier.

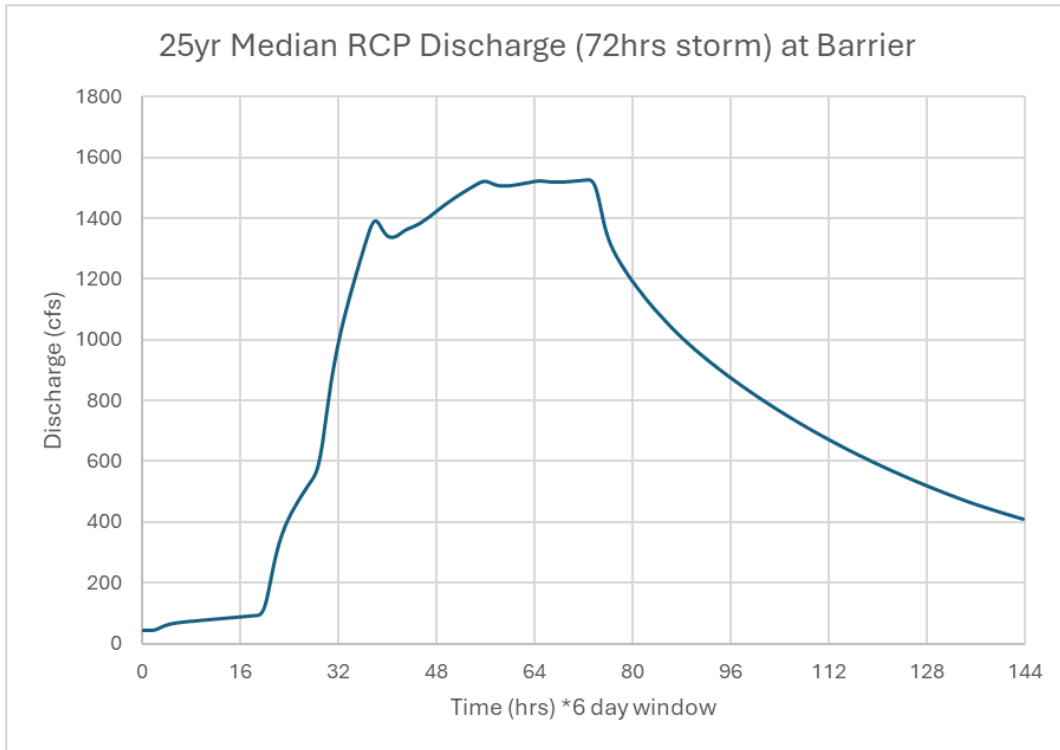


Figure B-51. 25-year median RCP discharge (72-hour storm) at barrier.

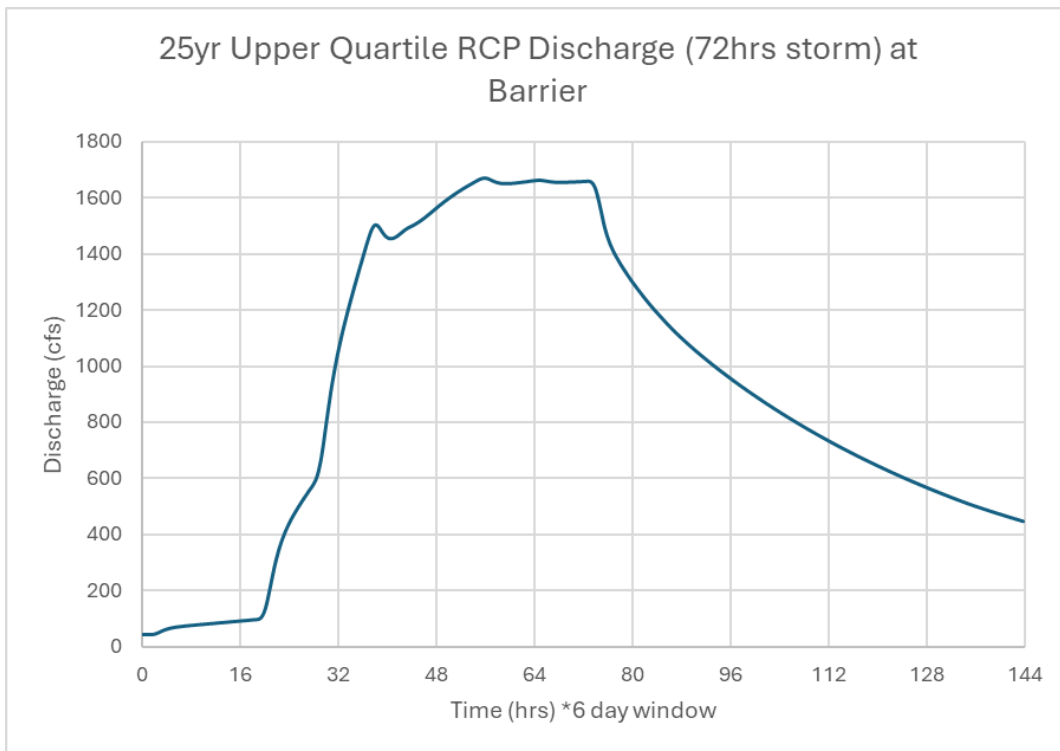


Figure B- 52. 25-year upper quartile RCP discharge (72-hour storm) at barrier.

