

EXHIBIT B
PROJECT OPERATIONS

**STEVENS CREEK HYDROELECTRIC PROJECT
FERC PROJECT NO. 2535**

**APPLICATION FOR NEW LICENSE
FOR MAJOR PROJECT – EXISTING DAM**

**EXHIBIT B
PROJECT OPERATIONS**

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**STEVENS CREEK HYDROELECTRIC PROJECT
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**EXHIBIT B
PROJECT DESCRIPTION**

1.0 POWER PLANT OPERATION

The Stevens Creek Hydroelectric Project (Stevens Creek Project or Project) operates as a re-regulating plant, mitigating the downstream effects of the routinely wide-ranging discharges due to the peaking operation from the upstream U.S. Army Corps of Engineers' (USACE) J. Strom Thurmond hydroelectric plant (Thurmond Dam). Typical dispatch practices are to have all available turbines on and to adjust generation to re-regulate projected inflows. By dispatching all available units, Dominion Energy South Carolina, Inc. (DESC) can remotely increase and decrease online turbines' gate settings to adjust flow releases as needed throughout the daily cycle, precluding the need to start and stop individual turbine units. The plant generates as a baseload facility.

The estimated annual plant factor based on data for complete calendar years from 2001 through 2018 with an average of 62,273 megawatt-hours (MWh), and the rated plant capacity of 17.28 megawatts (MW), is 41 percent. Although this plant factor is slightly low for run-of-river developments, it is reasonable for the Stevens Creek Project due to the daily use of moderate storage in conjunction with the re-regulation of the upstream peaking facility releases. In general, low plant factors can indicate hydraulically overdeveloped projects, low generation efficiency, or significant equipment outages. The Project's operation as a re-regulating facility requires significant adjustments to generation throughout the day, which causes efficiency changes as turbine flows are adjusted.

The applicant proposes to continue to operate the Stevens Creek Project in the same manner it has under the current license.

1.1 MANUAL OR AUTOMATIC OPERATION

The Stevens Creek Project is crewed in some manner seven days a week. Staff is on site five days a week, Monday through Friday, for eight hours a day. An operator is on site during the weekends for two or more hours per day as needed to support normal plant operations. The turbine gates are operated remotely from DESC's Urquhart Steam Station near Beech Island, South Carolina. The turbines must be placed in service locally on site and once on, can be adjusted remotely. The turbines' output is manually adjusted and monitored by the operators at the Urquhart Steam Station 24 hours a day, 7 days a week in response to the Thurmond Dam releases.

1.2 PROPOSED OPERATION DURING ADVERSE, MEAN, AND HIGH-WATER YEARS

Adverse (Low) Flow Years: During periods of low flow in the Savannah River, when Thurmond Dam discharges are reduced to a daily average of 4,000 cubic feet per second (cfs) to 4,200 cfs, the Stevens Creek Project will provide an hourly release of \pm 15 percent of the scheduled daily average discharge from Thurmond Dam depending on the reservoir elevation. The primary difference from normal conditions would be that the discharge from the Stevens Creek Project would not exceed about 4,200 cfs unless more water is discharged from Thurmond Dam. Stevens Creek Reservoir fluctuation would be slightly less than under normal conditions, due to the reduced storage required to reregulate the lower Thurmond Dam discharges.

During periods of drought, when Thurmond Dam discharges are reduced to a daily average of 3,800 cfs to 4,000 cfs, the Stevens Creek Project will provide an hourly release of \pm 15 percent of the scheduled daily average discharge from Thurmond Dam depending on the reservoir elevation. The primary difference from normal conditions would be that the discharge from the Stevens Creek Project would not exceed about 4,000 cfs unless more water is discharged from Thurmond Dam. Stevens Creek Reservoir fluctuation would be slightly less than under normal conditions, due to the reduced storage required to reregulate the lower Thurmond Dam discharges.

During periods of severe drought, when Thurmond Dam discharges are less than 3,800 cfs, the Stevens Creek plant will provide an hourly release of \pm 15 percent of the scheduled daily average discharge from Thurmond Dam. Daily average discharge from Thurmond can fall as low as 3,100 cfs as noted in the USACE's Savannah River Basin Drought Management Plan.

Mean (Normal) Flow Years: During periods of normal flow in the Savannah River, the Stevens Creek Project will provide an hourly release of ± 15 percent of the scheduled daily average discharge from Thurmond Dam with the Stevens Creek Reservoir elevation fluctuating within its normal operating range (183.0 to 187.5 feet) daily. When daily average discharges from Thurmond Dam vary within 500 cfs of those originally scheduled, Stevens Creek Project operation will be adjusted as needed to accommodate the change as soon as operators are notified of the change by the USACE. In the normal flow range, the re-regulating operation at Stevens Creek requires using the full active storage (between elevations 183.0 and 187.5 feet).

High Flow Years: During periods of sustained high discharge in the Savannah River, the Stevens Creek Project will generate to its full capability (approximately 8,300 cfs), while spilling all additional flow over the 2,000-foot-long overflow section of the dam (some flashboards will be tripped). In this situation, all water coming down the Savannah River passes directly through the Stevens Creek Reservoir. The reservoir may exceed elevation 187.5 feet, depending upon the volume and duration of the high flow. When river flow returns to a level controllable by normal operation at the Thurmond Dam, the Stevens Creek Reservoir will be drawn down to about elevation 183.5 feet so that flashboards can be reset. The amount of time required to reset the flashboards will depend upon the number of boards tripped and the amount of debris on the spillway. Normal operation of the Stevens Creek Project will resume when the flashboards have been reset.

2.0 GENERATION AND HYDROLOGY

2.1 ESTIMATE OF DEPENDABLE CAPACITY

Dependable capacity as defined by the Energy Information Administration is “The load-carrying ability of a station or system under adverse conditions for a specified period of time.” For the Stevens Creek Project, adverse conditions are extended periods of low inflow, with the headpond near the minimum level. Using the Thurmond Dam target daily average discharge under drought conditions of 3,100 cfs, the Stevens Creek Project can operate all units at approximately 30 percent gate, and near minimum headpond level produces an estimated dependable capacity of 3.5 MW.

2.2 GROSS GENERATION

Annual gross generation for the Stevens Creek Project for the years 2000 through 2021 is shown in Appendix B-1. The average gross annual generation over this period was 66,023 MWh.

2.3 STREAMFLOW DATA AND FLOW DURATION CURVES

The Stevens Creek Project is located on the Savannah River near Evans, Georgia. The total contributing drainage area at the Stevens Creek Project is 7,150 square miles. The monthly and annual flow regimen data was collected from a United States Geological Survey (USGS) gauge (02197000) located on the Savannah River 12 miles downstream of the Stevens Creek Project. There is no streamflow gauge located between Thurmond Dam and the Stevens Creek Dam gauge. Due to the location of gauge 02197000, it captures additional inflow below the Stevens Creek Dam and subject to the operations at New Savannah Bluff Lock and Dam. The contributing drainage area for gauge 02197000 is 7,330 square miles. Data from this gauge was used to develop the curves shown in Exhibits B-2 through B-14.

The flood of record for the Savannah River at the Project location occurred October 3, 1929, with a peak discharge estimated at 350,000 cfs, reaching a headpond of elevation 196.7 feet and tailwater at elevation 176.6 feet. Since the occurrence of the flood of record, the USACE constructed the Hartwell, Richard B. Russell, and J. Strom Thurmond dams for flood control, which have changed the frequency of flooding on the Savannah River. Since the three USACE dams were constructed, the maximum flood recorded occurred on April 9, 1964 with a flow of 87,100 cfs. The minimum daily mean flow prior to the three dams were constructed was 1,040 cfs on October 2, 1927, and since they were constructed the minimum daily mean flow of 1,710 cfs

occurred on September 7, 1951. No instantaneous minimum records are available during these extreme low flow dates.

2.4 AREA CAPACITY CURVES

Depth-area curves for the Steven Creek Reservoir are shown in Appendix B-15, with a corresponding table presented as Appendix B-16. Stevens Creek Reservoir has a gross storage capacity of approximately 23,600-acre feet at full pool elevation 187.5 feet and usable storage of approximately 7,800-acre feet between elevations 187.5 feet (full pool) and elevation 183.0 feet. The reservoir surface area is approximately 2,400 acres at full pool elevation of 187.5 and is approximately 1,800 acres at an elevation of 183.0 feet.

2.5 RESERVOIR GUIDE CURVES

This Project is a modified run of river and as such does not utilize reservoir guide or rule curves.

2.6 ESTIMATED HYDRAULIC CAPACITY

The estimated hydraulic capacity of the Stevens Creek Project is 8,300 cfs at 28.6 feet of head with wicket gates fully open on all eight units operating.

2.7 SPILLWAY RATING CURVE

Spillway discharge rating curves were developed by Alden Research Labs (Alden) in 2018 using a computational fluid dynamics (CFD) model. Alden ran the model for a range of upstream water levels to update the stage discharge rating curves. Rating curves were computed with the flashboards down but the area below the boards blocked with debris and operating without debris blockage (Appendix B-17). Since it is likely that the tripped flashboards will be blocked by debris, and Alden determined that it was unlikely that the nappe would self-ventilate, the final “with blockage” spillway rating curve shown in Appendix B-17 represents flashboards down, blocked with debris, and no ventilation of the nappe.

