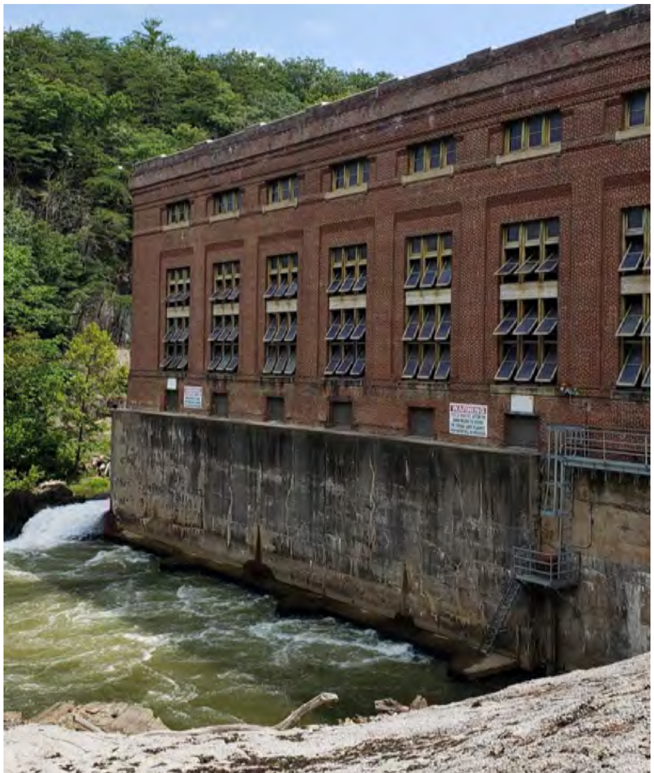

DRAFT LICENSE APPLICATION

Volume I of V

Byllesby-Buck Hydroelectric Project
(FERC No. 2514)

October 1, 2021

Prepared by:

Prepared for:

Appalachian Power Company

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Byllesby-Buck Hydroelectric Project
FERC Project No. 2514
DRAFT LICENSE APPLICATION

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AEP	American Electric Power
Appalachian or Licensee	Appalachian Power Company
Buck	Buck Development
Byllesby	Byllesby Development
CFR	Code of Federal Regulations
cfs	cubic feet per second
COC	Columbus Operations Center
CWA	Clean Water Act
CUI/CEII	Controlled Unclassified Information//Classified Energy/Electric Infrastructure Information
DLA	Draft License Application
EAP	Emergency Action Plan
EL.	elevation
FERC or Commission	Federal Energy Regulatory Commission
FLA	Final License Application
ft	feet/foot
FPA	Federal Power Act
GSU	generator step-up transformer
hp	horsepower
Hz	hertz
ILP	Integrated Licensing Process
kV	kilovolt
kW	kilowatt
MEP	most efficient point
MW	megawatt
MWh	megawatt hour
NGVD	Nation Geodetic Vertical Datum of 1929
PH	phase
POR	period of record
Project	Byllesby-Buck Hydroelectric Project
PM&E	protection, mitigation, and enhancement
rpm	rotations per minute
RSP	Revised Study Plan

USGS	U.S. Geological Survey
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USC	United States Code
V	volt
VAC	Virginia Administrative Code
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VWP	Virginia Water Protection

DRAFT LICENSE APPLICATION

BYLLESBY-BUCK HYDROELECTRIC PROJECT

(FERC NO. 2514)

EXECUTIVE SUMMARY

Executive Summary

Introduction

Appalachian Power Company (Appalachian or Licensee), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the two-development Byllesby-Buck Hydroelectric Project (Project) (Federal Energy Regulatory Commission [FERC or Commission] Project No. 2514), located on the upper New River in Carroll County, Virginia.

The Project is currently licensed by FERC under the authority granted to FERC by Congress through the Federal Power Act, 16 United States Code (USC) §791(a), et seq., to license and oversee the operation of non-federal hydroelectric projects on jurisdictional waters and/or federal land. There are no federal lands associated with the Project.

The Project underwent relicensing in the early 1990s, including conversion to run-of-river operations and incorporating additional protection, mitigation, and enhancement (PM&E) measures. The current operating license for the Project expires on February 29, 2024. Accordingly, Appalachian is pursuing a new license for the Project pursuant to the Commission's Integrated Licensing Process (ILP), as described at 18 Code of Federal Regulations (CFR) Part 5. In accordance with FERC's regulations at 18 Code of Federal Regulations (CFR) §16.9(b), Appalachian must file its application for a new license with FERC no later than February 28, 2022.

Appalachian is applying for a 50-year license for the Project. Appalachian believes that the level of investment in terms of plant modernization and environmental measures proposed in the final license application (FLA) will support this requested license term.

Summary of Byllesby-Buck Hydroelectric Project

The Project consists of two hydroelectric developments. The Byllesby Development (Byllesby) is located about nine miles north of the city of Galax, Virginia, on the New River. The Buck Development (Buck) is located about 3 miles downstream from the Byllesby dam. Each development consists of a reservoir, concrete gravity dam and spillway, and powerhouse, and the Project also includes a control house and switchyard located at the Byllesby Development and two 2-mile long 13.2-kV overhead transmission lines connecting the two developments. The Project has been operated by Appalachian over the previous license term in a run-of-river mode, utilizing upper New River inflows to provide up to 30.1 megawatts (MW) of renewable capacity and average annual energy generation of 92,891 megawatt hours (MWh).

Agency Consultation and Relicensing Process

This section will be developed for the FLA.

Summary of Proposed Action and Enhancement Measures

Appalachian proposes to continue operating the Project as presently licensed. The Project operates in a run-of-river mode under all flow conditions. Under normal operating conditions, Appalachian operates the Project to use available flows for powerhouse generation, maintaining the elevation (EL.) of the Byllesby reservoir between EL. 2,078.2 feet (ft) and 2,079.2 ft and the Buck reservoir between EL. 2,002.4 ft and 2,003.4 ft. Appalachian is also presently required to release a minimum flow of 360 cubic feet per second (cfs) or inflow to the Project, whichever is less, downstream of the Project powerhouses.

During the new license term, Appalachian proposes to modernize the Byllesby and Buck developments to include replacement of Byllesby Units 1, 2 and 4 and Buck Units 1 and 3. All but one (Buck Unit 2) of the seven turbine-generator units installed at the Project are the original major components of the Project as constructed in 1912. Many of the major electrical and mechanical and supporting systems and components of the Project developments are nearing the end of their useful service life, when compared to industry-recognized standards. The existing vertical Francis units would be replaced by fixed blade Kaplan units. Unit upgrade activities would be confined to within the powerhouse, and there would be minimal changes to operating parameters for the Project. Following completion of the upgrades, the authorized installed capacities for the Byllesby and Buck developments will be 20.85 MW and 10.39 MW, respectively, with maximum hydraulic capacities of 5,511 cfs and 3,570 cfs, respectively. Due to efficiencies of the Kaplan units and modern components, the upgrades are expected to increase average annual generation at the Project by approximately 25,927 MWh.

This section will be further developed for the FLA and take into consideration comments received on the Draft License Application (DLA) and the pending Updated Study Report (USR), to include proposed PM&E measures to be included in the new license.

Application Road Map

This DLA consists of five volumes.

<u>Volume I of V (Public)</u>

- **Table of Contents**
- **Executive Summary**
- **Initial Statement and Additional Information Required by 18 CFR §4.32**
- **Exhibit A – Project Description**
- **Exhibit B – Project Operations and Resource Utilization**
- **Exhibit C – Construction History and Proposed Construction Schedule**
- **Exhibit D – Costs and Financing**

<u>Volume II of V (Public)</u>

- **Exhibit E – Environmental Report:** Includes all study reports (as Appendices, including consultation). Final Study Reports are not included in this Draft License Application as they are still under preparation and will be filed under with the Updated Study Report (to be filed with FERC by November 17, 2021).

<u>Volume III of V (Public)</u>

- **Exhibit F – List of General Design Drawings:** Includes the list of design drawings filed as Critical Energy Infrastructure Information (CUI//CEII) in accordance with 18 CFR §388.112 in Volume IV.
- **Exhibit G – Project Boundary Maps:** Includes map showing the Project Boundary for the Byllesby-Buck Project (*Electronic project boundary files to be included with the FLA*.)
- **Exhibit H – Ability to Operate:** Describes the commitment and responsibility of Appalachian as a Licensee to continue to operate and maintain the Project and the needs and costs for power from the Project or alternate sources. The Single-line Diagram is provided in Volume IV (CUI//CEII). (*This section is still under development and will be included with the FLA.)*

<u>Volume IV of V (CEII)</u>

- **Exhibit F – General Design Drawings**
- **Exhibit H – Single-line Diagram**

<u>Volume V of V (Controlled Unclassified Information/Privileged [CUI/PRIV])</u>

- **Cultural Resources Study Report**

DRAFT LICENSE APPLICATION

BYLLESBY-BUCK HYDROELECTRIC PROJECT

(FERC NO. 2514)

Initial Statement (18 CFR §4.51(a))

BEFORE THE UNITED STATES OF AMERICA FEDERAL ENERGY REGULATORY COMMISSION

BYLLESBY-BUCK HYDROELECTRIC PROJECT
(FERC NO. 2514)

APPLICATION FOR A NEW LICENSE FOR A MAJOR WATER POWER PROJECT – GREATER THAN 5 MEGAWATTS

(1) Appalachian Power Company (Appalachian or Licensee or Applicant), a unit of American Electric Power (AEP) applies to the Federal Energy Regulatory Commission (FERC or Commission) for a new license for the Byllesby-Buck Hydroelectric Project (Project) (FERC Project No. 2514). The current license for the Project was issued on March 25, 1994 and expires on February 29, 2024.

(2) The location of the Project is:

State or territory:	Virginia
County:	Carroll
Township or nearby town:	City of Galax
Stream or other body of water:	New River

(3) The exact name, address and telephone number of the applicant are:

Appalachian Power Company
Robert A. Gallimore
Plant Manager Hydro
American Electric Power Service Corporation
40 Franklin Road SW
Roanoke, Virginia 24011

(4) The exact name, address and telephone number of each person authorized to act as agent for the applicant in this application are:

Ms. Elizabeth B. Parcell
Process Supervisor
American Electric Power Service Corporation
40 Franklin Road SW
Roanoke, VA 24011
(540) 985-2441
ebparcell@aep.com

Mr. Jonathan Magalski
Environmental Supervisor, Renewables
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, OH 43215
(614) 716-2240

jmmagalski@aep.com

(5) The applicant is a domestic corporation and is not claiming preference under Section 7(a) of the Federal Power Act. See 16 U.S.C. 796.

(6) The statutory or regulatory requirements of the state in which the Project is located that affect the Project as proposed with respect to bed and banks and the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purposes of the license under the Federal Power Act are: Water rights involved are merely the riparian rights appurtenant, under Virginia law, to the various lands needed for dam site, flowage and tailrace purposes.

The Project was constructed and being utilized prior to 1928, the effective date of the (Virginia) Water Power Act and thus was exempted from the requirement that a license be obtained under the Act. Under said Act (Section 3581(13) of Michie Code 1942), all persons, firms, associations, or corporations who constructed and were utilizing their water power developments prior to 1928, and their lessees, successors and assigns, have, as to such developments and any reconstructions or enlargements thereof, all of the rights and powers conferred by the Act to the same extent as if they were licensees under the Act except that they do not have the power of eminent domain thereunder. By Section 62-88 of Chapter 5 of Title 62 of the Code of Virginia, the provisions of Section 3581(13) of Michie Code 1942 were continued in effect. Appalachian is incorporated under the laws of the Commonwealth of Virginia and qualified to do business as a public utility in Virginia.

The applicant will apply for the Section 401 Water Quality Certification per 18 Code of Federal Regulations (CFR) § 5.23(b). Under Section 401 of the Clean Water Act (CWA) (33 USC § 1251 et seq.), a federal agency may not issue a license or permit to conduct any activity that may result in any discharge into waters of the United States unless the state or authorized tribe where the discharge would originate either issues a Section 401 Water Quality Certification finding compliance with existing water quality requirements or waives the certification requirement. In the Commonwealth of Virginia, under § 62.1-44.15 of the Code of Virginia, the Virginia Department of Environmental Quality (VDEQ) provides Section 401 Water Quality Certification through the Virginia Water Protection (VWP) Program, as authorized by the State Water Control Law and as described in the VWP Permit Regulation. Appalachian is preparing a joint permit application for a VWP permit and surface water withdrawal for the continued operation of the Project in parallel with the FERC licensing process and intends, to the greatest extent possible, to use licensing documents including but not limited to study reports and the license application exhibits to satisfy this parallel regulatory process. Requirements for a VWP permit are described in 9 Virginia Administrative Cody (VAC) 25-210-80 and 9VAC25-210-340.

(7) Brief Project Description: Appalachian is the owner and operator of the two-development (Byllesby and Buck developments) Project located on the upper New River in Carroll County, Virginia. The Byllesby development is located about 9 miles north of the City of Galax, and the Buck development is located approximately three river miles downstream

of Byllesby. The Project was constructed in 1912 and has been operated by Appalachian for hydroelectric power generation since 1926. Today the Project is operated by Appalachian in a run-of-river manner, utilizing upper New River inflows to provide up to 30.1 megawatts (MW) of renewable capacity.

Presently licensed project works are as follows:

The Byllesby Development consists of: (1) a 64-foot-high, 528-foot-long concrete dam and main spillway section topped with four sections of 9-foot-high flashboards, five sections of 9-foot-high inflatable Obermeyer crest gates, and six bays of 10-foot-high Tainter gates; (2) an auxiliary spillway including six sections of 9-foot-high flashboards; (3) a 239-acre impoundment with a gross storage capacity of 2,000 acre-feet; (4) a powerhouse containing four generating units with a total authorized installed capacity of 21.6 megawatts (MW); and (5) appurtenant facilities.

The Buck Development consists of: (1) a 42-foot-high, 353-foot-long concrete dam; (2) a 1,005-foot-long, 19-foot-high spillway section topped with 20 sections of 9-foot-highflashboards, four sections of 9-foot-high inflatable Obermeyer crest gates, and six bays of 10-foot-high Tainter gates; (3) a 66-acre impoundment with a gross storage capacity of 661 acre-feet; (4) a powerhouse containing three generating units with a total authorized installed capacity of 8.5 MW; and (5) appurtenant facilities.

Additional existing facilities expected to be included as project works in the new license, as further explained in the exhibits that follow, include the following: (1) the Byllesby control house and switchyard, and (2) two 2-mile long overhead 13.2-kilovot (kV) transmission lines extending from the Buck powerhouse to the Byllesby control house.

(8) The Project does not occupy any lands of the United States.

(9) The Project is an existing constructed project.

Additional Information Required by 18 CFR § 4.32(a)(2)

(1) *Identify every person, citizen, association of citizens, domestic corporation, municipality, or state Identify every person, citizen, association of citizens, domestic corporation, municipality, or state that has or intends to obtain and will maintain any proprietary right necessary to construct, operate, or maintain the project:*

Appalachian presently holds and will continue to hold the proprietary rights necessary to operate and maintain the Project.

(2) *Identify (providing names and addresses):*

i. *Every county in which any part of the project, and any Federal facilities that would be used by the project would be located:*

Name	Address
Carroll County, Virginia	Administrator Carroll County P.O. Box 515 Hillsville, VA 24343

ii. *The names and addresses of every city, town or similar local political subdivision in which any part of the Project, and any Federal facilities that would be used by the Project, are located or that has a population of 5,000 or more people and is located within fifteen (15) miles of the project dam are as follows:*

Name	Address
City of Galax, Virginia	Mayor City of Galax Galax, Virginia 24333
City of Pulaski, Virginia	Mayor City of Pulaski P.O. Box 660 Pulaski, Virginia 24330
Town of Fries, Virginia	Manager Town of Fries P.O. Box 452 Fries, Virginia 24330
Town of Hillsville, Virginia	Manager Town of Hillsville P.O. Box 545 Hillsville, Virginia 24343
Town of Wytheville, Virginia	Manager Town of Wytheville P.O. Box 533 Wytheville, Virginia 24382
Pulaski County, Virginia	Administrator

Name	**Address**
	Pulaski County 143 Third Street Pulaski, Virginia 24301
Grayson County, Virginia	Administrator Grayson County P.O. Box 217 Independence, Virginia 24348
Wythe County, Virginia	Administrator Wythe County 108 County Office Building 275 South Fourth Street Wytheville, Virginia 24382

There are no Federal lands of facilities associated with the Project.

iii. *Every irrigation district, drainage district, or similar special purpose political subdivision:*

A. *In which any part of the project, and any Federal facilities that would be used by the project, would be located, or (B) That owns, operates, maintains, or uses any project facilities or any Federal facilities that would be used by the project:*

There are no irrigation or drainage districts, or similar special purpose political subdivisions associated with or in the general area of the Project. There are no federal lands or facilities associated with the Project.

iv. *Every other political subdivision in the general area of the Project that there is reason to believe would likely be interested in, or affected by, the application.*

There are no other political subdivisions in the general area of the Project that there is reason to believe would likely be interested in, or affected by, the application.

v. All Indian tribes that may be affected by the Project:

Tribe	**Address**
Catawba Indian Nation	Wenonah Haire Tribal Historic Preservation Officer Catawba Indian Nation 1536 Tom Steven Rd. Rock Hill, SC 29730
Delaware Nation	Erin Paden Director of Historic Preservation Delaware Nation PO Box 825 Anadarko, OK 73005
Pamunkey Indian Tribe	Terry Clouthier Cultural Resources Director Pamunkey Indian Tribe 1054 Pocahontas Trail King William, VA 23086

VERIFICATION

(To be included in Final License Application)

This application is executed in the

State of: Virginia

County of: Roanoke

Robert A. Gallimore
Plant Manager Hydro
American Electric Power Service Corporation
40 Franklin Road SW
Roanoke, Virginia 24011

The undersigned being duly sworn, deposes and says that the contents of this application are true to the best of his knowledge or belief. The undersigned applicant has signed this application this ___ day of February, 2022.

____

Robert A. Gallimore

Subscribed and sworn to before me, a Notary Public of the Commonwealth of Virginia, this ___ day of February, 2022.

____

Notary Public

DRAFT LICENSE APPLICATION

BYLLESBY-BUCK HYDROELECTRIC PROJECT

(FERC NO. 2514)

EXHIBIT A

PROJECT DESCRIPTION

Exhibit A - Project Description (18 CFR §4.51(b))

A.1 Project Overview and Location

Appalachian Power Company (Appalachian or Licensee), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the two-development Byllesby-Buck Hydroelectric Project (Project) (Federal Energy Regulatory Commission [FERC or Commission] Project No. 2514), located on the upper New River in Carroll County, Virginia.

The Byllesby Development (Byllesby) is located about nine miles north of the city of Galax, Virginia, on the New River. The primary facilities, including the powerhouse and spillway, are located within the Austinville, Virginia Quadrangle at approximately N. 36 deg., 47 min., 9 sec. and W. 80 deg., 56 min., 1 sec.

The Buck Development (Buck) is located about 3 miles downstream from the Byllesby dam. The primary facilities are located within the Austinville, Virginia Quadrangle at approximately N. 36 deg., 48 min., 20 sec. and W. 80 deg., 56 min., 4 sec.

Each development consists of a reservoir, concrete gravity dam and spillway, and powerhouse, and the Project also includes a control house and switchyard located at the Byllesby Development and two 2-mile long 13.2-kilovolt (kV) overhead transmission lines connecting the two developments.

The Project is operated by Appalachian in a run-of-river manner, utilizing upper New River inflows to provide up to 30.1 megawatts (MW) of renewable capacity. Figure A.1-1 provides an overview of the Project setting and the FERC Project Boundary and Figure A.1-2 shows the location of the Project within the New River Basin.

All but one of the seven turbine-generator units installed at the Project are the original major components of the Project as constructed in 1912. Many of the major electrical and mechanical and supporting systems and components of the Project developments are nearing the end of their useful service life, when compared to industry-recognized standards. As described Section A.4 Appalachian proposes to modernize the Byllesby and Buck developments during the new license term to include replacement of Byllesby Units 1, 2, and 4 and Buck Units 1 and 3.

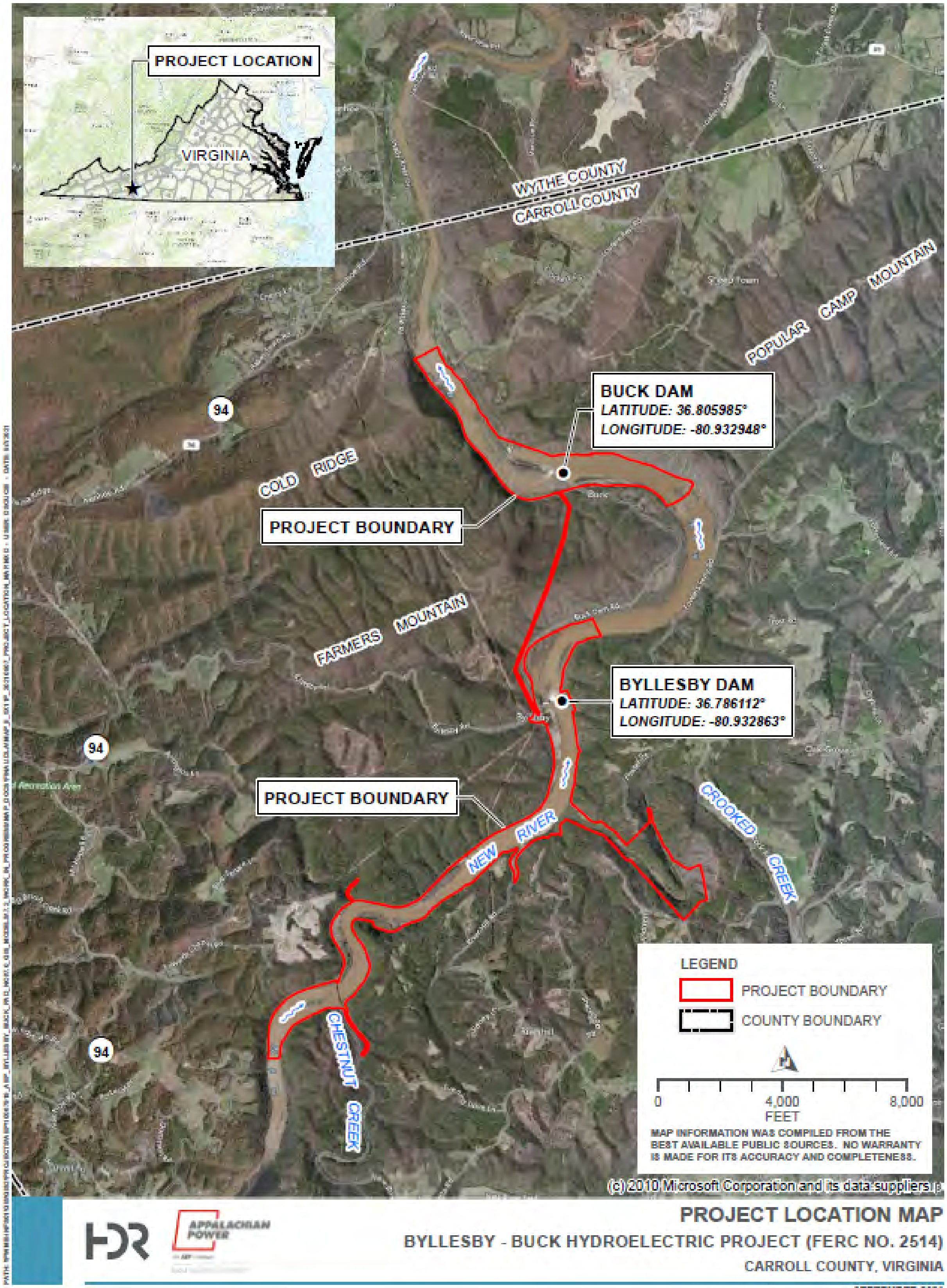

Figure A.1-1. Project Location Map

Figure A.1-2. Project Location on New River

A.2 Project Description

The Project was constructed in 1912 and has been operated by Appalachian for hydroelectric power generation since 1926.

The Byllesby Development consists of (1) a 64-foot[ft]-high, 528-ft-long concrete dam, sluice gate, and main spillway section topped with four sections of 9-ft-high flashboards, five sections of 9-ft-high inflatable Obermeyer crest gates, and six bays of 10-ft-high Tainter gates; (2) an auxiliary spillway including six sections of 9-ft-high flashboards; (3) a 239-acre reservoir with a gross storage capacity of approximately 2,000 acre-ft; (4) a powerhouse containing four generating units with a total installed capacity of 21.6 MW; (5) a control house and switchyard; and (6) appurtenant facilities.

The Buck Development consists of (1) a 42-ft-high, 353-ft-long concrete dam and sluice gate; (2) a 1,005-ft-long, 19-ft-high spillway section topped with 20 sections of 9-ft-high flashboards, four sections of 9-ft-high inflatable Obermeyer crest gates, and six bays of 10-ft-high Tainter gates; (3) a 66-acre impoundment with a gross storage capacity of approximately 661 acre-ft; (4) a powerhouse containing three generating units with a total installed capacity of 8.5 MW; (5) a two 2-mile long overhead 13.2-kV transmission lines extending from the Buck powerhouse to the Byllesby control house; and (6) appurtenant facilities (FERC 2017).

Each development recently underwent modification as approved by an order amending license issued by FERC on May 18, 2017 to replace several sections of existing wooden flashboards with inflatable Obermeyer pneumatic crest gates. The Obermeyer crest gates facilitate smoothing Project operations by reducing reservoir water level fluctuations and instances of inadvertent flow to the bypass reaches and reducing the frequency of maintenance drawdowns associated with wooden flashboard failure and replacement.

The facilities and structures listed above are described in the sections that follow, are depicted on Figure A.2-1 and Figure A.2-2, and are also shown on the project drawings included in Exhibit F (filed as Critical Energy/Electric Infrastructure Information [CEII] in accordance with 18 CFR §388.112) of this Draft License Application (DLA).

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Figure 0-1. Existing Project Facilities – Byllesby Development

Figure 0-2. Existing Project Facilities – Buck Development

A.3 Existing Project Facilities

A.3.1 Reservoirs

A.3.1.1 Byllesby Development

The Byllesby Development is operated year-round in a run-of-river mode under all flow conditions. Under normal operating conditions, Appalachian operates Byllesby to maintain the headwater between EL. 2,079.2 and 2,078.2 ft[1]. Byllesby has little storage capacity or ability to regulate river flow; inflow is either used for generation or passed through the spillway.

The normal maximum surface area of the reservoir formed by the Byllesby dam is 239 acres at a normal maximum surface EL. 2079.2 ft. The corresponding gross storage capacity of the Byllesby reservoir is approximately 2,000 acre-ft, and the usable storage capacity in the upper 5.2 ft of the pool is approximately 1,153 acre-ft. Table A.3-1 contains Byllesby Development reservoir data. A reservoir storage capacity curve is included in Exhibit B.

Table A.3-1. Byllesby Development Reservoir Data

Drainage area	1,310 square miles
Shoreline length	16.8 miles
Typical surface area	239 acres
Maximum Depth	35 ft
Permanent crest of dam elevation	2,071 ft NGVD
Typical normal surface water elevation	2079.2 ft NGVD
Operations	Run-of-river
Gross Storage capacity	2,000 acre-ft

A.3.1.2 Buck Development

The Buck Development is operated year-round in a run-of-river mode under all flow conditions. Under normal operating conditions, Appalachian operates Buck to maintain the headwater between EL. 2,003.4 and 2,002.4 ft. Buck has little storage capacity or ability to regulate river flow; inflow is either used for generation or passed through the spillway. Because the Buck Development is only approximately 3 miles downstream from the Byllesby Development, the operation of the two

[1] All elevations are referenced to national Geodetic Vertical Datum of 1929 (NGVD)

developments is closely coordinated, with Buck Development operations dependent on flows through the Byllesby Development.

The Buck reservoir has a surface area of approximately 66 acres and a storage capacity of 661 acre-ft at a normal maximum pool elevation of 2,003.4 ft. The normal maximum surface area of the reservoir formed by the Buck dam is 66 acres at normal maximum surface elevation (2003.4 ft). The corresponding gross storage capacity of the Buck reservoir is approximately 661 acre-ft, and the usable storage capacity in the upper 8.4 ft of the pool is approximately 579 acre-ft. Table A.3-2 contains Buck Development reservoir data. A reservoir storage capacity curve is included in Exhibit B.

Table A.3-2. Buck Development Impoundment Data

Drainage area	1,320 square miles
Shoreline length	5.8 miles
Typical surface area	66 acres
Maximum Depth	20 ft
Permanent crest of dam elevation	1995 ft NGVD
Typical normal surface water elevation	2003.4 ft NGVD
Operations	Run-of-river
Gross Storage capacity	661 acre-ft

A.3.2 Spillway and Dam

A.3.2.1 Byllesby Development

Water-impounding or controlling structures at the Byllesby Development include a main dam/spillway topped with Tainter gates, inflatable Obermeyer crest gates, and flashboard sections; a trash sluice gate; a powerhouse; and an auxiliary (or emergency) spillway surmounted by flashboards. The main spillway extends across the New River perpendicular to the flow. The spillway is a solid, concrete, gravity-type structure approximately 528 ft long by 44 ft high from toe to crest. The crest of the spillway is at elevation 2071 ft NGVD. Topping the main spillway, beginning at the western end, are six radial Tainter gates (Bays 1 – 6), three wooden flashboard sections (Bays 7 – 9), five inflatable

Obermeyer crest gates (Bays 10 – 14)[2], and one additional wooden flashboard section (Bay 15). The spillway gate configuration is shown on Figure A.3-1.

Each bay is supported by reinforced-concrete piers and is approximately 31 ft, 4 inches wide. The gates and flashboards have a total height of approximately 9 ft. The Tainter gates consist of a steel gate with a radius of 11 ft, 3 inches supported by reinforced-concrete piers. Each gate rotates on a pin. Each Obermeyer gate is also approximately 31 ft, 4 inches wide. The Tainter gates and are opened and closed by means of a hoist powered by an electric motor, and the Obermeyer gates are operated with air compressors installed inside the powerhouse that provide for redundant inflation of the air bladders via stainless steel piping that conveys the compressed air from the receiver tank to the Obermeyer control enclosure. The Tainter gates and Obermeyer gates can be remotely monitored and operated from AEP's 24-hour Columbus Operations Center (COC) in Columbus, Ohio. A propane-powered auxiliary generator is available in case of an electrical outage. A steel-grated foot bridge supported by steel beams on the concrete piers runs the length of the main spillway.

The auxiliary spillway is located upstream and to the west of the powerhouse and to the west of the main spillway. The auxiliary spillway is connected to the powerhouse by an angled 77-ft-long non-overflow bulkhead (or "wingwall") with a crest elevation of 2,085.0 ft and a structural height that varies from 24 ft to 43 ft. The auxiliary spillway is a concrete structure approximately 198 ft long and 6.5 ft high from toe to crest. It is topped by six spans of flashboards approximately 9 ft high. Reinforced-concrete piers support the flashboard sections and an access bridge. The existing access bridge is of metal grating grouted with concrete atop steel beams. The auxiliary spillway discharges into a 600-ft-long channel, excavated from rock, which curves around and empties into the New River further downstream.

The spillway capacity curve for the Byllesby Development is provided in Exhibit B.

[2] The first Obermeyer gate was installed in 1998 to replace the flashboards in Bay 14. Two additional bays of Obermeyer gates were installed in 2016 (Bays 12 and 13) and 2018 (Bays 10 and 11).