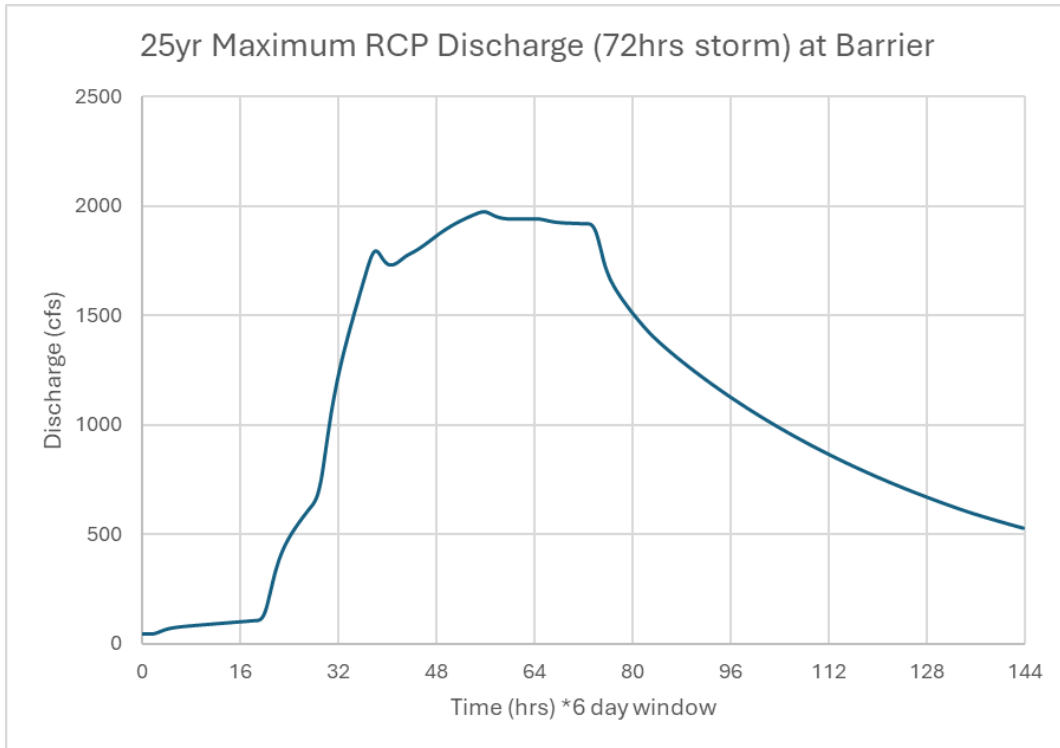


Figure B-53. 25-year maximum RCP discharge (72-hour storm) at barrier.

B.5.2.3. 50-Year Discharge Charts

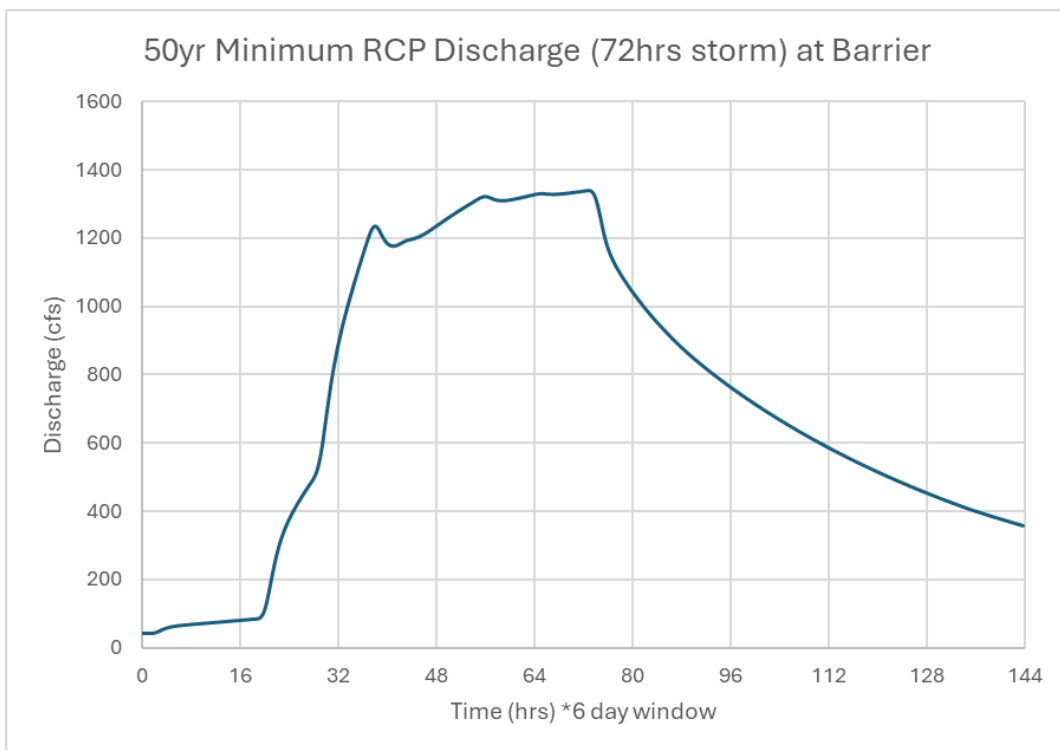


Figure B-54. 50-year minimum RCP discharge (72-hour storm) at barrier.