2.8 TAILWATER RATING CURVE

Normal tailwater level is at elevation 158.5 feet with the turbines at full discharge, flowing approximately 8,300 cfs. The tailwater at the dam is generally the same as recorded at the powerhouse and is hydraulically controlled by the Augusta Diversion Dam located one mile

downstream of Stevens Creek Dam. A tailwater rating curve for the Stevens Creek Project is given in Appendix B-18.

2.9 POWER PLANT CAPABILITY VS. HEAD CURVES

A plant capability curve is included as Appendix B-19.

3.0 POWER UTILIZATION

The Stevens Creek Hydroelectric Plant normally operates as a baseload, modified run of river plant using available flow in the Savannah River. Energy generated is utilized in the Applicant's system to serve customer demand.

4.0 FUTURE DEVELOPMENT

A resource utilization study was conducted in 2021 to determine feasibility of increasing capacity and/or energy production at Stevens Creek Hydroelectric Plant. The current operational practices of re-regulating project inflows from Thurmond Dam, the limited remote start/stop capabilities of the turbines and the debris loading that occurs often on the intake screens, results in an overall reduced efficiency. The results indicate that adding one or two turbines in the undeveloped turbine bays would not be justified at this time, therefore no additional development or capacity increases are currently planned.

APPENDIX B-1

GROSS ANNUAL GENERATION

EXHIBIT B – 1

Stevens Creek Hydroelectric Project, P-2535

Gross Annual Generation for the Period 2000 – 2021

YEAR	Stevens Creek Project Gross Annual Generation (MWH)
2000	56,432
2001	54,789
2002	52,894
2003	87,645
2004	72,934
2005	89,153
2006	68,047
2007	58,432
2008	47,952
2009	56,133
2010	71,378
2011	54,080
2012	48,471
2013	58,410
2014	80,471
2015	64,962
2016	57,309
2017	44,037
2018	59,662
2019	82,955
2020	99,276
2021	87,081
<hr/>	
Average 2000 - 2021	66,023

APPENDIX B-2 – B-14

FLOW DURATION CURVES

EXHIBIT B – 2

Stevens Creek Dam - Annual Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022

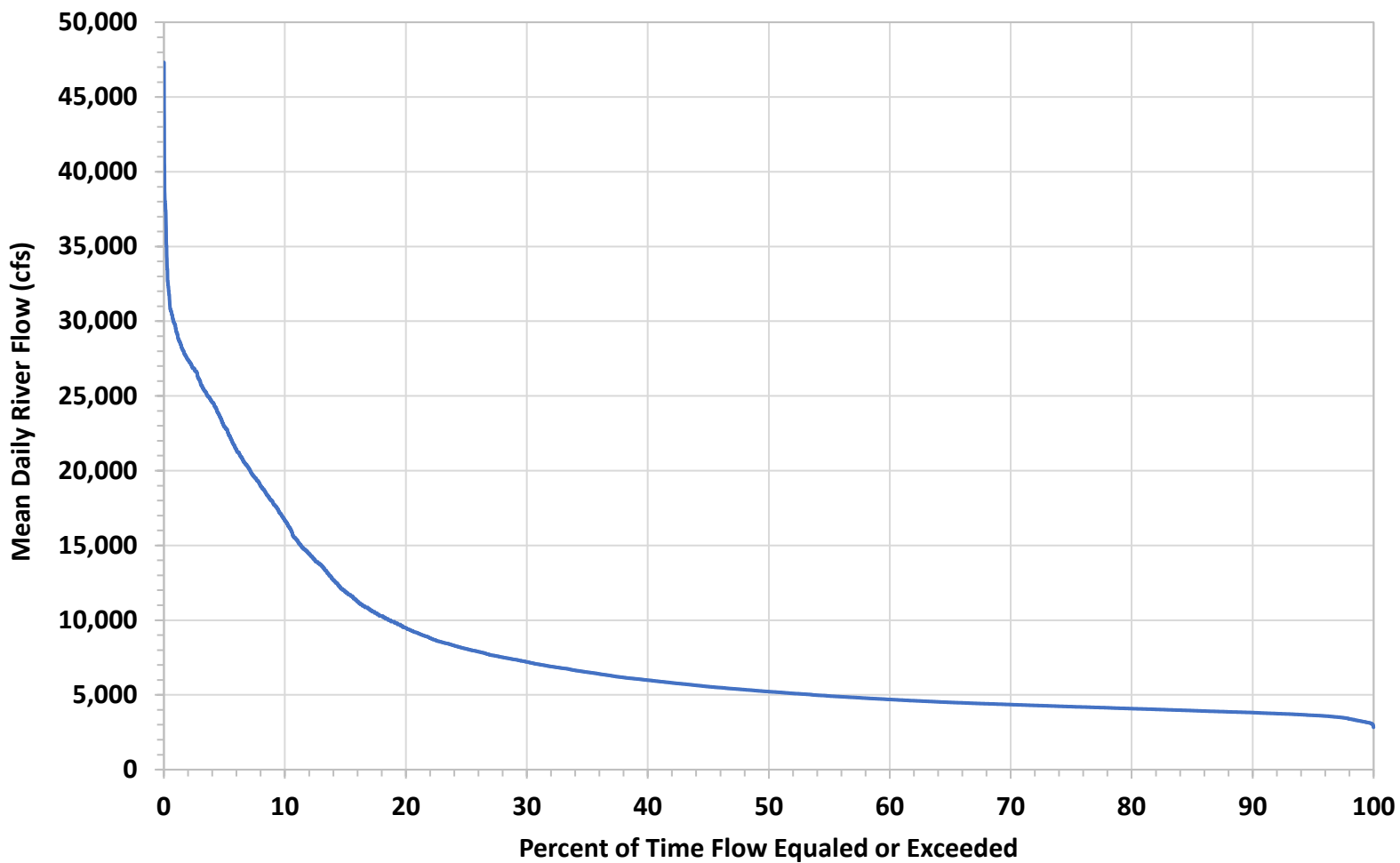


EXHIBIT B – 3

Stevens Creek Dam - January Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022

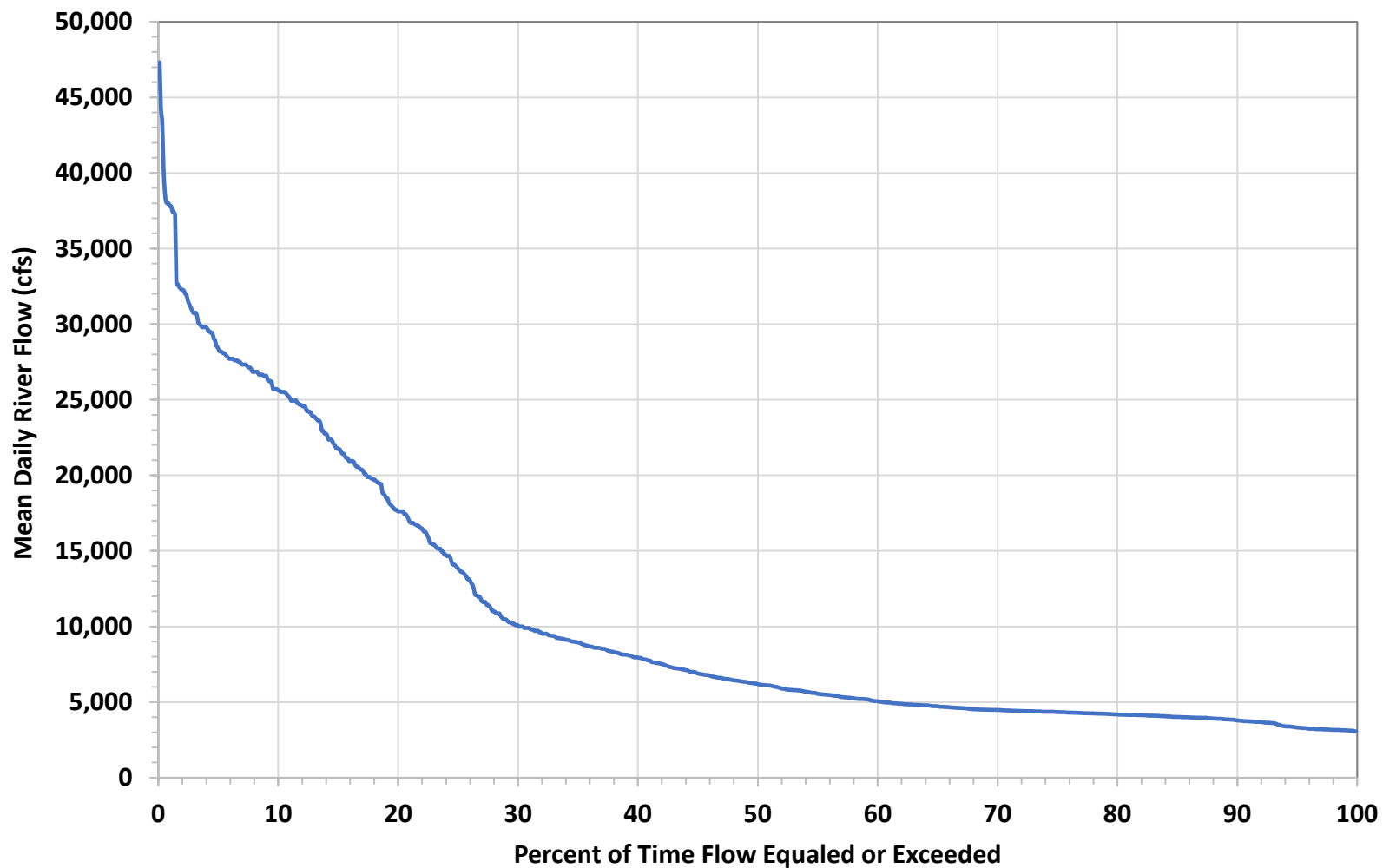


EXHIBIT B – 4

Stevens Creek Dam - February Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022