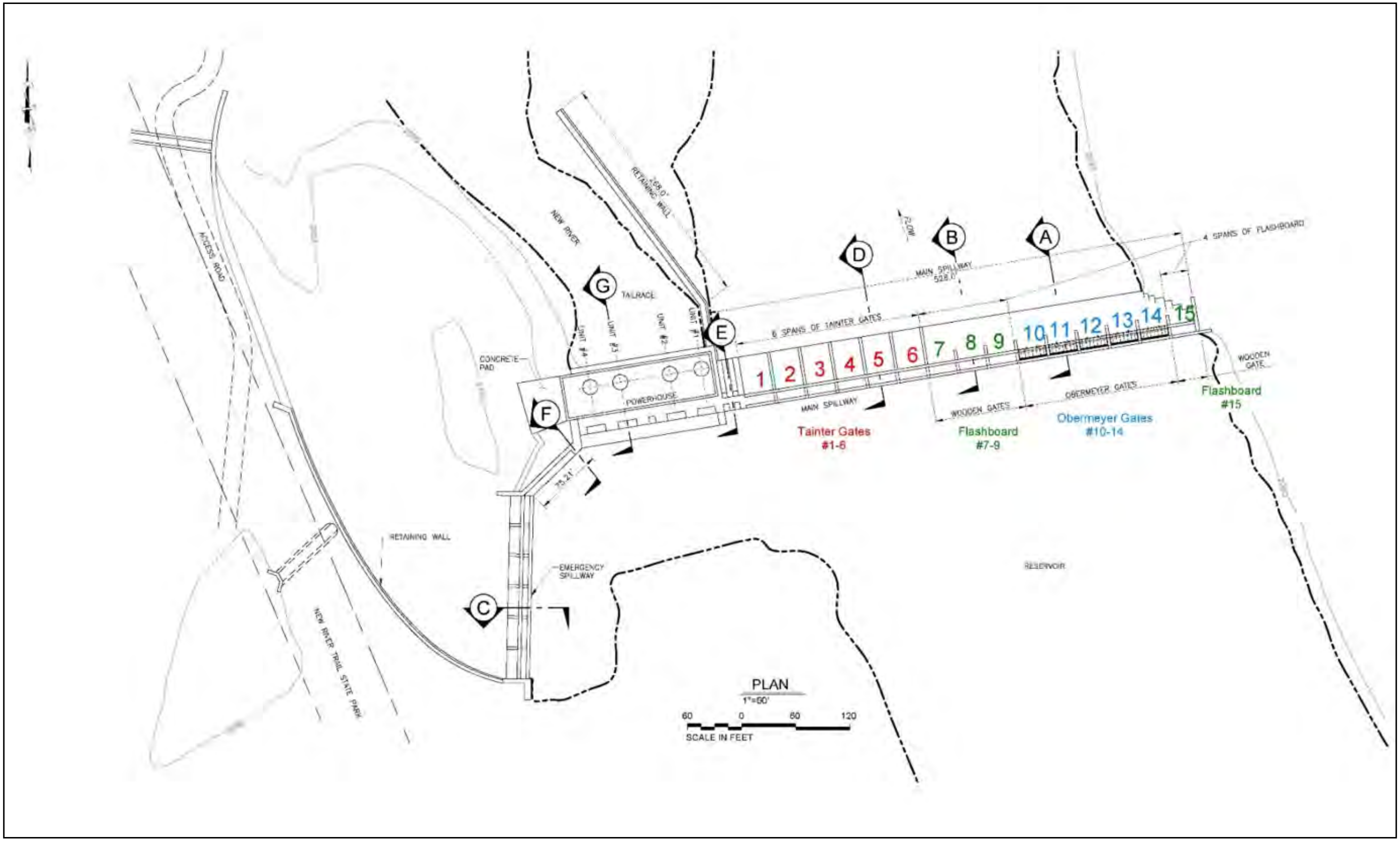

Figure A.3-1. Byllesby Dam Spillway Gates

A.3.2.2 Buck Development

Water-impounding or controlling structures at the Buck Development consist of spillway and main dam sections separated by Mountain (or Buck) Island that is bedrock controlled. The spillway section is located on the south side of the island. From left to right, the spillway section consists of 18 stanchion type flashboard bays, four Obermeyer gate bays, six Tainter gate bays and two additional flashboard bays. To the right of the spillway and approximately 1,300 ft downstream, and on the opposite side of Mountain Island, the 352-ft-long by 44-ft-high main dam consists of a left non-overflow (South Bulkhead) section, powerhouse with integral intake, a trash sluice with a vertical slide gate, and right non-overflow (North Bulkhead) section. The normal headwater at both sections ranges from EL. 2,002.41 ft to 2,003.4 ft. The normal tailwater at the spillway and main dam sections is EL. 1,980.0 ft and 1,962.7 ft, respectively.

The spillway, similar to the Byllesby spillway, is a solid, concrete, gravity-type structure approximately 1,005 ft long by 19 ft high from base to crest. The crest of the spillway is at EL. 1,995 ft. The spillway is flanked at both contacts by non-overflow wingwalls. The spillway is topped with a bridge, constructed of recast, pre-stressed concrete beams, supported atop the spillway gate piers.

Topping the spillway, beginning at the northwestern end, are two wooden flashboard sections supported by reinforced-concrete piers, with widths of 31 ft, 10 inches and 32 ft, 10 inches, respectively, and a height of approximately 9 ft. Adjacent to the flashboard sections are six radial Tainter gate bays (Gates 1 – 6). The spillway gate configuration is shown on Figure A.3-2.

Each Tainter gate bay is approximately 31 ft, 4 inches wide and contains a steel gate of radius 11 ft, 3 inches supported by reinforced-concrete piers. The gates rotate on a pin and are opened and closed by means of a hoist powered by an electric motor. Adjacent to the Tainter gates are four inflatable Obermeyer crest gates (Gates 7 – 10), with each Obermeyer gate measuring 9.2-ft-high by 31.3-ft-wide. The Obermeyer gates are operated with air compressors that provide for redundant inflation of the air bladders. Due to the distance of the spillway from the powerhouse, during installation of the first two Obermeyer gates in 2017, two new air compressors were installed in a newly constructed building adjacent to the spillway, with new stainless steel piping installed to convey the compressed air from the receiver tank to the Obermeyer control enclosure. Both the Tainter gates and Obermeyer gates can be remotely monitored and operated from AEP's 24-hour control COC. A propane-fueled auxiliary generator is available in case of an electrical outrage.

The spillway capacity curve for the Buck Development is provided in Exhibit B.

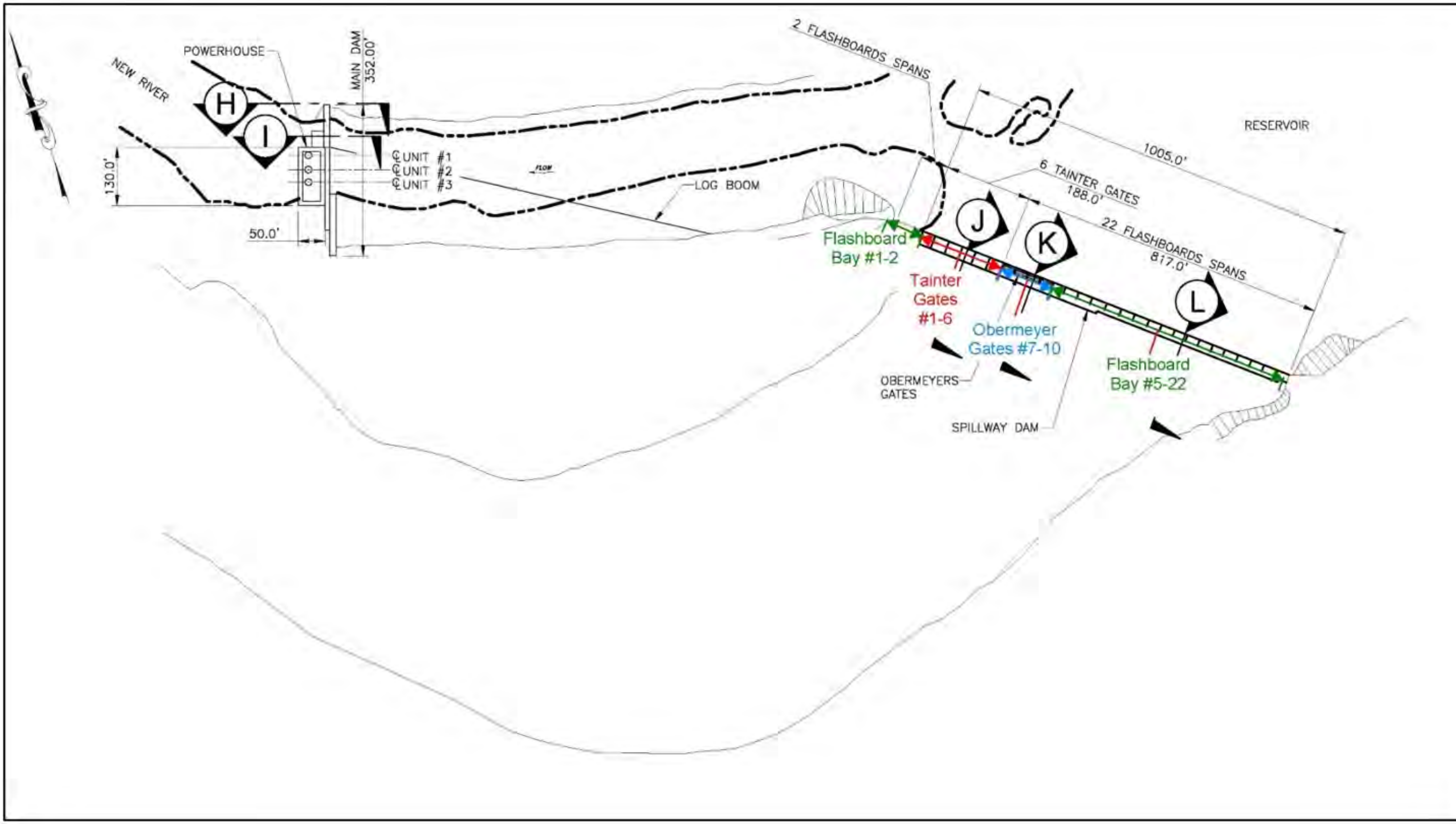

Figure A.3-2. Buck Dam Spillway Gates

A.3.3 Low-Level Outlets and Sluice Gates

A.3.3.1 Byllesby Development

The sluice gate section is a 24-ft-long mass concrete gravity structure located between the powerhouse and main spillway sections and founded directly on bedrock. In 1993, two post-tensioned rock anchors were installed through the downstream face at approximate elevation 2,073.5 and 2,077.2 ft, respectively. The crest of the sluice gate section is at elevation 2,085.0 ft corresponding to a structural height of 63.0 ft. When the Project was originally constructed in 1912, two mud sluice gates were installed between the Byllesby powerhouse and the main spillway. These mud gates have since been taken out of service and concreted in. A steel plate vertical drop gate approximately 6-ft-10 ¼-inch wide by 5-ft high has since been installed in the slots of the western-most mud sluice. This gate is manually lowered and raised by an electric motor powered hoist.

A.3.3.2 Buck Development

A 36-foot-long sluice gate section is located between the powerhouse and the right non-overflow section. The sluice gate section is constructed of mass concrete socketed into bedrock at and bearing at approximate EL. 1,965.0 ft. In 1993, three vertical post-tensioned rock anchors were installed through the crest at elevation 2,007 ft. The crest of the sluice section is at elevation 2,007.0 ft corresponding to a structural height of 42.0 ft. As for Byllesby, during original Project construction in 1912, two mud sluices and a vertical lift gate were installed in the main dam, immediately adjacent to the north end of the powerhouse. The mud sluices were reportedly abandoned with concrete in-fill in 1930. The sluice gate section also includes a 6-ft-wide by 14-ft-high vertical slide gate, which is manually operated as required to pass flotsam and debris through the sluice.

A.3.4 Forebay and Intake

A.3.4.1 Byllesby Development

The intake section, located immediately upstream of the powerhouse, consists of four inlet bays. Each bay has a 14.5-ft-high by 23-ft-wide headgate, which is used during maintenance periods. A 3-ft-wide, reinforced-concrete pier is set vertically in the middle of each inlet bay to support the headgate. Each headgate is closed and opened by a gear and screw lift shaft assembly powered by an electric motor. Each bay admits water to a concrete volute casing, which channels flow to a vertical-shaft Francis hydraulic turbine direct-connected to a generator on the upper level. Flow through the four turbines passes to concrete draft tubes and into the New River.

The intake section at Byllesby is faced with an intake screen approximately 143 ft wide and consisting of 3/8-inch by 3-1/2-inch steel bars. The bars are 47 ft, 6-3/8 inches long and are inclined toward the powerhouse at approximately 15 degrees to the vertical. The bars are spaced 2-21/32 inches center-to-center and have a cleared space of 2-9/32 inches.

A logboom consisting of interconnected floating platforms diverts large objects carried by the current away from the powerhouse intakes. The logboom, which is approximately 140 ft long, is anchored on land at one end and adjacent to the vertical drop trash sluice gate on the other end.

A.3.4.2 Buck Development

The Buck intake section, which is immediately upstream of the powerhouse, is of concrete construction and consists of three inlet bays. Each bay has a 14.5-ft-high by 23-ft-wide headgate which is used during maintenance periods. A 3-ft-wide, reinforced-concrete pier is set vertically in the middle of each inlet bay to support the headgate. Each gate is operated by a gear and threaded lift shaft assembly powered by an electric motor. The bays admit water to a concrete volute casing, which channels flow to a vertical-shaft Francis hydraulic turbine, direct-connected to a generator on the upper level. Flow through the three turbines passes to concrete draft tubes and into the New River.

The intake section at Buck is faced with an intake screen approximately 104 ft wide and consisting of 3/8-inch by 3-1/2-inch steel bars. The screen is 39 ft, 2-1/16 inches high and is inclined toward the powerhouse at approximately 15 degrees to the vertical. The bars are spaced 2-21/32 inches center-to-center and have a cleared space of 2-9/32 inches.

A logboom consisting of interconnected floating platforms diverts large objects carried by the current away from the powerhouse intakes. The logboom is anchored at one end to the north shore of Mountain Island, approximately 580 ft upstream of the main dam. The logboom spans approximately 620 ft and anchors at the other end, adjacent to the vertical lift trash sluice gate.

A.3.5 Bypass Reach

A.3.5.1 Byllesby Development

The Byllesby Development includes a 475-ft-long bypass reach consisting primarily of exposed bedrock and rock outcroppings. This reach normally receives only leakage flow, unless flows are being spilled at the dam or the flashboards are breached.

A.3.5.2 Buck Development

The Buck Development has a 4,100-ft-long, steep bypass reach consisting of exposed bedrock. This reach normally receives only leakage flow, unless flows are being spilled at the dam or the flashboards are breached.

A.3.6 Powerhouse

A.3.6.1 Byllesby Development

The Byllesby powerhouse is located to the west of the main spillway. The powerhouse is a 151-ft-long reinforced concrete water retaining structure with a 170-ft-long steel frame and brick superstructure. Four generators and their respective governors and exciters, pumps, a gantry crane and miscellaneous accessory equipment necessary for operation are housed in the upper level of the powerhouse. The powerhouse is supported directly on bedrock. The intake invert is at elevation 2,040.0 ft and the deck is at elevation 2,085.0 ft. The upstream substructure wall is integral with both the left non-overflow structure to the left and sluice gate section to the right.

A.3.6.2 Buck Development

The powerhouse, located at the main dam, includes a 116-ft-long reinforced concrete water retaining substructure with a 132-ft-long steel frame and brick superstructure. The powerhouse has two levels. Three generators, and their respective governors and exciters, switchboards, switching equipment, pumps, a gantry crane and miscellaneous accessory equipment necessary for project operation are housed in the upper level of the powerhouse. The powerhouse is supported directly on bedrock at approximate elevation 1,964 ft. The intake invert is at elevation 1,969 ft and upstream intake deck slab is at elevation 2,007.0 ft. The substructure walls are integral with the left non-overflow section and sluice gate section to the right.

A.4 Existing and Proposed Turbines and Generators

A.4.1 Authorized Installed Capacity

The Project's installed capacity is presently considered by FERC to be 30.1 MW, representing 21.6 MW at Byllesby and 8.5 MW at Buck (Appalachian 2019). These values are based on the capacities of the generators, which was the basis for installed capacity at the time of the last relicensing. Based on the installed nameplate ratings and the method now used by FERC to calculate authorized installed capacity (18 CFR §11.1(i)), the installed capacities for the Byllesby and Buck developments, should be considered 18 MW and 8.09 MW, respectively, for a total authorized installed capacity of 26.09 MW. A summary of existing and proposed, as described and proposed below, unit characteristics for both developments is provided at the end of this section in Table A.4-5 and Table A.4-6.

A.4.2 Byllesby Development

A.4.2.1 Existing Equipment

The powerhouse contains four, vertical Francis-type turbine generator units (Nos. 1 through 4 from right to left) under a normal gross head of 56.4 ft, each direct-connected to a generator on the upper level. The turbine units were manufactured by I.P. Morris Company in 1912 and contain 16 buckets per runner. The edge-to-edge diameter of the runners is 8-ft 9-inches measured at the bottom of the runner, inside the band. There are 20 cast iron wicket gates at each hydraulic turbine with heights of 2-ft 11-inches to 15/16-inches each. The wicket gates are placed in a circular pattern at a radial dimension of 4-ft 11-inches from the centerline of the turbine shaft to the pivot point of each gate. By adjusting the openings between the wicket gates, flow to the turbine is controlled. Outside of the wicket gates are ten stay vanes arranged in a circular pattern at a radial distance of 7 ft from the centerline of the turbine shaft to the leading edge of the stay vane. The stay vanes are stationary and are used to control the direction of flow and to support the structure overhead.

Maximum flow of 1,360 cfs through each unit (total capacity of 5,440 cfs) is discharged through four draft tubes into a 300-ft-long tailrace defined by the bedrock outcrop (island) on the left and a concrete training wall on the right. The right training wall separates the powerhouse discharge from the main spillway. In 1993, 12 vertical post-tensioned rock anchors (P-1 through P-12) were installed through the piers on the upstream side of the intake deck at elevation 2,085.0 ft.

Each Byllesby turbine is rated at 6,000 horsepower (hp) at a 49 ft design head and has a rated speed of 116 rotations per minute (rpm). Based on design curves, one unit can pass 1,467 cfs at 5,265 kilowatt (kW) turbine-generator output and a 56 ft net head.

The four AC generators, located in the upper level of the Byllesby powerhouse, are identical and were manufactured by the General Electric Company. These generators have been in service since 1912. They are rated at 5,400 kW at 90 percent power factor, 3 phase (PH), 60 cycles and 13,200 volts (V). Each 62 pole generator has a rotor speed of 116 rpm at 60 Hertz (Hz).

Each generator has an inside diameter of 13-ft 4-inch and contains 93 coils. Each coil slot is 42 and 1/8 inches high by 1.45 inches wide by 2.93 inches deep. Pertinent turbine and generator data for Byllesby is included in Table A.4-1.

Table A.4-1. Byllesby Development Turbine and Generator Data - Existing

Turbines	
Number of Units	4
Type	Vertical Francis, I.P. Morris Co.
Design Head	49 ft
Rated Capacity	6,000 hp / 4,500 kW (each unit)
Minimum Discharge	73 cfs (per unit)
Maximum Discharge	1,467 cfs (per unit)
Operating Speed	116 rpm
Generators	
Type	Vertical configuration, General Electric Co.
Rated Capacity	5,400 kW (per unit)
Power Factor	0.9
Phase	3 PH (per unit)
Voltage	13,200 V (per unit)
Frequency	60 Hz (per unit)
Synchronous Speed	116 rpm (per unit)

A.4.2.2 Proposed Upgrade

All of the turbine-generator units at the Byllesby Development are the original major components of the Project as constructed in 1912. Unit 4 is presently off-line and has been deemed by Appalachian to be non-repairable. Many of the major electrical and mechanical and supporting systems and components at Byllesby are nearing the end of their useful service life, when compared to industry-recognized standards. Appalachian proposes to modernize the Byllesby Development during the new license term to include replacement of Byllesby Units 1, 2, and 4. Byllesby Unit 3 would remain as-is and, following completion of the upgrades, would be operated in a last-on/first-off sequence.

Appalachian proposes to replace each existing vertical Francis turbine with a vertical Kaplan turbine. The most efficient point (MEP) operation setting for each new unit at the design head of 54 ft is 91.69 turbine efficiency, representing a unit discharge of approximately 1,348 cfs. The new Kaplan turbines would each have 6 runner blades, 16 wicket gates, and a runner diameter of 8.7 ft.

Each turbine upgrade will include:

- Mavel KV2650K5 Kaplan turbine including stay ring, operating ring, wicket gate mechanism, upper distributor ring, and wicket gates;
- Hydraulic Power Unit (HPU) with accumulator tank for control of the wicket gates, blades, and brake;
- Wicket gate, blade, and brake servomotors;
- Sensors for control and monitoring of the turbine;
- Steel portion of a replacement section of the draft tube;
- Civil work as needed to facilitate installation; and
- Controls, cabling, switchgear, and other electrical work.

Appalachian is also presently proposing to replace each generator. The highest efficiency point of the new generators would be approximately 96.9 percent at 100 percent load.

Proposed upgraded turbine and generator parameters for the Byllesby Development are presented in Table A.4-2.

Table A.4-2. Byllesby Development Turbine and Generator Data – Proposed (Upgrades to Units 1, 2, and 4)

Turbines	
Number of Units	4
Type	**Units 1, 2, and 4:** Vertical Kaplan, Mavel **Unit 3:** Vertical Francis, I.P. Morris Co.
Design Head	**Units 1, 2, and 4:** 54 ft **Unit 3:** 49 ft
Rated Capacity	**Units 1, 2, and 4:** 7,544 hp / 5,658 kW (per unit) **Unit 3:** 6,000 hp / 4,500 kW
Maximum Discharge	**Units 1, 2, and 4:** 1,348 cfs (per unit) **Unit 3:** 1,467 cfs
Operating Speed	**Units 1, 2, and 4:** 189.47 rpm **Unit 3:** 116 rpm
Generators	
Type	**Units 1, 2, and 4:** Vertical configuration, Mavel **Unit 3:** Vertical configuration, General Electric Co.
Rated Capacity	**Units 1, 2, and 4:** 5,885 kVA / 5,296.5 kW (per unit) **Unit 3:** 5,400 kW (per unit)
Power Factor	0.9
Phase	3 PH (per unit)
Voltage	13,200 V (per unit)
Frequency	60 Hz (per unit)
Synchronous Speed	**Units 1, 2, and 4:** 189.47 rpm (per unit) **Unit 3:** 116 rpm

A.4.3 Buck Development

A.4.3.1 Existing Equipment

Within the substructure of the Buck powerhouse are housed three vertical-shaft Francis hydraulic turbines, each direct-connected to a generator on the upper level. The three turbine units at Buck were manufactured by I.P. Morris Company in 1912. Unit 2 was refurbished in 2006 with an in-kind American Hydro runner replacement. The dimensions and configuration of each turbine's runner, wicket gates and stay vanes are identical to those of the Byllesby turbine units. Maximum flow of 1,180 cfs through each unit (total capacity of 3,540 cfs) is discharged through three draft tubes into the tailrace channel that was excavated into bedrock. Based on design curves, one unit can pass

1,180 cfs at 3,158 kW turbine-generator output and a 40 ft net head. In 1993, seven vertical post-tensioned rock anchors were installed through the concrete piers on the upstream side of the intake deck at elevation 2,007 ft. Each of the three turbines at Buck is rated at 3,500 hp at a 34 ft design head and has a rated speed of 97 rpm.

The three AC generators, located in the upper level of the Buck Powerhouse, are identical and were manufactured by the General Electric Company. These generators have been in service since 1912. They are rated at 2,835 kW at 90 percent power factor, 3 PH, 60 cycles and 13,200 V. Each 74 pole generator has a rotor speed of 97 rpm at 60 Hz.

Each generator stator has an inside diameter of 15-ft 10-inches and contains 222 coils. Each coil slot is 23 and 7/8 inches high by 1.312 inches wide by 3.75 inches deep. The Buck development has a total installed capacity of 8.5 MW. The turbines discharge into a tailrace channel that is approximately 1,700 ft long and 70 ft wide. The depth of the channel is fairly uniform downstream of the immediate vicinity of the powerhouse, averaging 6.5 to 10 ft at a point 160 ft downstream of the powerhouse. Pertinent turbine and generator data for the Buck Development is included in Table A.4-3.

Table A.4-3. Buck Development Turbine and Generator Data - Existing

Turbines	
Number of Units	3
Type	**Units 1 and 3:** Vertical Francis, I.P. Morris Co. **Unit 2:** American Hydro
Design Head	34 ft
Rated Capacity	**Units 1 and 3**: 3,500 hp / 2,626 kW **Unit 2:** 4,480 hp / 3,360 kW
Minimum Discharge	60 cfs (per unit)
Maximum Discharge	1,180 cfs (per unit)
Operating Speed	97 rpm
Generators	
Type	Vertical configuration, General Electric Co.
Rated Capacity	2,835 kW (per unit)
Power Factor	0.9
Phase	3 PH (per unit)
Voltage	13,200 V (per unit)
Frequency	60 Hz (per unit)
Synchronous Speed	97 rpm (per unit)

A.4.3.2 Proposed Upgrade

Two of three turbine-generator units at the Buck Development are the original major components of the Project as constructed in 1912. Many of the major electrical and mechanical and supporting systems and components at Buck are nearing the end of their useful service life, when compared to industry-recognized standards. Appalachian proposes to modernize the Buck Development during the new license term to include replacement of Buck Units 1 and 3.

Appalachian proposes to replace two of the existing vertical Francis turbine with vertical Kaplan turbines. The MEP operation setting for each new unit at a design head of 42.4 ft is 91.59 turbine efficiency, representing a unit discharge of approximately 930 cfs. The new Kaplan turbines would each have 6 runner blades, 16 wicket gates, a runner diameter of 8.7 ft, and a runner setting of 1,981.89 ft.

Each turbine upgrade will include:

- Mavel KV2650K5 Kaplan turbine including stay ring, operating ring, wicket gate mechanism, upper distributor ring, and wicket gates;

- HPU with accumulator tank for control of the wicket gates, blades, and brake;
- Wicket gate, blade, and brake servomotors;
- Sensors for control and monitoring of the turbine;
- Steel portion of a replacement section of the draft tube;
- Civil work as needed to facilitate installation; and
- Controls, cabling, switchgear, and other electrical work.

Appalachian is also presently proposing to replace each generator. The highest efficiency point of the new generators would be approximately 96.9 percent at 100 percent load.

Proposed upgraded turbine and generator parameters for the Buck Development are presented in Table A.4-4. Table A.4-5 and Table A.4-6 present existing and proposed unit characteristics.

Table A.4-4. Buck Development Turbine and Generator Data – Proposed (Upgrades to Units 1 and 3)

Turbines	
Number of Units	3
Type	**Units 1 and 3:** Vertical Kaplan, Mavel **Unit 2:** Vertical Francis, American Hydro
Design Head	**Units 1 and 3:** 42.4 ft **Unit 2:** 34 ft
Rated Capacity	**Units 1 and 3:** 5,210 hp / 3,908 kW (per unit) **Unit 2:** 4,480 hp / 3,360 kW
Maximum Discharge	**Units 1 and 3:** 1,195 cfs (per unit) **Unit 2:** 1,180 cfs
Operating Speed	**Units 1 and 3:** 156.52 rpm **Unit 2:** 97 rpm
Generators	
Type	**Units 1 and 3:** Vertical configuration, Mavel **Unit 2:** Vertical configuration, General Electric Co.
Rated Capacity	**Units 1 and 3:** 4,100 kVA / 3,690 kW (per unit) **Unit 2:** 2,835 kW
Power Factor	0.9
Phase	3 PH (per unit)
Voltage	13,200 V (per unit)
Frequency	60 Hz (per unit)
Synchronous Speed	**Units 1 and 3:** 156.52 rpm **Unit 2:** 97 rpm

Table A.4-5. Existing Unit Characteristics - Summary

Plant	Unit	Existing Units (Francis)								
		Efficiency			Generator Rating (MVA)	Generator Capacity (MW)(4)	Turbine Capacity (MW)	Synchronous Speed (RPM)	Max. Unit Discharge (cfs)	Unit Capacity Rating (MW)
		Generator	Turbine	Combined(1)						
Byllesby	1			78.00%	6.00	5.44	4.5	116	1,467	**4.50**
	2			78.00%	6.00	5.44	4.5	116	1,467	**4.50**
	3			78.00%	6.00	5.44	4.5	116	1,467	**4.50**
	4(2)			78.00%	6.00	5.44	4.5	116	1,467	**4.50**
					24.00	**21.76**	**18**		**5,868**	**18.00**
Buck	1			77.50%	3.15	2.84	2.63	97	1,180	**2.63**
	2(3)	94.00%	91.50%	86.01%	3.15	2.84	3.36	97	1,180	**2.84**
	3			77.50%	3.15	2.84	2.63	97	1,180	**2.63**
					9.45	**8.51**	**8.61**		**3,540**	**8.09**
Notes:	(1) - Feasibility Study for Upgrading the Byllesby and Buck Hydroelectric Plants, Department of Energy - BOFARS-NOHAB, May 1979, less 3% overall efficiency degradation over past 41 years									
	(2) - Byllesby Unit 4 has been out of service since 2018 and is proposed as the first upgrade unit									
	(3) - Buck Unit 2 turbine was replaced by American Hydro in 2006									
	(4) - Existing and proposed generators have 0.9 Power Factor									

Table A.4-6. Proposed Unit Characteristics - Summary

Plant	Unit	Proposed Units (Kaplan)[4]								
		Efficiency (%)			Generator Rating (MVA)	Generator Capacity (MW)	Turbine Capacity (MW)	Synchronous Speed (RPM)	Max. Unit Discharge (cfs)	Unit Capacity Rating (MW)
		Generator	Turbine	Combined[1]						
Byllesby	1	96.30%	91.69%	88.30%	5.89	5.45	5.66	189.47	1,348	**5.45**
	2	96.30%	91.69%	88.30%	5.89	5.45	5.66	189.47	1,348	**5.45**
	3			78.00%	6.00	5.44	4.50	116.00	1,467	**4.50**
	4[2]	96.30%	91.69%	88.30%	5.89	5.45	5.66	189.47	1,348	**5.45**
					23.66	**21.78**	**21.47**		**5,511**	**20.85**
Buck	1	95.90%	91.59%	87.83%	4.1	3.779	3.908	156.52	1,195	**3.78**
	2[3]	94.00%	91.50%	86.01%	3.15	2.835	3.355	97	1,180	**2.84**
	3	95.90%	91.59%	87.83%	4.1	3.779	3.908	156.52	1,195	**3.78**
					11.35	**10.393**	**11.171**		**3,570**	**10.39**
Notes:	(1) - Feasibility Study for Upgrading the Byllesby and Buck Hydroelectric Plants, Department of Energy - BOFARS-NOHAB, May 1979, less 3% overall efficiency degradation over past 41 years									
	(2) - Byllesby Unit 4 has been out of service since 2018 and is proposed as the first upgrade unit									
	(3) - Buck Unit 2 turbine was replaced by American Hydro in 2006									
	(4) – Information from OEM (Mavel)									

A.5 Transmission

Project power connects to AEP's 69 kilovolt distribution system at the single generator step-up transformer (GSU) located within the Byllesby switchyard (also known as the Byllesby 69 kV substation). The GSU is connected to the single 13.2 kV bus located within the Byllesby control house. Generator leads for each of the four Byllesby units are connected to this 13.2 kV bus. Generator leads for the three Buck units are connected to a common 13.2 kV bus within the Buck powerhouse, which is in turn connected to the two approximately 2-mile-long overhead 13.2 kV lines (Byllesby Buck #1 and Byllesby Buck #2) that cross the New River near the Buck spillway and extend to the Byllesby control house, where they connect to the 13.2 kV bus within. The GSU steps up the 13.2 kV generator voltage to 69 kV to match the voltage on the electrical distribution system.

Since constructed in 1911-1912, the Byllesby and Buck developments have been connected to a single transformer station located at the large "control house" building near the Byllesby powerhouse. The control house is located southwest of the Byllesby auxiliary spillway and several hundred feet back from the river. It is a two-level, rectangular, steel-framed, brick-walled building, surrounded by transformers and other appurtenant equipment. The building's interior contains offices, a maintenance area, and control rooms.

Primary transmission lines at the Project are limited to two approximately 2-mile long overhead 13.2-kV transmission lines (Byllesby Buck #1 and Byllesby Buck #2), which extend from the 13.2 kV bus within the Buck powerhouse to the 13.2 kV bus within the Byllesby control house.

Primary transmission lines at the Project are limited to the two 13.2-kV transmission lines (Byllesby Buck #1 and Byllesby Buck #2), which extend from the 13.2 kV bus within the Buck powerhouse to the 13.2 kV bus within the Byllesby control house.

Appurtenant mechanical, electrical, and transmission equipment required for efficient operation of the Byllesby powerhouse includes 13.2-kV generator leads to a 13.2-kV bus, the 13.2-kV bus, a 13.2-kV line from the bus to a 13.2/69 kV transformer, the 13.2/69 kV transformer, and the 69-kV connection from the transformer to the 69-kV transformer bus. Appurtenant mechanical and electrical equipment required for efficient operation of the Buck powerhouse includes 13.2-kV generator leads to a 13.2-kV bus, the common 13.2-kV bus, and 13.2-kV lines from the bus to the 13.2-kV Byllesby/Ivanhoe lines.

