UNITED STATES OF AMERICA

BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

DRAFT APPLICATION FOR NEW LICENSE FOR MAJOR PROJECT - EXISTING DAM

EXHIBIT B – PROJECT OPERATION AND RESOURCE UTILIZATION

Prepared by: Kleinschmidt

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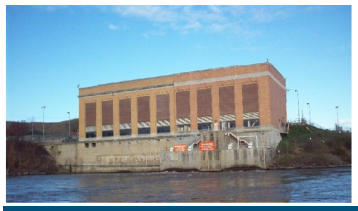
CRESCENT HYDROELECTRIC PROJECT RELICENSING

FERC NO. 4678




NEW YORK STATE OF OPPORTUNITY. | NY Power Authority

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1 Introduction

The Crescent Hydroelectric Project (Project) (FERC No. 4678) is an 11.8 MW hydroelectric project located on the Mohawk River in Saratoga, Albany, and Schenectady Counties, New York, and in the Towns of Waterford, Colonie, Halfmoon, Clifton Park, and Niskayuna. The Crescent Project and Vischer Ferry Project (FERC No. 4679) are located adjacent to one another on the Mohawk River in New York at river miles 4 and 14, respectively. The Crescent Project is the lower of the two projects and is located 2 miles upstream of the School Street Hydroelectric Project (FERC No. 2539) owned by Erie Boulevard Hydropower, L.P. The upstream project boundary of the Crescent Project is the downstream project boundary of the Vischer Ferry Hydroelectric Project. The Crescent Project generally consists of a dam, powerhouse, impoundment, and appurtenant facilities. The Crescent Project dam was originally constructed as part of the New York State Barge Canal System[1] (Barge Canal System[2]) to 'canalize' the Mohawk River from Scotia to Crescent, providing navigable conditions for barges and vessels and facilitating water level control and lock operations. To this day, the first priority for operation of the Crescent Project is to provide adequate water levels for operation of the New York State Barge Canal, with power generation being the second priority. The Crescent Project is owned and operated by the Power Authority of the State of New York (d/b/a "New York Power Authority" and referred to as "the Power Authority").

This exhibit is required under the Federal Energy Regulatory Commission (FERC) regulations which can be found in Title 18 of the Code of Federal Regulations (CFR) Sections 4.51(c) and 5.18(a)(5)(iii). The information provided herein covers the specifics prescribed for Exhibit B and serves the purpose of providing a statement of operation and resource utilization.

[1] The existing Barge Canal System was created following the passage of the Barge Canal Act in 1903. However, some portion of the original Erie Canal built between 1817 and 1825 still exists. For the purposes of this document, the Licensee will consistently refer to the portions of the Barge Canal or Erie Canal adjacent to the Projects as the Barge Canal System.

[2] The Barge Canal System is owned by the People of the State of New York and operated by the New York State Canal Corporation (NYSCC), which was created by the New York State Legislature in 1992 as a subsidiary of the New York State Thruway Authority (NYSTA). Prior to 1992, the operations of the Barge Canal System fell under the New York State Department of Transportation. On January 1, 2017, the NYSCC became a subsidiary of the Power Authority (N.Y. Public Authorities Law § 1005-b).

2 Project Operation (18 CFR Section 4.51(c)(1))

2.1 Operational Control

The Crescent hydropower plant can be operated remotely and manually. The plant is generally staffed Monday-Friday, during business hours, but the Project is typically operated remotely from the Power Authority's Blenheim Gilboa control room. The Project utilizes a programmable logic controller (PLC) system to monitor impoundment water levels and plant output. Many safeguards are in place for monitoring Project operations at all times.

2.2 Annual Plant Factor

The average annual plant factor is determined using the following equation:

$$\frac{\text{Average Annual Output}}{\text{Nameplate Capacity x 8,760 hrs./yr.}} = \text{Avg. Annual Plant Factor}$$

The Crescent Project has a gross average annual energy production of approximately 58,546 megawatt-hours (MWh) per year (2011-2020) and an annual plant factor of approximately 56.6% based on its current FERC-authorized capacity of 11.8 MW.

2.3 Existing and Proposed Power Plant Operations

2.3.1 Relevant Background Information

The Crescent Project dam was designed in 1907 and construction of the dam was completed in 1914 as part of the extensive modifications made to upgrade the original Erie Canal. These modifications allowed canal traffic to navigate on the Mohawk River, except where channels were constructed to bypass natural barriers. Cohoes Falls, an 80-foot-high set of falls located about 1.5 miles downstream from Crescent Dam, prevented direct navigation between the Mohawk and Hudson Rivers. Crescent Dam is associated with Lock E-6 and serves as the upstream terminus of the portion of the Barge Canal System known as the Waterford Flight, which includes the canal between Lock E-2 through Lock E-6. The Waterford Flight is a 2.5 mile-long section of canal (with a total lift of 169 feet) which allows boat traffic to bypass Cohoes Falls.

In 1913, hydropower was harnessed at the site. The original powerhouse was located at the east end of Dam A and dismantled *ca*. 1927 when a power line was strung across the river from a newly built, larger powerhouse to take its place. This current powerhouse, located on the western bank, was built in 1925 and expanded in the late 1980s. It houses the two original 2.8 megawatt (MW) Francis turbines and two newer 3.0 MW Kaplan turbines, for a total station capacity of 11.6 MW. On April 8, 1991, FERC issued an Order amending the license to an installed capacity of 11.8 MW based on actual performance.

2.3.2 Current Project Operations

The Crescent Project is operated on a run-of-river basis. The original purpose of the Crescent Dam was to impound water to support navigation on the Barge Canal; this remains true today. In 1983, the State of New York and the Power Authority entered into a Development Agreement whereby the State agreed to grant a perpetual hydroelectric easement to the Power Authority to develop and operate hydropower facilities at both the Crescent and Vischer Ferry project sites. The Development Agreement contains certain protocols

for standard operation and maintenance of both the Project and the Barge Canal System. During unusual conditions or emergencies associated with either system, public safety is always the first priority. Otherwise, navigation and Barge Canal System operations take priority over the operation of the Project. Unless emergency conditions exist, the Project operates in run-of-river mode. The Power Authority proposes to continue operating the Project in the same manner as under the current license.

The Crescent Project operations are performed in a manner to maintain the normal full pool elevation of the impoundment. Flow through the Project is through the powerhouse or over the dam. During the non-navigation season, a minimum flow of 100 cubic feet per second (cfs) (or inflow, whichever is less) is required to be passed at the Crescent Dam. In accordance with a July 31, 2007 FERC order, the minimum flow during canal navigation season is increased to 250 cfs and is passed through a notch in the Dam A flashboards. These minimum flows are for fish protection measures. Once minimum flows and any diversions required for canal operations are met, the remaining flow is available for power generation.

The Dam A and B sections of the Crescent Dam utilize 1-foot-high flashboards that are installed seasonally to help maintain the normal pool level in the Barge Canal System upstream of Lock E-6. The existing flashboards are wooden with vertical steel pin supports. The steel pins used to support the flashboards are set to fail when the headpond level overtops the flashboards by 4 feet. When the flashboards are up, the normal full pool elevation of the impoundment is elevation (El.) 185 ft. Barge Canal Datum (BCD). When the flashboards are out, the normal full pool elevation of the impoundment is El. 184 ft. BCD.

The Crescent hydropower plant operators monitor available water level and weather forecasting information (i.e., United States Geological Survey [USGS] webpage) for severe weather predictions. USGS maintains a streamflow gage upstream of the Crescent and Vischer Ferry Projects at Little Falls (USGS Gage No. 01347000), and downstream of the Crescent Project at Cohoes Falls (USGS Gage No. 01357500). The USGS also has streamflow gages in between the Projects and the Little Falls USGS gage, however, these gages have limited periods of records. The Little Falls USGS gage has a period of record extending back to 1927. The Cohoes USGS gage has a period of record extending back to 1917.

2.3.3 Operation During Adverse, Mean, and High Water Years

During normal water conditions, the Project is operated in accordance with the Power Authority's Water Management Plan for the Crescent and Vischer Ferry Projects. Under the Plan, the Crescent units are generally operated to maintain the impoundment elevation between 1 to 4 tenths of a foot below crest. Without flashboards the Crescent impoundment is maintained between 183.9 (max) and 183.6 (min), with a target elevation of 183.8 BCD. With flashboards the impoundment is maintained between 184.9 (max) and 184.6 (min), with a target elevation of 184.8 BCD. The newer Kaplan units are used first. As flow rises, one of the Francis units is brought on at full load, and the remaining load is balanced between the new units to maintain the required impoundment elevation. As the flow rises, output of new units is increased, and once all four units are operating at full output, water is spilled over the dam crest.

During high river flows the Project is operated in close cooperation with the Canal Corporation.