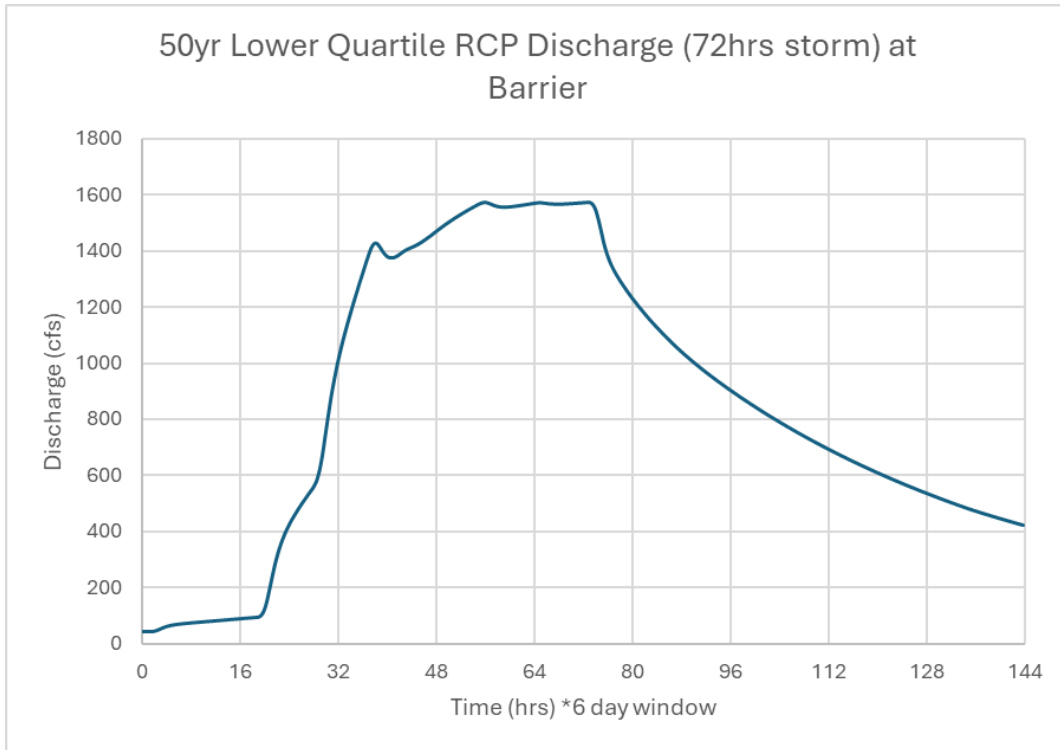


Figure B-55. 50-year lower quartile RCP discharge (72-hour storm) at barrier.

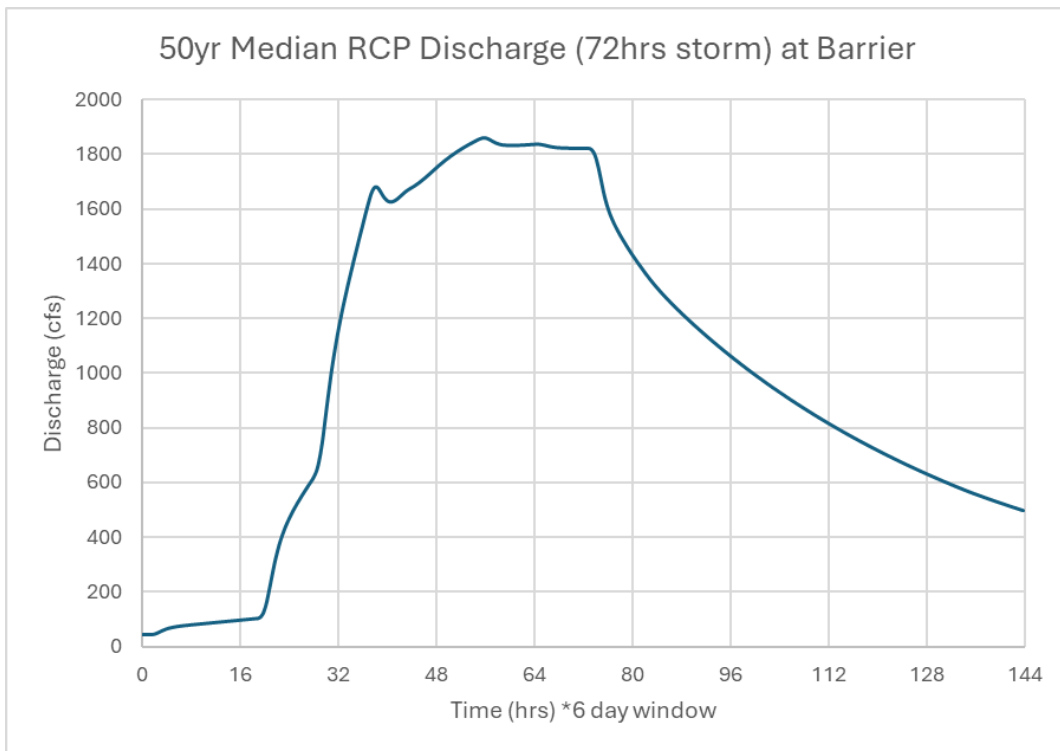


Figure B-56. 50-year median RCP discharge (72-hour storm) at barrier.

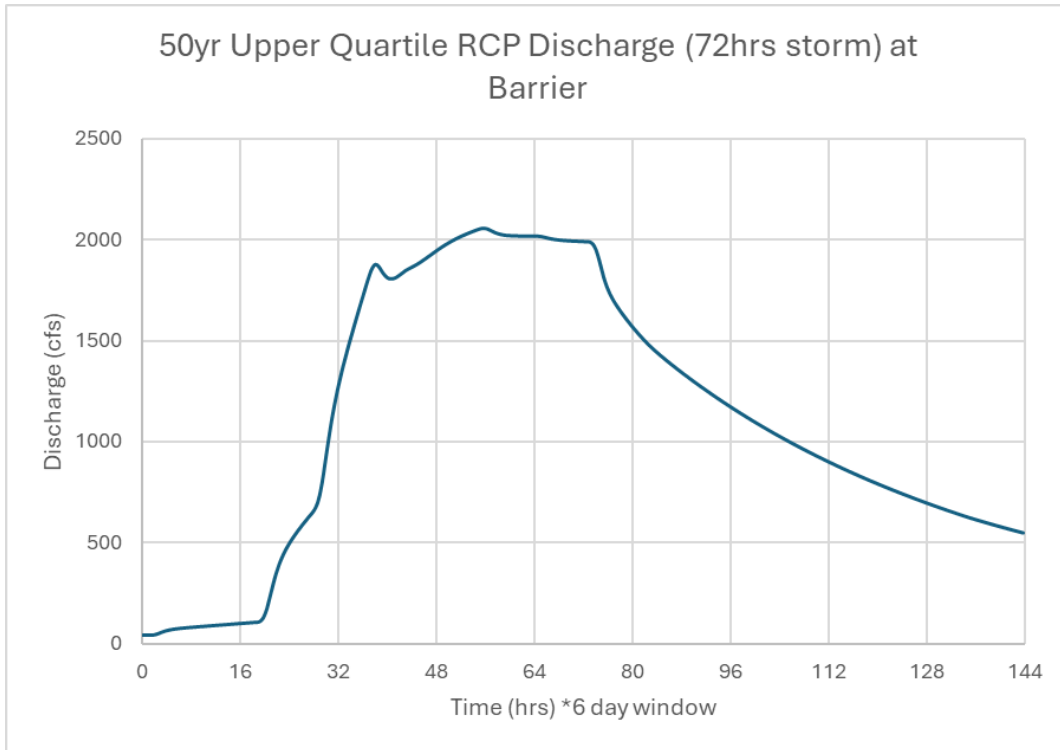


Figure B-57. 50-year upper quartile RCP discharge (72-hour storm) at barrier.