Specifications of additional mechanical and electrical equipment appurtenant to the Byllesby/Buck Hydroelectric Project are included in Table A.5-1 and Table A.5-2. The Project's single-line electrical diagram is included in Volume V of this draft license application (filed as CEII).

Table A.5-1. Appurtenant Mechanical, Electrical, and Transmission Equipment – Byllesby Development

Equipment			Manufacturer	Description
1)	Exciters		Allis-Chalmers Mfg. Co.	4-Type G Statex, Solid State, 75, kW, 250 V DC, 300 AMP
2)	Automatic Circuit Breaker		General Electric Company	Type C, Form K. 2,000 amps, 250 V
3)	Powerhouse Gantry Crane		Alliance	57/5 Tom capacity
4)	Actuators		Woodward Governor Co.	Type A
5)	Trash Rakes		Northfork Electric	Dragrake operated by system of motorized cable hoists that move a raking beam in a cyclical motion
6)	Motor Hoist & Controls		Harnischfeger Corporation	Gear and screw lift shaft assembly
7)	and other mechanical and electrical equipment required for efficient operation of the Project, including the following transmission equipment:			
	a)	The 13.2 kV generator leads to the 13.2 kV bus;		
	b)	The 13.2 kV bus (located within the Byllesby control house);		
	c)	The 13.2 kV line from the bus to the 13.2/69 kV transformer;		
	d)	The 13.2/69 kV transformer (located within the switchyard adjacent to the Byllesby control house);		
	e)	The 69 kV connection from the transformer to the 69 kV transformer bus (located within the switchyard adjacent to the Byllesby control house).		

Table A.5-2. Appurtenant Mechanical, Electrical, and Transmission Equipment – Buck Development

Equipment		Manufacturer	Description
1)	Motor Generator Exciter	Westinghouse Electric	1 – Type SK. DC Gen. 150 kW, 250 V, 600 amps, 1,180 rpm speed, shunt wound, style 6G6959
2)	Powerhouse Gantry Crane	Alliance	44/5 Ton Capacity
3)	Actuators	Woodward Governor Co.	Type A
4)	Trash Rake	Northfork Electric	Dragrake operated by system of motorized cable hoists that move a raking beam in a cyclical motion
5)	Motor Hoist & Controls	Harnischfeger Corp.	Gear and threaded lift shaft assembly
6)	and other mechanical and electrical equipment required for efficient operation of the Project, including the following transmission equipment:		

Equipment		Manufacturer	Description
	a)	The 13.2 kV generator leads to the 13.2 kV bus;	
	b)	The common 13.2 kV bus (located within the Buck powerhouse);	
	c)	The 13.2 kV line from the bus to the 13.2 kV Byllesby-Buck #1 and #2 transmission lines.	

A.6 Lands of the United States

There are no lands of the United States within the Byllesby-Buck Project Boundary.

Most the land to the west of the Project is owned by the U.S. Forest Service (USFS) and consists of the George Washington and Jefferson National Forest. The Mount Rogers National Recreation Area, a unit within the Jefferson National Forest and created in 1966, borders the Project to the west. These lands include approximately 100 acres of former Project lands that were transferred by Appalachian to the U.S. Forest Service in 1984, and subsequently removed from the Project Boundary, as authorized by FERC order dated December 18, 1984.

DRAFT LICENSE APPLICATION

BYLLESBY-BUCK HYDROELECTRIC PROJECT

(FERC NO. 2514)

EXHIBIT B

PROJECT OPERATION AND RESOURCE UTILIZATION

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Exhibit B - Project Operation and Resource Utilization (18 CFR §4.51(c))

B.1 Description of Plant Operations

B.1.1 Drainage Basin Description

The Byllesby and Buck developments (collectively the Project) are situated in the upper New River Basin (Hydrologic Unit Code 0505001) which extends from the Bluestone Dam near Hinton, West Virginia, to the headwaters of the New River's north and south forks in northwestern North Carolina near Blowing Rock. The New River originates in the mountainous northwest corner of North Carolina at approximate elevation 3,700 ft and extends northward into Virginia and eventually empties into the Ohio River in West Virginia. The Byllesby Development is approximately 3 miles upstream of the Buck Development. The drainage area is 1,310 square miles for Byllesby and 1,320 square miles for Buck.

The New River originates in North Carolina at the confluence of the North Fork New River and the South Fork New River. It then flows northward for 320 miles through Virginia before entering West Virginia and flowing to the confluence of the Gauley River forming the Kanawha River, a tributary to the Ohio River. The New River flows through valleys ranging in width from 200 to 1,000 ft and has banks with precipitous bluffs and steep side slopes; steep gradients throughout much of the upper basin result in increased overland runoff and high flow velocities.

B.1.2 Project Operation

During the term of a new FERC license, Appalachian proposes to continue operating the Byllesby-Buck Hydroelectric Project in a run-of-river mode with a 1-ft normal reservoir operating band at each development. There are no proposed changes to mode of operation.

The Project operates in a run-of-river mode under all flow conditions. Because the Buck Development is approximately 3 miles downstream from the Byllesby Development, operations of the two developments are closely coordinated and operations at Buck are dependent on flows through Byllesby. Under normal operating conditions, Appalachian operates the Project to use available flows for powerhouse generation, maintaining the elevation of the Byllesby reservoir between 2,078.2 ft and 2,079.2 ft and the Buck reservoir between 2,002.4 ft and 2,003.4 ft.

Appalachian is also required to release a minimum flow of 360 cfs or inflow to the Project, whichever is less, downstream of the Project powerhouses.

Under normal operating conditions, the minimum flow requirements and normal headwater elevation is maintained by passing flow through the turbine generating units. The unit operations are monitored and controlled either locally from the plant's computer or remotely from AEP's COC in Columbus, Ohio. Tainter gate and Obermeyer gate operation at both Byllesby and Buck are also remotely controlled from AEP's COC. Operators are stationed at the control center twenty-four hours per day, seven days per week. Plant personnel are typically present at the Project during normal working hours Monday through Thursday to perform routine maintenance. The plant is staffed four days a week (typically Monday through Thursday), 10 hours a day during normal operating conditions.

As further described in the section below, when inflow to either development exceeds the discharge capacity of the powerhouse (5,868 cfs for Byllesby and 3,540 cfs for Buck), the Tainter gates and/or Obermeyer gates are opened to pass the excess flow. Gate openings are planned and based on monitoring of the U.S. Geological Survey (USGS) gage at Galax, VA and Byllesby and Buck forebay elevations. If inflows exceed the capacity of the Tainter and Obermeyer gates, the wooden flashboards are manually released. The wooden flashboards must then be subsequently re-installed during a period when the reservoir is drawn down to the spillway crest elevation.

Ramping rates are required under Article 406 of the license for the protection of fish resources downstream of the Buck spillway. The gradual reduction of flow allows fish to progressively leave the area, versus possible stranding at sudden flow discontinuation. Following periods of spill from the Buck spillway when a spillway gate has been opened 2 ft or more, Appalachian is required to discharge flows through a 2-ft gate opening for at least three hours. Appalachian is then required to reduce the opening to 1 ft for at least an additional 3 hours, after which Appalachian may close the gate.

The frequency of spills to the bypass reaches during the period of record (POR), as well as dry and wet years, is presented in Table B.1-1. The values in the table below indicate the percentage of time in a given period where Project flows did not exceed the hydraulic capacity of the powerhouse, which is the same as the percentage of time where there would have been no spills to the bypass reach.

Table B.1-1. Non-Exceedance Probability of Discharge to the Bypass Reaches at Byllesby and Buck Dams

	Buck (3,540 cfs)			Byllesby (5,868 cfs)		
	1987-2020	1998	2020	1987-2020	1998	2020
Annual	89.0%	98.1%	70.9%	84.4%	97.0%	59.6%
Jan	85.2%	93.5%	80.6%	78.8%	93.5%	74.2%
Feb	83.5%	96.6%	55.2%	77.5%	93.1%	34.5%
Mar	81.4%	100.0%	80.6%	72.7%	100.0%	71.0%
Apr	80.2%	100.0%	63.3%	71.9%	100.0%	36.7%
May	86.3%	100.0%	35.5%	78.8%	100.0%	25.8%
Jun	90.3%	100.0%	50.0%	86.5%	100.0%	26.7%
Jul	95.1%	93.5%	100.0%	94.0%	90.3%	100.0%
Aug	94.9%	93.5%	80.6%	93.2%	90.3%	77.4%
Sep	94.9%	100.0%	80.0%	93.5%	100.0%	73.3%
Oct	93.8%	100.0%	77.4%	91.5%	100.0%	71.0%
Nov	92.5%	100.0%	70.0%	89.1%	96.7%	60.0%
Dec	90.1%	100.0%	77.4%	85.8%	100.0%	64.5%

Note: 1998 was the driest average year of the 30-year record. 2020 was the wettest average year of the 30-year record. Data based on operational model and prorated hydrology data from USGS 03165500

B.1.3 Flood Operations

B.1.3.1 Byllesby

When flows exceed the hydraulic capacity of the units during normal high-water events (approximately 5,868 cfs), the Tainter gates are opened in sequence from right to left towards the powerhouse. Tainter Gate No. 6 is opened first using a dedicated electric hoist and primary power provided through the powerhouse. When Tainter Gate No. 6 reaches the full-open position, the Obermeyer gates are opened. The Obermeyer gates are opened sequentially from right to left beginning with Bay No. 14, furthest from the powerhouse. (As flows recede, the gates are closed in reverse order of opening.) Tainter Gate No. 5 is used to manage river flows while the Obermeyer gates are being opened. The Tainter gates and Obermeyer gates are automated and can be remotely operated from the COC or manually on-site. The sluice gate is operated locally as needed to pass debris. The Obermeyer gates can also be used to sluice debris, as needed. The plant is staffed 24 hours per day, 7 days per week during unusual (i.e., flood) conditions when all the gates are in full-open position.

In advance of a forecast of two or more inches of rain, AEP may determine that a reservoir drawdown below EL. 2,078.2 ft is needed. Mutual agreement is also required for drawdown below EL. 2,078.2 ft.

During flood-stage flows, all generating units at the powerhouse may be shut down due to the loss of operating head. As the reservoir continues to rise, and with all gates in the full-open position, the main dam flashboards are manually released as required to maintain the reservoir at or below EL. 2,081.5 ft. The Byllesby auxiliary spillway is operated after all Tainter and Obermeyer gates have been opened and all wooden flashboard sections have been released, typically at flows in excess of 46,690 cfs. Each flashboard stanchion is released by striking a release pin with a hand-held steel bar, shearing a nail through the pin, allowing the stanchion to drop. The release is accessed via a sleeve through the spillway bridge deck. The flashboard release sequence varies with flashboard sections with old or deteriorated timber members being released first. The flashboards are released only after all six Tainter gates and five Obermeyer gates are fully opened and the reservoir level continues to rise. The Water Filtration Plants at Ivanhoe and Allisonia are notified before releasing flashboards. Prior to releasing the auxiliary spillway flashboards, the Emergency Action Plan (EAP) for the Project is activated.

During extreme flood conditions, once all the flashboards are released, the powerhouse unit head gates are closed, the powerhouse is de-energized and abandoned in preparation of dam overtopping. The powerhouse bulkhead door is closed to minimize flooding of the powerhouse.

The non-overflow (angled bulkhead) section begins to overtop at reservoir EL. 2,085.0 ft rendering the powerhouse and main spillway inaccessible. The spillway walkway and left abutment area are overtopped at reservoir EL. 2,087.5 ft, and flows proceed downstream to the Buck Development. The powerhouse generator floor at EL. 2,048.0 ft would be flooded by high tailwater when flows reached 192,000 cfs, based on tailwater rating curves.

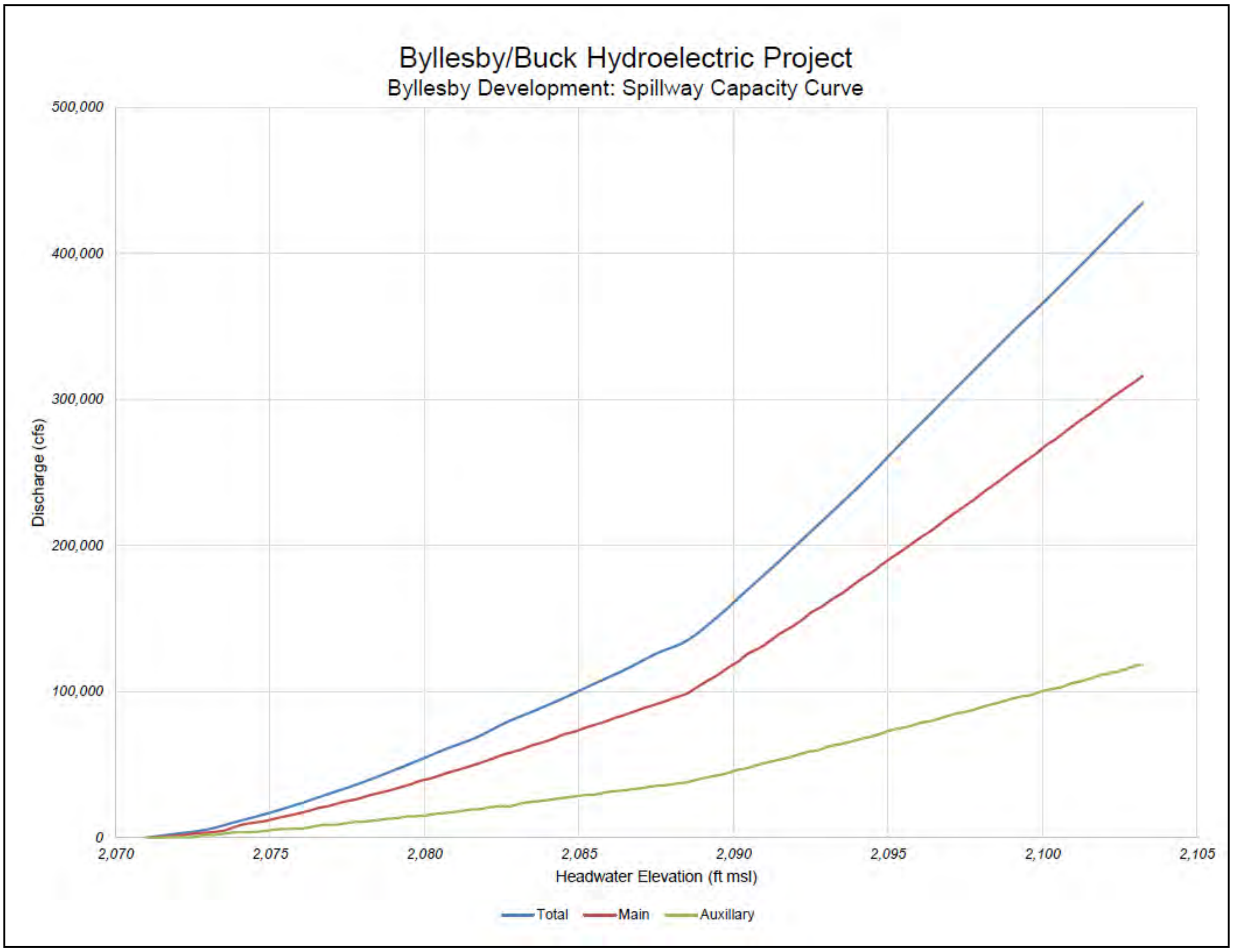

Figure B.1-1. Byllesby Spillway Capacity Curve

B.1.3.2 Buck

During high flows that exceed the hydraulic capacity of the generating units (approximately 3,540 cfs), the Tainter gates are opened in the following sequence: 1, 2, 3, 4, 5, and 6 using a dedicated electric hoist and primary power provided through the powerhouse. The four Obermeyer gates are then operated sequentially 7 through 10 to maintain the reservoir at EL. 2,003.4 ft. (As flows recede, the gates are closed in reverse order of opening.) The plant is staffed 24 hours per day, 7 days per week during unusual (i.e., flood) conditions when all the gates are in full-open position. The Tainter gates and Obermeyer gates are automated and can be remotely operated from the COC or manually on-site. The Obermeyer gates can be used to sluice debris, as needed. The plant is staffed 24 hours per day, 7 days per week during unusual (i.e., flood) conditions when all the gates are in full-open position.

In advance of a forecast of two or more inches of rain, AEP may determine that a reservoir drawdown below EL. 2,002.4 ft is needed. Agency approval is also required for drawdown below elevation 2,002.4 ft.

As the reservoir continues to rise, and with all gates in the full-open position, the flashboards are manually released as required to maintain the reservoir at or below EL. 2,005.5 ft. Each flashboard stanchion is released by striking a release pin with a hand-held steel bar, shearing a nail through the pin, allowing the stanchion to drop. The release is accessed via a sleeve through the spillway bridge deck. The flashboard release sequence varies with flashboard sections with old or deteriorated timber members being released first. The flashboards are released only after all six Tainter gates and four Obermeyer gates are fully opened, and the reservoir level continues to rise. The Water Filtration Plants at Ivanhoe and Allisonia are notified before releasing flashboards. The plant is staffed 24 hours per day, 7 days per week during unusual (i.e., flood) conditions when all the gates are in the full-open position.

During extreme floods, once all the flashboards are released, the powerhouse unit head gates are closed, the powerhouse is de-energized, bulkhead doors closed, and all staff would moved upland in preparation of dam overtopping. The powerhouse bulkhead door is closed to minimize flooding of the powerhouse. Prior to leaving the powerhouse, downstream communication is given in accordance with the EAP for the Project.

The main dam non-overflow sections and the spillway abutment at Mountain Island and wingwall sections begin to overtop at reservoir EL. 2,007.0 ft rendering the powerhouse, non-overflow sections and spillway bridge inaccessible. The spillway deck and left abutment are overtopped at reservoir EL. 2,010.0 ft. The powerhouse generator floor at EL. 1986.5 ft would be flooded by high tailwater when flows reached 175,000 cfs, based on tailwater rating curves.

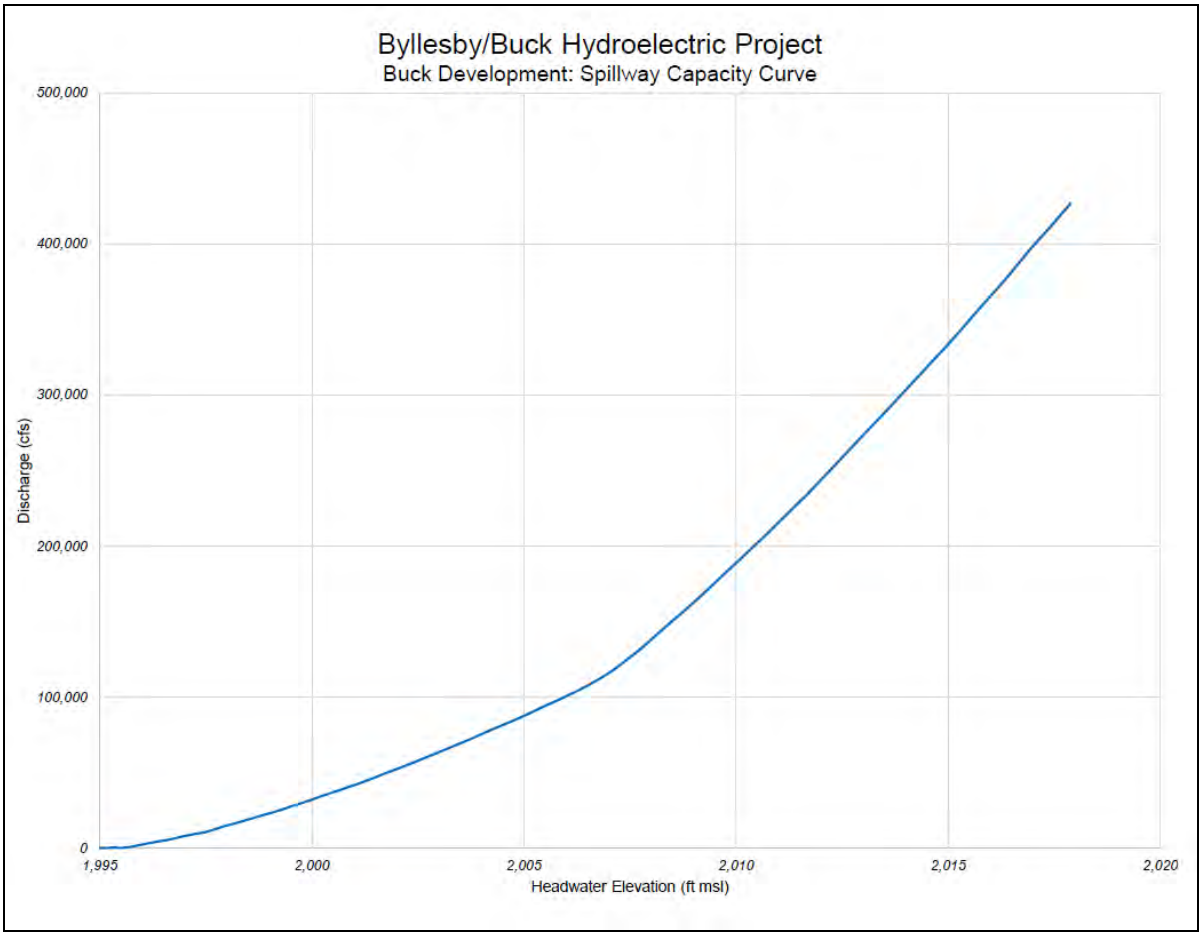

Figure B.1-2. Buck Spillway Capacity Curve

B.1.4 Plant Factor

The annual plant factor is the ratio of estimated average annual generation from the plant (in megawatt hours per year [MWh/yr]) to the energy that the plant might produce if it operated at full capacity for one year. Based on historical generation results, the plant factors at Byllesby and Buck are 34.2 percent and 55.3 percent, respectively. Following completion of the unit upgrades proposed by Appalachian, the plant factors are estimated to be 38.65 percent for Byllesby and 52.93 percent for Buck.

B.2 Estimated Energy Production and Dependable Capacity of the Project

B.2.1 Generation

Average annual historical generation at Byllesby and Buck over the past 50 years (approximately) is 53,913 MWh and 39,197 MWh, respectively. With the turbine-generator upgrades proposed by Appalachian for the new license term (Byllesby Units 1, 2, and 4 and Buck Units 1 and 3), average annual generation at the Byllesby and Buck developments is expected to increase to 70,600 and 48,220 MWh, respectively. Without the unit replacements, generation production and plant factors will degrade, and the probability of equipment failure will increase.

The Project operates in a run-of-river mode, and inflows to the Project are controlled by upstream flows. The Project experiences significant seasonal and annual variations in generation due to its run-of-river operation and seasonal precipitation events. Table B.2-1 provides a summary of monthly and annual generation in gross MWh for the past 5 years (2016 to 2020) for Byllesby and Table B.2-2 provides the same information for the Buck. This data also reflects the effects of plant and unit outages. Table B.2-3 provides a summary of monthly and annual average flows through the Byllesby-Buck Project (based on Byllesby outflows) in cfs for this same period from the USGS 03165500 New River at Ivanhoe, VA stream gage and prorating by drainage area.

Table B.2-1. Byllesby Monthly and Annual Generation (MWh) (2016-2020)

Period	2016	2017	2018	2019	2020	Monthly Average
January	6,757	4,318	2,902	6,496	5,526	5,200
February	3,976	2,369	6,383	5,198	4,476	4,480
March	7,270	3,183	3,692	6,752	6,775	5,534
April	4,324	5,561	4,850	8,098	5,304	5,627
May	5,649	8,778	6,103	7,164	5,096	6,558
June	3,215	5,275	5,299	7,372	5,292	5,291
July	1,822	2,941	2,783	5,834	4,887	3,654
August	2,662	2,771	3,840	4,049	5,083	3,681
September	1,129	2,731	2,247	2,113	4,492	2,542
October	1,400	3,919	4,188	3,778	4,163	3,489
November	1,046	3,882	5,754	4,327	2,565	3,515
December	2,849	2,609	5,373	5,251	2,712	3,759

Period	2016	2017	2018	2019	2020	Monthly Average
Total	42,099	48,337	53,416	66,430	56,370	53,330

Table B.2-2. Buck Monthly and Annual Generation (MWh) (2016-2020)

Period	2016	2017	2018	2019	2020	Monthly Average
January	5,366	3,597	2,255	1,482	5,391	3,618
February	4,563	1,883	3,584	1,362	5,784	3,435
March	5,941	2,298	1,595	3,759	5,449	3,808
April	3,937	4,668	3,773	4,057	4,847	4,256
May	4,394	6,445	4,962	3,887	5,006	4,939
June	2,986	4,138	3,532	3,992	3,048	3,539
July	2,113	2,203	1,852	3,341	3,064	2,515
August	2,609	2,191	3,896	2,105	4,503	3,061
September	583	2,028	3,660	1,119	3,875	2,253
October	1,170	3,062	2,438	2,152	3,872	2,539
November	1,056	2,588	3,444	1,981	4,366	2,687
December	2,261	1,629	2,385	2,851	5,072	2,839
Total	36,980	36,729	37,376	32,088	54,277	39,490

Table B.2-3. Monthly and Annual Average Project Outflows (cfs) (2016-2020)

Period	2016	2017	2018	2019	2020	Monthly Average
January	3,106	2,162	1,986	5,129	3,477	3,172
February	5,450	1,229	3,207	6,559	5,579	4,405
March	2,943	1,312	2,727	3,929	3,586	2,900
April	1,974	4,114	4,802	4,816	4,956	4,132
May	2,359	5,315	5,148	3,006	8,714	4,908
June	1,826	2,287	2,932	4,599	4,130	3,155
July	1,146	1,304	1,602	2,402	2,364	1,764
August	1,438	1,160	2,342	1,619	3,472	2,006
September	773	1,182	4,783	970	3,068	2,155

Period	2016	2017	2018	2019	2020	Monthly Average
October	945	2,456	5,337	1,701	3,648	2,817
November	751	1,638	3,807	2,052	4,806	2,611
December	1,044	1,145	7,017	2,826	3,378	3,082
Average	**1,980**	**2,109**	**3,807**	**3,301**	**4,265**	**3,092**

B.2.2 Dependable Generating Capacity

The estimated winter season dependable capacity for the Byllesby Development is 8 MW, while the estimated summer season dependable capacity is 5 MW. The estimated winter season dependable capacity for the Buck Development is 5 MW, while the estimated summer season dependable capacity is 3 MW. These estimates are based on the monthly project flow duration curves for the months of January (winter season) and August (summer season) and manufacturer's data relative to equipment performance. Flow duration curves for January and August were chosen because peak demands for energy on the AEP system typically occur during these months.

B.2.3 Flows

Monthly flow data from the USGS 03165500 New River at Ivanhoe, VA flow gaging station is provided in Table B.2-4. This gage is located approximately 2.8 miles downstream of the Buck Development and reports daily average flow data starting in October 1929 through present, with a data gap from September 1978 to January 1996, providing a discontinuous 74-year POR. Monthly mean flow data, along with the 25th and 75th percentile flow data[3] is provided from January 1996 through December 2020 (a 25-year POR[4]) to put recent historic river flows in perspective with Byllesby and Buck maximum hydraulic capacities and current minimum downstream flow release requirements. For example, mean monthly flows recorded at the USGS 03165500 New River at Ivanhoe, VA gage are less than the hydraulic capacities of both the Byllesby and Buck developments. And while the monthly 75th percentile flows are less than the Byllesby powerhouse capaci

[3] A percentile is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it. A flow percentile greater than 75 is considered to be wetter than normal; a flow percentile between 25 and 75 is considered normal; and a flow percentile less than 25 is considered to be drier than normal.

[4] The January 1996 – December 2020 POR is reflective of current land use and water use practices and uses more modern data collection and recording methods compared to the 1929 – 1978 POR. The more recent POR also contains a number of dry and wet periods that are sufficient for purposes of evaluating flow regimes relevant to the bypass reach flow and aquatic habitat study goals and objectives.

ty, they exceed the smaller Buck powerhouse capacity. As a result, flow releases into the Buck bypass reach are more common than into the Byllesby bypass reach.

Table B.2-4 New River Flow Data (USGS Ivanhoe Gage), 1996 through 2020

Month	Flow (cfs)			
	Average	Minimum	Median	Maximum
January	2,553	393	2,090	32,701
February	2,869	582	2,350	26,588
March	2,833	762	2,600	16,205
April	3.068	1,067	2,590	23,386
May	2,849	804	2,270	40,173
June	2,120	448	1,790	20,475
July	1,681	365	1,290	21,833
August	1,453	176	1,100	22,707
September	1,564	244	984	29,693
October	1,596	263	1,140	29,111
November	1,892	440	1,300	27,753
December	2,360	551	1,990	19,310
Annual	2,236	921	1,800	25,828

An annual as well as monthly flow duration curves for flows through the Project are included in Section B.5 Flow Figures. The flow duration curves are based on flow data from 1996 to 2020 at the USGS Ivanhoe gage, adjusted for drainage area as described above.

Due to the small surface area of the impoundment, evaporation is not considered to be a significant factor. Leakage at the dam is also not a significant contributor to flows in the bypass reach.

B.2.4 Reservoir Storage Capacity

The gross storage capacity for the Byllesby impoundment is approximately 2,000 acre-ft with a total area of 239 acres. The gross storage capacity for Buck is approximately 661 acre-ft with a total area of 66 acres. Since each development is operated in a run-of-river mode, net storage capacity is not applicable. Storage-volume (storage capacity) curves for each development are included in Exhibit A, Figure B.2-1 and Figure B.2-2.