The Project has a FERC-approved Emergency Action Plan (EAP) and is operated in accordance with EAP requirements. The Power Authority conducts periodic inspections upstream and downstream of the Project to verify that no changes have occurred that would reasonably be expected to adversely affect public health, safety, or property in the event of a dam failure. An independent inspection by the Licensee's engineering

staff is also conducted at least annually and routine repairs are performed as needed.

During both scheduled and unscheduled maintenance and unit shutdown events, the Licensee will continue to pass inflow downstream through operation of the remaining units, through the gates or over the crest of the spillway, as necessary. Order of operation or shutdown of any of the units is based on flow conditions and what specific event is taking place.

3 Resource Utilization (18 CFR Section 4.51(c)(2))

3.1 Dependable Capacity

There are two capability periods: summer (May 1 – October 31) and winter (November 1 – April 30). For each capability period, the New York Independent System Operator (NYISO) calculates the dependable capacity ("Unforced Capacity") for small hydro projects according to Market Services Tariff 5.12.6.2. The calculation is based on the amount of generation the Project produced during the NYISO's 20 peak load hours for each capability period. The dependable maximum net capability (DMNC) values for the limited control run of river projects are not supported by seasonal testing, but instead are representative of their nameplate installed capacity, and are not expected to change. The DMNC for the Crescent Project is 11.6 MW for the summer period and 11.6 MW for the winter period.

3.2 Average Annual Energy Generation

Table 3-1 lists the annual and monthly gross generation (kilowatt hours (KWh) at the Project for the past 10 years, 2011-2020.

Table 3-1 Crescent Project Annual and Monthly Gross Generation (KWh) 2011-2020

Month	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	10-year Avg
Jan	4,931,788	6,659,216	5,786,267	5,743,267	4,410,776	2,999,383	7,399,358	6,572,113	7,027,003	7,692,439	5,922,161
Feb	4,641,138	5,597,242	4,755,445	4,057,144	2,190,906	4,963,518	6,310,469	5,466,748	7,574,634	6,922,723	5,247,997
Mar	8,370,255	6,477,868	7,119,745	5,383,796	4,339,441	6,099,470	6,743,293	8,743,765	7,409,975	9,045,416	6,973,302
Apr	8,797,085	2,858,699	8,081,444	6,471,051	6,285,016	5,067,682	8,309,467	8,713,577	8,439,831	8,627,262	7,165,111
May	7,050,543	6,289,441	4,996,102	6,444,119	2,656,903	3,648,423	7,844,314	5,948,478	7,902,780	6,650,794	5,943,190
Jun	4,809,296	3,229,858	7,576,288	4,563,368	4,613,766	1,867,788	5,876,281	1,734,598	6,221,318	1,772,246	4,226,481
Jul	3,423,047	996,258	4,743,195	2,768,745	3,226,400	1,358,785	5,318,376	1,339,048	3,209,033	804,289	2,718,718
Aug	2,863,983	1,243,008	1,380,893	2,306,751	491,683	2,111,553	2,291,916	3,877,257	2,406,604	1,655,702	2,062,935
Sep	5,106,465	1,242,087	2,448,687	1,620,467	494,404	887,073	1,986,053	3,966,087	2,003,484	651,760	2,040,657
Oct	8,107,630	3,187,896	3,179,426	2,921,539	2,378,832	2,144,888	2,923,227	6,694,901	6,792,646	2,607,779	4,093,876
Nov	6,956,923	3,429,066	5,459,618	3,766,834	3,618,259	3,960,238	7,597,116	8,918,264	8,245,823	4,570,743	5,652,288
Dec	8,676,469	6,849,811	5,943,388	6,667,841	4,132,313	6,679,262	5,203,132	8,625,758	6,687,274	5,522,926	6,498,817
Total	**73,734,622**	**48,060,450**	**61,470,498**	**52,714,922**	**38,838,699**	**41,788,063**	**67,803,002**	**70,600,594**	**73,920,405**	**56,524,079**	**58,545,533**

Generation statistics are based on hourly generation data.

3.3 Project Hydrology

There are several methods and indicators available to monitor the flow rates on the Mohawk River. In addition to the hourly outflow data collected by the Licensee at the Projects, the USGS also collects streamflow data for the Mohawk River. The USGS maintains a streamflow gage downstream of the Crescent Project at Cohoes Falls (USGS Gage No. 01357500), and upstream of the Vischer Ferry Project at Little Falls (USGS Gage No. 01347000), The USGS also has streamflow gages between the Projects and the Little Falls USGS gage - however, these other gages have limited periods of records. The Little Falls USGS gage has a period of record extending back to 1927. The Cohoes USGS gage has a period of record extending back to 1917.

The annual and monthly minimum, median, mean, and maximum flows in cfs at the Crescent Project for the period January 1, 2011 through December 31, 2020 are provided in Table 3-2. Annual flow duration curves for the Crescent Project for the same period of record (January 1, 2011 through December 31, 2020) are shown in Figure 3-1. Monthly flow duration curves are provided in Figures 3-2 through 3-13. The flow statistics and flow duration curves were developed from outflow data collected by the Licensee at the Projects. Mean daily discharge data were used to develop the flow duration curves.[3]

[3] The Power Authority's Project outflow data used to develop the flow duration curves were reviewed and outliers excluded. To do this, inconsistent mean daily discharge values (values that were peaks or valleys as compared to adjacent daily discharge values) were excluded from the data used to develop the flow duration curves.

Table 3-2 Flow Statistics* (in cfs) for the Crescent Project

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	Period of Record: 10 years (January 1, 2011 - December 31, 2020)												
Min	1,447	989	835	718	731	225	143	146	141	313	1,322	1,614	141
Median	5,054	4,228	6,326	10,452	4,875	2,680	1,481	1,265	1,221	2,486	4,055	5,892	3,861
Mean	6,966	6,614	8,914	13,020	6,877	4,591	2,585	1,930	2,862	4,148	5,501	7,493	5,972
Max	31,692	49,453	59,306	61,261	41,489	54,487	29,720	30,186	72,841	29,656	51,259	56,335	72,841

Source: New York Power Authority

* Flow statistics are based on the average daily total station flow.