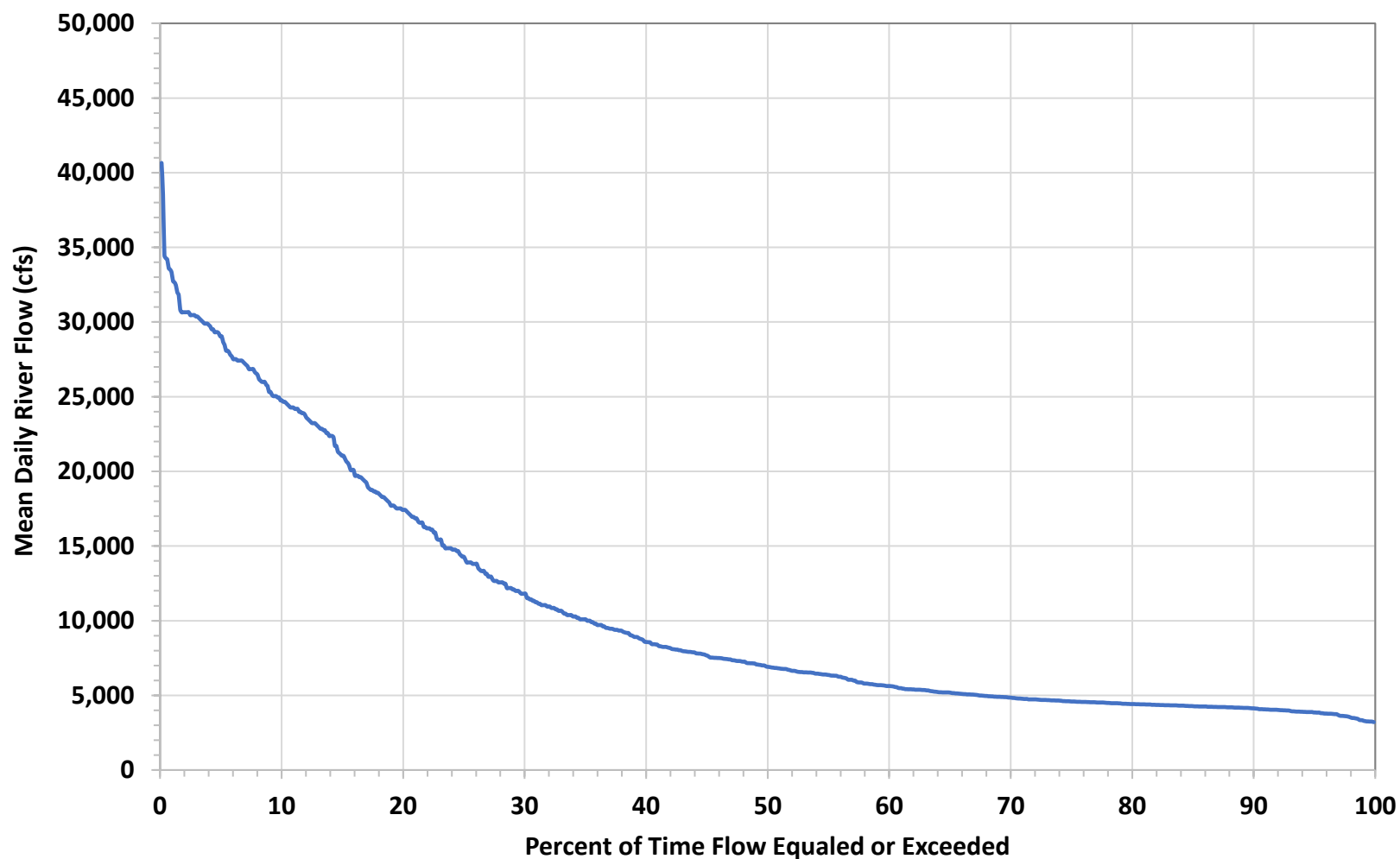


EXHIBIT B – 5

Stevens Creek Dam - March Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022