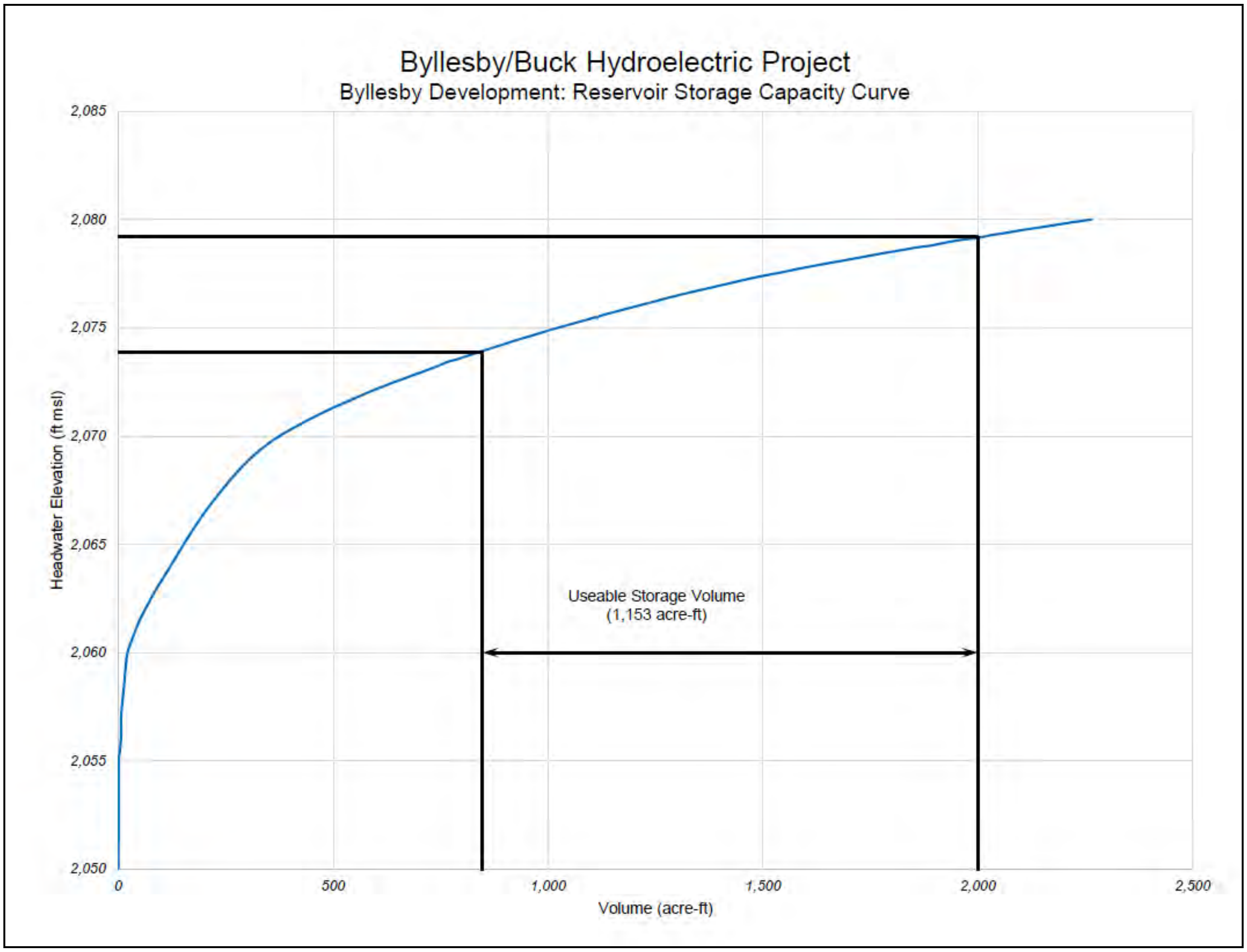

Figure B.2-1. Byllesby Development Reservoir Storage Capacity Curve

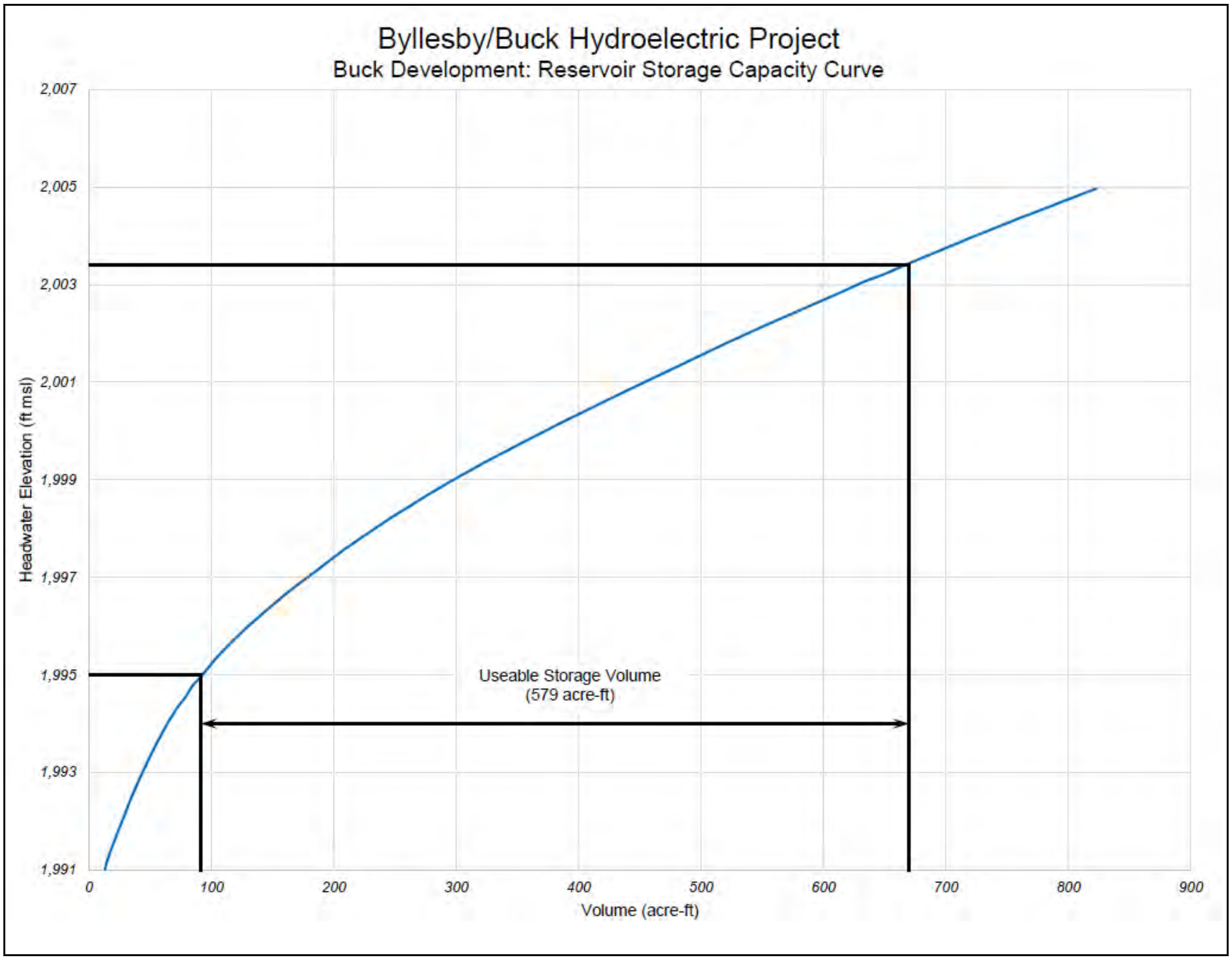

Figure B.2-2. Buck Development Reservoir Storage Capacity Curve

B.2.5 Hydraulic Capacity

B.2.5.1 Byllesby

The estimated combined maximum hydraulic capacity for all four existing turbine units installed at the Byllesby Development is 5,868 cfs. This estimate is based on manufacturer's turbine discharge information for all four units operating at full wicket gate opening and at a 56-ft head.

With the turbine-generator upgrades proposed by Appalachian for the new license term (Units 1, 2, and 4), the estimated combined maximum hydraulic capacity for all four turbine units is 5,511 cfs at full wicket gate opening and at a 54-ft head.

B.2.5.2 Buck

The estimated combined maximum hydraulic capacity for all three existing turbine units installed at the Buck Development is 3,540 cfs. This estimate is based on manufacturer's turbine discharge information for all three units operating at full wicket gate opening and at a 40-ft head.

With the turbine-generator upgrades proposed by Appalachian for the new license term (Units 1 and 3) the estimated combined maximum hydraulic capacity for all three turbine units is 3,570 cfs at full wicket gate opening and at a 42.4-ft head.

B.2.6 Tailwater Rating Curve

B.2.6.1 Byllesby

A tailwater rating curve for flows through the existing Byllesby generating units ranging is shown on Figure B.2-3. This rating curve was developed for the previous license application by curve fitting randomly selected discharges and elevations recorded from August 1988 through May 1990. A U.S. Army Corps of Engineers REC-II computer model of the tailwater area was also generated to estimate tailwater elevations for flows in excess of those recorded. The curve generated by the REC-II model was verified by the actual data for flows ranging from 0 cfs through 6,000 cfs, and an extended tailwater rating curve for flows up to approximately 600,000 cfs is shown on Figure B.2-4.

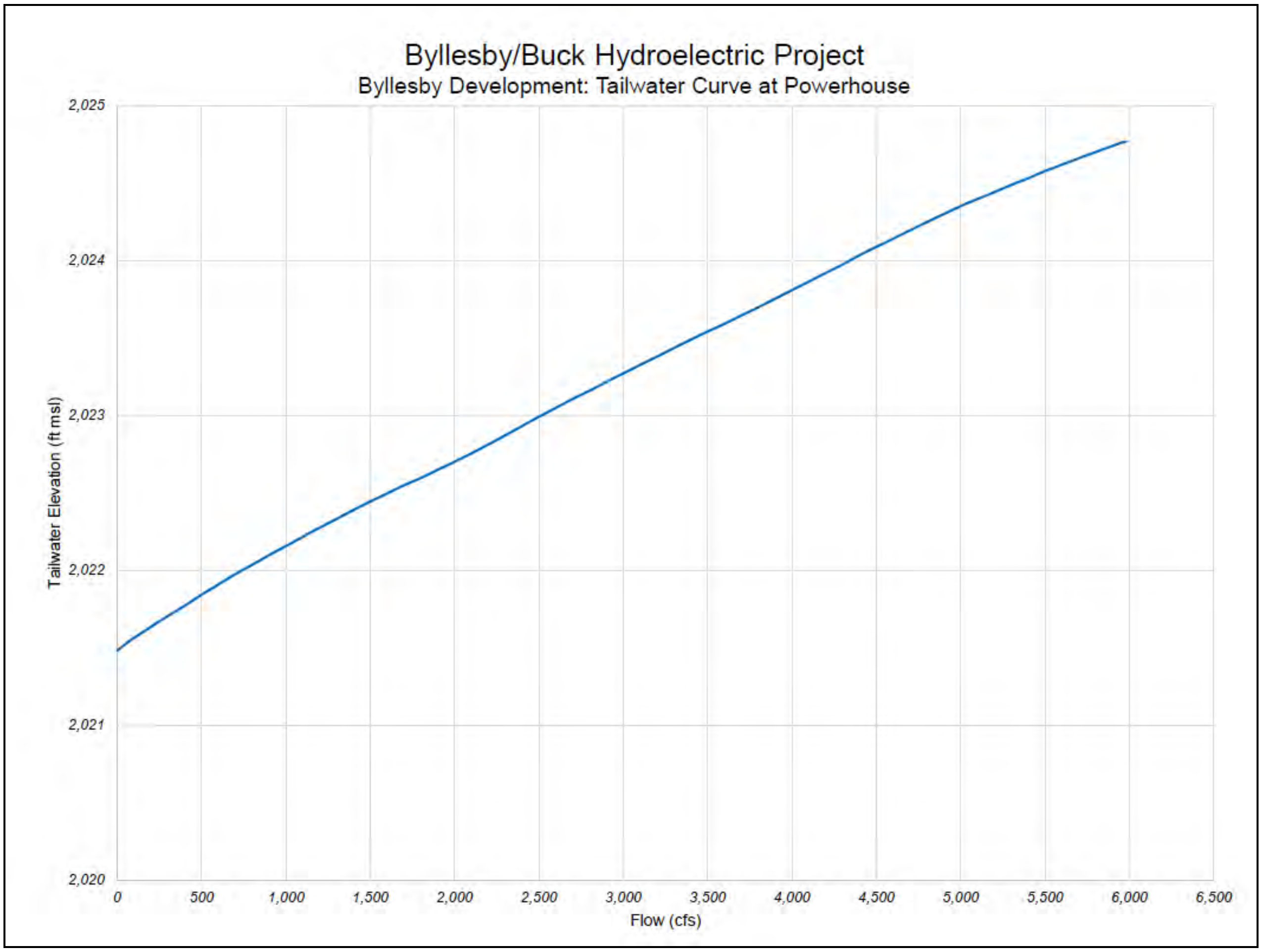

Figure B.2-3. Byllesby Development Tailwater Curve

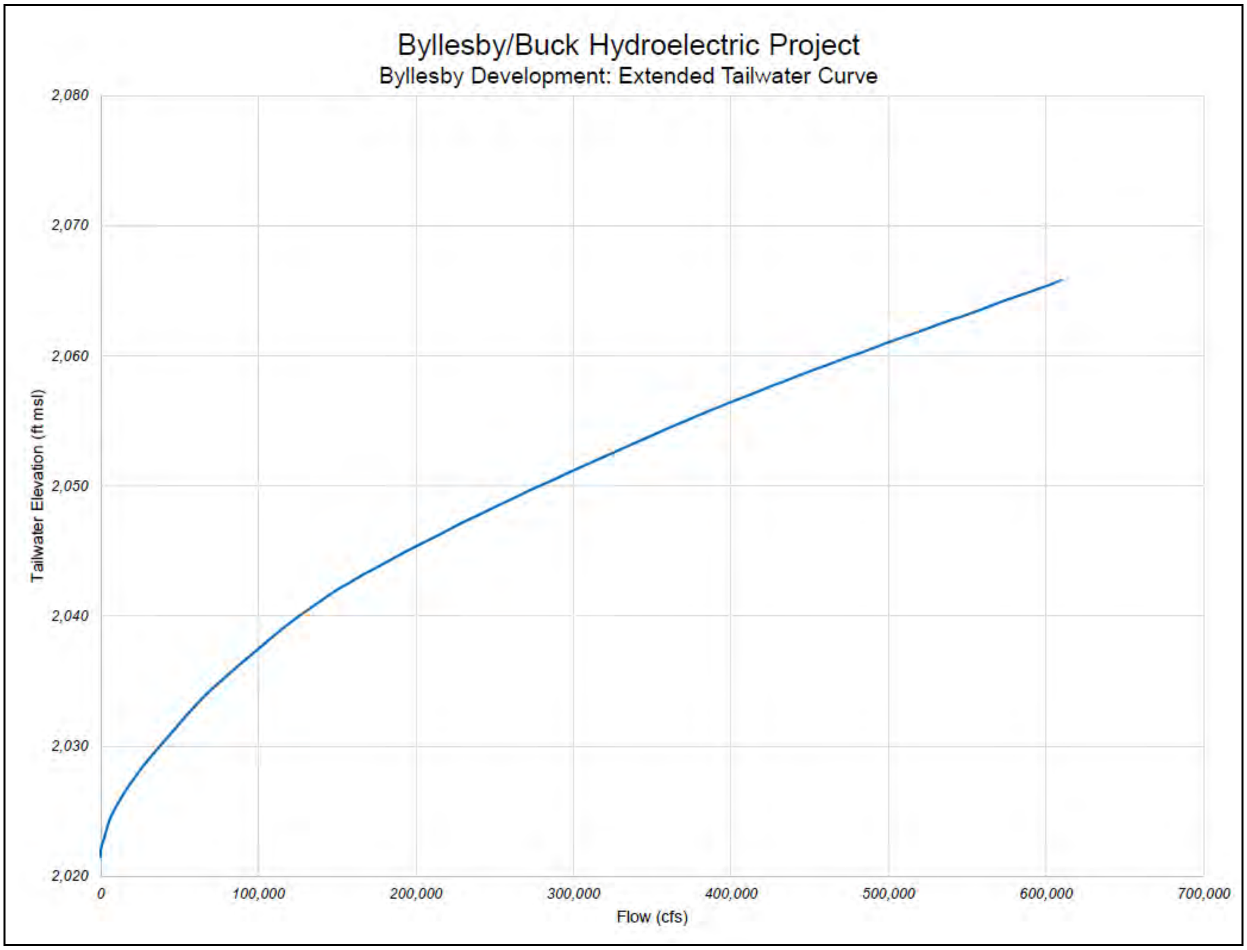

Figure B.2-4. Byllesby Development Extended Tailwater Curve

B.2.6.2 Buck

A tailwater rating curve for flows through the existing Buck generating units is shown on Figure B.2-5. This rating curve was developed for the previous license application by curve fitting randomly selected discharges and elevations recorded from August 1988 through May 1990. A U.S. Army Corps of Engineers HEC-II computer model of the tailwater area was also generated to estimate tailwater elevations for flows in excess of those recorded. The curve generated by the HEC-II model was verified by the ·actual data for flows ranging from 0 cfs through 4,000 cfs, and an extended tailwater rating curve for flows up to approximately 600,000 cfs is shown on Figure B.2-6.

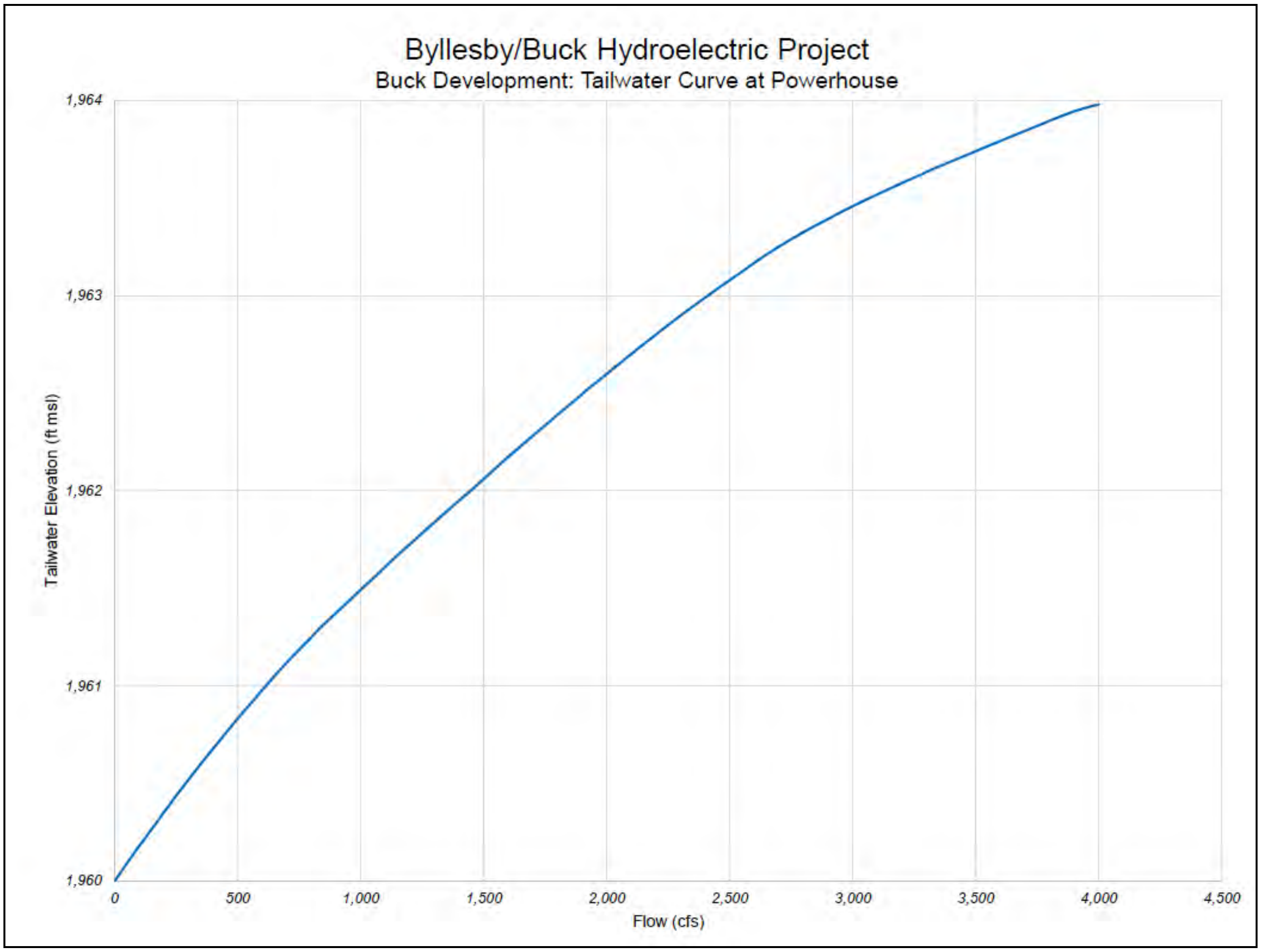

Figure B.2-5. Buck Development Tailwater Curve

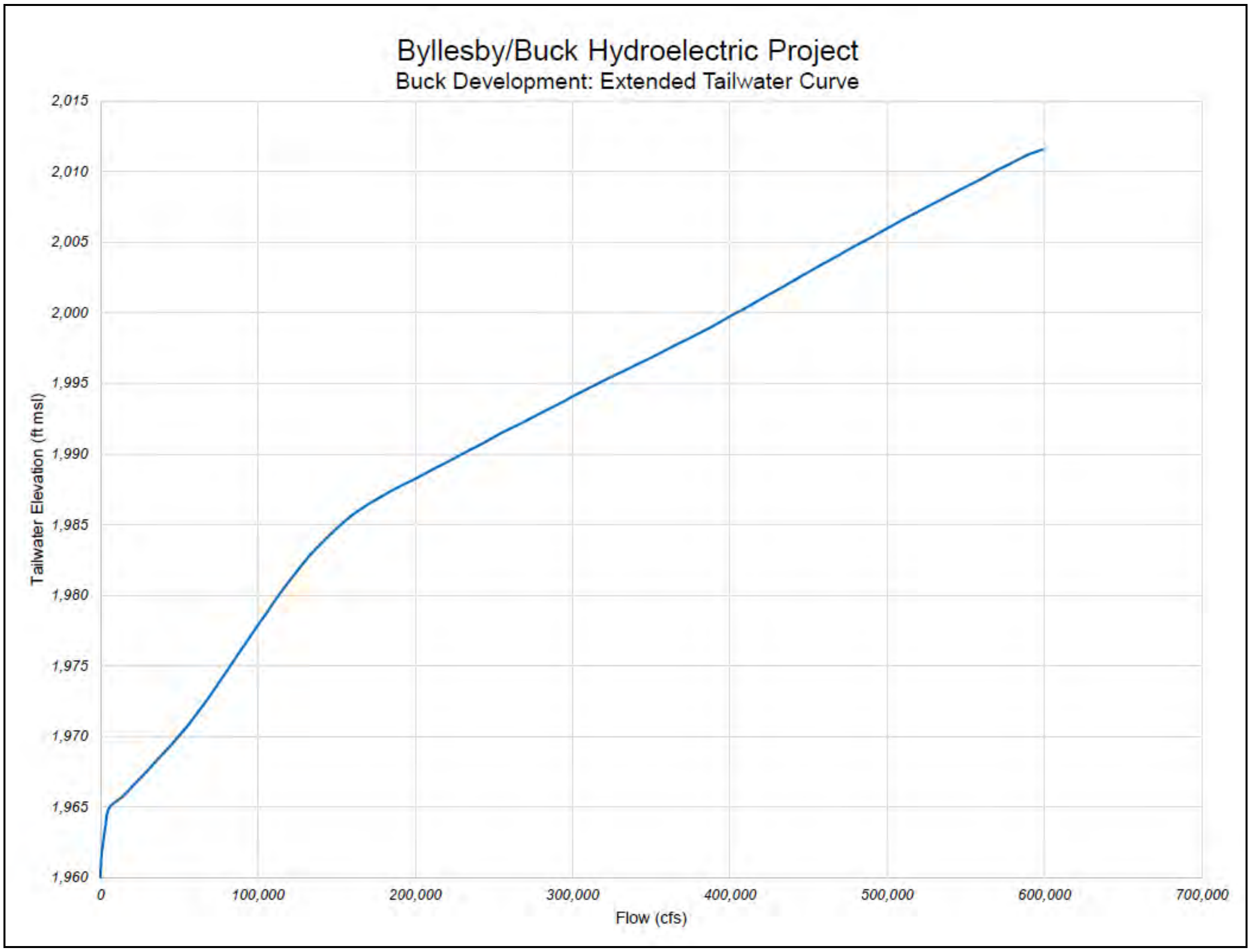

Figure B.2-6. Buck Development Extended Tailwater Curve

B.2.7 Head vs. Capability

The average head on the Project is based on the normal maximum forebay elevation and the normal tailwater elevation associated with the mean annual flow through the Project and is approximately 56.4 ft of net head for the existing Byllesby Development and 40 ft of net head for the existing Buck Development.

Minimum plant power output occurs when one unit operates at minimum discharge and maximum head conditions. Maximum plant power output occurs when both units are operating near full power output at approximately normal head conditions. The powerplant capability of the Byllesby and Buck developments from minimum output to maximum output is provided below.

B.2.7.1 Byllesby

Estimates of plant capability for the existing units were developed from manufacturer's unit performance data for various discharges and associated head conditions. The Byllesby head versus powerplant capability at various operating head conditions is shown in Figure B.2-7. For this figure, a minimum headwater elevation of 2079.2 ft was assumed. By referencing the tailwater rating curve for the Byllesby Development, head conditions for turbine discharges associated with cumulative plant loadings were developed.

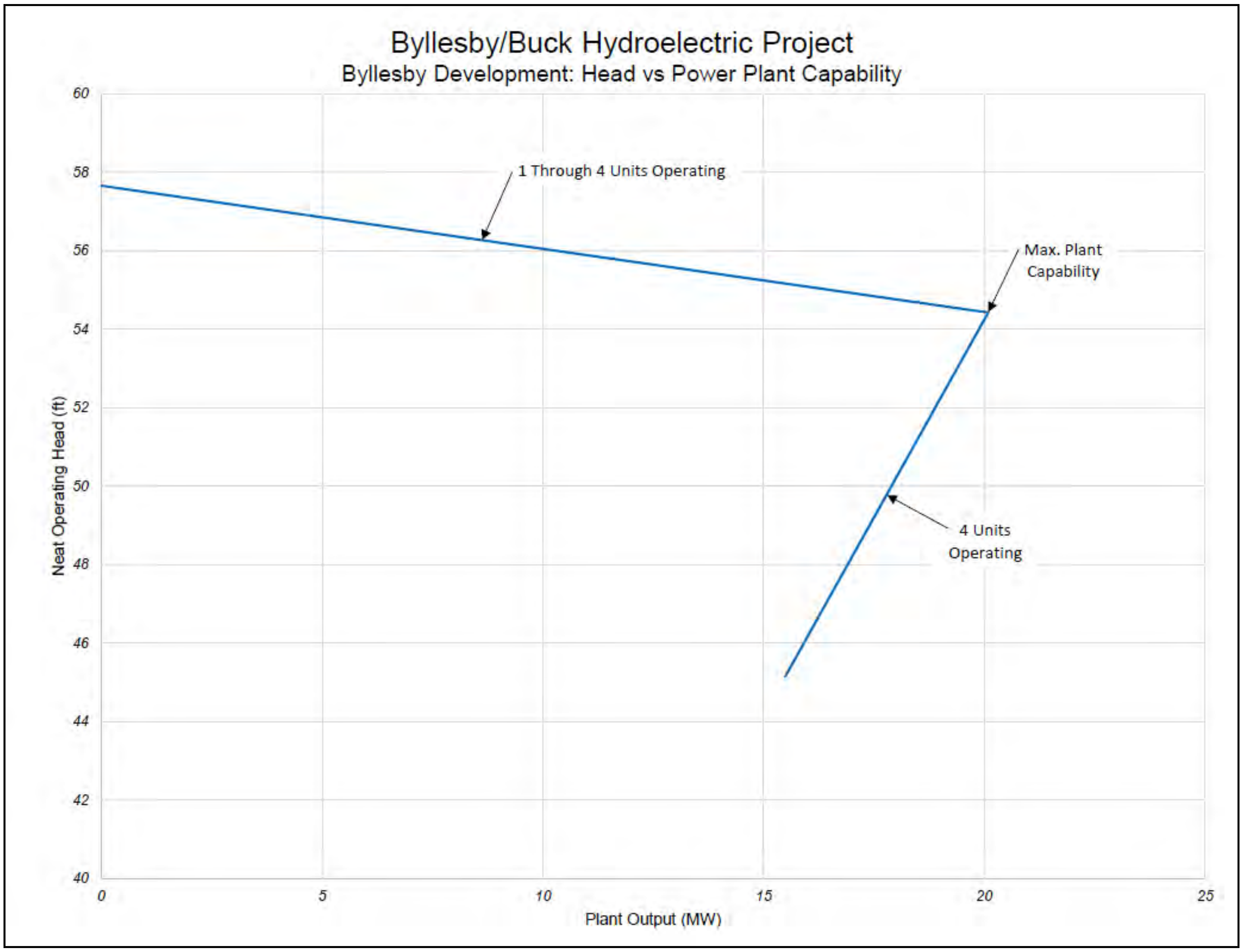

Figure B.2-7. Byllesby Development Head vs. Power Plant Capability

B.2.7.2 Buck

Estimates of plant capability for the existing units were developed from manufacturer's unit performance data for various discharges and associated head conditions. The Buck head versus powerplant capability at various operating head conditions is shown in Figure B.2-8. For this figure, a minimum headwater elevation of 2003.4 ft was assumed. By referencing the tailwater rating curve for the Buck Development, head conditions for turbine discharges associated with cumulative plant loadings were developed.

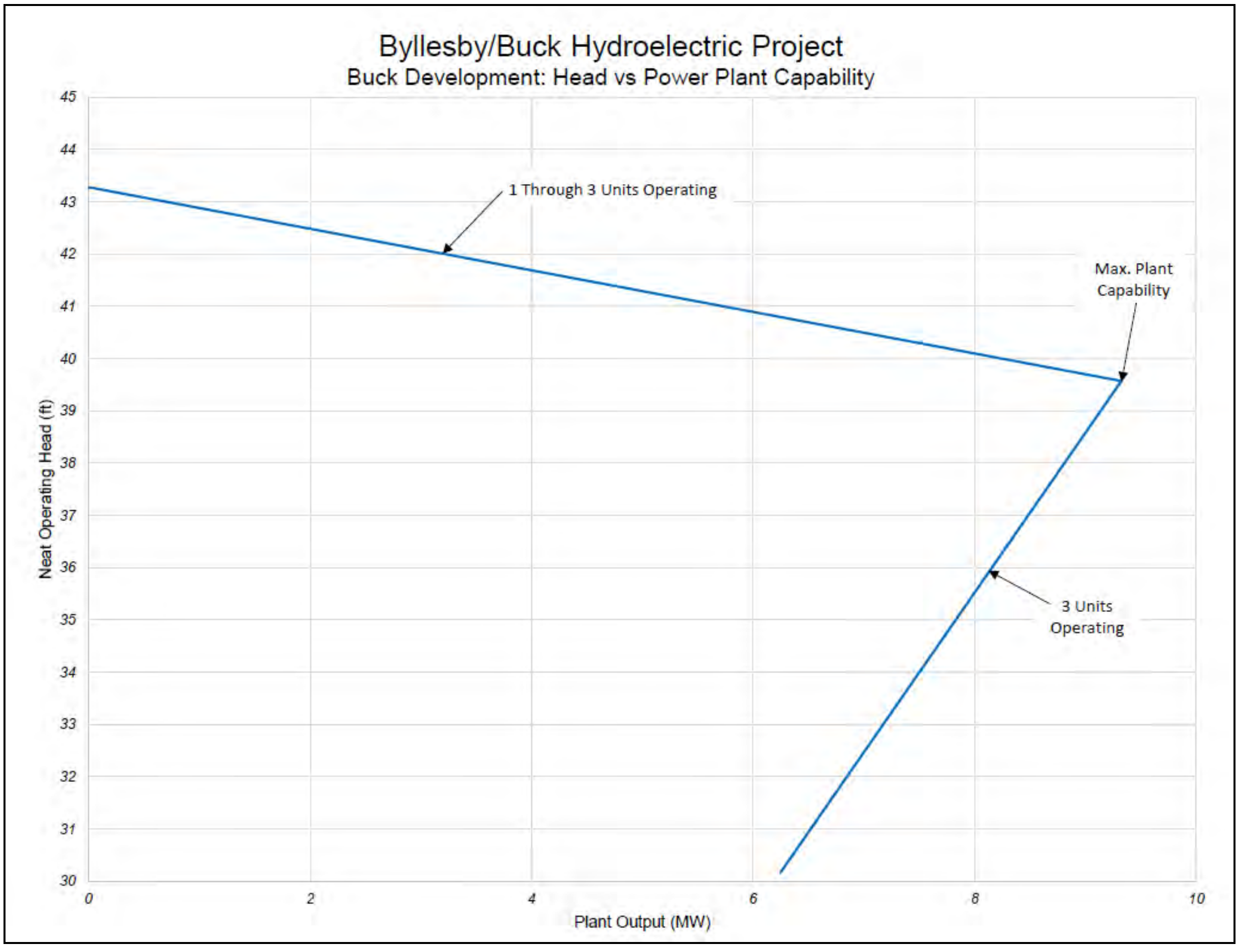

Figure B.2-8. Byllesby Development Head vs. Power Plant Capability

B.3 Power Utilization

Power generated at the Byllesby/Buck Hydroelectric Project is to be utilized by the internal customers of Appalachian Power Company.

B.4 Future Development

As described in Exhibit A and in the sections above, Appalachian proposes to upgrade six of the seven existing turbine-generator units at the Project in the new license term. Following completion of the upgrades, the authorized installed capacities for the Byllesby and Buck developments will be 20.85 MW and 10.39 MW, respectively, with maximum hydraulic capacities of 5,511 cfs and 3,570 cfs, respectively. The upgrades are necessary to support plant modernization and life extension. Appalachian Power Company has no current plans for future development of any other existing or proposed water power project on the New River.

B.5 Flow Figures

The following figures include unit discharge flows as well as annual and monthly duration flow curves for each development.