Figure 3-1 Annual Flow Duration Curves for the Crescent Project

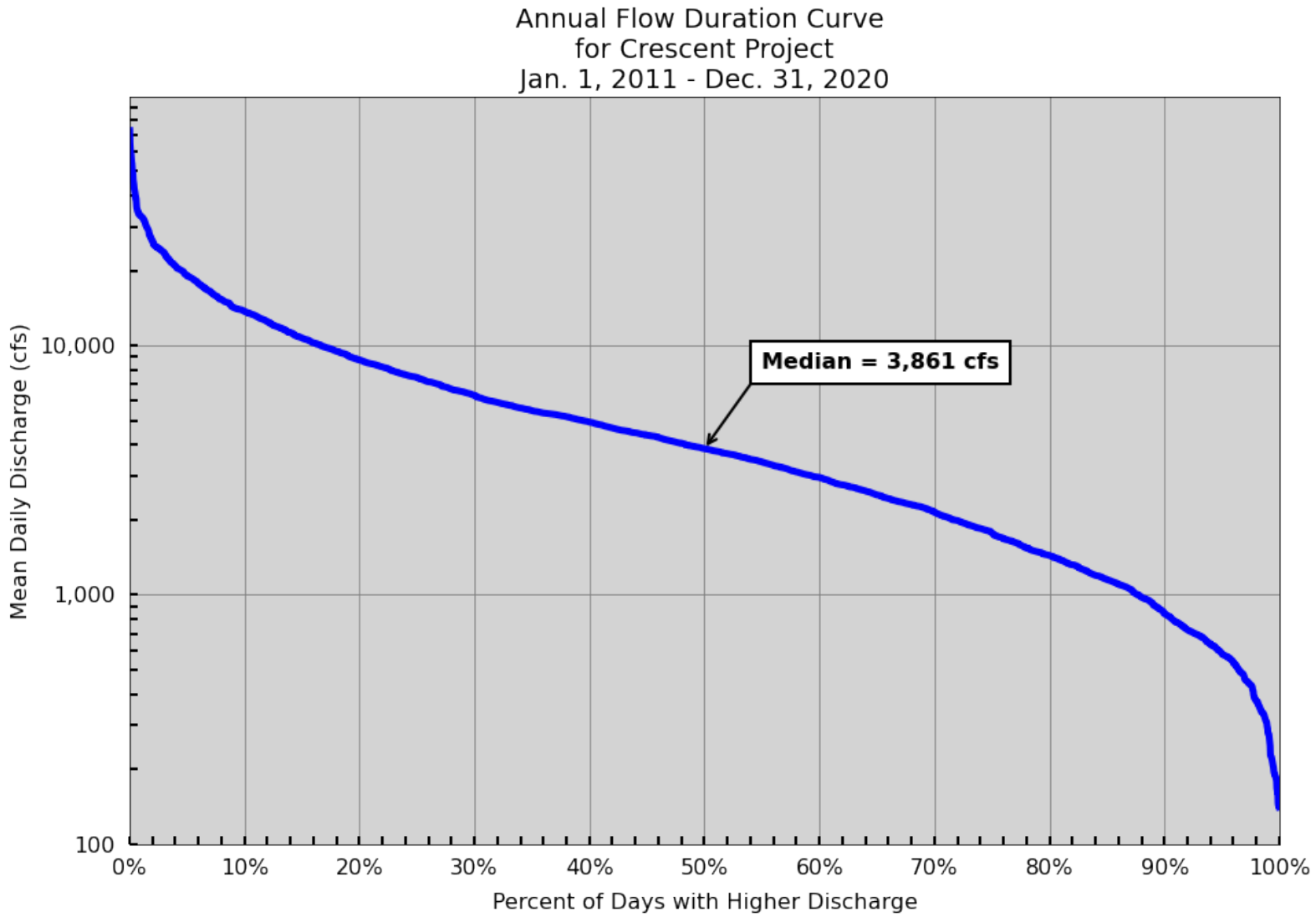


Figure 3-2 Monthly Flow Duration Curve for the Crescent Project - January

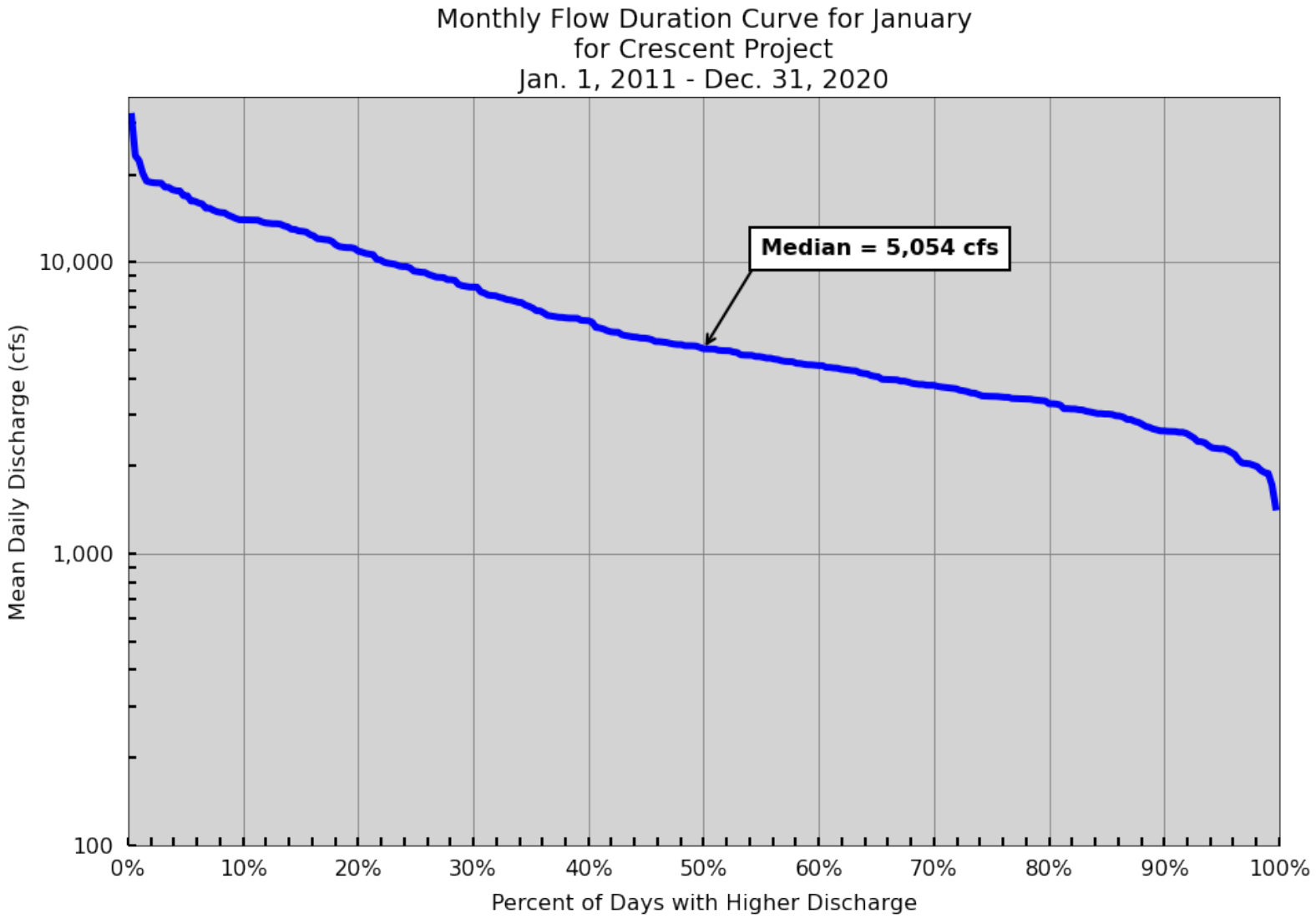


Figure 3-3 Monthly Flow Duration Curve for the Crescent Project - February