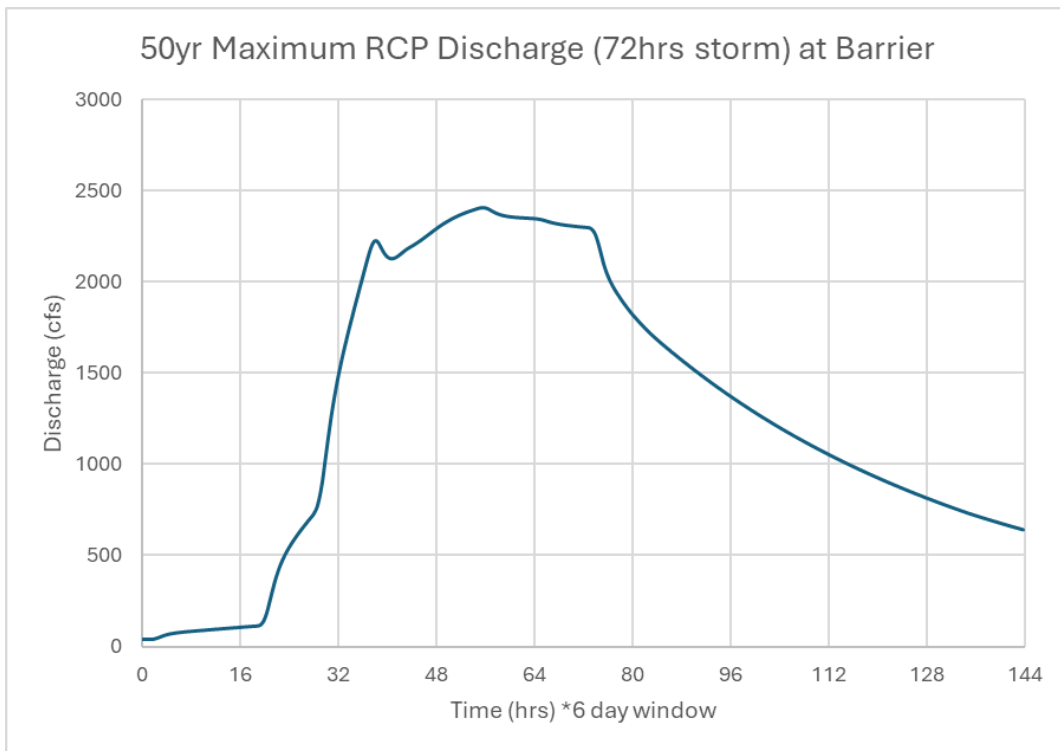


Figure B-58. 50-year maximum RCP discharge (72-hour storm) at barrier.

B.5.2.4. 100-Year Discharge Charts

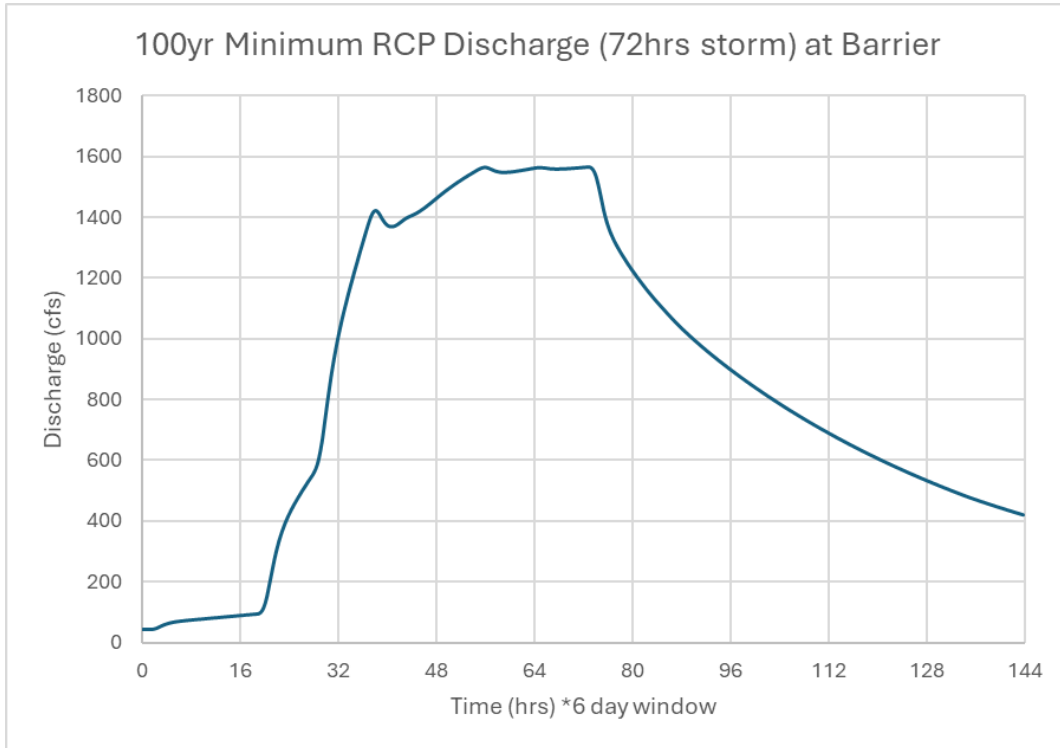


Figure B-59. 100-year minimum RCP discharge (72-hour storm) at barrier.