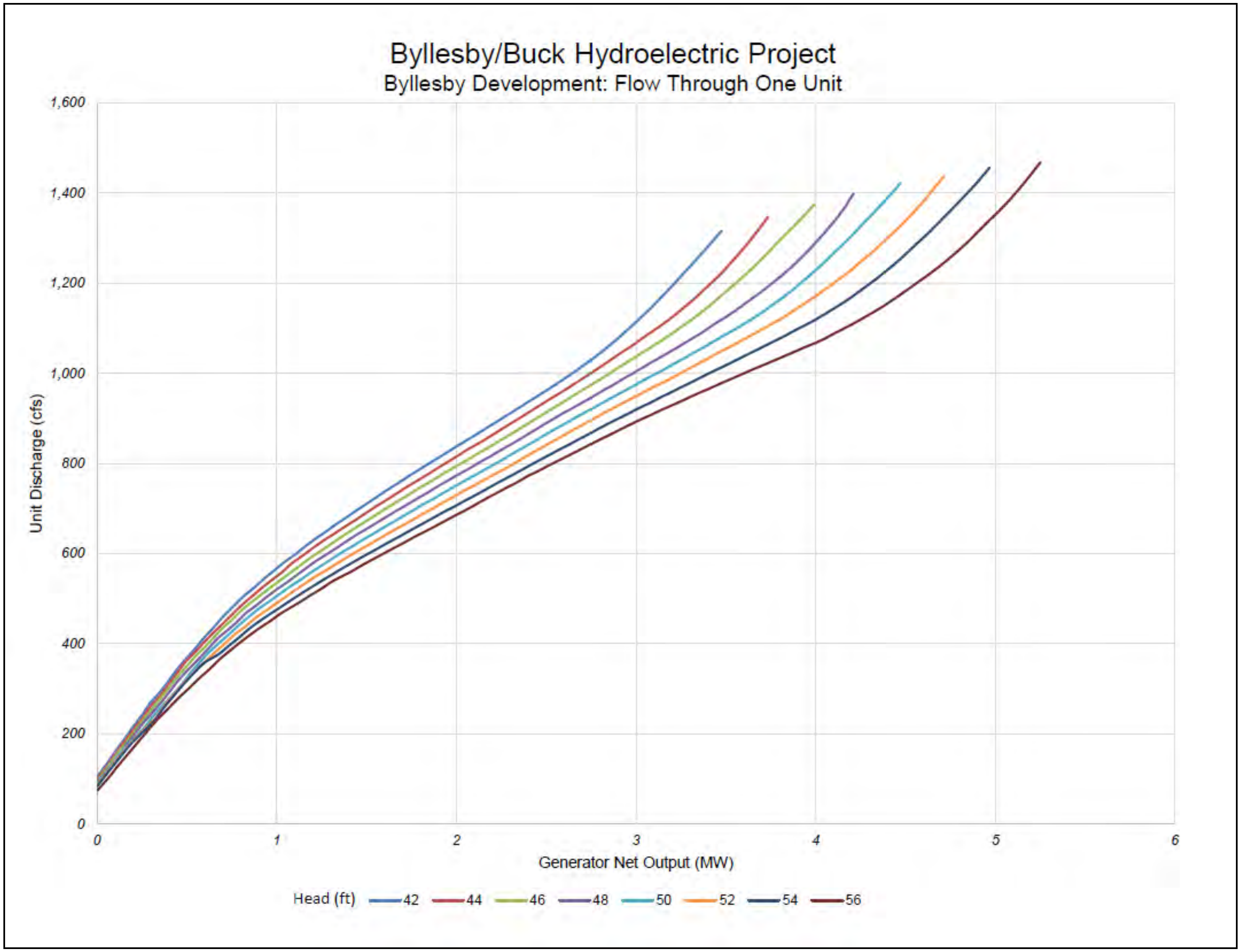

Figure B.5-1. Byllesby Development: Flow Through One Unit (Existing Units)

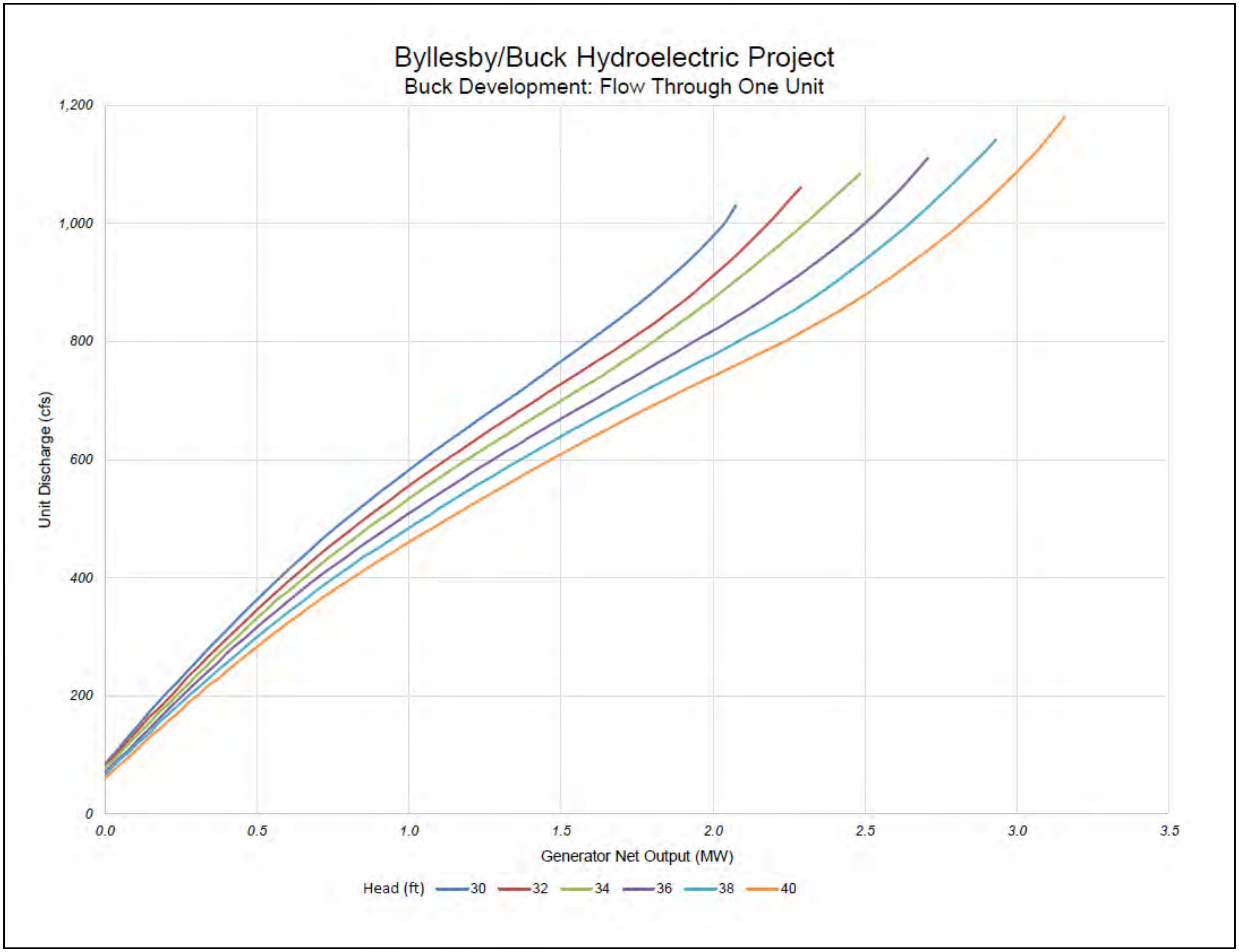

Figure B.5-2. Buck Development: Flow Through One Unit (Existing Units)