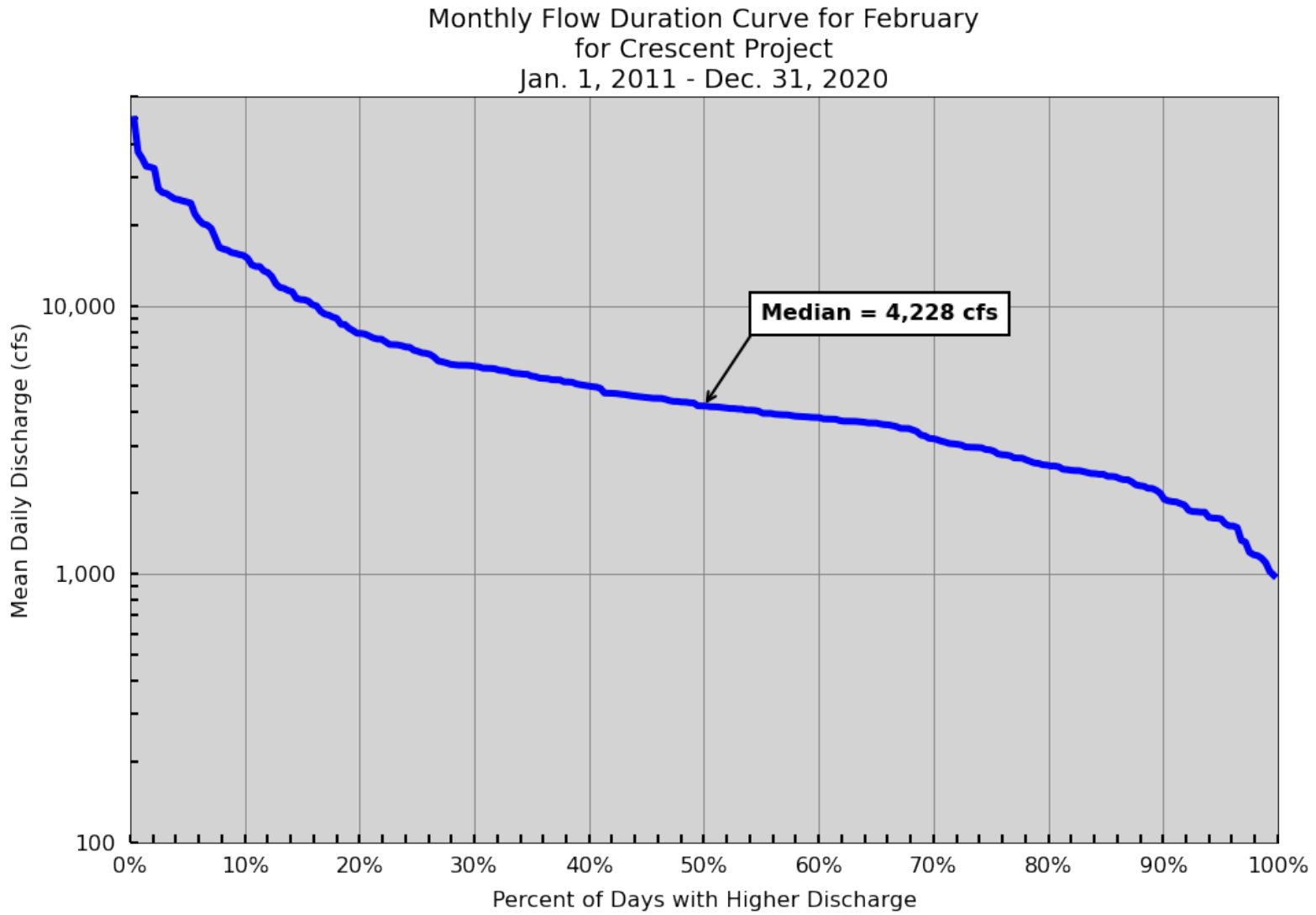


Figure 3-4 Monthly Flow Duration Curve for the Crescent Project - March

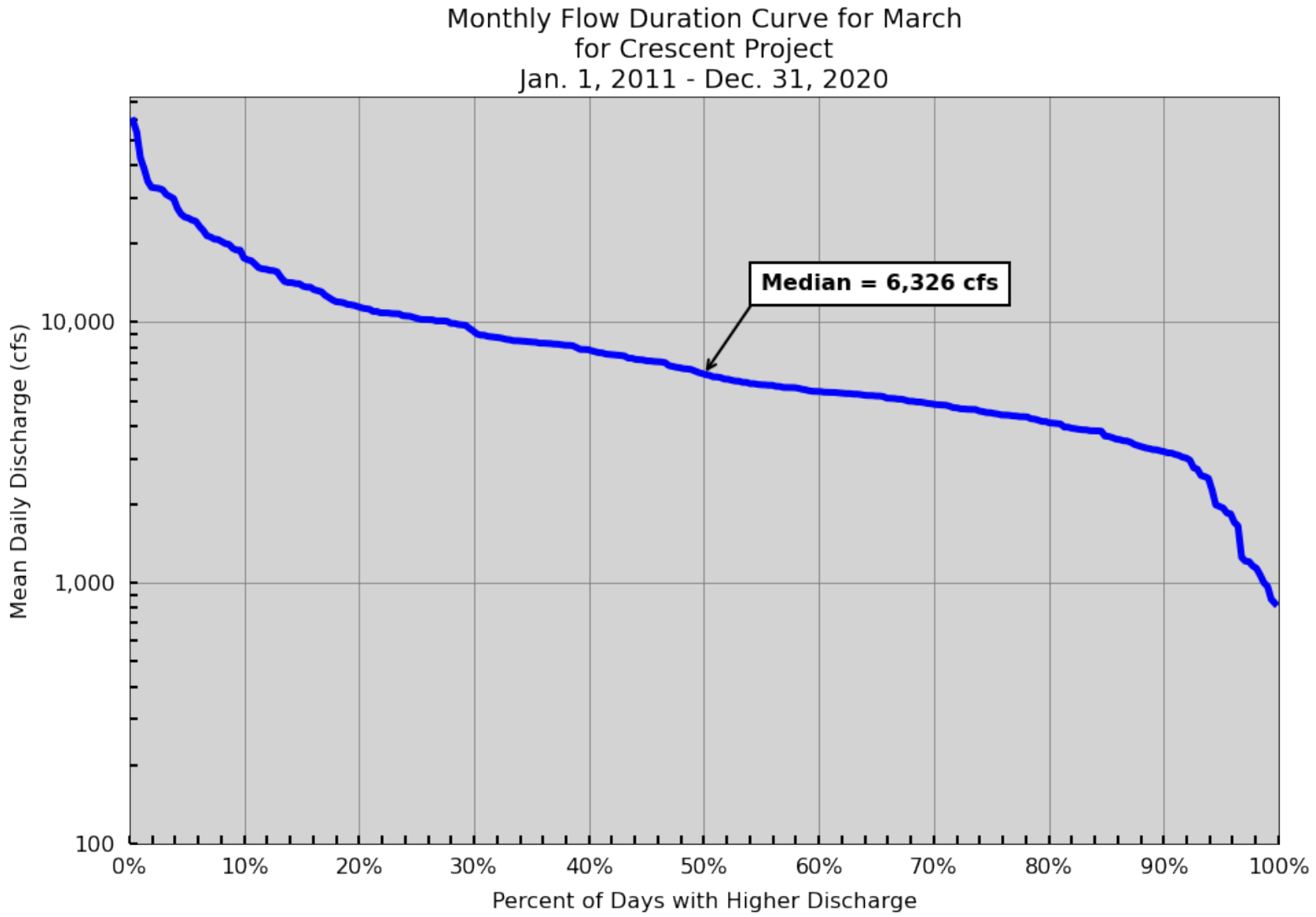


Figure 3-5 Monthly Flow Duration Curve for the Crescent Project - April

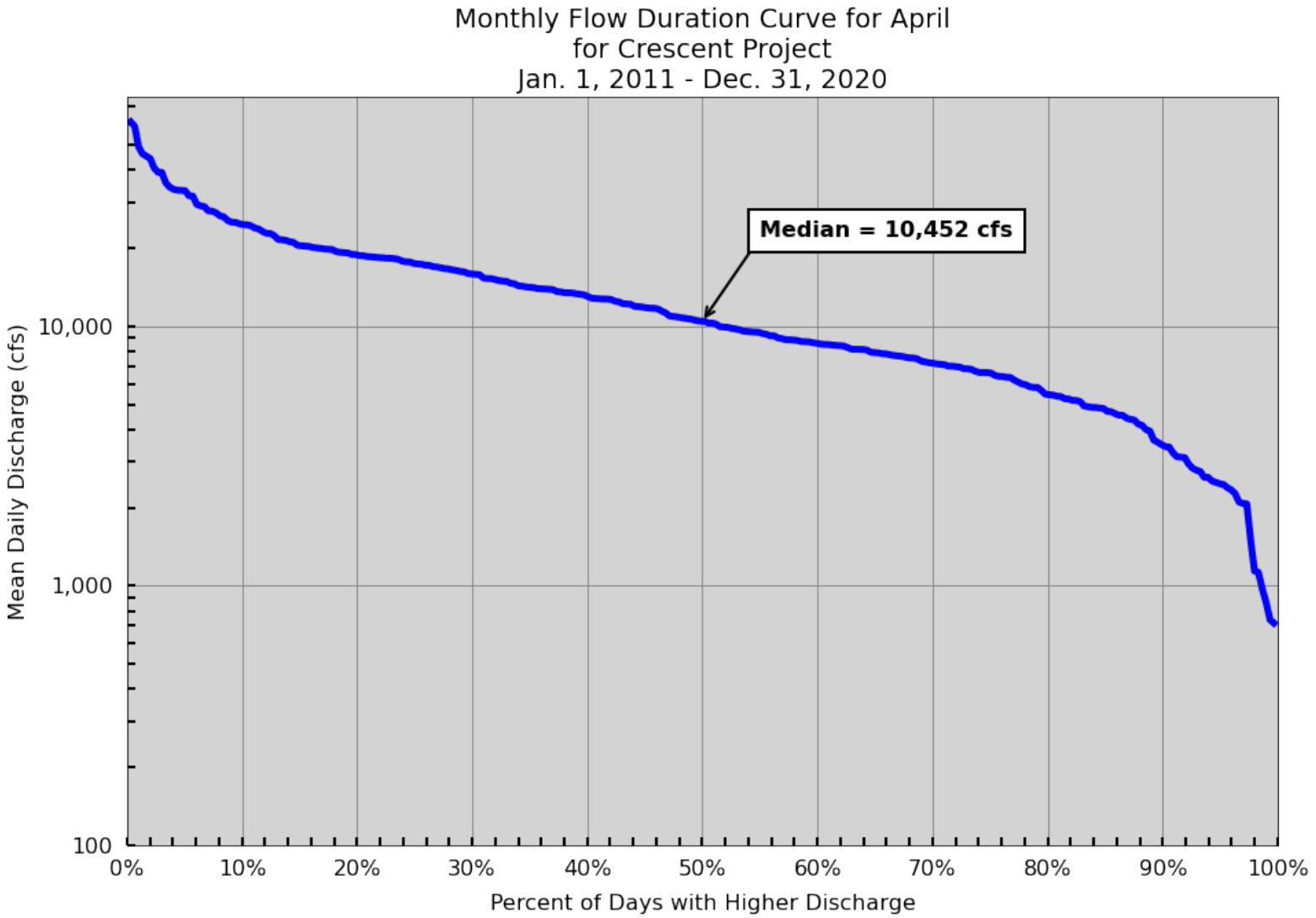