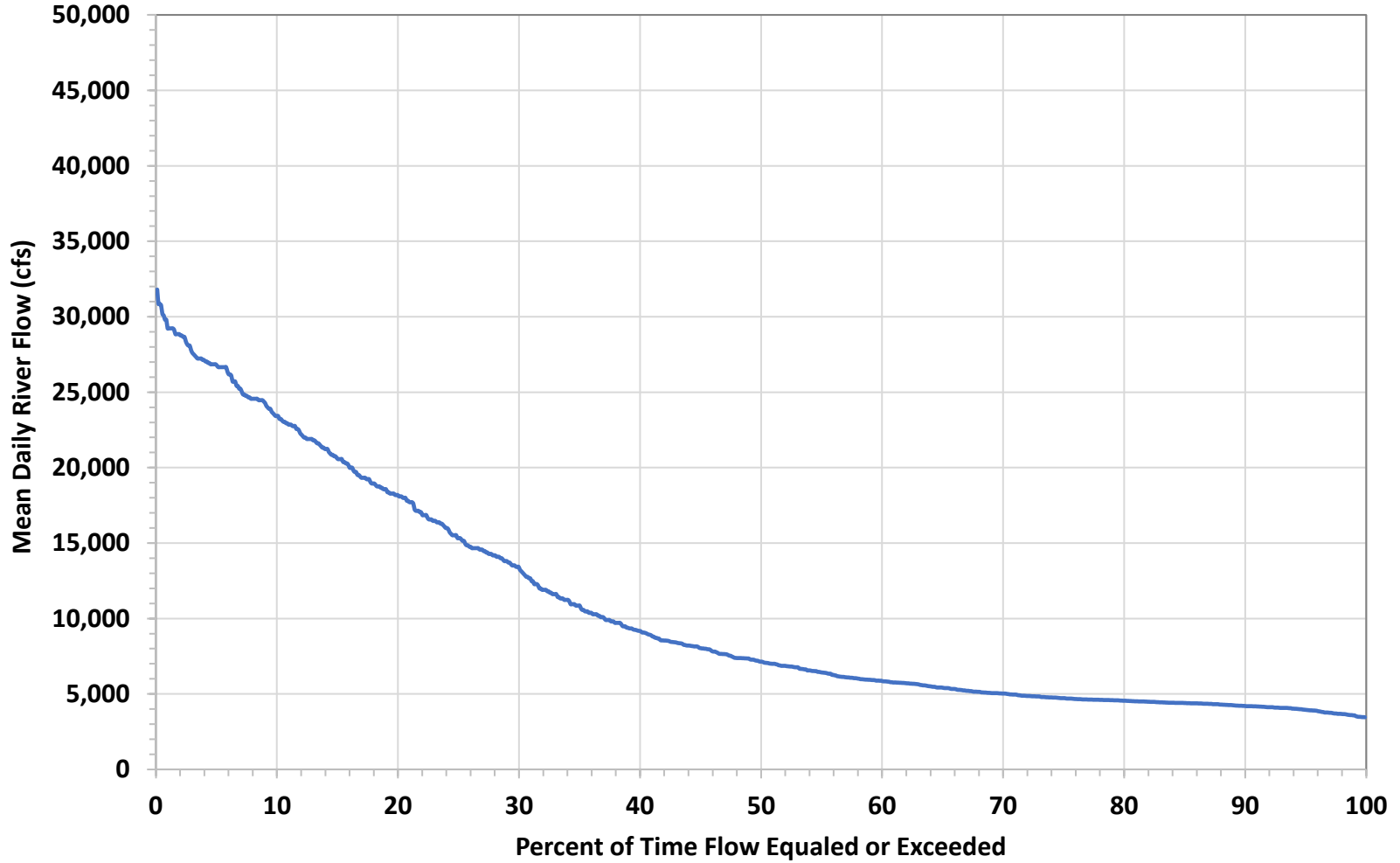


EXHIBIT B – 6

Stevens Creek Dam - April Flow Duration Curve

Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA

Period of Record 01/01/1993 to 12/31/2022

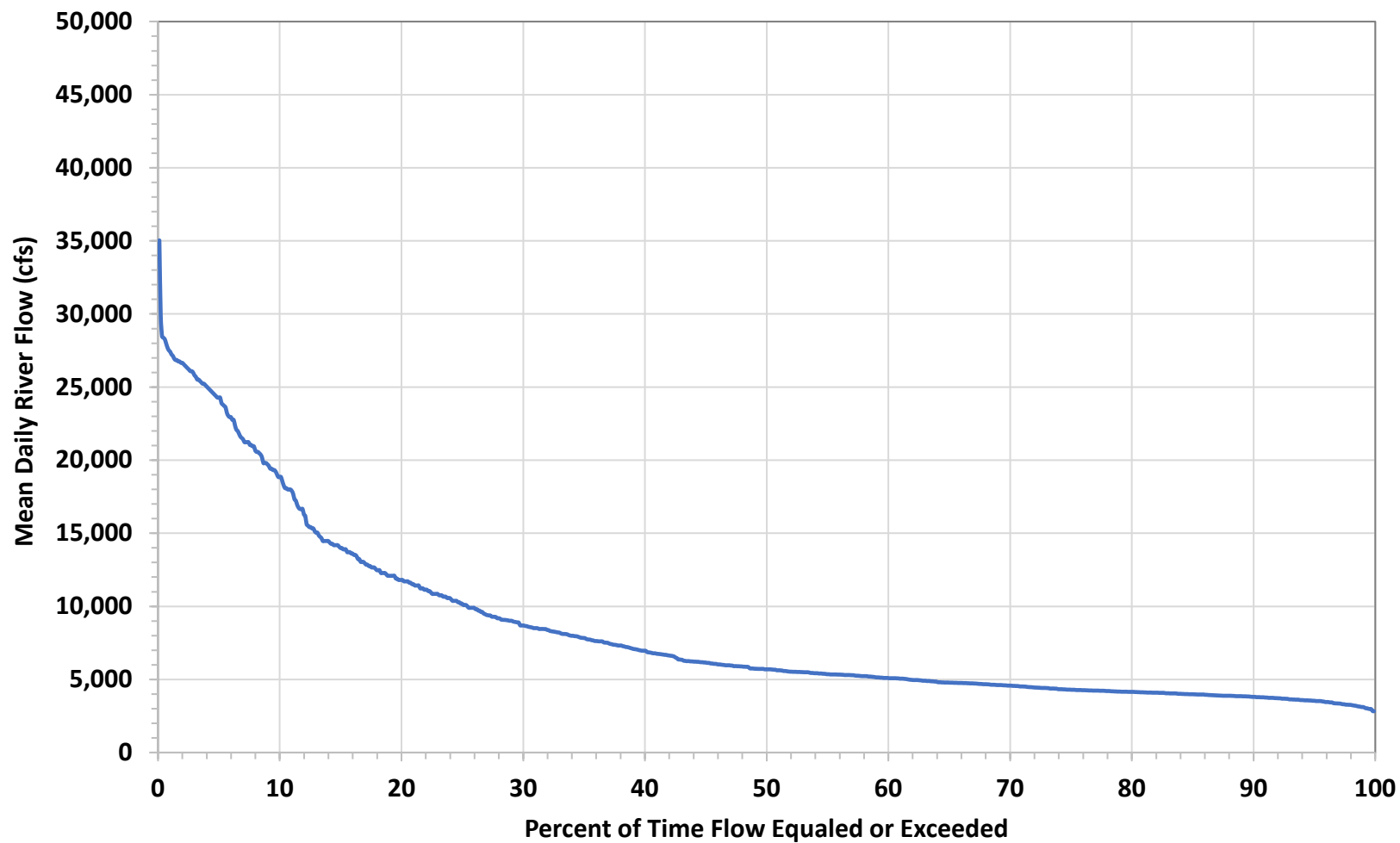


EXHIBIT B – 7

Stevens Creek Dam - May Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022