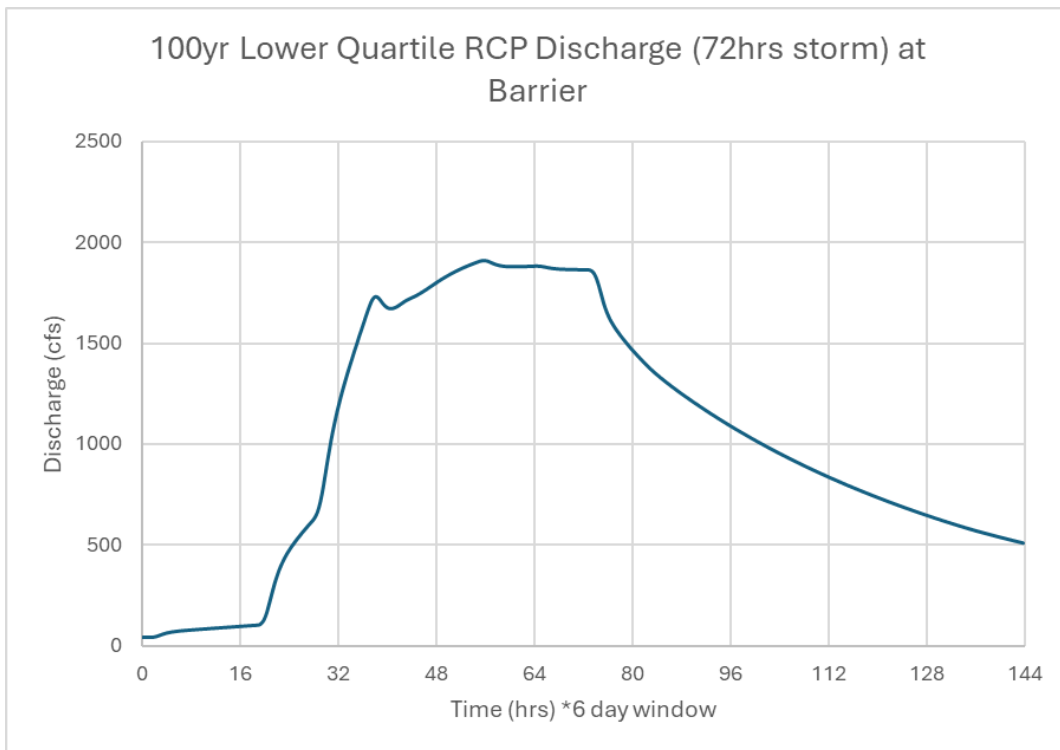


Figure B-60. 100-year lower quartile RCP discharge (72-hour storm) at barrier.

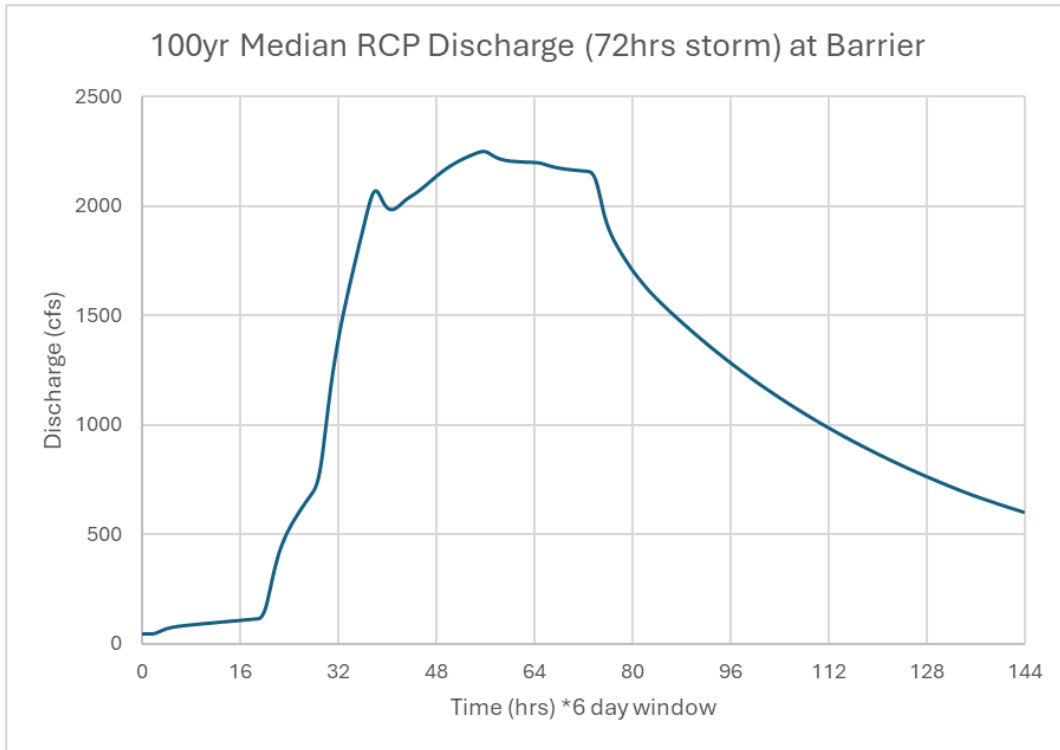


Figure B-61. 100-year median RCP discharge (72-hour storm) at barrier.