Figure 3-6 Monthly Flow Duration Curve for the Crescent Project - May

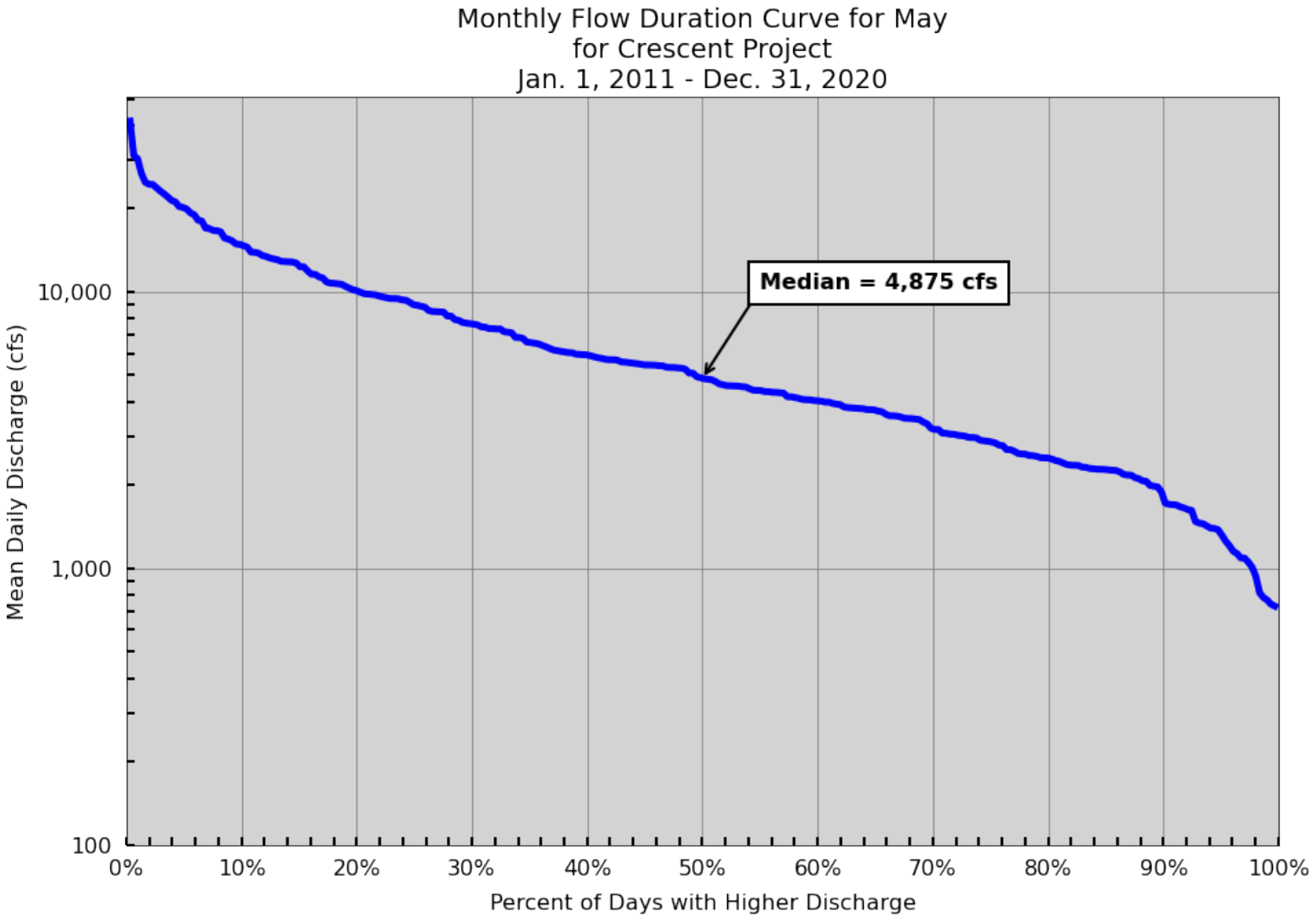


Figure 3-7 Monthly Flow Duration Curve for the Crescent Project - June

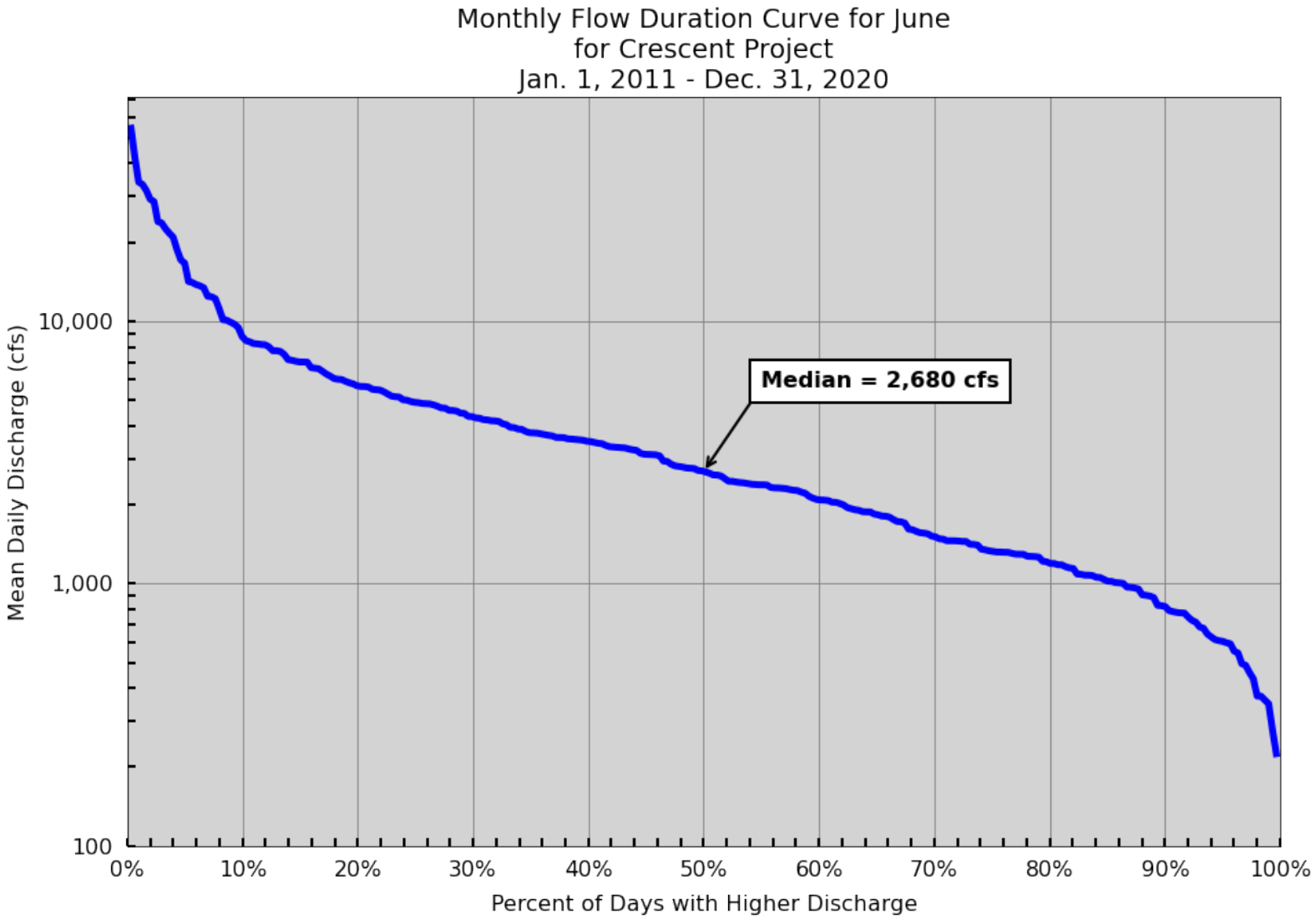


Figure 3-8 Monthly Flow Duration Curve for the Crescent Project - July