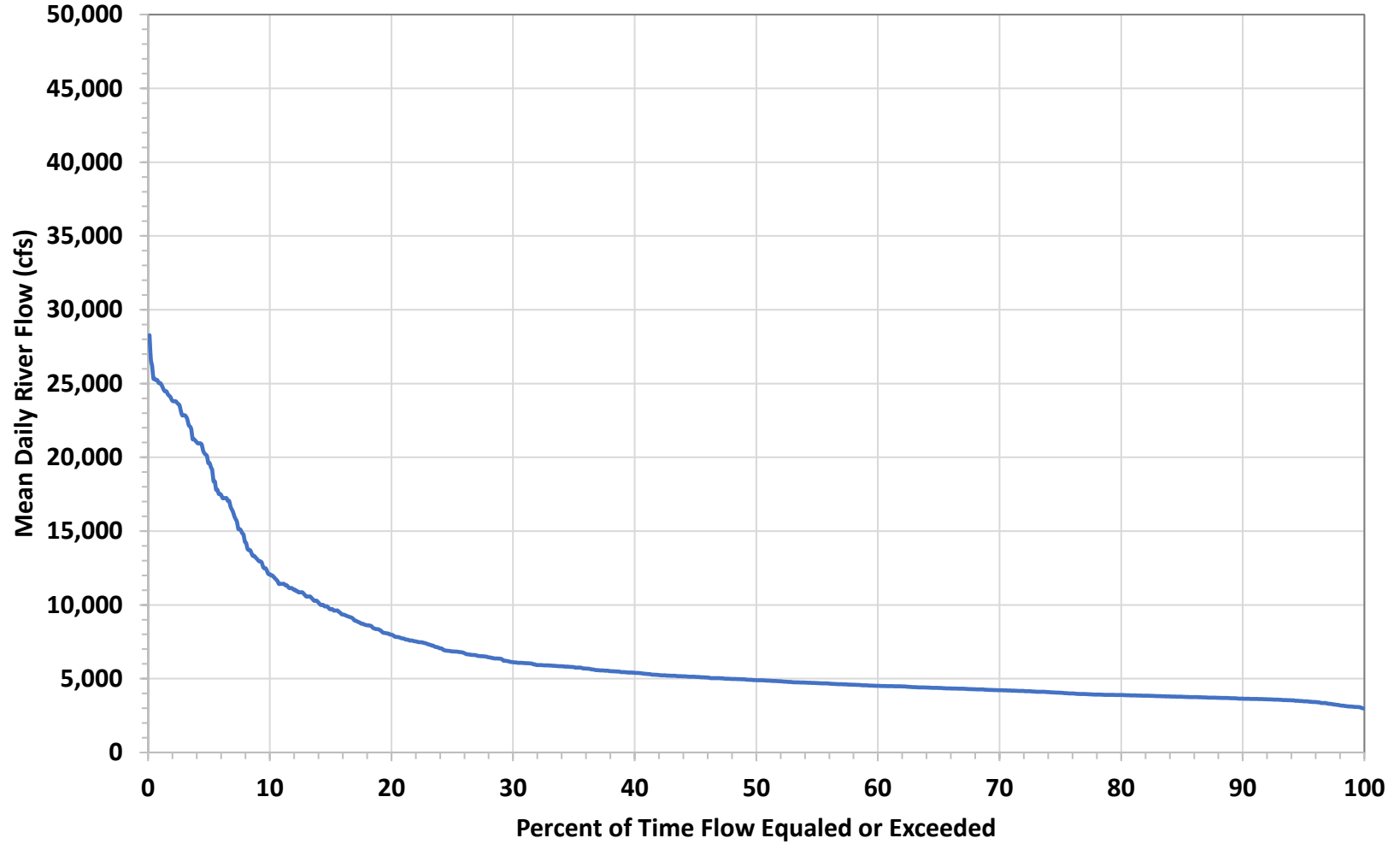


EXHIBIT B – 8

Stevens Creek Dam - June Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022

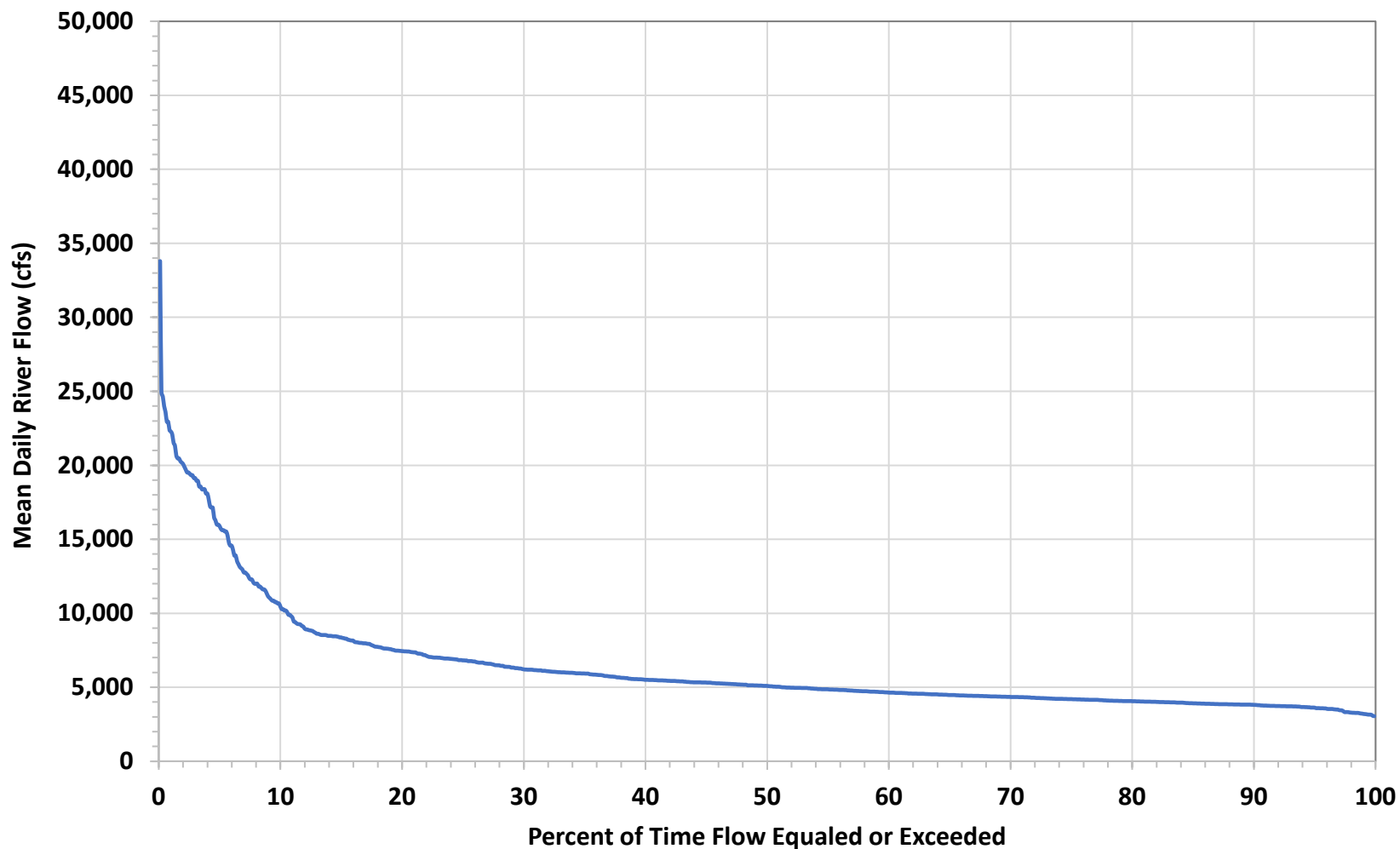
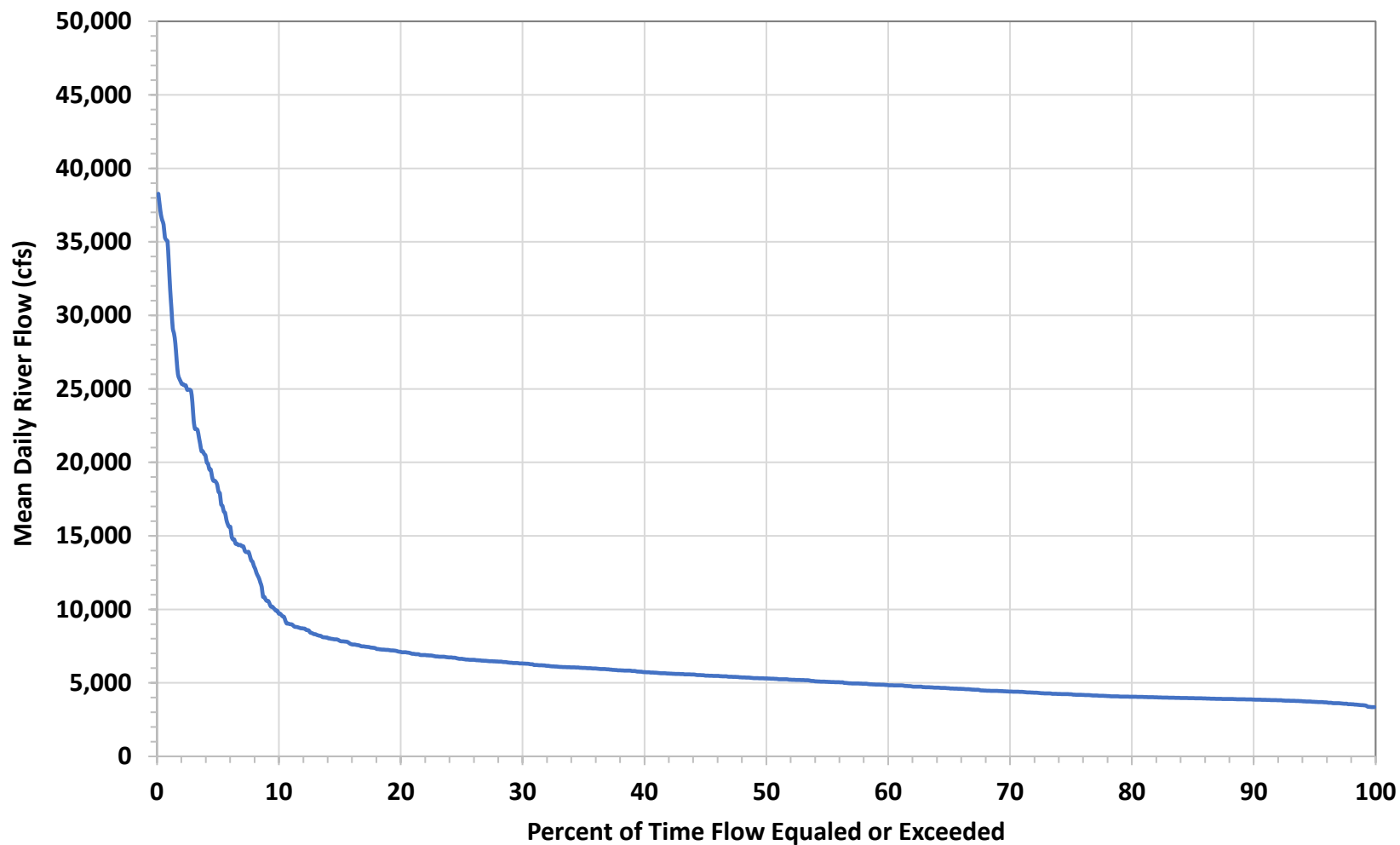
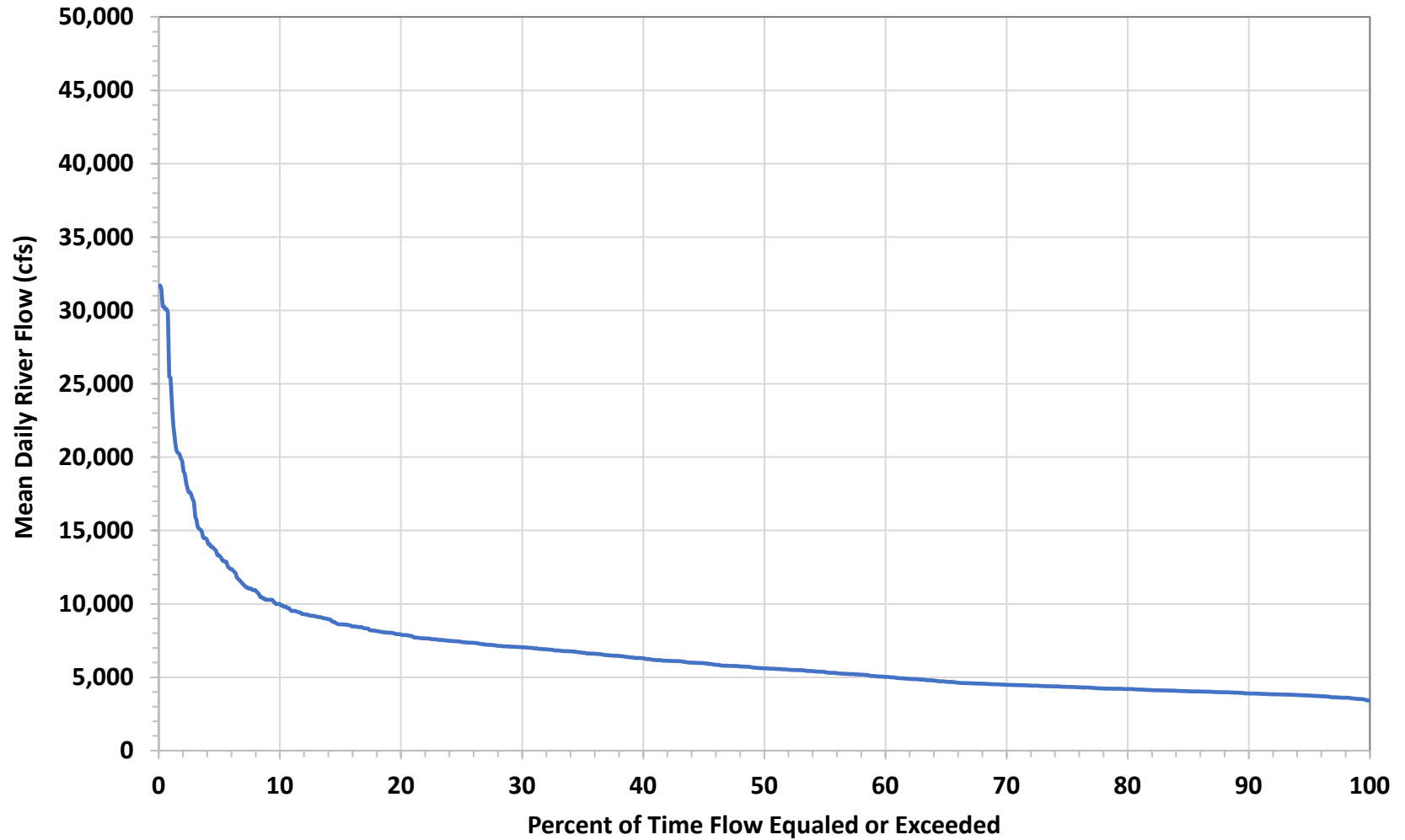