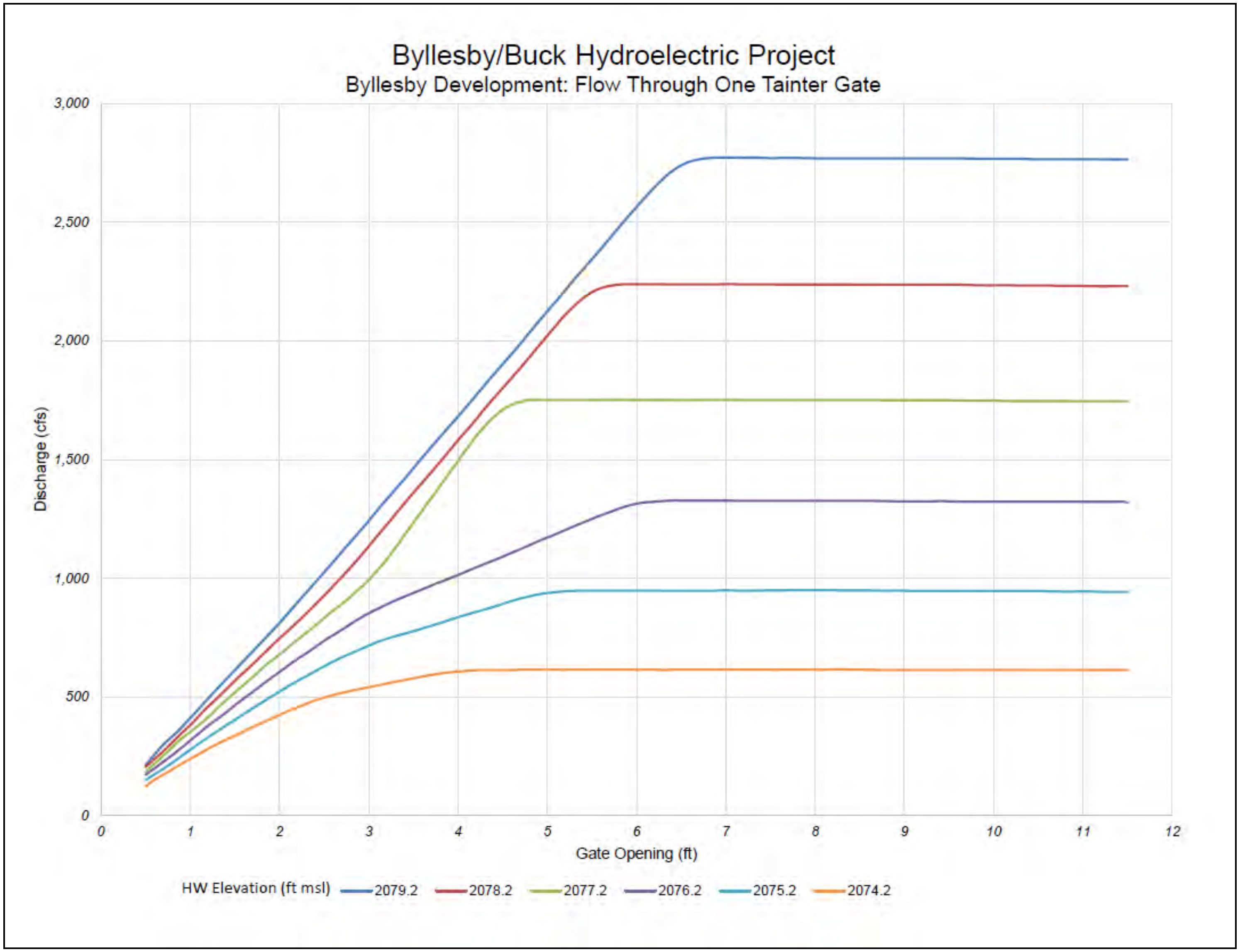

Figure B.5-3. Byllesby Development: Flow Through One Tainter Gate

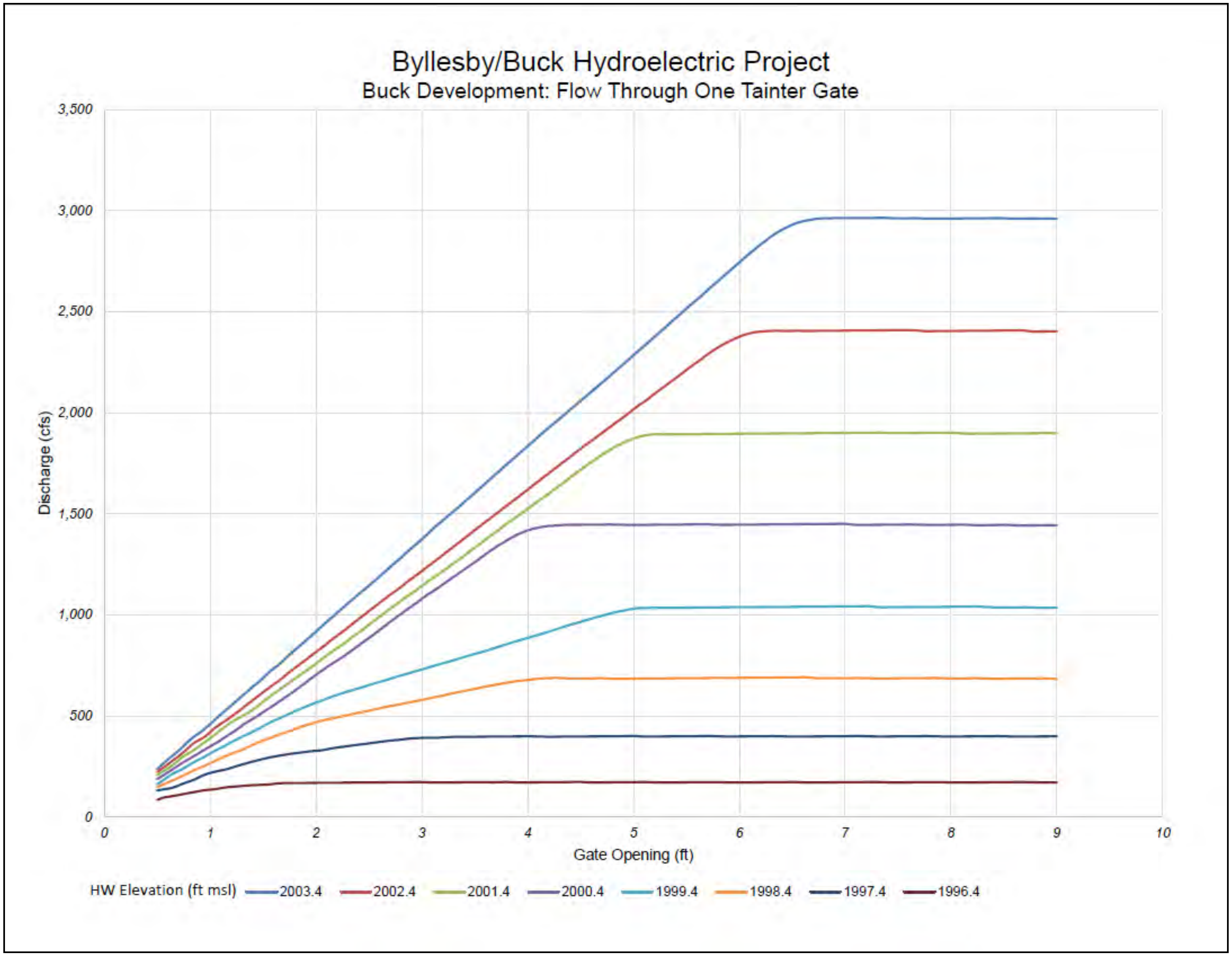

Figure B.5-4. Buck Development: Flow Through One Tainter Gate

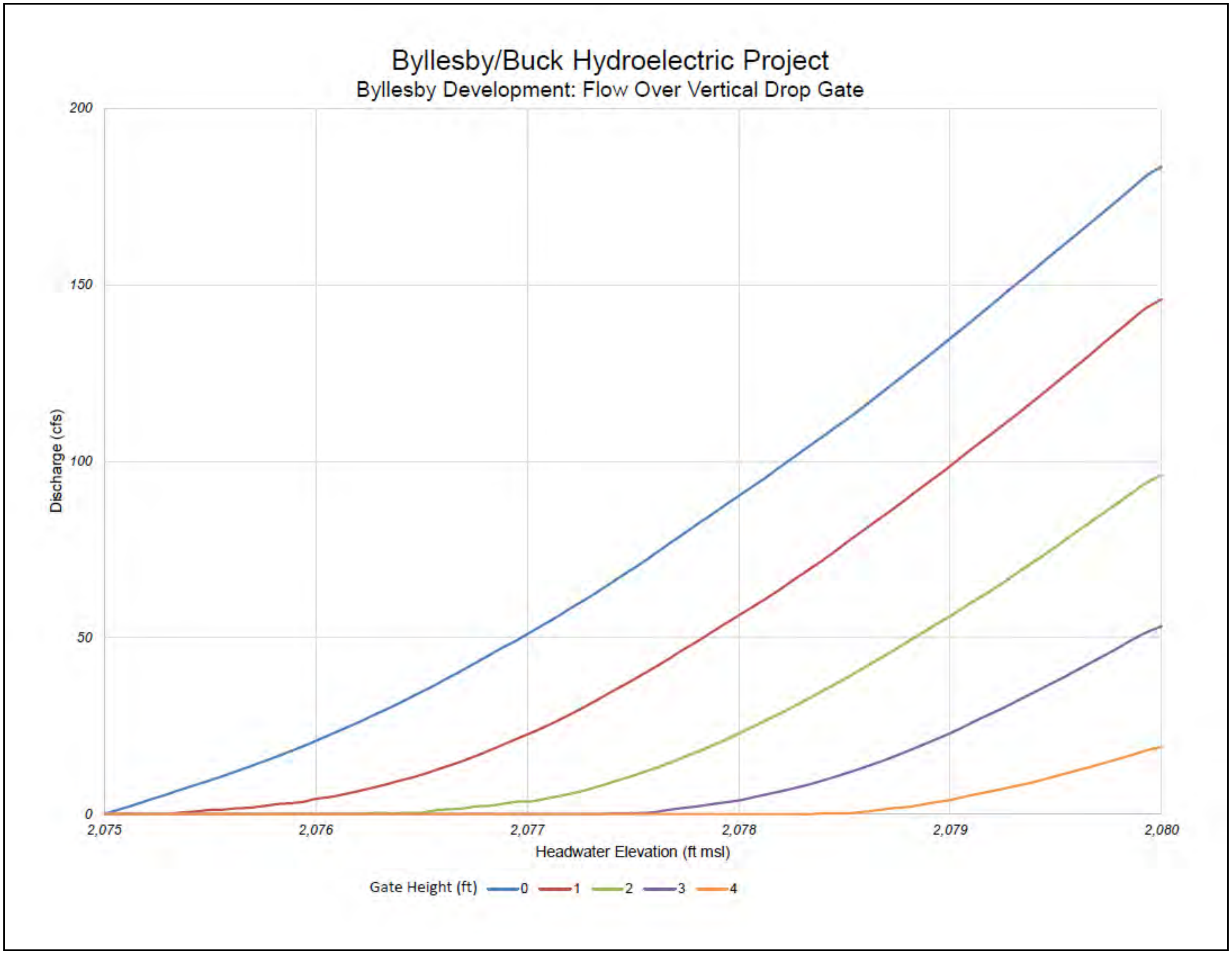

Figure B.5-5. Byllesby Development: Flow Over Vertical Drop Gate

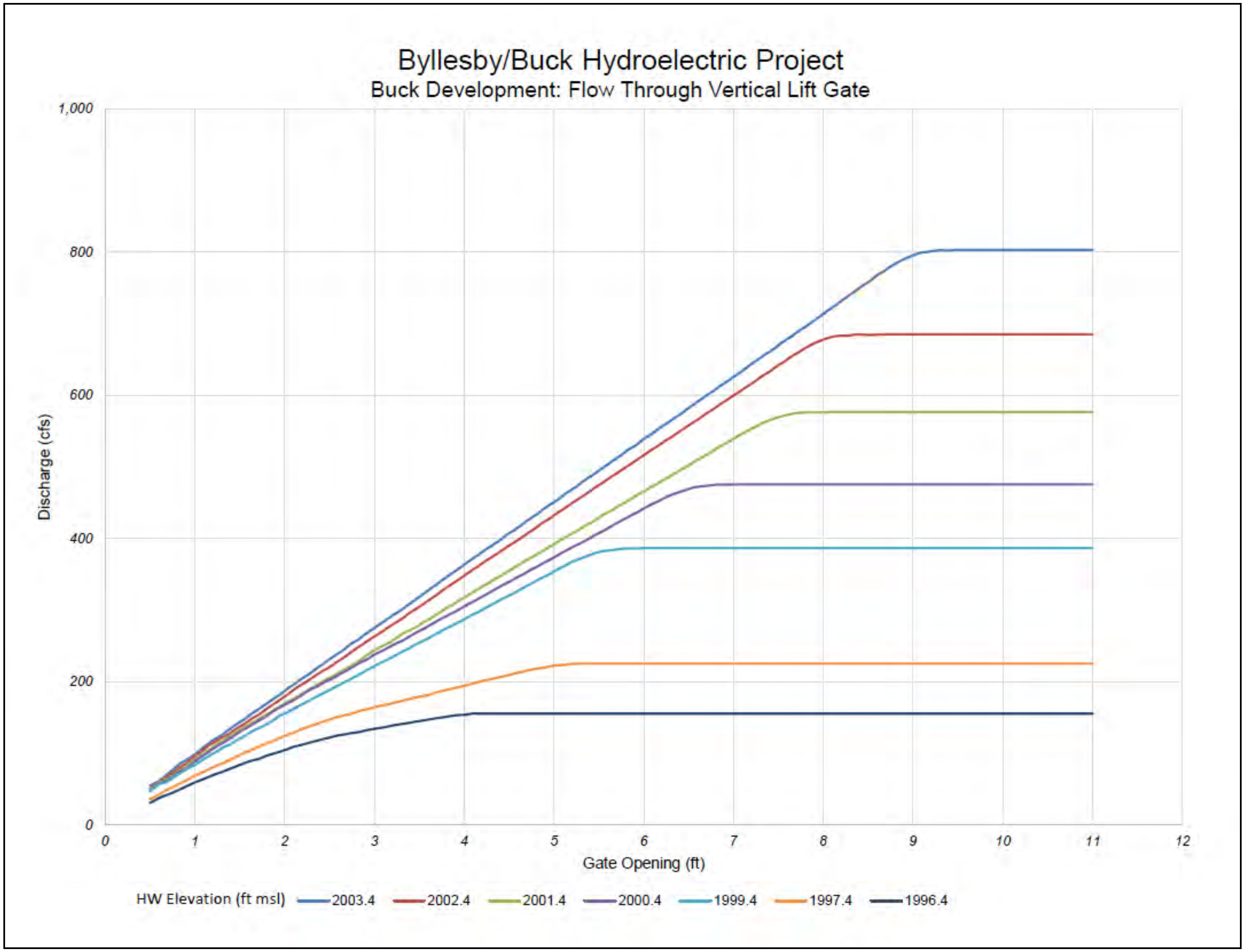

Figure B.5-6. Buck Development: Flow Through Vertical Lift Gate

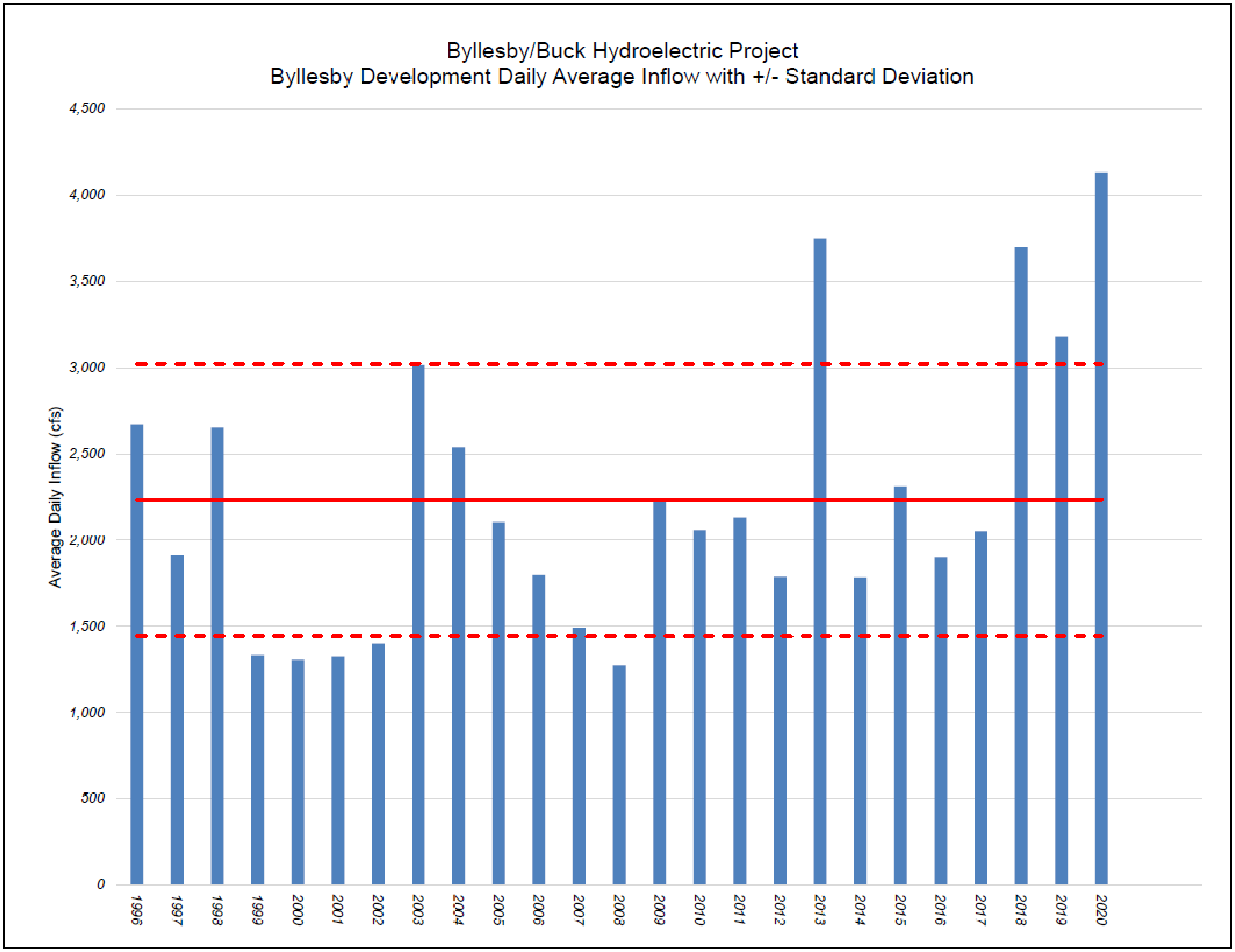

Figure B.5-7. Byllesby Development Daily Average Inflow

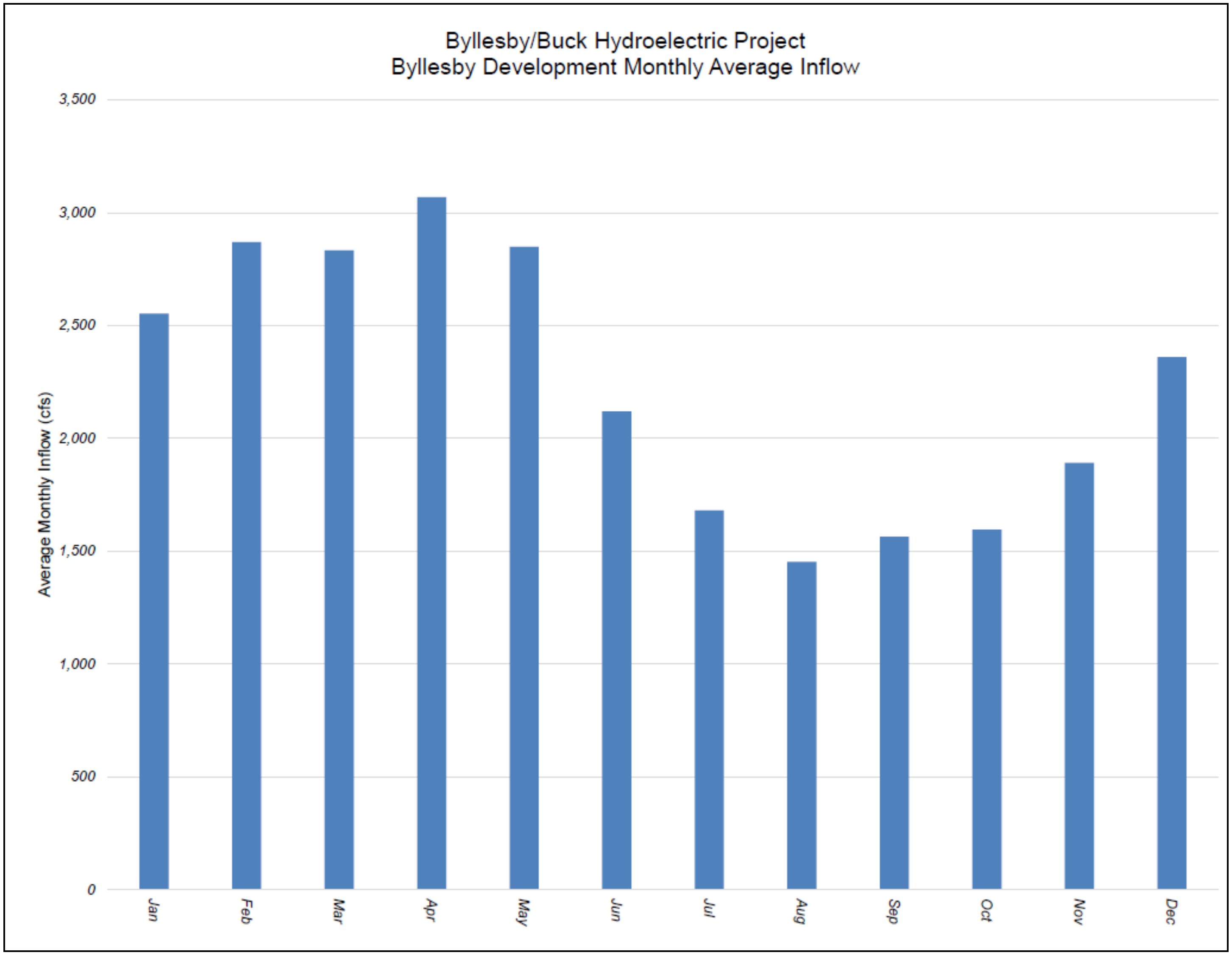

Figure B.5-8. Byllesby Development Monthly Average Inflow

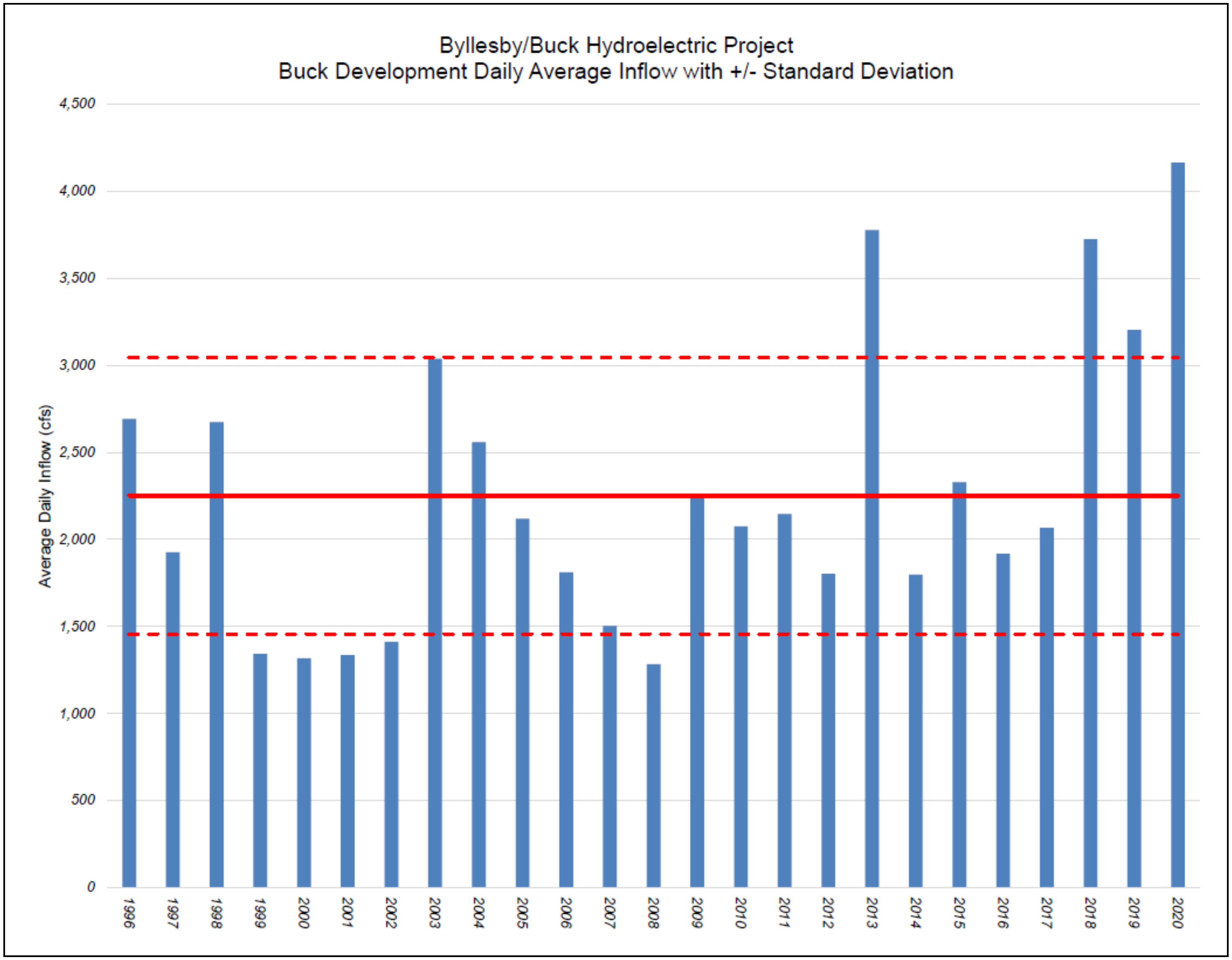

Figure B.5-9. Buck Development Daily Average Inflow

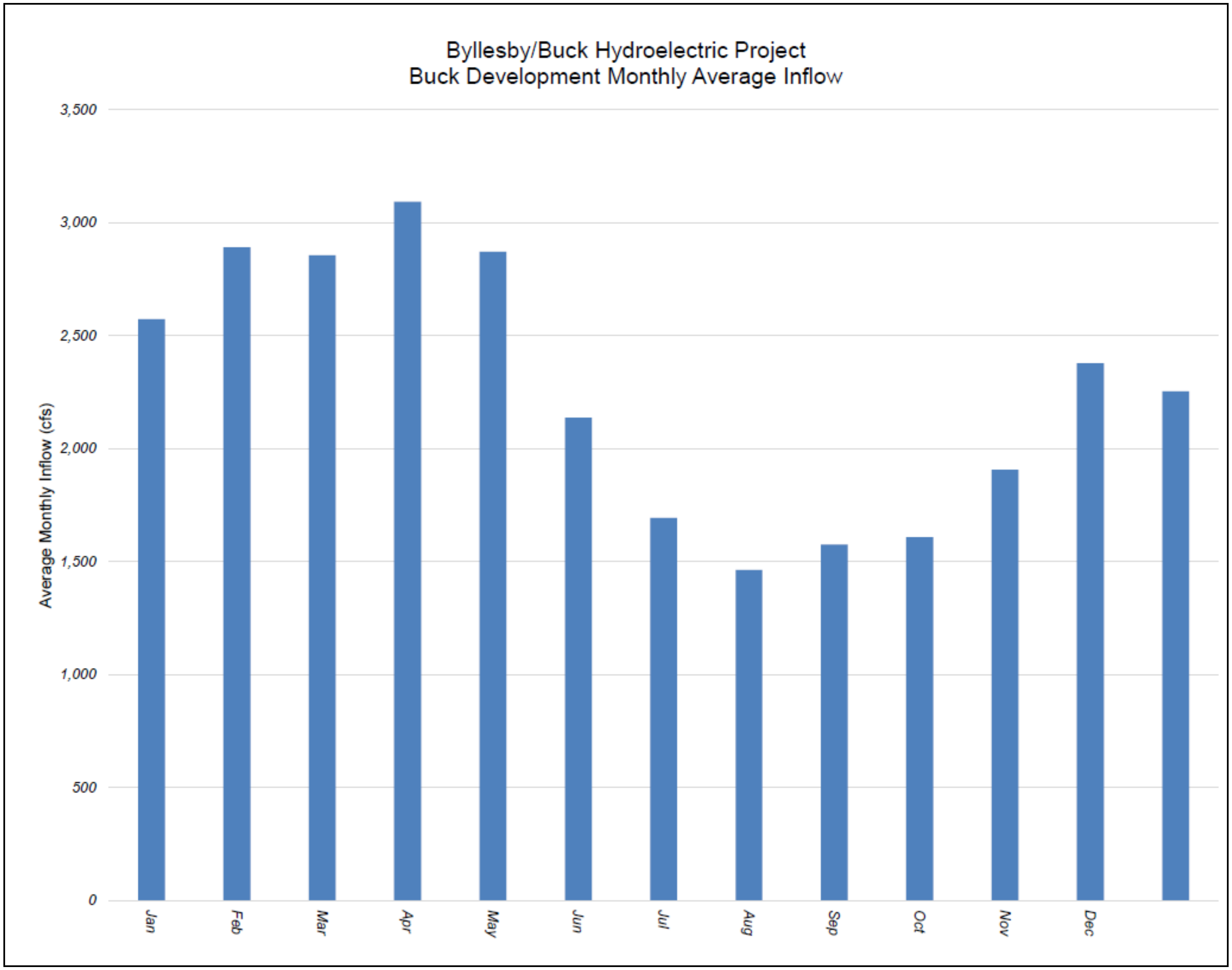

Figure B.5-10. Buck Development Daily Average Inflow

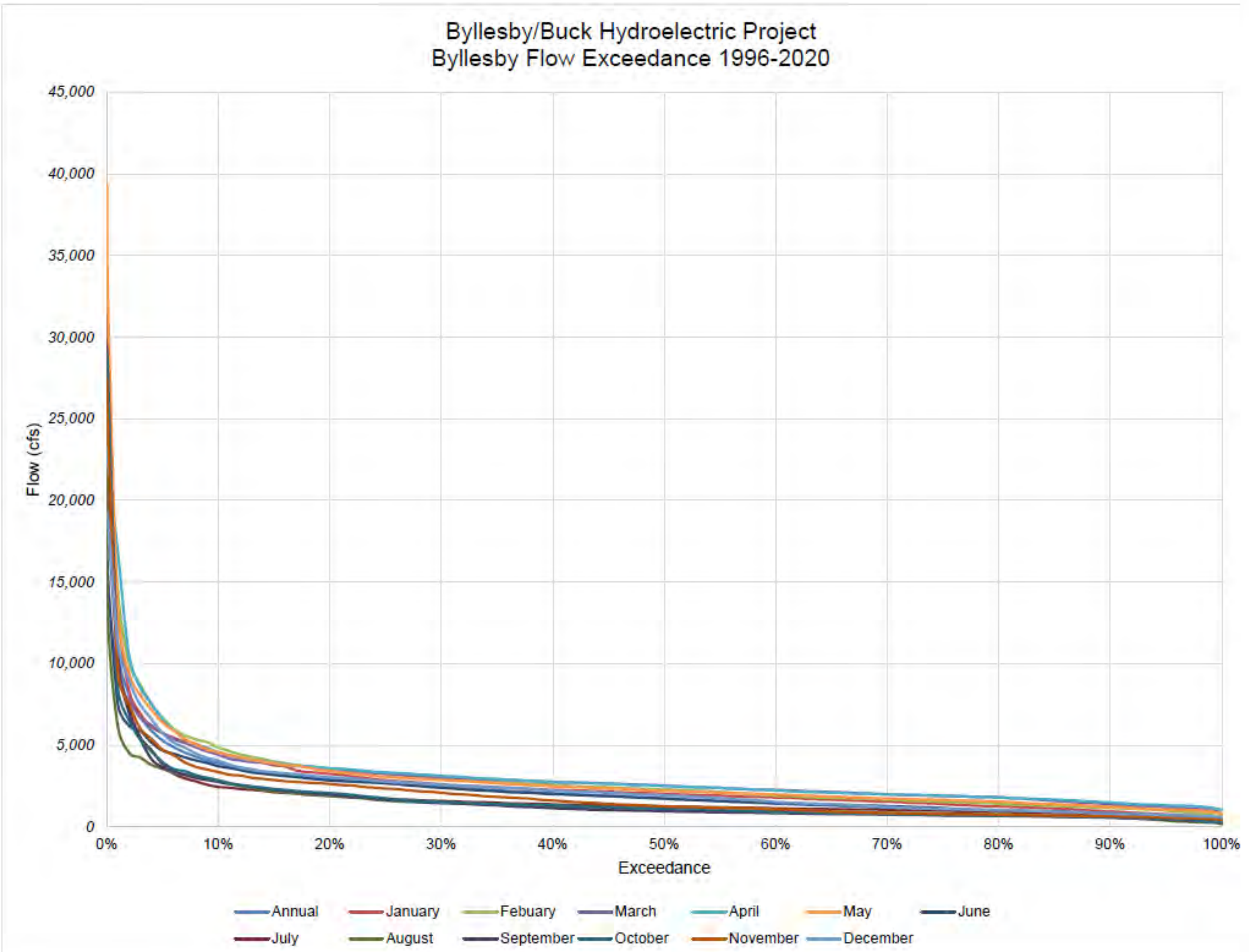

Figure B.5-11. Byllesby Development Monthly Flow Duration Curves

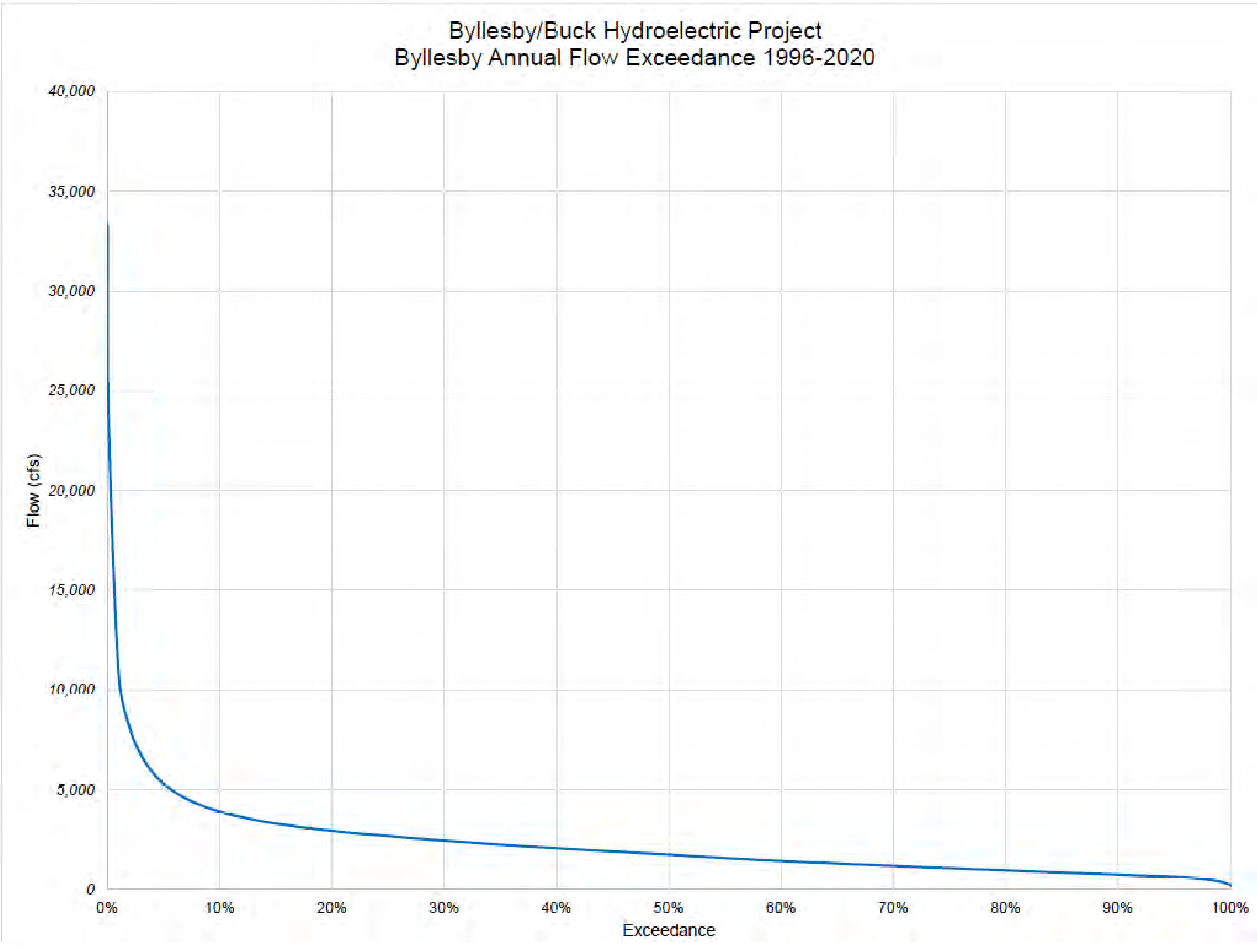

Figure B.5-12. Byllesby Annual Rating Curve

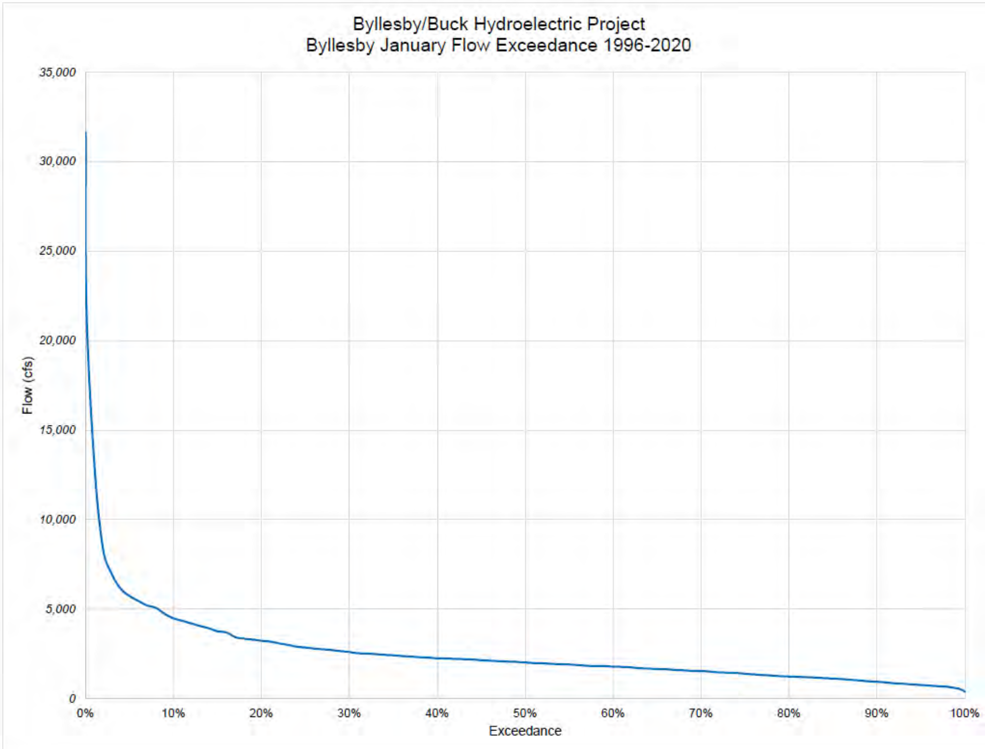

Figure B.5-13. Byllesby Development January Flow Duration Curve

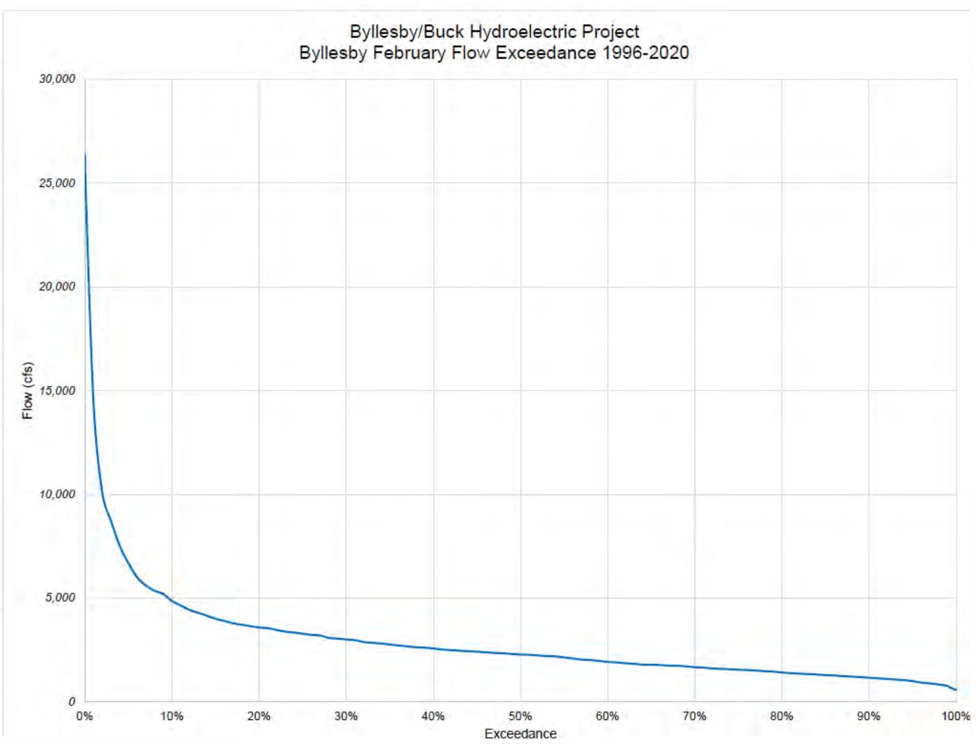

Figure B.5-14. Byllesby Development February Flow Duration Curve

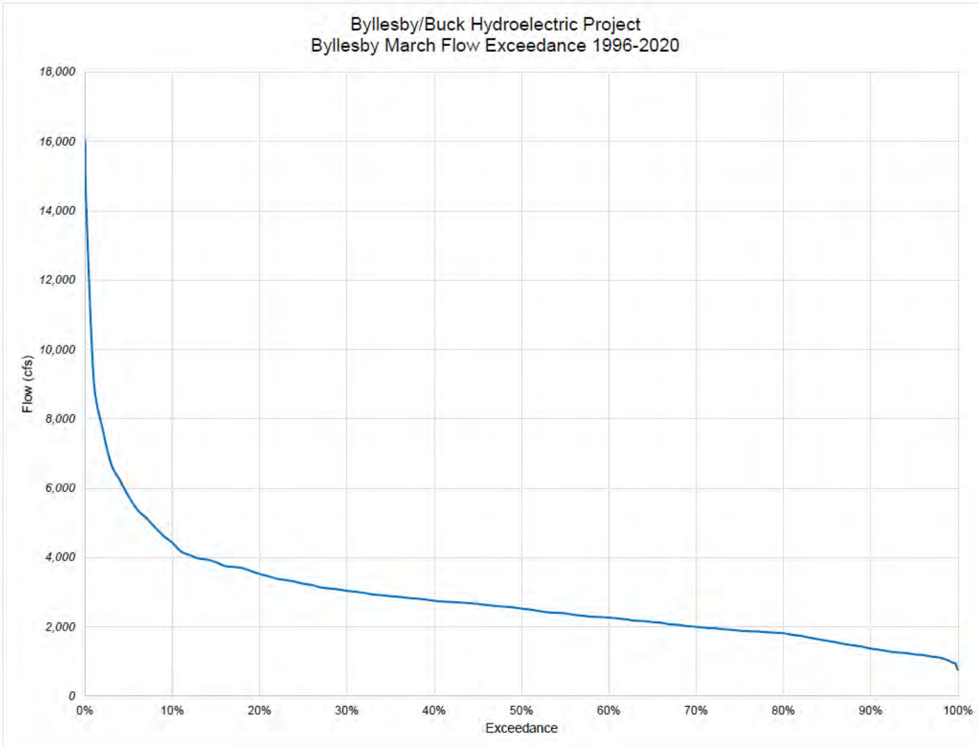

Figure B.5-15. Byllesby Development March Flow Duration Curve

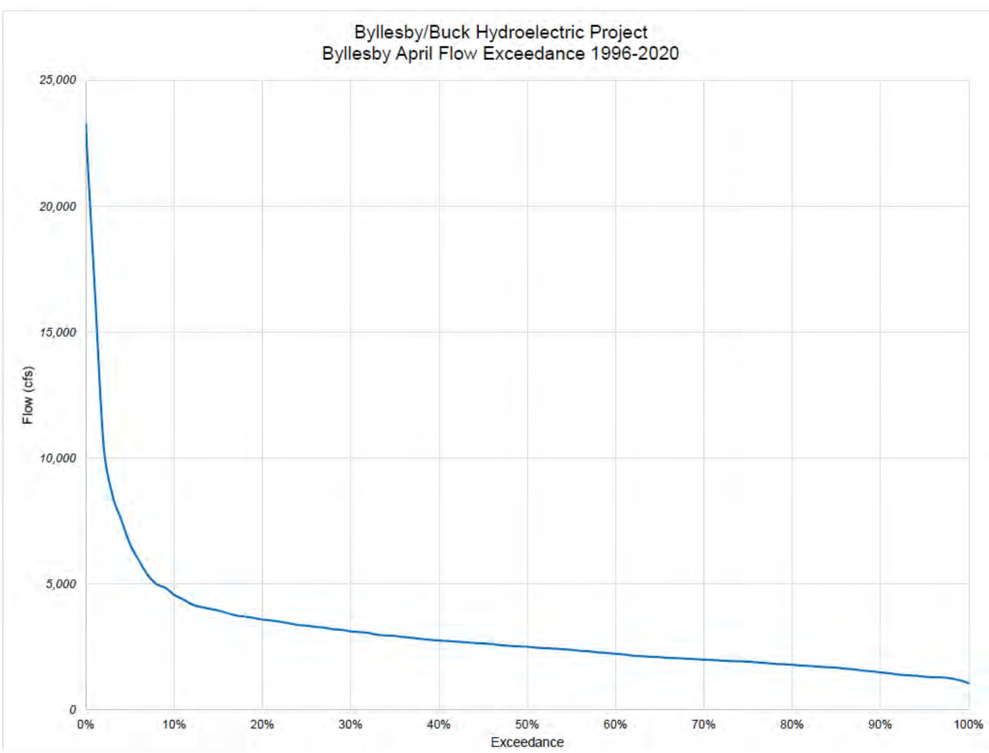

Figure B.5-16. Byllesby Development April Flow Duration Curve

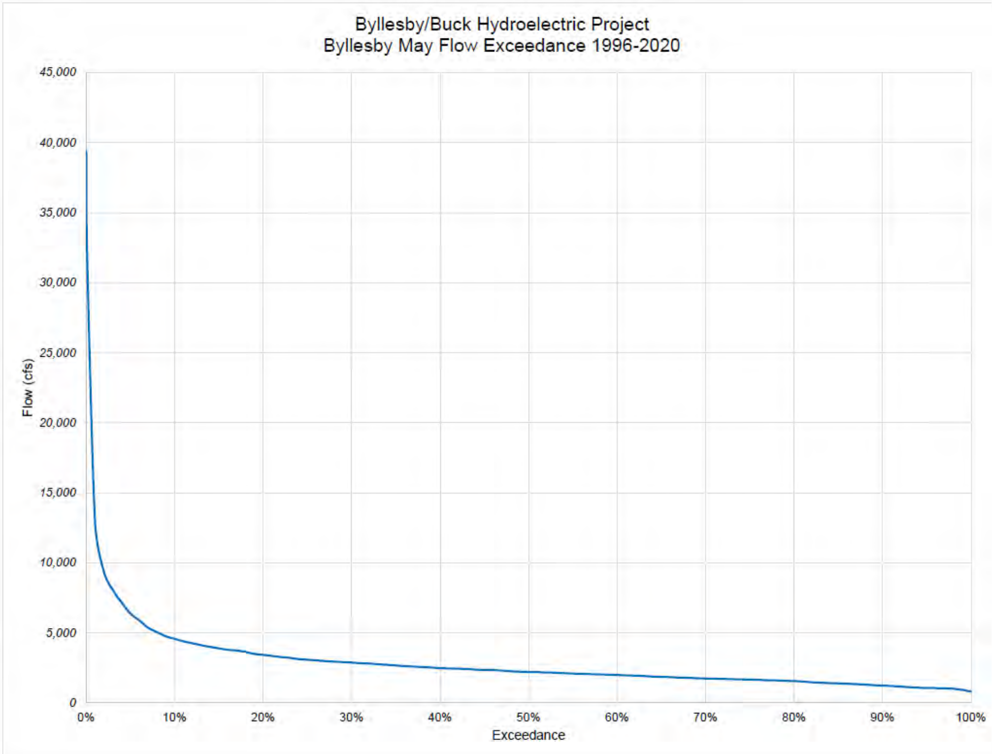

Figure B.5-17. Byllesby Development April Flow Duration Curve

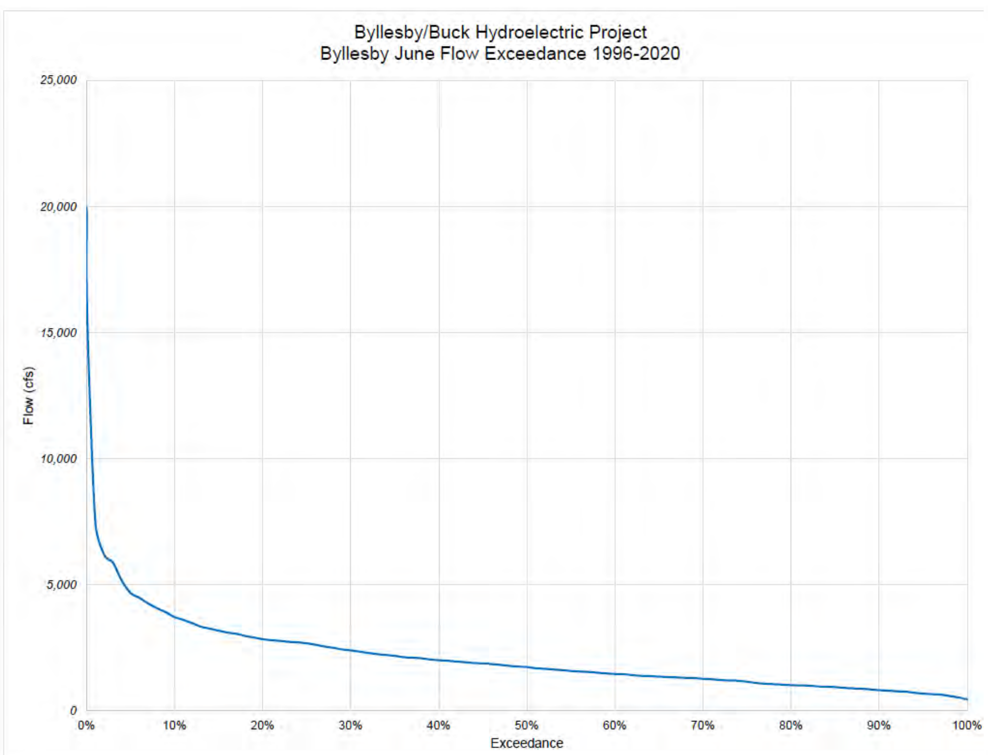

Figure B.5-18. Byllesby Development April Flow Duration Curve

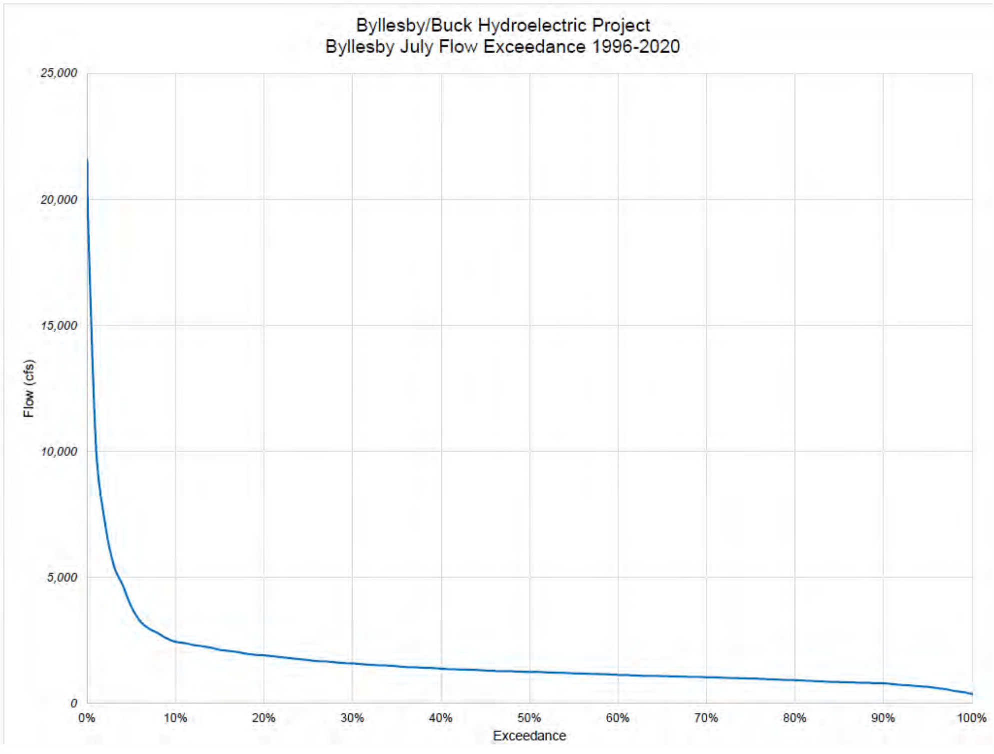

Figure B.5-19. Byllesby Development May Flow Duration Curve

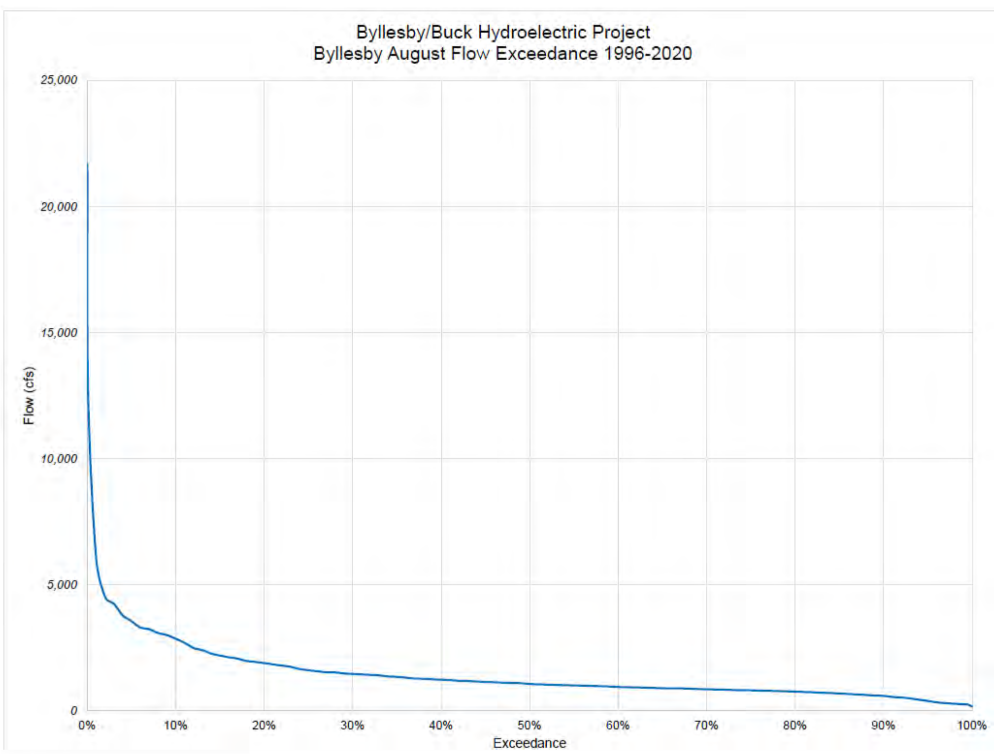

Figure B.5-20. Byllesby Development June Flow Duration Curve

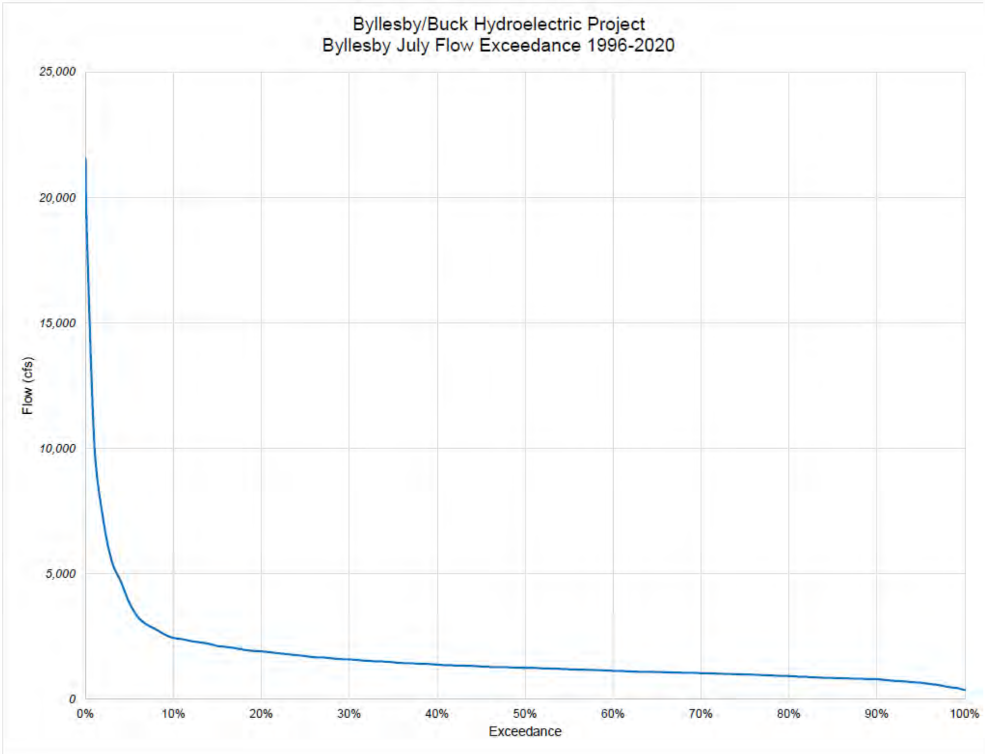

Figure B.5-21. Byllesby Development July Flow Duration Curve

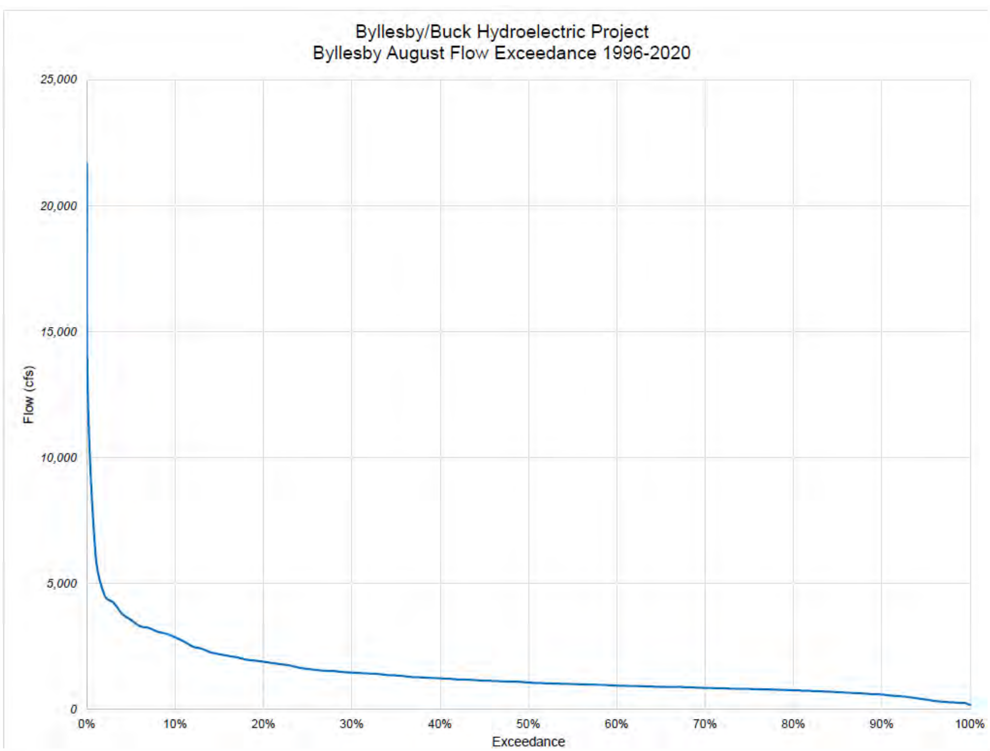

Figure B.5-22. Byllesby Development August Flow Duration Curve

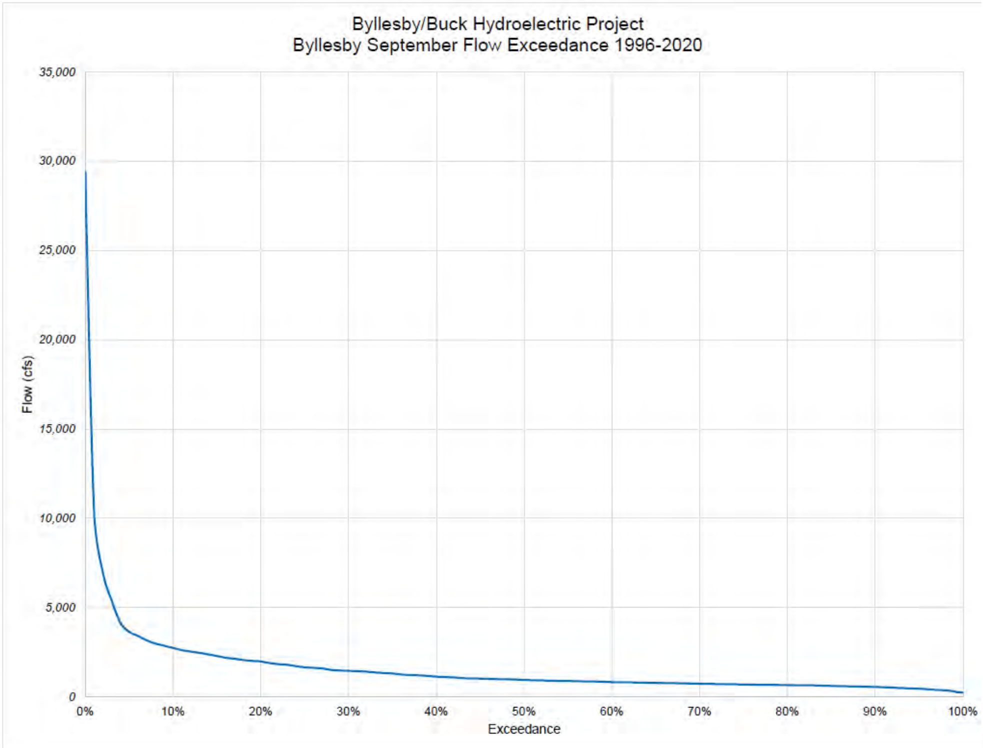

Figure B.5-23. Byllesby Development September Flow Duration Curve

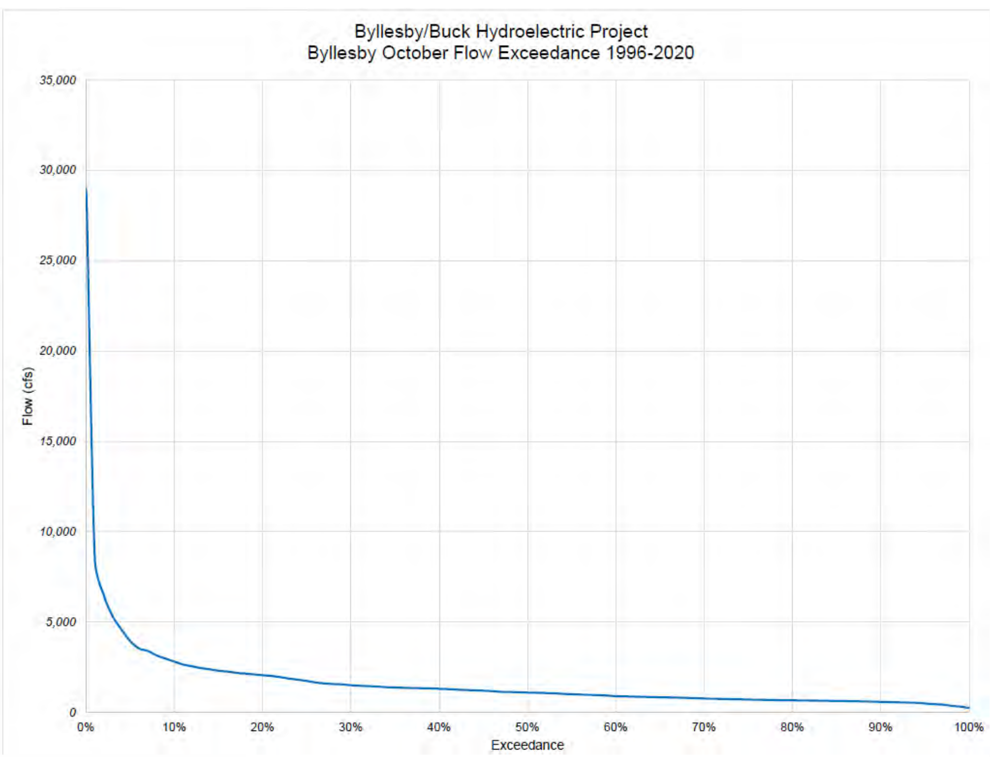

Figure B.5-24. Byllesby Development October Flow Duration Curve

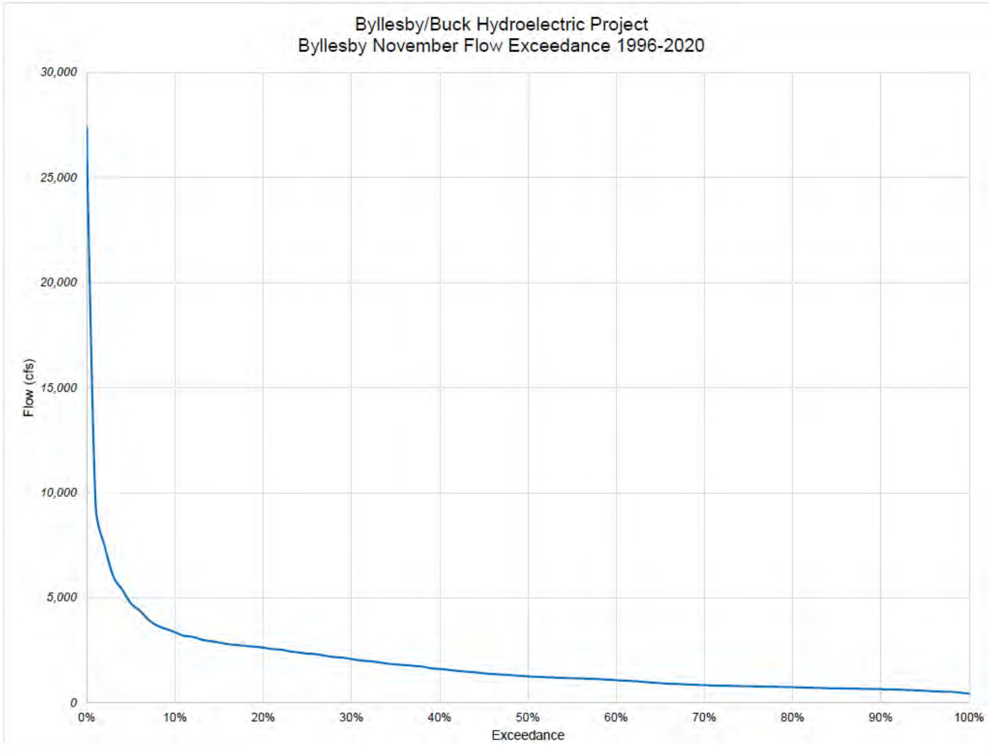

Figure B.5-25. Byllesby Development November Flow Duration Curve

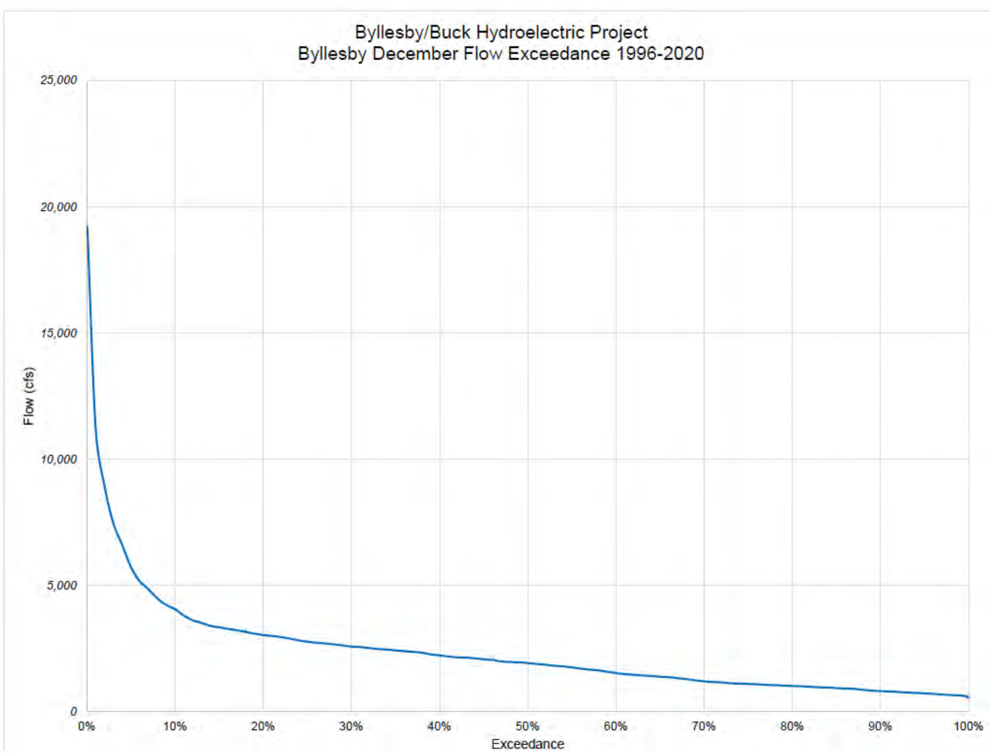

Figure B.5-26. Byllesby Development December Flow Duration Curve

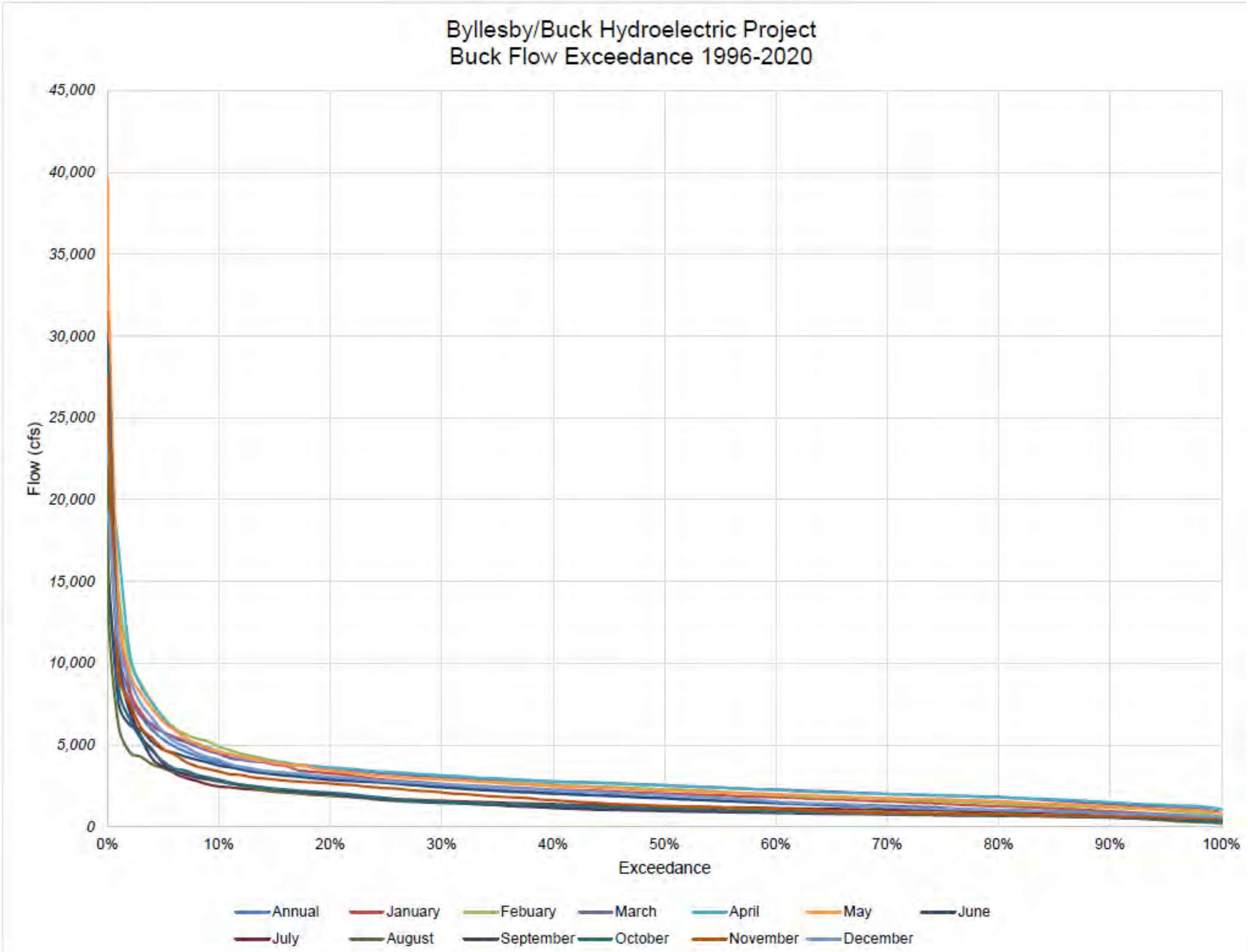

Figure B.5-27. Buck Development Monthly Flow Duration Curves

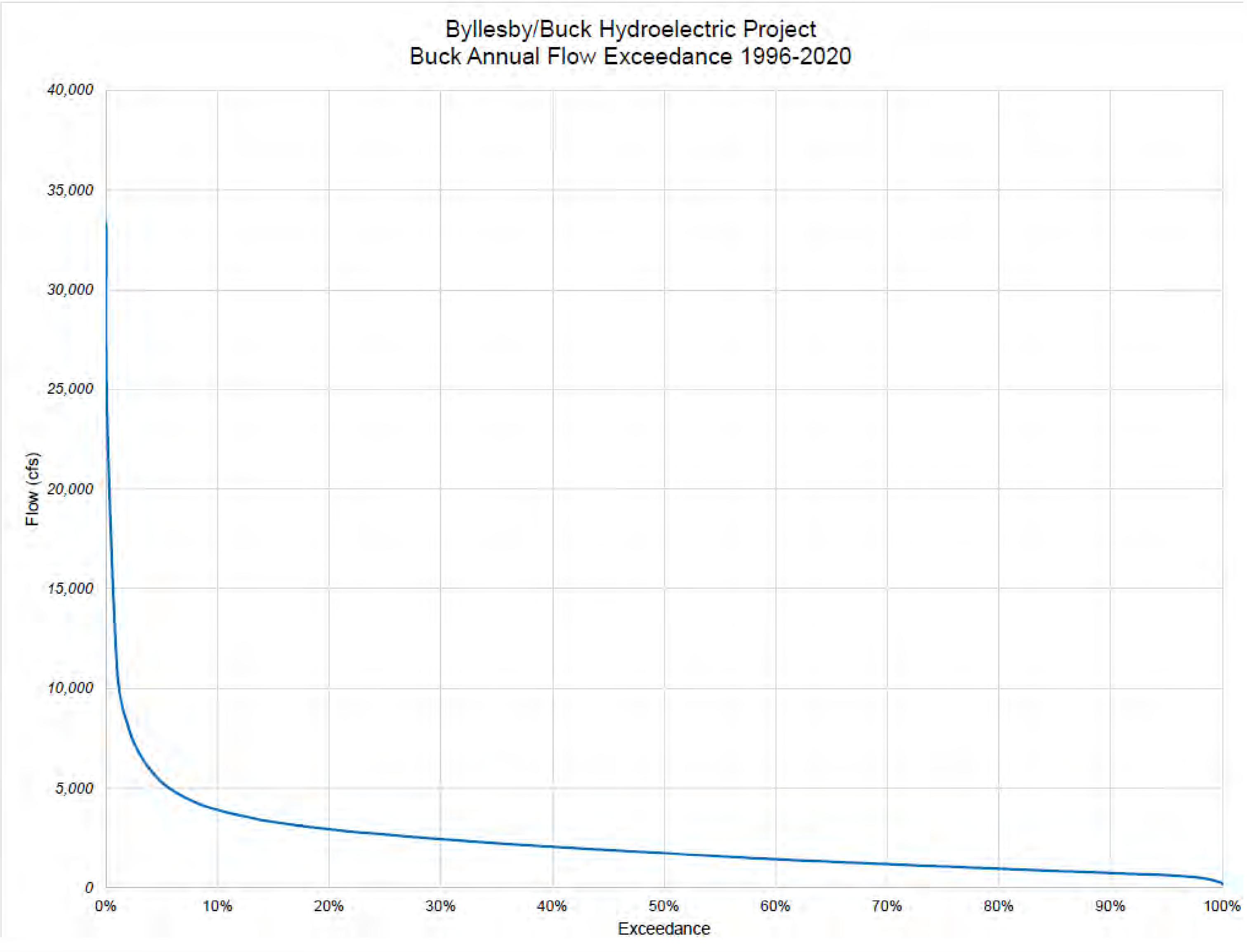

Figure B.5-28. Buck Development Annual Rating Curve

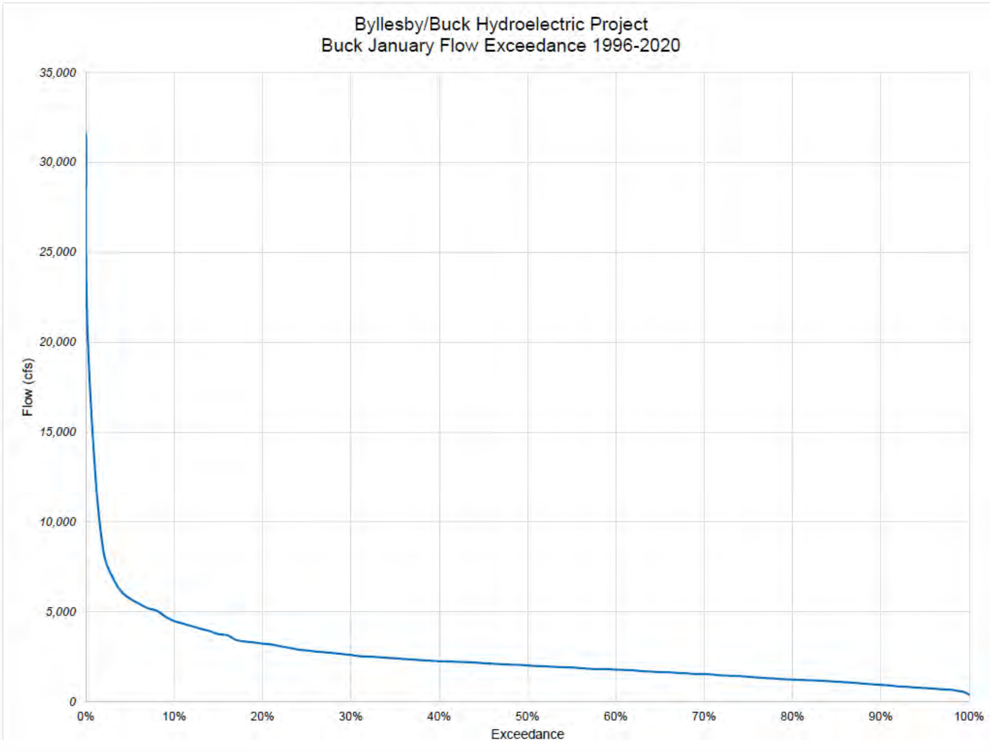

Figure B.5-29. Buck Development January Flow Duration Curve

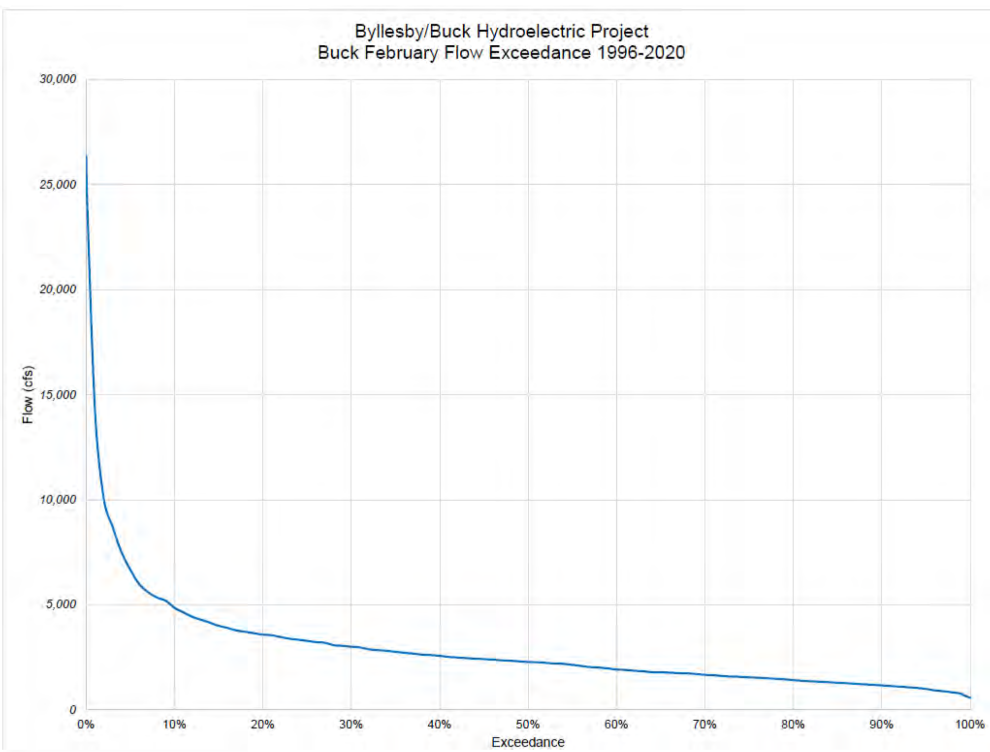

Figure B.5-30. Buck Development February Flow Duration Curve

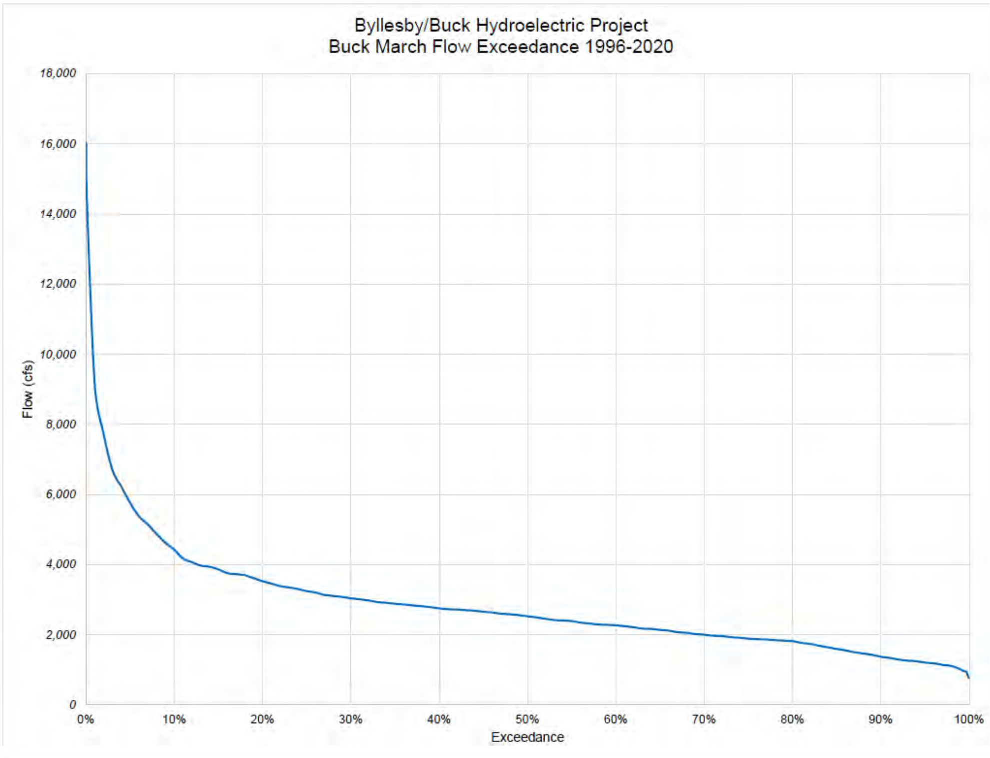

Figure B.5-31. Buck Development March Flow Duration Curve

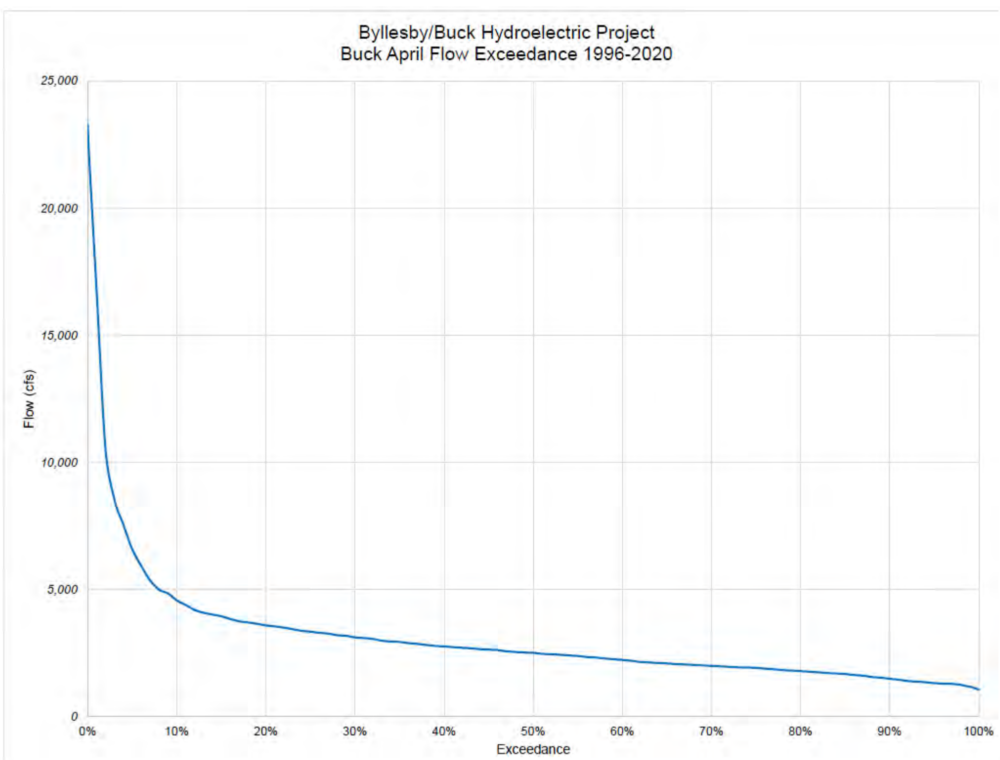

Figure B.5-32. Buck Development April Flow Duration Curve

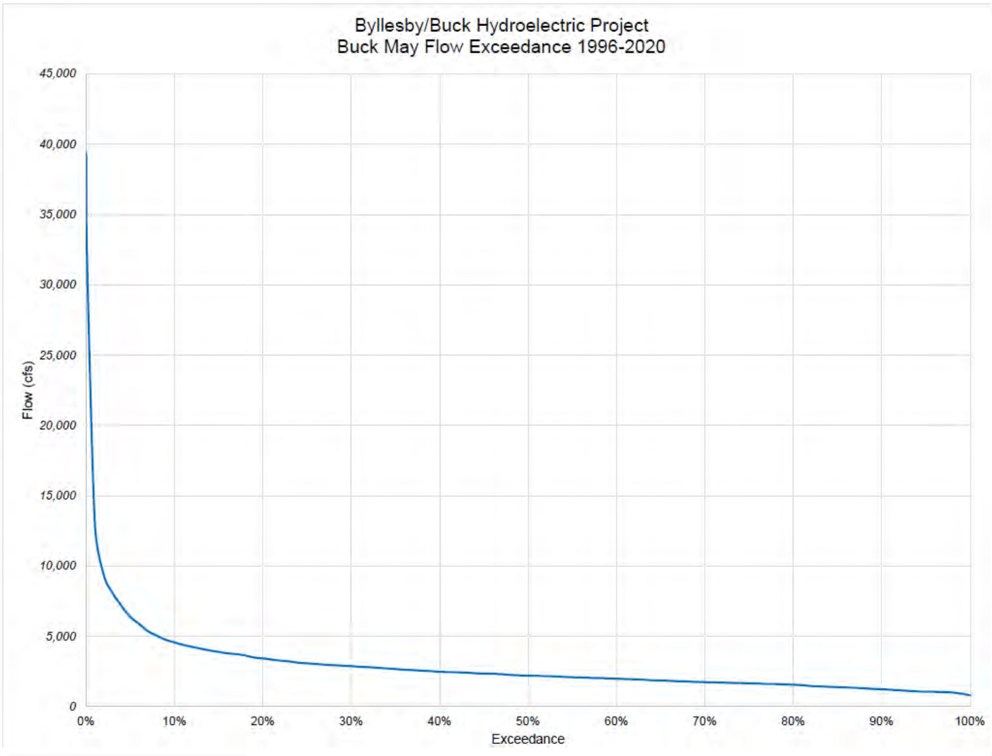

Figure B.5-33. Buck Development May Flow Duration Curve

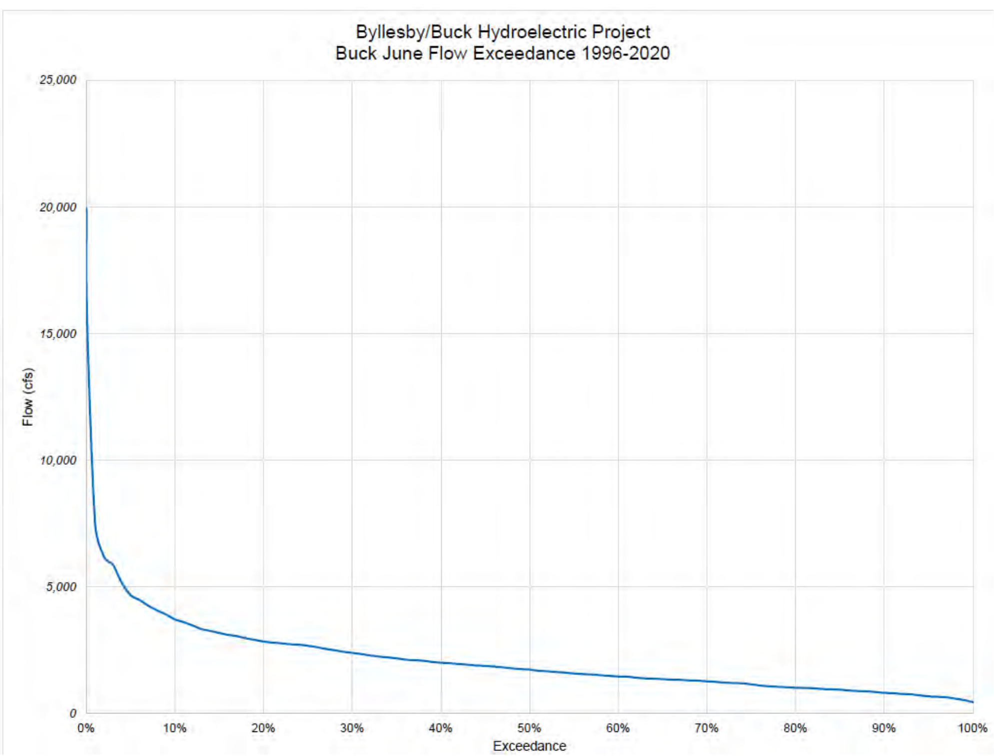

Figure B.5-34. Buck Development June Flow Duration Curve

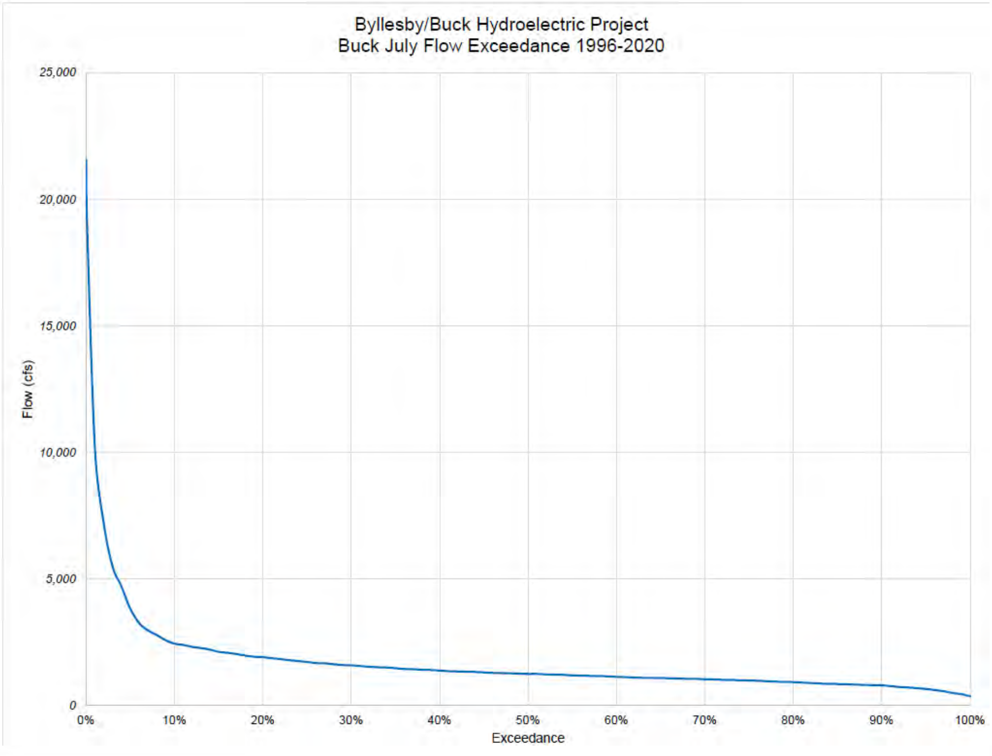

Figure B.5-35. Buck Development July Flow Duration Curve

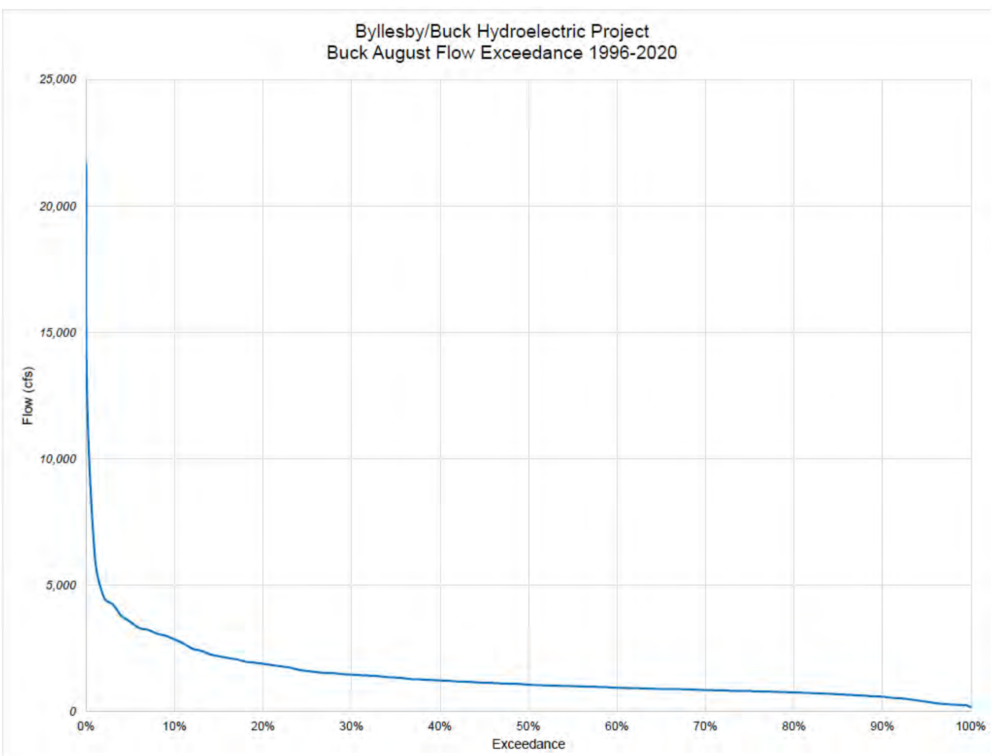

Figure B.5-36. Buck Development August Flow Duration Curve

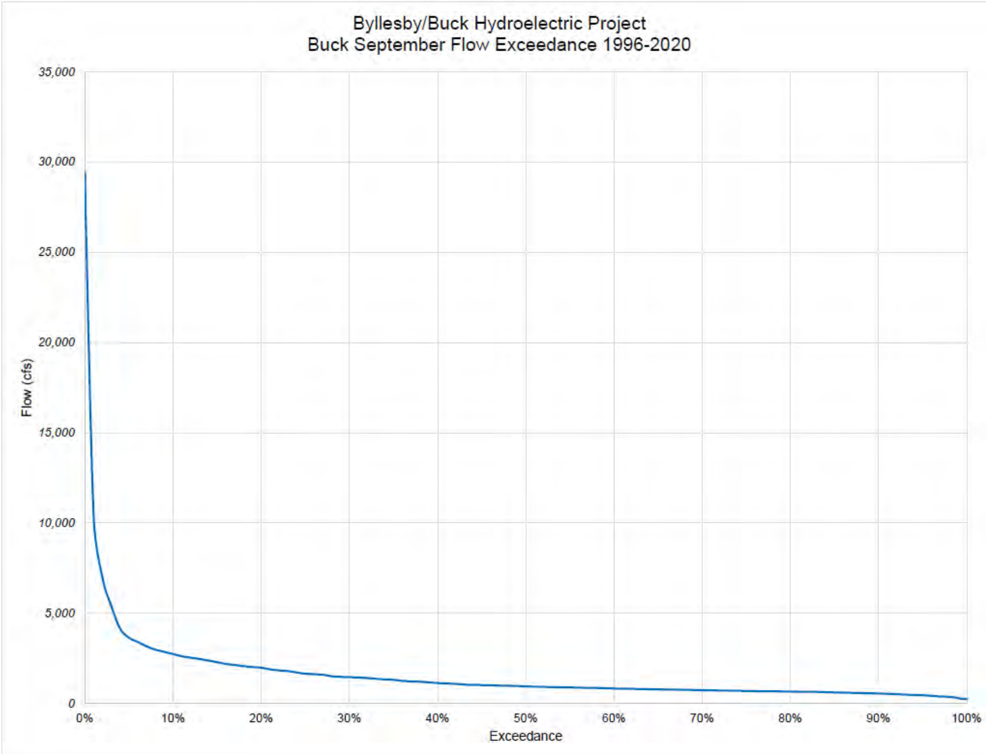

Figure B.5-37. Buck Development September Flow Duration Curve

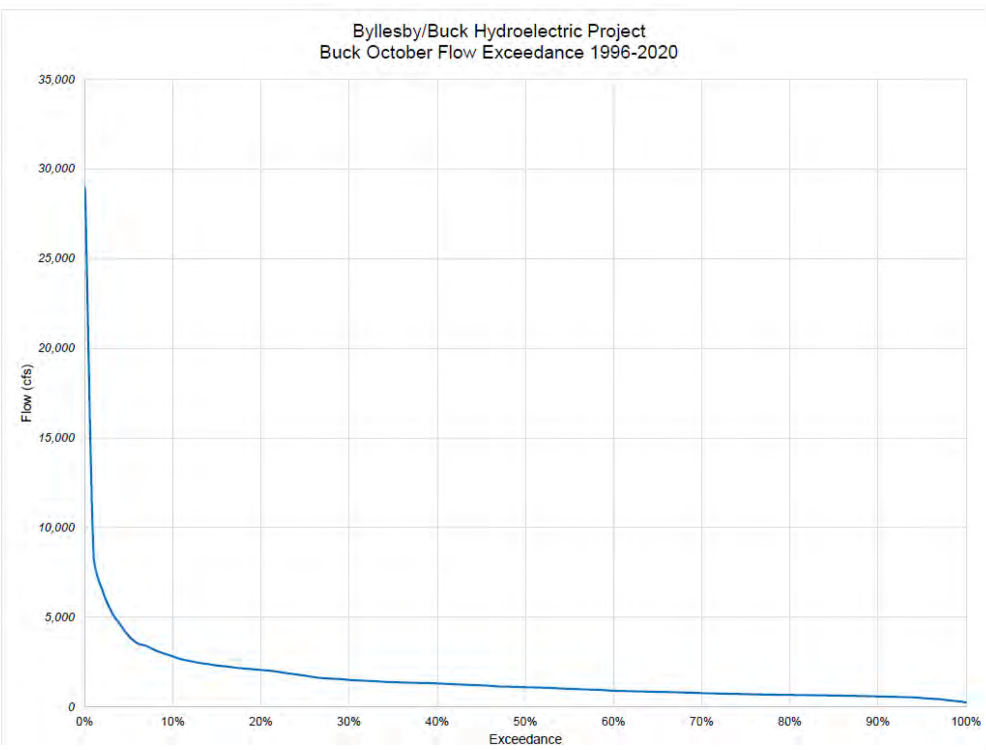

Figure B.5-38. Buck Development October Flow Rating Curve

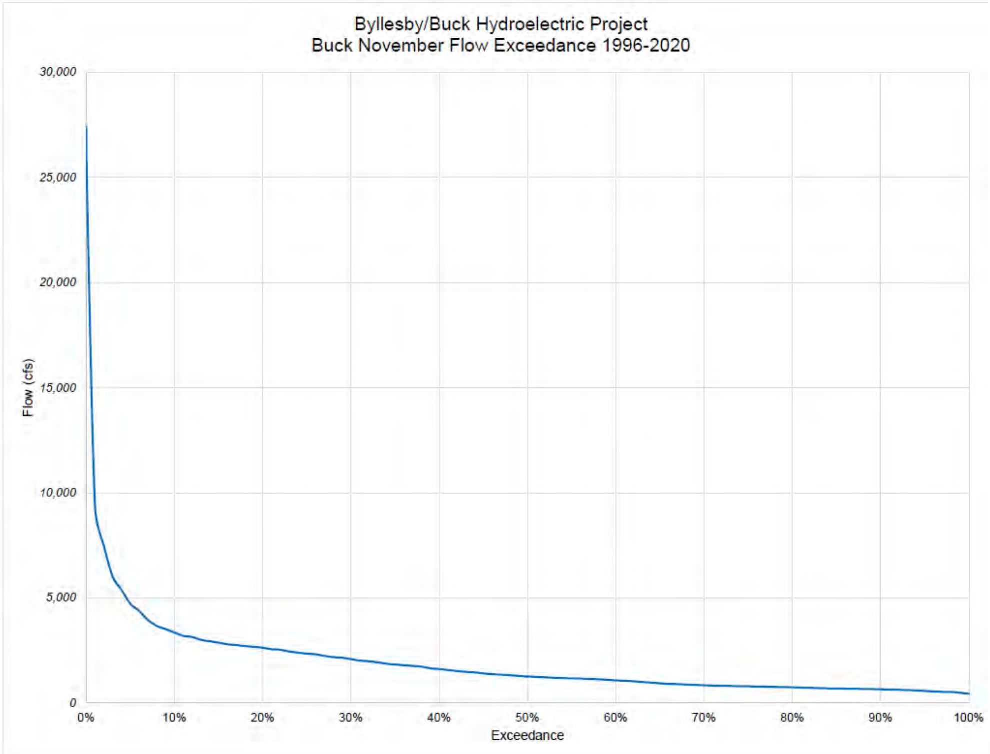

Figure B.5-39. Buck Development November Flow Duration Curve

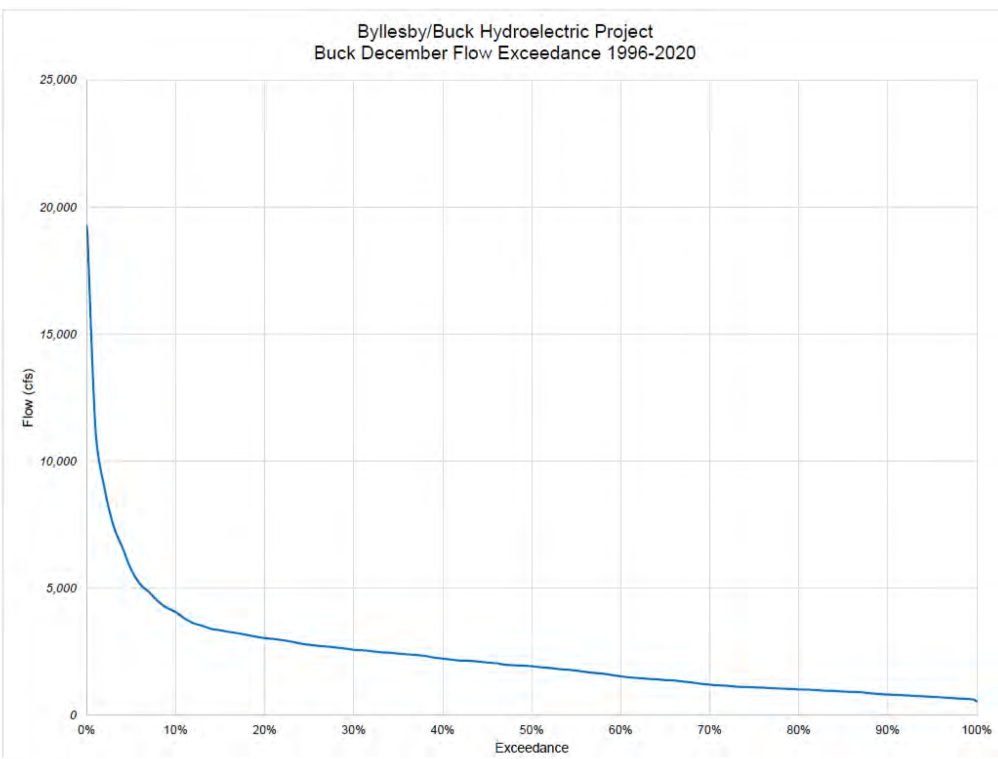

Figure B.5-40. Buck Development August Flow Duration Curve

DRAFT LICENSE AGREEMENT

BYLLESBY-BUCK HYDROELECTRIC PROJECT (FERC NO. 2514)

EXHIBIT C

CONSTRUCTION HISTORY AND PROPOSED CONSTRUCTION SCHEDULE

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Exhibit C - Construction History and Proposed Construction Schedule (18 CFR §4.51(d))

C.1 Construction of Existing Facilities

Because 18 CFR §4.51(d)(1) requires a construction history only for applications for an initial license, a construction history is not required for this relicensing application for the Project. However, to provide general and background information, a brief summary of the construction history of the Project is included below.

The construction and major events/alterations/repairs to each development are listed below.

C.1.1 Byllesby Development

The Byllesby Dam was constructed in 1912 to provide hydropower for the New River Power Company and Appalachian acquired the development in 1926. Original engineering was performed by Viele, Black and Buck, Consulting Engineers, New York, NY.

- In 1928, severe deterioration led to removal and replacement of defective concrete.
- The August 1940 Flood of Record caused substantial damage to the generating machinery when the powerhouse was flooded.
- To address the dam's stability and factors of safety under the Probable Maximum Flood loading conditions, post tensioned rock anchors were installed in September 1992 and April 1993 in all water-retaining structures.
- Concrete restoration was conducted during 1993 and 1994 to repair freeze-thaw damage and spalled areas. Other improvements included underpinning the toe of the main spillway and concrete (to address undercutting), and pressure grouting the powerhouse substructure to control leakage.
- In 1998, an Obermeyer (pneumatic) gate was installed in the main spillway. The gate replaced the flashboards in one spillway bay.
- In 2000, the main spillway and auxiliary spillway timber walkways were replaced with steel grating.
- In 2002, concrete restoration on the downstream face of angled bulkhead was performed.
- In 2003, spillway Gates No. 2 and 3 were repaired. The lower section of the skin plate and all the vertical rib supports were replaced and repainted. The bottom and side seals were also replaced.

- In 2004, spillway Gates No. 1, 4, 5, and 6 were replaced.
- In 2006, concrete restoration was performed on the upstream side of the spillway crest. The concrete slab on the west side of powerhouse at the generator floor level was replaced. The trash racks in front of all 4 units were replaced and the steel support members were repaired or replaced as required. Work began on replacing the Unit 4 headgate.
- In 2007, concrete restoration was performed on the downstream spillway surface at the main spillway flashboard section Bay 8. Concrete restoration was also performed on the main spillway right abutment wall. The Unit 4 headgate installation was completed, and work began on replacement of the Unit 3 headgate.
- In 2008, the Unit 3 headgate installation was completed as well as replacement of the Unit 1 and 2 headgates.
- On the night of January 17, 2010 large blocks of ice broke free upstream of Byllesby Dam and the force of the ice on spillway resulted in eight sets of flashboards failing. The flood wave mixed with ice sheets reached Buck Dam, approximately 3 miles downstream, in less than 30 minutes.
- In 2010, the six spillway Tainter gates were automated to be operated from the COC. In addition, repairs were made to the concrete caps over two post tensioned anchor heads.
- In 2012, new spillway gate operators were installed on all six spillway Tainter gates.