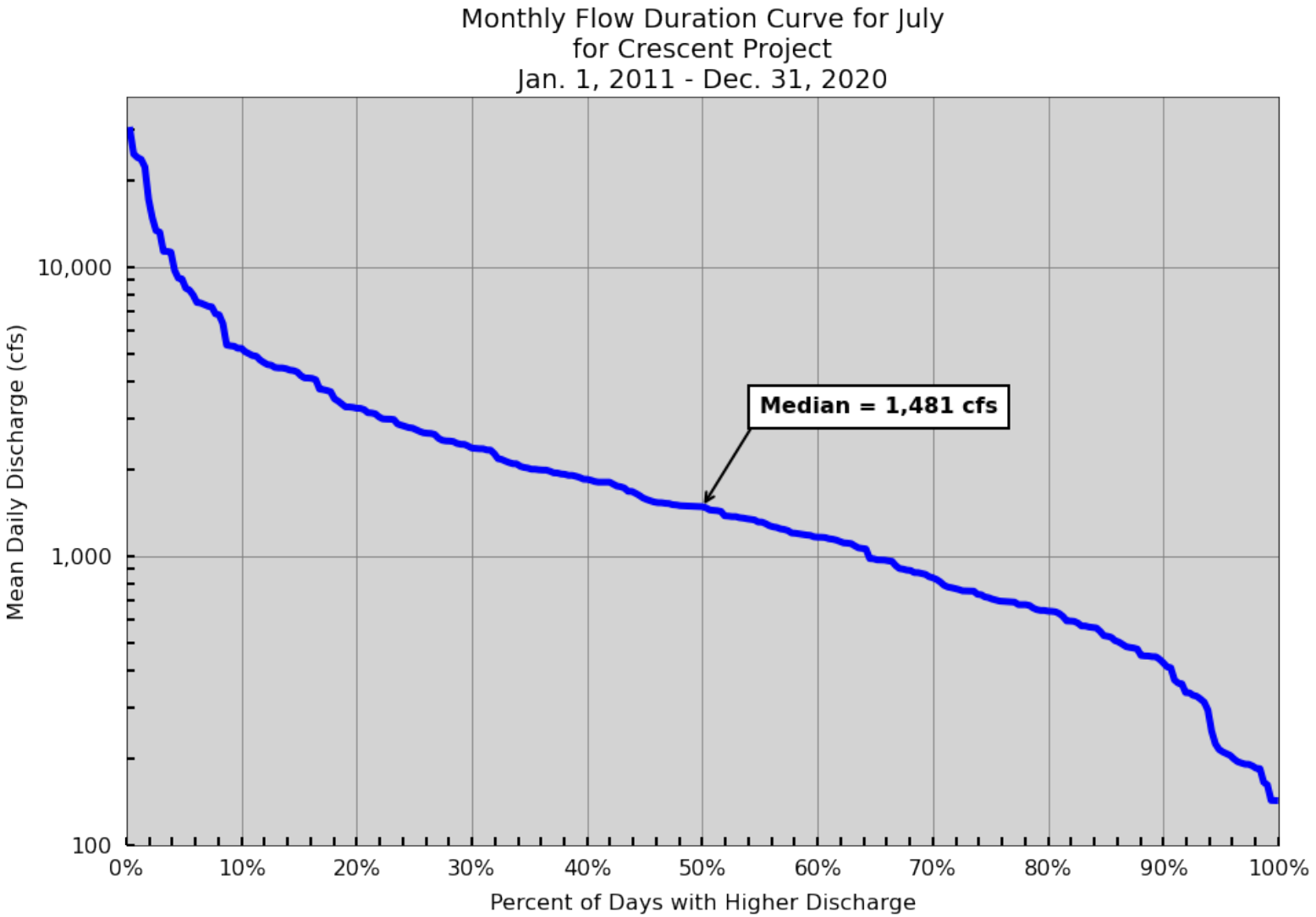


Figure 3-9 Monthly Flow Duration Curve for the Crescent Project - August

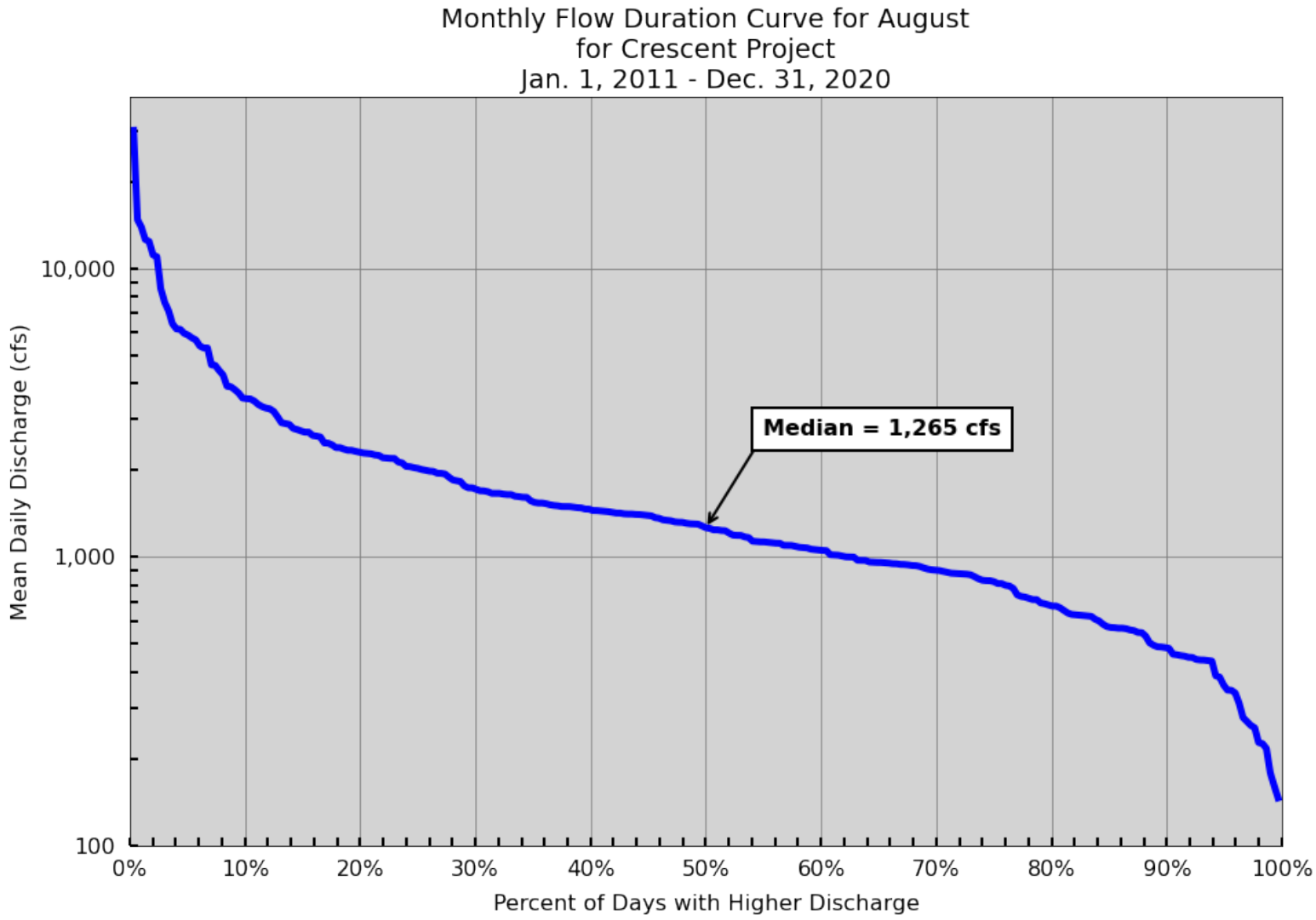


Figure 3-10 Monthly Flow Duration Curve for the Crescent Project - September

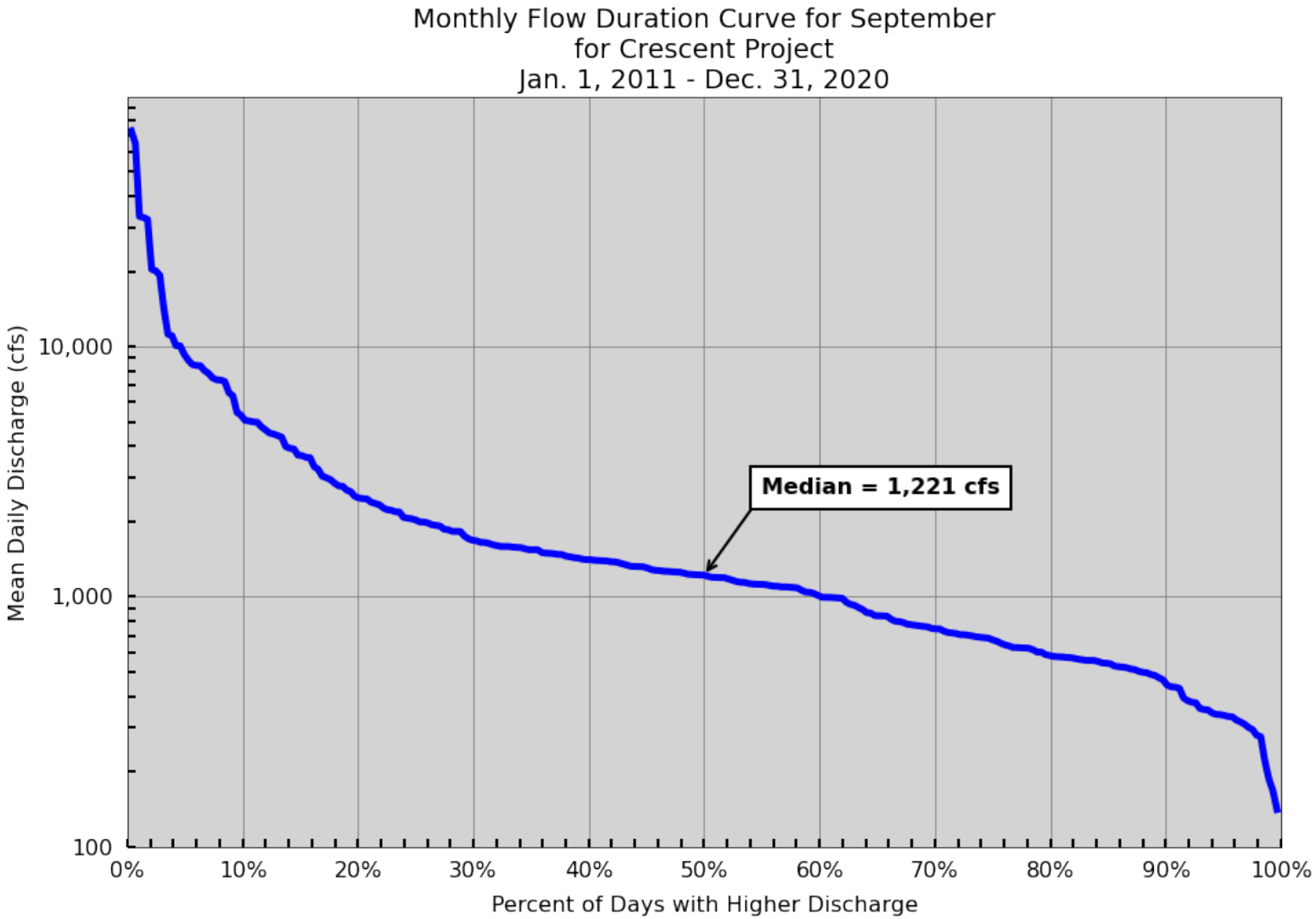