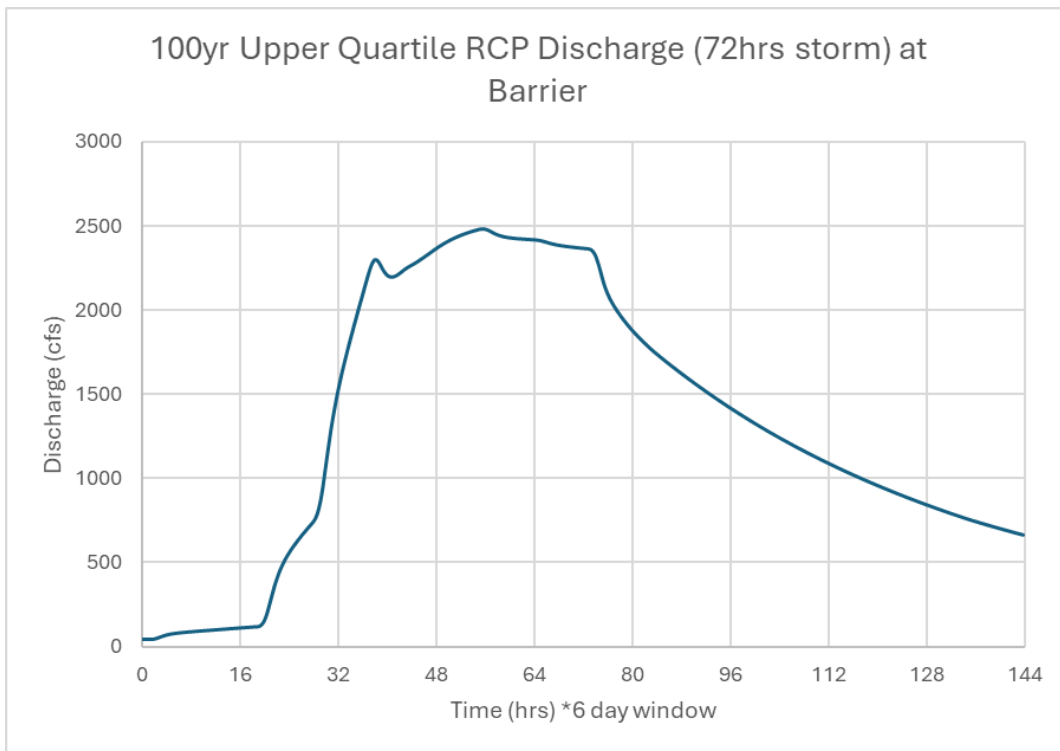


Figure B-62. 100-year upper quartile RCP discharge (72-hour storm) at barrier.

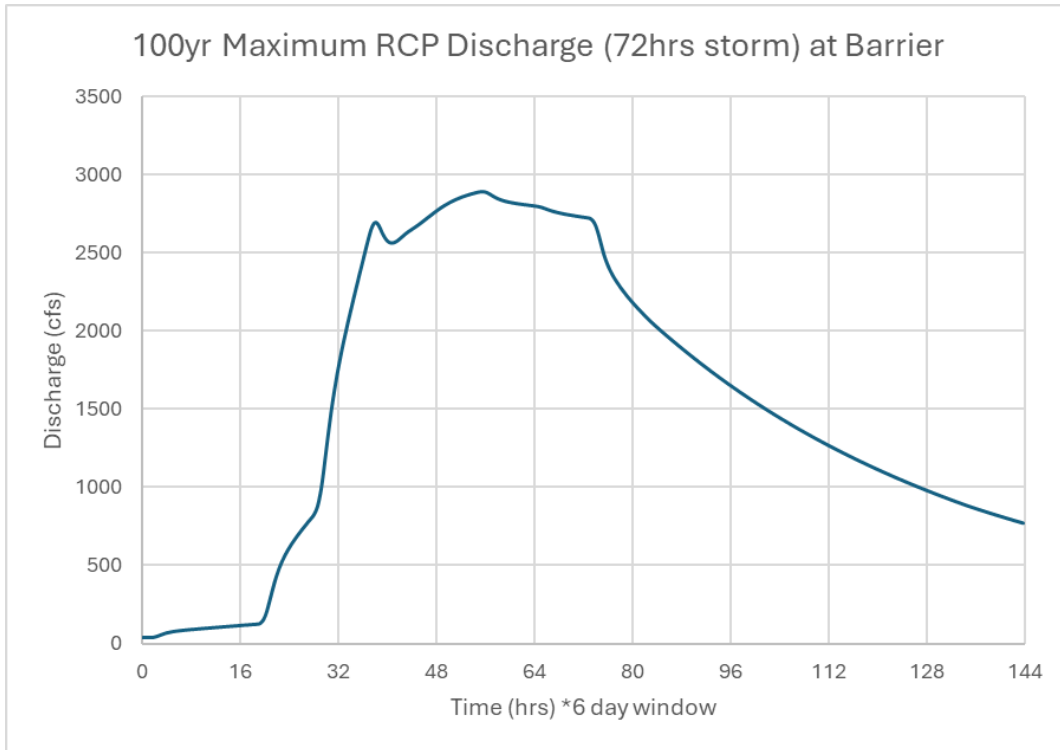


Figure B-63. 100-year maximum RCP discharge (72-hour storm) at barrier.