- In January 2013, the right spillway abutment and the non-overflow bulkhead section of the dam were overtopped during a flood event. Minor scour occurred on the downstream side of the angled bulkhead. The powerhouse was flooded with approximately 1 to 2 ft of water, which forced the generation units offline. In addition the flood event silted in the forebay in front of the intakes and damaged the intake structures.
- In 2014, the forebay was dredged and the intake structure and screens were repaired. Concrete restoration of the downstream face of spillway bay 15 was performed. All flashboards on the main spillway and auxiliary spillway were replaced and repairs were made to all four generating units.
- In 2015, spillway Tainter gate anchors were installed.
- In 2016, two new Obermeyer gates were installed to replace the stanchion flashboards in Bays 12 and 13.
- In 2018, two new Obermeyer gates were installed to replace the stanchion flashboards in Bays 10 and 11.

C.1.2 Buck Development

The Buck Dam was constructed in 1912 to provide hydropower for the New River Power Company and Appalachian acquired the development in 1926. Original engineering was performed by Viele, Black and Buck, Consulting Engineers, New York, NY.

- In 1928, expansive concrete due to the use of phyllite aggregates and high alkali cement resulted in significant damage in the powerhouse causing misalignment between the turbine and generator which broke the turbines' stay rings. The concrete floor supporting the generators and turbines was removed to a depth of 5 ft below the scroll case floor and was replaced with a new concrete floor. The damaged stay rings were also removed, repaired, and replaced.
- Within ten years, additional concrete repairs were made to the 1928 work due to deterioration. The exterior concrete surfaces on the powerhouse substructure, bulkhead sections of the dam, and spillway were removed to an average depth of 4 inches, with some areas requiring as much as 18 inches locally. Stage grouting was used to stop leakage through construction joints. The new concrete facing was divided into panels with v-joint separations to localize cracking and allow sealing of the joints; it was met with limited success.
- The August 1940 Flood of Record resulted in substantial damage to the generating machinery when the powerhouse was flooded.
- The spillway bridge and gate piers were replaced in 1988.
- To address potential stability concerns under the Probable Maximum Flood loading conditions, post tensioned rock anchors were installed between April and November of 1993 in all water-retaining structures.
- Concrete restoration was conducted during 1993 and 1994, consisting of epoxy grouting for leakage control through structures and filling the undercut area of the spillway toe with concrete.
- In 2001, the monitoring program for the piezometers in the spillway and main dam was discontinued based on recommendations made by the independent consultant for the Fifth Part 12 Safety Inspection.
- In 2002, concrete repairs to the deck on top of the north non-overflow bulkhead section were performed. The deck was chipped down 6 inches and repoured. The concrete caps over the post-tensioned anchors heads were also restored.
- In 2006, the I.P. Morris vertical Francis turbine runner for Unit 3 was replaced with a new vertical Francis turbine runner manufactured by American Hydro.

- In 2007, the concrete caps over six post-tensioned anchors in the main spillway were restored.
- On the night of January 17, 2010 ice jams on the New River resulted in overtopping of the non-overflow bulkheads at the Buck Development. Large blocks of ice broke free upstream of Byllesby Dam and the force of the ice on spillway resulted in eight sets of flashboards failing. The flood wave mixed with ice sheets reached Buck Dam in less than 30 minutes. The surge of water raised the pond level several feet until 3 sets of flashboard bays finally failed 1 hour and 45 minutes later, allowing the Buck pond to begin dropping.
- Minor overtopping of the abutments at the Buck Dam occurred during the peak of the event; however, there was no loss of integrity of the water impounding structures. The damage was limited to minor erosion around the toe of the left concrete bulkhead, bent handrails, and damaged log boom sections.
- Also in 2010, the six spillway Tainter gates were automated so they could be operated from the COC.
- In 2012 and 2013, repairs were made to the concrete caps over several post-tensioned anchors where the concrete was cracked or eroded. Concrete restoration was also performed on the two left spillway bay downstream surfaces.
- On January 31, 2013, heavy rains contributed to high river flows on the New River in Southwest Virginia resulting in overtopping of the Byllesby and Buck dams creating an emergency condition. At the spillway bridge, the right abutment was over overtopped which washed out stone on the entrance road and eroded the fill material on the downstream shoreline where the water reentered the river. At the powerhouse, the right and left non-overflow bulkheads were overtopped. The loss of fill material was not a dam safety concern. The powerhouse was flooded by about six inches. The top of the head covers and guide bearings were flooded on all the units. All necessary repairs were made in 2013 and the forebay was returned to normal operating level in December 2013.
- In 2014, repairs were made to the intake structure. The horizontal support beams were replaced and the vertical support members were reinforced. The intake screens were also replaced.
- Repairs were made to the gate hoist anchorage in 2015.
- In 2017, two new Obermeyer gates were installed to replace the flashboards in Bays 7 and 8.
- In 2018-2019, two new Obermeyer gates were installed to replace the stanchion flashboards in Bays 9 and 10.

C.2 Construction of Proposed Facilities

During the new license term, Appalachian proposes to modernize the Byllesby and Buck developments to include replacement of Byllesby Units 1, 2, and 4 and Buck Units 1 and 3. All but one (Buck Unit 2) of the seven turbine-generator units installed at the Project are the original major components of the Project as constructed in 1912. The existing vertical Francis units would be replaced by fixed blade Kaplan units. Unit upgrade activities would be confined to within the powerhouse, and there would be minimal changes to operating parameters for the Project.

Appalachian is presently planning a three-phase unit replacement program for the Project. The first phase involves the replacement of Byllesby Unit 4 starting in 2024. The second phase involves the replacement of Byllesby Units 1 and 2 in 2025 and 2026; existing Byllesby Unit 3 would remain in place and would be operated as last unit on and first unit off. The third phase involves the replacement of Buck Units 1 and 3 in 2027 and 2028, respectively. Existing Buck Unit 2 would remain in place and would be operated as last unit on and first unit off.

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DRAFT LICENSE AGREEMENT

BYLLESBY-BUCK HYDROELECTRIC PROJECT (FERC NO. 2514)

EXHIBIT D

COSTS AND FINANCING

Exhibit D - Costs and Financing (18 CFR §4.51(e))

D.1 Original Cost of Project

Since the Project is applying for a new license for an existing project, as compared to an initial license, a tabulated statement providing the actual or approximate cost of Project construction is not applicable.

D.2 Project Takeover Cost Pursuant to Section 14 of the FPA