Figure 3-11 Monthly Flow Duration Curve for the Crescent Project - October

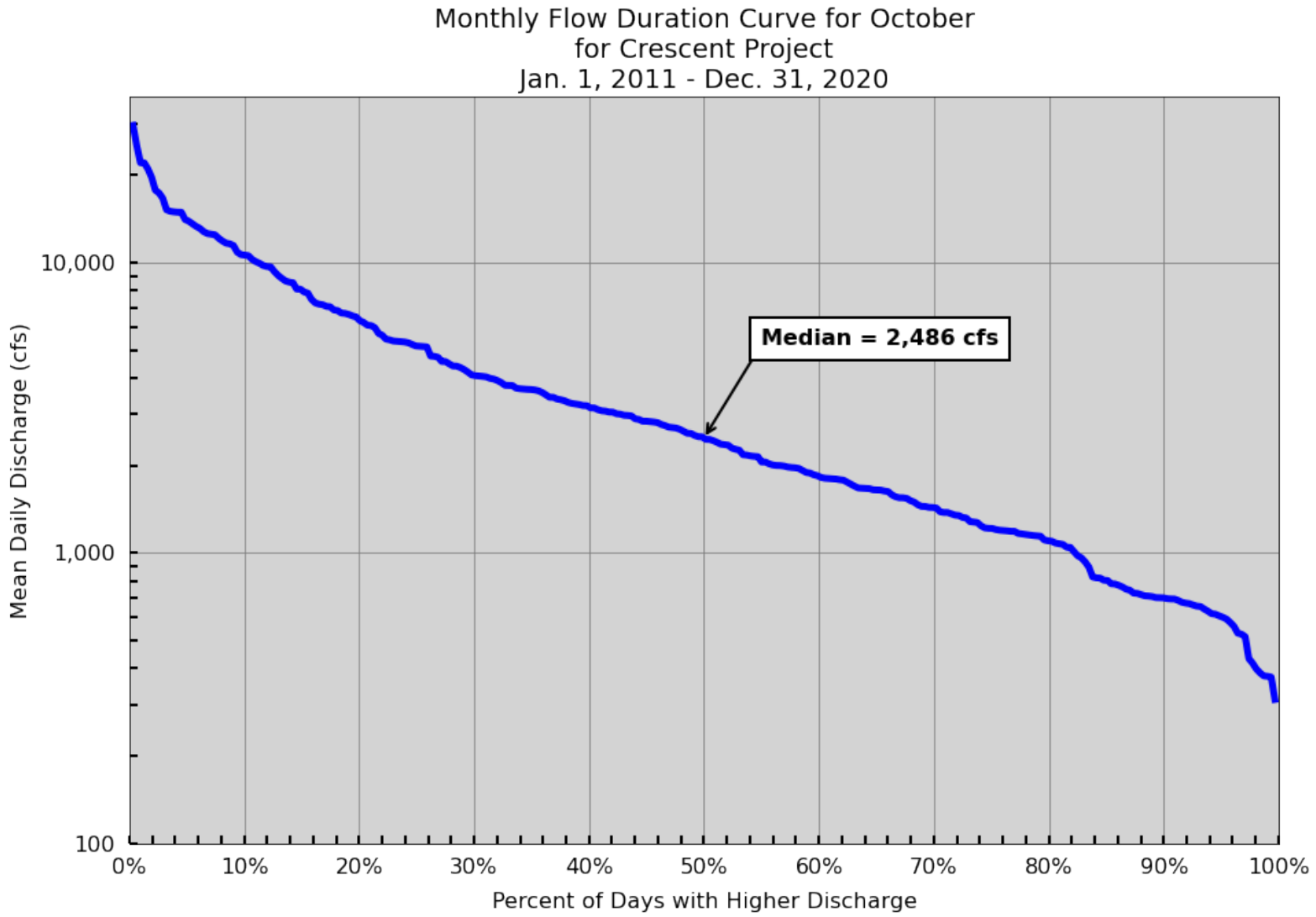


Figure 3-12 Monthly Flow Duration Curve for the Crescent Project - November

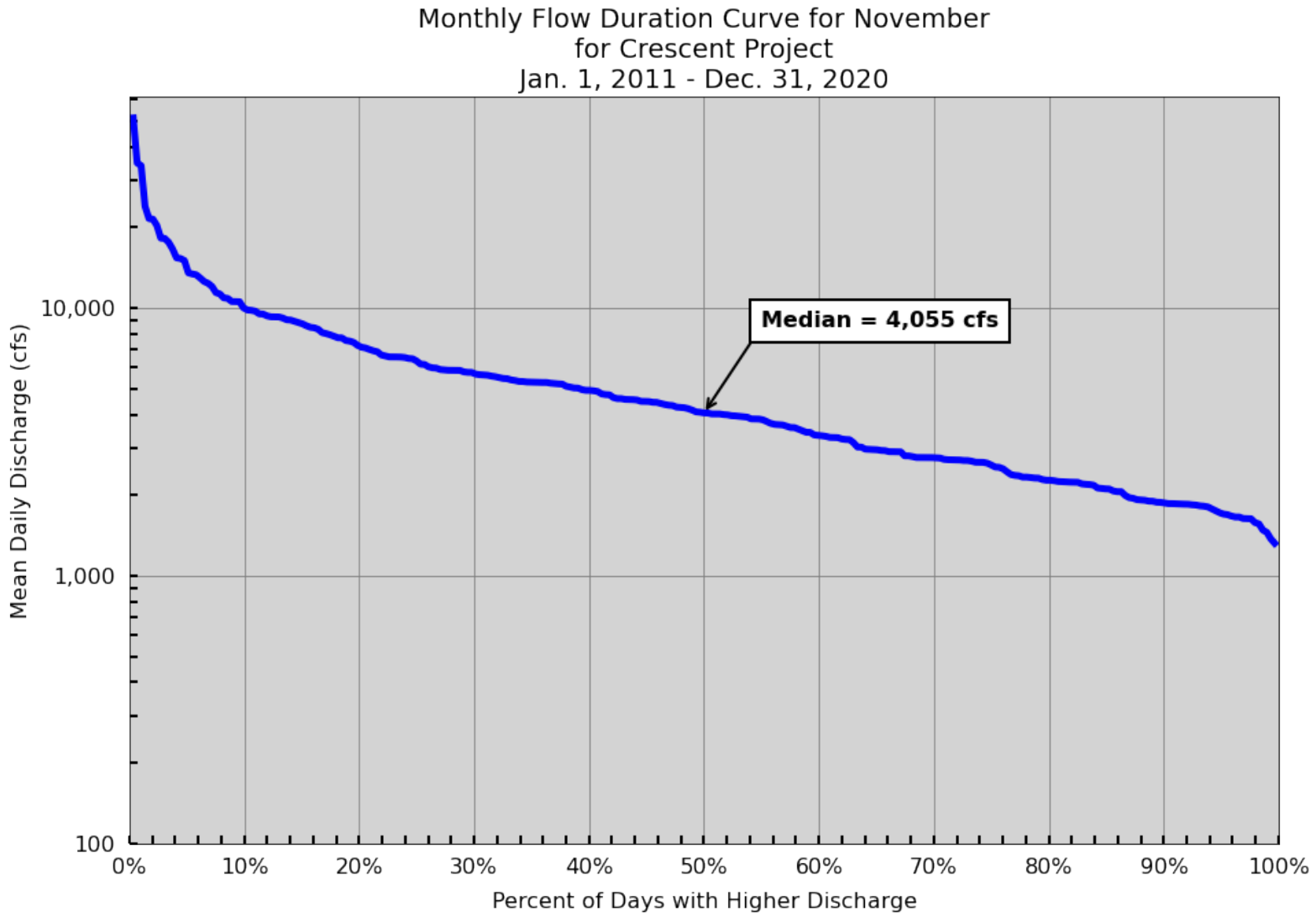
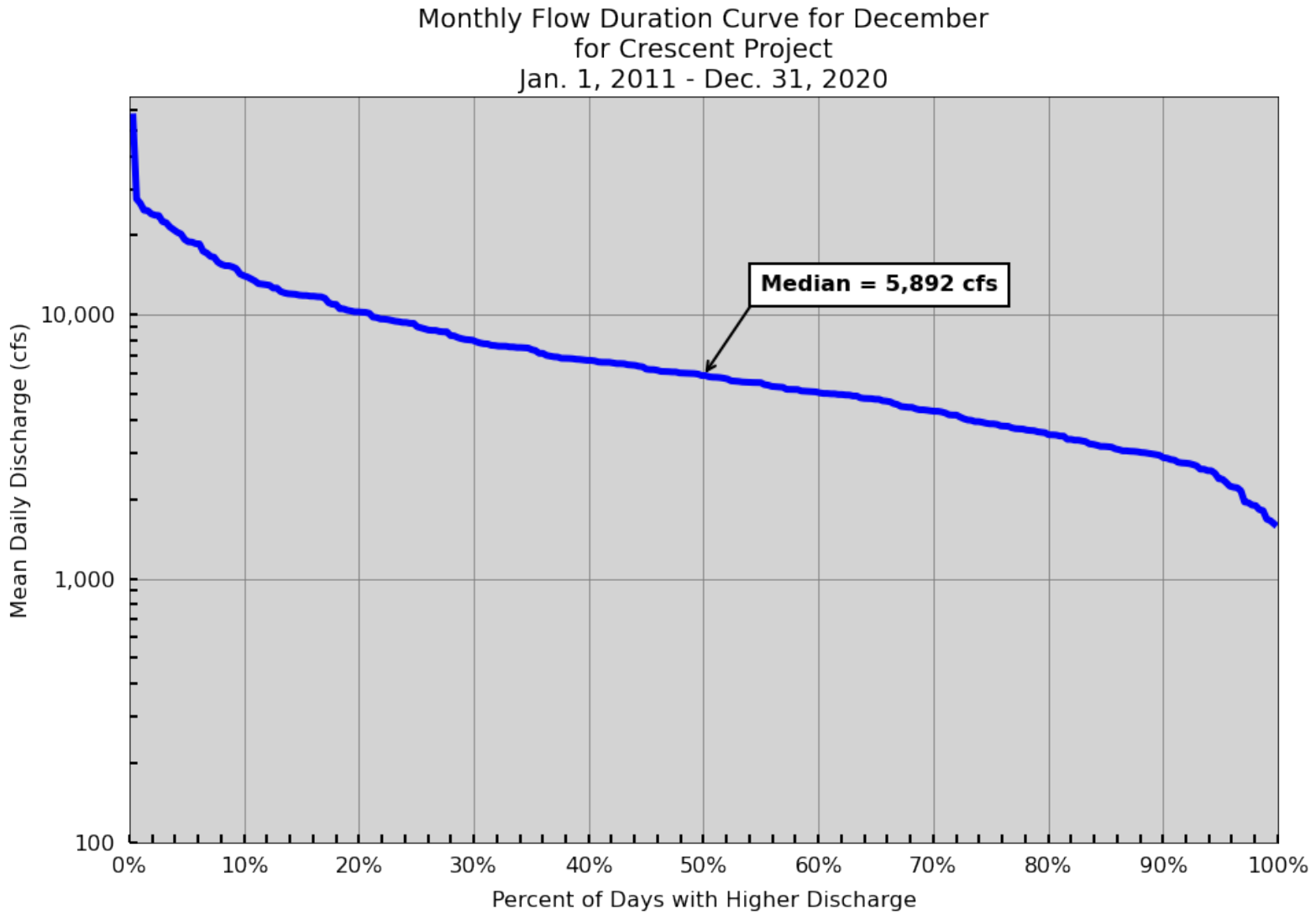