B.5.2.5. 500-Year Discharge Charts

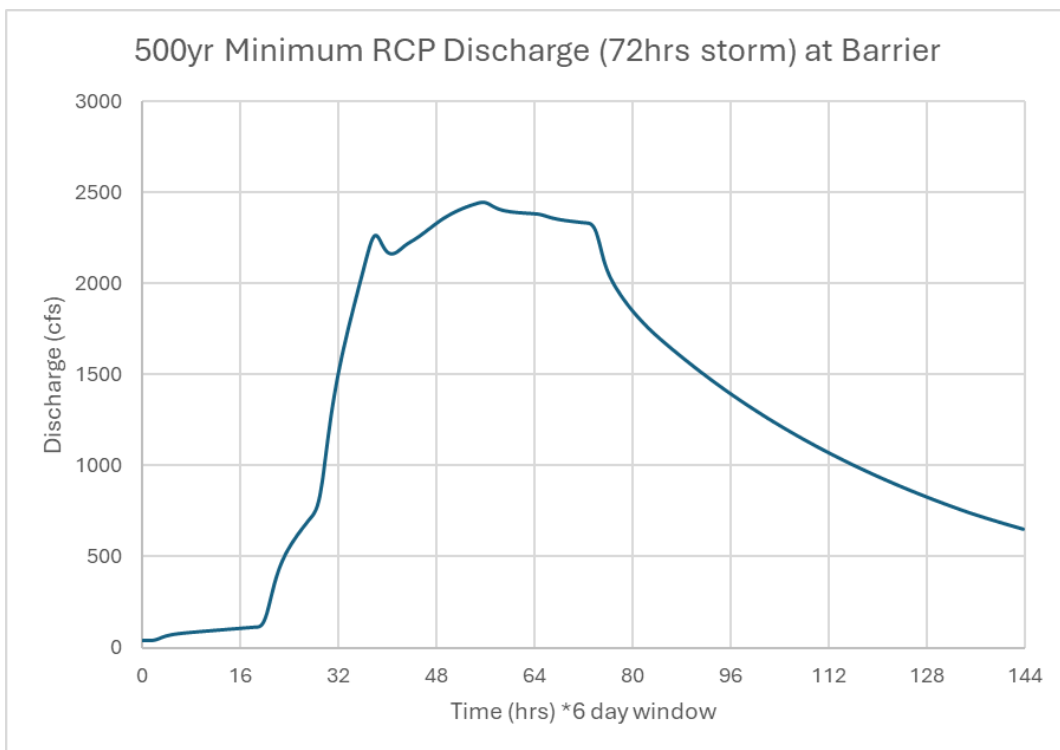


Figure B-64/ 500-year minimum RCP discharge (72-hour storm) at barrier.

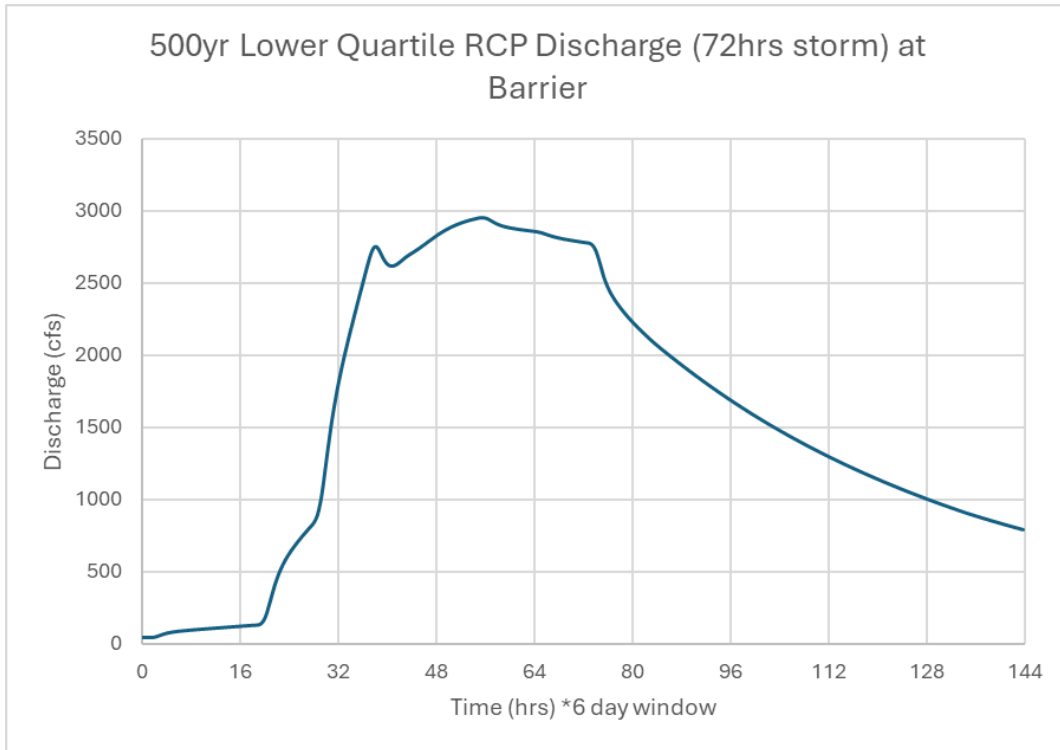


Figure B-65. 500-year lower quartile RCP discharge (72-hour storm) at barrier.

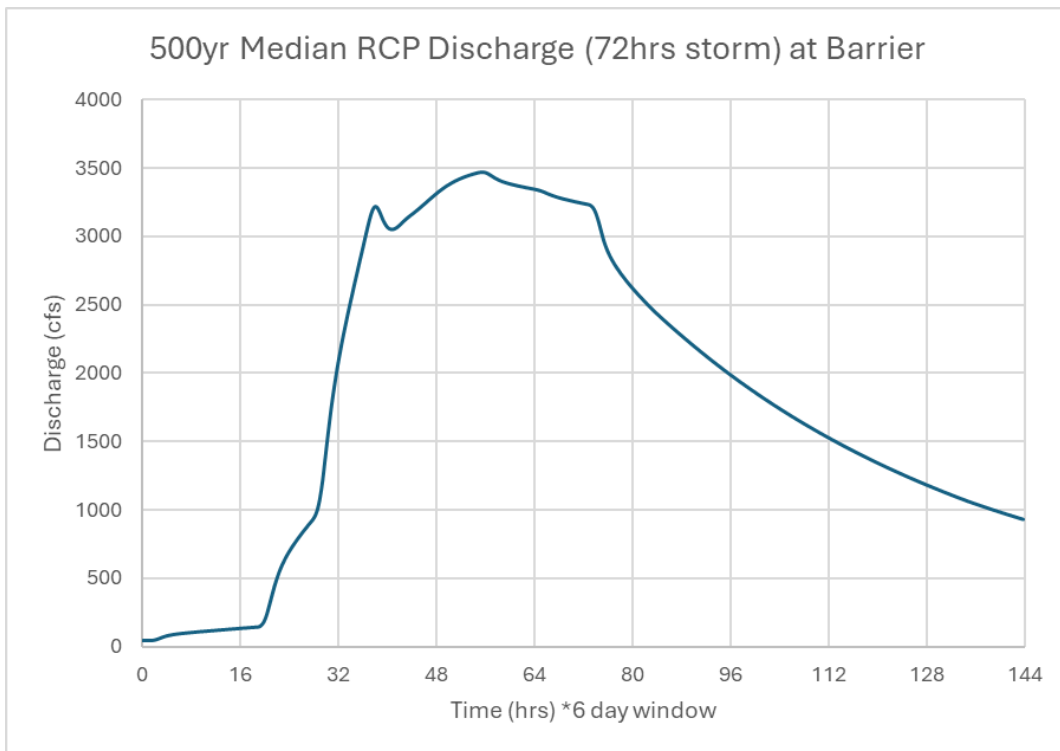


Figure B-66. 500-year median RCP discharge (72-hour storm) at barrier.