Under Section 14(a) of the Federal Power Act (FPA), the federal government may take over any project licensed by the Commission upon the expiration of the original license. The Commission may also issue a new license in accordance with Section 15(a) of the FPA. If such a takeover were to occur upon expiration of the current license, the Licensee would have to be reimbursed for the net investment, not to exceed fair value, of the property taken, plus severance damages. To date, no agency or interested party has recommended a federal takeover of the Project pursuant to Section 14 of the FPA.

D.2.1 Fair Market Value

Fair market value is not defined in the FPA or its implementing regulations. The fair value of the Project depends on prevailing power values and license conditions, both of which are currently subject to change. The best approximation of fair value is likely to be the cost to construct and operate a comparable power generating facility. Because of the high capital costs involved with constructing new facilities and the increase in fuel costs associated with operating such new facilities (assuming a fossil-fueled replacement), the fair value would be considerably higher than the net investment amount. If a takeover were to be proposed, the Licensee would calculate fair value based on then-current conditions.

Appalachian will provide the fair market value of the Project in the FLA to be filed with the Commission by February 28, 2022.

D.2.2 Net Investment

The FPA defines "net investment" as the original cost, plus additions, minus the sum of the following items (to the extent that such items have been accumulated during the period of the license from earnings in excess of a fair return on such investment): (a) unappropriated surplus; (b) aggregate credit balances of current depreciated accounts; and (c) aggregate appropriations of surplus or income held in amortization, sinking fund, or similar reserves.

Appalachian will provide the net investment of the Project in the FLA to be filed with the Commission by February 28, 2022m

D.2.3 Severance Damages

Severance damages are determined either by the cost of replacing (retiring) equipment that is "dependent for its usefulness upon the continuance of the License" (Section 14, FPA), or the cost of obtaining an amount of power equivalent to that generated by the Project from the least expensive alternative source, plus the capital cost of constructing any facilities that would be needed to transmit the power to the grid, minus the cost savings that would be realized by not operating the Project. These values would need to be calculated based on power values and license conditions at the time of Project takeover.

D.3 Estimated Costs of New Development

D.3.1 Land and Water Rights

The Licensee currently holds all land and water rights necessary to construct, operate and maintain the Project, and is not proposing expansion of its land or water rights as a consequence of this license application.

D.3.2 Cost of New Facilities

Construction of new facilities during the new license term is not presently proposed by Appalachian. During the new license term, Appalachian does propose to modernize the Byllesby and Buck developments to include replacement of Byllesby Units 1, 2, and 4 and Buck Units 1 and 3. Appalachian's preliminary cost estimate for these upgrades over the new license term is $32,023,000.

Proposed PM&E measures for the new license term, and costs for same, will be provided in the FLA, after additional consultation with stakeholders.

D.4 Estimated Average Annual Cost of Project

There is no fixed schedule for other elements of the Project's general life-extension program, rather a sequence of activities designed to be implemented when needed. Accordingly, there is not a fixed annual budget allocated for additional life-extension activities. These activities would be performed on an as-needed basis using existing planning procedures that provide short- and long-term windows to evaluate, schedule, and budget replacements and rehabilitation work in an orderly fashion.

The estimated average annual cost of the Project will be provided in the FLA. This estimate will include costs associated with existing and projected Project operations and maintenance, as well as local property and real estate taxes, but will exclude income taxes, depreciation, and costs of financing. Appalachian will also provide the average annual cost of the Project accounting for the items above in addition to the proposed unit upgrades.

D.4.1 Current Annual Costs

D.4.1.1 Cost of Capital (Equity and Debt)

The estimated Project capital costs will be provided in the FLA. Actual capital costs are based on a combination of funding mechanisms that include stock issues, debt issues, revolving credit lines, and cash from operations.

D.4.1.2 Local, State, and Federal Taxes

Property taxes for the 2020 fiscal year will be provided in the FLA. Income taxes for the Project are incorporated into costs of the Licensee's consolidated business and are not separated out for the Project.

D.4.1.3 Depreciation and Amortization

The annualized composite rate of depreciation for the Project will be provided in the FLA.

D.4.1.4 Operation and Maintenance Expenses

The estimated annual O&M expense for the Project, including corporate support costs, but excluding property and real estate taxes, will be provided in the FLA.

D.4.1.5 Estimated Capital and O&M Costs of Proposed PM&E Measures

The estimated capital and O&M costs for proposed PM&E measures for the new license term will be provided in the FLA, after additional consultation with stakeholders.

D.4.2 Annual Value of Project Power

The Licensee sells all the electricity generated at the Project into the regional grid. An approximation of the value of Project power, based on the average annual gross energy projection for the Project compared to the average annual cost of obtaining an equivalent amount of capacity and energy from the lowest cost alternative, will be provided in the FLA.

D.5 Sources and Extent of Financial and Annual Revenues

If determined to be needed, Appalachian's general plan for financing the environmental enhancements and life-extension cost of the Project initially will be to issue short-term debt (either bank line of credit or commercial paper) and to generate internal funding consisting of depreciation, retained earnings, and deferred federal income taxes. If short-term financing options become unattractive, Appalachian will issue permanent securities (i.e., long-term debt, preferred stock, and common stock) to replace short-term debt. This financing plan will adhere to Appalachian's overall corporate construction financing requirements.

D.6 Cost to Develop the License Application

The approximate cost to prepare the application for new license for the Project through February 28, 2022 will be provided in the FLA.

D.7 On-Peak and Off-Peak Values of the Project

The Project operates as a run-of-river generating facility. As per 18 CFR Â§ 4.51(e)(8), this section is not applicable to hydroelectric projects operating in run-of-river mode.

D.8 Estimated Average Increase or Decrease in Generation

The unit upgrades proposed by Appalachian are expected to increase average annual generation by approximately 25,927 MWh.

Appalachian is not presently proposing any PM&E measures or operational modifications at the Project that would cause a decrease in annual generation or decrease in the value of project power.