EXHIBIT B – 9

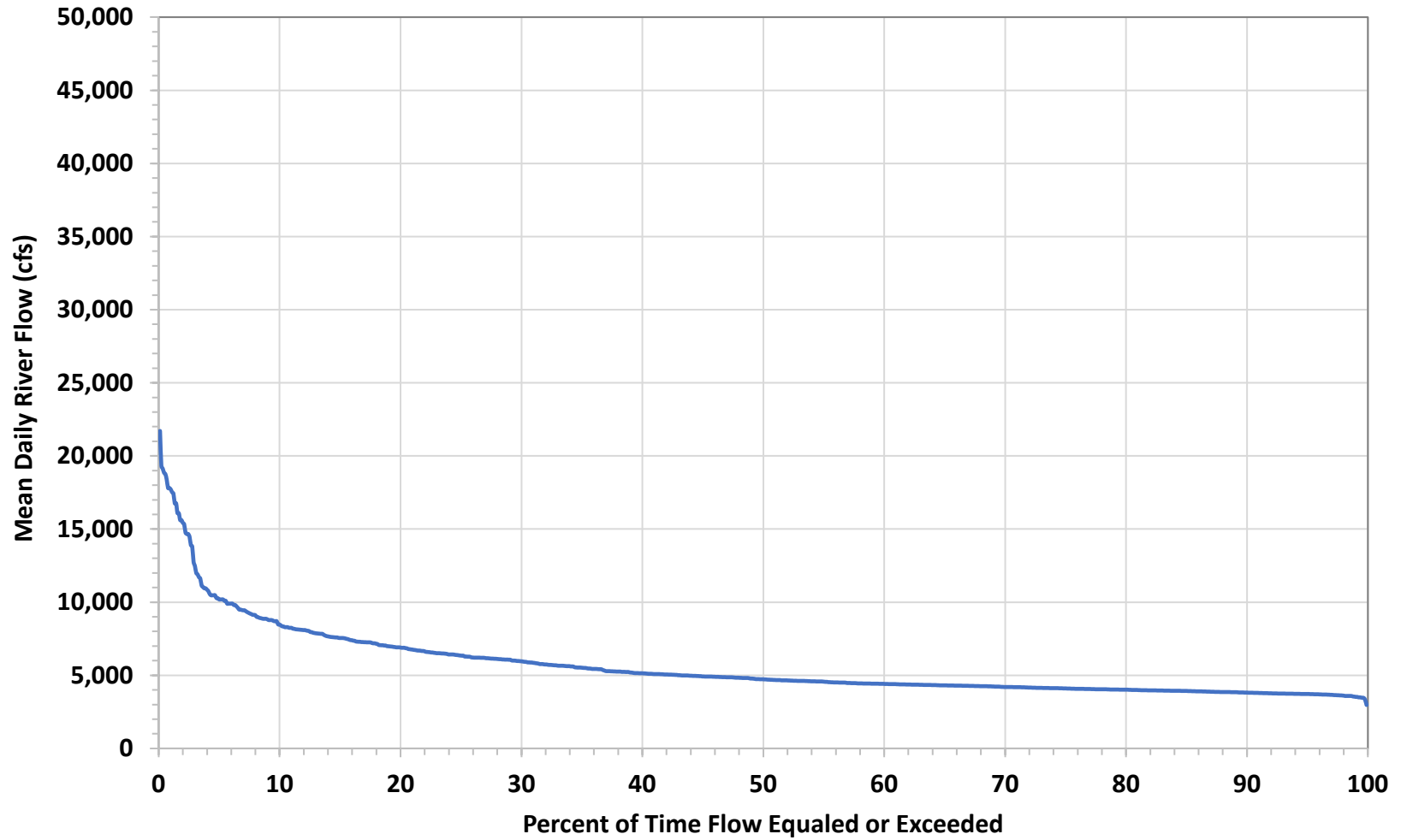
Stevens Creek Dam - July Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022



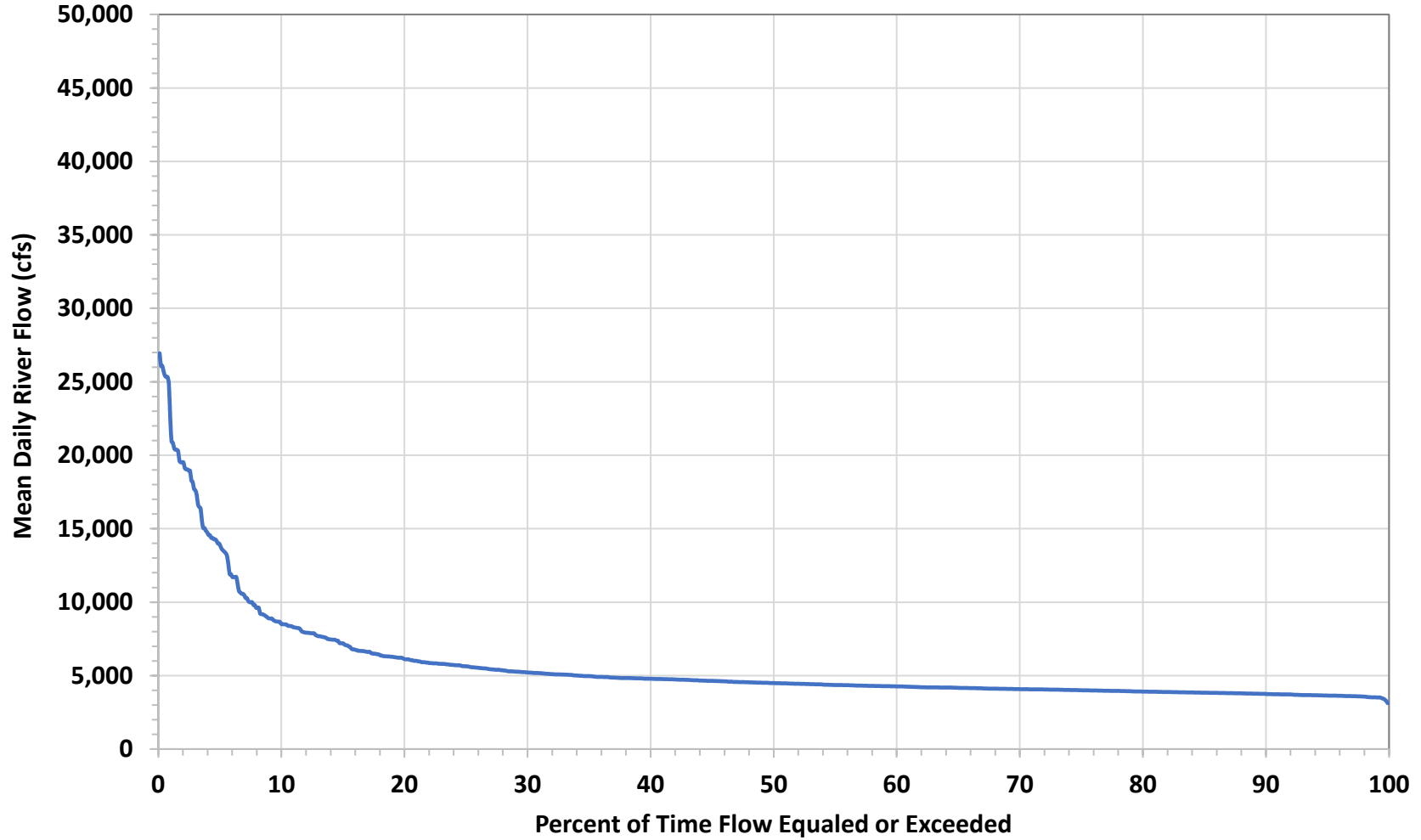
Stevens Creek Dam - August Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022



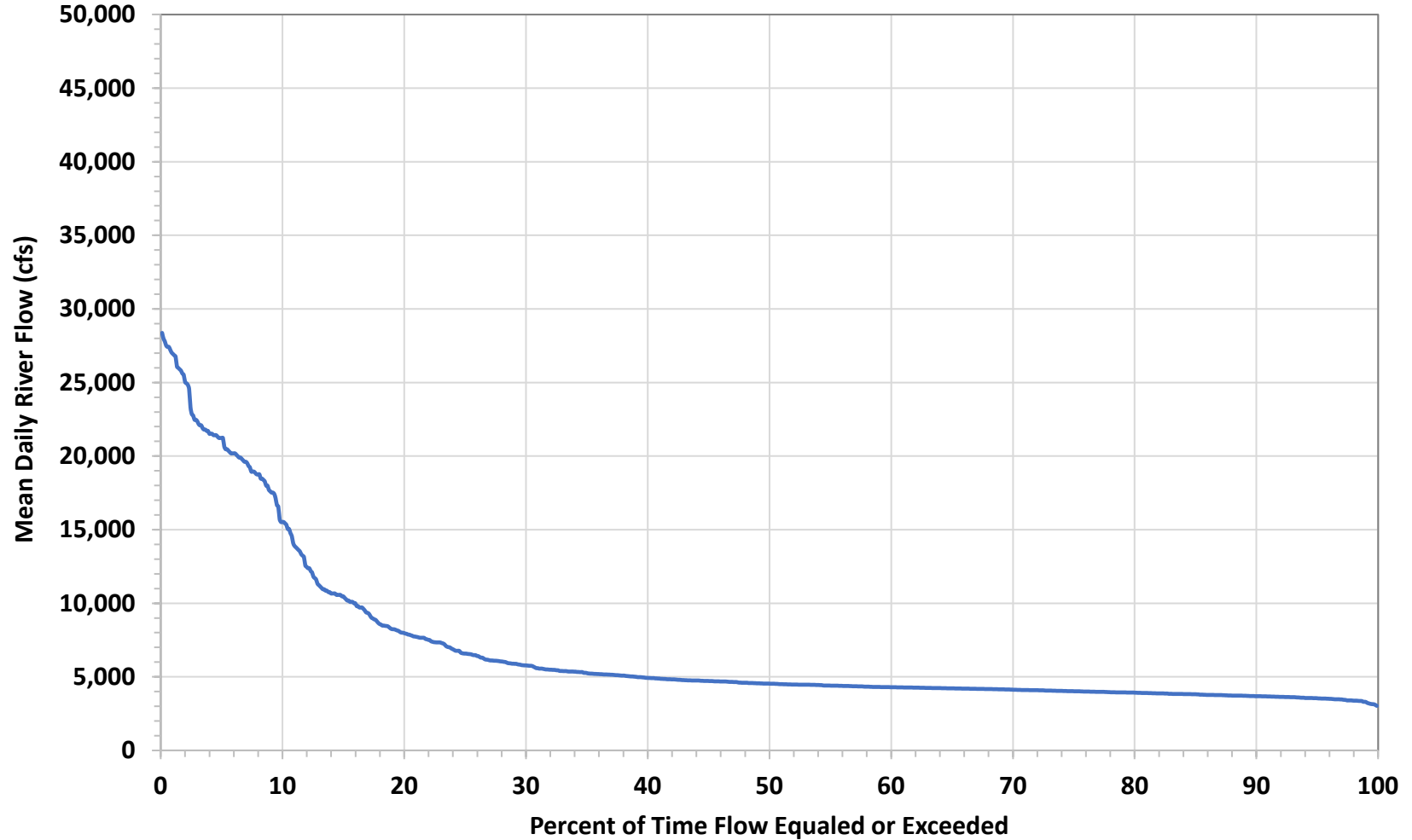
Stevens Creek Dam - September Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022