Figure 3-13 Monthly Flow Duration Curve for the Crescent Project - December



3.4 Area Capacity and Rule Curve

The Crescent Project is operated as run-of-river. The Project has limitations on impoundment level fluctuations and requirements for minimum flows and does not have the capacity to store or manage flows on a long-term basis.

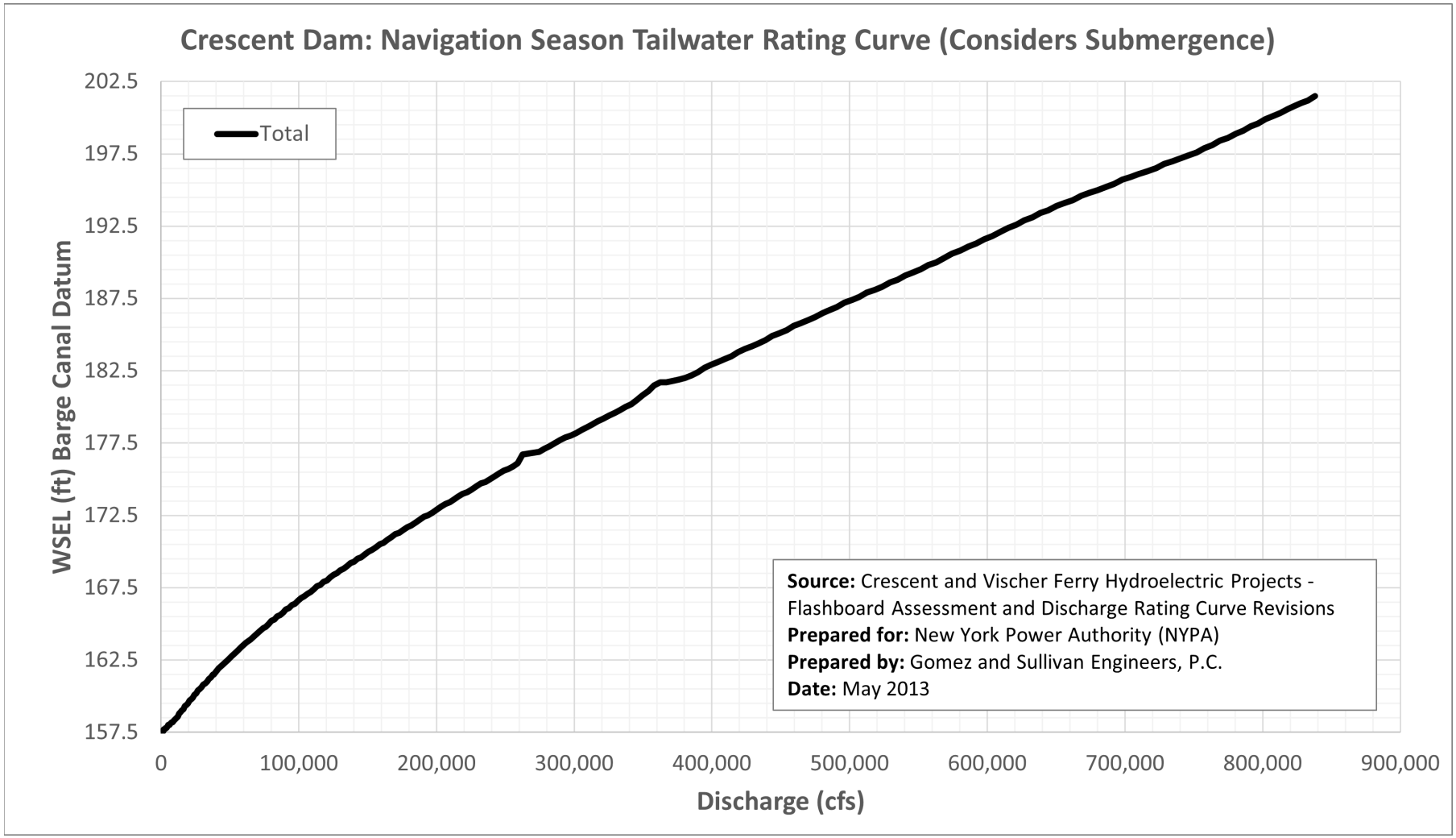
3.5 Hydraulic Capacity

The minimum hydraulic capacity of each of the Project's four turbine units is approximately 350-400 cfs. The maximum hydraulic capacity of each of the Project's four turbine units is approximately 1,500-1820 cfs.

3.6 Tailwater Rating Curve

The tailwater elevation for the Project is approximately El. 157 BCD. The tailwater rating curve for the Project is shown in Figure 3-14.

Figure 3-14 Crescent Project Tailwater Rating Curve



4 Utilization of Project Power (18 CFR Section 4.51(c)(3))

The primary purpose of the Project dam is for navigation in support of the operation of the Barge Canal System. The Project's other purpose is for generation of clean, renewable power. Electricity generated at the Project is used to supply energy and capacity to the NYISO, a regional transmission organization that coordinates the generation and transmission of wholesale electricity within the state of New York. The Project plays a role in New York's renewable energy portfolio because it provides low-cost emissions-free, baseload power.

5 Plans for Future Development (18 CFR Section 4.51(c)(4))

The Power Authority has no plans to construct new facilities or to alter operations at the Project. The Power Authority seeks authorization to continue operating the Project in its current configuration and as it is currently licensed to operate.

6 Literature Cited

Gomez and Sullivan Engineers. P.C. May 2013. Crescent and Vischer Ferry Hydroelectric Projects - Flashboard Assessment and Discharge Rating Curve Revisions. Prepared for the Power Authority.