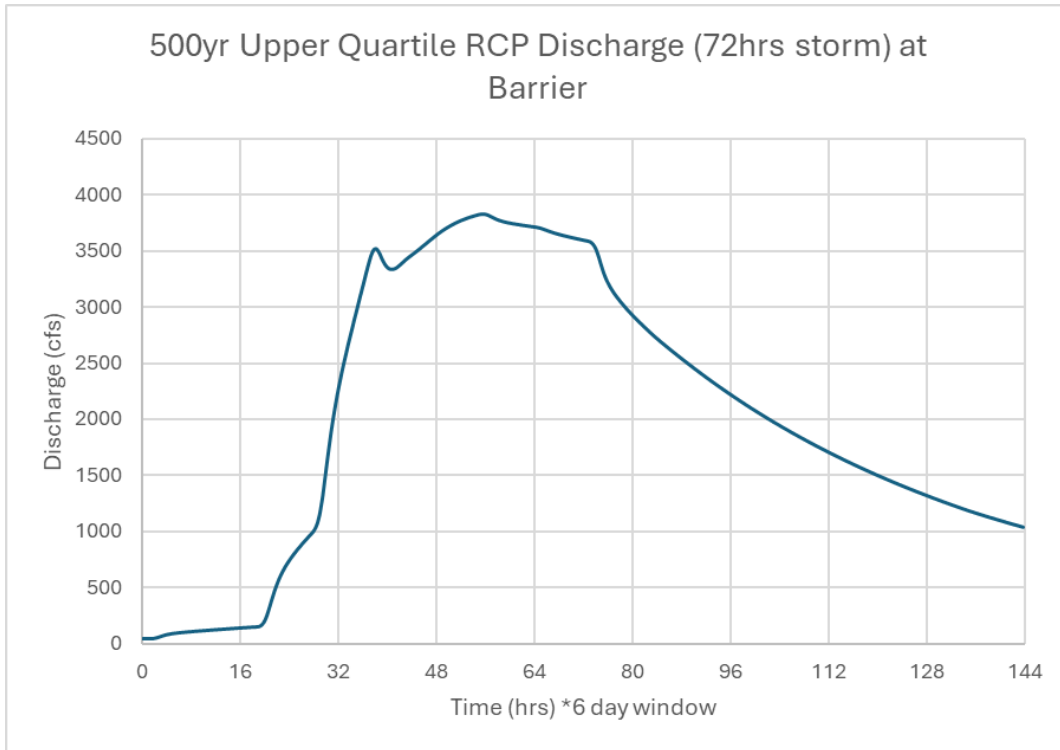


Figure B-67. 500-year upper quartile RCP discharge (72-hour storm) at barrier.

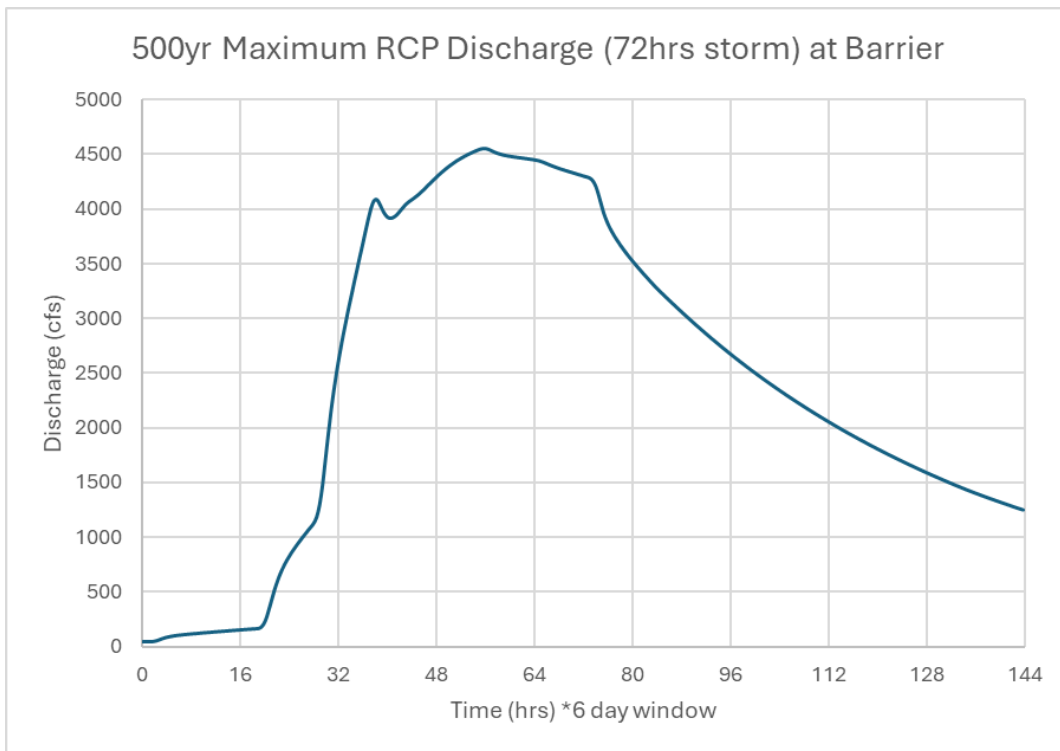


Figure B-68. 500-year maximum RCP discharge (72-hour storm) at barrier.