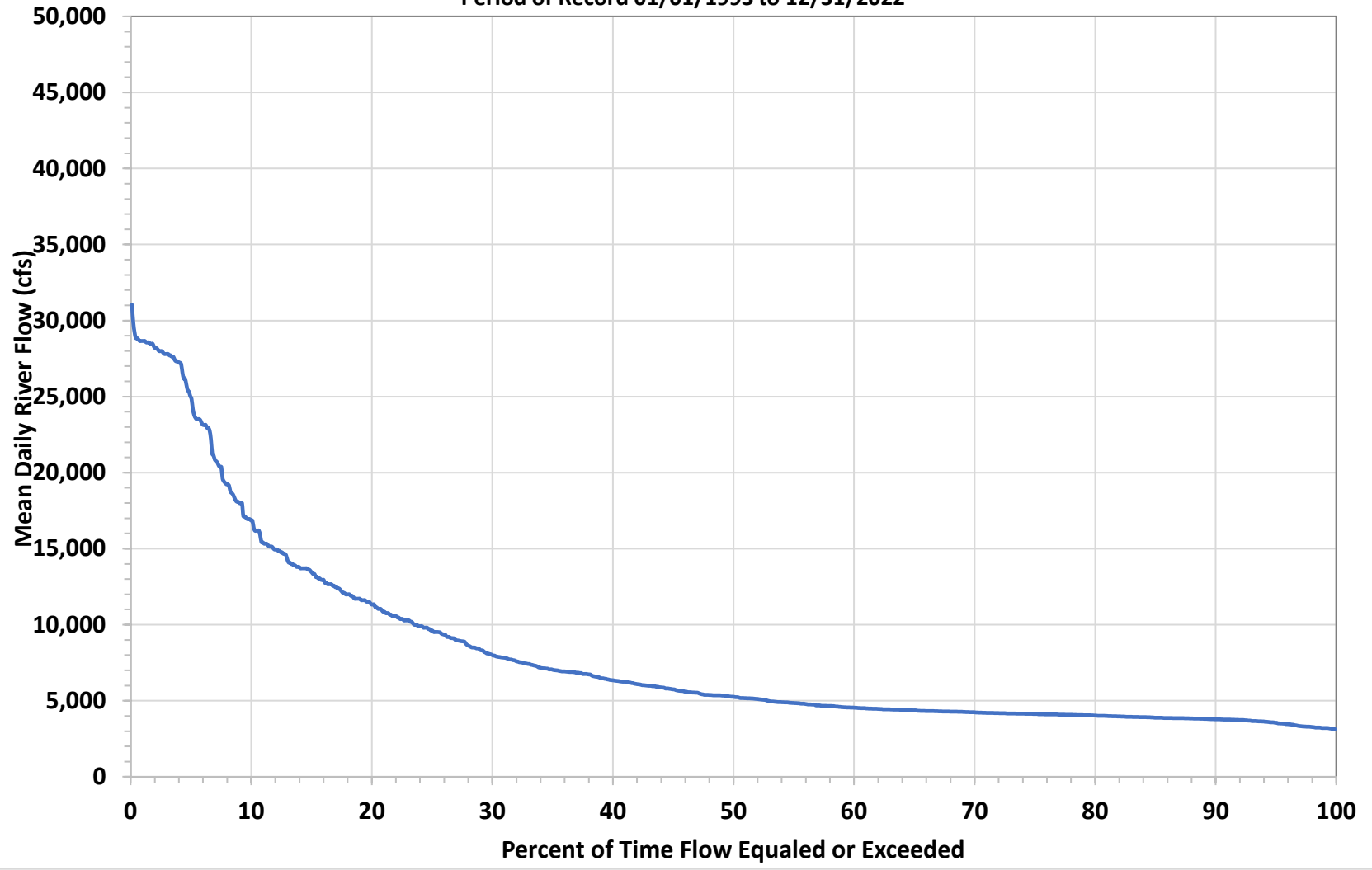
Stevens Creek Dam - October Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022



Stevens Creek Dam - November Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022



Stevens Creek Dam - December Flow Duration Curve
Prorated from USGS Gage No. 02197000 Savannah River at Augusta, GA
Period of Record 01/01/1993 to 12/31/2022



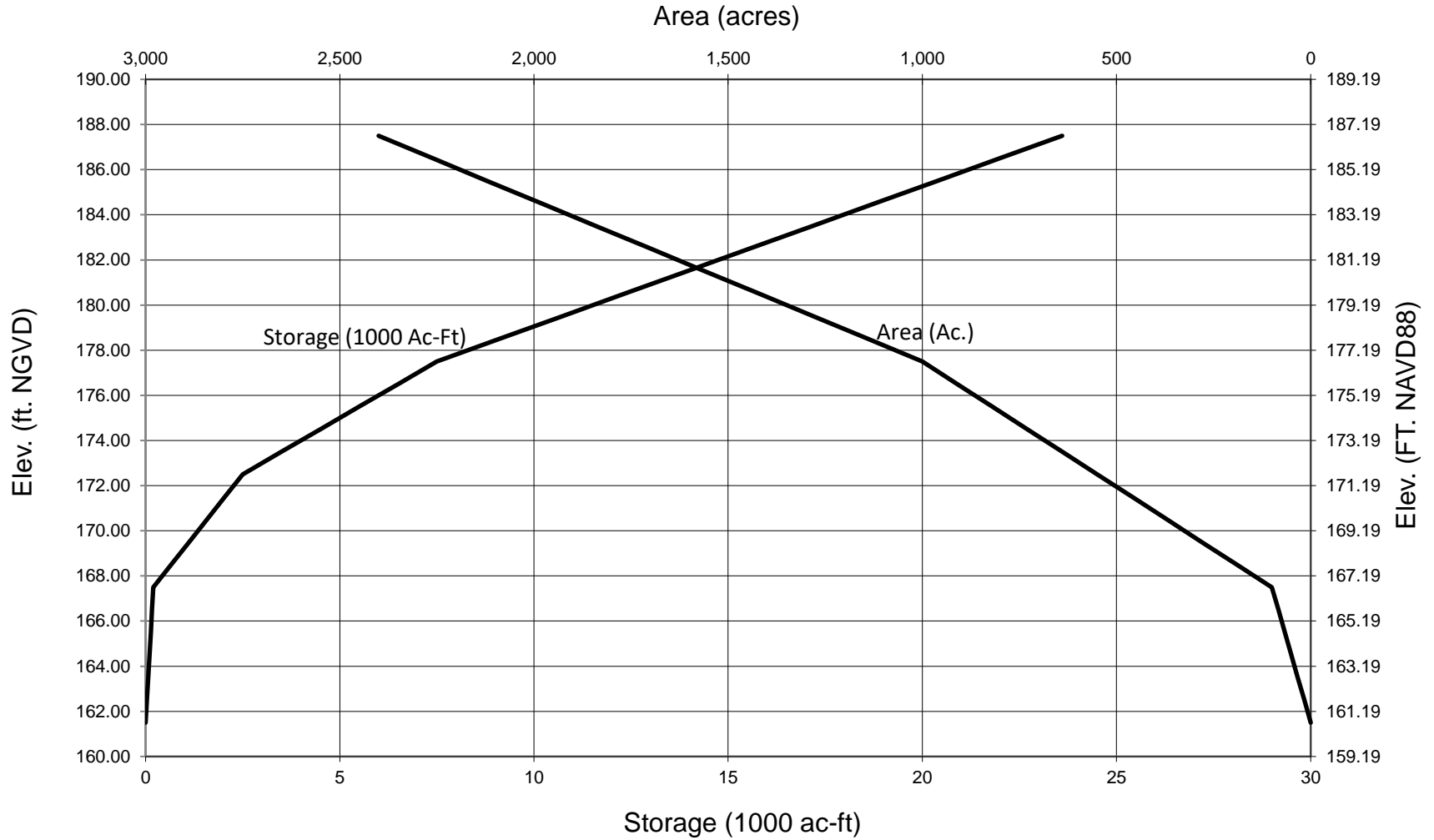
APPENDIX B-15

RESERVOIR AREA CAPACITY CURVES

EXHIBIT B-15

STEVENS CREEK HYDROELECTRIC PROJECT P-2535

RESERVOIR AREA CAPACITY CURVES



APPENDIX B-16

RESERVOIR AREA CAPACITY TABLE

EXHIBIT B-16

STEVENS CREEK HYDROELECTRIC PROJECT P-2535

RESERVOIR AREA CAPACITY TABLE

<u>Reservoir Elevation</u> <u>(FT. NGVD 1929)</u>	<u>Reservoir Elevation</u> <u>(FT. NAVD 1988)</u>	<u>Reservoir Area</u> <u>(acres)</u>	<u>Reservoir Storage</u> <u>(ac-ft)</u>
161.50	160.69	0	0
162.50	161.69	17	33
163.50	162.69	33	67
164.50	163.69	50	100
165.50	164.69	67	133
166.50	165.69	83	167
167.50	166.69	100	200
168.50	167.69	190	660
169.50	168.69	280	1,120
170.50	169.69	370	1,580
171.50	170.69	460	2,040
172.50	171.69	550	2,500
173.50	172.69	640	3,500
174.50	173.69	730	4,500
175.50	174.69	820	5,500
176.50	175.69	910	6,500
177.50	176.69	1,000	7,500
178.50	177.69	1,140	9,110
179.50	178.69	1,280	10,720
180.50	179.69	1,420	12,330
181.50	180.69	1,560	13,940
182.50	181.69	1,700	15,550
183.50	182.69	1,840	17,160
184.50	183.69	1,980	18,770
185.50	184.69	2,120	20,380
186.50	185.69	2,260	21,990
187.50	186.69	2,400	23,600

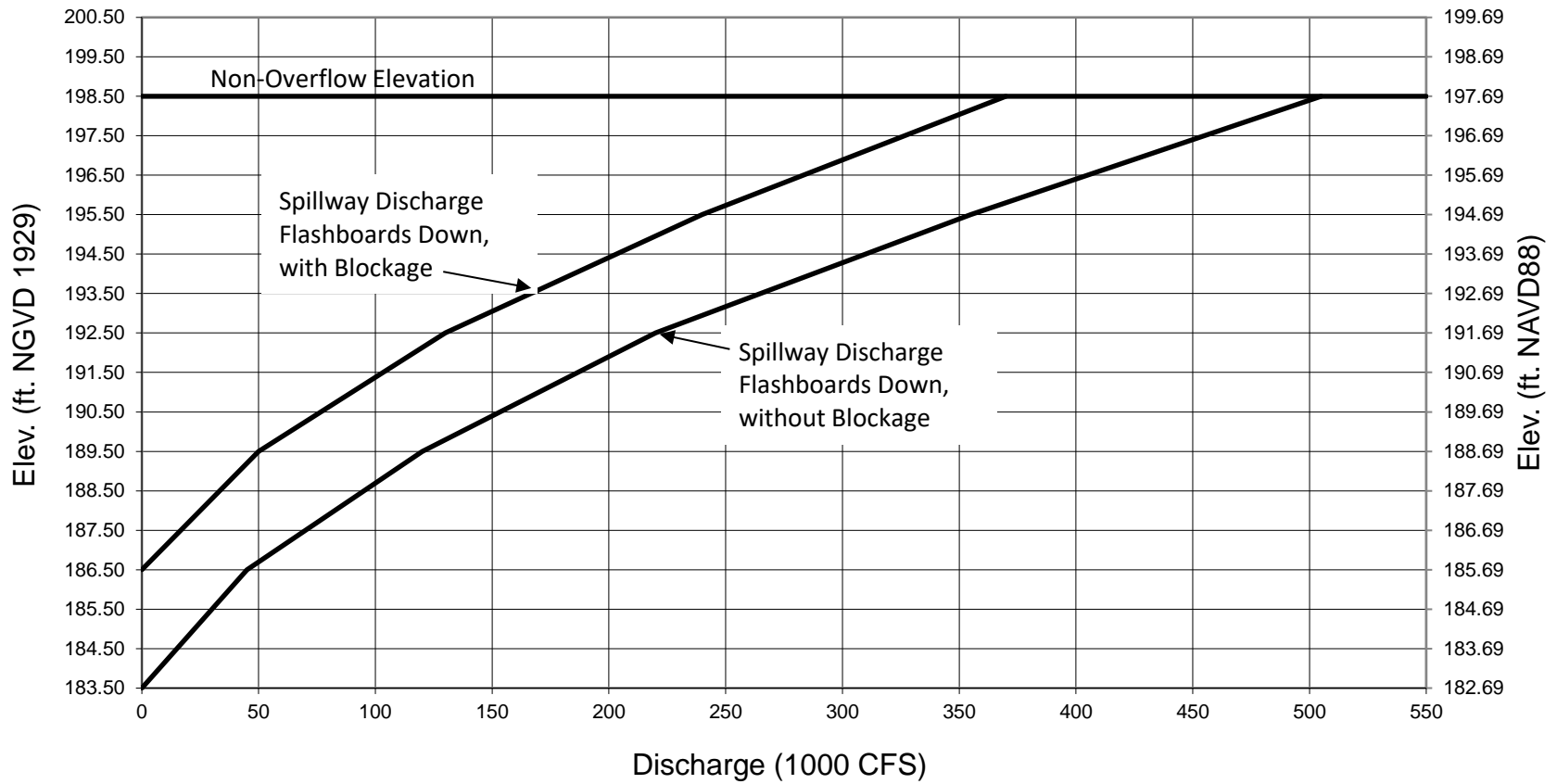
APPENDIX B-17

SPILLWAY RATING CURVE

EXHIBIT B-17

STEVENS CREEK HYDROELECTRIC PROJECT P-2535

SPILLWAY RATING CURVE (FLASHBOARDS DOWN)



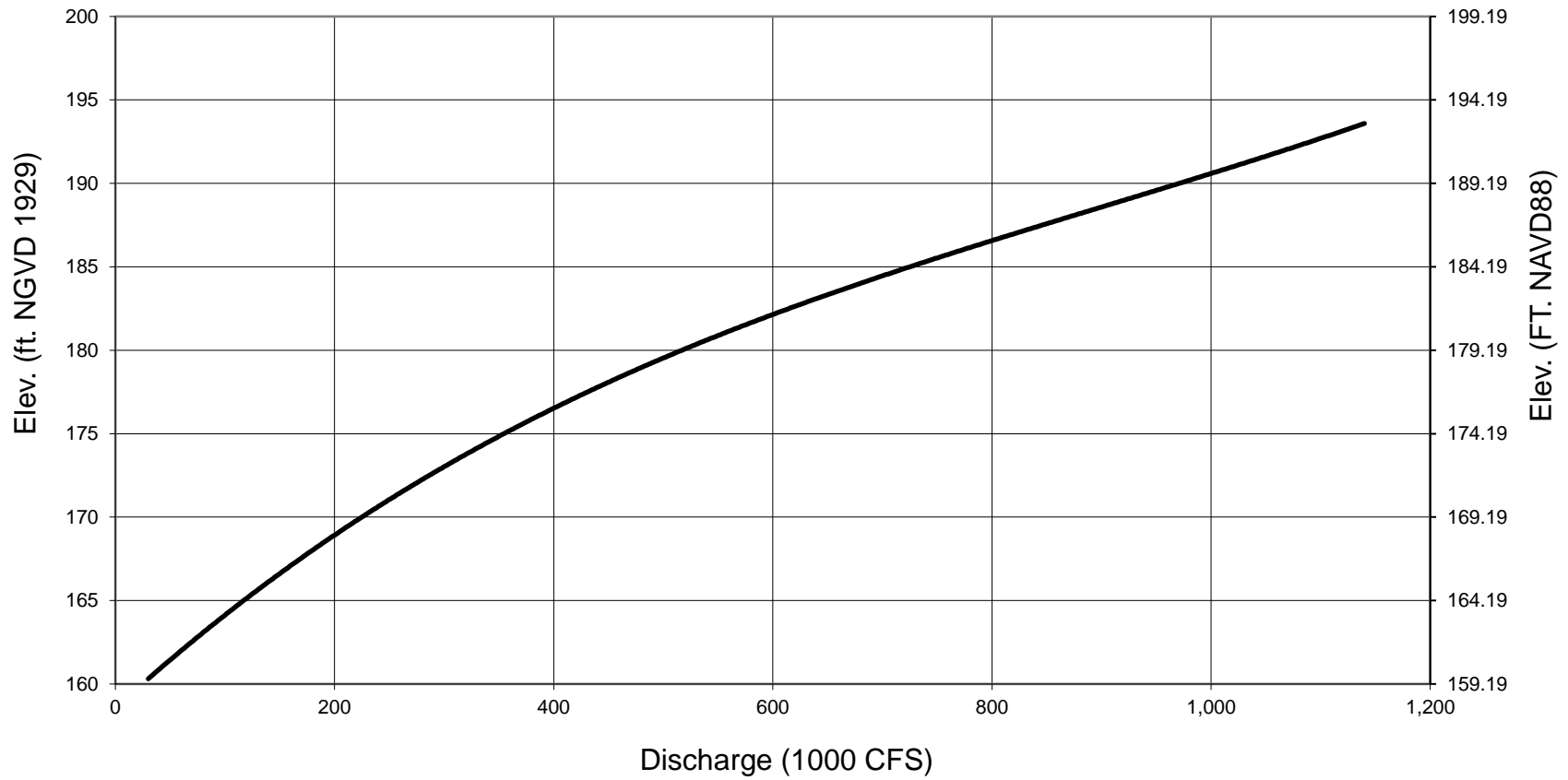
APPENDIX B-18

TAILWATER RATING CURVE

EXHIBIT B-18

STEVENS CREEK HYDROELECTRIC PROJECT P-2535

TAILWATER RATING CURVE



APPENDIX B-19

PLANT CAPABILITY CURVE

EXHIBIT B-19

STEVENS CREEK HYDROELECTRIC PROJECT P-2535

CAPABILITY CURVE

